

# **The Utilization of *Moringa oleifera* in Zimbabwe: A Sustainable Livelihood Approach**

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## **Abstract**

Information is provided on the uses of *Moringa oleifera* Lam. in Zimbabwe. Semi-structured interviews and open ended questions were conducted in both rural and urban areas. The tree introduced from India is prized for its edible leaves, seeds and the pods which are eaten as vegetables. The leaves have been compared to spinach in both its appearance and nutritional quality. The leaves and branches may also be used for fodder when nothing else is useable, and the high nutrient content of the leaves would make it a prime candidate to incorporate into a mulching system. This is assuming, however, that the leaves are in abundance and not required as a human food source. The roots, leaves and pods are said to have medicinal properties. Virtually every part of the tree is beneficial in some way and both rural and urban people depend on it for their livelihood. Depending on the purpose and quantity, moringa is grown in nurseries as a community project or on a small scale at the family level. It can function as windbreaks, for erosion control, live fences, as an ornamental or intercropped to provide semi-shade to species requiring less direct sunlight. The benefits of moringa are numerous.

The results from this study urge us toward a new perspective on the relationship between human actions and the environment. One theme surrounding the cultivation and use of moringa is the awesome power of our species to alter our land and its living systems. In the struggle for survival and improved living conditions, immediate needs are normally satisfied at the expense of the future. But this is not the case with the cultivation and use of moringa in Zimbabwe. A crucial transition has taken place in the country, where destructive farming practices have been replaced by new and improved cultivation methods which raise moringa without destroying natural systems on which agriculture ultimately depends. The central message of this report are that effective development and effective management of moringa are essential for sustainable growth and poverty reduction in Zimbabwe. Sustainable management of moringa must balance between the short-term needs of the people for their social and economic development and the protection of the natural resource base. Protection is a longer term goal for ensuring that the resource base is utilized wisely so that it can continue to provide benefits for improving people's livelihoods and quality of life, reducing poverty and fostering economic growth into the future on a sustainable basis.

## Introduction

Cultivation of *Moringa oleifera* Lam. is basically a development programme whose objective is centred on the concept of sustainability. Although moringa is essentially not indigenous to Zimbabwe, it has become part of the traditional diet in Zimbabwe in general and Binga District in particular. The sustainable utilization of moringa in Zimbabwe varies between regions and cultures. Its sustainable use has been shown to require controlled harvesting and periodic monitoring of its regeneration. Recently there has been increasing attention to the importance of biodiversity in agriculture (NRC 1993), especially for ecological sustainability (NRC 1992). The International Convention on Biological Diversity (CBD) signed and ratified by Zimbabwe and many other countries in 1992 has promoted a much broader interpretation of biodiversity. The main objectives of this convention are the conservation of biological diversity, the sustainable use of its components and fair and equitable sharing of the benefits arising out of the utilization of genetic resources (Glowka *et al.* 1994). Agenda 21 of the Earth Summit calls for programmes and policies for establishing and strengthening **in-situ** conservation of crop genetic resources in farmers fields and local **ex-situ** conservation farm communities (eg., community seed banks or field gene banks, etc) for development of sustainable agriculture (UNCED 1993). The purpose of this article is to examine the available data on the current and potential role moringa can play in the development of sustainable livelihoods, especially for small-scale, indigenously based agriculture.

Sustainable livelihoods comprise the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base (Ellis 2000; Dalal-Clayton *et al.* 2003). Continued cultivation and use of moringa over the past millennia has played a key role in the successful achievement of sustainable livelihoods in rural Zimbabwe. According to rural communities, the goal of development is not growth as defined by professionals but well-being as defined by the poor (Chambers 1997). Poor people will define their well-being in different ways. Many are likely to want livelihoods more than employment where livelihoods mean adequate assets, activities, food and incomes, and access to these, that together determine the level of living for an individual or family (Chambers 1997; Ellis 1998). The aim of development is to improve the quality of human life. It should enable people to realize their potential and lead lives of dignity and fulfillment. Development is a process more than it is an outcome and as such local community resource management and decision-making control are the foundation upon which successful development must rest (Norman *et al.* 1996). In community development it is important for the local people to keep or gain control of their own

knowledge (Smith & Williams 1999). This is not to say that they advocating a return to former life styles but rather acknowledge that what they know is also important and of value. The central concern of community and self-development is for individuals and the broader community to provide their basic human needs with a view to a better life for the individual and for the community as a whole.

Moringa and other plants grown in home gardens found in dooryards and agricultural fields provide rural families with income, food, nutritious vegetables, animal feed, etc. This helps the communities to lead self-sufficient lives. The rural poorer people have been described by Chambers (1997) as “foxes” with many different enterprises with which they cobble together a livelihood, doing different things at different seasons. Researchers have a lot to learn from the insights of local people who are acknowledged within their own communities as experts on local plants (Cunningham 2001). This type of approach, where local people help in conducting research and as sources of “ethnobotanical information” has given rise to participatory research. Participatory Rural Approach (PRA) is a growing family of approaches and methods to enable local people to share, enhance and analyse their knowledge of life and conditions and to plan, monitor and evaluate (Chambers 1997). PRA has often astonished facilitators and also surprised local people who have found themselves doing things they did know they could. Traditional knowledge, just like science-based knowledge has its own weaknesses and limitations (Maroyi 2006a). Chambers (1983) argued that complementarity of both knowledge systems should be pursued in order to achieve sustainable utilization of indigenous resources. In this way, the weakness of one can be improved by exploiting the strengths of the other. Empowerment of the rural people, means that the poorer are enabled to take more control of their lives and secure a better livelihood with ownership and control of productive assets as one key element (Chambers 1997).

Chambers (1998) argues that “people who rely immediately on natural resources for their livelihood, if they have been successful in establishing a sustainable mode of production, have typically developed methods to ensure the conservation of their environment. In spite of the inherent limitations of many such systems and the external and internal pressures to which they are subjected, traditional systems have remained not only viable but also active in many parts of the world where there are still extant today. These systems involve elaborate social, technological and economic mechanisms to safeguard resources”. This is exactly the case with the utilization of moringa where social controls have been developed in many communities in Zimbabwe together with intimate environmental knowledge, moringa’s biology and basic cultivation requirements.

## Background Information

*Moringa oleifera* Lam. (Horse-radish tree or Drumstick) is a medium-sized (about 10 metres high) tree belonging to the Moringaceae family. The moringaceae is a single genus family with 14 known species, of these only *M. oleifera* (synonym *M. pterygosperma* Gaertn.) is the most widely known species and is planted in the whole tropical belt (Jahn 1988). The tree is indigenous to northern India and Pakistan (Verdcourt 1985). Commonly known as the 'horse-radish' tree, arising from the use of the root by Europeans in India as a substitute for horse-radish, *Cochlearia armoracia* (synonym *Armoracia rusticana*). Like *C. armoracia*, the roots of moringa are pungent and were commonly used as a condiment or garnish. Such a practice would not now be recommended as the root has been shown to contain 0.105% alkaloids, especially moringinine and a bactericide, spirochine, both of which can prove fatal following ingestion (Oliver-Bever 1986; Watt & Breyer – Brandwijk 1962). The other widely used common name is 'drumstick' tree, arising from the shape of the pods, resembling the slender and curved stick used for beating the drum.

Common name of *M. oleifera* in Malabar is Moringo and this is the origin of the generic name (Palmer & Pitman 1972). Very little is known about its introduction in Zimbabwe prior to its first collection by Holland in 1943 (National Herbarium, Harare records). The early herbarium specimens document it as an ornamental tree, planted in public parks and private gardens. It has also been grown by Indian families as a vegetable. But moringa is now a permanent feature on the menu of the Tonga people of Zimbabwe, with its leaves being used as a spice when preparing food. *M. oleifera* may have been introduced during the European occupation or possibly long before Arab traders (Palgrave 1983). The highest concentrations of moringa tree is found in Binga District, where it is known as *Zakalanda* by the locals. It is believed that the tree was brought to Binga by the Indian traders using the Zambezi River in their search for gold, ivory and other items. It is now widely cultivated in several parts of the country and is naturalized in many areas including the Zambezi valley.

Global awareness has been raised on the crisis concerning the conservation of biodiversity after the United Nations Conference on Environment and Development in Rio de Janeiro, 1992. Sadly, however, the status of Indigenous Knowledge relating to the use of localized biodiversity has not received similar awareness (Warren 1995). Much of this knowledge faces a similar risk of being lost. What is also at risk is the undocumented Indigenous Knowledge on the use of these plants which according to Warren (1995) "...reflects many generations of experience and problem solving by thousands of ethnic groups across the globe". In this research, the focus is

on understanding relationships that a rural community in Zimbabwe has with *M. oleifera* in their environment, specifically on a sustainable basis.

## **Research Methodology**

This study was aimed at documenting the uses of moringa tree by both the rural and urban communities in Zimbabwe. Information on the uses of moringa was gleaned from the literature and also interviewing a wide range of people. Known uses of this species were derived from the works of Watt & Breyer-Brandwijk 1962; Palgrave 1983. The study was undertaken during the period 2004 – 2005. Field studies were carried out in some 20% of the districts of Zimbabwe mainly in Manicaland, Mashonaland, Matebeleland and Midlands. The process involved close consultation with the community in information sharing, data gathering and compilation. It involved visiting several villages, communities and discussing with many individuals. This study was consequently undertaken to illustrate the multiple uses of moringa in Zimbabwe.

Purposive sampling was used in the selection of participants in order to allow me to have an in-depth focus on the issues important to the study (Cohen & Manion 1989). The research process seeks to understand the uses of moringa from the perspective of a range of stakeholders and to involve them directly in planning follow-up action. This study also included decision makers from all levels of government, civil society and the local elite, thereby uncovering different interests. Participants comprised both elderly members of the community as well as the youth. Participant observation and interviews (unstructured individual and focus group) were the main methods used in data collection. This participatory approach though difficult to quantify, provide a valuable insight into the multiple meanings, dimensions and experiences with this particular plant species. It captures information that standard plant uses methods are likely to miss. “Open-ended methods” such as unstructured interviews and discussion groups allows the emergence of issues and dimensions that are important to the community but not necessarily known to the researcher.

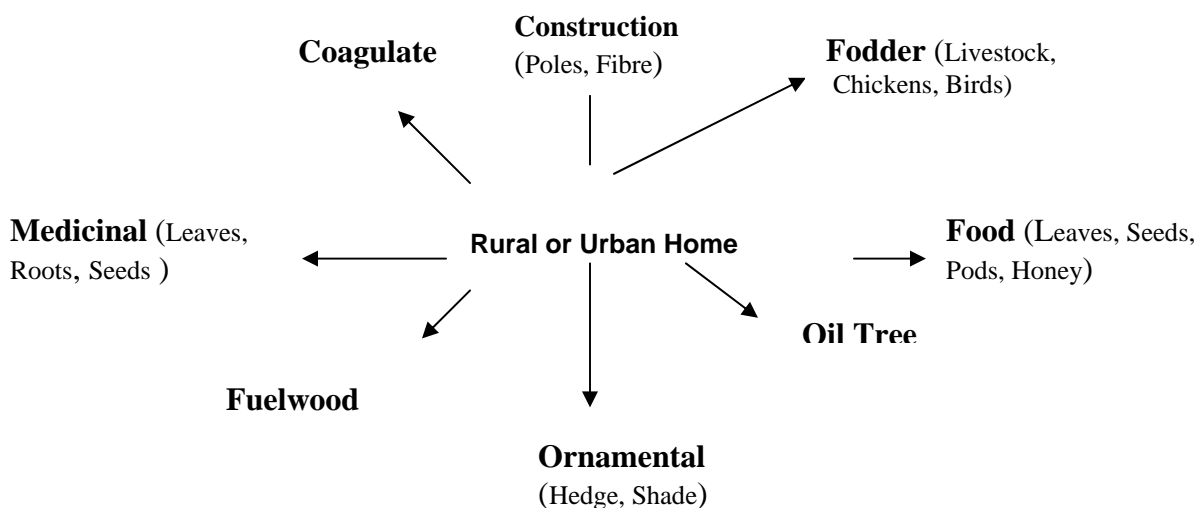
The research conducted uses both primary and secondary methods of data collection. Some of the quantitative data was also collected for accessing the environmental aspect of the study. The data was organized and analyzed by help of the SPSS programme (Norusis 1988; SPSS version 10, 1999). Because much of the data collected according to the study were descriptive in nature, so they were explained directly. The open ended questions were dealt with separately. Recurrent themes were uncovered in this report by a process of systematic content analysis. In its broadest sense, different researchers have emphasized various aspects of content analysis, from its capacity to generate quantitative descriptions by analyzing word counts (Silverman 1993) to its ability to help researchers draw inferences from a text by breaking that text into discrete

units of manageable data that can then be meaningfully reorganized (Weber 1990). In this study, interview data was coded and sorted into themes. Inconsistencies and unique statements were noted and given particular attention.

## Results and Discussion

In all the districts, moringa was found to be used for the following purposes: vegetable, medicine, ornamental and as a source of oil (Figure 1). Other non-common uses included firewood, coagulate, fencing, in construction of traditional huts, making rope and as fodder for livestock. The degree of involvement of both the rural and urban people in moringa raising activities is high. The extent of the local's knowledge on tree raising techniques is great, giving a valuable reserve of indigenous experience which had hitherto been much underestimated and thus remained unexplored. Moringa is generally grown in woodlots, hedges, windbreaks and within agricultural land. Owing to the high degree of land demarcation and privatization, tree-raising activities are very much confined within each household. Opportunities for establishing communal plantations are almost non-existent, so there is no doubt that any efforts to introduce a programme with the ultimate aim of providing a self-sustainable supply of moringa has to concentrate on the promotion of tree planting on individual farms.

**Figure 1: Multiple uses of *M. oleifera* in rural and / or urban areas in Zimbabwe**



Farmers exchange seeds and / or seedlings with relatives and neighbours within their surroundings. It has also been observed that the bulk of moringa seedlings come not from official nurseries, such as Forestry Commission or Agricultural Research and Extension Services (AREX), but from farmers' own nurseries or neighbours' on-farm nurseries. Communities are starting to think of moringa as a resource which can no-longer be obtained for free but which has to be either produced or purchased.

### **Vegetable**

The leaves of moringa are widely eaten like rape or spinach in many rural and urban communities in Zimbabwe. The leaves, the growing tips of the plant with or without flowers are first pounded then cooked with tomatoes and in some cases peanut butter is added. The leaves can be harvested during the dry season when no other vegetables are available. The leaves are known to have a high content of protein, minerals and vitamins (Table 1). The leaves of moringa are an excellent source of the sulphur containing amino acids methionine and cystine, which are often in short supply (Council of Scientific and Industrial Research 1962). The high concentrations of essential amino acids, mineral ions and vitamins makes moringa an ideal nutritional supplement. Its leaves can be dried and made into a powder by rubbing them over a sieve and stored for use as a nutritional additive to soups, sauces or meal dishes. Although some of the nutritional content is lost during the process, the powder remains an excellent source of vitamin A. As a nutritional additive, 2 or 3 spoonfuls of powder are usually added to rice, soups and sauces just before serving. Small amounts of leaf powder will not have a marked effect on the taste of the soup.

Regular intake of moringa in the form of relish made out of fresh leaves and dried leaf powder which can be added to porridge or other relishes prevent anaemia and most forms of malnutrition. It is therefore an ideal vegetable for young children and pregnant women. In Binga District, the Ministry of Health and Child Welfare is encouraging the use of moringa tree as a vegetable especially to children under the age of five years as this can halt malnutrition. In many parts of Matebeleland, the leaves are widely eaten by women during pregnancy and after childbirth. This is done probably to provide the proteins, vitamins and minerals to both the mother and the child during the most critical phase of their lives. Pregnant women believe that drinking of the broth from cooking moringa leaves as soon as a uterine contraction pain are felt speeds up and facilitates delivery.

**Table 1. Composition of leaves and pods (per 100g of edible portion) (Council of Scientific and Industrial Research 1962)**

	Leaves	Pods
Moisture (%)	75	86.9
Protein (g)	6.7	2.5
Fat (g)	1.7	0.1
Carbohydrate (g)	13.4	3.7
Mineral matter (%)	2.3	2
Fibre (g)	0.9	4.8
Calcium (mg)	440	30
Oxalic acid (%)	101	0.01
Phosphorus (mg)	70	110
Copper ( $\mu\text{g/g}$ )	1.1	3.1
Iodine ( $\mu\text{g/kg}$ )	51	18
Iron (mg)	7	5.3
Vitamin A (I.U)	11 300	184
Nicotinic acid (mg)	0.8	0.2
Vitamin C (mg)	220	120
Vitamin B ( $\mu\text{g}$ )	210	

Besides the leaves, the young pods can also be eaten as a vegetable. The immature green pods are probably the most valued and widely used of all the tree parts in countries like India (Council of Scientific and Industrial Research 1962). The pods are generally prepared in a similar fashion to green beans. The pods are highly nutritious containing all the essential amino acids (Table 1). Although primarily utilized world-wide by the Asian population as a vegetable, the usage by other people is increasing. An international market already exists for both fresh and tinned pods. The seeds are utilized in some regions of India either in their green immature state or are fried in their mature state (Council of Scientific and Industrial Research 1962). The Indian horticulturists have already attempted to grow moringa with long pods and very sweet taste (Council of Scientific and Industrial Research 1962; Jahn 1988). There is no doubt that such selective breeding with respect to pod size and taste is crucial if moringa is to be used as a nutrition supplement.

### **Medicinal Uses**

The flowers, leaves and roots are widely used as remedies for several ailments. The bark of the moringa root should be scraped off because of its toxicity and the flesh of the root should be eaten sparingly (Oliver-Bever 1986). Moringa seeds are effective against skin-infecting bacteria *Staphylococcus aureus* and *Pseudomonas aeruginosa* (Council of Scientific and Industrial Research 1962; Oliver-Bever 1986). They contain the potent antibiotic and fungicide terygospemin. Moringa seem to have most of the food nutrients (Table 1) required by the body to



replenish its defensive mechanisms. The Tonga people of Binga District use the root powder as an aphrodisiac and when it is mixed with milk, it is considered useful against asthma, gout, rheumatism and enlarged spleen or liver. It also helps in the removal of wind from the stomach and as a snuff can be used to alleviate ear and toothache.

The leaf juice has a stabilizing effect on blood pressure. The leaf juice controls glucose levels in diabetic patients. Fresh leaves and leaf powder are recommended for tuberculosis patients because of the availability of vitamin A that boosts the immune system. If leaf juice is used as diuretic, it increases urine flow and cures gonorrhoea. Leaf juice mixed with honey treats diarrhoea, dysentery and colitis (colon inflammation). Fresh leaves are good for pregnant and lactating mothers, they improve milk production and are prescribed for anaemia. Paste made from bark treats boils. Paste from ground bark can be applied to relieve pain caused by snake, scorpion and insect bites. Oil is sometimes applied externally for skin diseases.

### **Source of Oil**

Some families use oil from moringa seeds for cooking and lighting. The oil from the seeds of *M. oleifera* and *M. peregina* Fiori (synonym *M. aptera* Gaerlin) are known in the trade as 'ben oil' or 'behn oil' and are edible and also used for illumination and in cosmetics (Council of Scientific and Industrial Research 1962). Ben oil was erroneously reported to be resistant to rancidity and considered particularly suitable for enfluerage and as a lubricant for fine machinery. However, the oil turns rancid like any other vegetable oil. The oil is highly valued by watch makers as a lubricant. It is highly esteemed by perfumers, for its great power of absorbing and retaining even the most fugitive odours. The oil is useful in the manufacture of soap, producing a stable lather with high washing efficiency.

Extracting the oil is not easy as for example extracting oil from sunflower seeds and may need a machine operated press. The oil has a potentially high market value and could be a source of income. After expressing the oil from the seeds a seed-cake remains which is a very good fertilizer. Its use as a potential animal feed has in the past, not been recommended as it contains alkaloids and saponin (Council of Scientific and Industrial Research 1962).

### **Animal Forage**

Leaves are readily eaten by cattle, sheep, goats, pigs and rabbits. Branches are occasionally lopped for feeding cattle. Moringa tree is now a relief to the residents of Umguza District in Matebeleland as they face shortages of grass for cattle feeding. The residents cut back the main stem to encourage side shoots which they use for livestock feeding. Leaves can also be used for fish, chickens and several bird species. Chickens and birds feed on moringa seeds.

### **Coagulant**

Crushed moringa seed kernel and seed-cake are very effective in water purification (Jahn 1988). When seeds from the tree are crushed and poured into an open well, all the suspended dirt particles like silt, solids, bacteria and other microorganisms stick together (coagulates) and sink to the bottom and the rest of the water will be left as clean as tapped water. The process can also be applied at home for the treatment of unclean river water. Twenty litres of water can be purified with 2 grams (2 level teaspoons) of crushed seed or seedcake. This makes it possible to separate the dirt from the top purified water. This is cheaper and environmentally friendly alternative to water purification.

### **Ornamental**

Moringa is widely grown in urban areas as a garden plant, shade tree and as a hedge plant (Maroyi 2006b). Moringa can be used as a cut flower or flowers can be collected for decoration purposes. The trees can be planted close to each other if it is to be used as a live fence tree.

### **Its Use as Firewood and in Construction**

Umguza residents in Matebeleland and other dry regions face shortages of firewood and timber because such areas are bare as a result of high deforestation. Moringa is a relief in such areas because the tree which is perennial and available throughout the year can be used as fuelwood source. Although the soft and light wood is acceptable firewood for cooking, it makes poor charcoal. The wood is very soft and light, most villagers tend to use it for light construction work. The timber is not durable in the ground and is not resistant to moisture and termites. The corky, grey bark of the tree yields a coarse fibre which is utilized in the production of ropes or mats.

### **Source of Income**

Moringa is increasingly becoming an important source of livelihood for a number of people as several villagers in parts of Matebeleland have started nurseries to grow moringa in large quantities for sale to other villagers and other provinces. In most cases group members share the seedlings, planting most on their farms, selling some to other farmers. Of late, the small town of Binga has become a hive of activity hosting people from all over the country who buy the moringa products in bulk. The products range from fresh leaves and pods to powdered leaves. Most farmers also give seedlings to relatives and neighbours. The prize of a single seedling ranges from Z\$50 000.00 – Z\$100 000.00 (US\$0.5 – US\$1). The high prices for seedlings are indicative of their high demand. Demand generally outstrips supply. Moringa is the most important plant species in nurseries at the moment. Farmers' reasons for planting and perceptions of benefits varied across the country. Four of the most common and most important reasons are the need for: food; an important medicine for home consumption; a cash earning

enterprise and the diversity of other uses. Cultivation of this multiple-use species is an economic proposition unlike many slower-growing and more habitat-specific medicinal plant species. Moringa is already a popular tree for indigenous agroforestry in Zimbabwe and a multiple-use species with similar potential in Africa.

### **Other Uses**

The wood provides a pulp that is considered suitable for newsprint, wrapping, printing and writing papers (Council of Scientific and Industrial Research 1962). The bark and gum can be used in tanning hides. The wood yields a blue dye. Powdered seeds can be used to clarify honey without boiling. Seed powder can also be used to clarify sugarcane juice. Flowers are a good source of nectar for honey producing bees.

The presence of long taproot make it resistant to periods of drought. Moringa can be a benefit in the fight against desertification. As it is fast growing, grows best in arid conditions, this makes it ideal for mass planting. It is also suited to areas where strong winds and long, dry spells occur simultaneously, causing serious soil erosion. The green leaves of moringa make a useful mulch. The press cake left after oil extraction from the seeds can be used as a soil conditioner or as a fertilizer.

### **Conclusion**

This study was therefore undertaken not only to extract detailed information from respondents on known uses but also to elucidate further unknown uses of moringa and also reinforce the need to preserve this important plant resource. Very little research has been done on the species although it is widely used by the rural poor as a food resource. Zimbabwe has a large impoverished rural population which relies to a great extent on wild botanical resources (Campbell 1987). Environmental resources are often the only resources available to the poor of the rural communities. The plant resources form the basis for daily survival and the hope for any economic development for the people. These resources are also the basis for the economic development of the agricultural nation like Zimbabwe. And on the global scale, they are the basis for sustainable and predictable global progress and development. The protection of the environment and the development of food production are closely linked. Not only are they compatible but we cannot have one without the other. If we cannot protect the environment, we cannot continue to produce food. If we do not develop sustainable food production systems we cannot protect the environment.

Above all, people need to be made aware of the beneficial role played plant resources so that these are restored to their rightful place as an integral element of the farming landscape. Local

communities must also be involved in whatever land-use and conservation strategies being developed. Nothing lasting can be achieved without their willing cooperation. They must be given a say in the decisions which concern them. They must also be provided with incentives and the means to adapt their agricultural practices to increased production and environmental protection. Government must also ensure that the necessary investments are made in roads and other necessary infrastructural provisions. They must provide the rural people with technical assistance and extension services. Access to credit, improved marketing facilities, price support and help in the formation of cooperatives and other organizations for mutual support.

The results of this study illustrated some of the characteristics of moringa which are useful in our day-to-day lives. It is hoped that further research might be undertaken to explore some of the aspects discussed in this report. This research should be aimed at providing a more comprehensive and detailed information on plants which are important to human welfare. The lack of such preliminary data on economically important plant species limits our ability to devise conservation action plans and ascertain sustainable harvesting rates of such species. This also makes it difficult to promote the involvement of local people in resource management.

Most of Zimbabwe experiences a significant dry season and is subject to drought years. During years of drought, subsistence on the basis of crops obviously becomes difficult if not impossible. Therefore the cultivation of moringa under such circumstances is recommended. More and more urban people are turning to the use of moringa because of the high nutritional value. It contributes to a more balanced diet for many people and a significant improvement in food security for the community at large. Moringa play an important role in income generation and subsistence. It offers a significant opportunity for the poorest people to earn a living as producers and traders without requiring large capital investments. Commercial growers can make a lot of money from the fast growing moringa. Women are the key players in the production, processing and marketing of moringa. For these women and their families, the income earned are of utmost importance.

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