

Ethnobotanical Profile of Indigenous Tree Species Protected within Dryland Agricultural Farming System

Tshisikhawe MP*, Malunga G

Department of Botany, University of Venda, Private Bag X5050, Thohoyandou 0950, South Africa

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*For Correspondence

Tshisikhawe MP, Department of Botany, University of Venda, Private Bag X5050, Thohoyandou 0950, South Africa.

E-mail: tshisip@univen.ac.za

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ABSTRACT

Conservation of biodiversity on dryland agricultural farms, forests, and protected areas is likely to backup future livelihood options. The main objective of this research was to investigate the ethnobotanical importance of indigenous trees protected within agricultural farming system of Mutale local municipality. Tree layer of indigenous species were recorded and classified into families, parts used and their utilization purposes. Twenty two agricultural fields were visited and nineteen species were recorded. The 19 species were classified into sixteen families with Fabaceae, Combretaceae, Capparaceae being the dominating families. *Sclerocarya birrea* belonging to Anacardiaceae family was the plant species which was well represented in the agricultural farming fields, occurring in 21 farms, followed by *Adansonia digitata* (19 farms) which belongs to Malvaceae family, and *Boscia albitrunca* (16 farms), *Maerua angolensis* (15 farms) which both belong to the Capparaceae family. Shade use category amongst tree species protected within agricultural fields was the dominant category followed by medicine, food, demarcation fence, fodder, and firewood. Protection of these indigenous trees within agricultural fields will go a long way towards conservation of declared protected and endangered species.

INTRODUCTION

Millions of people across the globe depend mostly on the forest and woodlands for their livelihood ^[1]. Similarly, it is stated that plants are the basis of life on earth and are central to people livelihood ^[2]. Forest offers support not only to human beings, but also serves as a habitat to many biodiversity throughout the world ^[3]. Tropical rainforest is species rich ecosystem that is being depleted at very high rates ^[4]. According to the World Health Organization (WHO) about 65-80% of the world's population in developing countries depends essentially on plants for their primary healthcare due to poverty and lack of modern medicine. This trend has serious problems to the biodiversity and conservation of species, because of the resource depletion and overharvesting by the local communities ^[5].

Agriculture in Africa is and has been the main source of survival, and poverty alleviation in the poor stricken continent ^[6]. Agriculture is very much key in rural development through indigenous knowledge and, does increase its productivity ^[7]. A consideration of soil conservation is one issue that agriculturalist, should take note of when they are to produce more crops. Before the introduction of western technologies, African farmers had their ways of farming successfully. But as such, the introduction of fertilizers, pesticides, and others western technologies has helped in conserving soil fertility and, high yield of crops production in poor soil sites ^[8].

In Kenya farmers mainly utilize forest plantation because they want to make a living out of it. In addition to subsistence agriculture, activities like logging, clearing for cattle pastures, and commercial agriculture, contribute significantly to deforestation on a global scale ^[4]. It has also been observed that livestock farming is one of most ecologically degrading land uses in tropical land scales ^[9]. Because it converts large areas of highly bio diverse rainforest into pastures dominated by a few grass species used extensive for grazing by cattle's.

In South Africa it has been noted that the majority of rural households depend on fuel for cooking, and space heating ^[10].

This is because firewood is affordable or freely available to some communities when compared to electricity. Live wood stems are being harvested which results in reduction of the biodiversity, because certain tree species like Mupani (*Colophospermum mopane*) trees are targeted. Many household use the wood or the forest trees not only for fuel but for other uses, such as traditional medicine, food as well as construction. For example, *Elaeodendron transvaalense* species is a medicinal plant that is being utilized by Vhavenda people around Limpopo province, South Africa ^[11]. The barks and roots of *E. transvaalense* are the parts being utilized for medicinal purposes people and, it is facing serious threats of local extinction due to the high demand, as it is perceived to cures several ailments. Once the tree dies due to ring-barking the wood is harvested for firewood purposes.

Furthermore, indigenous trees play a role in cultural identity amongst many tribes ^[12,13]. Baobab tree species (*Adansonia digitata*) is a very important tree within the Vhavenda people of Limpopo province of South Africa ^[1]. It represents their culture as well as their identity.

The aim of the study was to investigate the ethnobotanical importance of indigenous trees protected within dryland agricultural farming system of Muswodi area in Mutale local municipality. In order to achieve the aim the following objectives were investigated:

- To document the diversity of indigenous trees protected with the farm lands.
- To determine the role played by indigenous trees protected within the farming system.
- To investigate the impact of indigenous trees species on the farming system.
- To documents the utilization categories of those indigenous trees.

Dryland agricultural farming system is a farming system that rely only on rain. In this agricultural system lack of moisture limits crop production during the better part of the year ^[14]. Farmers tend to leave certain tree species standing in their dryland farms as they farm with different crops during rainy seasons. Indigenous tree species protected within the dryland agricultural farming system have socio-economic uses within the local communities of Mutale local municipality. Overharvesting of trees in the forest either by logging, for firewood, medicinal purposes, food, and other means lead into depleting of biodiversity. In most cases certain plants are targeted for harvesting which might lead to local extinction or even global extinction of such species ^[4]. About 600 indigenous tree species in India are threatened with extinction due to unsustainable utilization options ^[15]. Malawi has lost her forest cover by 40% between 1972 and 1990, more forest cover has been lost in communal areas than in public protected areas ^[16]. Many trees especially the older trees plays essentially ecological roles ranging from storage of carbon dioxide, and their decline has negative impact on the environment ^[12]. For instance there are indigenous tree species that are used in the farming system of southern Ethiopia, where the trees are used as shade in coffee cultivation ^[17].

In a study done in India it was concluded that conservation of diversity on-farm, in forest and protected areas are likely to backup food and agricultural security options for the future ^[15]. In South Africa indigenous tree speices like *Colophospermum mopane* (Mupani) are targeted for their wood in making fire, while *Adansonia digitata* (Baobab) are targeted for their fruits, oil, and fibers ^[1].

This research took an attempt in addressing questions on; what are the roles played by indigenous tree species within the dryland agricultural farming system?, how diverse are the indigenous trees within the farms?, what customs, taboos and myth being followed in relation to the indigenous trees on the farms?, and what parts of the indigenous trees are being utilized by the dryland agricultural farmers?

MATERIAL AND METHODS

Study site

Mutale Local Municipality is one of the four local municipalities that make up Vhembe District Municipality in Limpopo province, South Africa. The inhabitants in this study area are Vhavenda people who are part of the eleven langauges of South Africa. The Municipality shares its 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 covers 3,886 km² in area as shown in **Figure 1**.

Unemployment within the municipality is very much high, most people depends on social grants and their direct natural environment for collections of fodder, food, fire woods and water, but mining, tourism and even agriculture are some of the contributors within the local economy ^[18].

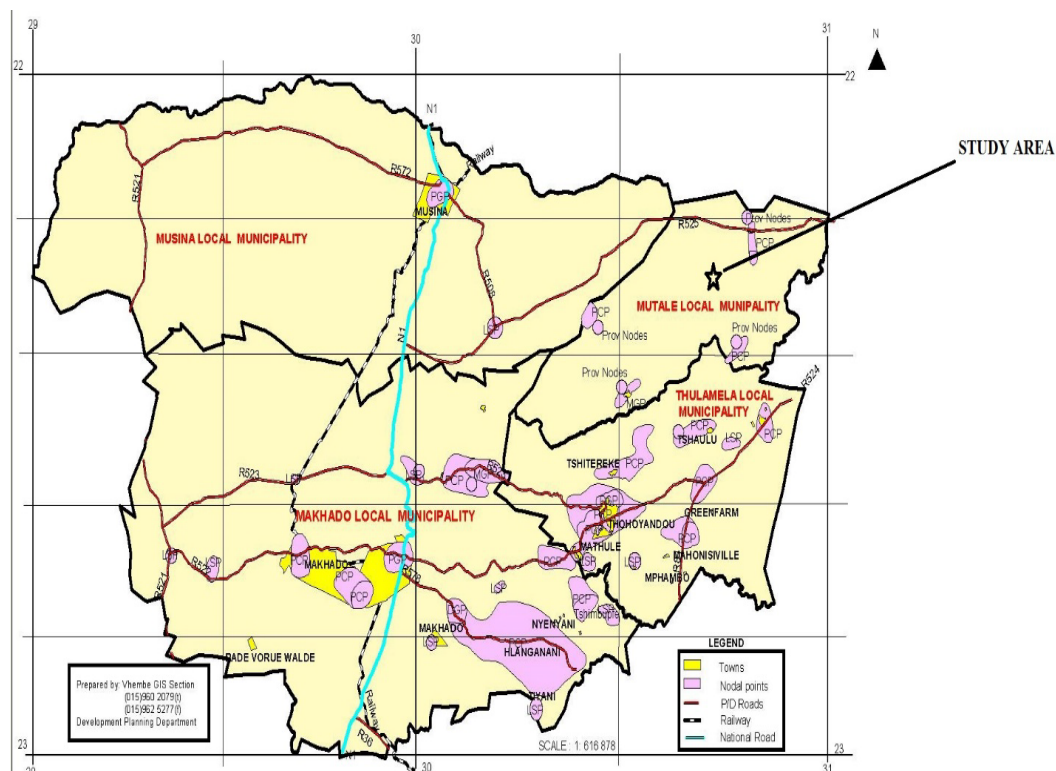


Figure 1. The map showing Mutale local municipality located within Vhembe district municipality (Mutale Local Municipality IDP 2013/14).

The study sites which are dryland farms in Muswodi area lies within summer rainfall area of South Africa with about 90% precipitation occurring between October and March, and the rainfall ranging from 300 to 1000 mm per year ^[19]. The temperature is normal high in summer reaching a maximum of 36 degrees Celsius and around 20 degrees Celsius or less during winter ^[20]. These farms since they are located in one area of Muswodi in Mutale local municipality, they share the same environmental factors. The study sites are adjacent to one another along the road in a low lying area dedicated for dryland agricultural farming. Muswodi area is 59.6 km north of Thohoyandou town which is the main urban area closer to it ^[21]. This study was therefore conducted in a communal rural area where communities continue to collect a number of resources from the wild. Collection of resources from the trees that are in the communal areas is non-discriminatory in nature and results in depletion of some of the most important species. However, tree species located inside the drylands farms are not tempered upon resulting in the protection of such trees.

The climatic conditions are described as semi-arid, and the soil is poorly developed, which then have negative impacts on agriculture practice within the regions. Farmers therefore faces a number of challenges, and the soil is very much sceptic to soil erosions ^[20].

The vegetation falls within the savanna biome and is classified as follows: Musina mopane bushveld, Limpopo ridge bushveld and Makulele sandy bushveld which are dominated by *Colophospermum mopane*, *Terminalia sericea*, and *Grewia flava* ^[22,23]. Vegetation in general is low sparse woodland with average tree height of 4-5 m. Bush fire are not common due to low grass and herb biomass. In the dryer, low lying areas, the vegetation in general is largely short shrubby trees. For example mopane (*Colophospermum mopane*), with scattered baobab trees and other indigenous trees form part of the vegetation of the region ^[23].

Methodology

Data was recorded from observations made during field visits. The collection of data was done from farms around Muswodi area located within Mutale Local municipality that were having indigenous trees protected within them. All the tree species sampled were identified and, their use categories together with parts used were recorded.

RESULTS AND DISCUSSION

Twenty two farms were visited and nineteen species were recorded and classified into sixteen families. Fabaceae, Combretaceae, and Capparaceae families were dominant amongst species recorded in dryland agricultural fields (**Table 1**), with Sterculiaceae, Burseraceae, and Rhamnaceae being the least dominant with one species each.

Table 1. Farms visited, indigenous tree species found in agricultural fields within Mutale local municipality area and the plant part that are utilized and their utilization purposes.

Family	Species name	Venda vernacular name	Voucher number	Part utilized	Utilization purpose	Number of farms on which species recorded
Anacardiaceae	<i>Sclerocarya birrea</i> Hosch.	Mufula	MPT00013	Roots, bark, Leaves	Medicinal, Food, fodder	21
Burseraceae	<i>Commiphora mollis</i> Jacq.	Muukhuthu	MPT131	Stem	Demarcation	1
Capparaceae	<i>Maerua angolensis</i> DC.	Mutambanamme	MPT00134	Roots, bark, crown	Medicinal, shade	15
Capparaceae	<i>Boscia albitrunca</i> (Burch.) Gilg & Gilg-Ben.	Muvhombwe, Muthobi	MPT00128	Fruit, crown	Food, medicinal, shade	16
Combretaceae	<i>Terminalia prunioides</i> M.A.Lawson	Mutwari	MPT00132	Whole plant, crown	Shade, demarcation	8
Combretaceae	<i>Terminalia sericea</i> Burch. ex DC.	Mususu	MPT00114	Crown	Shade	1
Combretaceae	<i>Combretum molle</i> R.Br. ex G. Don.	Mugwiti	MPT00129	Whole plant	Demarcation	1
Ebenaceae	<i>Diospyros mespiliformis</i> Hochst. Ex A. DC.	Musuma	MPT00133	Crown, fruit	Shade and food	1
Fabaceae	<i>Cassia abbreviata</i> Oliv.	Muvhonelathangu	MPT00122	Bark	Medicinal	3
Fabaceae	<i>Colophospermum mopane</i> Kirk ex Benth.	Mupani	MPT00044	Stem, leaves	Firewood, fodder	2
Fabaceae	<i>Philenoptera violacea</i> (Klotzsch) Schrire	Mufhanda	MPT00135	Whole plant	Medicine, demarcation	4
Fabaceae	<i>Acacia tortilis</i> (Forssk.) Galasso & Banfi	Muungakhanga	MPT00139	Crown	Shade	1
Fabaceae	<i>Albizia forbesii</i> Benth.	Mupfumbadzi	MPT00137	Crown	Shade	2
Fabaceae	<i>Acacia nigrescens</i> Oliv.	Munanga	MPT00140	Crown	Shade	3
Flacourtiaceae	<i>Dovyalis caffra</i> (Hook. F. & Harv.) Hook. f.	Mutunu	MPT00068	Fruit	Food	1
Malvaceae	<i>Adansonia digitata</i> L.	Muvhuyu	MPT00127	Fruit	Food	19
Malvaceae	<i>Grewia bicolor</i> Juss.	Murabva	MPT00136	Fruit	Food	1
Rhamnaceae	<i>Berchemia discolor</i> (Klotzsch) Hemsl.	Munie	MPT00130	Fruit	Food	9
Sterculiaceae	<i>Sterculia rogersii</i> N.E.Br.	Mukakate	MPT00138	Roots, Bark	Medicinal	1

This findings on the dominance of the recorded families were in partial agreement with work done on utilization and management of plant resources in Limpopo province of South Africa. Tree species in these families, play a vital economic role and are used either as fuelwood, in crafting, or as medicinal species, and are thus highly preferred ^[24].

The dominance of *Sclerocarya birrea* within agricultural farms in the present study might be due to its sacred status within the locals due to its many utilities. *S. birrea* is amongst others used for traditional wine making, medicine and food in the form nuts. Rituals ceremonies are also performed on the tree as a way of appeasing the ancestors. The other species that occur most are *Adansonia digitata*, and *Boscia albitrunca*. In the work done on the ethnobotany of the Vhavenda, these two species were also regarded as feminine food trees ^[25]. Trees that occur least in the dryland agricultural fields were; *Grewia bicolor*, *Sterculia rogersii*, *Vachellia tortilis*, *Dovyalis caffra*, *Diospyros mespiliformis*, *Combretum molle*, *Terminalia sericea*, and *Commiphora mollis*. They have only been recorded once within the agricultural fields visited during the duration of the study. But there are other plant species that are found in more than one agricultural fields, such as *Colophospermum mopane* (2), *Albizia forbesii* (2), *Accacia nigrescens* (3), *Cassia abbreviata* (3), *Philenoptera violacea* (4), and *Terminalia prunioides* (8).

Some of indigenous species found within the dryland agricultural fields are protected by South African's National Forest Act no. 84 of 1998. These species include *Boscia albitrunca* and *Sclerocarya birrea*. Propagation of these protected species should therefore be promoted. Cultivation of *S. birrea* (mufula) in homegardens is common in South Africa, due to the alcoholic beverage that can be made from its fruit ^[26].

The parts of plants that are being utilized by the indigenous farmers vary with crown (shade) at 29%. The most contributing factor to crown having the highest percentage is that Mutale local municipality is one of the hottest site in Limpopo province, South Africa. Because of the heat farmers needs shade during hot days while they are working in their agricultural fields. The second highest part utilized is the fruit at 21% with *Grewia bicolor*; *Sclerocarya birrea* and *Berchemia discolor* being the main sources of food to the farmers while working in their fields. This is supported by work done on utilization of plant resources in Limpopo

province which found that fruits was the second highest part utilized [24]. It was also found that the peri-urban area in Batswana realized the value of food in the form of leafy vegetables in alleviating food insecurity within their home gardens [27]. Therefore indigenous agricultural farming helps in food security as the results of the present study has shown that 21% are used as food (fruit). As shown in **Figure 2**, bark (14%), whole plant (11%), roots (11%), stem and the leaves (7% each) were mostly used for medicinal purposes.

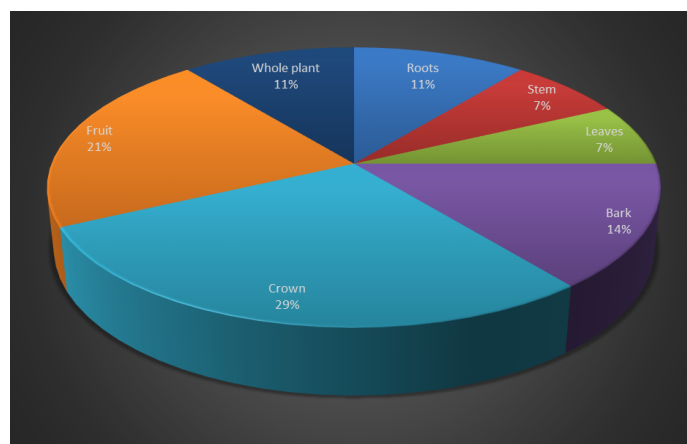


Figure 2. Pie chart showing plant parts utilized from indigenous trees within agricultural fields of Mutale local municipality.

In a study on utilization of alien invasive plants it was found that the stems of the alien invasive tree species were used in construction of fences around the farming fields [28]. This is regarded as one of the cheaper ways of providing protection of crops against livestock.

The highest frequency of utilization categories is in the form of shade (n=8), followed by food (n=7), medicine (n=6), and the least being for farm demarcation (n=3), fodder (n=2), and firewood (n=1). Shade is the highest utilization category because farmers need shade to rest under when they are working their dryland farms that are located in an area characterized by very hot summer months [20]. Trees with good canopies are usually left behind when clearing the areas for crop farming. Even trees that may be kept for other purposes such as food, medicine and demarcation of farms as indicated in **Table 1**, may also be utilized for shade provided they have good canopies. This findings indicated in **Figure 3**, correspond with those of peri-urban areas of Botswana, where shade and fruits trees were highly utilized parts [26]. The role of trees in the lives of rural communities appears obvious through many uses derived from tree products like in construction, fencing, furniture, foods, medicines, fibers, fuels and livestock fodders [13]. Cultural value is also attached to trees and their products.

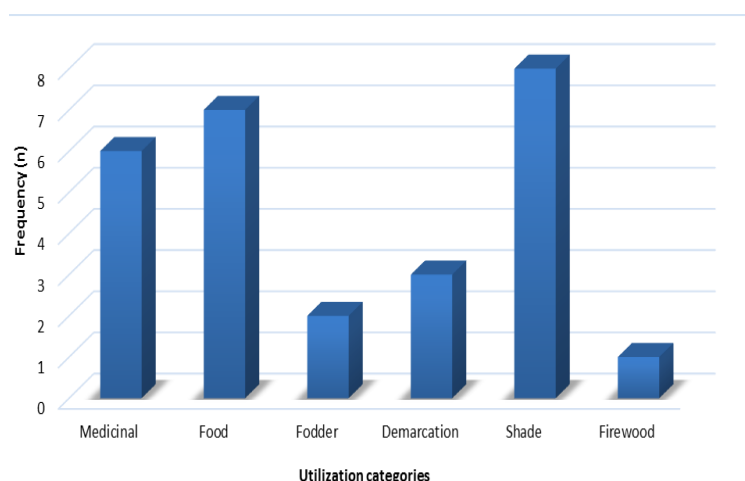


Figure 3. Utilization categories of indigenous trees within agricultural fields of Mutale local municipality.

In the homegardens of South Africa it was found that the occurrence of medicinal gardens is low, and in other Southern African countries many species are harvested from natural areas rather than the homegardens [27]. The natural areas within Tswana home gardens are also extensively harvested for indigenous medicinal species and can be considered as a type of medicinal garden, albeit unmanaged and temporary. In a study of cultivation of medicinal plants it was found that cultivation of these plants not only help in times of emergency but also their dual uses in medicine, ornamentals, food and acts as shade providers [26], with indigenous trees like *Philenoptera violacea*, *Combretum molle*, *Terminalia prunioides*, and *Colophospermum mopane*. It had been noted that of these species with their multi-use, future utilisation should proceed with caution in order to

ensure long term sustainable use ^[24].

Protection of these indigenous trees help in cultural identity because heavily reliance of outside sources might easily replace indigenous knowledge ^[26]. This will go a long way in reducing harvesting pressure of indigenous plants in the wild either for medicine, firewoods, ornamentals, and other utilization options. The fact that very low number of plants are used as fuel (e.g *Colophospermum mopane*) in this study might be the results of available wood sources outside agricultural fields. In another study done in Limpopo province, South Africa it was noted that species predominantly used for firewood include *Sclerocarya birrea* (42%), *Berchemia discolor* (35%), *Combretum kraussii* (35%), *Acacia karroo* and *Dichrostachys cinerea* (22% each) ^[21]. These species are preferred as fuel wood because of their durability. In a study done in Mutale basin in South Africa, it was found that many people collect firewoods in the wild and sell in the market which might be another reason of having low frequency in terms of indigenous trees found in the agricultural fields being used for firewood ^[20].

CONCLUSION AND RECOMMENDATION

This study has shown that the farms have a wide variety of indigenous trees protected within them. The indigenous plants are vital to the farmers as they are used as shade during hot days when the farmers are busy with their day to day duties and they may also act as wind breakers. The trees that bear edible fruits are used for food purposes while roots of some trees are used for medicinal purposes. Protection or keeping of the trees within agricultural fields helps in conserving endangered species that are getting threatened with extinction in the wild. But there is much information that still need to be gathered on uses of indigenous trees. Their effect on how they affect the soil, climate within the region, and strategies that can be used in conserving other endangered species should be further explored. The government and private stakeholders needs to engage with local farmers and encouraged them in practices that promote the protection of indigenous trees within their agricultural fields since such an act promote biodiversity.

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