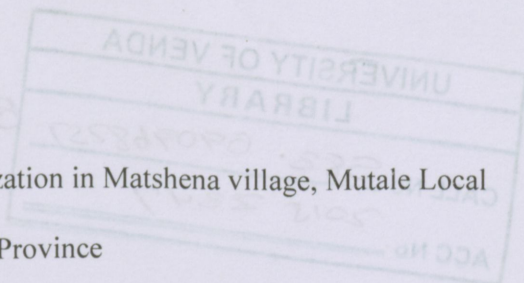


Assessment of *Androstachys johnsonii* Prain. stem utilization in Matshena village, Mutale Local
Municipality, Limpopo Province



BY

Bakali Mulalo (Student number: 11593131)

Dissertation submitted in fulfilment of the requirement of the degree of MASTER OF SCIENCE

In the

Department of Botany

University of Venda

Private Bag X5050

Thohoyandou 0950

Supervisor: Prof MP Tshisikhawe

Co-Supervisor: Mr MH Ligavha-Mbelengwa

2015

DECLARATION

I, the undersigned: **BAKALI MULALO (Student number 11593131)**, declare that this dissertation is my own work, and all the sources I have used or quoted have been indicated and acknowledged by means of complete references. This project work is being submitted for the degree of Master of Science in Botany at the University of Venda, Limpopo Province, South Africa, and the work contained herein is original and has not been submitted at any other University for any degree.

.....
BAKALI MULALO

10/07/2015
.....

M. BAKALI

Date

ACKNOWLEDGEMENTS

I thank the Almighty God for giving me knowledge, strength and proctecting me throughout the whole project. I also thank my supervisor Prof. M.P. Tshisikhawe for the support, encouragement and guidance he has given me to complete my research. I also wish to thank my co-supervisor Mr. M.H. Ligavha-Mbelengwa for his support throughout my academic development. Mr. K. Magwede, M. Mulamuli and N. Mulaudzi are acknowledged for their assistance with data collection in the field. My family and friends are thanked for their unconditional support during the duration of my studies.

The University of Venda and my parents are thanked for their financial support.

DEDICATION	PAGE
------------	------

I dedicate this work to my biological parents Mr Mphuphudzeni Enock and Mrs Sarah Shumani Bakali who believed in me. A special dedication to my son Wanga.

ACKNOWLEDGEMENTS.....	ii
DEDICATION.....	iii
TABLE OF CONTENTS.....	iv
LIST OF FIGURES.....	viii
LIST OF TABLES.....	ix
ABSTRACT.....	x
CHAPTER I	
INTRODUCTION	
1.1 Background and literature review.....	1
1.2 Description of the studied species.....	4
1.3 Study aim and objectives.....	7
1.4 Hypothesis.....	8
1.5 Problem statement.....	8
1.6 Structure of dissertation.....	8
References.....	10

TABLE OF CONTENTS	PAGE
DECLARATION.....	i
ACKNOWLEDGEMENTS.....	ii
DEDICATION.....	iii
TABLE OF CONTENTS.....	iv
LIST OF FIGURES.....	viii
LIST OF TABLES.....	ix
ABSTRACT.....	x
CHAPTER 1	
INTRODUCTION	
1.1 Background and literature review.....	1
1.2 Description of the studied species.....	4
1.3 Study aim and objectives.....	7
1.4 Hypothesis.....	8
1.5 Problem statement.....	8
1.6 Structure of dissertation.....	8
References.....	10

CHAPTER 2

POPULATION DYNAMICS OF *Androstachys johnsonii* IN THE PRESENCE OF HARVESTING IN MATSHENA VILLAGE

2.1 Introduction.....	13
2.1.1 Rationale of the study.....	15
2.1.2 Aims and objectives.....	15
2.1.3 Hypothesis.....	15
2.2 Study area.....	16
2.2.1 Description of the study area.....	16
2.3 Method and material.....	18
2.3.1 Line intercepts method of sampling <i>Androstachys johnsonii</i>	18
2.4 Results and Discussion.....	19
2.4.1 Population structure.....	19
2.4.2 Crown health status.....	22
2.4.3 Harvesting impact.....	23
2.5 Conclusion.....	25
References	26

CHAPTER 3

ETHNOBOTANICAL SURVEY OF *Androstachys johnsonii* IN MATSHENA VILLAGE, MUTALE LOCAL MUNICIPALITY

3.1 Introduction.....	32
3.2 Aim and objectives.....	34
3.3 Study area.....	35
3.4 Materials and methods.....	37
3.4.1 Ethnobotanical survey of <i>Androstachys johnsonii</i>	37
3.5 Results and discussion.....	37
3.5.1 Profile of informants.....	37
3.5.2 Use categories of <i>Androstachys johnsonii</i>	38
3.5.3 Utilized parts of <i>Androstachys johnsonii</i>	43
3.5.4 Availability status of <i>Androstachys johsonii</i>	44
3.6 Conclusion.....	45
References.....	46

CHAPTER 4 *URES*

GENERAL CONCLUSION AND RECOMMENDATIONS *5*

4.1 Conclusion.....50

4.2 Recommendations.....51

Figure 2.1: A map of Mafale Local Municipality, Limpopo, South Africa (Community Survey, 2007).....17

Figure 2.2: Stem class size against individuals revealed by data collected in 2013.....21

Figure 2.3: Crown health in scale of 1-3 with their percentages..... 21

Figure 2.4: Plants heights among the individual plants24

Figure 3.1: Map of Limpopo Province, showing projected area (indicated by circled area).....36

Figure 3.2: Different age groups of participant.....38

Figure 3.3: Uses of *Andropogon johnsonii* in Matchene village.....39

Figure 3.4 A and C showing livestock kraals, and household yard (B) built with *Andropogon johnsonii* stems.....40

Figure 3.5: Frequency of plant parts used.....43

Figure 3.6: Availability of *Andropogon johnsonii* as indicated by respondents.....44

LIST OF FIGURES

Figure 1.1: <i>Androstachys johnsonii</i> stand at the Mutale study site.....	5
Figure 1.2: The evergreen leaves of <i>Androstachys johnsonii</i>	6
Figure 2.1: A map of Mutale Local Municipality. Limpopo, South Africa (Community Survey, 2007).....	17
Figure 2.2: Stem class-size against individuals revealed by data collected in 2013.....	21
Figure 2.3: Crown health in scale of 1-5 with their percentages.....	22
Figure 2.4: Plants heights among the individual plants.....	24
Figure 3.1: Map of Limpopo Province, showing projected area (indicated by circled area).....	36
Figure 3.2: Different age groups of participant.....	38
Figure 3.3: Uses of <i>Androstachys johnsonii</i> in Matshena village.....	39
Figure 3.4 A and C showing livestock kraals, and household yard (B) built with <i>Androstachys johnsonii</i> stems.....	40
Figure 3.5: Frequency of plant parts used.....	43
Figure 3.6: Availability of <i>Androstachys johnsonii</i> as indicated by respondents.....	44

LIST OF TABLES

Table 1.1: Number of individuals within different stem size-classes..... 20

APPENDIX A52

The study was done in order to verify what was going on in terms of the population dynamics of *Androstachys johnsonii*, seeing that the plants species are being overharvested. The study took place in Matshosa village in Mutale Municipality in Limpopo Province, South Africa. At the study area, 10 transects of 100 m by 5 m were conducted using a measuring tape. Two methods were employed: (1) line intercept method used to document population dynamics, and (2) an observational survey to verify the use of this plant species.

The study revealed that the status of crown health was generally good; about 70% of *A. johnsonii* plant occurred in the 0-5 m height class. The majority of the studied plants fall under 0-10 cm on the stem size-classes. It was found that the community uses the plant for fencing their homesteads along with other structures. The most common part used from *Androstachys johnsonii* was the stem. About 70% of this species was used, which emphasize availability status.

Keywords: *Androstachys johnsonii*, Mutale, Plant population, Species, Harvested, Utilization, Population dynamics.

ABSTRACT

Androstachys johnsonii Prain. is a tree species belonging to the family Euphorbiaceae. It is a gregarious species that occurs only in selected areas in Mozambique, South Africa, Swaziland and Madagascar. It is mostly valued for its wood and is also used for construction purposes.

1.1 Background and literature review

The study was done in order to verify what was going on in terms of the population dynamics of *Androstachys johnsonii*, seeing that the plants species are being overharvested. The study took place in Matshena village in Mutale Municipality in Limpopo Province, South Africa. At the study area, 10 transects of 100 m by 5 m were constructed using a measuring tape. Two methods were employed; (1) line intercept method used to document population dynamics, and (2) an ethnobotanical survey to verify the use of this plant species.

The study revealed that the status of crown health was generally good; about 70% of *A. johnsonii* plant occurred in the 0-5 m height class. The majority of the studied plants fall under 0-10 cm on the stem size- classes. It was found that the community uses the plant for fencing their homesteads along with other structures. The most common part used from *Androstachys johnsonii* was the stem. About 70% of this species was used, which emphasize availability status.

change other plant variables (e.g. growth rates, seed production, branching patterns, leaf area,

root area, and size of the individuals). Plant distribution, survival, and patterns of growth and

Keywords: *Androstachys johnsonii*, Mutale, Plant population, Species, Harvested, Utilization, Population dynamics.

CHAPTER 1

INTRODUCTION

1.1 Background and literature review

Androstachys johnsonii Prain. is a tree species belonging to the family Euphorbiaceae. It is a gregarious species that occurs only in selected areas in Mozambique, South Africa, Swaziland and Madagascar. It is mostly valued for its wood, which is used for construction purposes (Samie *et al.*, 2005).

Plants are not evenly distributed in nature. There are a number of factors that influence the population dynamics and distribution pattern of plants. These factors include differences in environmental conditions, resources, neighbours and disturbance. Different environmental conditions not only modify the distribution and abundance of individuals, but are likely to change other plant variables (e.g. growth rates, seed production, branching patterns, leaf area, root area, and size of the individuals). Plant distribution, survival, and patterns of growth and reproduction reflect the plant's adaptations to a particular environment, and are thus a critical part of plant ecology (Barbour *et al.*, 1987).

Population structure in most forestry and ecological studies has been defined in terms of size-classes, or the diameter distribution of individuals, with frequency histograms showing the number or percentage of individuals in each size-class (Knight, 1975; Peters, 1996). Determining the structure of a population is a first step that, combined with demographic data, such as size-specific growth rates (Condit *et al.*, 1998), can be the basis for management (Bruna and Kress, 2002).

About 80% of the population of many developing countries still use traditional medicines for their primary health care. Modern pharmacopoeia still contains at least 25% drugs derived from plants and many others, which are synthetic analogues, are built on prototype compounds isolated from plants. China, India, Sri Lanka and a few other countries have officially recognized the use of traditional medicines in their primary health care delivery systems (Tcheknavorian-Asenbauer and Wijesekera 1982).

Today there is an urgent need for conservation measures and adoption of sustainable use methods throughout Africa to avoid further degradation of natural resources (Huntley, 1988; Sayer *et al.*, 1992; Myers, 1994). According to Chazdon (2003) human impact in savanna environments frequently lead to vegetation changes that take places faster than natural vegetation transformations, as human-caused disturbances often occur in form of continuous and wide spread stress, e.g. frequent fires, grazing, and logging.

A major factor impeding the development of the medicinal plant based industries in developing countries has been the lack of information on the social and economic benefits that could be derived from the industrial utilization of medicinal plants (Tcheknavorian-Asenbauer, 1993). A lot of woodland species have been investigated for use in addressing local health care needs, and their market potential in improvement of livelihoods and alleviation of poverty have also been investigated (Shackleton *et al.*, 2007). As a result, the real potential of these plants still need further exploitation by governments or entrepreneurs (De Silva, 1993).

1.3 Description of the studied species

India is a veritable emporium of medicinal and aromatic plants. It has been estimated that out of 15,000 higher plants occurring in India, 9,000 are commonly useful, 7,500 are medicinal, 3 900 are edible, 700 are culturally important, 525 are used for fibre, 400 are fodder, 300 for pesticide and insecticide, 300 for gum, resin and dye, and 100 for incense and perfume (Anonymous,1994). In terms of the plant material for traditional medicine, it is estimated that local communities used over 7,500 plants species. Indian flora has innumerable medicinal plants, which are collected from forests by tribal villagers. Many of them are being exported to developed countries (Anonymous, 1993).

The utilization of exotics species for medicinal purposes is also a common practice in African countries. In Kenya Njoroge *et al.* (2004) found that 75 exotics species are being used to cure 59 human ailments in traditional medicinal practices of central Kenya. This remarkable finding made Njoroge *et al.* (2004) to postulate that traditional medicine in their study area is undergoing changing patterns as far as medicinal plant utilization is concerned. South Africa is not

excluded; a review on important exotic species by Lewu and Aflolayan (2009) revealed that 34 species are used to treat 21 diseases by major ethnic groups (Xhosa, Zulus, Vendas and Swatis) of South Africa, excluding Bapedi; one of the largest ethnic groups in South Africa. Similarly, Dold and Cocks (2002) noted that of 130 plant species used as medicine by Xhosa traditional healers in the Eastern Cape Province, 33 are declared exotics species.

1.2 Description of the studied species

Androstachys johnsonii, the Lebombo Ironwood, *Musimbiri* is an evergreen tree species and the sole member of the genus *Androstachys*. It is native to Africa and Madagascar. The tree can reach a maximum height of about 15 m (Palgrave, 1997), depending on soil and environmental conditions. Within Southern Africa, it occurs in Limpopo Province, Mpumalanga, Swaziland and Mozambique. It is widely used in the Southern part of Mozambique, where it is known as *Simbirre*, for flooring, and is commonly traded for use as pillars of huts and fences. South African tourist operators in Mozambique used it extensively for building structures near or in sea water. <https://en.wikipedia.org/wiki/Androstachys>

The evergreen *A. johnsonii* canopy remains throughout the year and provides important forage and shade for wildlife at a time when many other trees are leafless. Commonly found at altitudes *Androstachys johnsonii* secrete secondary or allelopathic compounds that suppress the establishment, and hence growth and development of other species under its canopy (Molotja, 2001; Lukhele and Van Ryssen, 2003).



Figure 1.1: *Androstachys johnsonii* stand at the Mutale study site.

Figure 1.2: The evergreen leaves of *Androstachys johnsonii*

The wood is extremely hard and durable. It is of economic interest, as it is rarely traded as mecrussé, and makes good flooring. Its rare trade is, presumably because of a lack of supply.

<https://en.wikipedia.org/wiki/Androstachys>

The evergreen *A. johnsonii* canopy remains throughout the year and provides important forage and shade for wildlife at a time when many other trees are leafless. Commonly found at altitudes up to 1000 m, forming dense shrub-like thickets, it thrives in hot and dry climates with well-drained soils; commonly found on rocky hillsides or along seasonal watercourses (Smith, 1996).

The evergreen *A. johnsonii* canopy remains throughout the year and provides important forage and shade for wildlife at a time when many other trees are leafless. Commonly found at altitudes up to 1000 m, forming dense shrub-like thickets, it thrives in hot and dry climates with well-drained soils; commonly found on rocky hillsides or along seasonal watercourses (Smith, 1996).

and vary in both arrangement and appearance. Male flowers are yellow and are arranged in a 3 flower cluster up to 3 cm long. Central flowers are longer than the laterals with their pedicel



Figure 1.2: The evergreen leaves of *Androstachys johnsonii*.

Androstachys johnsonii is a medium-sized, tree growing up to 20 m high (Smith, 1996). It is characterised by a rough bark with a whitish, woolly, hair like covering on the new growth. The leaf blades are 3-9 x 2-7 cm, and are oppositely paired at right angles. They are ovate to heart-shaped with both the apex and base rounded. The upper surfaces are shiny and are a green to blue-green colour, beneath the surface is covered in dense, white, woolly hairs (Smith, 1996).

1.3 Study aim and objectives

Flowering time of *Androstachys johnsonii* is October–November. Flowers are axillary, unisexual and vary in both arrangement and appearance. Male flowers are yellow and are arranged in a 3 flower cluster up to 3 cm long. Central flowers are longer than the laterals with their pedicel

being 1-1.3 cm long versus the lateral length of 5-6 mm sepals; greenish petals that the form the calyx of the flower differ in number; 5 in central flower and 2-3 in laterals. The bulbous base or receptacle of flower from which its organs grow are 2 cm long in central; 1.5 cm in laterals. Stamens up to 50 in central, 35 in lateral, filaments of lowest stamens up to 1 mm long, anthers 3 x 0.5 mm, covered in fine silky hairs in early development and then smooth, lacking hairs with maturation. Female flowers are yellow, and situated at the end of a long, white hairy stalk. Pedicels are 1-1.5 cm long, extending to up to 3 cm long in fruit; sepals are 7-8 x 2-2.5 mm and are an ovate shape, blunt tapering or sometimes split at apex, minutely ruffled with fine hairs on edge and base; otherwise smooth. Ovary is 3 mm in diameter, oval in shape, densely covered in fine white woolly hairs. Styles are long with fine hair covering, stigmas are globe-shaped.

<https://en.wikipedia.org/wiki/Androstachys>

Fruit is bright green at first and ripens to yellow or light reddish brown, and is covered in fine bristle-like hairs. It is a 3-lobed capsule, 8-10 x 12-13 mm in size, and easily detachable. Seeds are a brown chestnut with long, shallow, and linear ridge. Their dimensions are 6.5-7(8) x 4.5-5(6) x 2-3 mm. <https://en.wikipedia.org/wiki/Androstachys>

1.2 Structure of dissertation

1.3 Study aim and objectives

This dissertation consists of a collection of chapters on several aspects related to the assessment of *Androstachys johnsonii* stem utilization. Chapter 1 provides the background and literature. The study aimed to investigate the utilization of *Androstachys johnsonii* stems by the local people of Matshena in Mutale Local municipality. The following objectives were looked at:

1. To investigate the population structure of *Androstachys johnsonii*.
2. To document the ethnobotanical importance of *Androstachys johnsonii*.

1.4 Hypothesis

The harvesting intensity of *Androstachys johnsonii* observed at Matshena suggests that the species is probably used for a number of reasons.

1.5 Problem statement

Androstachys johnsonii, as a savanna plant, is known to be a survival plant since it is can to have withstood different environmental conditions. These plant species have been flourishing at Mabena village and it has played a role in benefiting the community. The community use *Androstachys johnsonii* for fire, shade on sunny days and its wood is used as timber for construction. Besides the beneficial effects, this plants species is harvested in large quantities which could result in its extinction in the near future. This study will try to suggest ways for preserving the species.

1.6 Structure of dissertation

This dissertation consists of a collection of chapters on several aspects related to the assessment of *Androstachys johnsonii* stem utilization. Chapter 1 provides the background and literature review. Chapter 2 deals with the population structure of *Androstachys johnsonii*. Chapter 3

provides the ethnobotanical importance of *Androstachys johnsonii*. General conclusions and recommendations are given in Chapter 4

- Anonymous. 1993. *Annual Report*. (Indian Council of Forestry Research and Education, Dehradun). 193-207.
- Anonymous. 1994. Ethnobotany in India. A Status report. All India coordinated research project in ethnobotany. Ministry of Environment Forests, Government of India, New Delhi.
- Barbour, M.T., Burck, J.H., Paus, W.D. 1987. *Terrrestrial Plant Ecology*. 2nd edition. The Benjamin/Cummings Publishing Company, Inc. U.S.A.
- Brana, E.M., Kress, W.J. 2002. Habitat fragmentation and the demographic structure of an Amazonian understory herb (*Heliconia acuminata*). *Conservation Biology* 16: 1256-1266.
- Chazdon, R.J. 2003. Tropical forestry recovery: legacies of human impact and natural disturbances. *Perspectives in Plant Ecology, Evolution and Systematics* 6: 51-71.
- Codit, P., Sukumar, R., Hubbell, S.P., Foster, R. 1998. Predicting population trends from size distribution: A direct test in a tropical tree community. *American Naturalist* 152: 495-509.
- De Silva, T. 1993. UNIDO development programmes on industrial utilization of medicinal and aromatic plants. *Acta Horticulturae* 333: 47-54.
- Dell, A.L., Cocks, M.J. 2002. The trade in medicinal plants in the Eastern Cape Province, South Africa. *South African Journal of Science* 98: 589-597.

References

- Anonymous. 1993. *Annual Report*, (Indian Council of Forestry Research and Education, Dehradun), **193–207**.
- Anonymous. 1994. Ethnobotany in India. A Status report, All India coordinated research project in ethnobotany. Ministry of Environment Forests, Government of India, New Delhi.
- Barbour, M.G., Burk, J.H., Pitts, W.D. 1987. *Terrestrial Plant Ecology*. 2nd edition. The Benjamins/Cumings Publishing Company. Inc. U.S.A.
- Bruna, E.M., Kress, W.J. 2002. Habitat fragmentation and the demographic structure of an Amazonian understory herb (*Heliconia acuminata*). *Conservation Biology* **16**: **1256–1266**.
- Chazdon, R.L. 2003. Tropical forestry recovery: legacies of human impact and natural disturbances. *Perspectives in Plant Ecology, Evolution and Systematics* **6**: **51–71**.
- Condit, R., Sukumar, R., Hubbell, S.P., Foster, R. 1998. Predicting population trends from size distribution: A direct test in a tropical tree community. *American Naturalist* **152**: **495–509**.
- De Silva, T. 1993. UNIDO development programmes on industrial utilization of medicinal and aromatic plants. *Acta Horticulturae* **333**: **47–54**.
- Dold, A.L., Cocks, M.L. 2002. The trade in medicinal plants in the Eastern Cape Province, South Africa. *South African Journal of Science* **98**: **589–597**.

- <http://en.wikipedia.org/wiki/Androstachys>. [Accessed: 2013-10-26]. Description of *Androstachys johnsonii*.
- Huntley, B.J. 1988. Conserving and monitoring biotic diversity – some African examples. In Biodiversity. 1988. Wilson, E.O. and Peter, F.M. pp. 348- 360: National Academy Press. Washington, DC.
- Knight, D.H. 1975. A phytosociological analysis of species-rich tropical forest on Barro Colorado Island, Panama. *Ecological Monographs* **45**: 259-284.
- Lewu, F.B., Afolayan, A.J. 2009. Ethnomedicine in South Africa: The role of weedy species. *African Journal of Biotechnology* **8**: 929-934.
- Lukhele, M.S., Van Ryssen, J.B.J. 2003. The chemical composition and potential nutritive value of foliage of four subtropical tree species in South Africa for ruminants. *South African Journal of Animal Science* **33** (2): 132-141.
- Molotja, M.G. 2001. The inhibition of growth and productivity of *Zea mays* and *Apios tuberosa* by *Androstachys johnsonii*. Honours Degree Report. University of Venda, South Africa.
- Myers, N. 1994. Protected areas- protected from greater ‘what’? *Biodiversity and Conservation* **3**: 411-418.
- Njoroge, N.G., Bussmann, W.R., Gemmill, B., Newton, L.E., Ngumi, V.W. 2004. Utilisation of weed species as sources of traditional medicines in central Kenya. *Lyonia* **7**: 71-87.
- Palgrave, C.K. 1997. Trees of Southern Africa. Struik Publishers. Cape Town, South Africa

Peters, C.M. 1996. Chapter I-II: Introduction to ecology of tropical resources, pp5-91. In: The Ecology and Management of Non-Timber Forest Resources. World Bank. Technical papers number 322. The World Bank.

Samie, A. Obic, L., Bessong, P.O., Namrita, L. 2005. Activity profile of fourteen medicinal plants from rural Venda communities in South Africa against fifteen clinical bacterial species. *African Journal of Biotechnology* **4**: 1443-1451.

Sayer, J.A., Harcourt, C.S., Collins, N.M. 1992. The conservation Atlas of Tropical Forests, in Ghana. *Ghana Journal of Science* **16**: 35-51.

Shackleton, C.M., Shackleton, S.E. Buiten, E, Bird, N. 2007. The important of dry woodland and forest in rural livelihoods and poverty alleviation in South Africa. *Forest Policy and Economics* **9**: 558-577.

Smith, A. 1996. Euphorbiaceae - Flora Zambesia ca: Taxon detail retrieved 2013-11-09

Tcheknavorian-Asenbauer, A. 1993. Industrial utilization of medicinal and aromatic plant resources in developing countries. *Acta Horticulturae* **333**: 19-46.

Tcheknavorian-Asenbauer, A., Wijesekera, R.O.B. 1982. Industrial Utilization of Medicinal and Aromatic Plants. UNIDO IO.505.

CHAPTER 2

POPULATION DYNAMICS OF *Androstachys johnsonii* IN THE PRESENCE OF HARVESTING IN MATSHENA VILLAGE

2.1 Introduction

Population biology, more specifically population dynamics, attempts to explain the origin of different kinds of structure, and understand how and why they change with time (Silvertown and Charlesworth, 2001). Population structure in forestry and ecological studies has been defined in terms of the size-class or stem diameter distribution of individuals (Klimas *et al.*, 2007).

The population structure can be assessed by analysis of frequency distribution of stems across diameter classes (Condit *et al.*, 1998, Lawes *et al.*, 2004). The size class distribution data can also be used to assess the potential of the population for its sustainable use (Everard *et al.*, 1994; Everard *et al.*, 1995; Obiri *et al.*, 2002; Lawes and Obiri, 2003; Gaugris and Van Rooyen, 2007). Investigating the various aspects of the life cycle of a plant (e.g. age/size at flowering, seed output per size class) is crucial to gain an understanding of the dynamics of the population (Solbrig, 1980). This knowledge can then be used to quantify the demographic variables of a population, which can be used in more refined analyses of the population, such as matrix analysis (Caswell, 2001; Crone *et al.*, 2011).

Stand characteristic such as tree population size and tree density can also be strongly modified following anthropogenic disturbances which in turn may have important consequences for tree pollen flow pattern and mating (Ouborg *et al.*, 2006; Eckert *et al.*, 2010). Altogether, this can be expected to lower the opportunity for trees to outcross and can result in increased inbreeding, which may in the long term negatively impact on the genetic diversity and viability of fragmented tree populations (Young *et al.*, 1996; Vranckx *et al.*, 2012).

Changes in tree populations are difficult to quantify directly because there are often different controls or filters on recruitment, growth, and mortality of individuals (Coomes and Allen, 2007; Kuijper *et al.*, 2010). Despite these factors, there is an increasing desire to manage and monitor tree populations for the maintenance of forest ecosystem process or to determine the long-term effects of management's activities (Kurz *et al.*, 2008; Luyssaert *et al.*, 2008; Pelterzer *et al.*, 2010).

a. Stem size-classes

Species and functional group size class structures can be used to assess drivers of population change in tree species (Knox *et al.*, 1989; Helm and Witkowski, 2012; Cousins *et al.*, 2014). Change in size class distribution of plant population have been widely applied in ecology and evolutionary biology to quantify the effects of self-thinning, allometric scaling of resources, and abiotic influences on population demographic processes (Menning *et al.*, 2007; Muller-Landau *et al.*, 2006; Coomes *et al.*, 2012). For example, the “inverse j-shaped” size class distribution reflects the relatively high abundance of juveniles relative to adults, and can indicate health and growing populations, where as other distributions may not (Beschta, 2005; Feeley *et al.*, 2007; Venter and Witkowski, 2010).

2.1.1 Rationale of the study

Harvesting of *Androstachys johnsonii* has been an activity which is being done by Matshena community. The plant species is being harvested for various purposes due to its extreme hard wood. The study will focus on the preference the local people of Mutale area have on the stem size of the species for their use and also studying the population dynamics of *A. johnsonii*.

2.1.2 Aim and objectives

The aim of this research project was to evaluate the declining population structure of *Androstachys johnsonii* in Matshena village as influenced by local use. To achieve the aim the following objectives were looked at:

1. To determine the population dynamics of *Androstachys johnsonii*.
 - a. Stem size-classes
 - b. Crown health status
2. Harvesting impact.

2.1.3 Hypothesis

The intensity of harvesting of *Androstachys johnsonii* population at Matshena village seems to be increasing thereby leaving the population under stress.

2.2 Study area

2.2.1 Description of the study area

The study was conducted in Matshena village, which is situated in the Mutale Local Municipality. This municipality is one of four local municipalities comprising the Vhembe District Municipality. It is situated in the far north eastern corner of the District (Fig. 2.1). The Kruger National Park forms the eastern boundary of Mutale Local Municipality, with Limpopo River forming the north eastern boundary. The Municipality's strategic location affords it many opportunities for tourism development. According to the Statistics South Africa (Community Survey, 2007), the population of Mutale Municipality is estimated at 131 215. It is estimated that 24239 households live in the Municipality area, and the average household size is 5 people.



Figure 2.1: A map of Mutale Local Municipality, Limpopo, South Africa (Community Survey, 2007).

Mutale Local Municipality (Fig. 2.1) shares the borders with Musina Local Municipality and Zimbabwe on the North, Mozambique on the East, Makhado Local Municipality to the west and Thulamela Local Municipality to the South. The Municipality is accessed through the R525 road linking the Kruger National Park to the other local municipalities within Vhembe District.

Mutale municipality as a rural municipality has lots of opportunities for development. Opportunities are available in the area of agriculture, mining, tourism, arts and culture (Community Survey, 2007).

2.3 Method and material

2.3.1 Line intercepts method of sampling *Androstachys johnsonii*

The populations of *Androstachys johnsonii* species was sampled using line intercept method. The Line Intercept method consists of horizontal, linear measurements of plant intercepts along the course of a line (tape). It is designed for measuring grass or grass-like plants, forbs, shrubs, and trees. The following vegetation attributes are monitored with this method: Foliar, basal cover and composition (by cover) (Coulloudon, 1999). A total number of 10 transects of 100 m by 5 m in size were sampled in the field. From the 10 transects 353 individual of *A. johnsonii* plants were recorded.

Crown health assessment was done on individual plants using a sliding scale of 0 to 5. Classes of sliding scale were categorised as follows:

0 = 100% crown mortality,

1 = severe crown damage,

2 = moderate crown damage,

3 = light crown damage,

4 = traces of crown damage,

5= healthy crown.

The stem size-classes were divided into nine categories (Table 1.1). Stem circumference measurements (Table 1.1) were taken in centimetres on the basal area of the plants. Breast height was not measured because most of the plants are multi-stemmed.

2.4 Results and Discussion

2.4.1 Population structure

A total of 353 individual *Androstachys johnsonii* plants were documented, which represented different categories in terms of development.

The majority of the very young individuals in the size-class of 0 – 10 cm ($n = 128$), while the least number of individuals were found in the size-class of 71 – 80 cm ($n = 1$), within the individual plants the very young plants (seedlings, juveniles and adults). Disturbances such as harvesting of timber, fire, and other human activities is likely to greatly change the size class distribution of the population and also result in increased mortality (Lange and Wierowski, 2004). The very young individuals in the size-class 0–10 cm are considered to be the fact that local people harvest the stems of the plants for fuel, leaving only a few for each (Fig. 1.2).

Table 1.1: Number of individuals within different stem size-classes.

STEM SIZES- CLASSES (IN CM)	NO OF INDIVIDUAL PLANTS
1-10	128
11 – 20	99
21 – 30	58
31 – 40	43
41 -50	16
51 - 60	2
61 – 70	3
71 – 80	1
81 – 90	3

The majority of the stem circumferences are in the size-classes of 0 – 10 cm ($n= 128$), while the least number of individuals were found in stem size-classes of 81 – 90 cm ($n= 1$), within the individuals plants they were all plants groups (seedlings, juveniles and adults). Disturbances such as harvesting of trees by humans for fuel and building materials is likely to greatly change the size class distribution of harvested species and also result in increased mortality (Luoga and Witkowski, 2004). The low number of individuals in the last size-class 89-90 is attributed to the fact that local people harvest individuals with thick stems like adults rather than seedlings, leaving only a few for them (Fig. 2.2).

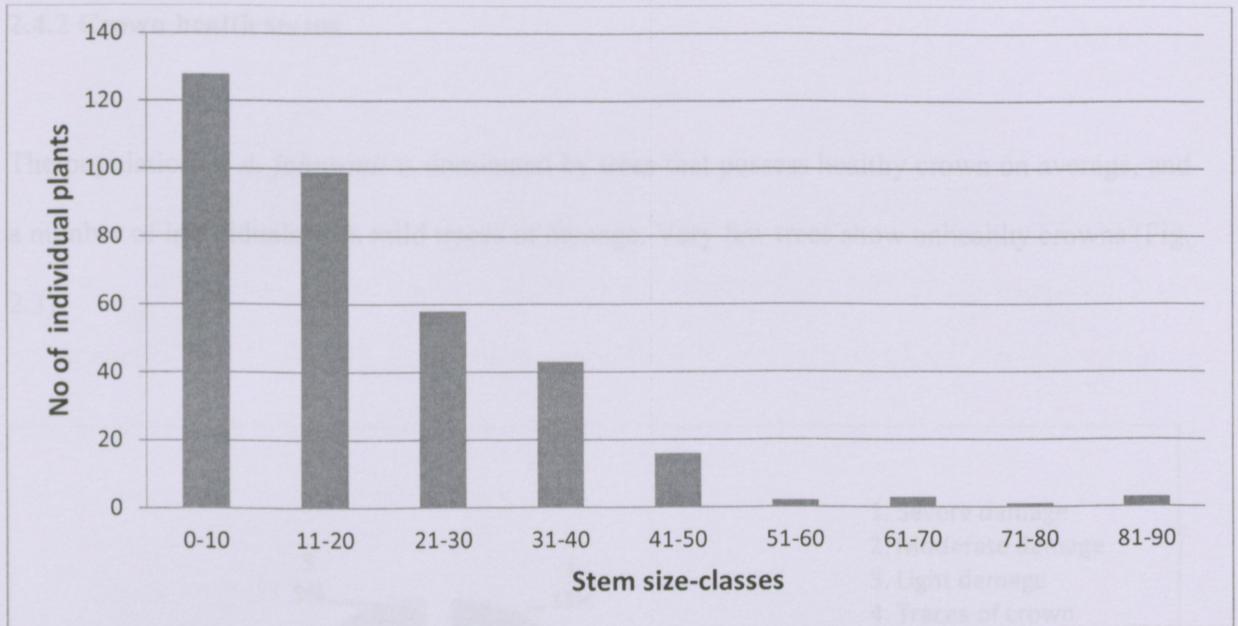


Figure 2.2: Stem class-size against individuals revealed by data collected in 2013.

The removal of medium-sized stems and that of large reproductive trees may lead to a lack of sub-adults in the larger stem diameter classes, thereby reducing seed availability leading to a decrease in tree regeneration that may result in a substantial decline in population numbers (McLaren *et al.*, 2005; Makana and Thomas, 2006). The trend or pattern of stem class sizes decrease from top to bottom. According to Siaga (2006), a healthy plant population is able to produce a large number of seedlings, which proceed to become older individuals.

The high proportion of healthy crown gives a healthy indication of the population. This proves that most species were in a healthy state regardless of environmental factors. Tshikahwa *et al.* (2012) in their studies also concluded that the high proportion of healthy crowns gives a population a healthy appearance in particular vegetation.

2.4.2 Crown health status

The population of *A. johnsonii* is dominated by trees that possess healthy crown on average, and a number of individuals with mild traces of damage. Very few trees show unhealthy crowns (Fig. 2.3).

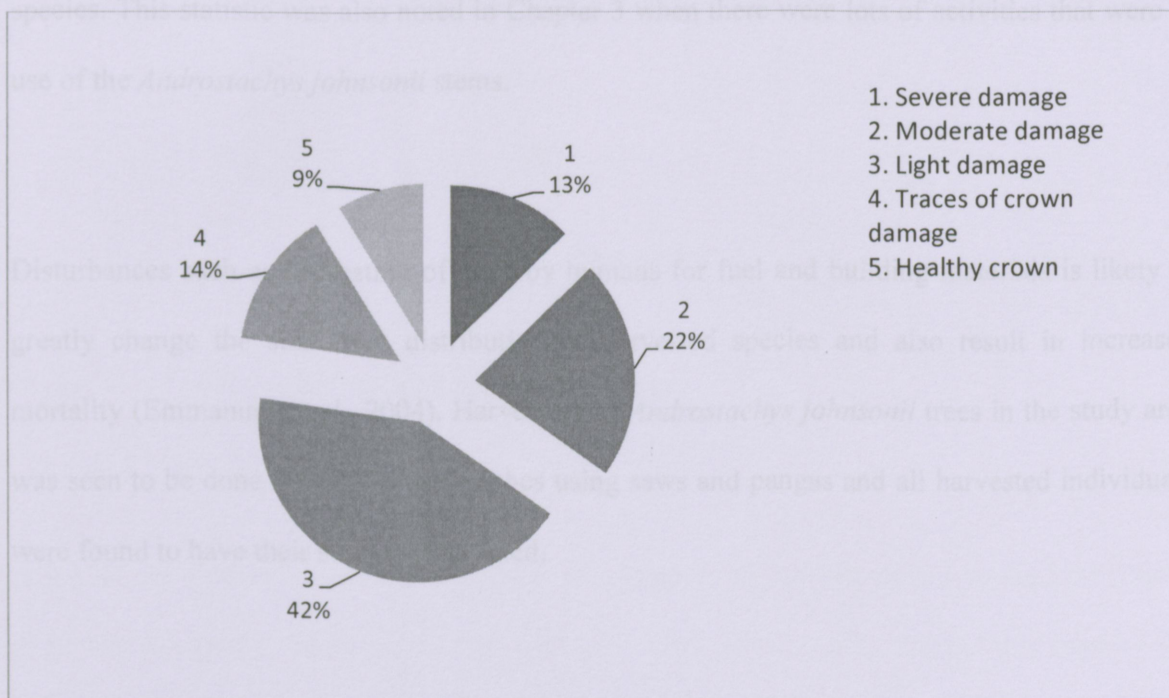


Figure 2.3: Crown health in scale of 1-5 with their percentages.

The high proportion of healthy crown gives a healthy indication of the population. This proves that most species were in a healthy state regardless of environmental factors. Tshisikhawe *et al.* (2012) in their studies also concluded that the high proportion of healthy crowns gives a population a healthy appearance in particular vegetation.

2.4.3 Harvesting impact

The fact that 65% of the plants were harvested is an indication that this species is extensively harvested in the study area (fig.2.4). Few of *Androstachys johnsonii* plants were seen to be unharvested. This proves that the community members within such area have a great use of such species. This statistic was also noted in Chapter 3 when there were lots of activities that were in use of the *Androstachys johnsonii* stems.

Disturbances such as harvesting of trees by humans for fuel and building materials is likely to greatly change the size class distribution of harvested species and also result in increased mortality (Emmanuel *et al.*, 2004). Harvesting of *Androstachys johnsonii* trees in the study area was seen to be done by removing branches using saws and pangas and all harvested individuals were found to have their stumps resprouted.

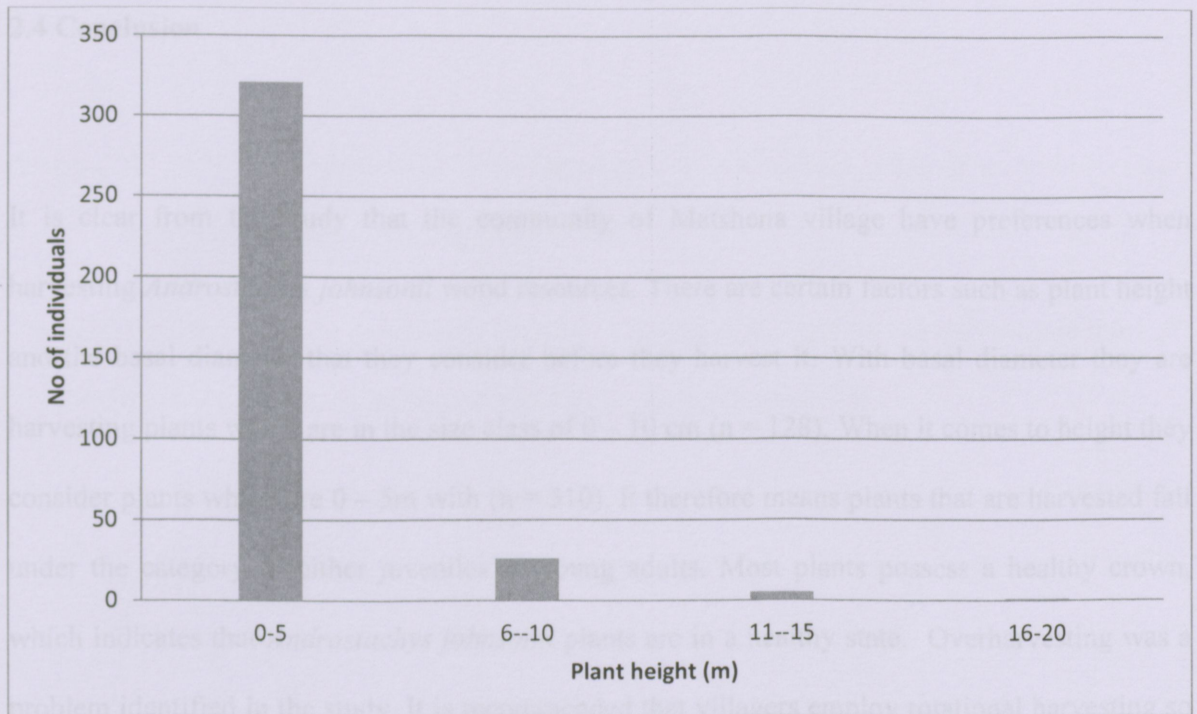


Figure 2.4: Plants heights among the individual plants.

A few of individuals were found to be tall while majority of individuals fall on the lowest scale of height which is between the 0- 5 m with ($n = 310$). These results showed that most of the plants were short. The height also play a major role in determining plants to be overharvested since collectors may prefer long poles.

2.4 Conclusion

It is clear from the study that the community of Matshena village have preferences when harvesting *Androstachys johnsonii* wood resources. There are certain factors such as plant height and the basal diameter that they consider before they harvest it. With basal diameter they are harvesting plants which are in the size class of 0 – 10 cm ($n = 128$). When it comes to height they consider plants which are 0 – 5m with ($n = 310$). It therefore means plants that are harvested fall under the category of either juveniles or young adults. Most plants possess a healthy crown, which indicates that *Androstachys johnsonii* plants are in a healthy state. Overharvesting was a problem identified in the study. It is recommended that villagers employ rotational harvesting so that it gives plants the best chance to recover and resprout again. This will help in the conservation and long term management of *Androstachys johnsonii*.

References

- Beschta, R.L. 2005. Reduced cottonwood recruitment following extirpation of wolves in Yellowstone's northern range. *Ecology* **86**: 391-403.
- Caswell, H. 2001. Matrix Population Models: Construction, Analysis and Interpretation. 2nd edition. Sinauer Associates, Inc. Publishers, Massachusetts, USA.
- Condit, R., Sukumar, R., Hubbel, S., Foster, R. 1998. Predicting population trends from size distributions: A direct test in a tropical tree community. *American Naturalist* **152**: 495-509.
- Coomes, D.A., Allen, R.B. 2007. Mortality and tree-size distribution in natural mixed- age forests. *Journal of Ecology* **95**: 27-40.
- Coomes, D.A., Holdaway, R.J., Kobe, R.K., Lines, E.R., Allen, R.B. 2012. A general integrative framework for modelling woody biomass production and carbon sequestration rates in forests. *Journal of Ecology* **100**: 42-64.
- Cousins, S.R., Witkowski, E.T.F., Pfab, M.F. 2014. Elucidating pattern in the population size structure and density of *Aloe plicatilis*, a tree aloe endemic to Cape Fynbos, South Africa. *South African Journal of Botany* **90**: 20-36.
- Coulloudon, B. 1999. Sampling Vegetation Attributes. Technical Reference **1734**: 4, Bureau of Land Management. Denver, Colorado.
- Crone, E.E., Menges, E.S., Ellis, M.M., Bierzychudek, P., Ehrlen, J., Kaye, T.N., Knight, T.M., Lesia, P., Moris, W.F., Oostermeijer, G., Quintana-Ascencio, P.F., Stanley, A., Ticktin,

- T., Valverde, T., Williams, J.L. 2011. How do plant ecologists use matrix population models? *Ecology Letters* **14**: 1-8.
- Eckert, C.G., Kaliz, S., Geber, M.A., Sargent, R., Ellle, E., Cheptou, P.O., Goodwille, C., Johnston, M.O., Kelly, J.K., Moeller, D.A., Porcher, E., Ree, R.H., Vallejo-Marin, M., Winn, A.A. 2010. Plant mating systems in changing world. *Trends in Ecology and Evolution* **25**: 35-43.
- Everard, D.A., Van Wyk, G.F., Midgley, J.J. 1994. Disturbance and the diversity of forests in Natal, South Africa: Lessons for their utilization. *Strelitzia* **1**: 275-285.
- Everard, D.A., Midgley, J.J., Van Wyk, G.F. 1995. Dynamics of some forests in KwaZulu-Natal, South Africa, based on ordinations and size class distributions. *South African Journal of Botany* **61**: 283- 292.
- Feeley, K.J., Davies, S.J., Noor, M.N.S., Kassim, A.R., Tan, S. 2007. Do current stem size distributions predict future population changes? An empirical test of intraspecific patterns in the tropical trees at two spatial scales. *Journal of Tropical Ecology* **23**: 191-198.
- Gaugris, J.Y., Van Rooyen, M.W. 2007. The structure and harvesting potential of the sand forest in Tshanini Game Reserve, South Africa. *South African Journal of Botany* **73**: 611-622.
- Gaugris, J.Y., Van Rooyen, M.W. 2011. The effect of herbivores and humans on the Sand Forests species of Maputaland, northern KwaZulu-Natal, South Africa. *Ecological Research* **26**: 365-375.
- Grogan, J., Jennings, S.B., Landis, R.M., Schutze, M., Baima, A.M.V., Lopes, J.D.C.A., Norghauer, J.M., Oliveria, L.R., Pantoja, F., Pinto, D., Saliva, J.N.M., Vidal, E.,

- Zimmerman, B.L. 2008. What loggers leave behind: Impacts on big leaves mahogany (*Swietenia macrophylla*) commercial populations and potential for post-logging recovery in the Brazilian Amazon. *Forest Ecology and Management* **255**:269-281.
- Helm, C.V., Witkowski, E.T.F. 2012. Characterizing wide spatial variation in population size structure of a keystone African savanna tree. *Forest Ecology and Management* **265**: 175-188.
- Klimas, C.A., Kainer, K.A., Wadt, L.H.O. 2007. Population structure of *Carapa guianensis* in two forest types in the southwestern Brazil Amazon. *Forest Ecology and Management* **250**: 256-265.
- Knox, R.G., Peet, R.K., Christensen, N. 1989. The population dynamics in loblolly pine stands: Changes in skewness and size inequality. *Ecology* **70**: 1153-1166.
- Kuijper, D.P.J., Cromsigt, J.P.G.M., Jedrzejewska, B., Miscicki, S., Churski, M., Jerdrzkewskai, W., Kwezclich, I. 2010. Bottom-up versus top-down control of tree regeneration in the Bialowieza Primeval Forest (Poland). *Journal of Ecology* **98**: 888-889.
- Kurz, W.A., Dymond, C.C., Stinson, G., Rampley, G.J., Neilson, E.T., Carroll, A.L., Ebata, T., Safranyik, L. 2008. Mountain pine beetle and forest carbon feedback to climate change. *Nature* **452**: 987-990.
- Lawes, M.J., Obiri, J.A.F. 2003. Using the spatial grain of regeneration to select harvestable tree species in subtropical forests. *Forest Ecology and Management* **184**: 105-114.

- Lawes, M.J., Eeley, H.A.C., Shackleton, C.M., Geach, B.G.S. 2004. Indigenous Forests and Woodlands in South Africa: Policy, People and Practice. University of KwaZulu-Natal Press, Pietermaritzburg.
- Luoga, E.J., Witkowski, E.T.F. 2004. Regeneration by coppicing (resprouting) of Miombo (African savanna) trees in relation to land use. *Forest Ecology and Management* **189**: 23-35.
- Luyssaert, S., Schulze, E.-D., Borner, A., Knohl, A., Hessenmoller, D., Law, B.E., Ciais, P., Grace, J. 2008. Old-growth forests as global carbon sinks. *Nature* **455**: 212-215.
- Makana, J-R., Thomas, S.C. 2006. Impacts of selective logging and agricultural clearing on forest structure, floristic composition and diversity, and timber tree regeneration in the Ituri Forest, Democratic Republic of Congo. *Biodiversity and Conservation* **15**: 1375-1397.
- McLaren, K.P., McDonald, M.A., Hall, J.B., Healey, J.R. 2005. Predicting species response to disturbance from size class distributions of adults and saplings in a Jamaican tropical dry forest. *Plant Ecology* **181**: 69-84.
- Menning, K.M., Battles, J.J., Benning, T.L. 2007. Quantifying change in distributions: A new departure index that detects, measures and describes change in distributions from population structures, size-classes and other ordered data. *Oecologia* **154**: 75-84.
- Muller-Landau, H.C., Condit, R.S., Harms, K.E., Marks, C.O., Thomas, S.C., Bunyavejchewin, S., Chuyong, G., Co, L., Davies, S., Foster, R., Gunatilleke, S., Gunatilleke, N., Hart, T., Hubbell, S.P., Itoh, A., Kassim, A.R., Kenfack, D., LaFrankie, J.V., Lagunzad, D., Lee, H.S., Losos, E., Makana, J.R., Ohkubo, T., Samper, C., Sukumar, R., Sun, I.F., Supardi, M.N., Tan, S., Thomas, D., Thompson, J., Valencia, R., Vallejo, M.I., Muoz, G.V.,

- Yamakura, T., Zimmerman, J.K., Dattaraja, H.S., Esufali, S., Hall, P., He, F., Hernandez, C., Kiratiprayoon, S., Suresh, H.S., Wills, C., Ashton, P. 2006. Comparing tropical forest tree size - distributions with the predictions of metabolic ecology and equilibrium models. *Ecology Letters* **9**: 589-602.
- Obiri, J., Lawes, M., Mukolwe, M. 2002. The dynamics and sustainable use of high value tree species of the coastal Pondoland forests of the Eastern Cape Province, South Africa. *Forest Ecology and Management* **166**: 131-148.
- Ouborg, N.J., Vergeer, P., Mix, C. 2006. The rough edges of the conservation genetics paradigm for plants. *Journal of Ecology* **94**: 1233-1248.
- Peltzer, D.A., Allen, R.B., Lovett, G.M., Wardle, D.A., Whitehead, D. 2010. Effects of biological invasions on forest carbon sequestration. *Global Change Biology* **16**: 732-746.
- Poortesur, L., Bongers, F., Van Rompaey, R.S.A.R., De Klerk, M. 1996. Regeneration of canopy tree species at five sites in Western African moist forest. *Forest Ecology and Management* **84**: 61-69.
- Siaga N.M. 2006. Population dynamics of *Millettia stuhlmannii* Taub. population of Ha-Makhuvha, Vhembe district in Limpopo Province. Honours mini-dissertation. University of Venda, South Africa.
- Silvertown, J., Charlesworth, D. 2001. Introduction to Plant Population Biology. 4th edition. Blackwell Science Publishers, Melbourne, Australia.
- Solbrig, O.T. 1980. Demography and evolution in plant populations. Blackwell Scientific Publishers, California.

Venter, S.M., Witkowski, E.T.F. 2010. Baobab (*Adansonia digitata* L.) density, size class distribution and population trends between four land-use types in northern Venda, South Africa. *Forest Ecology and Management* **259**: 294-300.

Vranckx, G., Jacquemyn, H., Muys, B., Honnay, O. 2012. Meta-analysis of susceptibility of woody plants to loss of genetic diversity through habitat fragmentation. *Conservation Biology* **26**: 228-237.

Young, A.G., Boyle, T., Brown, T. 1996. The population genetic consequences of habitat fragmentation for plants. *Trends in Ecology and Evolution* **11**: 413-418.

CHAPTER 3

ETHNOBOTANICAL SURVEY OF *Androstachys johnsonii* IN MATSHENA VILLAGE, MUTALE LOCAL MUNICIPALITY

3.1 Introduction

In recent years, researchers have used a much more ecological approach, introducing studies about the interaction between the natural environment and humans. According to Martin (1995), ethnoecology is a multidisciplinary field that integrates techniques from biology, anthropology, ethnology, linguistics, economy and other fields.

Since the beginning of civilization, people have used plants. Plants provide people with food, medicines, as well as materials for construction and the manufacture of crafts and tools and many other products like fuel, paints and poisons. Their chemical and genetic constituents are being increasingly explored for human benefit (Gerique, 2006).

Out of more than 5000 plant species growing in Zimbabwe, about 10% of these have medicinal properties and are used as traditional medicines (Gelfand *et al.*, 1985). Traditional medicine has remained as the most affordable and easily accessible source of treatment in the primary healthcare system of resource poor communities in Zimbabwe. About 80% of the population in developing countries use traditional medicines because they cannot afford the high cost of

western pharmaceuticals and health care, and because traditional medicines are more acceptable from a cultural and spiritual perspective (Cunningham, 1988).

Harshberger in 1895 coined the term ethnobotany to indicate plants used by the aboriginals. It included the study and evaluation of plant-human relations in all phases and the effect of plant environment on human society (Sharma and Kumar, 2011). Subsequently, Schultes (1962) defined ethnobotany as “the study of the relationship which exists between people of primitive societies and their plant environment”. Plants have been used by tribal and local people for cure of various diseases. As most of the diseases of modern society are life style diseases and the use of herbal medicines can overcome such ailments (Sharma and Kumar, 2000).

Plants have great economic and medicinal importance throughout the world. Almost all daily human basic and luxurious requirements like feeding, clothing, sheltering, nursing and hunting are fulfilled by plants. As source of medicines, plants have formed the basis for innovative and traditional systems and continuously providing mankind with new remedies. In recent years, the interest in traditional medicine has increased significantly. This discipline is gaining the scientific basis for its appropriate application (Ullah *et al.*, 2010). The knowledge of herbal remedies, developed through trial and error over millennia, is being used by the chemists to synthesize different useful compounds. That is why 25% of all medical prescriptions are based on substances derived from plants or plant-derived synthetic analogues (Sara *et al.*, 2009).

More than 200 species of plants native to the United States are at risk of extinction due to collection for consumptive purposes, and half of these are herbaceous forest perennials (Kartesz, 1999; Robbins, 1999). Continued over-harvesting of these plants due to a lack of management strategies based on empirical data could lead to loss of these forest resources (Chamberlain *et al.*, 1998).

Indigenous medicine is recognized by WHO (1978, 2002) as an important healthcare resource due to its effectiveness and affordable cost. But traditional use of medicinal plants is continuously decreasing with the easy availability of the modern medicines and unavailability of information of local flora of medicinal importance.

The rationale of the study is that, from years ago until now (2013), people of Matshena village are seen to be harvesting *Androstachys johnsonii* tree, which is known for its extremely hard wood for various purposes. The study focused on uses of *A. johnsonii* by the local community of Matshena village. Since the increase in the population of inhabitants of Mutale, the rate of harvesting *A. johnsonii* trees has increased, thereby putting the population in danger of being eradicated in the few years to come.

3.2 Aim and objectives

The aim of the study is to evaluate the ethnoecological importance of *Androstachys johnsonii* to the local people of Matshena village. To achieve the aim the following objectives were looked at:

- i. To document and analyze ethnoecological values and plant use of *A. johnsonii* by the ethnic groups (vha-venda) living within the region.
- ii. To understand the plant part utilization patterns of the species by inhabitants of the Mutale region in order to develop conservation strategies.

The hypothesis is that knowing the plants age groups and patterns of harvesting of *A. johnsonii* may assist in the management of its harvesting and thereby allowing the population to continue to be viable.

3.3 Study area

The study was conducted in Matshena village in the Mutale Local Municipality which falls under the Vhembe District Municipality as part of the Limpopo Province, South Africa (Fig. 3.1). It has two southerly neighboring districts, Capricon and Mopani District Municipalities. On the eastern side, it shares the border with the Kruger National Park. Vhembe District Municipality is further made-up of four Local Municipalities being: Mutale, Thulamela, Makhado and Musina. The entire population (estimated at 89 000) of the Mutale Local Municipality is spread over former homeland areas, commercial farms, towns and semi-urban centers. The settlement pattern is dispersed in terms of size, function, services and population. The area largely consists of communally occupied land and include a large number of rural settlements (estimated at 150), administered by tribal or local authorities. The study area falls within the Savanna Biome of South Africa (Acocks, 1988), and constitute the southernmost extension of the most widespread biome in Africa (Mucina and Rutherford, 2005). Most of the savannas are associated with old

plantation surfaces and are believed to represent a legacy of the vegetation which flourished during the Tertiary and even earlier geological periods when hot, wet climatic conditions and laterisation processes were active (www.lda.gov.za, 2009).



Figure 3.1: Map of the Limpopo Province, showing projected area (indicated by circled area) (Community Survey, 2007).

3.4 Materials and methods

3.4.1 Ethnobotanical survey of *Androstachys johnsonii*

To get the utilization of *Androstachys johnsonii*, after collection of the plants population statistic, community members were interviewed to obtain information on the utilization of *Androstachys johnsonii*. These interviews were conducted to all age groups and from both males and females. Interviews were conducted in the informants' language. The questionnaire elucidated information as reflected in Appendix I.

Participants were interviewed using a semi-structured questionnaire after they have given their informed consent to take part.

3.5 Results and Discussion

3.5.1 Profile of informants.

Forty six households of Matshena village participated in the questionnaire. From the study it shows that most female participated during the interview with 52%, while the male were fewer in number (48%). Rural women are the ones who play vital roles in having knowledge about properties of plants, as well as how they can be best utilised in their communities (Bhagwati *et al.*, 2005).

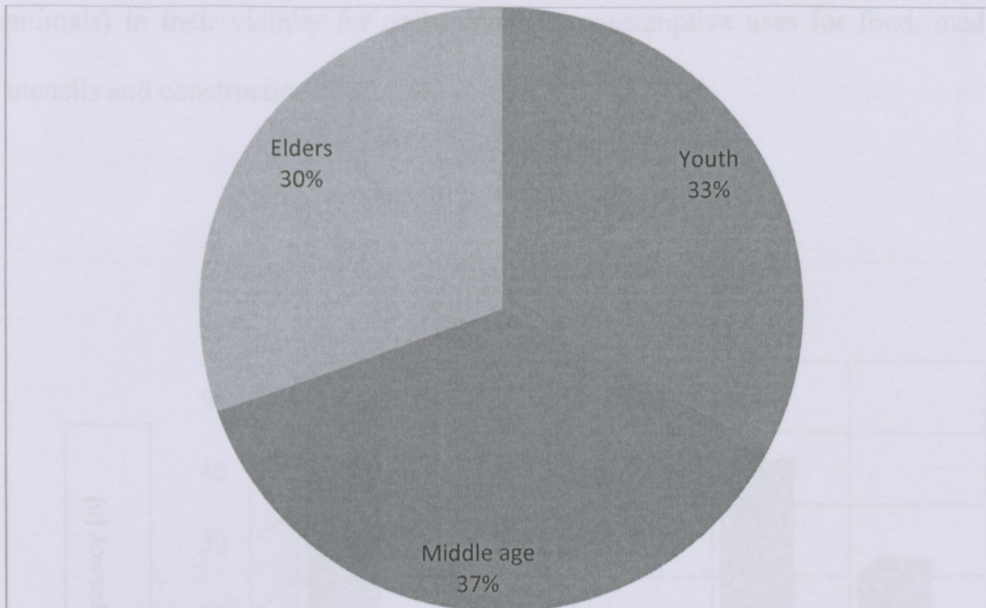


Figure 3.2: Different age groups of participants.

The questionnaire was categorised into three age groups (Fig. 3.2). Through the interview most people from the middle-age group were seen to be participating in great numbers (37%), which was a significant response. The youth participated by 33% and the elders by 30%. A lot has been preserved by middle aged group which was passed upon by elders.

3.5.2 Use categories of *Androstachys johnsonii*.

African biological resources are used for direct and indirect socio- economic benefits in many ways (Geldenhuys and Van Wyk, 2002). In most cases people harvest the resources (plants and

animals) in their vicinity for daily domestic consumptive uses for food, medicine, household utensils and construction (Fig. 3.3).

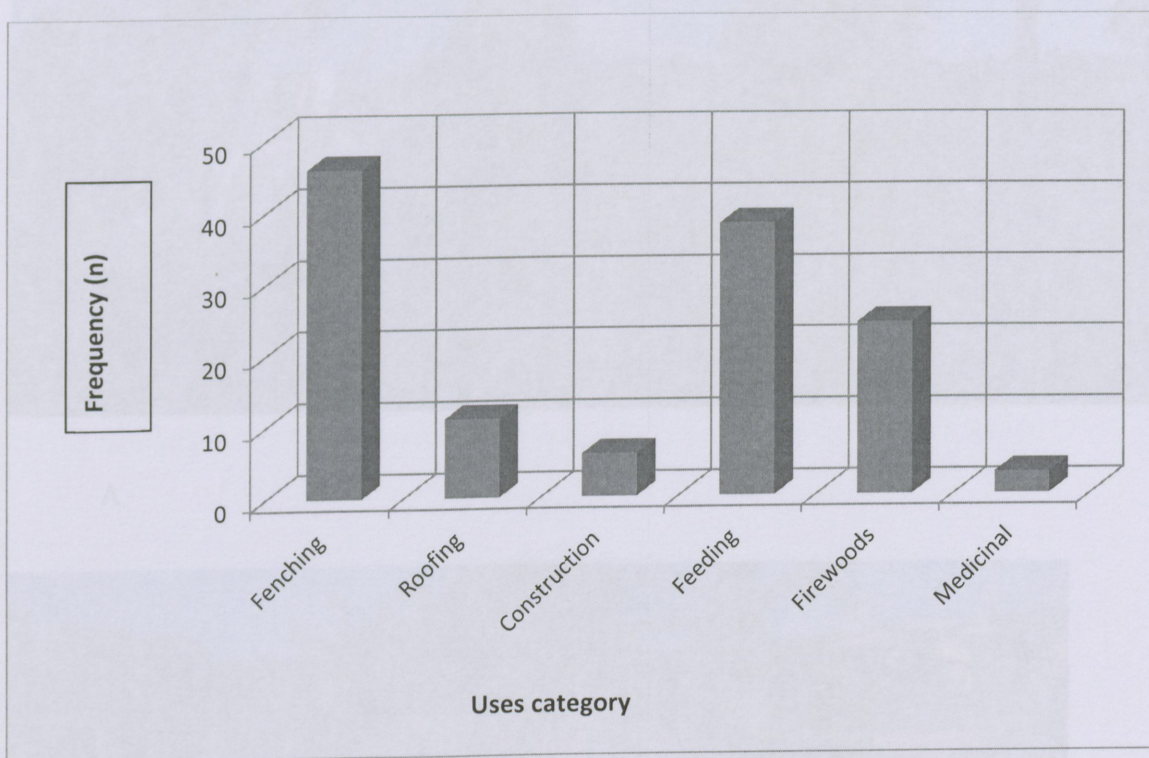


Figure 3.3: Uses of *Androstachys johnsonii* in Matshena village.

i. Fencing

Amongst all the uses, fencing seems to be the most dominated one. This was also visible because most of the homesteads, visited had their fence made of stem wood of *Androstachys johnsonii*. Distance also plays a major role in the overharvesting of *Androstachys johnsonii*. Increased

distance and time for fuelwood harvesting was also reported in most parts of southern Africa. Liengme (1983) indicated that women in certain woodland abundant villages of Zimbabwe spent between one and seven hours to harvest firewood.



A

B



C

Figure 3.4: A and C showing livestock kraals, and household yard (B) built with *Androstachys johnsonii* stems.

Fencing was not only done in homestead yards, but also involves kraal and gardens. This is due to the fact that the stem of the studied plant are strong and are not easy eaten by termites. Villagers also indicated that fence made from *Androstachys johnsonii* can last for close to 10 years, but as the stem decay they replace stems.

ii. Feeding

Feeding was seen to be the second uses amongst other categories. This is only done by livestock during famine periods. The animals (cows and goats) are fed with dry or fresh leaves.

iii. Firewood

Firewood's as one of the uses, it was not used necessary for household activities but was used when brewing home-made traditional beer due to the fact that if use the woods of *Androstachys johnsonii* to make fire it produce a significant black smoke which will spoil the food. Fuelwood is an essential energy source to over 85% of southern Africa rural inhabitants (MacGarry, 1987; Erkkilä and Siiskonen, 1992). About 20% of population in Matshena village use fuelwood as source of energy (Fig. 3.3). Fuelwood is currently, and likely to remain the primary source of energy in rural areas for the foreseeable future. Rural people live without cash and with no affordable alternative energy sources but wood (Willis, 2004), as fuelwood is the cheapest,

available and most accessible source of energy (Liengme, 1983; Mercer and Soussan, 1992; Okello *et al.*, 2001).

Different parts such as stem, leaves, roots and barks of *Andropogon johnsonii* were used for various purposes in the community of Matshena village (Fig. 3.5). The lack of information on the effects of harvesting wild plants is a critical concern, particularly at a time of increased collections (Fuller, 1991).

For construction, *A. johnsonii* stems are used to make roofing for huts and thatched buildings. Most pit toilets in Matshena village were divided by the stems of the studied plants. That is why construction falls under uses category. Other community members used the stems to create the wall before plastering it with mud.

v. Medicine

Few of community members used the plants bark along with the roots to make medicine used for sexual problems. Since the beginning of civilization, people have used plants. Plants provide people with food, medicines (Gerique, 2006). According to Molotja (2001), *A. johnsonii* may be selected as one of plants utilized in traditional medicines.

Most part used among all is the stem; this was also proven on uses because most uses require the stem. About 60% of stems were used. Leaves were second used with about (33%), then roots (5%), and bark (2%) were least used.

3.5.3 Utilized parts of *Androstachys johnsonii*

Different parts such as stem, leaves, roots and barks of *Androstachys johnsonii* were used for various purposes by the community of Matshena village (Fig. 3.5). The lack of information on the effects of harvesting wild plants is a critical concern, particularly at a time of increased environmental management and land use pressures have been based on inferences from modern collections (Fuller, 1991).

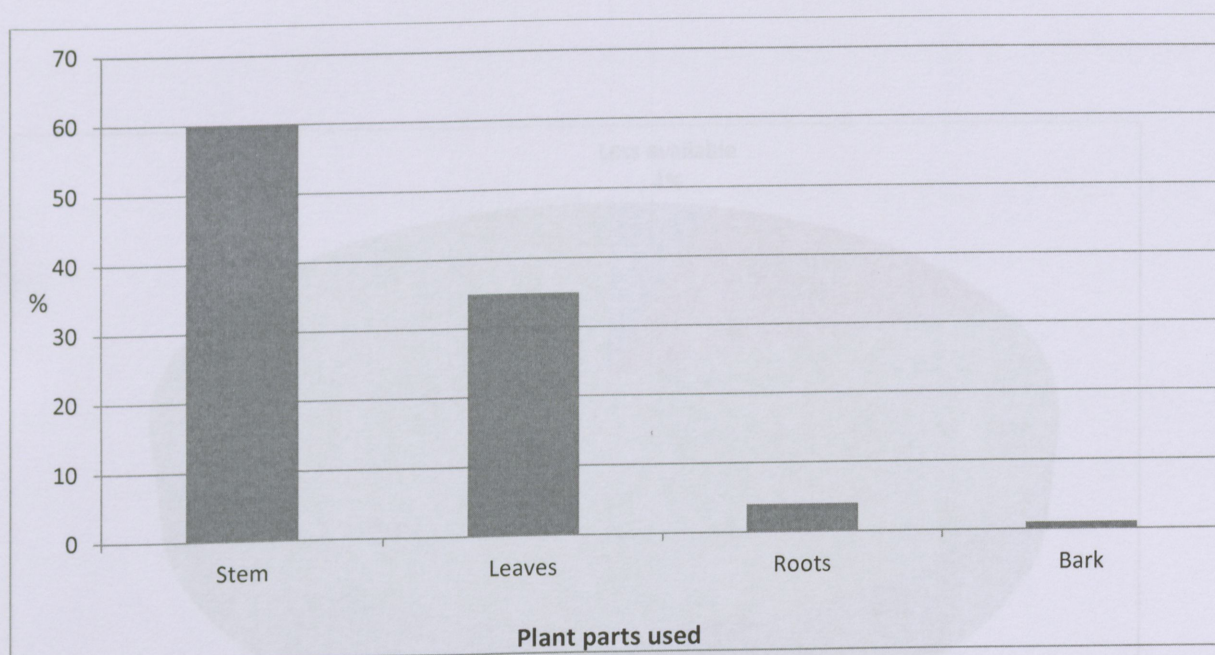


Figure 3.5: Frequency of plant parts used.

Most part used among all is the stem; this was also proven on uses because most uses require the stem. About 60% of stems were used. Leaves were second used with about (33%), then roots (5%), and bark (2%) were least used.

3.5.4 Availability status of *Androstachys johnsonii*

Availability of plant species helps in conservation of natural resources. The understanding and appreciation of changing resource utilisation in southern Africa over time has long been limited owing to a lack of appropriate data. Most discussions on historic resource utilisation, environmental management and land use practices have been based on inferences from modern natural resources, as other data was lacking (Morais, 1988).

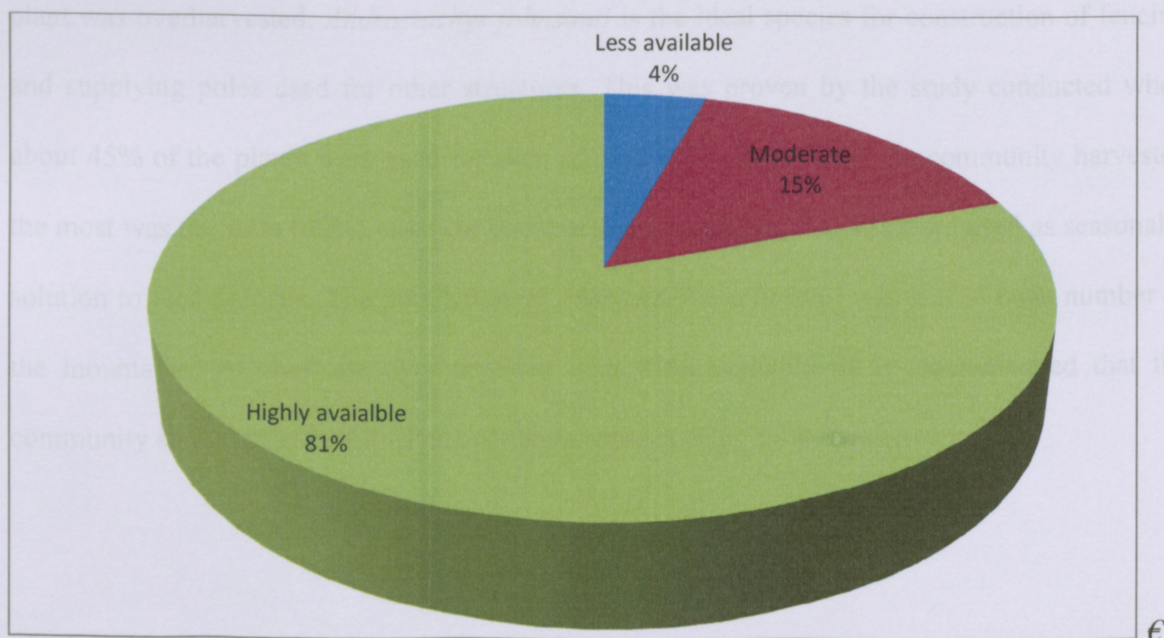


Figure 3.6: Availability of *Androstachys johnsonii* as indicated by the respondents.

Respondents reported that *Androstachys johnsonii* species is highly available (81%) in the mountainous side of the village (Fig. 3.6). This shows that the availability status of *A. johnsonii*

is good status. The studied plant was mostly seen in the mountains. *Androstachys johnsonii* is an indigenous tree species found dominant in the poorly drained soil and rocky outcrops of north-eastern part of Limpopo Province of South Africa (Schmidt *et al.*, 2002).

3.6 Conclusion

From the study, a few of uses of *Androstachys johnsonii* were identified which results in why the plant was overharvested. *Androstachys johnsonii* is the ideal species for construction of fencing and supplying poles used for other structures. This was proven by the study conducted when about 45% of the plants were used for such purposes. The part which the community harvested the most was the stem (60%), used for construction and fencing. Leaves were used as seasonally solution to feed animals. The population of *Androstachys johnsonii* was still in huge number in the mountains, yet they are overharvested with 81% available. It is recommended that the community should be mindful when they harvest the species daily requirement.

References

- Acoccks, J.P.H. 1988. Veld types of South Africa. 3rd edition. *Memoirs of the Botanical Survey of South Africa* No. **57**: 1-146.
- Bhagwati, U., Vandanu. S. 2005. Traditional knowledge on medicinal plants among rural women of the Garhwal Himalaya. *Uttaranchal* **4**: 259-266.
- Chamberlain, J., Bush, R., Hammett, A.L. 1998. Non-timber forest products — the other forest products. *Forest Products Journal* **48(10)**: 10-19.
- Cunningham, A.B. 1988. An investigation of the Herbal medicine Trade in Natal/KwaZulu. Pietermaritzburg: Investigational Report No 29 Institute of Natural Resources.
- Fuller, D. 1991. Medicine from the Wild: An Overview of the Native Medicinal Plant Trade and its Conservation Implications. TRAFFIC USA, Washington, DC.
- Geldenhuys, C.J., Van Wyk, B.-E. 2002. Indigenous Biological Resources of Africa. Briza Publication, Pretoria, South Africa.
- Gelfand, M., Drummond, R.B., Mavi, S., Ndemera, B. 1985. The Traditional Medical Practitioner in Zimbabwe: His Principles of Practice and Pharmacopoeia. Mambo Press. Gweru, Zimbabwe.
- Gerique, A. 2006. An Introduction to Ethnoecology and Ethnobotany, Theory and Method. Advanced Scientific Training, Loja, Ecuador.
- Kartesz, J.T. 1999. A synonymized checklist and atlas with biological attributes for the vascular flora of the United States, Canada, and Greenland. In: Kartesz, J.T., Meacham, C.A.

- (Eds), Synthesis of the North American Flora, Version 1.0, 1st edition. Botanical Garden, Chapel Hill. North Carolina, United States of America.
- Liengme, C.A. 1983. A study of wood use for fuel and building in an area of Gazankulu. *Bothalia* **14**: 245-257.
- Limpopo department of Agriculture. 2009. [Online] Available from:
http://www.lda.gov.za/_layouts/OSSSearchResults.aspx?k=annual%20report%202009&cs=This%20Site&u=http%3A%2F%2Fwww.lda.gov.za. [Accessed: 2013-11-13]
- MacGarry, B. 1987. Biomass Resource Assessment: Measuring family fuelwood consumption in Zimbabwe. Commonwealth Science Council. Technical Publication Series no 217, London, pp. 54.
- Marais, J. 1988. Early farming communities of southern Mozambique. (studies in African Archeology 3). The Swedish Central Board of National Antiquities. Stockholm.
- Martin, G.J. 1995. Ethnobotany. A "People and Plants" Conservation Manual. World Wide Fund for Nature. Chapman and Hall Publishers, London, United Kingdom.
- Mercer, E., Soussan, J. 1992. Fuelwood problems and solutions. In: Sharma, N.P. (ed.), Managing the World's Forests: Looking for Balance between Conservation and Development, pp. 139-176. International Bank for Reconstruction and Development, Kendall/Hunt, United States of America.
- Molotja, M.G. 2001. The inhibition of growth and productivity of *Zea mays* and *Apios tuberosa* by *Androstachys johnsonii*. Honours Degree mini-dissertation. University of Venda, South Africa.

- Mucina, L., Rutherford, M.C. 2005. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.
- Okello, B.D., O'Connor, T.G., Young, T.P. 2001. Growth, biomass estimates, and charcoal production of *Acacia drepanolobium* in Laikipia, Kenya. *Forest Ecology and Management* **142:143-153**.
- Peters, C.M. 1996. The Ecology and Management of Non-Timber Forest Resources. World Bank Technical Papers, Washington, DC
- Robbins, C. 1999. Medicine from U.S. Wildlands: An Assessment of native plant species harvested in the United States for medicinal use and trade and evaluation of the conservation and management implications. A report from TRAFFIC North America for The Nature Conservancy.
- Sara, V., Franca, T., Gelsomina F. 2009. Traditional uses of medicinal plants in Valvestino (Italy). *Journal of Ethnopharmacology* **121: 106-116**.
- Schmidt, E., Lotter, M., McClelland, W. 2002. Trees and Shrubs of Mpumalanga and Kruger National Park. Jacana, South Africa.
- Schultes, R.E. 1962. The role of ethnobotanist in search for new medicinal plants. *Lloydia* **25: 257-266**.
- Sharma, S., Kumar, A. 2000. Ethnobotanical studies on medicinal plant: chitrak. *International Journal Mendel* 19: 129.
- Sharma, H., Kumar, A. 2011. Ethnobotanical studies on medicinal plants of Rajasthan (India): A review. *Journal of Medicinal Plants Research* **5: 1107-1112**.

- Ullah, R., Hussain, Z., Iqbal, Z., Hussain, J., Khan, F.U., Khan, N., Muhammad, Z., Ayaz, S., Ahmad S., Rehman, N.U., Hussain, I. 2010. Traditional uses of medicinal plants in Darra Adam Khel, N.W.F.P., Pakistan. *Journal of Medicinal Plant Research* **4**: 1815-1821.
- Upadhyay B., Parveen Dhaker, A.K., Kumar, A. 2000. Ethno medicinal and ethnopharmacological studies of Eastern Rajasthan, India *Journal of Ethnopharmacology* **129**:64-86.
- White, G.F. 1983. The Vegetation of Africa: A Descriptive Memoir to Accompany the UNESCO/AETFAT/UNSO Vegetation Map of Africa, Natural Resource Research No. 20, pp. 356, UNESCO. Paris, France.
- Willis, C.B. 2004. Policy frameworks pertaining to the conservation and sustainable use of forests and woodlands in South Africa. In: Lawes, M.J., Eeley, H.A.C., Shackleton, C.M., Geach, B.G.S. (eds), *Indigenous Forests and Woodlands in South Africa. Policy, People and Practice*, pp. 77-108. University of KwaZulu-Natal Press, Scottsville, South Africa.
- World Health Organization (WHO). 1978. The Promotion and Development of Traditional Medicine. Report of a World Health Organization Meeting. Technical Report Series 622 Geneva.
- World Health Organization (WHO). 2002. Traditional Medicine Strategy. World Health Organization Geneva: World Health Organization, WHO/ EDM/TRM/2002.1.



CHAPTER 4

GENERAL CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

From the study it was proven and seen that most of the rural community still depend on wood products for various purposes. This may also be influenced by the high poverty rates that are found in Limpopo Province communities. This study provided some basic estimates of wood products used in rural livelihood. *Androstachys johnsonii* is the ideal species for construction of fencing and supplying poles for other structures. There are certain factors which were considered for one to harvest such plants, including basal diameter and height of plants. These factors can lead to extinction of species populations. Uncertain in the management of natural resources in rural areas as a result of high rate of unemployment coupled with poverty and population growth, which has increased the demand. Land use conversion and unclear responsibility in the management of woodland has also exacerbated the situation.

4.2 Recommendations

Questionnaire

Assessment of local uses of *Andropogon squarrosus* used by the local community of Mat-hang village in

It is recommended for future harvest of such plants there are certain things one should consider, they should ensure efficient use of woodland resources and they should be rules that binds one as to how to collect such species. The community structures such as civics or local authorities should initiate a community project that aims at conservation of natural resources and eradication of poverty in rural areas, along with educational programmes to educate local people (young and old) about the need for conservation and its subsequent benefits. Within such programmes they should also consider topics such as application of coppice woodland management, method and season of woodland resource harvesting in rural areas.

Information about the *Andropogon squarrosus*

What is the name of this plant?

What do you mostly use this plant and which part?

It is also recommend that there should be greater cooperation between villagers, traditional leaders and provincial conservation departments in an attempt to conserve plants resources. This might require setting up of a committee comprised of the above-mentioned stakeholders to take the responsibility in the management of plants resources and for amendment of permits, which are in line with villagers' needs and resource availability.

Availability

Highly

Moderate

Less available

Any myth or legend you know regarding this plant?

APPENDIX A

Questionnaire

Assessment of local uses of *Androstachys johnsonni* by the local community of Matshena village in Mutale, Limpopo Province, South Africa

NB: Informants were interviewed with their consent.

Information about the informant

Age: Youth Middle-aged Elder
Gender: Male Female

Physical address and contact telephone number

Information about the *Androstachys johnsonni*

What is the name of this plant?

What do you mostly use this plant and which part?

Availability: Highly Moderate Less available

Any myth or legend you know regarding this plant?