

DISTRIBUTION, ETHNOBOTANY AND CONSERVATION OF *ALOES* OF MALAWI

MSc. (Conservation Biology) Thesis

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**A thesis submitted to the Faculty of Science, Biology Department,
University of Malawi in partial fulfillment of the requirements for the
degree of Master of Science in Conservation Biology**

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DECLARATION

I, Gladys Chipiliro Mkwapatira, do hereby declare that this thesis is of my own origin and that it has not been submitted to any other university for a degree. Acknowledgements have been made where work done by other people has been used.

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CERTIFICATE OF APPROVAL

We certify that this thesis is the candidate's original work and where assistance has been sought, this has been duly acknowledged. It is therefore submitted with our approval to the University of Malawi, in partial fulfillment of the requirements for the degree of Master of Science in Conservation Biology.

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DEDICATION

This thesis is dedicated to my children, Amon, Jonathan and Edna for their sacrifice during my study period. They could stay without my company for some days when I went away for fieldwork and training courses for this study; and my mother for bringing me into this world.

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ABSTRACT

Aloes, socio-economically important plants in the world, are mostly used for medicines. In Malawi, Aloes are threatened because of loss of habitats due to high population growth rate, poverty, agriculture expansion and unsustainable utilization. This study mapped out occurrences of Aloes in Malawi in order to note widely and rare species and also areas that were rich in Aloes for conservation purposes. Utilization of Aloes was assessed because results would help in poverty alleviation and would also improve medicinal quality of Malawian products. Conservation measures were formulated to ensure continuous supplies for future use.

Coordinates for mapping out occurrences of the species were derived from literature, records from herbarium specimens and fieldwork for this study. Distribution maps were produced by means of Geographical Information Systems (GIS), ArcView, 3.2 program. Geographical Position system (GPS) was used to find coordinates and altitudes. Participatory Rural Appraisal (PRA) and questionnaires were used to obtain the information on local uses and opinions on conservation.

In this study, some species were noted to wide spread, rare and restricted to some areas due to possible reasons such as differences temperature, rainfall, soil types, habitats and capacity of the species to disperse itself. *Aloe christianii*, *Aloe chabaudii* and *Aloe swynnertonii* were widely spread in Malawi while *Aloe buchananii*, *Aloe myriacantha*, *Aloe canii* and *Aloe buettneri* were rare, and *Aloe mzimbana* and *Aloe menyharthii* were restricted to some areas.

This study noted that Rumphi, Mzimba, Dedza, Zomba and Mulanje were the districts that were rich in Aloes in Malawi. Most Aloe species grow between 500 and 2000 m, and *Aloe christianii* had the widest range of altitudes, from 400 m to 2395 m. These results and habitats would help in cultivation for good growth of the plants. Ethnobotany results revealed that Aloes were used in different ways locally; medicines, cosmetics, charms as well as in domesticated animals. Therefore, this study formulated conservation measures as in-situ, ex-situ conservation and suggested designating Aloes as one of the protected species of Malawi to ensure continuous supplies of Aloes in Malawi.

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LIST OF ACRONYMS AND ABBREVIATIONS

IUCN	International Union for Conservation of Nature
PRA	Participatory Rural Appraisal
WHO	World Health Organization
WWF	World Wildlife Fund
TFR	Total Fertility Rate
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora Regulations
GIS	Geographical Information Systems
CBD	Convention on Biological Diversity
GPS	Global Positioning System
STD	Sexually Transmitted Disease
JCE	Junior Certificate Examinations
MSCE	Malawi School Certificate of Education
NSO	National Statistical Office
NUFU	Biodiversity of Southern Tropical Africa (Monocotyledonous Plants) Taxonomy, Conservation and Use
NHBGM	National Herbarium and Botanic Gardens of Malawi
AIDS	Acquired Immunodeficiency Syndrome

CHAPTER ONE

INTRODUCTION TO THE PROBLEM

1.1 BACKGROUND

The increasing destruction of natural habitats is threatening the survival of many valuable plant species in the world today. Great dependence on plant resources, especially in developing countries, is also endangering some plant species. This situation occurs particularly in countries with high population and where poverty is high like Malawi. The world is losing plants every minute due to habitat destruction (Seyani and Chikuni, 1997).

Some of the major factors that are threatening sustainable management of wild plant resources in Malawi include high population growth rate (2.38%) (NSO, 2006), poverty and agriculture expansion. Malawi is one of the most densely populated countries in sub-Saharan Africa. The major cause of high population growth in Malawi is the high total fertility rate (TFR) which is the average number of children a woman will give birth to during her lifetime. Malawi's TFR of 5.92 (NSO, 2006) is one of the highest in Africa. The high TFR is due to several reasons including early marriage, early age at pregnancy and relatively short birth intervals (Department of Environmental Affairs, 1998; Msekandiana and Mlangeni, 2002).

The increase in human population results in an increase in the demand for services and products offered by the forests and other ecosystems, more land for settlement and cultivation of crops that may lead to habitat destruction and possibility for some species to go extinct. About 85% of the population in Malawi depends on subsistence agriculture

(Department of Environmental Affairs, 1998). The country is developing, and industrialization and urbanization are on the increase, making some of Malawi's species endangered due to habitat loss (Msekandiana and Mlangeni, 2002; Lane, 2000). This merits the monitoring of threatened taxa to note and possibly prevent local extinction.

Poverty is also one of the major contributing factors to deforestation in Malawi. Poverty is widespread in both urban and rural areas and affects more than half of the population. Areas with high levels of poverty experience the greatest pressure on forest and other plant resources. Some of the contributing factors to poverty in Malawi include low agriculture productivity, low non-farm income, low education and poor health (Department of Environmental Affairs, 1998). Poor people's common strategy for survival is to sell forest products in order to obtain cash for purchasing basic needs and services. For example, when the agricultural harvest is poor in a particular year, the trade in firewood and charcoal increases to buy food.

According to Msekandiana and Mlangeni (2002), Malawi has about 5,000-6,000 plant species, total of 248 taxa are listed as threatened and Aloaceae is one of the families with the highest representation.

1.2 RATIONALE OF THE STUDY

This study was carried out in Malawi with the aim of investigating distribution, ethnobotany and conservation measures of Aloes of Malawi. Aloes being socio-economically important need to be studied in the stated areas for conservation purposes.

1.2.1 Distribution

Species distribution is defined as the manner in which a biological taxon is spatially arranged (http://en.Wikipedia.org/wiki/species_distribution). Knowledge of the distribution of plant species is vital for conservation because there is need to know which species are rare or areas that are rich in a particular species so as to determine the type of management to be applied.

1.2.2 Ethnobotany

In broad terms, ethnobotany is the study of relationships between plants and people (Balick and Cox, 1996). Knowledge of ethnobotany combined with vigorous conservation of plant species is very important for the development of pharmaceutical products. Ethnobotany also provides an important basis for drug development from medicinal plants. The development of drugs like quinine, morphine and its congeners, digoxin, reserpine and artemisinin and its congeners have all started from ethnobotanical information (Kofi-Tsekpo, 1997). Traditional medicines are relatively cheaper and more available to people and usually readily accepted by the local population as opposed to western medicines, which have to be imported into the country. Besides, traditional medicines could be environmentally friendly if it is considered that their residues are more degradable and easy to dispose than those from western drugs (Seyani and Chikuni, 1997; Plotkin, 1988). According to Plotkin (1988), developing countries simply cannot in many cases, afford to spend millions of dollars on imported medicines that they could produce or extract from the forest resources.

1.2.3 Conservation Measures

According to Carter (2001), many *Aloe* species are threatened because of their medicinal and horticultural or commercial value that has led to over-collection of some species. *Aloe* species of Malawi have been listed in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora Regulations (CITES) (Government of Malawi, 1995). Plant species that have been listed in Appendix II of CITES are the species that might not be threatened with extinction now but may become so, unless the use of these species are strictly regulated and effectively controlled, in order to avoid unsustainable utilization (Wijnstekers, 1995). According to Msekandiana and Mlangeni, 2002, 14 species of Aloes of Malawi were listed on the SABONET Red Data List. Five species were listed as critically endangered, two species endangered and seven species vulnerable. In the Republic of South Africa, Aloes are protected by environmental legislation in all the provinces. It is therefore illegal to remove Aloes from their natural habitats, unless one is in possession of a collecting permit issued by a provincial nature conservation authority and has the consent of the land owner (van Wyk and Smith, 1996). According to Newton (1994), reports of commercial exploitation of wild Aloes in Kenya for medicinal purposes led to their being declared protected species in November, 1996, with a call to establish plantations for commercial use.

1.3 PROBLEM STATEMENT

1.3.1 Distribution

No detailed studies specifically on distribution of Aloes of Malawi has been done. Major studies done on Aloes in Malawi by Reynolds (1954) and Lane (2004) focused on

taxonomy. Even though their studies include some citation of specimens for each species, they do not provide a detailed survey of the specimens' distribution. Other studies done by Reynolds (1966) and Carter (2001) also focused on taxonomy. Both studies covered large areas of Tropical Africa and Madagascar (Reynolds, 1966) and the Flora Zambesiaca area (Carter, 2001), such that it was not possible to carry out a detailed study of the distribution in Malawi. Therefore, further investigation was needed in Malawi. Furthermore, the locations in all these studies were not geo-referenced. According to Poole (1995), geo-referencing refers to the identification of any piece of information by its geographic coordinates.

1.3.2 Ethnobotany

No major study has been done and a detailed investigation is, therefore, required to document the uses of Aloes for the development of appropriate conservation measures. Lane (2004) has given a few records on uses of some Aloes of Malawi but it is scanty and not systematic.

1.3.3 Conservation Measures

No conservation measures specifically for Aloes have been formulated in Malawi since *Aloe* species of Malawi are threatened. There is no existence of any policy in the country for utilization of Aloes other than the CITES. According to Government of Malawi (2001), Aloes are not among the protected species.

1.4 IMPORTANCE OF THE STUDY

1.4.1 Distribution

This study would help in identifying areas that are rich in Aloes in Malawi as well as rare species that would later be targeted for conservation. The coordinates and altitudes would also help in proper allocation of resources for conservation of the species when the resources are limited and do not allow the conservation of big areas and where the accurate identification of smaller areas for conservation is needed. In addition, data on the altitudes at which the species are collected help to assess the general environmental conditions in which each species grows. This information is important in *ex-situ* conservation for survival or good growth of the species.

1.4.2 Ethnobotany

For a developing country like Malawi, use of natural resources to promote socio-economic development is vital. Since Aloes are known to be of economic value, ethnobotanical study will provide a window for poverty alleviation. Some companies will start including Aloes of Malawi as additional ingredients in their products to improve the medicinal quality of the products as is done in some countries with *Aloe vera* L. Ethnobotanical study on Malawian Aloes will also provide a window for development of new drugs for other diseases. In Malawi, the history of traditional healing is difficult to trace because knowledge of the medicinal plants use and the art of practice are not documented and are handed down from the elders to their children by word of mouth (Mwanyambo and Nihero, 1998). So, this study was carried out to document uses of Aloes for future reference.

1.4.3 Conservation Measures

Since *Aloe* species of Malawi have been listed in Appendix II of CITES and that according to Seyani (1990), Aloes of Malawi are traditionally utilized for medicines and that there is a threat of extinction due to loss of habitats, this study should be carried out to formulate conservation measures of these plants. In addition, Malawi being a signatory to Convention on Biological Diversity (CBD) that aims at conservation and sustainable utilization of biological diversity (The Secretariat of the Convention on Biological Diversity, 2003), it is necessary that this study be carried out to formulate conservation measures of Aloes of Malawi.

1.5 OBJECTIVES

1.5.1 General Objective

The general objective of this study was to investigate the distribution, ethnobotany (local uses) and formulate conservation measures of Aloes of Malawi.

1.5.2 Specific Objectives

- a) To map out the distribution and determine altitudinal range of *Aloe* species of Malawi.
- b) To determine the habitat preferences (soil and vegetation types)
- c) To assess areas that are rich in Aloes in Malawi
- d) To investigate how Aloes are utilized in Malawi
- e) To formulate conservation measures of *Aloe* species of Malawi

CHAPTER TWO

LITERATURE REVIEW

2.1 TAXONOMY

The family Aloaceae was up to 1981 most often included in the family Liliaceae (Cronquist, 1981). Cronquist (1981) reappraised the family Aloaceae, which was first given family status by the German botanist J.G.C. Batch (Smith and Steyn, 2004). Later, the genus *Aloe* and closely related genera were placed in the family Asphodelaceae (Dahlgren and Clifford, 1982; Dahlgren *et al.*, 1985). Smith and Steyn (2004) preferred to keep Aloaceae as a separate family. As Aloaceae is regarded as a separate family in modern Eastern and Southern African floras, the preference in this study is also to refer the genus *Aloe* to the family Aloaceae. The family Aloaceae constitutes 550 species in seven genera (*Aloe* Linnaeus, *Gasteria* Duval, *Haworthia* Duval, *Lomatophyllum* Willdenow, *Chortolirion* A. Berger, *Poellnitzia* Uitewaal and *Astroloba* Uitewaal). The genus *Aloe* L. is by far the largest in the family Aloaceae (Smith *et al.*, 2000) and it constitutes over 350 species.

2.2 GEOGRAPHIC DISTRIBUTION

Aloes are mainly found in Africa, Arabia and Madagascar (Grantham and Klaassen, 1999; White *et al.*, 2001) with a distribution ranging from the Arabian Peninsula and Socotra throughout the African continent. There are about 250 species on the African mainland chiefly on the eastern side. In southern Africa, there are about 119 indigenous species

(Court, 1981; Barkhuizen, 1978; Glen and Hardy, 2000), 53 species are within the Flora Zambesiaca area, with numerous endemic species concentrated especially in the Eastern Highlands border region between Zimbabwe and Mozambique (Carter, 2001; White *et al.*, 2001). In Malawi, Reynolds (1954) and Carter (2001) recognized 15 species while Lane (2004) recognized 20 species. The differences are due to discovery of new species and revision of names.

Aloes are xerophytes with structural and physiological adaptations for survival in arid regions. All *Aloe* species are perennial and leaf-succulent xerophytes. They occupy many different kinds of habitats, from forest to exposed rock surfaces, but are absent from the moist lowland forests of mainland Africa (Newton, 2004). *Aloes* may either be stemless or may have very short stems that are completely hidden by the leaves. *Aloes* may also have stems that may grow to several meters. In some species the leaves may be arranged in rosettes that are basal or apical. In other species, leaves may be spaced out along the stems. Some species occur as solitary while others sucker from the base to form clumps. Flowers are produced on racemose inflorescences, which may be either simple or paniculate (Newton, 2004; Jackson, 1977; Sajeva and Costanzo, 1995; Carter, 2001; White *et al.*, 2001). The name *Aloe* comes from the Arabic ‘alloeh’ which means bitter and shiny substance (Jackson, 1977; Krymow, 2002).

Plant distribution is affected by a number of factors, but the most important are climate, land use, habitat, soil type and nutrients, competition among plants, dispersal ability and genetic factors. These factors mostly do not work in isolation, they interact. However, the major factor affecting distribution is climate. Climate affects different species in different

ways. The most important climatic factors are temperature and precipitation. Other climatic variables include day length, light intensity, humidity and wind speed.

2.3 ETHNOBOTANY

WHO, IUCN and WWF, (1993), noted that ethnobotany has great potential to provide new and useful plant products for the benefit of the world. Many of the plant extracts used in western medicine were discovered through their uses in traditional societies, though not necessarily for the same purpose. In addition, WHO, IUCN and WWF (1993) and Plotkin (1988), also noted that as many as 80% of the world's people depend on traditional medicine for their primary health care needs.

2.3.1 Medicinal Value

Aloes are socio-economically important because their juice has been used medicinally for centuries, in ancient times as well as in the modern times. It was believed that it is a plant that Adam and Eve brought from the Garden of Eden, and it is found on the wall carvings of ancient Egyptians (Hargreaves and Hargreaves, 1972). Egyptian records of 550BC indicate use of Aloes for skin infections. Mesopotamian clay tablets from 1750BC also reveal the use of *Aloe vera* for medicinal purposes (Krymow, 2002). Aloes have also been mentioned in the Bible that they were used by the Jews to preserve the body, to make it fragrant and to express affection for the deceased (Krymow, 2002). Alexander the Great conquered the island of Socotra to gain control over the main supply of aloetic medicine (van Wyk and Smith, 1996). Morton (1977), Swerdlow (2000), Lewis and Elvin-Lewis (1977), and Grantham & Klaassen (1999) noted that the peeled fresh gel is applied to inflamed eyes and on all kinds of skin inflammations, sores and burns. The pulp is taken

internally to relieve sore-throat, ulcers and intestinal ailments. Furthermore, Krymow (2002) noted that Aloes are also used in the treatment of asthma, digestive disorders, immune system deficiency and cancer. However, Morton (1977) warned that Aloes are dangerous in pregnancy and in individuals afflicted with hemorrhoids because they may cause kidney irritation. Morton (1977) also noted that other Aloes including *Aloe vera* are added in cosmetics, such as, in creams, lotions and ointments for softening, soothing or moisturizing the skin. In addition, according to Hargreaves and Hargreaves (1972), Aloes are hung over houses to drive away bad spirits.

Mnimh (1996), Simpson and Ogorzaly (2001) and Skousen (1982) noted that some of the healing agents of the world are produced from *Aloe vera* and this species has been prescribed since ancient Greek times for a long list of disorders, which include skin problems such as burns caused by fire, grazers, scalds, sunburn, ringworm and venereal sores. Some cosmetic firms add *Aloe vera* to their products such as moisturizers, cleansers, face-lifts because it improves skin beauty. In addition, *Aloe vera* is used in the treatment of ulcers and bowel syndrome. According to Watt and Breyer–Brandwijk (1962), the Zulu administer a decoction of the leaf of *Aloe arborescens* Mill. to a woman just before parturition in order to assist the process. Furthermore, the fresh leaf of *Aloe ferox* Mill. is used in West Africa as a remedy for ophthalmia and syphilis.

In Malawi, a foreign species, *Aloe vera* is cultivated and used as the remedy for some problems resulting from AIDS, such as abdominal pains, skin rashes, sores and itching (Government of Malawi, 1998). According to Lane (2004), some Malawian species such as *Aloe chabaudii* Schönland, *Aloe swynnertonii* Rendle, *Aloe menyharthii* Baker, *Aloe*

christian Reynolds, *Aloe cryptopoda* Baker, *Aloe duckeri* Christian, *Aloe mawii* Christian and *Aloe arborescens* Mill. are utilized as medicines. The uses include treatment for impotence, infertility, toothache, sexually transmitted diseases, snake bites and newcastle disease in chickens.

2.3.2 Food Value

In South Africa, the nectar from flowers of *Aloe ferox* is used as food for Xhosa children. Peters *et al.* (1992) noted that raw leaves and flowers of *Aloe zebrina* Bak. are used for food in the sub-Saharan Africa. The boiled flower of *Aloe zebrina* is pressed into a cake and used as sweetmeat (Watt and Breyer–Brandwijk, 1962). In Malawi, according to Lane (2004), the flowers of spotted Aloes are mixed with okra as relish at Madziabango in Blantyre and along Mkurumadzi River in Mwanza.

2.3.3 Ornamental Value

Aloes have been cultivated as ornamentals for a long time. The utilization as ornamentals is well documented by Van Wyk (2000), Pienaar (2000) and Pooley (1998). According to Bolnick (1995), Aloes are grown in many homes as ornamentals in Zimbabwe because of scarcity in the wild due to over collection by horticulturists. One example is *Aloe chabaudii* that now is protected by national legislation in Zimbabwe. Kinyua *et al.* (1997) stated that farming practices in most areas of Kenya, incorporate medicinal plants as ornamentals and Aloes are included. Aloes are also grown as ornamentals in Malawi and this has been observed in many homes, offices and hotels.

2.4 CONSERVATION

Any database on the conservation of medicinal plants should include not only the names of the plants but also their distribution in nature, how rare or abundant they are, and where cultivated stocks or their seed might be found (Synge and Heywood, 1988). Many Aloes are regarded as endangered species and the threats that exist fall into the three main categories of overcollection of plants for cultivation, destruction of plants in harvesting leaf exudates and destruction of natural habitats (Reynolds, 2004). Some species of Madagascar and Republic of South Africa are overcollected by people supplying the nursery trade. There is also some trade in leaf exudates, required mainly for medicinal and cosmetic purposes, and these are frequently harvested from wild plants. Reynolds (2004) noted that in the Republic of South Africa ‘Aloe tapping’ is a well established industry that has been operating for over 200 years and the main species used is *Aloe ferox*. In contrast, the harvesting of leaf exudates is more recent in Kenya, with local people being paid by foreigners without considering sustainability. With no traditional or other controls in place, various species are harvested regardless of chemical composition and this leads to destruction of populations.

One problem in the destruction of habitats is overgrazing. Reynolds (2004) noted that many people in arid areas have herds of domestic animals in large numbers far greater than the carrying capacity of the land, and the land becomes increasingly denuded of vegetation. Furthermore, the continued expansion of human population in some areas is forcing people to move into arid areas where many Aloes occur.

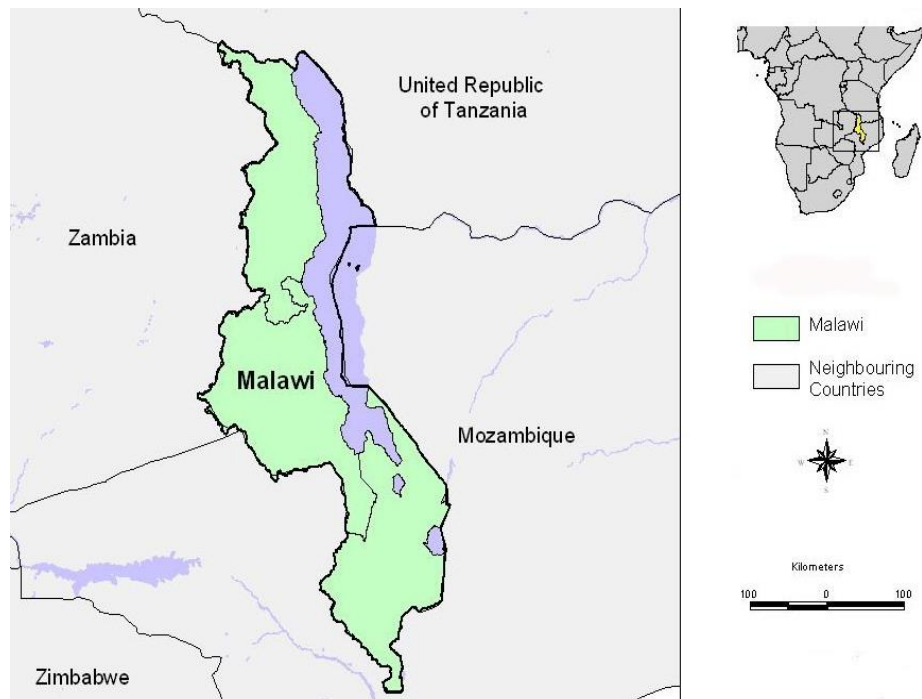
According to Reynolds (2004), attempts to protect Aloes have been made at two levels; national and international. At international level, many countries have signed various agreements on the conservation of biodiversity. Unfortunately, enforcement of the legislation is poor in most African countries because of lack of enforcement personnel and a need to concentrate on solving economic and social problems. Only the Republic of South Africa has strong enforcement activity although some illegal practices are also known to occur. Reynolds (2004) also noted that the most effective protection attempt at the international level is provided by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) that started in 1976. This convention aims at controlling the movement of endangered species and derivatives between countries, prohibiting trade in some species listed in Appendix I, and requiring official documentation for numerous species listed in Appendix II. Reynolds (2004) added that currently, 22 species of Aloe (mostly in Madagascar) are listed in Appendix I and the rest are in Appendix II, except *Aloe vera*, which is free of restrictions.

CHAPTER THREE

STUDY AREA, RESEARCH DESIGN AND METHODOLOGY

3.1 STUDY AREA

This study took place in Malawi. The country is in Southern Africa, south of equator, between latitude 9°45' and 17°16' South and between longitude 33°00' and 36°00' East (Government of Malawi, 1995). Malawi is a land-locked country sharing borders with Tanzania to the north and north-east, Mozambique to the east, south and south-west, and Zambia to the west and north-west (Figure 3.1).



Source: GIS Data, Bunda College of Agriculture

Figure 3.1: Map of Malawi Showing its Neighboring Countries

The country is 900 km long from north to south, 80-200 km wide, with a land area of 118,484 km² (Government of Malawi, 1995) and it is divided into three administrative regions; South, Central and Northern Regions, which are further subdivided into 28 districts. Most of the land, north of 14°30'S is occupied by the Central African peneplain at 1000-1100 m, above which isolated hills and several high plateaux rise to 1500-2400 m, for example, Nyika Plateau (2606 m), North Vipya Plateau (2058 m), South Vipya Plateau (1954 m) and Dedza Mountain (2198 m). South of the lake peneplain lies both lower (500-600 m) and highland areas with peaks in the Shire highlands rising to 2085 m (Zomba) and in the southeast to 3002 m (Mulanje) being the highest mountain in south-central Africa (Dowsett-Lemaire, 2001).

The climate of Malawi is continental in character with a large seasonal variation in temperature. The climate is sub-humid with average temperatures mostly ranging from 14°C to 23°C on high elevation areas and 30°C to 37°C along lakeshore and the Shire valley. Malawi has two main seasons, the dry season (May - September) and rainy season (October - April) with rainfall between 635 mm to 3050 mm with low rainfall in low lying areas and high rainfall on high altitude and plateau areas (Government of Malawi, 1995; Chapman and White, 1969).

The most soils in Malawi are leached soils that cover extensive woodlands, wooded grasslands and grasslands that lie between 1100 m and 1400 m above the sea level. These

soils have been classified as ferralitic, ferruginous, ferrisols and lithosols (Mwanyambo and Nihero, 1998; Government of Malawi, 1995; Chapman and White, 1969).

Malawi contains various vegetation types dependent on the varying altitude, rainfall pattern, soil types and locations on which they grow. Such vegetation types include lowland rain forests, montane and sub-montane rain forest, dry evergreen forests, wooded grasslands, wooded farmlands and swamp forests (Government of Malawi, 1995). However, the Miombo-Brachystegia woodlands dominate most areas of Malawi (Chapman and White, 1969). Recent trends showed that most of the main vegetation types are fragmented and small. The contributing factor to the decrease in the vegetation area is deforestation due to high population, overdependence on subsistence agriculture and fuelwood resource for energy and income. Most of the forest reserves, wildlife reserves and national parks are fairly protected but some suffer heavy poaching for wood resources (Government of Malawi, 1995). The vegetation of Malawi comprises an estimated 5,500–6,000 plant species (Msekandiana and Mlangeni, 2002).

3.2 RESEARCH DESIGN AND METHODOLOGY

Data for both distribution and ethnobotany were collected during the same fieldwork trip. Each field trip was for two weeks, one week for collecting distribution data and the other week for ethnobotany data collection due to limited time (one year) given for this research. Field work was conducted for six months (February to July, 2005) during flowering period of *Aloes* for easy spotting and identification and 22 districts were visited.

3.2.1 Distribution

The coordinates of the occurrences of *Aloes* were derived from literature (Reynolds (1954), (1966), Carter (2001), and Lane (2004)), records from herbarium specimens and fieldwork for this study. Eighty seven sample points were used from herbarium records while one hundred and ten were used from fieldwork records. Sampling in fieldwork was done because records from herbarium and literature were not adequate. During fieldwork, emphasis was put on areas that were identified as under-collected based on the herbarium records and literature from Reynolds (1954), (1966), Carter (2001) and Lane (2004). Where the data was not geo-referenced, which mostly was the case for locations found in the literature, Flora Zambesiaca list of collecting locations in Malawi by Pope (1992) and the National Atlas of Malawi were used to find the coordinates. Occurrences that were very old were not revisited because the period that was provided to carry out this study (one year) was not adequate. The Global Positioning System (GPS), Magellan 315 (by Magellan Satellite Access Technology Company of China) was used to find the coordinates during fieldwork.

3.2.2 Collection and Identification

Twenty eight plant specimens of *Aloes* that were found flowering or fruiting were collected from 22 districts during fieldwork for the herbarium. Flowering or fruiting parts and leaves were collected and pressed using plant presses. The *Aloe* specimens were taken to the herbarium, dried using drying boxes, frozen to kill insects, mounted on sheets of paper, identified and kept in the herbarium. Twenty one *Aloe* specimens were identified by the researcher in the field and seven specimens were taken to the herbarium to be

identified using the stored specimens in the herbarium with the help of the technicians because they could not be identified in the field.

3.2.3 Determination of Altitudes

The altitudes of collection sites for each species were obtained from herbarium data and fieldwork where GPS was used. Some altitudes from Reynolds (1966) and Lane (2004) have also been used. 80% of altitude data was derived from herbarium records while 20% was taken from Reynolds (1966) and Lane (2004) because their recorded data was little.

3.2.4 Habitats

The habitat was recorded for each species together with coordinates and altitudes during fieldwork. During fieldwork, description of the habitats was based on soil and vegetation types. No formal soil tests were conducted due to limited time provided for this study. So, in this study, the soil type was determined from observation of soil texture. Vegetation type was determined by means of noting species composition by considering dominant species of a particular area. Some of the habitat records were derived from herbarium records.

3.2.5 Areas Rich in Aloes

In this study, areas rich in Aloes have been determined by species richness (number of species). Species richness is recommended as a measure of biodiversity by Gaston and Spicer (2004). In this study, number of species per district that were derived from the produced distribution maps was used. Measures of biodiversity are commonly used as bases for making decisions about conservation action. In this study, areas (districts)

containing more than 65% of the species were regarded as rich areas (Gaston and Spicer, 2004).

3.2.6 Ethnobotany

Participatory Rural Appraisal (PRA) and questionnaires were used to obtain the information on local uses. Questionnaires were administered for personal detailed responses while PRA enabled participants to express and share information through brainstorming since some questions required perceptions and views from a group of people.

3.2.6.1 Participatory Rural Appraisal (PRA)

A total of 172 people were involved in 10 PRA meetings. Three meetings each were conducted in the Northern (T.A. Chikulamayembe, Rumphi; T.A. Mtwalo, Mzimba and Nthalire, Chitipa) and Central Regions (T.A. Kalumo, Ntchisi; T.A. Kamenyagwaza, Dedza and T.A. Chadza, Lilongwe) while four were conducted in the Southern Region (T.A. Changata, Thyolo; T.A. Nthache, Mwanza; T.A. Mabuka, Mulanje and T.A. Chikpwi, Zomba). Choice of PRA meeting areas was based on number of species that existed in a particular area. Areas that contained more than two species were targeted in order to get information of more than two species from one meeting since research period was limited. Men and boys, women and girls discussed separately because some responses were gender sensitive. There were specific uses that were carried out by men or women and would not want the other sex to know and could not be discussed in the presence of both sexes.

All these meetings were conducted in rural areas because it was difficult to converge people in urban areas where people are pre-occupied with their businesses. Before the meeting, some interviewees were taken into the field on a transect walk to show interviewers the species of *Aloe* that were to be talked about for identification and use. A sample of the species was collected to show the other members. If the species could not be identified in the field, it was collected and pressed to be identified at the herbarium with the help of technicians.

The discussions included information on the importance of Aloes in their area, collecting methods, pressures on Aloes in their area and their views on conservation (Appendix A).

3.2.6.2 Questionnaires

Questions were individually produced based on objectives of this study. Questionnaires were administered to people in rural and urban areas using detailed questions (Appendix B). One hundred and two people were interviewed using open-ended questions where the interviewer was reading out the questions. Of the 102 respondents, 75 were from rural areas while 27 were from urban areas because most respondents from urban areas were not familiar with Aloes. Questionnaire respondents were chosen at random. Administration of questionnaires stopped when five to ten respondents provided similar responses in a particular area. Questionnaire respondents went on a transect walk to show the interviewers the *Aloe* species that was talked about for identification as in PRA. If the species could not be identified in the field, it was collected and pressed to be identified at the herbarium with the help of technicians as in PRA.

The type of data that were assembled from the questionnaires were on medicinal use, preparation and dosage, economic value, sources of Aloes and conservation. Pretesting of questionnaires was conducted in Zomba, T.A. Chikowi area for effectiveness.

3.2.7 Conservation Measures

Conservation measures were formulated using information from questionnaire respondents, PRA meetings, literature and professional judgement.

3.2.8 Data Analysis

Known occurrences (latitudes and longitudes) of all *Aloe* species were mapped out by means of Geographical Information Systems (GIS) using Arc View 3.2 Program. Numbers of species per district were compiled manually to compare number of species per district before and after research to find areas rich in Aloes. Data for species number per district was explored and analyzed by Box-And-Whisker plot. Altitude data was analyzed manually by grouping them to form ranges.

Qualitative data from questionnaires was analyzed by content analysis where the information was coded by content. Information from PRA was analyzed manually by attaching it to similar information obtained from the questionnaires.

3.2.9 Scope and Limitations

The study investigated distribution, ethnobotany and conservation of Aloes of Malawi where altitudinal range, habitats and areas rich in Aloes were also assessed. The study would have visited very old occurrences of Aloes because of the problem of loss of habitats, but this could not be done because of the limited time (one year) that was

provided for this study. The study could as well have focused on a particular area for a detailed and effective assessment but this could not be done as well because of the interest of the donor.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 RESULTS

4.1.1 Distribution

Occurrences of known Aloes of Malawi (Appendix E) were mapped out before (Appendix F) and after (Appendix G) this study. Occurrences of species before, and after this study have been shown on one map for each species and using different symbols as follows;

4.1.1.1 Distribution of *Aloe duckeri*

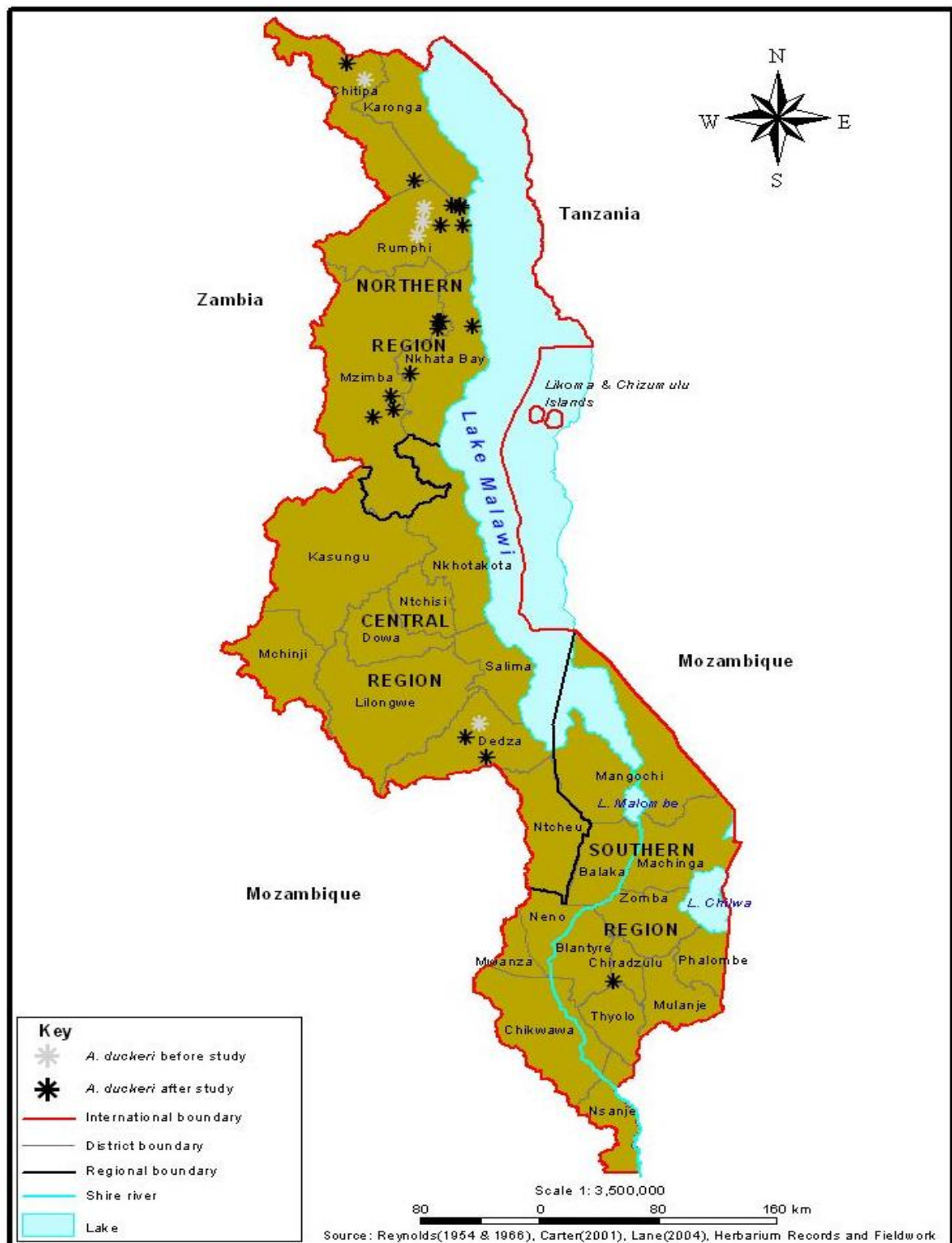


Figure 4.1: The Known Distribution of *A. duckeri* Before and After this Study

4.1.1.1.1 Distribution of *Aloe duckeri* Before this Study

Before this study, in the Northern Region of Malawi, *Aloe duckeri* was recorded in Chitipa district; in Nyika National Park, around Nganda, near Chilinda Rest House and northern part of the district. In Rumphi district, this species was recorded in the hills near Livingstonia Mission. In the Central Region, *Aloe duckeri* was recorded in Dedza district in Chongoni Forest Reserve (Reynolds, 1954, 1966, Carter, 2001, Lane, 2004) (Figure 4.1). In addition, this species was recorded in Mzimba district, on Vipya plateau, in the Northern Region and Thyolo district in the Southern Region, but these locations were not shown on Figure 4.1 because of lack of coordinates.

4.1.1.1.2 Distribution of *Aloe duckeri* After this Study

This study added 14 new occurrences of *Aloe duckeri* in Malawi. The recorded new occurrences were Kandoli Hills, Lwaniatonga in Nkhata Bay district, Mtangatanga Forest Reserve, Perekezi Forest Reserve and Lunyangwa in Mzimba district. In Rumphi district, this study recorded *Aloe duckeri* at South Rukuru River Bridge, Chippingawatu Village in Traditional Authority Mwalweni and on Chombe Mountain. In addition, this study found coordinates of this species in Thyolo district (Figure 4.1).

4.1.1.2 Distribution of *Aloe zebrina*

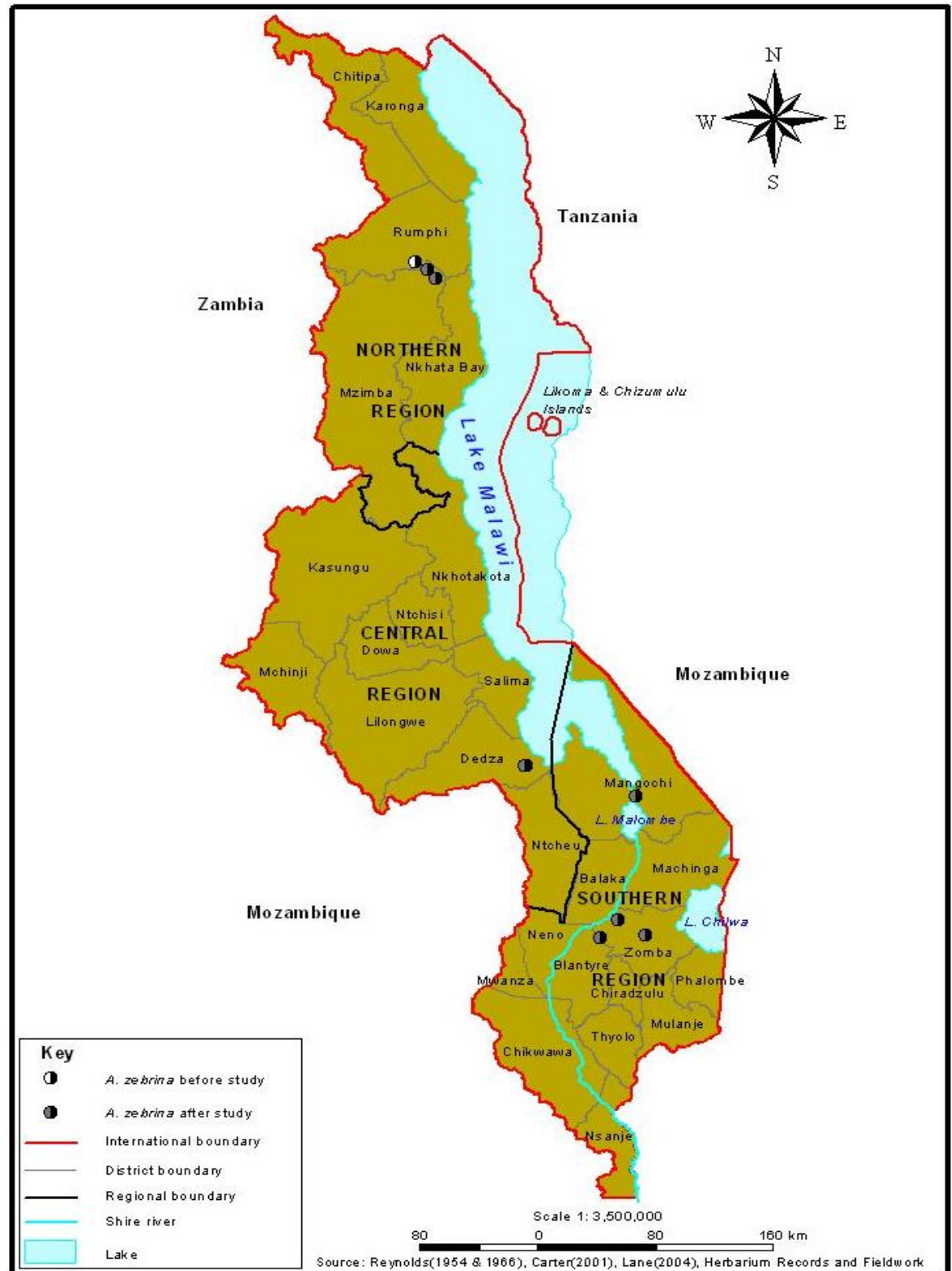


Figure 4.2: The Known Distribution of *A. zebrina* Before and After this Study

4.1.1.2.1 Distribution of *Aloe zebrina* Before this Study

Before this study, *Aloe zebrina* was recorded in Rumphi district, 11 Km from Rumphi on Livingstonia road, in the Northern Region of Malawi (Figure 4.2). Furthermore, *Aloe zebrina* was recorded in Zomba district in Namatunu Forest Reserve in the Southern Region (Reynolds, 1954, 1966, Carter, 2001, Lane, 2004) but the occurrence was not shown on Figure 4.2 because of lack of coordinates.

4.1.1.2.2 Distribution of *Aloe zebrina* After this Study

This study recorded seven new occurrences of *Aloe zebrina* in the Northern Region in Mzimba district at Thumbi Primary School ground. In the Central Region, this study recorded this species in Dedza district in Mua–Tsanya Forest Reserve. In addition, this study recorded *Aloe zebrina* in Mangochi district between airfield and secondary school in the Southern Region (Figure 4.2). This study also found coordinates of this species in Zomba district (Figure 4.2).

4.1.1.3 Distribution of *Aloe christianii*

4.1.1.3.1 Distribution of *Aloe christianii* Before this Study

Before this study, *Aloe christianii* was recorded at Fort Lister, at the foot of Mulanje Mountain and Thyolo district (Figure 4.3) in the Southern Region of Malawi. Furthermore, *Aloe christianii* was recorded at 99 Km north of Rumphi in the Northern Region, at 29 Km southeast of Dedza district, Salima district, areas between Lilongwe and Nkhosakota and between Ntcheu and Dedza districts in the Central Region. In the Southern Region, *Aloe christianii* was noted in Zomba and eight Kilometers south of Thyolo district (Reynolds, 1954, 1966, Carter, 2001, Lane, 2004). The locations in Mulanje and Thyolo were shown on Figure 4.3 and the rest of the locations were not shown due to lack of coordinates.

4.1.1.3.2 Distribution of *Aloe christianii* After this Study

This study recorded 30 new occurrences of *Aloe christianii* in the Northern Region of Malawi in Nthali, Wenya, Chisenga, Ipenza, Kameme, and along Lufita River in Chitipa district Figure 4.3. In addition, this species was noted along Chitipa–Karonga road. In Karonga district, this species was recorded around North Rukuru Bridge, along Uliwa–Wovwe road and on Mwale Hill in Mdeka Village. Furthermore, *Aloe christianii* was noted in some areas of Mzimba district (Figure 4.3).

In the Central Region, this study recorded *Aloe christianii* in Ntcheu district in the Kirk Range, Lefani and Chikhamwazi Villages in Traditional Authorities Masasa and Njolomole respectively. In Mchinji district, this species was recorded in Nyamawende and Tikoliwe Villages in Traditional Authorities Zulu and Mulonyeni respectively (Figure 4.3).

In the Southern Region, this species was recorded in Machinga district in Liwonde Forest Reserve, Mwanza district in Thambani Forest Reserve and Gonamwaki Village, Traditional Authority Nthache in Mwanza district. In addition, this study recorded *Aloe christianii* in Mwamunammodzi Village in Blantyre and in Njuli area in Chiradzulu district (Figure 4.3). Furthermore, this study found coordinates of this species in Rumphu, Dedza and Zomba districts. In Rumphu, the coordinates were taken along the Rumphu–Chitipa road and Nyika National Park road while in Dedza the coordinates were taken in Chongoni Forest Reserve, between Lizulu and Bembeke, between chimbiya and Linthipe, between Kasina and Nkhoma Missions at Nachikunga Village and along Masasa–Golomoti Road. In Zomba, the coordinates were taken in Malosa Forest Reserve, as well as in Ulumba and Mwinje Hills (Figure 4.3).

4.1.1.4 Distribution of *Aloe menyharthii*

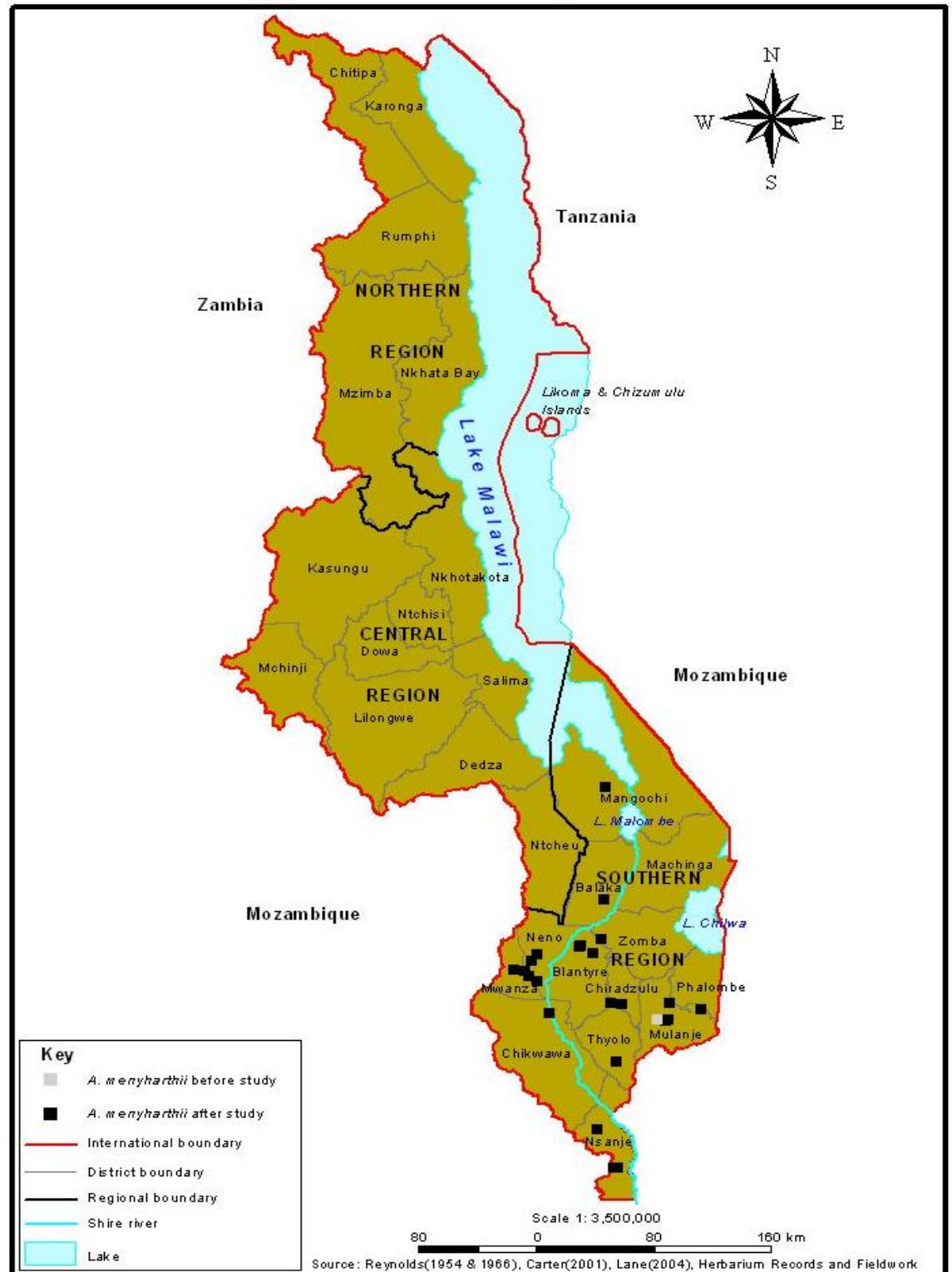


Figure 4.4: The Known Distribution of *A. menyarthii* Before and After this Study

4.1.1.4.1 Distribution of *Aloe menyharthii* Before this Study

Before this study, *Aloe menyharthii* was recorded at Likhubula, at the foot of Mulanje Mountain in Mulanje district (Figure 4.4). In addition, *Aloe menyharthii* was recorded in Mwanza district, 40 Km west of Blantyre and 16 Km southeast of Mpatamanga Gorge (Reynolds, 1954, 1966, Carter, 2001, Lane, 2004). These locations have not been shown on Figure 4.4 due to lack of coordinates.

4.1.1.4.2 Distribution of *Aloe menyharthii* After this Study

This study recorded *Aloe menyharthii* in Chiradzulu district in Mikolongwe area at the foot of Malowa Hill, Thyolo in Kalulu Forest Reserve and Nsanje in Mchacha and Nyenyezi I Villages. In Chikwawa *Aloe menyharthii* was recorded along Shire River at Kapichira Falls, along the borders of Majete Wildlife Reserve (Figure 4.4). Furthermore, this species was recorded in Mwanza and Neno districts in the following areas: along Mwanza River, Gonamwaki and Magaletta Villages, around Makali Primary School and along the road to Feremu Village and Mpatamanga. In addition, this study noted *Aloe menyharthii* between Mdeka and Shire River in Traditional Authority Chigalu in Blantyre district (Figure 4.4).

4.1.1.5 Distribution of *Aloe cameronii*

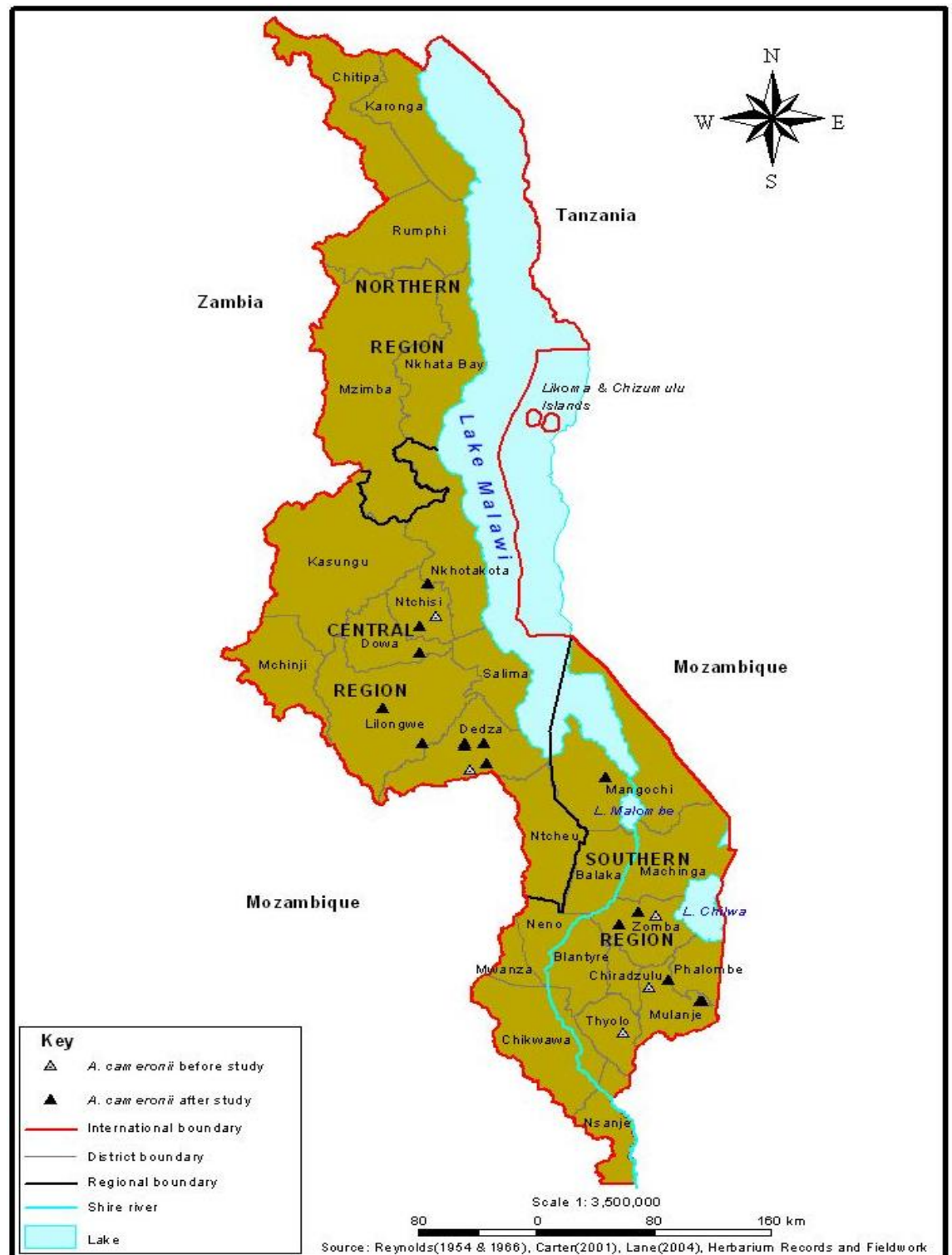


Figure 4.5: The Known Distribution of *A. cameronii* Before and After Study

4.1.1.5.1 Distribution of *Aloe cameronii* Before this study

Before this study, *Aloe cameronii* was recorded in the five districts of the Central and Southern Regions of Malawi in the following areas: Ntchisi Mountain and Dedza mountain in the Central Region; Zomba district at Namadidi; east of Sombani bridge on Mulanje Mountain; and Thyolo district in the Southern Region (Figure 4.5). In addition, *Aloe cameronii* was recorded on Lilongwe–Kasungu road, 48 Km north of Mangochi, and Blantyre district (Reynolds, 1954, 1966, Carter, 2001, Lane, 2004). These locations were not shown on Figure 4.5 because of lack of coordinates.

4.1.1.5.2 Distribution of *Aloe cameronii* After this study

This study recorded 13 new occurrences of *Aloe cameronii*. It is the first time that *Aloe cameronii* was recorded in Lilongwe at the foot of Ngala Hill in Traditional Authority Chadza and Dowa at Kongwe Mission at the river bank in the Central Region. In addition, this study recorded this species in Mangochi Forest Reserve in the Southern Region (Figure 4.5). Furthermore, this study recorded some more occurrences of this species in Dedza at Chongoni Forest Reserve, Ntchisi on Chenje Hills, Mulanje, Mangochi and Zomba (Figure 4.5).

4.1.1.6 Distribution of *Aloe chabaudii*

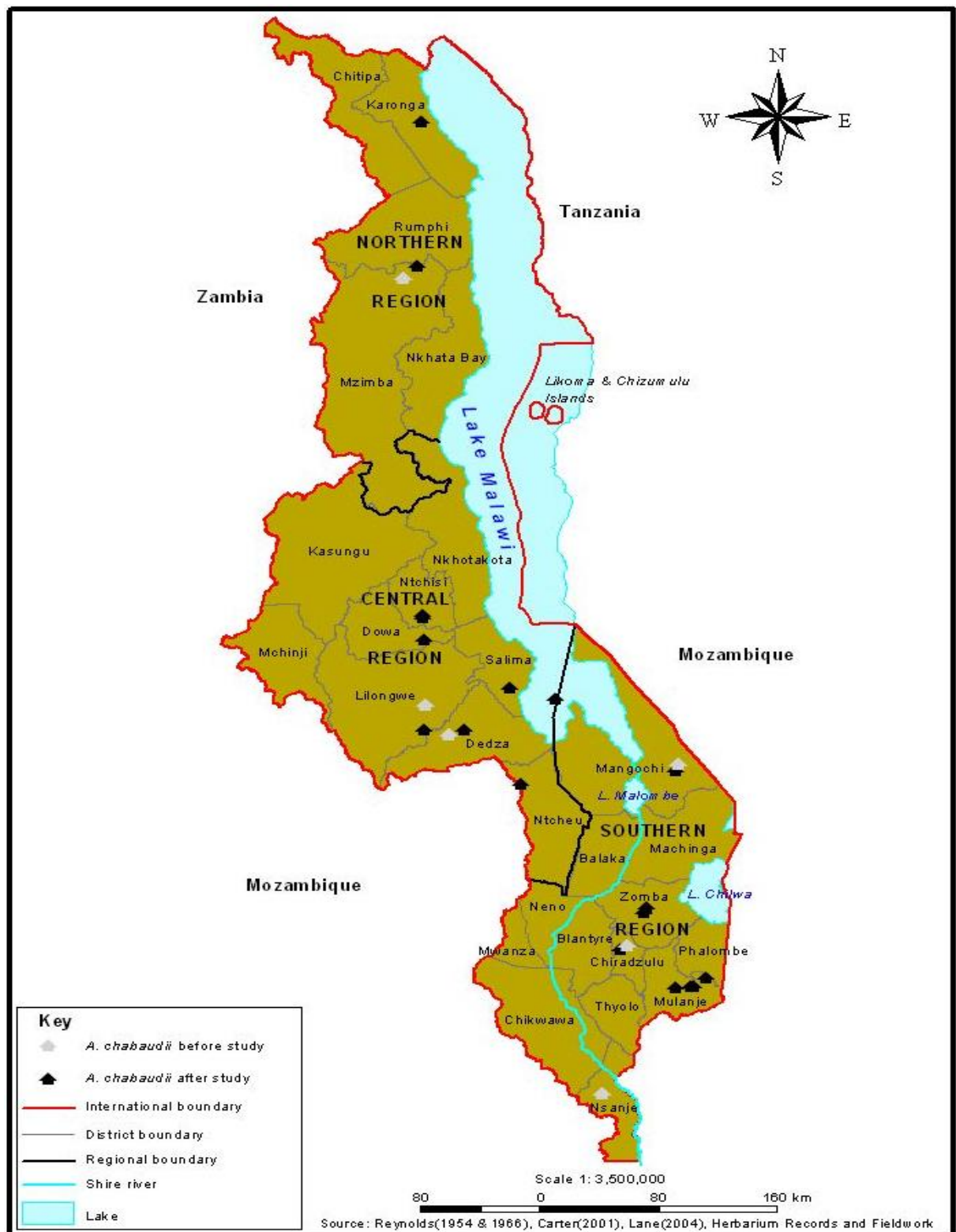


Figure 4.6: The Known Distribution of *A. chabaudii* Before and After Study

4.1.1.6.1 Distribution of *Aloe chabaudii* Before this Study

Before this study, *Aloe chabaudii* was recorded in all the three regions of Malawi. In the Northern Region, this species was recorded in Mzimba on Njakwa mountains while in the Central Region this species was recorded in Chongoni Forest Reserve in Dedza district. In the Southern Region *Aloe chabaudii* was noted in Mangochi Forest Reserve in Mangochi district, eight Kilometers west of Chiradzulu Mountain and on Mulanje Mountain (Figure 4.6). In addition, *Aloe chabaudii* was noted in Thyolo district at Nasonia Estate and Zomba district on Ntonya Hill in the Southern Region of Malawi (Reynolds, 1954, 1966, Carter, 2001, Lane, 2004). But these locations were not shown on Figure 4.6 because of lack of coordinates.

4.1.1.6.2 Distribution of *Aloe chabaudii* After this Study

This study noted 10 new occurrences of *Aloe chabaudii* in Ntcheu on Chilobwe Hill, Lilongwe in Mpombeza Village, Traditional Authority Chadza at a place called Mwala wa Simoko. In addition, this study recorded this species in Salima at Lifidzi, Dowa in Kongwe Forest Reserve and Ntchisi district on Chenje Hills (Figure 4.6). Furthermore, this study noted this species in Zomba on Ntonya and Chikanda Hills.

4.1.1.7 Distribution of *Aloe mzimbana*

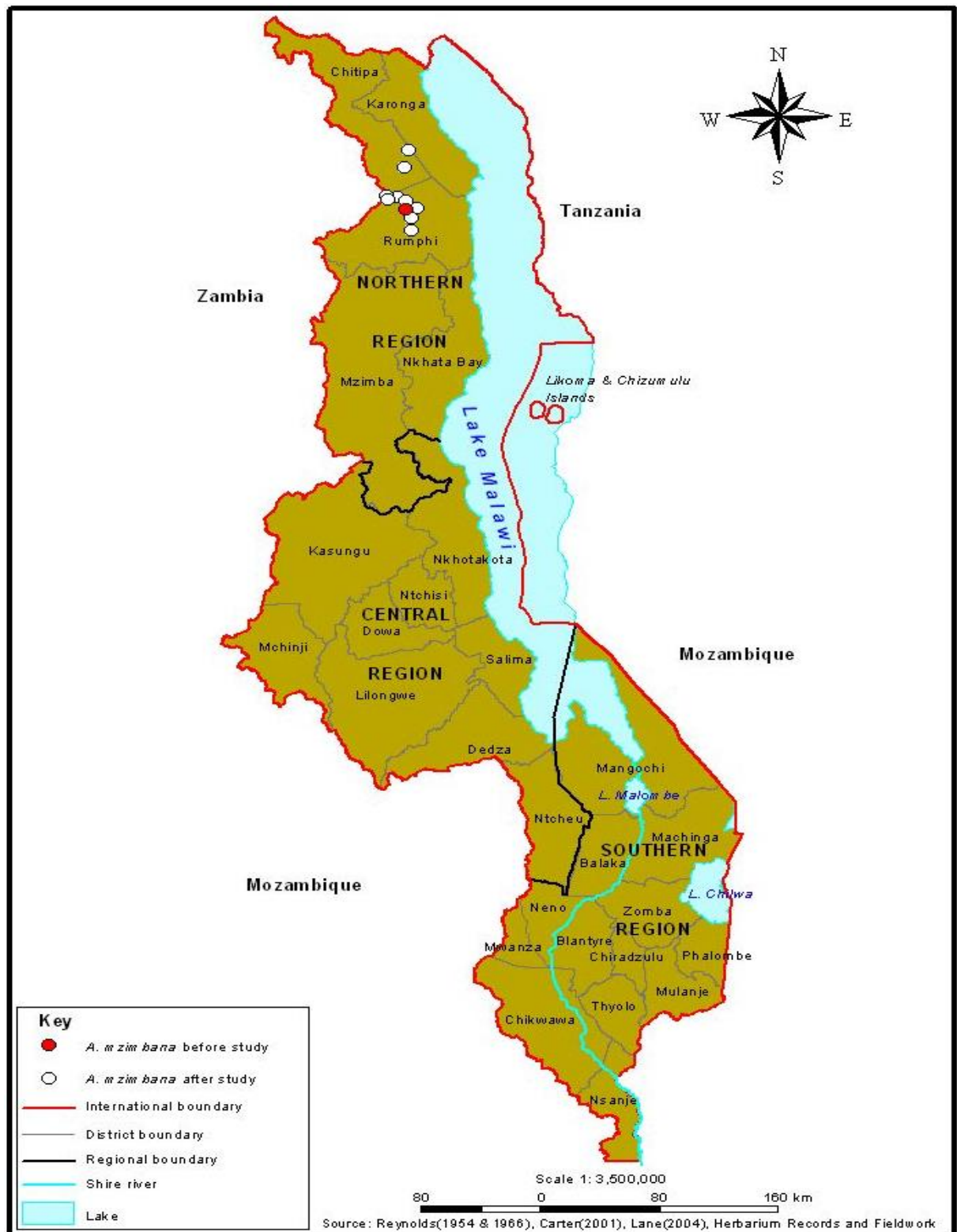


Figure 4.7: The Known Distribution of *A. mzimbana* Before and After Study

4.1.1.7.1 Distribution of *Aloe mzimbana* Before this Study

Before this study, *Aloe mzimbana* was noted in Nyika National Park, Rumphi district, in the Northern Region of Malawi (Figure 4.7). In addition, *Aloe mzimbana* was noted 30 Km north of Mzimba (Reynolds, 1954, 1966, Carter, 2001, Lane, 2004). But this location was not shown on Figure 4.7 because of lack of coordinates.

4.1.1.7.2 Distribution of *Aloe mzimbana* After this Study

This study added six new occurrences of *Aloe mzimbana* in Nyika National Park in Rumphi district. In Nyika National Park, the coordinates were taken at Chilinda Hill, Jalawe area, Chikomawanakazi and Chowo areas (Figure 4.7). It is the first time that this species was noted in Chitipa at the northern end of the Nyika National Park.

4.1.1.8 Distribution of *Aloe nuttii*

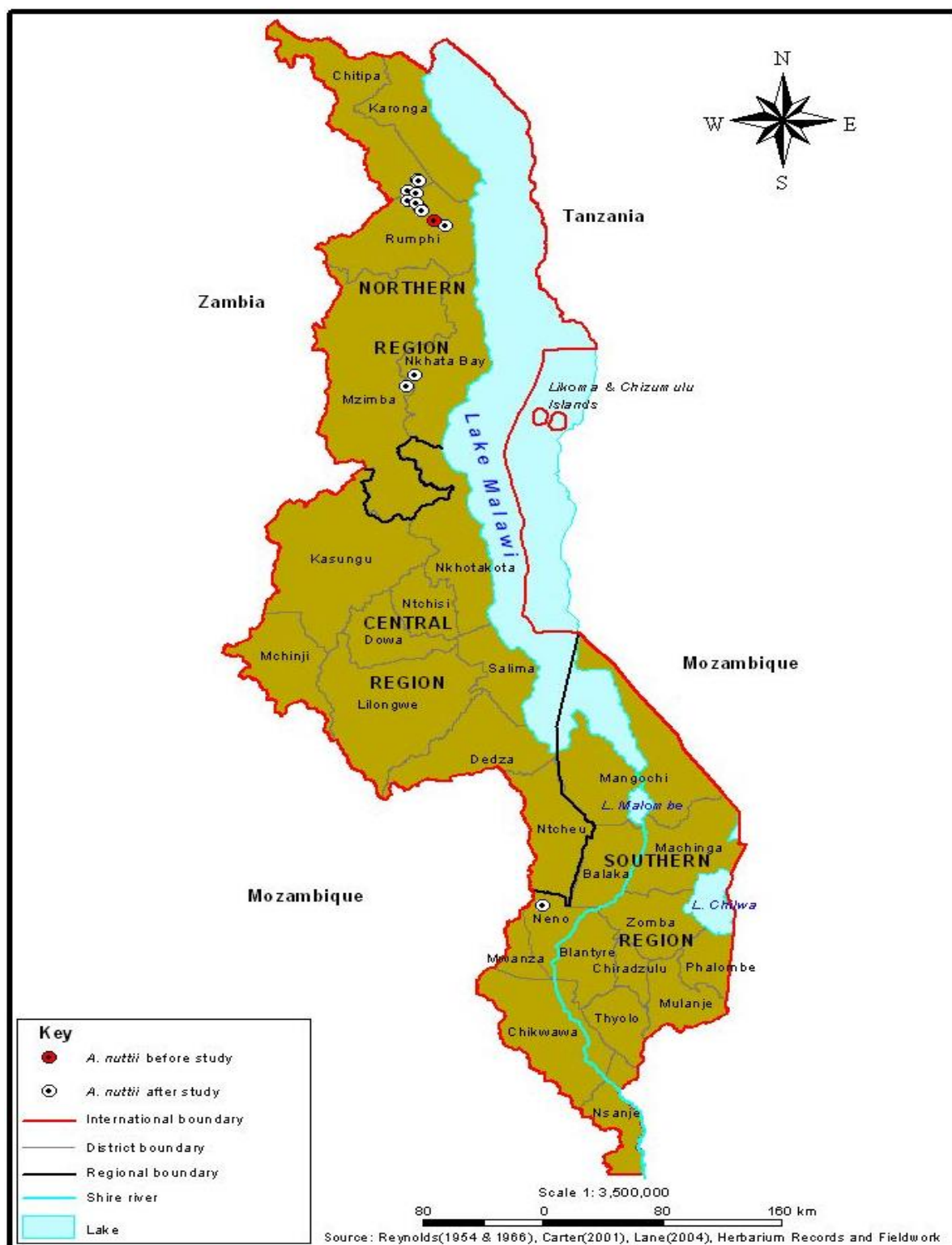


Figure 4.8: The Known Distribution of *A. nuttii* Before and After Study

4.1.1.8.1 Distribution of *Aloe nuttii* Before this Study

Before this study, *Aloe nuttii* was recorded in Rumphu district, in Nyika National Park (Figure 4.8). In addition, *Aloe nuttii* was noted near Dedza (Reynolds, 1954, 1966, Carter, 2001, Lane, 2004). But this location was not shown on Figure 4.8 due to lack of coordinates.

4.1.1.8.2 Distribution of *Aloe nuttii* After this Study

This study recorded *Aloe nuttii* on Nthalire Hills in Chitipa district and found other new locations of *Aloe nuttii* in Nyika National Park such as the base of Nganda Peak, Jalawe area and along the path to Chilinda Hill from Chilinda Camp (Figure 4.8). In Nkhata Bay district, *Aloe nuttii* was noted at Lwaniatonga area. In Mzimba district, this species was recorded at the southern end of Vipya Plateau. In the Southern Region of Malawi, *Aloe nuttii* was noted in Neno district, on Kirk Range, near Matandani Mission (Figure 4.8).

4.1.1.9 Distribution of *Aloe buettneri*

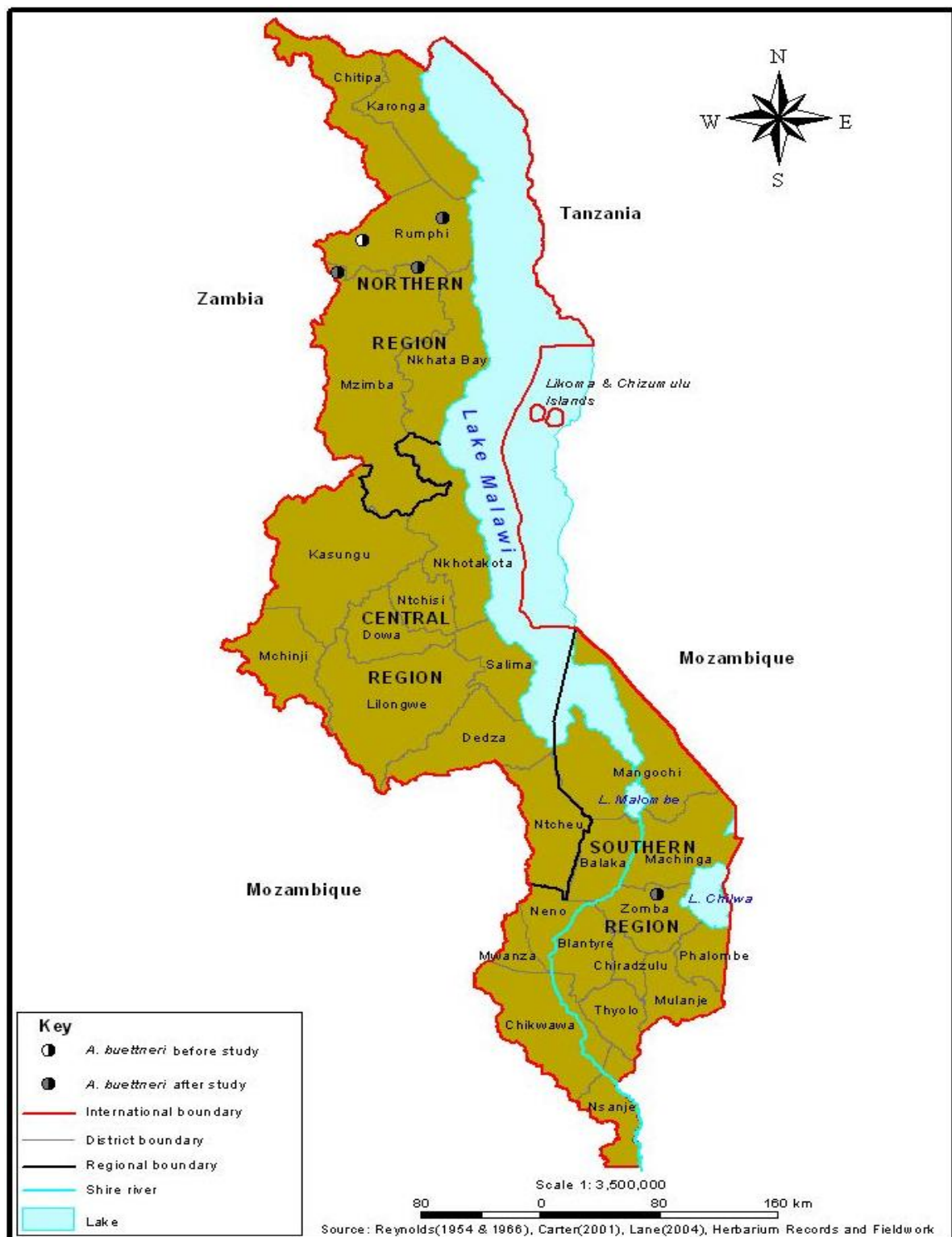


Figure 4.9: The Known Distribution of *A. buettneri* Before and After Study

4.1.1.9.1 Distribution of *Aloe buettneri* Before this Study

Before this study, *Aloe buettneri* was recorded in Vwaza Marsh in Rumphi district (Figure 4.9). In addition, this species was noted 60 Km north of Njakwa in Mzimba district (Reynolds, 1954, 1966, Carter, 2001, Lane, 2004) (Reynolds, 1954, 1966, Carter, 2001, Lane, 2004) but this location was not shown on Figure 4.9 because of lack of coordinates.

4.1.1.9.2 Distribution of *Aloe buettneri* After this Study

This study recorded *Aloe buettneri* in Zomba district in Domasi Valley in the Southern Region of Malawi. In addition, this study recorded coordinates of this species in Mzimba (Figure 4.9).

4.1.1.10 Distribution of *Aloe arborescens*

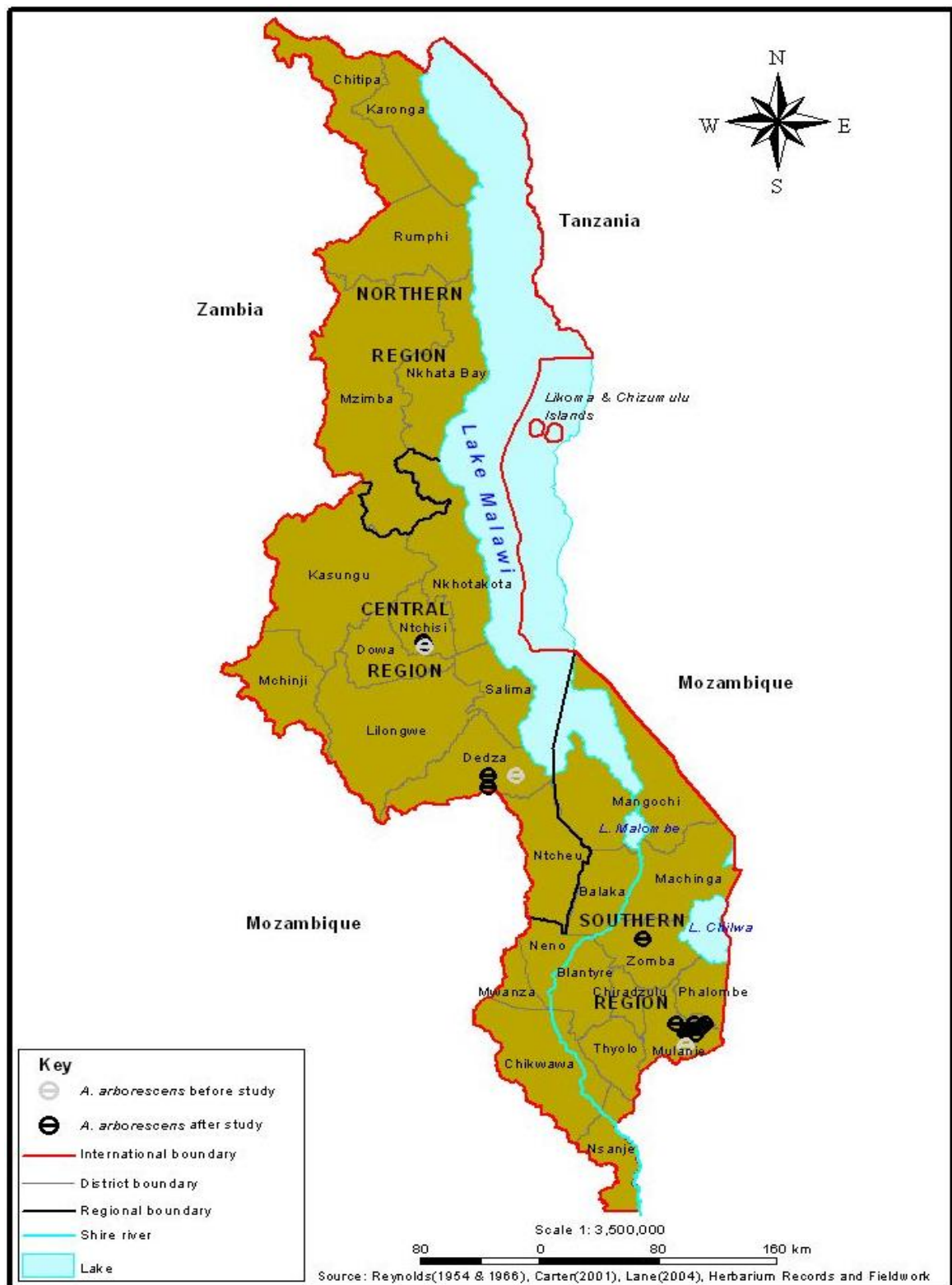


Figure 4.10: The Known Distribution of *A. arborescens* Before and After Study

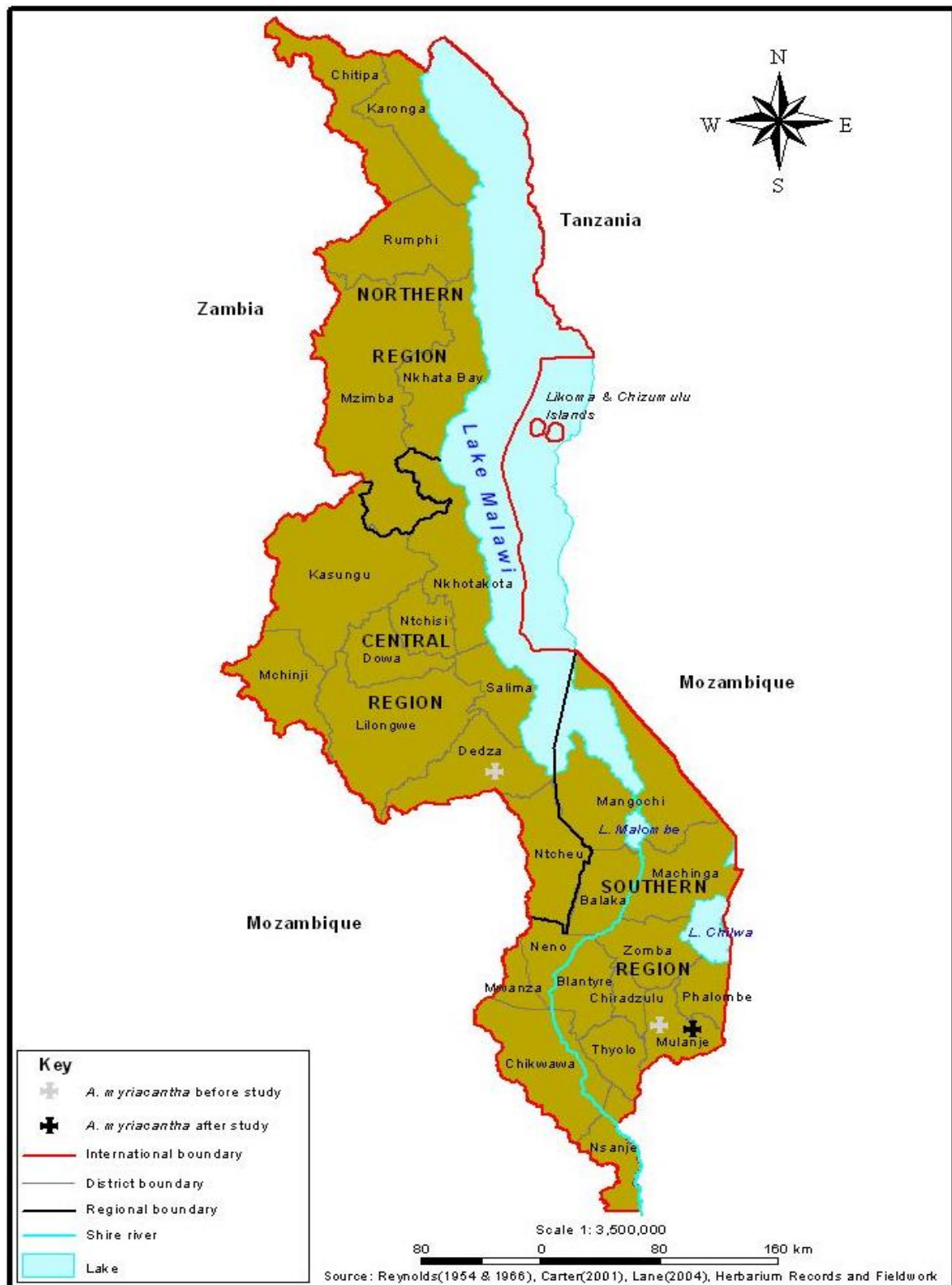
4.1.1.10.1 Distribution of *Aloe arborescens* Before this Study

Before this study, *Aloe arborescens* was noted in Ntchisi on Mwera Hills and Dedza on top of Dedza Mountain in the Central Region. In addition, this species was recorded on Mulanje Mountain in Mulanje district in the Southern Region (Reynolds, 1954, 1966, Carter, 2001, Lane, 2004) (Figure 4.10).

4.1.1.10.2 Distribution of *Aloe arborescens* After this Study

This study recorded three new occurrences of *Aloe arborescens* on Mulanje Mountain in the Southern Region of Malawi. These occurrences were Chisepu Shelter, between Thuchila and Chinzama, at the foot of Nandalanda Peak, Sombani Plateau, Chambe Plateau, at the foot of Sapitwa Peak and between Sombani and Chinzama (Figure 4.10). In addition, this study noted *Aloe arborescens* on Zomba Plateau in the Southern Region (Figure 4.10).

4.1.1.11 Distribution of *Aloe myriacantha*



4.1.1.11.1 Distribution of *Aloe myriacantha* Before this Study

Before this study, *Aloe myriacantha* was noted in Dedza district at Chongoni Forestry School campus in the Central Region and on Mulanje Mountain in the Southern Region of Malawi (Reynolds, 1954, 1966, Carter, 2001, Lane, 2004) (Figure 4.11).

4.1.1.11.2 Distribution of *Aloe myriacantha* After this Study

This study noted one new occurrences for *Aloe myriacantha* on Mulanje Mountain (Figure 4.11). Figure 4.11 shows that *Aloe myriacantha* is rare in Malawi, it was noted in two districts only in the Central and Southern Regions.

4.1.1.12 Distribution of *Aloe swynnertonii*

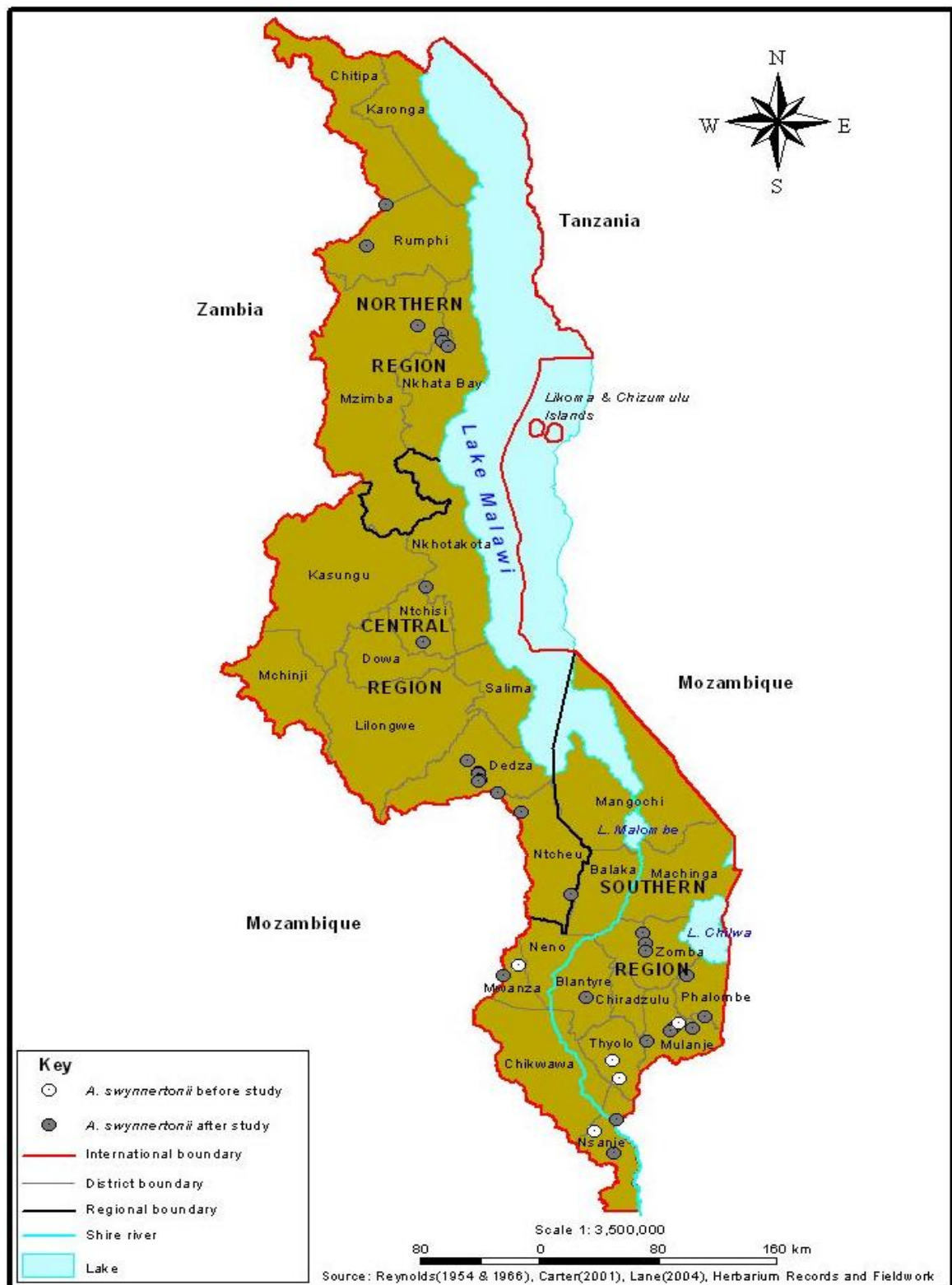


Figure 4.12: The Known Distribution of *A. swynnertonii* Before and After Study

4.1.1.12.1 Distribution of *Aloe swynnertonii* Before this Study

Before this study, *Aloe swynnertonii* was noted at the foot of the Kirk Range in Mwanza district, Likhubula at the foot of Mulanje Mountain, Thyolo and 24 Km north of Chiromo in Nsanje district in the Southern Region (Figure 4.12). In addition, this species was recorded in some areas of Ntcheu district in the Central region (Reynolds, 1954, 1966, Carter, 2001, Lane, 2004) but these occurrences lacked coordinates and were not shown on Figure 4.12.

4.1.1.12.2 Distribution of *Aloe swynnertonii* After this Study

This study recorded 20 new occurrences of *Aloe swynnertonii* in Chitipa district in Ipenza area, Rumphi district around Kapili School, Mzimba district at Marymount and Ekwendeni Mission, and Nkhata Bay district at Chintheche in the Northern Region (Figure 4.12). In the Central Region this study noted this species in Ntchisi district on Chenje Hills along Chiliwa River, on Chipata Hill in Nkhotakota Wildlife Reserve, Dedza district in Chongoni Forest Reserve and between Mlanda and Bembeke (Figure 4.12). In the Southern Region, the new recorded occurrences for this species were Zomba on Ntonya Hill, Blantyre district on Michiru Hills and Nsanje district in Matambwe Forest Reserve (Figure 4.12).

4.1.1.13 Distribution of *Aloe canii*

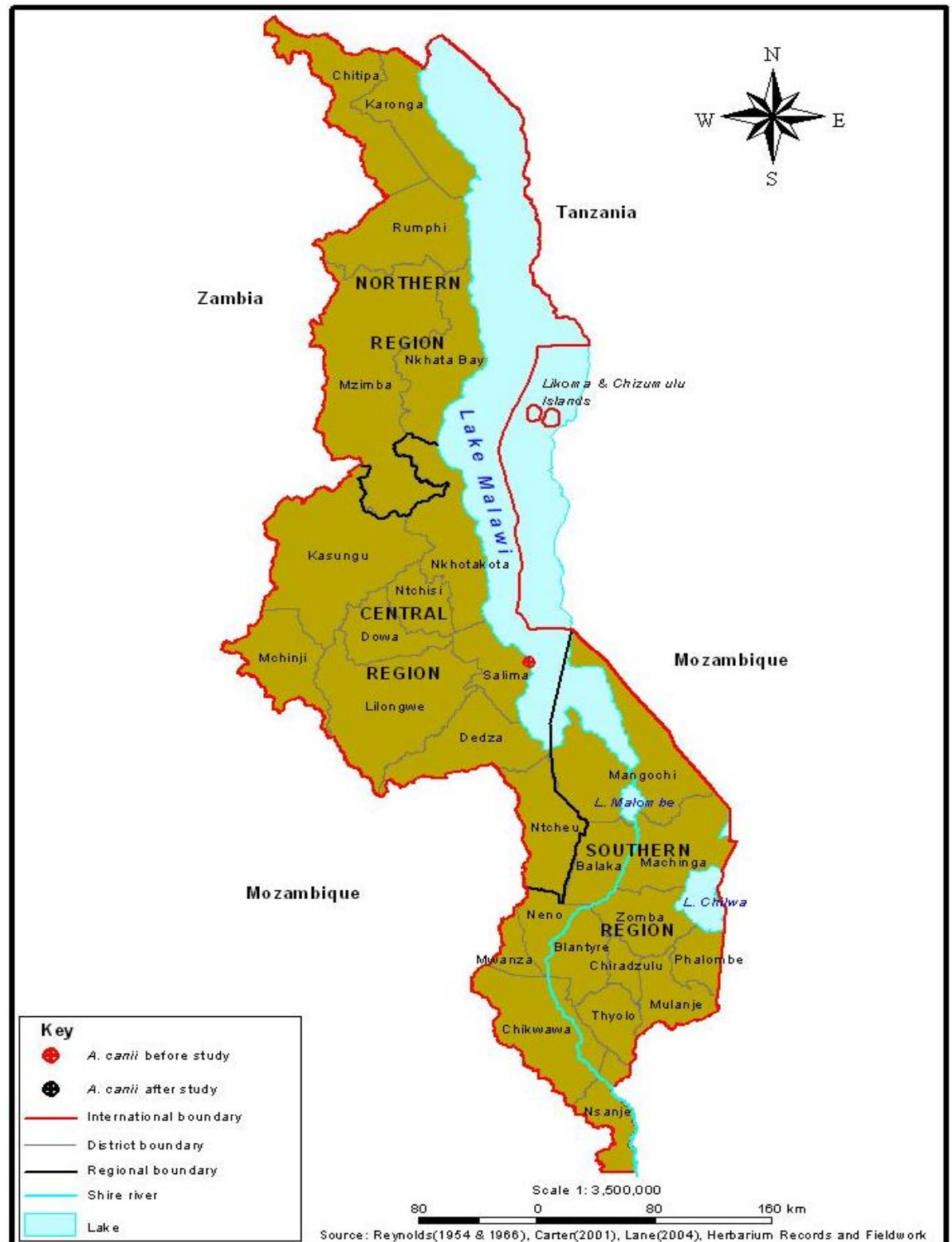


Figure 4.13: The Known Distribution of *A. canii* Before and After Study

4.1.1.13.1 Distribution of *Aloe canii* Before this Study

The location of *Aloe canii* that has been shown on Figure 4.13 was recorded before this study was done. This location is Senga Hills in Salima district (Lane, 2004).

4.1.1.13.2 Distribution of *Aloe canii* After this Study

This study did not find new occurrences for *Aloe canii* but found this species grown in a medicinal garden at Eva Demaya Health Centre in Rumphi district and the interviewer was told that it was collected from some hills of Rumphi. This shows that this species exists in Rumphi district but adequate time is required to hunt for it.

4.1.1.14 Distribution of *Aloe cryptopoda*

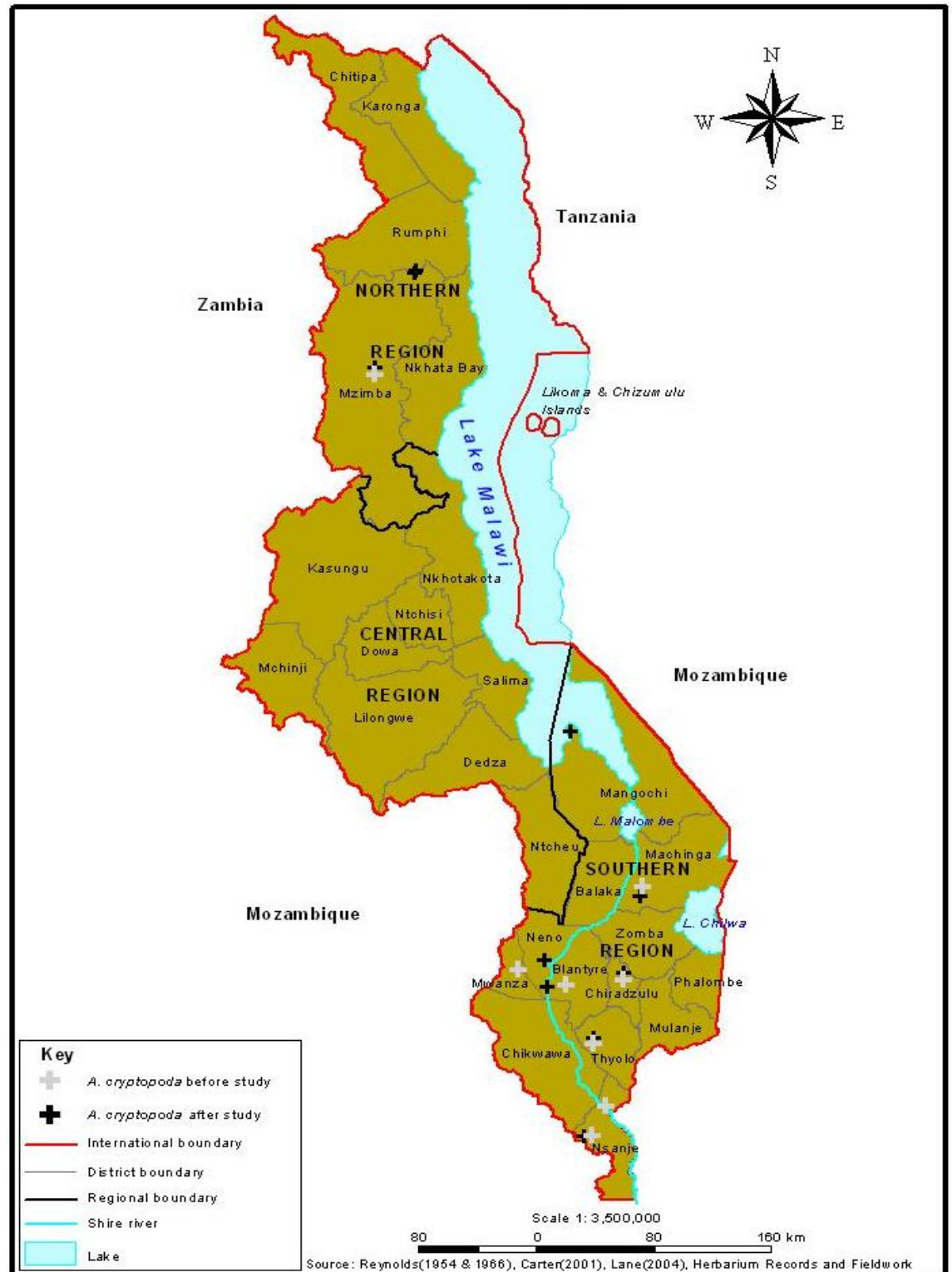


Figure 4.14: The Known Distribution of *A. cryptopoda* Before and After Study

4.1.1.14.1 Distribution of *Aloe cryptopoda* Before this Study

Before this study, *Aloe cryptopoda* was recorded in Mzimba district at Njakwa Gorge in the Northern Region of Malawi. In the Southern Region, *Aloe cryptopoda* was noted in Machinga district on Mongolwe Hills in Liwonde Forest Reserve, Blantyre district at Mpatamanga, Mwanza district along Shire River, Nsanje district in Mwavi Wildlife Reserve and some areas of Chiradzulu and Thyolo districts (Figure 4.14). In addition, this species was noted in Rumphu district at South Rukuru bridge (Reynolds, 1954, 1966, Carter, 2001, Lane, 2004) but this occurrence was not shown on Figure 4.14 because of lack of coordinates.

4.1.1.14.2 Distribution of *Aloe cryptopoda* After this Study

This study noted three new occurrences of *Aloe cryptopoda* in Lake Malawi National Park in Mangochi district and along Shire River in Neno district (Figure 4.14).

4.1.1.15 Distribution of *Aloe mawii*

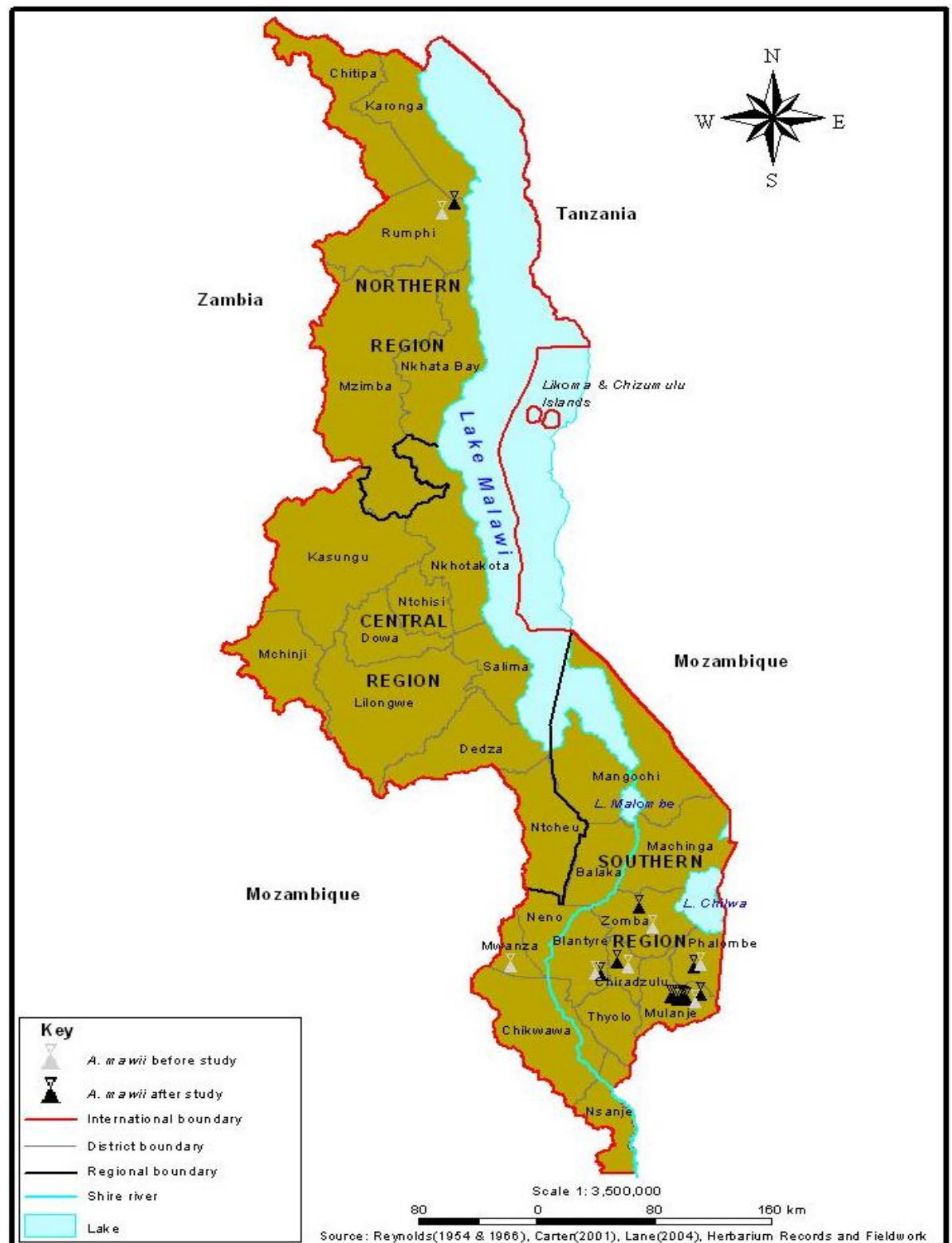


Figure 4.15: The Known Distribution of *A. mawii* Before and After Study

4.1.1.15.1 Distribution of *Aloe mawii* Before this Study

Before this study, *Aloe mawii* was noted on Zomba plateau, Blantyre district on Ndirande Hill, on Chiradzulu Mountain, in Phalombe district and on Mulanje Mountain along Likhubula–Lichenya trail and on Lichenya plateau. Furthermore, this species was recorded in Rumphi district (Reynolds, 1954, 1966, Carter, 2001, Lane, 2004) (Figure 4.15).

4.1.1.15.2 Distribution of *Aloe mawii* After this Study

This study noted two new occurrences of *Aloe mawii* on Mulanje Mountain and the occurrences were along the path to Chambe from Likhubula and between Chisepu Shelter and Thuchila (Figure 4.15).

4.1.1.16 Distribution of *Aloe buchananii*

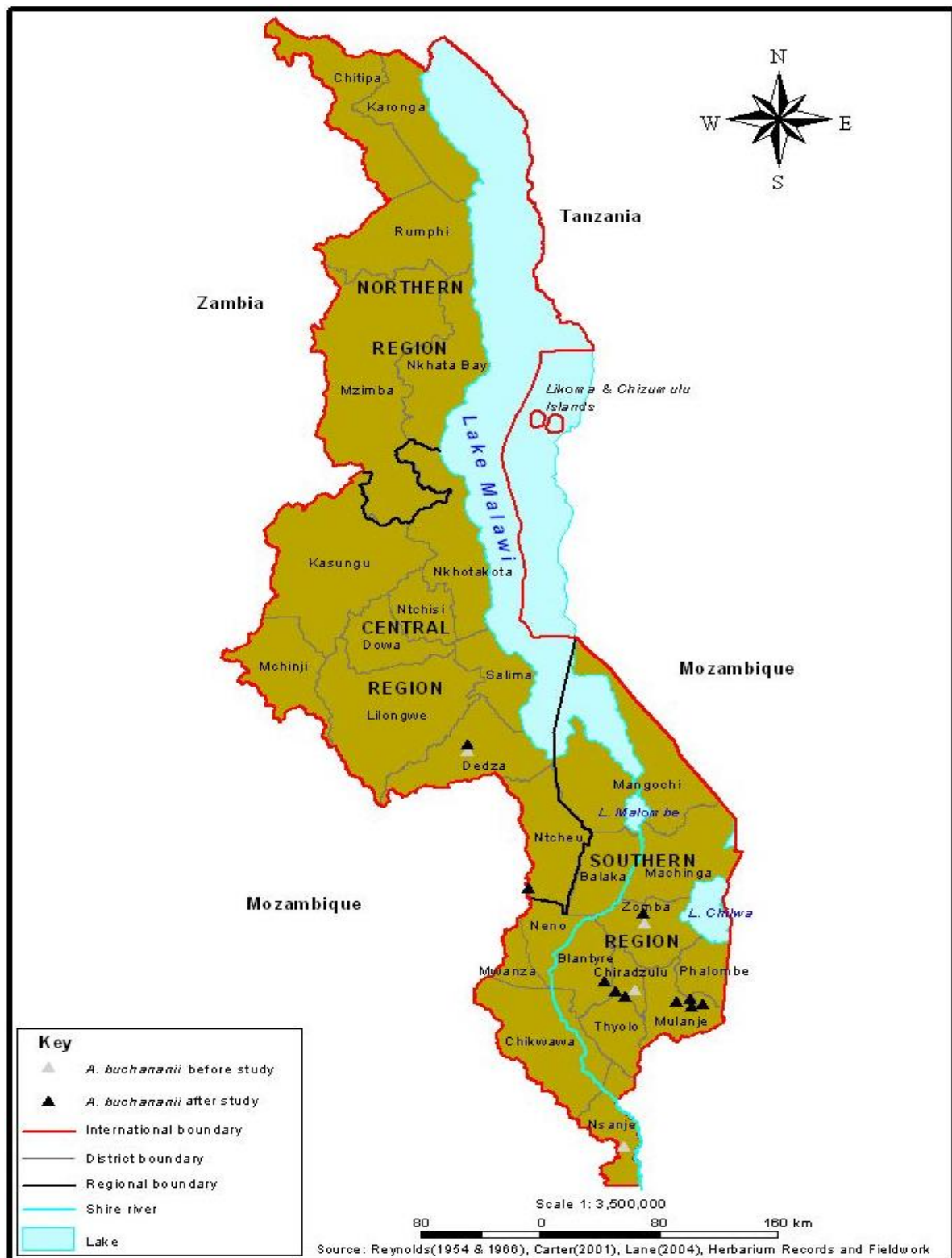


Figure 4.16: The Known Distribution of *A. buchananii* Before and After Study

4.1.1.16.1 Distribution of *Aloe buchananii* Before this Study

Before this study, *Aloe buchananii* was noted in Chongoni Forest Reserve in Dedza district, on Zomba Plateau, and in Chiradzulu and Nsanje districts (Figure 4.16). In addition, this species was noted on Shire Highlands (Reynolds, 1954, 1966, Carter, 2001, Lane, 2004) but the occurrence was not shown on Figure 4.16 because of lack of coordinates.

4.1.1.16.2 Distribution of *Aloe buchananii* After this Study

This study recorded three new occurrences of *Aloe buchananii* on Kirk Range in Ntcheu district and on Dedza Mountain in the Central Region. In the Southern Region, this study noted *Aloe buchananii* on Mulanje Mountain around Thuchila and along the path to Chambe. In addition, this study noted this species on Mpingwe and Ndirande Hills in Blantyre district and on Thyolo Hills (Figure 4.16).

Occurrences of *Aloe excelsa* A. Berger along Thuchila and Ruo Rivers, *Aloe greatheadii* Schönland in Thyolo district, *Aloe suffulta* Reynolds in Nsanje north and *Aloe lateritia* Engl. along Songwe River in Chitipa district (Lane 2004 and Reynolds, 1954) were not shown on the distribution maps due to lack of coordinates. This study did not find these species as well. Therefore, further investigations are required to confirm existence of these species in Malawi and were not included in Appendix E.

In general, this study added new occurrences of Aloe species in Malawi.

4.1.1.17 Areas Rich in Aloes

After this study, the known number of species per district had been summarized in Table 4.1 below. Total known number of *Aloe* species in Malawi was 16 (Appendix E).

Table 4.1: Known Number of *Aloe* Species in Each District After this Study

District	Number of species
Chitipa	4
Karonga	2
Rumphi	12
Mzimba	12
Nkhata Bay	4
Nkhotakota	1
Kasungu	2
Nthisi	4
Dowa	2
Mchinji	1
Salima	2
Lilongwe	3
Balaka	1
Likoma	0
Dedza	11
Mangochi	7
Ntcheu	4
Machinga	2
Zomba	11
Mwanza	5
Blantyre	8
Chiradzulu	6
Mulanje	12
Thyolo	8
Chikwawa	1
Nsanje	4
Neno	4
Phalombe	3

4.1.1.17.1 Box-And-Whisker plot

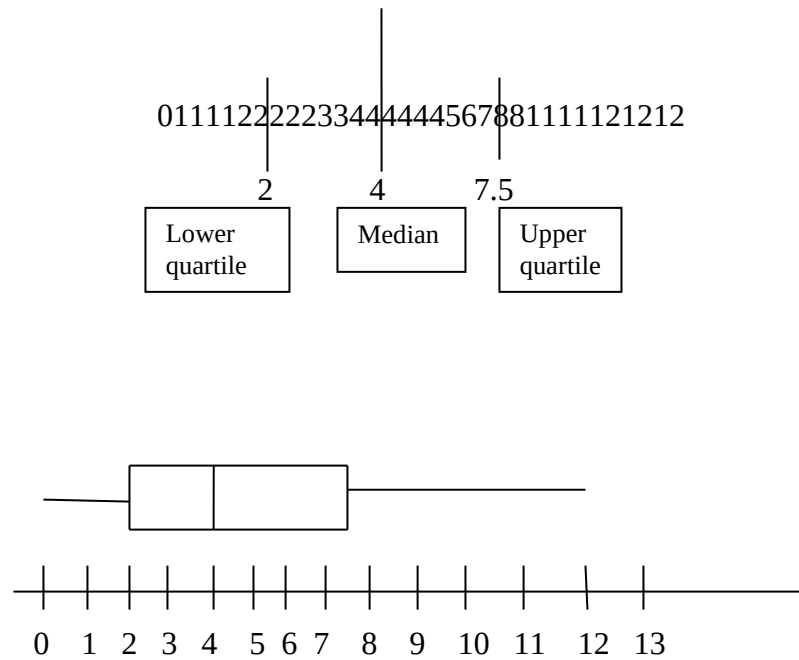


Figure 4.17: Box-And-Whisker plot based on number of *Aloe* species per district

4.1.1.18 Altitudes at which Aloe Species Grow

Table 4.2: Altitudes at which *Aloe* species grows

Species	Altitude (m)					
	0-500	501-1000	1001-1500	1501-2000	2001-2500	2501-3000
<i>A. arborescens</i>				*	*	*
<i>A. buchananii</i>			*	*		
<i>A. buettneri</i>			*			
<i>A. cameronii</i>			*	*		
<i>A. chabaudii</i>		*	*	*		
<i>A. christianii</i>	*	*	*	*	*	
<i>A. cryptopoda</i>	*	*	*	*		
<i>A. duckeri</i>		*	*	*		
<i>A. mawii</i>			*	*	*	
<i>A. menyharthii</i>	*	*				
<i>A. myriacantha</i>			*			
<i>A. mzimbana</i>			*	*	*	
<i>A. nuttii</i>			*	*	*	
<i>A. swynnertonii</i>	*	*	*	*		
<i>A. zebrina</i>	*	*	*			

This study noted that most of the species grow between 500 and 2000 m (Table 4.2). Other species were recorded at low altitudes, for example, *Aloe christianii* (400 m), *Aloe cryptopoda* (169 m), *Aloe menyharthii* (110 m), *Aloe swynnertonii* (366 m) and *Aloe zebrina* (474 m). In addition, this study noted some species such as *Aloe nuttii* (1500-2434

m), *Aloe mzimbana* (1280-2436 m), *Aloe mawii* (1219-2287 m), *Aloe duckeri* (750-2350 m), *Aloe christianii* (400-2395 m) and *Aloe arborescens* (1585-2743 m) at high altitudes of above 2000 m (Table 4.2).

4.1.1.19 Habitats

This study noted that *Aloe* species of Malawi grow on thin soils on rocks, in rock crackings and in stony or rocky soils. Some species grow on hills or mountains while others favor lowlands. For example, *Aloe zebrina*, *Aloe buettneri* and *Aloe swynnertonii* grow in low areas while *Aloe arborescens*, *Aloe cameronii*, *Aloe chabaudii*, and *Aloe mawii* grow on hills or mountains. Other species such as *Aloe christianii* grow both in low areas and on mountains (Appendix C).

This study noted that all the species in Appendix C grow in open *Brachystegia* woodlands except *Aloe zebrina* that favors *Colophospermum mopane* woodlands. In addition, this study noted that some species grow both in grasslands and open woodlands, for example, *Aloe swynnertonii*, *Aloe nuttii* and *Aloe christianii*. *Aloe buehneri* and *Aloe nuttii* were noted in montane grasslands. *Aloe menyharthii*, *Aloe mawii*, *Aloe cryptopoda*, *Aloe chabaudii* and *Aloe arborescens* were noted in the woodlands. Furthermore, this study noted Aloes in tree plantations and such species were *Aloe buehneri*, *Aloe christianii*, *Aloe duckeri*, *Aloe menyharthii* and *Aloe swynnertonii*. Therefore, Aloes are found in grasslands, in natural forests, specifically *Brachystegia* dominated woodlands and even in exotic forests.

4.1.1.20 Ethnobotany and Conservation

Table 4.3 Questionnaire Respondent Characteristics

Sex								
Male	Female							
62	40							
Marital status								
Married	Single	Widowed	Divorced					
87	1	5	9					
Occupation								
Traditional Healer	Farmer	Business	Environmental Officer	Village Headman	Tour Guide	Birth Attendant	Teacher	Guards
7	62	15	2	8	2	3	1	2
Tribes								

Chewa	Lomwe	Sena	Mang'anja	Tumbuka	Tonga	Ngoni	yao	Kokhola
39	10	3	4	14	1	21	5	5
Education Level								
Illiterate	Primary	JCE	MSCE	Diploma	Degree			
22	64	9	5	1	1			
Age								
<20	21-25	26-30	31-35	36-40	41-45	46-50	>50	
0	8	8	12	15	8	24	27	

Table 4.4: Aloe species used in the treatment of human diseases

Disease Treated	Aloe Species	Parts Used	Preparatory Method
Toothache	<i>Aloe christianii</i>	Leaves/Roots	Sap/soaking
STDs	<i>Aloe christianii</i>	Leaves	Soaking /boiling
	<i>Aloe swynnertonii</i>	Leaves	Soaking /powder
	<i>Aloe duckeri</i>	Leaves	Soaking /powder
	<i>Aloe cameronii</i>	Leaves	Sap
	<i>Aloe arborescens</i>	Leaves	Soaking
	<i>Aloe mawii</i>	Leaves	Soaking
	<i>Aloe chabaudii</i>	Leaves	Soaking
	<i>Aloe menyharthii</i>	Leaves	Soaking
	<i>Aloe mzimbana</i>	Leaves	Soaking
Painful legs	<i>Aloe christianii</i>	Leaves/Roots	Sap/powder
	<i>Aloe chabaudii</i>	Leaves/Roots	Sap/powder
Diarrhoea	<i>Aloe christianii</i>	Leaves/Roots	Soaking/powder
	<i>Aloe zebrina</i>	Roots	Soaking
	<i>Aloe cryptopoda</i>	Roots	Soaking
	<i>Aloe chabaudii</i>	Leaves	Soaking
	<i>Aloe menyharthii</i>	Leaves	Soaking
Chlamydia	<i>Aloe christianii</i>	Roots	Boiling
	<i>Aloe duckeri</i>	Leaves	Soaking

Disease Treated	Aloe Species	Parts Used	Preparatory Method
Wounds	<i>Aloe christianii</i>	Leaves	Sap/powder
	<i>Aloe swynnertonii</i>	Leaves	Sap
	<i>Aloe duckeri</i>	Leaves	Sap
	<i>Aloe cameronii</i>	Leaves	Sap
	<i>Aloe arborescens</i>	Leaves	Sap
	<i>Aloe mawii</i>	Leaves	Sap
	<i>Aloe chabaudii</i>	Leaves/Roots	Sap/powder
	<i>Aloe menyharrthii</i>	Leaves	Sap
	<i>Aloe mzimbana</i>	Leaves	Sap
	<i>Aloe cryptopoda</i>	Leaves	Sap
	<i>Aloe zebrina</i>	Leaves	Sap
	<i>Aloe canii</i>	Leaves	Sap
Skin diseases	<i>Aloe christianii</i>	Leaves	Sap
	<i>Aloe canii</i>	Leaves	Sap
	<i>Aloe duckeri</i>	Leaves	Sap/soaking
	<i>Aloe mawii</i>	Leaves	Sap
	<i>Aloe chabaudii</i>	Leaves	Sap
	<i>Aloe menyharrthii</i>	Leaves	Sap
	<i>Aloe mzimbana</i>	Leaves	Sap
Vomiting	<i>Aloe menyharrthii</i>	Leaves	Boiling
	<i>Aloe christianii</i>	Leaves	Soaking

Disease Treated	Aloe Species	Parts Used	Preparatory Method
Pneumonia	<i>Aloe christianii</i>	Leaves/roots	Sap/powder
	<i>Aloe swynnertonii</i>	Leaves	Sap
	<i>Aloe arborescens</i>	Leaves	Sap
Malaria	<i>Aloe christianii</i>	Leaves	Powder
Backache	<i>Aloe christianii</i>	Roots	Soaking
	<i>Aloe cryptopoda</i>	Roots	Soaking
	<i>Aloe menyharthii</i>	Roots	Soaking
Earache	<i>Aloe christianii</i>	Leaves	Sap
	<i>Aloe menyharthii</i>	Leaves	Sap
Heart attack	<i>Aloe christianii</i>	Leaves	Soaking
Abdominal swellings	<i>Aloe christianii</i>	Leaves	sap
Ulcers	<i>Aloe christianii</i>	Leaves	Soaking
	<i>Aloe duckeri</i>	Leaves	Soaking
	<i>Aloe menyharthii</i>	Leaves	Soaking
	<i>Aloe cryptopoda</i>	Leaves	Soaking
Asthma	<i>Aloe duckeri</i>	Leaves	Soaking
Cancer	<i>Aloe duckeri</i>	Leaves	Sap/soaking
	<i>Aloe menyharthii</i>	Leaves	Soaking
Rectal prolapse	<i>Aloe duckeri</i>	Leaves	Soaking
Dyspnoea	<i>Aloe duckeri</i>	Leaves	Soaking

Disease Treated	Aloe Species	Parts Used	Preparatory Method
Stomachache	<i>Aloe christianii</i>	Leaves	Soaking/boiling
	<i>Aloe swynnertonii</i>	Leaves	Soaking
	<i>Aloe duckeri</i>	Leaves	Soaking
	<i>Aloe cameronii</i>	Leaves	Soaking
	<i>Aloe arborescens</i>	Leaves	Soaking
	<i>Aloe mawii</i>	Leaves	Boiling
	<i>Aloe chabaudii</i>	Leaves	Soaking
	<i>Aloe menyharthii</i>	Leaves	Soaking
	<i>Aloe mzimbana</i>	Leaves/roots	Soaking/boiling
	<i>Aloe cryptopoda</i>	Leaves	Soaking
	<i>Aloe zebrina</i>	Leaves/roots	Soaking
	<i>Aloe canii</i>	Leaves	Soaking
Tape/ringworm	<i>Aloe duckeri</i>	Leaves	Soaking
Blood pressure	<i>Aloe chabaudii</i>	Roots	Soaking
Epilepsy	<i>Aloe chabaudii</i>	Roots	Soaking
	<i>Aloe menyharthii</i>	Roots	Boiling
Cough	<i>Aloe christianii</i>	Leaves	Soaking/powder
	<i>Aloe menyharthii</i>	Leaves	Soaking
	<i>Aloe arborescens</i>	Leaves	Soaking

Soaking and boiling was done with water

Table 4.5: Number of uses for each *Aloe* species

Name of Species	Number of Uses
<i>A.arborescens</i>	7
<i>A.cameronii</i>	5
<i>A.canii</i>	7
<i>A.chabaudii</i>	16
<i>A.christianii</i>	37
<i>A.cryptopoda</i>	8
<i>A.duckeri</i>	17
<i>A.mawii</i>	9
<i>A.menyharthii</i>	30
<i>A.mzimbana</i>	5
<i>A.swynnertonii</i>	6
<i>A.zebrina</i>	4

Table 4.6: Use Categories of the Recorded *Aloe* Species

Name of Species	Categories			
	1	2	3	4
<i>A.arborescens</i>	*	*		
<i>A.cameronii</i>	*			*
<i>A.canii</i>	*	*	*	*
<i>A.chabaudii</i>	*	*	*	*
<i>A.christianii</i>	*	*	*	*
<i>A.cryptopoda</i>	*	*	*	
<i>A.duckeri</i>	*	*	*	*
<i>A.mawii</i>	*			*
<i>A.menyharthii</i>	*	*	*	*
<i>A.mzimbana</i>	*			*
<i>A.swynnertonii</i>	*	*		*
<i>A.zebrina</i>	*	*		

Table 4.7: Local Names of Recorded Aloes by Region

Species Name	Local Names		
	Northern Region	Central Region	Southern Region
<i>A. christianii</i>	Iwani (Chinyika) Chinthembwe (Tumbuka)	Chinthembwe (Chichewa) Nemba (Ngoni) Chizima-muliro (Ngoni)	Khuzi (Ngoni) Lichongwe (Yao) Senjelele (Lomwe) Khonje wamtchire (Lomwe) Mdyang'oma (Ngoni) Senjele (Yao)
<i>A. cryptopoda</i>	Chinthembwe	Chinthembwe	Galitchanga (Sena) Khonje wamtchire
<i>A. canii</i>	Chinthembwe	Chinthembwe Nemba	Manyesa (Lomwe) Namanyesa (Mang'anja)
<i>A. mzimbana</i>	Chinthembwe	Chinthembwe Nemba	Manyesa Namanyesa

Species Name	Local Names		
	Northern Region	Central Region	Southern Region
<i>A. swynnertonii</i>	Chinthembwe	Chinthembwe Nemba	Khonje wamtchire Galitchanga Khuzi Senjele Mdyang'oma
<i>A. zebrina</i>		Chinthembwe	
<i>A. menyharthii</i>			Khuzi

4.2 DISCUSSION

4.2.1 Distribution

Figures 4.1 to 4.16 show that Aloes were spread all over Malawi but with different patterns. Some were widely spread while others were rare. There were other species that were restricted to some areas. Figures 4.1 – 4.16 show that *A. christianii*, *Aloe chabaudii* and *Aloe swynnertonii* were widely spread in Malawi while *Aloe buchananii*, *Aloe myriacantha*, *Aloe canii* and *Aloe buettneri* were rare, and *Aloe mzimbana* and *Aloe menyharthii* were restricted to some areas.

Figure 4.3 shows that *Aloe christianii* is a widely distributed *Aloe* species in Malawi and it is the first time that such a wide distribution of an *Aloe* species has been noted in this country. *Aloe christianii* occurred in all the three regions and this shows that this species tolerates a wide range of temperatures and rainfall since plant distribution is affected by a great number of factors. In addition *Aloe christianii* favors a great range of habitats and soils. Furthermore, this species might have an ability to disperse to new sites. From professional judgement, *Aloe christianii* reproduces by means of seeds and probably the seeds have structures that enable the seeds to travel long distances. Mostly, it is unusual to find a big population of this species, individual plants are usually found in isolation.

Figure 4.6 shows that *Aloe chabaudii* is another widely distributed species in Malawi, especially in the Central and Southern Regions. The reasons might be the same as in *Aloe christianii*. However, the difference is on habitats, from observation, *Aloe chabaudii* grows on hills, mountains and rocks in open woodlands while *Aloe christianii* was found growing on both hills and lowlands, in long open grasslands. This explains why *Aloe christianii* was shown to be more widely spread than *Aloe chabaudii* (Figures 4.3 and 4.6). This study noted that *Aloe chabaudii* reproduces by means of suckers and this may explain the reason why this species forms big populations.

Aloe swynnertonii was another widely spread species (Figure 4.12). This also shows that this species tolerates a wide range of temperatures, rainfalls, soil types and habitats. But from the professional point of view, this study observed that there was a possibility of taxonomic confusion between *Aloe swynnertonii*, *Aloe duckeri* and *Aloe menyharthii*. *Aloe menyharthii* and *Aloe duckeri* were in the same group and were later separated when

Aloe menyharthii was described by Carter (2001). For example, occurrences of both species were Mulanje was Likhubula (Reynolds, 1966 and Carter, 2001) and through knowledge gained from this study, this site contained one spotted species. *Aloe duckeri* was common in the Northern region where *Aloe swynnertonii* was also recorded. Therefore further investigations based on both morphological and molecular characters are required to identify these three species.

This study noted *Aloe buehneri*, *Aloe myriacantha*, *Aloe canii* and *Aloe buettneri* to be rare. The first three species are grass Aloes that can easily be affected by overgrazing thereby reducing their occurrences. In addition, these species are also difficult to be spotted since they look like grasses. The flowering period of these species (January / February) is the time when vegetation is bushy and this makes spotting of this species difficult to be spotted for records. According to Moriarty (1975) and Carter (2001), this species is endemic to Malawi. *Aloe buettneri* was also observed to be rare probably because its rate of reproduction and dispersal is slow or difficult. May be requires special conditions for good growth and multiplication.

Aloe mzimba and *Aloe menyharthii* were restricted to some areas. *Aloe mzimba* was restricted to the Northern Region while *Aloe menyharthii* was restricted to the Southern Region of Malawi. *Aloe mzimba* might have spread from Tanzania and Zambia while *Aloe menyharthii* might have spread from Mozambique. This restriction might be due to some physical features that might be preventing the spread of these species and such structures might be mountains ranges. So, in case of *Aloe menyharthii*, its spread might be prevented by Shire Highlands.

4.2.2 Areas that are Rich in Aloes

According to Gaston and Spicer (2004), areas that contained more than 65% of biodiversity were rich. In this study such areas (districts), in terms of richness in Aloes were Rumphi, Mzimba, Dedza, Zomba and Mulanje districts. Rumphi and Mzimba districts are in the Northern Region and population density for the Northern Region is low with a density of 63 persons per square Kilometer (NSO, 2008). The population density for Rumphi is 35 persons per square Kilometer (NSO, 2008). In addition, part of Nyika National Park is in Rumphi district and Nyika National park has been classified as one of the Africa's Centre of plant Diversity (Barrows and Willis, 2005). In addition, Nyika National Park has favorable habitats and Altitudes for Aloes because most Aloes favor high altitudes. Mzimba district has some highlands that include Viphya Plateau that has favorable altitude and habitats such as rocky areas. Mzimba has several forest reserves where Aloes were also protected and examples of these forest reserves were Chimaliro, Perekezi, Mtangatanga, Lunyangwa, Vipya Forest Reserves and Vwaza Marsh. Furthermore, Mzimba is the biggest district in Malawi with land area of 10,382 square Kilometers (NSO, 2008) and the bigger the area the more the plants that it contains. Population Density for the Central Region is higher (154 persons per square Kilometer) (NSO, 2008) than that of Northern Region. Dedza district is in the Central Region and although its current population density is high, 172 persons per square Kilometer, Dedza has some forest reserves and highlands that provide favorable habitats and altitudes for Aloes and examples were Dedza Mountain, Chongoni, Mua-Tsanya Forest Reserves and Dedza-Salima escarpment and several hills.

According to NSO (2008) Southern Region of Malawi has the highest population density of 185 persons per square kilometer where deforestation rate is expected to be high due to opening of new settlements and gardens. Mulanje and Zomba districts are in the Southern Region of Malawi. Mulanje has a high population density of 256 persons per square kilometer (NSO, 2008) and yet this study noted this district as being rich in Aloes because of Mulanje Mountain Forest Reserve that provides favorable altitude and habitats for the growth of Aloes. Zomba - Malosa Forest Reserve and several hills provide favorable conditions for the growth of Aloes because most Aloes grow at high altitudes and growing in rocky areas and these areas are usually cultivated.

This study noted that since most Aloes grow at high altitudes, most of these species favor low temperatures and high rainfalls with few exceptions that grow at low altitudes.

According to figure 4.17 the minimum and maximum numbers of Aloes per district were 0 and 12. Table 4.1 shows that Likoma did not contain any Aloes. This study did not find records either from literature or herbarium and the area was not visited as well during field work for this study because travelling to this area is difficult. Rumphi, Mzimba and Mulanje had 12 species each. Figure 4.17 shows that 50% of the districts contain two to seven Aloe species. Furthermore, it also shows that 25% of the districts contain less than two species while 75% of the districts contain less than eight species. Since the box is significantly shifted to the low end, the sample's distribution is positively skewed and it indicates a wider peak of distribution.

In Flora Zambesiaca region, Mozambique has the highest number of *Aloe* species with 29 species, followed by Zimbabwe, 27 species; Zambia, 16; Malawi, 15 then Botswana with

10 Aloe species. The differences might be due to different climatic conditions, soils and different conservation policies.

4.2.3 Altitudes at which *Aloe* species grow

This study agrees with Lane (2004) that *Aloe arborescens* grow at high altitudes only, as high as 2743 m. The recorded occurrences of this species are also areas where there are highlands, for example, Mulanje Mountain and Dedza Mountain. Furthermore, this study noted that *Aloe christianii* has the widest range of altitudes, from 400 m to 2395 m and this explains why this species was recorded as a widely distributed species in Malawi. This shows that this species grows both in lowlands and highlands. *Aloe cryptopoda* was noted at 169 m to 1524 m because mostly this species was recorded along or close to water bodies, for example along Shire River at Mpatamanga and at Lake Malawi National Park, around Cape Maclear.

4.2.4 Habitats

The Miombo-Brachystegia woodlands dominate most areas of Malawi (Chapman and White, 1969) and this also explains why *Aloe christianii* was found to be the widely spread species because it also grows in Brachystegia woodlands apart from other vegetation types such as open grasslands and grasslands with scattered trees. Furthermore, *Aloe christianii* was also recorded to grow in more than five vegetation types and this also helps to explain why it was a wide spread species in Malawi. *Aloe zebrina* was recorded that it grows in *Colophospermum mopane* woodlands only. There should be a certain type of a relationship between this species and *Colophospermum mopane* woodland and this needs to be investigated further. This study recorded that Aloes grow in rocky or stony

soils that are well drained and this explains why Aloes survive at high altitudes where rainfalls are high. Aloes are succulents that do not require water logged soils for survival.

4.2.5 Ethnobotany

This study recorded 53 uses of 12 *Aloe* species from questionnaires and PRA (Appendix D). Uses of four species (*A. buehneri*, *A. buertonii*, *A. myriacantha* and *A. nuttallii*) were not recorded because the samples were not found. Lane (2004) recorded 22 different uses of seven species and other spotted *Aloes*. Morris and Msonthi (1991) recorded 11 different medicinal uses of five species. Some of the human diseases that did not appear in Lane (2004) and Morris and Msonthi (1991) were shingles, diarrhoea, pneumonia, chlamydia, heart attack, backache, asthma, cancer, rectal prolapse, blood pressure, worms, chicken pox and epilepsy. So, this study has made some new findings on human diseases that are treated by Aloes in Malawi.

In this study, the uses were grouped into four categories as follows:

- i. Aloes used in treating human diseases;
- ii. Aloes used as feeds and medicines for domesticated animals;
- iii. Aloes used in cosmetics and human well-being;
- iv. Aloes used as charms, human food and ornamentals.

All the 12 species (100%) were used in category one, nine species (75%) in category two, six (50%) in category three and 10 (83%) in category four.

4.2.5.1 Category One: Aloes used in treating human diseases

This study recorded 28 human diseases that were being treated by Aloes (Table 4.4). Lane (2004) recorded 12 while Morris and Msonthi (1991) recorded seven human diseases. This study noted that one disease was treated by more than one species and one species was used for several diseases. For example, stomachache and wounds were treated by all the 12 listed species, while sexually transmitted diseases and skin diseases were treated by nine and seven species respectively. Other diseases such as diarrhoea, pneumonia and cancer were treated by five, three and two species respectively. 50% of human diseases in Table 4.4 were treated by one species. The sexually transmitted diseases referred to in this study were gonorrhoea (chizonono) and syphilis (chindoko) while wounds included cuts, burns, shingles, navel in newly born babies, snake bites and inflammations. On the other hand, stomachache referred to abdominal pains that included stomach pains after child birth or miscarriage and constipation while skin diseases included scabies, skin rashes or sores and athlete foot (Appendix D). In Lesotho, people use *Aloe striatula* for stomach problems (Schmitz, 1982). The sexually transmitted disease (syphilis) has been treated locally in West Africa by using *Aloe ferox* (Watt and Breyer-Brandwijk, 1962). According to Lane (2004), any of the *Aloe* species could be used in treating skin and stomach problems.

4.2.5.2 Category Two: Aloes used as feeds and medicines for domesticated animals.

This study noted that Aloes were also used as feeds and medicines for some infections in domesticated animals and birds. For example, sores on goats and dogs (nkupe) and newcastle (chitopa/chipumphu) in domesticated birds. According to Lane (2004), *Aloe mawii* is used in deworming cattle in Malawi. In this study, 66% of the recorded species

(eight species) were used in the treatment of Newcastle in domesticated birds while 17% (two species) were used in treating sores in goats and dogs. Two species (*Aloe cryptopoda* and *Aloe menyharthii*) were used as feeds in rabbits and goats when grass is scarce (Appendix D).

4.2.5.3 Category Three: Aloes used in cosmetics and human well-being

This study recorded Aloes that were being used to improve status of a human body and its functioning such as improving potency in men and fertility in women. Lane (2004) and Morris and Msonthi (1991) recorded this as well. It is the first time that Aloes were recorded for use in hastening child birth, general body cleaning, improving hair condition and growth, and smoothing cracking heels. For example, five species (42%) (*Aloe christianii*, *Aloe canii*, *Aloe duckeri*, *Aloe menyharthii* and *Aloe cryptopoda*) were used in improving potency in men and increasing fertility in women while four species (33%) (*Aloe christianii*, *Aloe canii*, *Aloe duckeri* and *Aloe menyharthii*) were used in hastening child birth by traditional birth attendants (Appendix D). In Lesotho, people use an infusion of *Aloe krusii* roots to increase fertility in women (Schmit, 1982) while the Zulu people use *Aloe arborescens* to hasten child birth (Watt and Breyer-Brandwijk, 1962).

4.2.5.4 Category Four: Aloes used as charms, human food and ornamentals

This study recorded that Aloes were also being used as, charms, food for human beings and ornamentals. 75% of the recorded species were planted as ornamentals in many homes, offices and hotels of Malawi, as is done in other countries such as Zambia, Zimbabwe and South Africa (Bolnick, 1995; Schmitz, 1992; van Wyk, 2000). Three species (25%) were used charms (to gain favor when convicted and for protection from

witchcraft) in some parts of Malawi. Flowers of *A. cryptopoda* in Chikwawa, *A. menyharthii* in Mwanza and *A. chabaudii* in Lilongwe were being used as food (as vegetables, for flitters and as an alternative to tomato (Appendix D). The flowers of spotted species, the group to which *Aloe menyharthii* belongs, were added to okra and use of flowers of Aloes as food is also quite widespread in South Africa (Lane, 2004). *Aloe zebrina* flowers were used as food in the Sub-Saharan Africa (Peters *et al.*, 1992).

This study noted that *Aloe cameronii* was used to eradicate bad spirits in certain ceremonies while in Lesotho, young girls who enter the initiation school, bathe on their first night with a lotion prepared from *Aloe krausii* for protection from witchcraft and bad spirits (Peters *et al.*, 1992).

4.2.5.5 Multipurpose use of Aloes

This study recorded more than one use for all the 12 *Aloe* species, however, the number of uses for each species differed. *Aloe christianii* had the highest number of uses (37) followed by *Aloe menyharthii* (30) then *Aloe duckeri* (17) and *Aloe chabaudii* (16). *Aloe zebrina*, had the lowest number of uses (4) (Table 4.5). Since none of the species had a single use, *Aloe* species are multipurpose. From distribution point of view, *Aloe christianii* was also recorded as the most wide spread species in Malawi. This is so probably because this study observed that people used species that were around them. The case is the same with *Aloe chabaudii* and *Aloe menyharthii* in the Southern Region. Therefore, these *Aloe* species were used in many areas in Malawi for different uses because of being wide spread. *Aloe* species that are found in more than one region were expected to have more uses than the one that was found in one region. However, accessibility of the species contributed in number of uses for the species. For example,

Aloe menyharthii and *Aloe Mzimbana* were both restricted to Southern Region and Northern Region respectively. The first one had more uses because it was wide spread in that region, mostly, in customary lands, therefore, accessible than the second one where most individuals or populations were in Nyika National Park which is a protected area, therefore, not accessible to local people. *Aloe arborescens* has a small number of uses because it was found at very high altitudes, therefore, not very accessible in many areas.

The highest number of uses in Lane (2004) was from the spotted species group that had 11 uses. In terms of species, *Aloe arborescens* had the highest number, with eight uses.

Some *Aloe* species were used in all the four categories while others were used in two categories only. Five species by the names of *Aloe canii*, *Aloe christianii*, *Aloe duckeri*, *Aloe chabaudii* and *Aloe menyharthii* were being used in all the four categories while the other two species (*A. swynnertonii* and *Aloe cryptopoda*) were used in three categories. The rest of the five species belonged to two categories each (Table 4.6). No species belonged to one category, showing that Aloes are multipurpose.

4.2.5.6 Parts of Aloes Used

This study recorded that leaves and roots are the main parts utilized in Aloes. 90% of medicinal uses, utilized leaves (Table 4.5). Fruits, flowers and the whole plant are rarely used except in ornamentals. This study recorded 31 uses that involved the leaves, six uses involved the roots, three uses involved the whole plant and one use involved the flowers (Appendix D). Morris and Msonthi (1991) stated that leaves only were being utilized except in one case where either leaves or roots were utilized. Lane (2004) did not mention

the parts that were utilized in most cases, except in *Aloe chabaudii*, where roots were reported being utilized, *A.chrstianii*, where the stem was used, *Aloe duckeri* and *Aloe mawii* where the leaves were utilized. Since leaves and roots are mostly used, unsustainable and intensive use of Aloes can lead to loss of Aloes in the wild. The most widely and the most utilized species, *Aloe christianii* utilizing parts were also leaves and roots (Table 4.5) and this would affect abundance of this species unless sustainable management takes place. This study has provided detailed information for all recorded uses and therefore, provided relative pressure of utilization of plant parts.

4.2.5.7 Preparation of Aloes for Use

In this study, methods of preparation for the uses were recorded. The recorded methods were soaking the pieces or crushed material in water, using the sap directly from the leaves, boiling the material and production of powder from the leaves or roots. In some cases, the Aloe was prepared in different ways for the same use. For example, preparing medicines for gonorrhea and syphilis involved either boiling or soaking the material in water (Appendix D). In medicinal use of Aloes, 57% of the preparations were by soaking the leaves or roots in water while 34% involved utilizing the leaf sap directly from the plant (Table 4.5). This study shows that most of the uses involved soaking the material in water and using the sap directly.

This study recorded that Aloes could either be used alone or mixed with other plants or substances. For example, Aloes alone were used in most cases for the treatment of stomachache, wounds, skin diseases and pneumonia while Aloes mixed with other plants (*Carica papaya* or *Cassia abbreviata*) were used in treating sexually transmitted diseases (Appendix D). Morris and Msonthi (1991) recorded that *Aloe cryptopoda* should be mixed with *Pericopsis angolensis* (Mwanga) to treat infertility and menstrual complaints.

4.2.5.8 Respondent Characteristics and Utilization of Aloes.

This study looked into relationships between occupation, Education level, age of respondents with utilization of Aloes.

4.2.5.8.1 Occupation and Utilization of Aloes

A big number of farmers followed by businessmen than village headmen were involved in responding to questionnaires. This is so probably because farming and business are the main occupations in the rural areas as well as in the urban areas. Occupations that are not common in both rural and urban areas are traditional healing, traditional birth attendants and the rest of the occupations in Table 4.3. Traditional healers and traditional birth attendants were the expected leading group in utilization of Aloes because utilization of herbs is their profession. This shows that Aloes were known by a cross-section of people in both rural and urban areas as mainly medicines and being utilized in other ways.

4.2.5.8.2 Education Levels and Utilization of Aloes

This study noted that the highest number that responded to questionnaires were Primary school level (64) followed by primary school (22) (Table 4.3). This was so because most of the people that are found in rural and urban areas are of that education level and poor (Department of Environmental Affairs, 1998) therefore, rely on traditional medicine much more than the western medicine because of poverty.

4.2.5.8.3 Age and Utilization of Aloes

This study noted that the general trend was that as the age of respondents increased, the knowledge in utilization of Aloes increased as well such that there was a larger number of older respondents involved than the younger ones (Table 4.3).

4.2.5.9 Local Names of Aloes by Region

Aloes were known by different local names in Malawi. In some areas, different species were known by the same local names, for example, in the Central Region *Aloe chabaudii*, *Aloe arborescens* and *Aloe swynnertonii* were known as Nemba (Table 4.9). In the Northern and Central Regions, Aloes were known as Chinthembwe apart from a few other names (Table 4.9), while in the Southern Region they were known by several names such as Garitchanga, Mdyang'oma, Khuzi, Manyesa and Lichongwe (Table 4.7). In other areas of the Northern Region, *Aloe christianii* was called Iwani while in Central Region, Aloes were known as Nemba or Chizima-muliro. The names in Table 4.7 are different from those cited by Lane (2004) with an exception of Chinthembwe, Lichongwe and Khuzi. Local names recorded by Morris and Msonthi (1991) are also different from those recorded in this study except Nsenjere, Lichongwe and Chinthembwe. All the names recorded by Morris and Msonthi (1991) also appeared in Lane (2004). So, this study has recorded new names. Although the local names were attached to specific species (Lane, 2004; Morris and Msonthi, 1991) the findings of this study are that people use the same local names for all the species existing in a particular area (Table 4.7). Differences of local names in a region arise because of different languages. Although Lane (2004) doubted the local name Senjele for Aloes, the name also appeared in this study.

4.2.5.10 Utilization of Aloes by Region

Some *Aloe* species were utilized differently in the three regions of Malawi. For example, *Aloe chabaudii* in the Southern Region was used to remedy cracking heels while in the Central Region, it was being used as medication for high blood pressure. *Aloe christianii* in the Northern Region had been used to treat pneumonia while in the Central Region, people used *Aloe arborescens*. On the other hand, there were some similarities in utilization of species in the three regions of Malawi. For example, *Aloe chabaudii* in the Central and Southern Regions had been used to treat newcastle disease in chickens, stomachache and shingles in human beings. In the Southern and Northern Regions, *Aloe christianii* had been used to remedy impotence in men and low fertility in women. In addition, *Aloe chistianii* had also been used to treat wounds and snake bite. Furthermore, *Aloe christianii* had also been used to treat newcastle disease in chickens and sexually transmitted diseases in human beings in both regions. In Malawi, the history of traditional healing is difficult to trace because knowledge of the medicinal plants use and the art of practice are not documented and are handed down from the elders to their children by word of mouth (Mwanyambo and Nihero, 1998). This is the possible reason why there are such variations in utilization of Aloes by region.

This study noted that people utilize species that grow around them, for example, *Aloe menyharrthii*, *Aloe mawii*, *Aloe christianii*; *Aloe cryptopoda* and *Aloe chabaudii* in the Southern Region, *Aloe mzimbana*, *Aloe duckeri*, *Aloe cryptopoda*, *Aloe canii* and *Aloe*

christianii in the Northern Region; *Aloe zebrina*, *Aloe swynnertonii*, *Aloe cameronii*, *Aloe chabaudii*, *Aloe arborescens* and *Aloe christianii* in the Central Region.

4.2.6 Conservation

It is important to conserve biodiversity because a species lost is lost forever together with all its attributes and those that are dependant on the lost species suffer (Wickens, 2001). It was noted in this study that people collect leaves, roots and even the whole plant to utilize. Therefore, conservation measures are necessary to protect the plants.

4.2.6.1 Abundance of Aloes

This study compared the current abundance of Aloes and ten years ago through questionnaire respondents and PRA meetings. Results showed that Aloes were abundant 10 years ago probably as a result of a low rate of deforestation due to smaller population, less agricultural coverage, low rate of urbanization and little utilization. This means that Aloes are reducing in number and it was predicted that Aloes will still reduce in the coming years because of loss of habitats due to increased urbanization, opening new gardens, wild fires and increased utilization. It was also observed that Aloes were scarce in areas where population density was high and vice-versa. For example, Aloes were widely spread in the Northern Region, especially in rural areas unlike the rural areas of Southern Region.

4.2.6.2 Conservation Measures

All PRA meetings and questionnaire respondents supported *ex-situ* conservation (planting Aloes in new habitats) and *in-situ* conservation (conserving them in their natural habitats).

4.2.6.2.1 *Ex-situ* conservation

According to WHO, IUCN and WWF (1993), the best way to provide plant material needed for medicine is to cultivate the plant because it does not deplete wild stocks. Furthermore, cultivation has pharmacological advantages over collecting from the wild in that wild-collected plants vary in quality and composition due to environmental and genetic differences unlike in cultivation. In cultivation, Aloes are irrigated to increase yields and they are harvested at the right time.

4.2.6.2.2 *In-situ* conservation

In Malawi, *in-situ* conservation of species in the forest reserves falls under the Forestry Department, those in game reserves and national parks are looked after by the Department of National Parks and Wildlife while those that grow on customary land are looked after by the owner of that particular land (Government of Malawi, 1995). As such, survival of endangered species on farmers' land is very unreliable. According to Wickens (2001), *in-situ* and *ex-situ* conservation complement each other. This study concluded that both *ex-situ* conservation and *in-situ* conservation should be considered as conservation measures for Aloes in Malawi.

4.2.6.2.3 Protected Species

In Malawi there is a list of protected species under the Department of Forestry. This study suggests that Aloes should be added to the list and be declared protected species under the forestry rules of Malawi in order to protect them from being depleted due to unsustainable utilization, deforestation due to establishment of new settlements and gardens, and expansion of agriculture due to increased population.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 CONCLUSION

5.1.1 Distribution and Areas that are rich in Aloes

This study has recorded occurrences of Aloes of Malawi such that it is now known where to find what species of Aloes in Malawi. It is now possible to identify districts that are rich in Aloes because this study used districts as a unit measure of richness. Rich areas within the identified districts can later be identified if occurrences of all the species were mapped out on one map. That would be the second stage of identifying specific areas that are rich in those identified districts and those particular areas would then be targeted for conservation and this would help in proper allocation of resources for *in-situ* conservation. Identification of these specific areas within these districts could not be done in this study because of limited time that was given for this study (one year) and this could be done in the second phase of the study.

5.1.2 Altitudes and Habitats

This study noted specific altitudes and habitats at which each species grow such that tracing of the species in areas where particular species occur would now be easier. The Information on altitudes at which each species grow is now available and this would help to assess the general environmental conditions in which each species grows and this information is important in *ex-situ* conservation for survival or good growth of the

species. This study did not carry out detailed tests of soils to determine the soil types for different species due to time constraint and this can be another area of further research.

5.1.3 Utilization of Aloes

This ethnobotanical study has provided a window for poverty alleviation because since medicinal information of Aloes is now available, people can use them any time they want because they can be made available through cultivation. However, sustainable utilization is important. Some companies can even start including particular species of Aloes of Malawi as additional ingredients in their products to improve the medicinal quality of the products. Drugs for other diseases can even be produced from Aloe species of Malawi having known their local uses. However, chemical analysis of the locally utilized species is required to know their chemical ingredients.

5.1.4 Conservation Measures

This study has documented uses of Aloe species of Malawi for the development of appropriate conservation measures. This study was so detailed that it included the parts of Aloes that were utilized to ensure that proper conservation measures are formulated having noted other threats to Aloes of Malawi such as fires and loss of habitats due to opening of new gardens and settlements. The formulated conservation measures would ensure continuous supply of Aloes for future use.

5.2 RECOMMENDATIONS

1. This study recommends that an investigation of old locations of Aloes should be done to confirm the existence of Aloes because of unsustainable utilization and loss of habitats.
2. An investigation of occurrence of *Aloe excelsa*, *Aloe greatheadii* and *Aloe lateritia* should be done to confirm their existence.

3. Morphological combined with molecular studies should be done on spotted species of Malawi because there is sometimes confusion when identifying these species.
4. An investigation on environmental impact on Aloes of Malawi should be done because these plants seem to change with a change in environment.
5. It is recommended that all the occurrences of Aloes should have coordinates for easy tracing.
6. Since Aloes of Malawi were being utilized locally as medicines, it is recommended that chemical analysis of *Aloe* species of Malawi should be done to compare their chemical ingredients with that of *Aloe vera* which is known to be a medicinal Aloe species worldwide.

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APPENDICES

APPENDIX A: PARTICIPATORY RURAL APPRAISAL; DISCUSSION GUIDING QUESTIONS

TO RECORD:

(A) REGION.....

(B) VILLAGE.....

T.A.....

(C) NUMBER OF PARTICIPANTS INVOLVED.....

Questions

1. Introduction of research study (**Student**)
2. Importance of research study (**student**)
3. How important are Aloes to you? (**Respondents**)
4. Which parts do you use? (**Respondents**)
5. How do you collect them? (**Respondents**)
6. Are they common or scarce now? 10 years ago? (**Respondents**)
7. What are the other pressures on Aloes apart from utilization? (**Respondents**)
8. What should be done to conserve them? (**Respondents**)

APPENDIX B: QUESTIONNAIRE

1. ENUMERATOR

RESPONDENT'S PARTICULARS

2. Name

3. Sex ☐ Male ☐ Female

4. Age of respondent

☐ <20 ☐ 21-25 ☐ 26-30 ☐ 31-35 ☐ 36-40

☐ 41-45 ☐ 46-50 ☐ 50+

5. District.....

6. Village.....T.A.....
.....

7. Marital status ☐ Married ☐ Single

☐ Widowed ☐ Divorced

8. Religion

☐ Christianity ☐ Islam

☐ Other (specify).....

9. Tribe

☐ Chewa ☐ Lomwe ☐ Sena

☐ Yao ☐ Tumbuka ☐ Tonga

☐ Other (specify).....

10. Occupation

- ☐ Traditional healer ☐ Farmer
☐ Business ☐ Other (specify).....

Literacy Level

11. Can you read and write?

- ☐ Yes ☐ No

12. If yes, what is the highest level of education?

- ☐ Primary J.C ☐ M.S.C.E ☐ Diploma
☐ Degree ☐ Other (specify).....

MEDICINAL USE OF ALOES

13. Have you ever used Aloes for medicines?

- ☐ Yes ☐ No

14. If yes, for what disease did you use it?

- ☐ Malaria ☐ Stomachache ☐ Skin rash ☐ Shingles ☐ Diarrhea
☐ Gonorrhea
☐ Syphilis ☐ Other (specify).....

15. What do other people use Aloes for?

- ☐ Medicines ☐ Vegetable ☐ Ornaments
☐ Other (specify)

Explain how people collect Aloes for each use.....

.....
.....
.....

16. Which parts do they use?

- (a) Medicines ☐ Leaves ☐ Roots ☐ Flowers
☐ Other (specify)
- (b) Vegetable ☐ Leaves ☐ Roots ☐ Flowers
☐ Other (specify)
- (c) Ornamentals ☐ Leaves ☐ Roots ☐ Flowers
☐ Other (specify)
- (d) Other (specify) ☐ Leaves ☐ Roots ☐ Flowers
☐ Other (specify)

18. If medicines, which diseases do they use *Aloes*? ☐ Malaria ☐ Stomachache
☐ Skin rash ☐ Shingles ☐ Diarrhea ☐ Gonorrhea ☐ Syphilis
☐ Other (specify).....

19. Do people mix with other plants for *Aloes* to be effective on the disease?

☐ Yes ☐ No

20. If yes, list plants which are used together with *Aloes*?.....
.....
.....
.....

PREPARATION AND DOSAGES

21. In what forms do you prepare *Aloe* medicines?

☐ Liquid ☐ Powder ☐ Chew
☐ Other (specify)

22. How do you prepare?

Species combination	Part used	Preparation

ECONOMIC USE OF ALOES

24. Do you sell Aloes? ☐ Yes ☐ No

25. If yes, do you sell locally or internationally?

☐ Locally ☐ Internationally

26. Locally, how much do you charge
(Explain).....
.....
.....
.....

27. Internationally, how much do you charge
(Explain).....
.....
.....
.....

28. How much do you sell per month?
(Explain).....
.....
.....
.....

SOURCE OF ALOES

29. How do you get supplies of Aloes?

☐ Self-collection ☐ Assistant collector

☐ From friend for personal use

☐ Other (specify).....

30. Where do you collect Aloes from and how?

☐ Forest reserves
(name).....

☐ Customary lands (Village, district).....

☐ Other (specify).....

Explain how you collect them.....
.....
.....
.....

31. How far do you travel to get them?

☐ 0-5km ☐ 6-10km ☐ 11-15km ☐ 16-20km
☐ 20km+

32. How would you rate the availability of Aloes now?

☐ Abundant ☐ Scarce

33. How would you rate the availability 10 years ago?

☐ Abundant ☐ Scarce

34. How would you rate it in 10 years to come?

☐ Abundant ☐ Scarce

35. Do you have your own or communal medicinal plot?

☐ Yes ☐ No

36. If yes, do you have Aloes in your plot?

☐ Yes ☐ No

37. What are the other pressures on Aloes of Malawi?

- ☐ Cultivation ☐ Settlements ☐ Fires ☐ Other
(specify).....

38. What should be done to ensure continued availability in future?

- ☐ *Ex-situ conservation* ☐ *In-situ conservation*
- ☐ Commercialization ☐ Other (specify).....

APPENDIX C: VEGETATION TYPE AND HABITATS RECORDED FOR ALOE SPECIES OF MALAWI

Each row represents a compilation of several observations.

Species	Vegetation Type	Habitat Description
<i>A. arborescens</i>	Brachystegia woodlands with short grasses and Proteas	Growing on thin soils collected on rocks
	Mixed woodlands	Growing from a cracking of a bare rock, in the mountains
		Between rocks
<i>A. buchananii</i>	Montane grasslands	Rocky soils on the hill / mountain slope
	Brachystegia woodlands	Thin soils on rocks
	Eucalyptus plantations	Stony soils
<i>A. buettneri</i>	Grasslands	Stony soils
	Dry Brachystegia woodlands	
	Savanna woodlands	
<i>A. cameronii</i>	Brachystegia / Uapaca woodlands	On thin soils on rocks in the hills / mountains
	Brachystegia woodlands	Gravel / rocky soils
	Open mixed woodlands	
<i>A. canii</i>	Brachystegia woodlands	Rocky soils in the hills
<i>A. chabaudii</i>	Mixed woodlands	On thin soils on rocks in the hills / mountains
	Open Brachystegia woodlands	Between the rocks
		Hill / mountain slopes
<i>A. christianii</i>	Brachystegia-Uapaca woodlands	Gravel / Stony soils
	In long grasses	Hill / mountain slope
	Grasslands with scattered trees	Non hilly areas and dambo areas
	Brachystegia woodlands	
	Open grasslands	
	Open mixed woodlands	
	Pine plantations	
<i>A. cryptopoda</i>	Brachystegia dominated woodlands	Growing on thin soils on rocks
	Mixed woodlands	Hill mountain slope
		Between rocks in hills / mountains

<i>A. duckeri</i>	Grasslands with scattered Protea species	Stony / rocky soils
	Brachystegia woodlands	Hill / mountain slope
	Mixed woodlands	
	Pine plantations	
	Brachystegia-Uapaca woodlands	
<i>A. mawii</i>	Brachystegia woodlands with Proteas	Growing on thin soils on rocks with very short grasses
	Mixed woodlands	Hill / mountain slope
		Between rocks
<i>A. menyharthii</i>	Eucalyptus plantations	Between the rocks
	Brachystegia / Uapaca woodlands	Rocky / stony soils
	Mixed woodlands	
	Mopane woodlands	
<i>A. myriacantha</i>	Brachystegia / Uapaca woodlands	Stony soils
<i>A. mzimbana</i>	Grasslands with scattered trees	Growing on thin soils on rocks
		Rock cracks
<i>A. nuttii</i>	Montane grasslands	Hill / mountain slope
	Open Brachystegia woodlands	Rocky soils
<i>A. swynnertonii</i>	Brachystegia woodlands	Growing on thin soils on rocks
	Grasslands	Ant-hill, gravel soils
	Open grasslands with scattered trees	Rocky soils
	Mixed woodlands	
	Brachystegia dominated woodlands	
	Eucalyptus plantations	
<i>A. zebrina</i>	Mopane woodlands	Stony soils
		Flat areas

APPENDIX D: USES OF ALOES OF MALAWI

Each row represents a compilation of several pieces of similar information.

*indicates that the plant was not seen.

Species Name	Use /Disease	Local Name of User/ Disease	Plant Part Used	Preparation and Application Method
A. <i>christianii</i> Reynolds	Eradicating lice on human hair or clothes	Kupha nsabwe	Leaves	Leaves are crushed and the material used to wash hair or clothes. This is done only once.
	Burns	Mabala a moto	Leaves	The sap from the leaves is applied on wounds once a day. The leaves may also be peeled off and cover the burnt area with inside stuff which is left there for a day.

	Toothache	Dzino	Leaves Roots	Apply drops of sap from the leaf onto the infected tooth. Another method is to peel off the thick skin and rub the soft stuff inside the gum of infected tooth. Roots are soaked in water and this water is kept in the mouth for some time (kuvumata)
	Newcastle in Chickens	Chitopa, pupe	Leaves Roots Stem	Leaves, roots or stem are crushed and added to the water which the chickens drink. *Mvunguti (<i>Kigelia africana</i>) roots may also be added.

	Gonorrhea and Syphilis (sexually transmitted Diseases)	Chizonono Chindoko	Roots Leaves	Roots or leaf pieces are boiled in water, to which salt is added, and the patient drinks the liquid. Roots of Aloe may also be mixed with roots of *Kavundula (<i>Psorospermum febrifugum</i>) and Papaya (<i>Carica papaya</i>) or *Tsabora (<i>Capsicum minimum</i> , *Muwawani (<i>Cassia abbreviata</i>) or *Thombozi chipeta. Soak the mixture in a bottle of cold water and let the patient drink the liquid or the liquid is used to cook porridge for the patient. Other people just soak pieces of Aloe leaves
				for some time and give it to the patient.
	Painful legs	Kupweteka kwa miyendo	Roots	Roots are burnt from which some powder is made. The powder is then applied on incisions around the painful area.
	Pneumonia	Chibayo	Leaves	Make incisions (mphini) on the infected area and apply the sap.

	To increase fertility in women	Kusula amayi	Roots	Roots of the Aloe are crushed and mixed with crushed leaves of *Chimika. Add cold water to the mixture and drink for a week. The other way is to chop the whole plant, dry it, make some powder which is added to porridge.
	Snake bite	Bala la njoka	Leaves	Rub the snake bite with the leaf to remove the poison and teeth. Another way is site with a burnt flesh leaf. Others scratch the bitten site while applying a mixture of the sap and the white part of the egg.
	Malaria	Malungo	Roots	Roots are crushed into powder which is added to porridge.
	Skin Diseases	Nthenda za pakhungu	Leaves	The skin is firstly cleaned by bathing, then the mixture of crushed leaves of the Aloe and *Sambwe are applied. After 5 minutes, the material is removed by washing again. This is done once a day.

	One of the sexually transmitted diseases	Mabomu	Leaves	Leaves are soaked in water for some time together with *Muwawani (<i>Cassia abbreviata</i>) roots and other plants. The liquid is then given to the patient.
	Diarrhea	Kutsakula mmimba	Roots	Aloe roots are mixed with that of *Msimbwi(Mpono-mbwe, Mbankhu) and *Kankhande (<i>Ziziphus mucronata</i>) and
				pounded into powder. Hot water is added and given to the patient. The other way is to soak the Aloe roots in water and give the liquid to the patient.
	Similar symptoms to HIV/AIDS	Kanyera /Sira	Leaves Roots	Water is added to crushed leaves or roots, the patient drinks the liquid. Roots may also be pounded into powder, and added to porridge. Other plants may also be added.
	Vomiting	Kusanza	Leaves	Leaf skins are peeled off, the stuff is soaked in water and drink the liquid.

	For favor when answering charges	Kuwina pa mlandu	Leaves	Step on the Aloe leaves placed on the ground before going to the court.
	Cough	Chifuwa	Leaves Roots fruits	Aloe leaves, roots or fruits are mixed with roots of *Kayunga (Berberis) and *Kayokayoka / muwawani (Cassia abbreviata) or *Pupwe / Mzobala (Fagara), pounded into powder which is added to porridge.
	Sores on domesticated animals (Dogs, Goats)	Nkupe	Leaves	Apply the sap from the leaves on the sores, for 1 week.
	Swollen part on the abdomen especially in children	Pamba	Leaves	Press the swollen part with warmed leaf (The leaf is warmed on fire).
	Fracture	Kubinya	Leaves	Warm the leaf on the fire and press the fractured area with this warmed leaf without squeezing out the sap.
	Increases immunity	Kulimbisa thupi	Leaves Roots	Leaves or roots are burnt, squeeze off the sap onto honey. The mixture is eaten.

	Shingles		Leaves	Add water to pounded leaves, apply the stuff to the infected areas after taking a bath.
	Increases or improves potency in men		Leaves Roots	Leaves or roots of the Aloe are burnt on fire, squeeze off the sap onto some honey. The mixture is then eaten. The other method is to dry roots, pounded into powder which is added to tea or porridge. Other people soak leaf pieces in water and drink. The remains should be
				disposed in a rubbish pit (kudzala)

	Increases energy during child birth in women	Kubereka	Leaves	Add water to crushed leaves in a cup and let the patient drink the stuff during labor, only once. The other method is to pound Aloe leaves together with that of *Msutula (<i>Allophylus africana</i>). Water is then added to the mixture. The medicine is taken twice a day using a teaspoon. This is done when the woman is on labor.
	Chlamydia	Libale (Mauka)	Roots	The roots are boiled and let the steam reach the private parts (Kufungatira)
	Ornamental	Kukongole-tsa pakhomo		Plants are grown around homes as ornamentals
	Wounds / cuts	Zilonda	Leaves	Apply the sap to the wounds. If the wound is very deep, peel off the leaf skin and cover the wound with the inside stuff. Other people apply powder produced from pounded roots and leaves.

	Chemical (Shampoo)	Mankhwala a tsitsi	Leaves	Pound the leaves and use the stuff like soap when washing the hair for good growth of the hair.
	Umbilical cord / navel	Mchombo wa mwana	Leaves	Apply the sap
	Bad spirits / demons	Ziwanda	Leaves	Add the liquid from the soaked leaf pieces to water for bathing the patient
	Earache	Mkutu	Leaves	Peel off the skin, wrap the material in a piece of cloth. Squeeze out the sap into the infected ear.
	Heart attack	Matenda a mtima	Leaves	Soak the leaf pieces in water and give the liquid to the patient.
	Backache	Msana	Roots	Soak the roots in water and drink the liquid.
	Miscarriage	Chitayo	Leaves	Soak leaf pieces in water and give the liquid to the patient.
	Human head sores	ziwengo	Leaves	Leaves are dried and burnt to produce black powder which is applied on the sores.
	Ulcers	Zilonda za mmimba	Leaves	Soak leaf pieces in water and drink the liquid.
	Protection from witchcraft	Kuteteza mfiti kuti zisakuta- mbire	Whole plants	Plants are planted around homes as ornamentals

	Stomachache	Mmimba mopweteka	Leaves	Leaf pieces are soaked in water and give the liquid to the patient.
A. <i>swynnertonii</i> Rendle	Pneumonia	Chibayo	Leaves	Leaf pieces are mixed with roots of *Kankhande (<i>Ziziphus mucronata</i>) or *Tsitsimzukwa (<i>Asparagus africana</i>) and add water. This liquid is used to cook porridge or just drink the liquid. The other method is to make incisions and apply the Aloe sap. Start making incisions on the opposite side of affected area and finish with the painful side.
	Stomachache	Mmimba	Leaves	Aloe leaf pieces are mixed with roots of <i>Ziziphus mucronata</i> or <i>Asparagus africana</i> . Water is added. This liquid is drank or used for cooking porridge.

	Sexually transmitted disease	Songeya	Leaves	Aloe leaves are pounded, soaked in water which is later given to the patient to drink once per day. Leaves are also pounded and soaked in warm water which is used to bathe the genitals.
	Sexually transmitted disease	Mabomu	Leaves	Aloe leaves are soaked in cold or hot water and liquid given to the patient to drink. Leaves are also dried, burnt to make some powder which is applied on the wounds. Salt may be added to the powder.
	Newcastle in chickens	Chipumphu Chitopa Chidelu	Leaves	Leaves are crushed and added to drinking water for chickens.
	Burns	Mabala a moto	Leaves	Leaves are crushed and applied on the burnt area as soon as the area is burnt.
	Gonorrhea (sexually transmitted disease)	Chizonono	Leaves	Leaves are cut into pieces, soaked in water and given to the patient.

	Ornamental	Kukongole-tsa pakhomo		The plants are grown around homes to beautify the area
<i>A. canii</i> Lane	Child birth in women	Kubereka	Leaves	Leaves are pounded together with that of Msutula (<i>Allophylus africana</i>). Water is then added to the mixture. The medicine is taken twice a day using a teaspoon. This is done when the woman is on labor.
	Improves potency men		Root	The root is dried, pounded into powder. This powder is added to tea or porridge.
	Favor during charges	Kuwina mlandu	Leaves	Leaves are plucked and left on the ground to step on when to the court for charges.
	Stomachache	Mmimba	Leaves	Soak leaf pieces in water. Then give the liquid to the patient.
	Shingles		Leaves	Leaves are crushed and apply the stuff on the wounds.

	Newcastle in chickens	Chitopa	Leaves	Leaves are crushed and added to the drinking water of the chickens
	Ornamental	Kukongole-tsa pakhomo		The whole plant is planted around homes to beautify the area
A. <i>duckeri</i> Christian	Gonorrhea (sexually transmitted disease)	Chizonono	Leaves	Peel off the skin, soak the stuff in the bottle and add water. Let the patient drink the liquid.
	Asthma	Chifuwa cha Mphumo	Leaves	Cut the leaves into pieces and add water. Drink the liquid 3 times a day.
	Cancer		Leaves	Peel off the skin and cover the infected area with the peeled off material as a dressing. Clean the area next day using the liquid from the soaked crushed leaves.
	Wounds/cuts	Zilonda	Leaves	Apply the sap to the wound.
	Scabies (skin disease)	Mphere	Leaves Roots	Roots are soaked in water. Then this liquid is used for bathing. Leaf sap is applied on the sores after bathing.
	Abdominal pains	mmimba	Leaves	Leaves are crushed, water added and the liquid is drunk.

	Rectal prolapse / hydrocele	Mudzi	Leaves Roots	Roots are soaked in water and drink the liquid. The crushed leaves of the Aloe plus that of Chawayi (<i>Trichodesma venosum</i>) are inserted into the rectum to push in the rectum.
	Newcastle in chicken	Chigodola/ Chitopa	Leaves	Leaves are crushed and added to the drinking water of the chicken
	Dyspnoea (Shortness of breath)	Befu	Leaves	Crush the leaves, add water and drink the liquid.
	Chlamydia	Mauka	Leaves	Crush the leaves, soak in water and use the liquid for washing the infected area.
	Ulcers	Zilonda za mmimba	Leaves	Crush the leaves, add water and drink the liquid.
	Removal of placenta after child birth and opening the path during labor	Kutsalidwa Kutsakula njira	Leaves	Add water to crushed leaf stuff and drink the liquid. Other people mix with Leaves of Msutula (<i>Allophylus africana</i>).
	Ringworms / Tapeworm	Njoka za mmimba	Leaves	Peel off the skin, add water and drink the liquid.

	Improves potency in men		Roots	The roots are dried, pounded into powder. This powder is added to tea or porridge.
	For favor during charges	Kuwina mlandu	Leaves	Aloe leaves are left on the ground to step on when going to the court for trial.
	Ornamental	Kukongole-tsa pakhomo		The plant is grown around homes as ornamentals
<i>A. mzimbana</i> I. Verd. & Christian	Stomachache	Mmimba	Leaves	Crush the leaves, add water and drink the liquid.
	Skin rashes	Nthenda za pakhungu	Leaves	Peel off the skin and rub onto the infected area after cleaning it.
	Wounds/cuts	Zilonda	Leaves	Apply the sap onto the cuts/ wounds
	Sexually transmitted diseases	Matenda opatsana pogonana	Leaves Roots	Add water to crushed leaves or roots and drink the liquid. Other people add other plants.
	Ornamental	Kukongole-tsa pakhomo		Aloe plants are planted around homes for flowers

<i>A. zebrina</i> Baker	Shingles		Leaves	Leaves are crushed and Apply crushed leaves on the wounds
	Diarrhea	Kutsakula mmimba	Leaves	Soak the leaf pieces in water for some time. The liquid can be drunk or used to cook porridge for the patient.
	Abdominal pains	Kupweteka kwa mmimba	The whole plant	The whole plant including the roots are dried from which some
				powder is produced. This powder is added to porridge for the patient.
	Newcastle in chickens	Chitopa	Leaves	Leaves or the underground stem and the roots are crushed and added to the drinking water of the chickens
<i>A. cryptopoda</i> Baker	Diarrhea	Kutsakula mmimba	Roots	Soak the Aloe roots in water and give the liquid to the patient
	Backache	Msana	Roots	Soak the roots in water and drink the liquid.
	Stomachache due to miscarriage or child birth	Chitayo kapena chammimba	Leaves	Leaves are cut into pieces, soak in water and give the liquid to the patient.
	Ulcers	Zilonda za mmimba	Leaves	Cut leaves into pieces, soak in water and drink the liquid

	Feeds for termed animals (rabbits)	Chakudya cha mbira	Whole plant	Plants are collected from the wild and given to rabbits.
	Impotence		Leaves	Soak the leaf pieces in water, and drink the liquid. The remains after the dosage should be disposed in a rubbish pit (Kudzala).
	Wounds	Mabala	Leaves	Apply the sap
	Vegetable (Food)	Ndiwo zamasamba	Flowers	Flowers are plucked and cooked as a vegetable. Groundnut flour can also be added.
	Abdominal pains	Mmimba mopweteka	Leaves	Cut leaves into pieces, soak in water and drink the liquid.
A. <i>cameronii</i> Hemsl	Abdominal pains	Mmimba mopweteka	Leaves	Cut leaves into pieces, soak in water, and drink the liquid.
	Shingles		Leaves	Crush leaves and apply the stuff on the wounds. Can also soak the leaf pieces and the patient drink concoction.
	Gonorrhea	Chizonono	Leaves	Soak the leaf pieces in water and give the liquid to the patient.
	Weaning a child	Kuletsa mwana kuyamwa	Leaves	Leaves are crushed and applied on the breast.

	One of the sexually transmitted diseases	Mabomu	Leaves	Aloe leaves are soaked water and the liquid is given to the patient. Leaves are also dried, burnt to make some powder which is applied on the wounds.
	Ornamental	Kukongole-tsa pakhomo	Whole plant	Plants are collected from the wild and planted around homes to beautify the area
<i>A. arborescens</i> <i>Mill</i>	Newcastle in chickens	Chipumphu	Leaves	Leaves are crushed and added to the drinking water of the chickens
	Stomachache	Mmimba	Leaves	Leaves of an Aloe are chopped into pieces. The pieces are mixed with roots of <i>Cassia abbreviata</i> (Muwawani) and <i>Jeteorhiza cumbensis</i> (Mjoka). Soak the mixture in water and give the liquid to the patient. Other people soak the Aloe leaves only, and drink

	Chicken pox	Nthomba	Leaves	Soak pieces of leaves in bathing water for some time, and use the water to bathe the whole body.
	Sores on goats or dogs	Nkupe	Leaves	Add water to crushed leaves, then apply on the infected animals.
	Pneumonia	Chibayo	Leaves	Make incisions at the site and apply the sap on the area.
	Swollen breast	Kutupa kwa bele	Leaves	Warm Aloe leaf on fire, then press on the swollen breast with warmed leaf.
	One of the sexually transmitted diseases	Mabomu	Leaves	Aloe leaves are soaked in water and liquid given to the patient. Leaves are also dried, burnt to make some powder which is applied on the wounds. Salt can also be added to the powder.
A. Mawii Christian	Constipation	kudzimbidwa	Leaves	The leaf pieces are boiled and the hot liquid given to the patient once. This makes the patient to open bowels and this gives relief.
	Skin diseases	Matenda a pakhungu (Ziwengo)	Leaves	Leaf sap is squeezed and rubbed onto the infected area.
	Wounds / Cuts	Mabala	Leaves	Apply the sap

	Abdominal pains	Mmimba Mopweteka	Leaves	Leaves are soaked in water or boiled and given to the patient to drink.
	Gonorrhea	Chizonono	Roots Leaves	Roots or leaves are boiled in water or soaked in water and the patient drinks the liquid.
	Symptoms similar to HIV/AIDS	Kanyera	Leaves	Squeeze the sap from the leaves, mix it with eggs. Give the mixture to the patient to drink. This causes the patient to open bowel removing bad things from the stomach.
	Fishing	Kuphera nsomba	Leaves	Mix the leaf pieces with *Ombwe and apply the mixture to the waters / river to kill fish.
	Pitriasis vesicolor	Zikanga	Leaves	Take a bath first, then apply the sap and rub strongly.
	Ornamental	Kukongole-tsa pakhomo	Whole plant	The plants are uprooted from the wild and planted around homes to beautify the area

A. <i>chabaudii</i> Schönland	Symptoms similar to HIV/AIDS	Kanyera	Leaves	Soak the leaf pieces in water and leave them on the sun to warm the material. Let the patient drink the liquid.
	Skin Diseases	Nthenda za pakhungu (Ziwengo)	Leaves	Rub the sap onto the infected area
	Newcastle in Chicken	Chitopa	Leaves	Pound leaves and add to husks (madeya) or drinking water for chickens.
	Crackings on human heels	Manziru, Zikang'a	Leaves	Rub the heels with Aloe leaves.
	Abdominal pains	Mmimba mopweteka	Leaves	Cut leaves into pieces, soak in water, and drink the liquid.
	Shingles		Leaves	Crush leaves and apply the stuff on the wounds. The leaves are also soaked drink the liquid.
	Ornamental	Kukongole-tsa pakhomo	Whole plant	Plants are collected from the wild and planted around homes to beautify the area.
	Constipation	Kudzimbidwa	Leaves	Soak the leaf pieces, in water and leave the material on the sun to warm. Let the patient drink.

	Painful legs	Kupweteka kwa miyendo	Roots	Aloe roots are burnt to produce some powder which is applied on incisions made around the affected area
	Burns	Mabala a moto	Leaves	Pound the leaves and apply the sap on the wounds. Other people apply powdered Irish potato (<i>Solanum tuberosum</i>) on the wound after applying the sap.
	Sexually transmitted disease	Mabomu	Leaves	Aloe leaf is warmed on fire and press the infected part with it. Pieces of Aloe leaves are also soaked in water together with roots of *Kaumbu (<i>Lannea schimperi</i>), liquid is given to the patient. Aloe leaves only can also be soaked in water and the liquid given to the patient. Leaves are also dried, burnt to make some powder which is applied on the wounds. Salt may be added to the powder.
	Blood Pressure	Kuthamanga kwa magari	Roots	Soak the roots and give the liquid to the patient.

	Wounds Cuts	Mabala	Leaves	Aloe leaves are dried and make some powder which is applied to the wounds. Instead of making the powder, other people apply the sap from the leaves.
	Gonorrhea Syphilis	Chizonono Chindoko	Leaves	Leaf pieces are soaked in water and given to patient. Other people add *Muwawani (<i>Cassia abbreviata</i>) or *Thombozi Chipeta. The liquid is used to cook porridge which is given to the patient three times a day for one week.
	Epilepsy	Matenda a kugwa	Roots	Roots are soaked in water for some time and then given to the patient.
	Diarrhea	Kutsakula mmimba	Leaves	Leaves are crushed, soaked in water for some time and give it to the patient
	Vegetable	Ndiwo	Flowers	Flowers are mixed with Sweet potato (<i>Ipomoea batatas</i>) leaves (Kholowa) when cooking.

A. <i>menyharthii</i> Baker	Symptoms similar to HIV/AIDS	Kanyera	Leaves	Soak Aloe leaf pieces in water, leave for some time and give it to the patient. Other plant species can be added, such as *Namaning'ina
	Allergy usually manifested in skin sores	Mwanamphe-po	Leaves	Aloe leaves are chopped into pieces, soak in water, leave for some time and give it to the patient. Other plant can be added.
	General body cleaning	Kutsuka mthupi	Leaves	Chop leaves into pieces, soak in water and drink
	Newcastle in chicken	Chitopa	Leaves Roots Stem	Leaves, roots and stems are cut into pieces, pounded, and added to drinking water or maize husks (madeya) for chickens. Other people mix with *Cassia sp roots.
	Vomiting yellow stuff	Chintchofu	Leaves	Boil pieces of leaves and give the liquid to the patient.
	Earache	Mkutu	Leaves	Apply the sap.
	Crackings on heels	Manziru, Zikang'a	Leaves	Rub the heels with the Aloe leaves.
	Cough	Chifuwa	Leaves	Peel off the skin, soak the material in water, add some salt and drink.

	Pitriasis vesicolor	Zikanga	Leaves	Apply the sap from the leaves
	Skin rash	Nthenda ya pakhungu	Leaves	Squeeze out the sap and rub onto the infected area.
	Stomachache	Mmimba	Leaves	Cut leaves into pieces, soak in water and give the liquid to the patient
	Wounds / Cuts	Mabala	Leaves roots	Apply the leaf sap to the wound. If the wound is very deep, peel off the leaf skin and cover the wound with the inside material and wrap the wound using <i>Annona senegalensis</i> (Mpoza) bark. Other people apply powder produced from pounded Aloe roots and leaves
	Shingles		Leaves	Add water to pounded leaves and apply the liquid onto the infected areas after taking a bath.
	Ornamental	Kokongole-tsa pakhomo	Whole plant	The seedlings are uprooted from the wild and planted around the homes.

	Syphilis and Gonorrhea	Chindoko ndi chizonono	Leaves roots	Cut Aloe leaves into pieces, add salt, boil and give it to the patient. Other people mix Aloe roots with that of male <i>Carica papaya</i> (Papaya) or *Chamasala.
	Uterus Cancer		Leaves	Cut leaves into pieces and soak in water and let the patient drink.
	Diarrhea	Kutsakula mmimba	Roots	Soak the Aloe roots in water and give the liquid to the patient.
	Backache	Msana	Roots	Soak the roots in water and drink the liquid.
	Stomachache due to miscarriage or after child birth	Chitayo	Leaves Roots	Leaves are cut into pieces, soaked in water or boil roots and give the liquid to the patient.
	Ulcers	Zilonda za mmimba	Leaves	Cut leaves into pieces, soak in water and drink the liquid
	Impotence		Leaves	Cut leaves into pieces, soak in water, and drink the liquid. The remains after the dosage should be disposed in a rubbish pit (Kudzala).
	Flitters (Food)	Mandasi	Flowers	Flowers are dipped in dough and fry in the same way as flitters.

	Vegetables (Food)	Ndiwo zamasamba	Flowers	Pluck flowers and cook like pumpkin leaves, groundnut flour is added. Flowers may also be added to sweet potato leaves as tomatoes. Flowers can also be preserved by drying to be used later.
	Protection from witchcraft	Kuteteza mfiti kuti zisakuta- mbire	Whole plants	Plants are planted around homes as ornamentals
	Child birth	Kubereka kwa amayi	Leaves	Add water to crushed leaves and give the liquid to the patient using chipande, and drug the chipande down. This is done when labor has started.
	Snake bite	Bala la njoka	Leaves	Make incisions around the bitten area and apply sap. Other people just rub on the site with sap/leaves to remove the teeth.
	Athlete foot	Linyetsu	Leaf	Warm a leaf on fire, peel off the skin and press the infected area with the warmed leaf material.

	Animal feeds	Zakudya za ziweto (goats)	Leaves	Some domesticated animals graze on Aloes especially when grasses are scarce.
	Epilepsy	Khunyu / matenda akugwa	Roots	Mix Aloe leaves with that of other three plant species. Boil the mixture and give the liquid to the patient
	Burns	Mabala a moto	Leaf	Apply the sap on the burnt area
	Induce fertility in women	Kusula amayi	Whole plant	Chop the whole plant, dry, and make some powder. Add this powder to porridge. Other people add roots of other plant species such as <i>*Mondia whitei</i> (Gondolosi). Another way is to soak the mixture in water and drink the liquid.

APPENDIX E: A LIST OF KNOWN *ALOE* SPECIES OF MALAWI

1. *A. Arborescens* Mill.
2. *A. buchananii* Baker
3. *A. buertneri* Berger
4. *A. cameronii* Hemsl.
5. *A. canii* S. Lane
6. *A. chabaudii* Schönland
7. *A. christianii* Reynolds
8. *A. cryptopoda* Baker
9. *A. duckeri* Christian
10. *A. mawii* Christian
11. *A. menyharthii* Baker
12. *A. myriacantha* (Haw.) Schult. & Schult.f.
13. *A. mzimbana* I. Verd. & Christian
14. *A. nuttii* Baker
15. *A. swynnertonii* Rendle
16. *A. zebrina* Baker

APPENDIX F: COORDINATES USED IN GIS (BEFORE THIS STUDY)

<i>A.buchananii</i>		<i>A. nuttii</i>		<i>A.mzimbana</i>		<i>A.christianii</i>	
S	E	S	E	S	E	S	E
14,12,00	34,12,00	10,45,00	34,02,00	10,37,00	33,48,00	15,46,00	35,30,00
15,19,00	35,18,00					15,51,00	35,42,00
15,56,00	35,37,00						
16,52,00	35,12,00						

<i>A.swynnertonii</i>		<i>A.arborescens</i>		<i>A.menyharthii</i>		<i>A.mawii</i>	
S	E	S	E	S	E	S	E
14,32,00	34,32,00	13,27,00	33,56,00	15,57,00	35,29,00	10,35,00	34,07,00
15,36,00	34,26,00	14,20,00	34,20,00			15,19,00	35,18,00
15,54,00	35,30,00	15,56,00	35,37,00			15,41,00	35,10,00
15,57,00	35,29,00					15,43,00	35,39,00
16,32,00	35,09,00					15,46,00	35,04,00
						15,54,00	35,42,00
						15,56,00	35,37,00

<i>A.zebrina</i>		<i>A. cryptopoda</i>		<i>A.duckeri</i>		<i>A.buettneri</i>	
S	E	S	E	S	E	S	E
11,01,00	33,55,00	11,03,00	33,53,00	09,40,00	33,27,00	11,03,00	33,53,00
		11,40,00	33,38,00	10,27,00	33,52,00	11,05,00	33,23,00
		15,08,00	35,19,00	10,37,00	34,06,00		
		15,38,00	35,13,00	10,45,00	34,02,00		
		15,44,00	34,44,00	14,12,00	34,12,00		
		16,04,00	35,02,00				
		16,42,00	35,02,00				

<i>A.canii</i>		<i>A.myriacantha</i>		<i>A.cameronii</i>		<i>A.chabaudii</i>	
S	E	S	E	S	E	S	E
13,38,00	34,33,00	14,19,00	34,16,00	13,21,00	34,01,00	10,04,00	33,54,00
		15,50,00	35,36,00	14,20,00	34,20,00	11,03,00	33,53,00
				15,19,00	35,18,00	13,59,00	34,45,00
				15,46,00	35,30,00	14,12,00	34,11,00
				15,54,00	35,42,00	14,28,00	35,30,00
						15,41,00	35,10,00
						15,56,00	35,37,00

APPENDIX G : COORDINATES RECORDED DURING THIS STUDY

<i>A.buchananii</i>		<i>A. nuttii</i>		<i>A.mzimvana</i>		<i>A.christianii</i>	
S	E	S	E	S	E	S	E
15,09,00	34,35,00	10,38,02	33,52,40	10,16,00	33,49,00	09,29,44	33,06,55
15,46,00	35,04,00	10,26,80	33,51,26	10,23,02	33,47,20	09,39,33	33,14,27
15,50,00	35,08,00	10,27,00	33,52,00	10,34,93	33,44,76	09,49,20	33,29,01
15,53,00	35,36,00	10,31,00	33,48,00	10,35,00	33,41,00	09,51,02	33,31,19
15,54,00	35,31,00	10,32,00	33,51,00	10,36,24	33,41,16	09,53,29	33,33,33
15,55,00	35,41,00	10,35,00	33,48,00	10,36,30	33,41,20	09,54,27	33,35,17
		10,36,00	33,51,00	10,39,54	33,51,56	09,54,28	33,42,55
		10,38,35	33,52,76	10,44,00	33,50,00	09,55,05	33,39,36
		11,45,00	33,51,00	10,49,00	33,50,00	09,56,29	33,46,05
		11,50,00	33,48,00			09,57,33	33,24,02
		15,19,00	34,39,00			10,01,38	33,29,42
						10,14,24	33,33,50
						10,17,19	33,35,18
						10,20,40	33,36,53
						10,20,45	33,36,39
						10,21,33	33,39,00
						10,21,52	33,39,37
						10,22,20	33,39,51
						10,22,40	33,39,50
						10,23,00	33,39,44
						10,23,50	33,40,03
						10,25,25	33,36,50
						10,26,47	34,07,35
						10,27,33	34,08,40
						10,51,34	33,33,23
						10,52,35	34,03,07
						10,54,16	33,34,03
						10,55,00	33,34,53
						10,55,09	33,36,42
						10,55,13	33,34,24
						12,24,00	33,38,00
						12,35,92	33,32,93
						13,46,16	32,47,40
						13,46,31	32,48,12
						13,46,45	32,54,36
						14,06,62	34,07,08
						14,11,90	34,11,21
						14,12,60	34,08,17
						14,14,55	34,13,93
						14,15,41	34,13,24
						14,15,71	34,13,39
						14,25,62	34,27,74
						14,26,33	34,30,74
						14,36,03	34,32,49
						15,07,00	35,27,00

15,19,00	35,18,00
15,22,58	35,19,00
15,26,84	34,39,03
15,28,00	35,08,00
15,33,00	35,20,00
15,37,43	34,28,82
15,39,79	34,26,24
15,42,00	35,07,00
15,50,00	35,16,00
15,56,52	34,55,31

<i>A.swynnertonii</i>		<i>A.arborescens</i>		<i>A.menyharthii</i>		<i>A.mawii</i>	
S	E	S	E	S	E	S	E
09,00,00	33,05,00	13,25,04	33,55,09	14,25,05	35,95,10	15,55,66	35,31,44
10,35,00	33,41,00	14,21,65	34,19,45	15,09,31	35,05,00	15,55,68	35,30,38
10,51,11	33,33,56	15,21,00	35,18,00	15,25,09	35,04,25	15,55,77	35,34,53
11,22,00	33,53,00	15,53,64	35,37,52	15,27,32	34,56,19	15,55,88	35,35,48
11,25,05	34,01,19	15,54,00	35,31,00	15,28,06	34,56,11	15,56,60	35,32,55
11,28,00	34,02,00	15,54,00	35,42,00	15,30,47	35,01,00		
11,30,04	34,04,15	15,55,00	35,41,00	15,31,22	34,39,57		
13,04,00	33,56,00	15,55,86	35,34,77	15,33,41	34,37,57		
13,26,00	33,55,07	15,57,00	35,35,00	15,36,80	34,31,11		
13,26,02	33,55,13			15,38,01	34,35,20		
14,12,00	34,12,00			15,39,57	34,37,90		
14,16,33	34,15,65			15,41,53	34,40,08		
14,16,40	34,15,79			15,49,49	35,30,21		
14,16,44	34,15,73			15,49,82	35,12,78		
14,18,79	34,16,31			15,50,00	35,08,00		
14,19,95	34,15,58			15,51,92	35,42,25		
14,23,84	34,23,10			15,53,93	34,45,02		
15,04,00	34,51,00			15,56,14	35,30,17		
15,19,00	35,18,00			16,13,21	35,10,23		
15,22,58	35,19,00			16,40,11	35,03,25		
15,26,00	35,19,00			16,55,00	35,11,14		
15,35,00	35,35,00			16,55,11	35,10,89		
15,44,00	34,57,00						
15,51,00	35,42,00						
15,55,00	34,04,00						
15,56,00	35,30,00						
15,56,00	35,37,00						
16,01,00	35,20,00						
16,45,00	35,08,00						

<i>A.zebrina</i>		<i>A. cryptopoda</i>		<i>A.duckeri</i>		<i>A.buettneri</i>	
S	E	S	E	S	E	S	E
11,01,35	33,56,12	11,02,00	33,53,27	10,37,08	34,09,76	10,43,00	34,02,00
14,17,22	34,34,40	14,03,81	34,51,55	10,38,00	34,09,04	15,17,00	35,23,00
14,17,36	34,34,62	15,33,27	34,43,64	10,45,00	34,10,00		
14,17,37	34,34,60	16,42,34	34,59,81	11,24,00	34,02,00		
14,29,00	35,16,00			11,24,00	34,01,00		

15,18,00	35,10,00			11,26,00	34,14,00
15,24,00	35,20,00			11,27,00	34,01,00
15,25,00	35,03,00			11,45,00	33,51,00
				11,54,00	33,44,00
				12,00,00	33,45,00
				12,03,00	33,37,00
				14,20,00	34,20,00
				15,50,00	35,08,00

<i>A.canii</i>		<i>A.myriacantha</i>		<i>A.cameronii</i>		<i>A.chabaudii</i>	
S	E	S	E	S	E	S	E
		15,56,00	35,37,00	13,08,88	33,57,39	13,25,04	33,55,09
				13,25,94	33,55,00	13,25,70	33,55,10
				13,35,42	33,54,49	13,34,93	33,55,46
				13,58,00	33,41,00	13,55,00	34,28,00
				14,12,00	34,12,00	14,12,00	33,56,00
				14,12,00	34,19,00	14,25,00	35,95,12
				14,12,00	33,56,00	14,33,74	34,31,67
				14,13,84	34,12,63	15,24,00	35,20,00
				14,20,00	34,20,00	15,26,00	35,19,00
				14,25,01	35,95,13	15,52,28	35,42,20
				15,24,00	35,11,00	15,55,99	35,30,75
				15,54,00	35,43,00		