

**ENVIRONMENTAL AND SOCIO-ECONOMIC SUSTAINABILITY OF MARULA
HARVESTING IN THE LUBOMBO REGION, SWAZILAND**

By

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DECLARATION

- i. I, Alfred Francis Murye, declare that the thesis that I herewith submit for the degree of Doctor of Philosophy in Environmental Management at the University of the Free State, is my independent work, and that I have not previously submitted it for a qualification at another institution of higher education.
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ABSTRACT

People form an integral part of ecosystems and derive a range of products from, and also influence, ecosystem processes. Poverty stricken people in rural areas of Swaziland utilize marula to alleviate poverty and earn a living. To reduce poverty, the Government of Swaziland developed a Poverty Reduction Strategy and Action Plan, and put up a programme of action (2013-2018) to meet His Majesty King Mswati III's¹ dream of Swaziland becoming a developed country by 2022. Her Majesty Ntombi Thwala - the Queen Mother² of Swaziland also initiated poverty eradication projects for rural women through the harvesting of marula fruits (*Sclerocarya birrea*).

However, limited data exist on the socio-economic contribution of marula to rural livelihoods. Additionally, the possible impact of excessive harvesting (propelled by the commercialisation of the resource) on rural communities depending on marula for their livelihood is not known, let alone the impact of harvesting pressure on marula regeneration and recruitment. This situation can lead to overharvesting and local extinction of marula. This thesis aimed at determining the role that marula plays in the livelihoods of, and poverty alleviation among the rural population in Swaziland and set out to identify policy interventions to facilitate means of sustaining marula for future availability.

A cross-sectional socio-economic survey embedded in an exploratory and descriptive research design and supplemented by a survey of the marula tree populations was carried out in the Lubombo region of Swaziland. Both quantitative and qualitative research approaches to data collection and analysis were employed. The study established that marula contributes significantly to the livelihoods of rural households in Swaziland as 53.3% of the respondents in the socio-economic survey supplemented their household income by harvesting marula. Marula was considered to be a very important source of household income by 68.5% of the respondents. About 49.8% of respondents earned an equivalent of US Dollar 36.2 (E500) per season, of which 46% used the income to buy books and uniforms and pay school fees and 42.4% used it to buy groceries, electricity and medication. Marula also contributes to cultural and spiritual enrichment and the creation of social ties. Several

¹ Hereafter referred to as "His Majesty the King"

² Hereafter referred to as "the Queen Mother"

socio-demographic factors, such as gender, age, lack of employment and low level of education were found to be drivers of people to harvest marula for livelihoods.

The thesis concluded that:

- marula harvesting makes a substantial contribution to the economies and livelihoods of rural households in Swaziland;
- marula harvesting plays a fundamental role in cultural practices and festivities in Swaziland and is paramount in creating social ties and cohesion among the Swazi nation;
- the increased harvesting of marula fruits and seeds has a detrimental impact on the sustainability of marula tree species in Swaziland;
- the current level of commercialized harvesting of marula in Swaziland is unsustainable and requires official monitoring and control of the harvesting process;
- environmental factors impact negatively on the regeneration, growth and sustainability of marula;
- distinctive socio-demographic attributes, such as gender and age, drive rural people to harvest marula beyond its sustainability thresholds;
- the depletion of marula will deepen the existing poverty levels of the respondents and lead to the deterioration of quality of life, especially in those impoverished households that are proportionately more dependent on marula;
- there are insufficient policy and legal frameworks for the protection of marula in Swaziland.

The thesis recommended that:

- the marula population structure be stabilized by planting marula trees and nurturing seedlings in the agricultural fields and also by leaving some fruits in the fields during harvesting in order to ensure regeneration;
- the Department of Forestry should develop programmes to educate and train rural communities on the importance of conserving and sustaining marula trees and products in Swaziland;

- the Department of Forestry should revise the existing floral policies and legal frameworks in Swaziland so as to fill the existing gap in these policies on access to and control of marula harvesting;
- the Government of Swaziland should revisit the policies on rural development in order to encourage and strengthen the creation of employment opportunities in rural areas so as to reduce the dependency on natural resources and marula in particular;
- the Department of Forestry should establish the maximum sustainable yield of marula in order to set quotas for harvesting per individual/ household;
- the Department of Forestry should address the gaps in the existing knowledge base of marula biology in Swaziland.

ABSTRAK

Die mens vorm 'n integrale deel van ekosisteme en gebruik verskeie produkte wat deur ekosisteme gelewer word, terwyl ekosisteemprosesse terselfdertyd wedersyds beïnvloed word. Landelike inwoners in Swaziland wat onder armoede gebuk gaan ontgin maroela om armoede te verlig en 'n bestaan te maak. Ten einde armoede te verlig het die regering van Swaziland 'n "*Poverty Reduction Strategy and Action Plan*" ontwikkel, en 'n program van aksie ingestel (2013-2018) om Sy Majesteit se wens te vervul dat Swaziland teen 2022 'n Eerste Wêreldland sal wees. Haar Majesteit die Koninginmoeder het ook armoedeverligtingsprojekte vir landelike vroue geïnisieer deur die oes van maroelavrugte (*Sclerocarya birrea*) te bevorder.

Die data betreffende die sosio-ekonomiese bydrae van maroela tot landelike bestaanswyses is egter beperk. Daarby is die moontlike impak van die oormatige oes van maroela (aangevuur deur die kommersialisering van die hulpbron) op die landelike gemeenskappe wat van maroela afhanklik is vir 'n bestaan, onbekend. Dit geld ook vir die impak van oesdruk op die regenerering en aanvulling van maroela. So 'n situasie kan lei tot die oorbenutting en plaaslike uitwissing van maroela. Hierdie tesis het ten doel gehad om die rol van maroela in die lewensbestaan van en armoedeverligting onder die landelike bevolking in Swaziland te bepaal, asook om beleidsintervensies te identifiseer wat die toekomstige beskikbaarheid van maroela sal verseker.

'n Kruisseksionele sosio-ekonomiese opname, geanker in 'n verkennende en beskrywende navorsingsontwerp, en aangevul deur 'n opname van die maroelaboompopulasie, is in die Lubombo streek van Swaziland uitgevoer. Daar is van beide kwantitatiewe en kwalitatiewe benaderings tot dataversameling en -analise gebruik gemaak. Die studie het bevind dat maroela 'n beduidende bydrae lewer tot die lewensbestaan van landelike huishoudings in Swaziland, aangesien 53.3% van die respondente in die sosio-ekonomiese opname hulle huishoudelike inkomste aangevul het met die oes van maroela. Sowat 68.5% van die respondente het maroela as 'n baie belangrike bron van huishoudelike inkomste beskou. Nagenoeg 49.8% van die respondente het die ekwivalent van USD 36.2 (E500) per seisoen met die oes van maroela verdien, waarvan 46% die inkomste gebruik het om boeke en

uniforms te koop en skoolfonds te betaal. In 42.4% van die gevalle is die geld gebruik vir kruideniersware, elektrisiteit en medikasie. Maroela dra ook by tot kulturele en spirituele verryking en die skep van sosiale netwerke. Daar is verder bevind dat verskeie sosio-demografiese faktore soos geslag, ouderdom, gebrek aan indiensneming en lae vlakke van onderwys as drywers dien vir die oes van maroela vir doeleindes van 'n lewensbestaan.

Die studie het tot die gevolgtrekking geraak dat:

- maroela 'n substansiële bydrae lewer tot die ekonomieë en lewensbestaan van landelike huishoudings in Swaziland;
- maroela 'n fundamentele rol speel in kulturele praktyke en feestelikhede in Swaziland en deurslaggewend is in die skep van sosiale bande en kohesie onder die Swazi bevolking;
- die toenemende oes van maroelavrugte en -sade 'n nadelige impak het op die volhoubaarheid van die maroelaboomspesie in Swaziland;
- die huidige vlak van kommersiële benutting van maroela in Swaziland is onvolhoubaar en benodig amptelike monitering en beheer van die oesproses;
- omgewingsfaktore impakteer nadelig op die regenerering, groei en volhoubaarheid van maroela;
- onderskeie sosio-demografiese eienskappe soos geslag en ouderdom dryf landelike bewoners om maroela te oes tot verby die drempel van volhoubaarheid daarvan;
- die uitputting van maroela sal lei tot die verdieping van die bestaande armoedevlakke van respondente en tot die agteruitgang van lewensgehalte, veral in die geval van verarmde huishoudings wat proporsioneel meer afhanklik is van maroela;
- daar is ontoereikende beleidsraamwerke en wetgewing vir die beskerming van maroela in Swaziland.

Die studie beveel aan dat:

- die maroelabevolkingstruktuur gestabiliseer moet word deur die aanplant van maroelabome in die landerye en die kweek van saailinge en ook deur sommige vrugte tydens oestyd in die veld te los sodat regenerering kan plaasvind;

- die Departement van Bosbou programme behoort te ontwikkel wat landelike gemeenskappe sal opvoed en oplei in die belangrikheid van die bewaring en volhoubare benutting van maroelabome en –produkte in Swaziland;
- die Departement van Bosbou die huidige beleidsraamwerke en wetgewing insake plantspesies in Swaziland moet hersien ten einde die bestaande leemte in beleid rondom toegang tot en kontrole oor die oes van maroela aan te spreek;
- die regering Swaziland bestaande beleid rondom landelike ontwikkeling moet hersien ten einde die skepping van werkseleenthede in landelike gebiede aan te moedig en te versterk sodat die afhanklikheid van natuurlike hulpbronne, en van maroela in besonder, verminder kan word;
- die Departement van Bosbou die maksimum volhoubare opbrengs van maroela moet bepaal ten einde kwotas per individu/ huishouding vir die oes van maroela daar te stel;
- die Departement van Bosbou leemtes in die bestaande kennisbasis van maroelabiologie in Swaziland moet aanspreek.

LIST OF ACRONYMS

AIDS	Acquired Immunodeficiency Syndrome
CBD	Convention on Biological Diversity
CEO	Chief Executive Officer
CL	Crown Land
CPR	Common Property Resource
DFID	Department for International Development (United Kingdom)
FAO	Food and Agriculture Organization of the United Nations
HIV	Human Immunodeficiency Virus
IFAD	International Fund for Agricultural Development
IISD	International Institute for Sustainable Development
KNP	Kruger National Park
MDGs	Millennium Development Goals
MEA	Millennium Ecosystem Assessment
MoA	Ministry of Agriculture
NPK	Nitrogen Phosphorus Potassium fertilizer
NTFPs	Non-Timber Forest Products
NWFPs	Non-Wood Forest Products
NZAID	New Zealand Agency for International Development
OECD	Organization for Economic Cooperation and Development
PRSAP	Poverty Reduction Strategy and Action Plan
SACU	Southern African Customs Union
SARUA	Southern African Regional Universities Association
SDGs	Sustainable Development Goals
SEA	Swaziland Environment Authority
SLA	Sustainable Livelihoods Approach
SNL	Swazi Nation Land
SWADE	Swaziland Water and Agricultural Development Enterprise
TDL	Title Deed Land
UN	United Nations
UNDP	United Nations Development Programme

UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children’s Educational Fund
WFP	World Food Programme
WMA	Women Marula Association
WRI	World Resources Institute
WWF	World Wildlife Fund

GLOSSARY OF TERMS

Buganu	A traditional brew from marula fruits
Huhlaba	Crushed marula fruits
Indlovukazi	Her Majesty, the Queen Mother
Ingwenyama	His Majesty, King Mswati III
Inkhundla	Constituency
Khonta	Land allocation system in Swaziland
Sangoma	A traditional healer
Shangaan	Mozambican nationals living in Swaziland
Tindvuna	Regiment leaders
Tikolosi	Gremlins

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CHAPTER 1: INTRODUCTION

1.1 Background to the study

The intricate linkages between human populations and the environment are well documented and cannot be overemphasized (Cosyns, Van Damme, De Wulf & Degrande, 2013; Cosyns, Van Damme, De Wulf, Degrande & Tchoundjeu, 2011; Dakubo, 2011; Daily, Alexander, Ehrlic, Goulder, Lubchenco, Matson, Mooney, Postel, Schneider, Tilman & Woodwell, 1997; Thompson, Mackey, McNulty & Mosseler, 2009). Ecosystems offer a number of services that humans tap for their survival and livelihood. These ecosystem services interact with, and are intrinsically linked to, social structures and processes. As such, human beings are considered an integral part of ecosystems, since they derive a range of services from the ecosystems and also act as a driver influencing ecosystem processes (Levin, Fogarty, Murawski & Fluharty, 2009).

Swaziland falls under the low-middle-income economy (L-MIE) countries, typically with a per-capita Gross Domestic Product (GDP) of US\$ 5,940 per annum as of 2014 estimates (Population Reference Bureau, 2015). Hence, the poverty rate (i.e. the proportion of people with an income below USD 2.00 per day) is estimated at 69% (Ministry of Economic Planning and Development, 2005; Nindi & Odhiambo, 2015; World Bank Group, 2011). Economic development depends, to a large extent, on investment and trade, which is directly influenced by legal protection and the abilities of the country to put in place physical, financial and public infrastructure (Ladefoged, Hansen, Worsoe & Fredslund, 2009; Myerson, 2015). However, a lack of economic development can contribute to the exploitation of natural resources by a majority of poor people, especially in rural areas. In addition, economic development can also contribute to the exploitation of natural resources, thus complicating the human-ecosystems linkages. The exploitation of the natural resources may include the harvesting of wild fruits to generate an income and earn a living, thus contributing to a complex intricate link between people and their environment. This people–environment link has been echoed by UNEP and IISD (2004) who point out that all people depend on ecosystem services for their well-being. Hence, the poor relies more

directly on the environmental services than the affluent and are therefore more directly dependent on ecosystem services functioning than affluent communities.

People depend on natural products for food, shelter, medicine, source of energy, income, oxygen, recreation, and spiritual sustenance (Secretariat of the Convention on Biological Diversity, 2010; Sunderland, Harrison & Ndoye, 2004; Wynberg, Laird, Botha, den Adel, & McHardy, 2002a). This means that local people's livelihoods and even their survival often depend on the exploitation of local and regional natural resources (Fisher, 2005; Whittingham, Campbell & Townsley, 2003). One such natural resource base being exploited for poverty alleviation is non-timber forest products (NTFPs). In Swaziland, this includes, amongst others, the harvesting and selling of marula fruits and seeds.

Many countries in sub-Saharan Africa encourage rural communities, especially women to harvest natural products for income generation purposes (Ladefoged *et al.*, 2009; Myerson, 2015; UNEP & IISD, 2004). This means that biodiversity has become the basis for ecosystem services that people primarily depend on for commercial harvesting to sustain their livelihoods and well-being. Hence, the increasing demands on these resources, the decrease in their availability and the probable consequence of environmental degradation emphasize the need for a coordinated approach to their sustainable utilization. Initiatives on biodiversity and natural resources conservation in the form of terrestrial and marine parks and protected areas, as well as commercial ventures into the harvesting of such resources, thus, often come in conflict with the livelihood strategies of local populations (Borrini-Feyerabend, Kothari & Oviedo, 2004; Naughton-Treves, Holland & Brandon, 2005). Therefore, Hugo (2010) rightly emphasizes that the sustainable management and use of such resources requires an interdisciplinary approach and sound knowledge of each resource, while the ecological and socio-economic factors related to their use must be sorted as well. Furthermore, since the long-term success of any initiative hinging on the utilization of natural resources depends on local benefit and support, it is imperative that local livelihoods and poverty reduction are considered during the formation and management of such initiatives (Baral, Stern & Heinen, 2007; Lockwood & Kothari, 2006; Nepal, 2005).

Despite its pivotal role in local livelihoods and poverty mitigation, commercializing natural product harvesting tends to complicate the intricate linkages between human beings and their environment. One example of such complications is the creation of new markets or expansion of existing market demands for NTFPs, which will contribute to overharvesting and resource depletion (Neumann & Hirsch, 2000). In Southern Africa, for example, the handicraft industry in the early 1970s introduced basketry in Ngami land, Botswana, as an economic development project for the Hambukushu refugee population (Bishop, Cunningham, Pimbert, Scoones & Terry, 1994). This handicraft industry is reported to have expanded to several communities and countries around the southern African region and resulted in an upset in ecological balance (Neumann & Hirsch, 2000). Some of the negative ecological impacts regarding commercial ventures into the NTFPs include resource depletion from destructive harvesting techniques and overharvesting (Neumann & Hirsch, 2000). Therefore, the unsustainable harvesting of traditional forest products for the purposes of medicines and food has been reported to impact negatively on the sustainability of biodiversity (Gayton, 2007; Secretariat of the Convention on Biological Diversity, 2010).

Poverty alleviation featured as Goal One among both the past UN eight Millennium Development Goals (MDGs) and the newly approved 17 Sustainable Development Goals (SDGs) (Lunn, Downing, & Booth, 2015). Expounding on the Millennium Declaration (2000), a major observation is that, although it had set the goal to cut by half the numbers of hunger-stricken people who live on less than USD 1.00 per day by the year 2015, many countries, including Swaziland, did not manage to meet the set target (UNDP, 2010; UNDP, 2014). The major challenges that hampered member states from attaining the MDGs were a range of interacting factors: slow economic growth prospects; resource constraints; a lack of institutional reforms; inadequate capacity for development; uneven income distribution; the general global economic situation; a lack of political will and commitment to the MDGs; the absence of an enabling environment to attract investment and encourage private sector development; and a lack of inclusive growth (Bello & Suleman, 2011). In trying to address MDG 1 and close the gap between the rich and the majority of the world's rural poor, the World Resources Report of the World Resource Institute (2000) underscored the importance of exploiting natural resource bases (FAO, 2003; Adams, Aveling, Brockington, Dickson, Elliott, Hutton, Roe, Vira & Wolmer, 2004; Bird & Dickson, 2005).

Hence, on 25th September 2015, the member states attending an extraordinary Summit of the General Assembly on the post-2015 development agenda agreed on the SDGs, with 169 associated targets for human development, to be achieved by 2030 (Lunn *et al.*, 2015). The rallying cry throughout the General Assembly negotiations was 'leave no one behind'. Of importance to this study among the SDGs are Goal 1, which calls for the ending of poverty in all forms and Goal 15, which calls for member states to protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification and halt and reverse land degradation and halt biodiversity loss.

Deepening poverty is a major force that leads people to degrade the environment and overexploit natural resources in an unsustainable manner to an extent of depletion and extinction (Campbell Luckert & Scoones, 1997; Cunningham, Cunningham & Saigo, 2005). While the MDGs were still being implemented, the Government of Swaziland developed a Poverty Reduction Strategy and Action Plan (PRSAP) that called for a reduction of the incidence of poverty from the rate of 69% by the year 2015 (Ministry of Economic Planning and Development, 2005; World Bank Group, 2011). In addition, it developed a programme of action for the period between 2013 and 2018 and projected its programme of action to the year 2022 in order to track its national progress towards the attainment of the vision of His Majesty the King and the nation of being a First World country by 2022 (Kingdom of Swaziland, 2013). The goal for reducing poverty by 30% by the year 2015 was, however, not achieved following the global economic meltdown and reduction in the revenue received by the Swaziland Government from the Southern African Customs Union (SACU), which had a major impact on the Swaziland economy. In addition, like most countries in southern Africa, Swaziland is characterized by an unacceptably high level of unemployment rated at 30% by the year 2010 (African Economic Outlook, 2013; Brixiová & Kangoye, 2013). With the recent developments in the international arena, the Government of Swaziland is expected to realign its development agenda to meet the SDGs.

The main pillars of the PRSAP included strategies such as: rapid acceleration of economic growth based on broad participation; empowering of the poor to generate their own income; and an equitable distribution of benefits of growth through public spending. The targets set out in the PRSAP prompted Her Majesty the Queen Mother to initiate poverty

eradication projects amongst rural women through marula harvesting for commercial consumption and processing. However, overharvesting and possible extinction of a non-timber forest product, such as marula, can become more intensified in cases where the local population depends on this very resource for their livelihood (Padoch, 1992).

1.2 The marula tree as non-timber forest product

The marula tree (*Sclerocarya birrea*.) belongs to the family *Anacardiaceae* – a plant family of about 70 genera and 650 species that includes the mango tree (*Mangifera indica*), pistachio (*Pistacia vera*), cashew nut (*Anacardium occidentale*) and the pepper tree (*Schinus molle* L.) (Mojeremane & Tshwenyane, 2004). *Sclerocarya birrea caffra* is one of three species of *Sclerocarya*, the others being *Sclerocarya gillettii* which is endemic to a small arid area in Eastern Kenya and *Sclerocarya multifoliolata* that has been reported to be endemic to Tanzania, and is majorly found in mixed deciduous woodland and wooded grassland (Hall, 2002; Shackleton, Botha, Emmanuel & Ndlovu, 2002). The genus name *Sclerocarya* is believed to have been derived from the Greek word *scleroses* (meaning “hard”), and *karyon* (meaning “nut”), thus, referring to the hard stone of the fruit (Shone, 1979). The World Agro-forestry Centre claims that the word ‘*birrea*’ originates from the word ‘*birr*’, the common name of the marula tree in Senegal, and the word ‘*caffra*’ deducted from ‘*kaffaria*’ (Eastern Cape, South Africa) (Kgomoamagodi, 2008). The same source also explains that the name ‘*caffra*’ comes from the Hebrew word ‘*kafri*’ meaning a countryman, and that it also refers to the British ‘*Caffraria*’ where the first collection of the tree had taken place.

Marula tree is one of Africa’s botanical treasures. It grows abundantly in Swaziland, especially in the lowveld and the lower parts of the middleveld. It is estimated that there are about two million marula trees growing in Swaziland and that each tree can produce up to 500kg of fruits per year (UNDP, 2012). Marula (Image 1) is a large dioecious tree that grows to about 15m in height with spreading crowns and dense foliage (Gadd, 2002; Mojeremane & Tshwenyane, 2004; Palgrave, 2002; Shackleton *et al.*, 2002). It produces fruits whose fresh mesocarp of the ripened fruit is edible and rich in minerals and vitamins. According to (Hall, O’Brien & Sinclair, 2000), the stone of a marula fruit contains nut-like seeds that are rich in protein and oil and can be eaten fresh, mixed and cooked with other foods or stored for later consumption. This makes marula an integral part of the diet, tradition and culture of

rural communities in southern Africa and sought after for many commercial initiatives (Shackleton *et al.*, 2002; von Teichman, 1983; Wynberg *et al.*, 2002a).



Image 1: A picture of a marula tree

Source: Picture taken by A.F. Murye, 25th September 2013

From time immemorial, people in Swaziland have been collecting marula fruits and seeds for livelihoods in the form of food and for producing a traditional brew known as *Buganu*. The latter is largely consumed during traditional festivals or sold to local customers for income generation (Magagula, 2012; Mathunjwa, 2010; Nkambule, 2015). Swazis have used the kernels in relishes, eating the fresh fruits and seeds, using the bark for relieving stomach aches and for spirituality (Swazi Secrets, 2009). Marula also features extensively in traditional ceremonies, such as the *Buganu* Ceremony, celebrated annually in the country where people gather together with their King (The *Ingwenyama*) and Queen Mother (The *Indlovukazi*) to celebrate the marula (Magagula, 2012; Mathunjwa, 2010; Nkambule, 2015). This annual ceremony marks the beginning of the *Buganu* season whereby after the ceremony every Swazi becomes free to drink the brew (Jele, 2013; Swazi Observer, 2015).

Recognizing its cultural and commercial values, the Queen Mother established two commercial processing plants known as Swazi Secrets and Swaziland Marula as initiatives to empower rural women economically through enterprising on marula harvesting and processing.

1.3 Problem statement

Swaziland, like many other developing countries, continues to fight the battle for economic growth and poverty alleviation. This is compounded by the current global economic meltdown that started in 2008, reduction in SACU revenue as of 2011, and the environmental challenge of global climate change which is impacting developing countries the most (Basdevant, Chikako & Mircheva, 2011; Funder, Fjalland, Ravnborg & Egelyng, 2009; SARUA, 2014). The consequences of climate change in turn present one of the most fundamental threats to biodiversity and the functioning of ecosystems (Osman-Elasha, Parrotta, Adger, Brockhaus, Pierce, Sohngen, Dafalla, Joyce, Nkem & Robledo, 2009). This means that developing countries are faced with a dual dilemma playing out simultaneously: on the one hand, they grapple with the challenge of how to marry economic growth and poverty reduction and, on the other; they are expected to engage in efforts for environmental conservation and resource sustainability.

In the past few decades, marula has increasingly gained popularity in the international market due to demand for its many by-products, such as marula oil and the well-known Amarula cream liqueur (Cant & Machado, 2010; Castro & Nielsen, 2003; Shackleton *et al.*, 2002; Swazi Secrets, 2009; Wynberg *et al.*, 2002a). The Fairtrade (2010) reports that certified marula harvesters receive a fixed Fair-trade premium of 50% above the average market price for every kilogramme of marula fruit they sell to processors or Fair-trade – certified buyers. In South Africa, in 1987 for example, Lawes, Eelly, Shackleton and Geach (2004) reported that 2000 tons of marula fruit were processed into liqueurs, 500 tons into fruit juice, and 40,000 bottles of marula jelly were produced as well.

The increased demand for marula products, coupled with the high incidence of poverty, especially among rural women in Swaziland, led to the establishment of the two marula products' processing plants in the Lubombo Region in 2004. One of these processing plants -

the Swazi Secrets is based at Mphaka and produces chemical value added products from marula kernels, while the other plant, Swaziland Marula, is located at Siphofaneni, bottles *Buganu* and manufactures other value added products from the marula stones, including briquettes. These initiatives have attracted a large number of Swazi women to scout the forests and fields around their homesteads in search for marula fruits and seeds to sell and earn an income.

The UNDP (2012) has observed that the Swazi Secrets project alone is supporting 2400 rural women who earn a living through selling seed kernels from marula trees. This means that, if the number of women supported by Swaziland Marula is factored in too, the total figure could be more than double this number. This poses a potential threat to the marula tree species as more and more of the seeds that would support regeneration and recruitment of new marula trees are removed through harvesting.

According to Peters (1995), when the bark, fruits, seeds, wood and other parts of a species are harvested for processing into various products at household and/or commercial levels, there may be significant impacts on the population structure and distribution of the species, depending on the nature and intensity of the harvest. This imposes a potential threat to the species in the sense that it might be driven to depletion and/or extinction if proper sustainability measures are not put in place. It is clear, therefore, that the potential depletion or extinction of marula in Swaziland could compromise the livelihood activities of large numbers of the rural poor in terms of income generation and well-being as they derive their livelihoods from harvesting marula (Figure 1.1). Should marula get depleted, the effects would not only impact on the rural women harvesting the raw material, but would also trickle down to the marula processing enterprises. If this would be the scenario, these marula entrepreneurs might be forced to travel long distances to collect marula fruits and seeds or buy them at a higher price from neighbouring countries. This would escalate the prices of marula, thus threatening the operations of the enterprises as a whole.

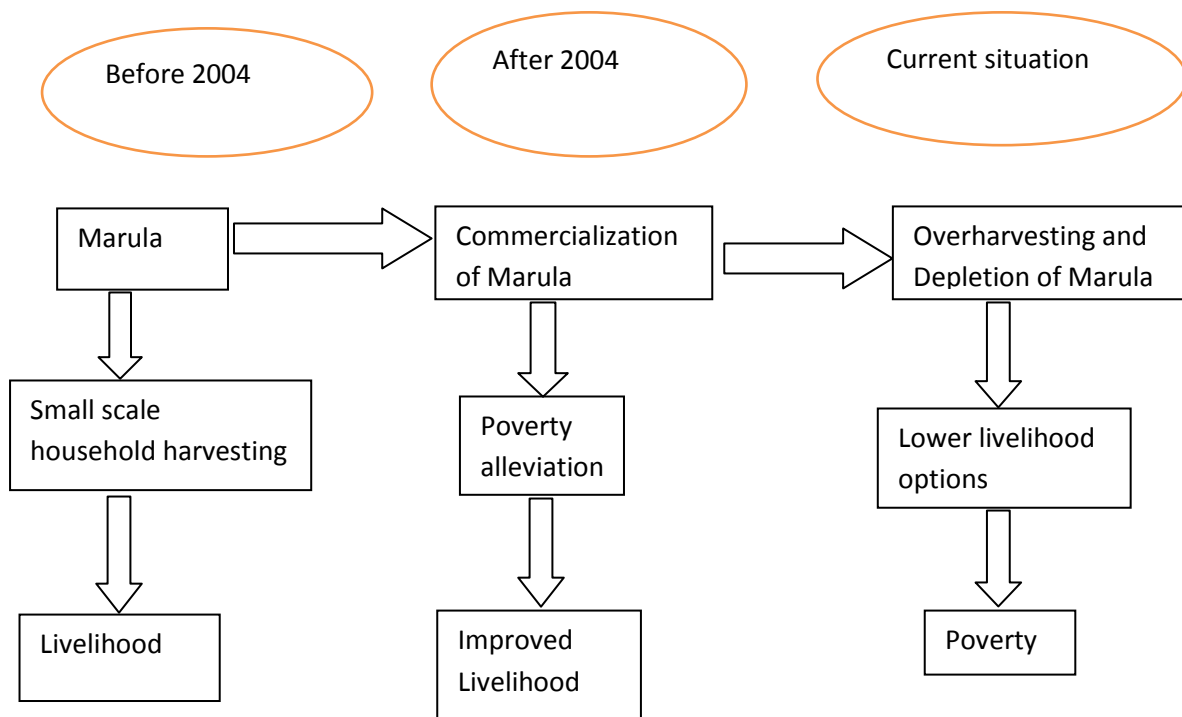


Figure 1.1: A conceptual framework of the research problem

Source: Developed by A.F. Murye

The current amount of marula sold during the harvest season in Swaziland is unknown, with the result that the impact of fruit/seed harvesting on the regeneration and sustainability of marula is not known. The harvesting of marula fruits implies the removal of seeds from the existing population and, in time, reduced recruitment will alter the population size-class structure (Bernal, 1998). In addition to its impact on seedling establishment and size structure, the overharvesting of marula products can also lead to the loss of potential genetic material from the population. As the removal of the fruits progresses, the resulting population tends to be dominated by trees of insignificant economic value (Peters, 1995).

Despite the traditional and commercial recognition of marula, limited data are available on the socio-economic contribution of marula harvesting to rural livelihoods in Swaziland. In addition, few studies have been conducted on marula consumption in Swaziland. Those available include a study by Dlamini (2007) and Murye (2015) that focused on the improvement and strengthening of policy and strategy development for the sustainable management of non-timber forest products and environmental management in general. These did not delve into an analysis of policy and institutional factors which govern and

affect marula in particular. Another study by Masarirambi and Nxumalo (2012) focused on the post-harvest physiological indicators on the phenotypic variation of marula fruits (*Sclerocarya birrea* subsp. *caffra*) in Swaziland. Other studies by Mlambo, Dlamini, Nkambule, Mhazo and Sikhosana (2011a), Mlambo, Dlamini, Nkambule, Mhazo and Sikhosana (2011b) and Mariod & Ibrahim (2012) concentrated on the nutritional value of marula seed cake as a protein supplement for goats fed grass hay and commercial cattle fattening diets, respectively.

Scrutinizing these studies and other available literature revealed that little/no information is available regarding the environmental and socio-economic sustainability of marula harvesting and the role of marula in income generation activities of the rural poor in Swaziland. In addition, the economic contribution of marula to rural household income is neither known nor documented. Besides, the possible impact of marula depletion on the communities that depend on it for their livelihoods has not been studied – let alone the potential impact on regeneration and recruitment of new marula trees. Thus, the current conditions pertaining to marula harvesting and commercialization clearly called for a need to generate adequate information about the environmental requirements of marula and its socio-economic contribution to livelihoods of poor rural communities in Swaziland. Stemming from the aforementioned, this study aimed to seek answers to the following questions:

- What is the contribution of marula harvesting to rural livelihoods in Swaziland?
- Are the current population of marula trees and the level of regeneration sufficient to ensure the future sustainability of marula in the light of existing commercialization and harvesting practices?
- Which biophysical and socio-economic factors impact upon the sustainability of marula trees and harvesting of their products in Swaziland?
- How will marula depletion/scarcity affect the livelihoods and well-being of the rural populations who depend on it?
- What cultural practices and spiritual beliefs are associated with the marula trees and harvesting of its products?

- What kinds of livelihood coping strategies are in place for the rural households that depend heavily on marula harvesting in the event of marula getting depleted?
- What policy interventions are required to sustain marula availability and harvesting?

1.4 Aim and objectives of the study

The aim of this study was two-fold: first, to determine the role that marula plays in the livelihoods of and poverty alleviation among the rural population in Swaziland and; second, to identify policy interventions that will facilitate means of sustaining the marula tree population for its continual availability for harvesting by local communities.

1.4.1 The specific objectives of the study were to:

1. investigate the impact of marula harvesting on rural livelihoods and poverty alleviation;
2. examine the current population structure of marula trees in Swaziland in order to determine the regeneration and recruitment of new marula seedlings in three different types of land use;
3. assess how depletion/scarcity of marula will affect rural household income, livelihoods and cultural practices;
4. identify the environmental factors and socio-economic conditions that might contribute towards and propel the depletion of marula;
5. identify the strategies that rural households have put in place in order to prevent marula from becoming depleted/scarce and develop mechanisms that could be put in place for sustaining marula harvesting;
6. describe the cultural and spiritual practices associated with marula;
7. identify policy interventions that are required to sustain marula availability and sustainable harvesting.

To inform these objectives, the theoretical framework of the thesis was underpinned by two theories - the people-ecosystem theory and the sustainable livelihoods theory. These are discussed in more detail in Chapter Two.

The next chapter – Chapter Two – elaborates on the theoretical framework that underpinned the study. Chapter Three presents the review of literature related to environmental and socio-economic aspects of marula. Chapter Four discusses and explains the methodology that was adopted for the study. The research findings are presented in Chapter Five, while Chapter Six analyses and interprets the findings. The thesis ends with Chapter Seven which contains the conclusions and recommendations of the study. Figure 1.2 presents the diagrammatical outline of the thesis.

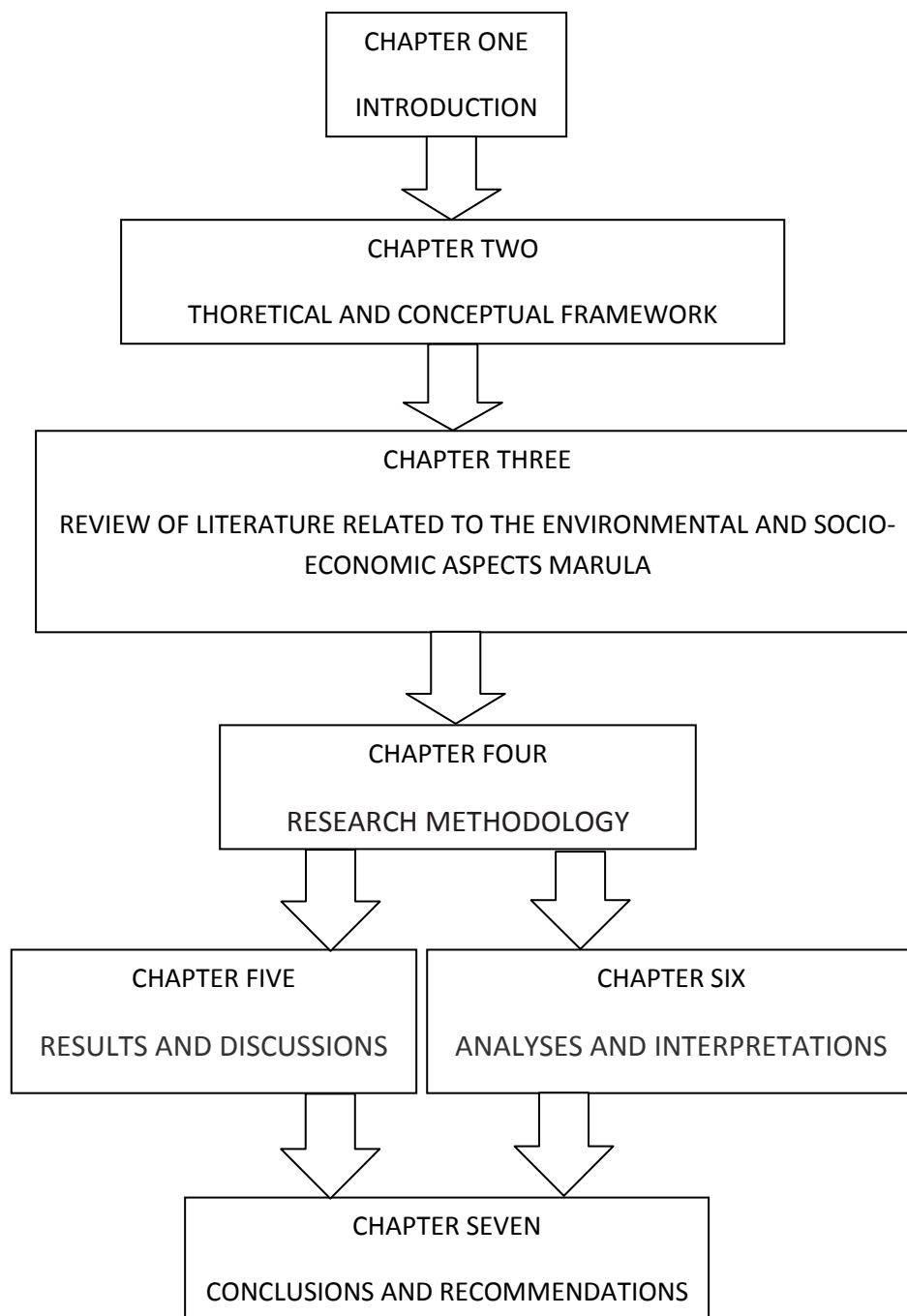


Figure 1.2: An outline of the thesis

CHAPTER 2: THEORETICAL AND CONCEPTUAL FRAMEWORK

2.1 Introduction

The purpose of this chapter is to present the theoretical and conceptual framework for the study. The study has been grounded in two theories - the theory of people-ecosystem links as well as the sustainable livelihood theory. The reasons for using dual theories were that the two complement each other: people derive resources from ecosystems to sustain their livelihoods and any adverse impact exerted on ecosystems will also impact negatively on peoples' livelihood sustainability. In addition, it was deemed prudent to utilize both theories given that population dynamics are often equally linked to livelihood strategies, which are themselves directly or indirectly affected by local environments (De Sherbinin, VanWey, McSweeney, Aggarwal, Barbieri, Sabina, Hunter & Twine, 2008; Massey, Axinn & Ghimire, 2010). This chapter is divided into two parts. Part I presents the people-ecosystems linkages theory and Part II presents the sustainable livelihoods theory.

2.2 Part I: The theory of people – ecosystems links

The significant growth in the human population since the Industrial Revolution has negatively impacted upon the environment through increasing demands for ecosystem services such as food, water, energy and natural resources (Harper, 2012). Hence, a large body of literature abound on the people-ecosystem linkages. One of these works that have made a huge contribution in documenting, communicating and developing understanding of the importance of ecosystem services to human well-being is the Millennium Ecosystem Assessment (MEA) (MEA, 2005; Shackleton, Shackleton, Gambiza, Nel, Rowntry & Urquhart, 2008). In addition, several research works reported among a plethora of literature attest to the fact that the well-being of humanity is in an intricate linkage with the provision of ecosystem services such that it is impossible to separate people from ecosystems (Harper, 2012; Silvis & van der Heide, 2013; UNEP, 2004; UNDP & UNEP, 2009; UNEP & IISD, 2004; MEA, 2005; World Bank, 2004; World Resource Institute (WRI), 2007).

Many frameworks have also been developed on the linkages between people and ecosystems. In addition, researchers have classified ecosystem services and have attached values to them (Costanza, 2008; MEA, 2005; Wallace, 2007). Nonetheless, there still exist a

challenge of conducting and demonstrating the practical applications of the concepts of these frameworks and methods to improve ecosystem service provision at a regional scale (Cowling, Egoth, Knight, O'Farrell, Reyers, Rouget, Welz & Wilhelm-Rechman, 2008). Therefore, to achieve sustainable development, the connections between people, the environment and development must be carefully examined since ecosystem services interact with, and are intrinsically linked to, social structures and processes (Harper, 2012).

People are an integral part of ecosystems, since they draw a number of services from ecosystems and influence ecosystem processes (Levin *et al.*, 2009). This puts people at the centre of all concerns surrounding sustainable development and sustainability of livelihoods. In fact, there is currently growing concern about the effects of people on ecosystems and the reciprocal impact of ecosystems degradation on the quality of human life (United Nations, 2002; UNEP & IISD, 2004). The 20th Century had been a century of unprecedented population growth, economic development and environmental change (Harper, 2012). During the period 1900 to 2000 the world population grew from 1.6 billion to 6.1 billion UN (2002) and hit the 7 billion mark in 2011. Projections indicate that, by the year 2030, the human population will have reached 8.3 billion (Botkin & Keller, 2012; Harper, 2012; Rutherford, 2009). If this is to happen, it will lead to severe implications for resource use as most researchers are of the opinion that consumption levels will become increasingly acute as the world population increases to 9 or 10 billion in the next century (Harper, 2012). In fact, as the world population increased almost four times between 1900 and 2000, the world gross domestic product (GDP) hiked by 20 to 40 times (DeLong, 1998), permitting the world not only to sustain a fourfold population increase, but also one that is accompanied by vastly higher standards of living in some regions.

This rapid population and economic growth of the past century nevertheless occurred unevenly throughout the world and not all regions benefited from the accelerated economic growth. Population pressure contributed to both migration and urbanization, thus leading to the environmental impact of population growth not to be evenly distributed (Harper, 2012). Nevertheless, population growth and economic development happened simultaneously with an accelerated unsustainable utilization of natural resources and ecosystem degradation.

2.2.1 The links between biodiversity, ecosystem services and human well-being

Most theories on the interaction between people and their ecosystems have been expounded primarily in relation to agricultural resource use. However, they can be applied *mutandis mutatis* to all types of natural resource uses (United Nations, 2002). From the natural sciences point of view, humanity is one of the many species competing for the resources of the biosphere, yet they pride themselves as dominant species over the other species due to their highly-developed brain and thumb that enables them to use tools to manipulate the environment in which they live (Hugo, 2010). However, because the resources and carrying capacity of any ecosystem are finite, each additional human being in the ecosystem has a potentially negative impact not only on the productivity of resources, but also on the livelihood and well-being of people – especially the rural poor (Harper, 2012; Khitoliya, 2004; UNEP & IISD, 2004).

The livelihoods and food security of the poor often depend directly on ecosystems, and the diversity of goods and services derived from these ecosystems (Haines-Young & Potschi, 2009; Silvis & van der Heide, 2013). Borrowing from the Millennium Ecosystems Assessment, MEA (2005) and UNDP & UNEP (2009), this study defines an ecosystem as a dynamic complex of plant, animal and micro-organism communities and their non-living (chemical and physical factors) environment interacting as a functional unit. The chemical and physical factors include sunlight, rainfall, soil nutrients, climate and salinity. Ecosystems are functional units that result from the interactions of abiotic, biotic, and cultural (anthropogenic) components and occur at different spatial (geographical area) and temporal (time) scales. Therefore, ecosystem services are the benefits that people derive from ecosystems and have been described as the lifeblood of human societies, economies and identities around the world (Haines-Young & Potschi, 2009; MEA, 2005). These ecosystem services interact with, and are intrinsically linked to; social structures and processes, and the development process (Harrison & Pearce, 2000). According to Groenewald (2011), this implies that the multiple interactions among the three primary fields – population, environment and development - should be described as a nexus of interrelationships (Figure 2.1).

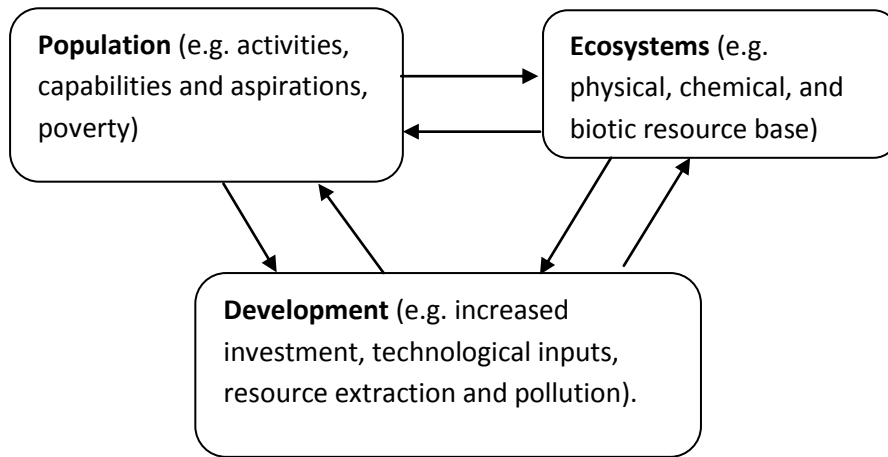


Figure 2.1: Conceptualizing the linkages between people, ecosystems and development

Source: A.F. Murye, 2015

In these interactions and linkages, poverty is seen as the main driver of people, especially the rural poor, to exploit natural resources, such as harvesting wild fruits for income generation and livelihood, thus creating a delicate poverty-ecosystem linkage between people and ecosystems (Harper, 2012; Harrison & Pearce, 2000; MEA, 2005; Silvis & van der Heide, 2013). These interactions and linkages can be conceptualized in many ways, such as in terms of their relationship to livelihood, resilience to environmental risks, health, and economic development (Haines-Young & Potschi, 2009; UNDP & UNEP, 2009). Ecosystem services provide benefits to people which support livelihood and human well-being, such as by generating income and alleviating poverty or providing nutritional diversity in people's diets and, in so doing, the ecosystem services are depleted (Costanza, 2008; Silvis & van der Heide, 2013; Mariod & Ibrahim, 2012).

The quality and type of benefits that people receive from such ecosystem services hinge on the biological processes, creating tightly coupled socio-ecological systems and, at the same time depending on whether the services and benefits are equitably accessible and available for people to use (Silvis & van der Heide, 2013). The range of ecosystem services provided is grouped into four categories (Dempsey & Robertson, 2012; Haines-Young & Potschi, 2009; MEA, 2005; UNDP & UNEP, 2009). These comprise of:

(i) *Provisioning services*: This includes the direct provision of food, fibre, fuel, water and air. These constitute direct support to livelihoods;

(ii) *Regulating services* entail the purification, detoxification and mitigation of drought, floods and other natural hazards. This is a critical category of services, even in developed countries, as there are generally no alternatives, unlike in direct provisioning;

(iii) *Cultural services* point at spiritual enrichment or satisfaction, aesthetic values attached to ecosystems, and social amenities;

(iv) *Supporting services*: Ecosystems provide base or support services that enable provision of other services e.g. soil formation, nutrient recycling, growth and primary production. These services, generally, tend to cover biological (and physico-chemical aspects in case of processes, such as weathering and geological changes) processes that support provision of other services to humanity.

The broad range of services provided by ecosystems underscore the critical importance that ecosystems play in economic, social, cultural and political transformation of societies (Groenewald, 2011; Harper, 2012). The complex relationship between ecosystems and human well-being, however, remains unclear to many people, and this limited knowledge and understanding has contributed much to the degradation of ecosystems (Harrison & Pearce, 2000).

Human well-being and progress towards sustainable development are closely dependent upon improving the management of the earth's ecosystems in order to ensure their conservation and sustainable use (Harrison & Pearce, 2000). However, while human demands for ecosystem services, such as clean air and water are growing, the actions exerted by humans on the ecosystems are, at the same time, diminishing the capacity of the ecosystems to meet the growing demands (Costanza, 2008). In fact, these ecosystem services, once degraded or depleted, are difficult to restore to their original state since they are produced through a complex of interacting processes/functions (Hugo, 2010; Maynards, James & Davidson, 2010). There is wide consensus amongst scholars on the importance of conserving ecosystem functions and structure in order to maintain the services they offer (Groenewald, 2011; Hugo, 2010; MEA, 2005). This could be achieved through the ecosystem approach which is recognised in this context as the principal strategy for the integrated management of resources and for the promotion of their conservation and sustainability.

This would mean the integration of population and environment in a manner that sustainable development would be possible (Groenewald, 2011).

Unfortunately, there is often no simple one-to-one relationship between ecosystem functions and ecosystem services as it may take two or more functions to provide a service and, at the same time, the function may provide more than one ecosystem service (De Groot, Stuij, Finlayson & Davidson, 2006; Hugo, 2010). Therefore, for analytical purposes, ecosystems must be taken as systems within themselves, having strong interactions among components of the system and weak interactions across its boundaries. It is, thus, important to recognise that many elements of an ecosystem may contribute to its function, for example vegetation, soil, fauna, water and atmosphere (Harper, 2012; Hugo, 2010; MEA, 2005).

2.2.2 Growing population, consumption and environmental impact

Even in the absence of human beings, the natural environment undergoes continual change. Aggravating this natural change are the superimposed changes on the natural environment as a result of the interaction between people and their environment (Khitoliya, 2004). As a hunter-gatherer, the use of fire by humankind had modified some natural environments (Khitoliya, 2004; Hugo, 2010). In addition, with the domestication of animals and the introduction of agriculture, the effect of human actions on the environment became more and more widespread, especially as large human settlements came into being (Khitoliya, 2004). This implies that the rate at which human actions affected the environment increased with unprecedented population growth, coupled with the development of industry (as muscle power was replaced by energy derived from fossil fuels) and changes in human consumption patterns which became unsustainable. During the last few decades, human impact on the environment reached unprecedented intensity and has affected the whole world due, mainly, to increased population and higher consumption per individual.

According to Harrison and Pearce (2000), effective measures for dealing with how human populations affect the environment require good understanding of the way things interact. In this endeavour, the biologist Paul Ehrlich and the energy scientist John Holden developed a mathematical equation ($I = P \times A \times T$) to conceptualize these interactions (Chertow, 2001;

Harper, 2012). They argued that the impact (I) of any population or nation upon its environment is a product of its population (P), its level of affluence (A), and the damage done by particular technologies (T) (Botkin & Keller, 2012; Harper, 2012; Harrison & Pearce, 2000). A huge debate exists among theorists on this notion although most of them are in agreement with the, generally, accepted standpoints that emphasize a single one of these factors as being the dominant cause of our rising environmental impact. For instance, some emphasize population growth, others the polluting technology and yet others stress excessive consumption, policy and market failures, or common ownership of key environmental resources (Harrison & Pearce, 2000).

The equation conceptualizes the relationship between technological innovation and the resulting environmental impact of human actions (Botkin & Keller, 2012; Chertow, 2001). When computed, the equation demonstrates that the environmental impact of human actions increases as either P, A or T increases, and declines when either of these variables decreases (Chertow, 2001). This implies that, when there are few people on earth, and their level of affluence is low, and there is limited technology, the human impact on the environment will be localized as demonstrated earlier by the scenario of the hunter-gatherer. Furthermore, the equation is a simple way of illustrating the different dimensions of environmental impact in terms of functions of the number of people, the amount of goods (resources) they consume, and the technologies they use to produce those goods (Harper, 2012; Harrison & Pearce, 2000).

However, the problem that arises is that there are now too many people on earth and our technologies are so powerful that our effects on the environment are becoming even more global than local and even more significant (Botkin & Keller, 2012; Harrison & Pearce, 2000). The implication of such a scenario is that it could cause negative feedback – the more people, the worse the environment; and the worse the environment; the fewer the people. In fact, Botkin and Keller (2012) argue that the modern technology we have today increases our use of resources and enables us to adversely affect the environment in many ways as compared to the times of the hunters and gatherers or the people who farmed with simple wooden and stone tools.

In the application of the equation $I = P \times A \times T$, population size and growth rate are the immediate indicators for (P), the measures of per capita gross domestic product, or per capita consumption of selected goods are the obvious indicators of (A), and the indicators for (T) are, for example, the per capita kWh of electricity or some other energy measure of economic productivity (Harper, 2012; Harrison & Pearce, 2000). In the equation, (A) models inequality more broadly, and (T) models a measurable item of material culture, but also implies that nonmaterial culture (including beliefs and values) are broadly considered too (Harper, 2012). The impact (I) can then be measured in terms of hectares of eroded lands or deforestation, depleted resources, pollution and gaseous emissions. Nonetheless, the environmental impact also depends on the sensitivity of the environment, which always offers uncertainty in prediction – yet has certain thresholds that, when crossed, can lead to rapid depletion and degradation.

Resources, such as forests, have a maximum sustainable yield beyond which they will be unable to replenish themselves (Harrison & Pearce, 2000). In addition, sinks (such as soils, rivers, and the atmosphere) for the waste that humans generate, have thresholds for various pollutants, beyond which important aspects of their productivity will degrade. In some instances, the environment may successfully evolve as human pressures increase, yet at some instances it may change abruptly when human pressure exceeds certain thresholds – such as when erosion washes away fertile soils rendering them infertile, thus leading to poor crop yields (Botkin & Keller, 2012; Chertow, 2001). The environmental impact measured using the $I = P \times A \times T$ formula is, therefore, not a true reflection of what is obtaining, but takes the amount of resources used or pollution produced as a proxy for environmental damage (Harrison & Pearce, 2000). In many situations, an extra factor needs to be included into the equation to arrive at the real damage, thus demanding a full formula such as: $I = P \times C \times Tr \times Tw \times S$:

Where C = level of affluence or consumption, Tr = Technology of resource use, Tw = the Technology of waste management, and S = the degree of sensitivity, or the amount of environmental change due to a given amount of resource extraction or pollution (Harrison & Pearce, 2000; Harper, 2012).

Therefore, even if the $I = P \times A \times T$ equation assumes independence of each of the PAT factors, Harrison & Pearce (2000) recognize that these factors are not independent but that they interact among each other. They argue that, in the 1980s, slower population growth seems to have facilitated faster growth of consumption in developing countries and higher income levels improved environmental technology because wealthier nations have a greater willingness and ability to pay for environmental quality. Other factors still do affect the elements of the $I = P \times A \times T$ equation. For example, population change is influenced by fertility, mortality and migration – which, in turn, are affected by a number of other factors, such as patterns of breastfeeding, status of women education, child health, availability of contraception, land and income distribution, and migration opportunities (Botkin & Keller, 2012; Harrison & Pearce, 2000; Khitoliya, 2004; Rutherford, 2009). This complex scenario calls for a systems approach to dealing with issues surrounding population-ecosystems linkage.

At this juncture, although the conceptual framework presented in Figure 2.2 below gives an over-simplified description of the real world (in terms of marula harvesting), the left hand side of the Figure can assist in analyzing the linkages between marula as a resource and livelihood development via ecosystems and biodiversity and through ecosystems services. Figure 2.2 show that ecosystem services provide food, raw materials, regulation of the natural environment, amenity, culture, as well as maintaining natural habitats. It further shows that the economic gains from the use of marula can, in theory, be connected to the ecosystem services provided. The governance and policy environment then will influence the access people have to the services offered by marula. This will, in turn, affect livelihood outcomes across the economic, social and ecological dimensions.

Marula is derived from natural capital. However, with increased harvesting pressure the marula cannot be used sustainably for ever as it will not withstand the increasing harvesting pressure, thus driving it to depletion. The right-hand side of Figure 2.2 presents the linkage from the harvesting of marula through to livelihood outcomes. Marula harvesting produces direct gains for those involved, such as jobs or income and government revenue through taxation or payment of royalties that finance government expenditure. Both these benefits

from marula harvesting can contribute to livelihood outcomes with the governance and policy environment determining the beneficiaries.

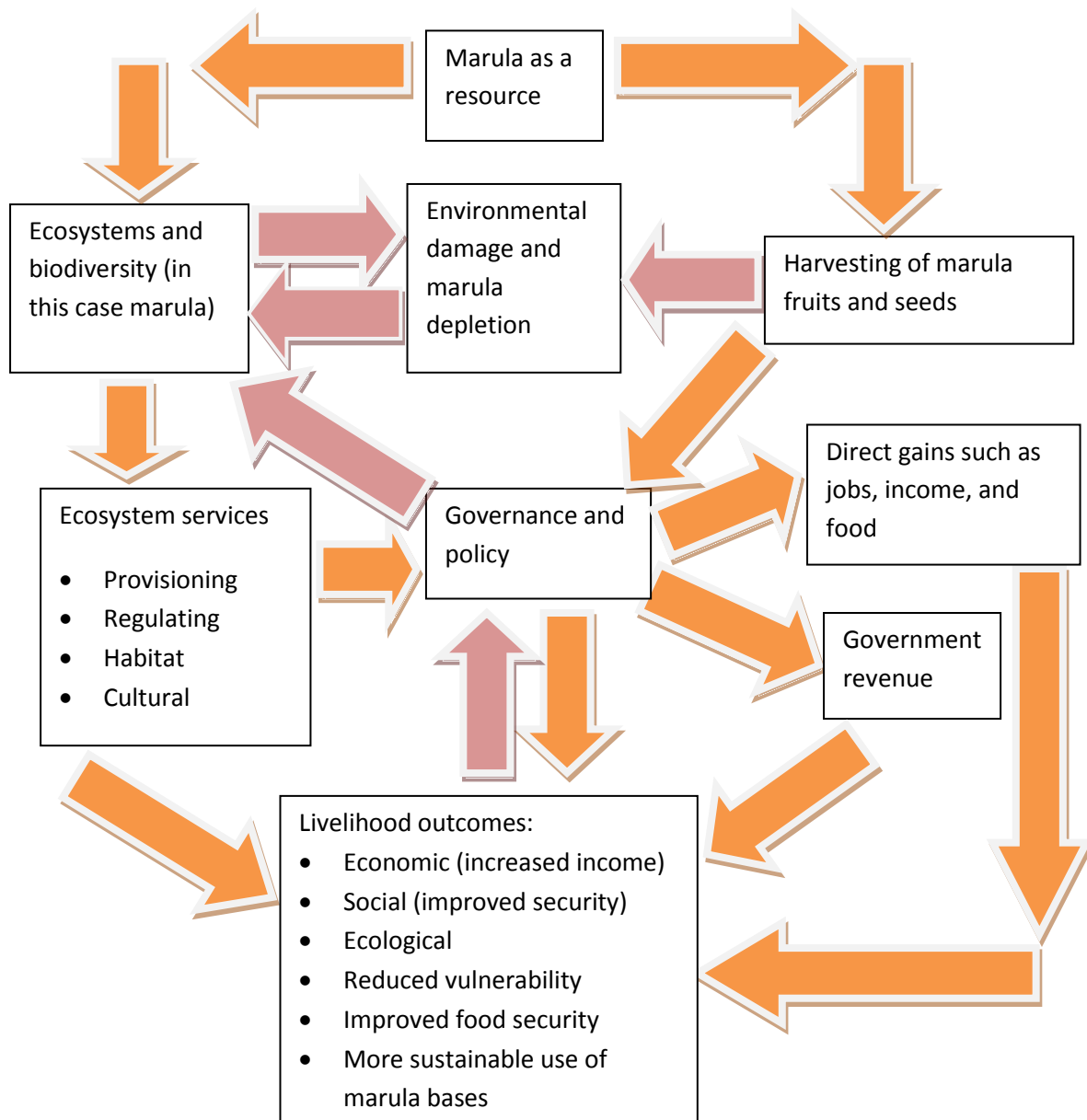


Figure 2.2: A conceptual framework for marula harvesting in Swaziland based on the people-ecosystems linkages

Source: Adapted and reconstructed from UNDP & UNEP(2012)

From Figure 2.2, it can further be seen that government policy and local governance fulfil a potentially very important function in determining how much or how little the rural communities gain from marula harvesting. In Figure 2.2, the orange arrows represent the

pathways through which marula harvesting contributes to rural livelihood strategies. The pink arrows show how marula harvesting may produce environmental damage and result in the depletion/scarcity of marula. Furthermore, Figure 2.2 shows that marula harvesting has a potential negative impact on the environment which will, in turn, affect ecosystem services available to the rural communities. Livelihood outcomes in themselves are also likely to affect ecosystem services, for example, through overharvesting and depleting the seeds that could otherwise contribute to regeneration and recruitment of new trees.

2.3 Part II: The sustainable livelihood framework

This study also adopted the sustainable livelihood framework as it has become increasingly significant in the development debate, particularly with regard to poverty reduction and environmental management. To begin with, the concept “sustainable livelihood” relates to a wide set of issues that encompass much of the broader debate about the relationships between poverty and the environment (Nawrotzki, Hunter & Dickinson, 2012; Scoones, 1998). In addition, the Conference of 1992 on Environment and Development (UNCED) put forward that the sustainable livelihood concept can simultaneously serve as an integrating factor that allows policies to address development, sustain resource management and poverty eradication (UNDP, 1997). Furthermore, both Krantz (2001) and Momentum (2012) argue that the concept of sustainable livelihoods provides prospects of a more logical and holistic approach to poverty reduction.

The Sustainable Livelihoods Approach (SLA), as developed by the UK Department for International Development (DFID), has become the most prominent framework among various concepts developed by other agencies. Basically, DFID subscribes to a systems approach that attempts to capture the many factors that influence people's livelihoods and helps to identify priorities for action based on the needs and interests of poor people by reflecting their perceptions of poverty and well-being. The SLA is, therefore, a holistic approach that tries to capture and provide a means of understanding the fundamental causes and dimensions of poverty without collapsing the focus onto only a few factors, such as economic issues and food security (Figure 2.3).

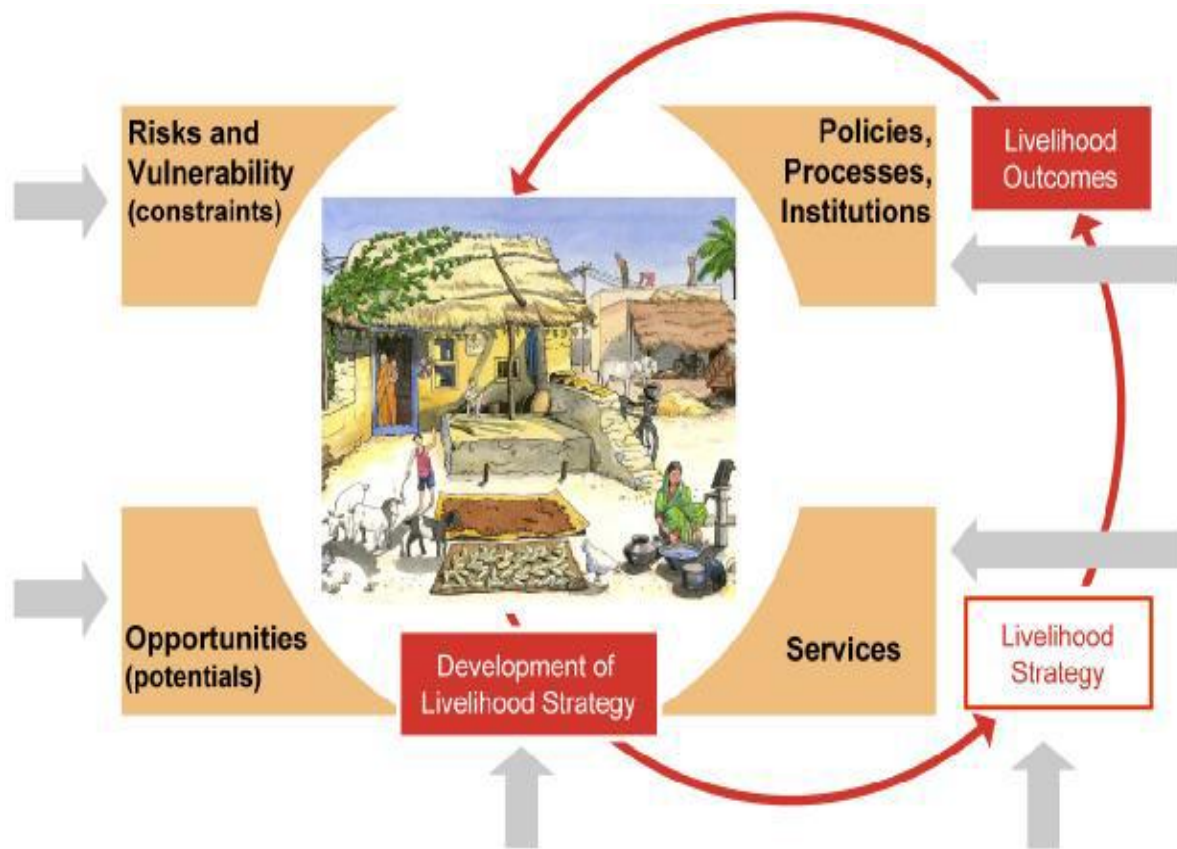


Figure 2.3: The Sustainable Livelihoods Approach

Source: Adopted from the Swiss Agency for Development and Cooperation, in NADAL, IDEC and SAMPARC (2007).

Therefore, the SLA has the added advantage of trying to sketch out the relationships and connections between the different aspects of poverty allowing for more effective prioritization of action at the operational level. In fact, the SLA helps poor people to achieve lasting livelihood improvements through its holistic investigative approach.

Like the people-ecosystem linkages approach, the SLA framework too views poor people and their activities as operating in a context of vulnerability in terms of their livelihood outcomes. Within this context, they have access to natural capital, such as fruits, nuts and roots for harvesting to reduce poverty through the prevailing social, institutional and organizational environment. The SLA also considers poor communities living in poverty as being confronted with multiple challenges in meeting their livelihoods (Hayes & Perks, 2012). These challenges are perceived to originate from failed policies, inappropriate

regulatory frameworks and administrative procedures, dysfunctional land markets, unresponsive financial systems, bad governance, corruption and a fundamental lack of will (Krantz, 2001; Majale, 2002; Perks, 2011; Hayes & Perks, 2012).

Hence, the past few decades have seen a proliferation of theoretical and practical literature in the area of sustainable livelihoods and livelihood enhancement and diversification as tools for rural development and poverty reduction. This has led to a proliferation of definitions and frameworks for sustainable livelihoods, which have been adopted by a number of different organizations and adapted to fulfill a wide range of different practical applications (Ellis, 2000; Hoon, Singh & Wanmali, 1997).

In addition, the SLA has also been applied in biodiversity conservation and development projects and research (Wilder & Walpole, 2008). Therefore, drawing from Bennett (2010), Chambers and Conway (1992) and also Krantz (2001), the definition of sustainable livelihoods in this study is as follows:

A livelihood comprises of the capabilities, assets (stores, resources, claims, and access) and activities necessary for a means of living. A livelihood is sustainable once it can cope with and recover from stresses and shocks, conserve or advance its capabilities and assets, and provides sustainable livelihood opportunities for the coming generation; and which contributes net benefits to other livelihoods at the local and global levels and in the short and long term basis (Krantz, 2001, p. 6).

From the above definition, various components of a livelihood emerge, of which the most complex is the range of assets from which people construct their living – including both material assets and resources, and non-material assets, such as claims and access (Krantz, 2001; Ladefoged *et al.*, 2009). This implies that the concept of sustainable livelihoods was developed on the basis of the available assets and the ability of people to pursue different livelihood strategies. Sustainable livelihoods, therefore, depend on the basic assets that people have in their possession (Scoones, 1998). Accordingly, Ladefoged *et al.* (2009) maintain that every individual should have the freedom to comply with whatever needs he/she may have and, through that, the freedom to improve on his/her own livelihood. Therefore, to fulfill this obligation, individuals need access to a wide range of assets

(Halsnæs & Verhagen, 2007; Halsnæs, Shukla & Garg, 2008; Jongschaap, Corre, Bindraban & Brandenburg, 2007).

One should bear in mind that the concept of sustainable livelihoods does not necessarily aim at addressing all aspects of the livelihoods of the poor. In fact, the intention of the sustainable livelihood concept is to draw a holistic perspective in the analysis of livelihood in order to identify those issues of subject areas where an intervention could be strategically important for effective poverty reduction (Krantz, 2001; Nawrotzki *et al.*, 2012). The sustainable livelihoods concept, therefore, provides an endeavour that goes beyond conventional definitions and approaches to poverty alleviation as they focus primarily on certain aspects of poverty, such as low income; or does not consider other vital aspects of poverty, such as vulnerability and social exclusion (Dorward, Poole, Morrison, Kydd & Urey, 2003; Krantz, 2001; Ladefoged *et al.*, 2009). In agreement with these authors, Hopley & Shields (2000) as well as the New Zealand Agency for International Development (NZAID) (2009) point out that the sustainable livelihoods concept helps one in understanding the main factors that impact on the livelihoods of poor people.

Accordingly, the sustainable livelihoods concept was founded on the notion that intervention must be based upon an appreciation of what underpins livelihoods. Hence, Momentum (2012) and Scoonnes (1998) point out that livelihoods approaches are conceptual frameworks that generate a deeper understanding of the complexity of poverty. The sustainable livelihoods concept emphasizes that, even if economic development may be necessary for poverty reduction, it all depends on the capabilities and willingness of poor people to take advantage of expanding their economic opportunities. This means that poverty is not just a question of low income, but also lack of knowledge, lack of social services and vulnerability, among others (Scoones, 1998). Hence, more consideration should be paid to the various factors and processes which either hinder or improve poor people's capacity to make a sustainable living (Krantz, 2001; Hayes & Perks, 2012).

The SLA for this study was adapted from the DFID sustainable livelihoods framework and presents a number of factors that impact on livelihood strategies and outcomes of the rural poor and also emphasizes the many relationships between these factors (Figures 2.3 and 2.4). According to Bennett (2010), fundamental to the framework is the presence of

interchangeable livelihood assets or capitals that can be utilized for achieving self-determined outcomes of livelihood strategies in order to reduce the vulnerability of households and communities to such things as shocks, trends, and seasonality. Access to these capital resources is mediated by transforming structures (government, private sector, civil society) and processes (laws, policies, culture, institutions, power, relations), which are also perceived to be contributing factors to the vulnerability of livelihoods (Bennett, 2010). Figure 2.4 recognizes five different assets as bases for sustainable livelihood: natural assets, economic assets, human assets, physical assets, and social assets (Krantz, 2001; Scoonnes, 1998; Ladefoged *et al.*, 2009).

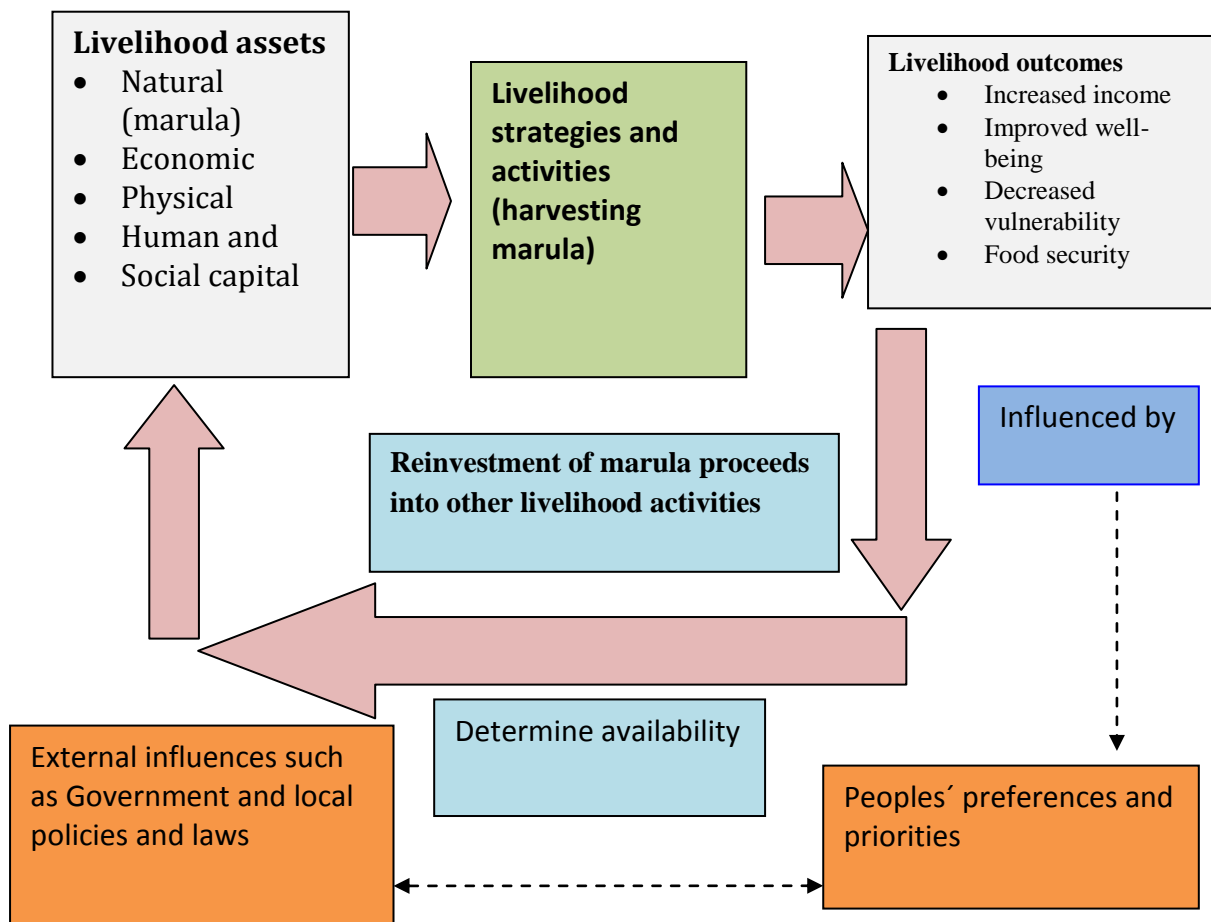


Figure 2.4: Conceptual framework for sustainable harvesting of marula in Swaziland based on the Sustainable Livelihoods Approach

Source: Adapted and reconstructed from DFID (2003).

Figure 2.4 indicates that people utilize livelihood assets to achieve their livelihood strategies and activities, which in turn help them to meet their livelihood outcomes. Furthermore, it shows that people's livelihood outcomes are influenced by their preferences and priorities and external influences, such as government and local policies and laws. On meeting their livelihood outcomes, depending on availability of the livelihood assets, people may reinvest the proceeds obtained from the livelihood assets into other livelihood activities, such as investing in small-scale enterprises to sustain their livelihoods.

2.3.1 Meaningful concepts of poverty for effective poverty reduction

Usually, approaches to decrease poverty are informed by, and are based on, conceptual perceptions of poverty. This emphasizes the importance of meaningful concepts and indicators surrounding poverty alleviation. Therefore, criteria should be defined and indicators specified according to the purpose intended. According to NADAL *et al.* (2007), simple poverty line concepts, for example, allow comparisons and the tracing of impacts. However, dealing with poverty requires one to define poverty concepts, such as livelihood assets on which poor people depend. The pursuit of the different livelihood strategies by poor people depends on a number of factors – the tangible and intangible assets and the basic material and social assets that poor people have in their possession. Such livelihood assets may be seen as the capital base from which different productive streams may be derived in order to construct livelihoods. Five different types of capital bases are recognized which are illustrated in Figure 2.5 and explained further in the subsequent subsections.

2.3.1.1 Natural Capital

Natural capital refers to the natural resources stocks (such as soil, water, air, biodiversity) and environmental services (such as the hydrological cycle, natural cleansing processes, pollination, nutrient cycling and photosynthesis) from which resources flow and services useful for livelihoods are derived (Bennett, 2010; Binning, Cork, Parry & Shelton, 2001). In developing countries, natural capital provides an important livelihood fall back option for the poor when, for example, harvest fails, or in the outbreak of natural disasters, or when the breadwinner in a household dies, where the households may be driven to extract forest products to sustain their livelihoods (Binning *et al.*, 2001; Casse, Milhoj & Randriamanarivo, 2004; Hunter, Twine & Johnson, 2011; Mahdi & Schmidt-Vogt, 2009; Paumgarten, 2005;

Shackleton & Shackleton, 2004). In times of crisis, coping strategies may include replacing previously purchased goods with wild equivalents or engaging in temporary sale of natural products and handicrafts to supplement household income (Dovie, Shackleton & Witkowski, 2002; Shackleton & Shackleton, 2004). This livelihood “safety net” is, particularly, important for poor and vulnerable households (Hunter *et al.*, 2007; Shackleton & Shackleton, 2004). Figure 2.5 shows the Interactive core dimensions of poverty and well-being.

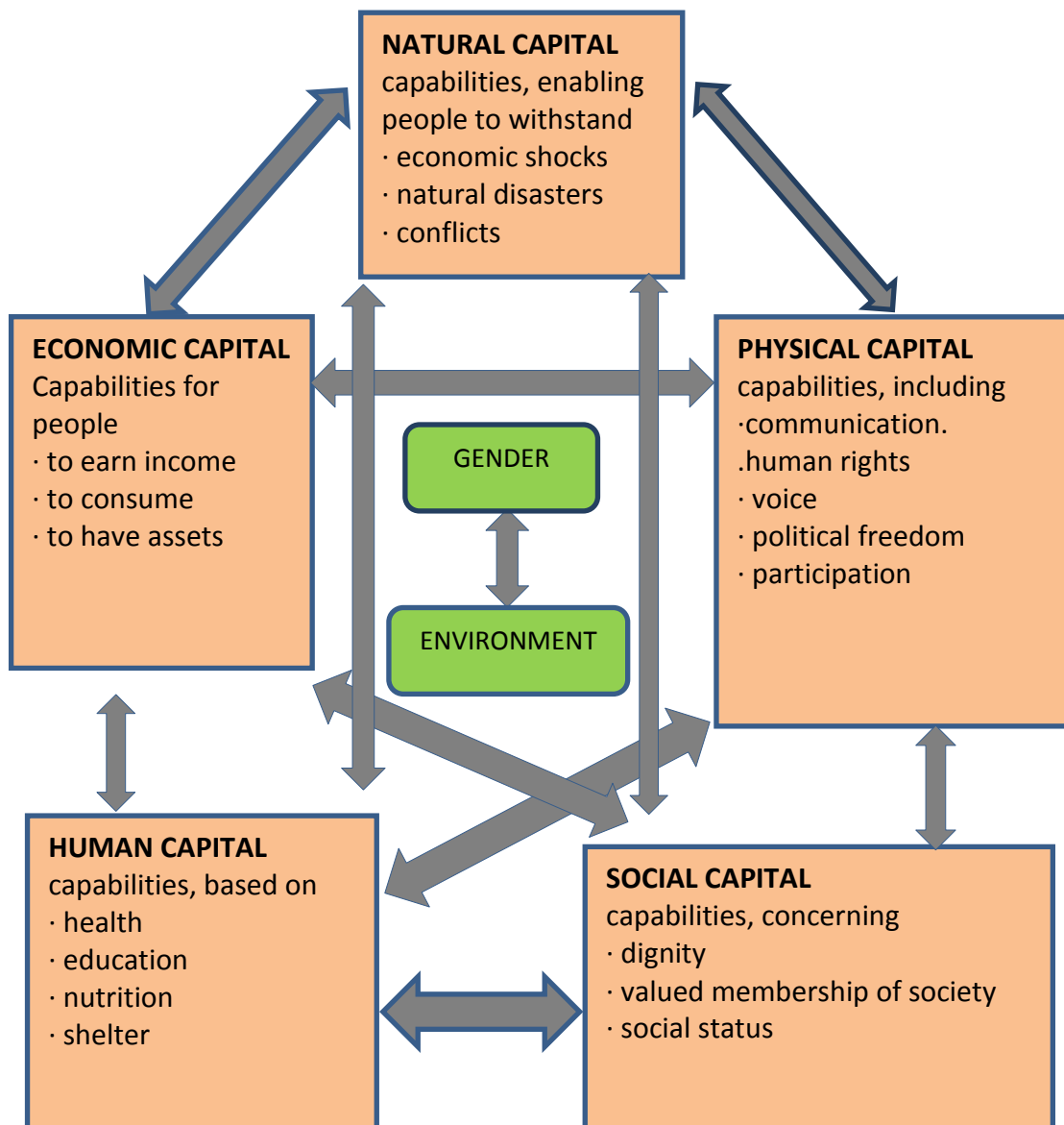


Figure 2.5: Interactive core dimensions of poverty and well-being

Source: Adapted and reconstructed from OECD (2001)

Natural capital has been chosen for this study because the activities related to land use are the main drivers of the environmental condition and ecosystems sustainability. The reason here is that the soil on which marula grows – whether on arable agricultural fields, grazing areas or protected areas – and the harvesting practices under which marula is being harvested, are important factors affecting livelihood outcomes. As the study area falls under Swazi Nation Land tenure, and as marula is harvested from agricultural fields, grazing areas and the protected areas, there was need to include a reflection of the impact of marula harvesting on the different land uses in the study. A survey of prospects of planting marula either on agricultural fields and grazing areas or protected areas had to be taken into consideration as planting of marula could be the only viable option for its availability and sustainability. The presence or absence of policies (national, regional and local) related to land rights; subsidies and prioritized plans for marula do play a role with regard to accessibility to land and marula harvesting.

2.3.1.2 Economic capital

Economic capital refers to the capital base (cash, credit/debt, savings, and other economic assets, including basic infrastructure and production equipment and technologies) which are necessary for the pursuit of any livelihood strategy (Scoones, 1998). To assess whether marula harvesting and utilization can contribute to economic growth at the household level, this study selected indicators that relate to income and costs. The selling price of the harvested fruits and seed constitutes the main income factor, whereas the main expenditures are constituted by the cost of transport and the household items (including paying for school fees, food, medicines and electricity) needed by the household. In addition, there are other income generating factors that are not directly related to cash flow. In other words, the potential substitution of other products (such as crop production or traditional brewing of *Buganu*) with commercial marula harvesting is another factor that needs to be considered as it would determine the profitability of commercial marula harvesting.

To assess whether marula harvesting would be economically viable, the price of labour in terms of “woman-hour” used in harvesting and cracking of marula stones compared to the actual cash earned after selling and also other previous/available income generating

activities, was used to reflect the cost-effectiveness of the labour in marula harvesting. To establish and sustain harvesting and utilization of marula products, investment in technology is crucial, thus making another indicator to be considered. Indicators referring to policy issues in marula harvesting are believed to play a role, as requisite policies towards price settings affect profitability of selling marula fruits and seeds. Another crucial economic indicator is the assessment of whether there are policies that are directed at influencing harvesters to plant marula trees around their homes, fields and communal grazing areas to increase harvest and, subsequently, income and indirectly conserving the marula species.

2.3.1.3 Human capital

Human capital refers to the skills, knowledge, ability to use labour and good health and physical capability that is necessary for the successful pursuit of different livelihood strategies (Bhuiyan, Siwar, Ismail & Islam, 2012; DFID, 2001). These are core elements of well-being, as well as crucial means to improving livelihoods. Disease and illiteracy are barriers to productive work and, thus, to economic and other capabilities for poverty reduction (NADAL *et al.*, 2007). Reading and writing facilitate communication with others, which is crucial in social and political participation. Education, especially for girls, is considered the single most effective means for defeating poverty and some of its major causal factors, for example illness – in particular HIV and AIDS – and excessive fertility. These factors were utilized as indicators to assess the human capital in the study area.

2.3.1.4 Physical capital

Physical capital refers to the basic infrastructure (transport, shelter, water, energy, human rights, voice, political freedom, participation and communication) and the production equipment and means which enable people to pursue their livelihoods (Bennett, 2010; Nawrotzki *et al.*, 2012). The choice to include physical capital in the study was based on the perception that physical infrastructure plays a key role in the livelihoods of communities. Rural households often combine a number of livelihood activities, such as agricultural crop production, wage labour, or forest product collection, such as harvesting marula fruits and seeds, to meet their subsistence needs. Quite often than not, the household's access to these different livelihood capitals and opportunities will shape the potential mix of activities and, in part, is influenced by certain rules and rights (Breyceson, 2001; Ellis, 1998). The SLA

has been successfully used to explore health behaviours, food security, household diversification strategies and even watershed management (Bank, 2005; Mahdi & Schmidt-Vogt, 2009; Rugalema, 2000; Yaro, 2006). It is also well suited to examining people-ecosystem interactions, given that population dynamics are often equally linked to livelihood strategies, which are themselves directly or indirectly affected by local environments (De Sherbinin *et al.*, 2008; Massey *et al.*, 2010). Access to natural capital may facilitate improvements in other livelihood assets, such as economic capital – when households collect marula fruits and seeds that are sold at markets. This study, therefore, explored how these capital assets may play different roles in livelihood strategies among rural communities in the study area.

2.3.1.5 Social capital

Social capital refers to the social resources (such as networks, social claims, social relations, affiliations, associations) upon which people draw when pursuing different livelihood strategies requiring coordinated actions (Bhuiyan *et al.*, 2012; Scoones, 1998). These capabilities concern the ability to participate as a valued member of a community. They refer to social status, dignity and other cultural conditions for belonging to a society, which are highly valued by the poor themselves (NADAL *et al.*, 2007). The social assets in the study area were analyzed on the basis of the level of respondent's participation and equity. These factors were based on the perception that capacity building is a core development objective in order to facilitate sustainable livelihoods in social assets. The selected indicators for this study were institutional capacity, participation in decision-making processes in the marula fruits and seeds harvesting and selling, and the manner in which knowledge of legal rights is strengthened among the local people.

2.4 Summary

Part I of this chapter reviewed literature regarding the people-ecosystem theory and has demonstrated that, in their interactions with ecosystems, people tend to impact on the ecosystems and at the same time, the resulting negative impact of their actions in terms of ecosystems degradation impact adversely on the survival of the human population. In Part II of the chapter, the sustainable livelihoods approach was explored and it has been

demonstrated that the SLA framework views the rural poor people and their activities as operating in a context of vulnerability in terms of their livelihood outcomes. Within this context, they also have access to natural capital, such as marula trees, for harvesting their products to reduce poverty through the prevailing social, institutional and organizational environment. However, the SLA has shown that, as people continue accessing such assets, they tend to degrade them with time.

CHAPTER 3: THE ENVIRONMENTAL AND SOCIO-ECONOMIC ASPECTS OF MARULA

3.1 Introduction

This chapter presents a review of literature related to the environmental aspects, socio-economic aspects, as well as the policy and legal framework related to the use of marula. It is divided into three parts. Part I presents literature related to the environmental aspects of marula; Part II deals with literature related to the socio-economic aspects of marula; and Part III explores the policy and legal framework regulating the harvesting and utilization of marula in Swaziland.

3.2 Part 1: Environmental aspects of marula

Environmental factors control the growth and survival of all species. However, there has been little autecological research conducted on marula in the southern African region given its household and commercial importance. This section provides an overview of a range of environmental factors that affect the growth and survival of marula.

3.2.1 Geographical distribution and environmental requirements for marula

Marula is endemic to Africa and has been valuable to people in the continent for many years (Hall, 2002; Helm & Witkowski, 2012; Gouwakinnou, Kindomihou, Assogbadjo & Sinsin, 2009). It occurs in open woodland and is widespread throughout the semi-arid and deciduous savannas of much of sub-Saharan Africa covering South Africa, Swaziland, Mozambique, Zimbabwe, Malawi, Zambia, Botswana, Namibia and Madagascar (Figure 3.1) (Enweremadu & Rutto, 2015; Hall, 2002; Hamidou, Iro, Boube, Malik & Ali, 2014; Shackleton *et al.*, 2002; Teichman, 1983; Walker, 1986).

The distribution range of marula also extends to the semi-arid and deciduous savannas of East Africa, including Kenya, Uganda and South Sudan. The species may occur as a component of riparian forest (Hall *et al.*, 2002; Palgrave, 2002; Teichman, 1983). Figure 3.1 shows the range distribution of the three *S. birrea* subspecies. It shows that these subspecies occur in different locations of the sub-Saharan African range. The subspecies

caffra is the most common covering the whole of eastern, southern and western Africa, as well as Madagascar (Hall *et al.*, 2002; Hall, 2002; Ngorima, 2006; Shackleton *et al.*, 2002). This is also the species that occurs in Swaziland. Subspecies *gillettii* has been recorded only in areas south of the Equator and, as indicated in Chapter One, it is endemic to a small area in eastern Kenya (Hall, O'Brien & Sinclair, 2000; Hall *et al.*, 2002). Subspecies *multifoliolata* has been reported to be endemic to Tanzania, and is found in mixed deciduous woodland and wooded grassland (Shackleton *et al.*, 2008; Shackleton *et al.*, 2002).

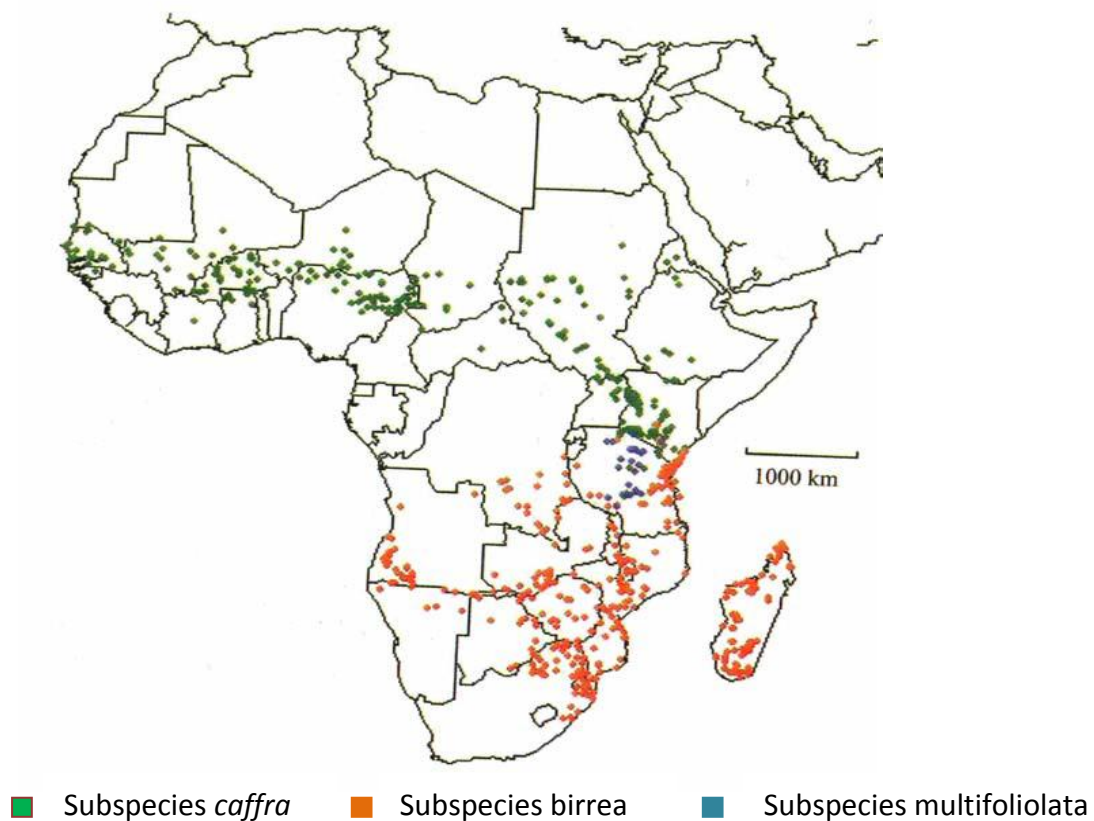


Figure 3.1: The distribution of marula in Africa and Madagascar

Source: (Hall *et al.*, 2002).

Marula is found in a diversity of vegetation types; mainly open, deciduous savannah, but it is also a component of semi-deciduous forest (Johnson & Johnson, 1998). According to Jacobs (2001) and also Jacobs and Biggs (2002), there are no specific studies conducted on the specific habitat requirements for marula except in the Kruger National Park of South Africa. Marula seems to occur on medium to low elevation of open woodlands (Gadd, 2002; Hall *et*

al., 2002; Jacobs & Biggs, 2002; McCullum, 2000). Marula trees grow from an altitude ranging from sea level to 1800m above sea level (Bandeira, Albano & Barbosa, 1999; Jacobs & Biggs, 2002; Ngorima, 2006).

Although marula trees grow in places at high altitudes where short and sporadic frosts occur, it is common in warm, frost-free places, such as those in the lowveld of Swaziland (Neumann & Hirsch, 2000; Ngorima, 2006). Marula is sensitive to frost (a key factor that limits its distribution) and is moderately resistant to drought. Marula trees occur in areas where temperatures vary between 10⁰C (in high altitudes) and 40⁰C (in low altitudes) (Coetzee, Englebrect, Joubert & Retief, 1979; Hall *et al.*, 2000). Such a wide temperature range is good for marula seed germination, which happens usually at temperatures between 27⁰C and 37⁰C (Bandeira *et al.*, 1999; Hamidou *et al.*, 2014; Lawes *et al.*, 2004; Lewis, 1987).

Marula grows in a wide range of annual rainfall amounts, ranging from as little as 200mm to as much as 1500mm (Hall, 2002; Hamidou *et al.*, 2014; Peters, 1999). Accordingly, Shone (1979) clearly stated that marula occurs in areas with humid to sub-humid environmental conditions and that marula trees are best suited to drier areas receiving an annual rainfall between 250mm to 800mm (Figure 3.2). However, to the extreme, (Hall *et al.* (2002); McCullum(2000); Wynberg, Laird, Shackleton, Mander, Shackleton & Du Plessis, (2002b) singled out that the subspecies *gillettii* is associated with widely varying seasonal rainfall patterns with mean annual rainfall ranging from 200–1500 mm. Nevertheless, higher marula populations are associated with a rainfall range of 400 to 1000 mm (Hall *et al.*, 2002; Hamidou *et al.*, 2014). This makes this particular subspecies to be common in hotter areas as it is relatively drought-tolerant in areas where the annual rainfall is as low as 200mm.

The soils where the marula species grows are derived from geological formations ranging from basalts, basement complex rocks and sedimentary rocks of various ages to Quaternary deposit (Hall *et al.*, 2002; Helm, Wilson, Midgley, Kruger & Witkowski, 2011a; Helm, Scott & Witkowski, 2011b; Masarirambi & Nxumalo, 2012; Ngorima, 2006). The soil types range from deep sand on granite to sandy loam and basaltic clays (Jacobs & Biggs, 2002). Marula hardly grows on rocky surfaces (Timberlake, Nobanda & Mapaure, 1993; Teichman, 1983). It grows best in well-drained soils, especially sandy textural class soils and occasionally on

sandy loam and loam soils (Duke, 1989; Hall *et al.*, 2000; Hall *et al.*, 2002; Helm *et al.*, 2011a; Masarirambi & Nxumalo, 2012).

The soil pH as a measure of the level of alkalinity and acidity is crucial and governs the growth and survival of marula as it determines the availability of nutrient elements in the soil. Hence, various studies showed marula populations to be highly clumped – an indication of nutrient availability in those areas (Gadd, 2002; Jacobs & Biggs, 2002; Lewis, 1987; Walker, 1986). Observations by Jacobs and Biggs (2002) in the Kruger National Park indicated that marula trees occur widely but clumped on sandy granitic soils, mostly on the crests, mid-slopes and on dolerite intrusions where the soils are shallow.

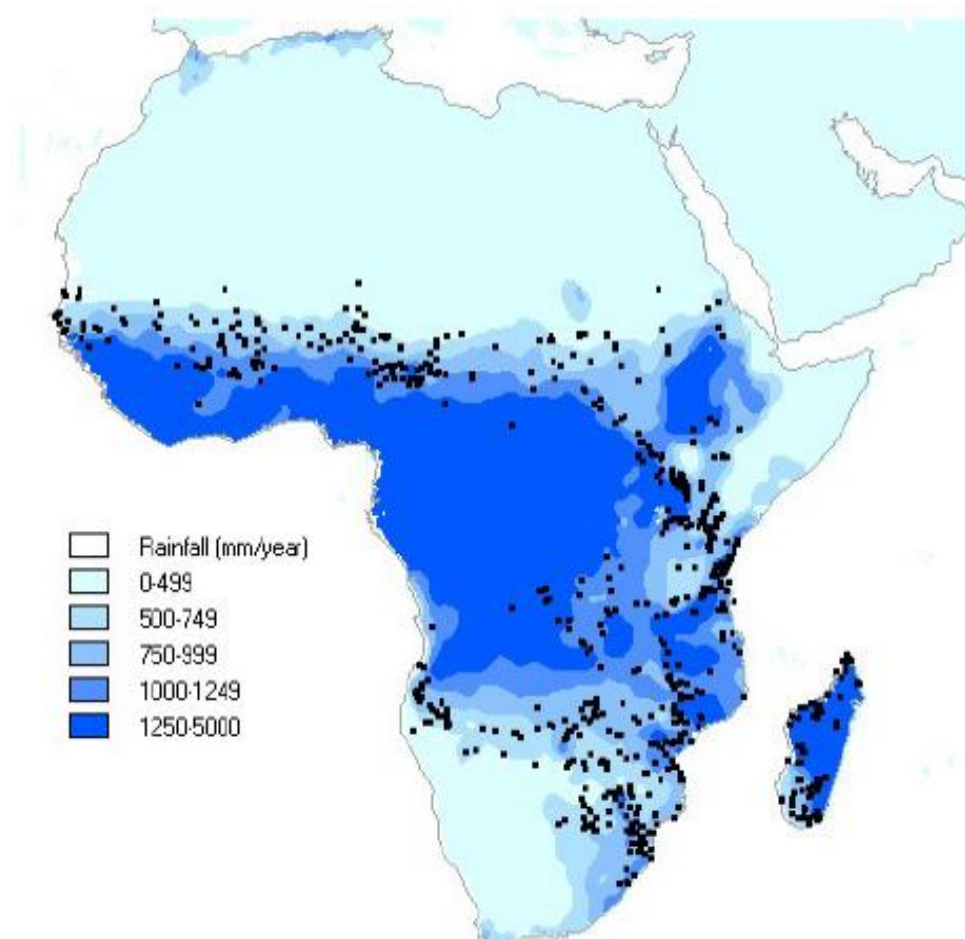


Figure 3.2: The distribution of *Sclerocarya birrea* in relation to the amount of rainfall

Source: Hall *et al.* (2002)

Marula tree populations in the Kruger National Park, though, are claimed to be decreasing as soils with high clay (basaltic) contents become more dominant and, thus, are largely restricted to moister microclimates in such areas (Jacobs & Biggs, 2002). This indicates that, apart from the chemical properties of soils (such as nutrient content and pH), the physical properties (such as soil depth and permeability) also do play a role in marula distribution.

3.2.2 Ecosystem function of marula in relation to other species

Marula plays a fundamental role in ecosystems and provides a number of important services to human beings. Marula being a keystone tree species also plays an important role in the ecology of other plants and animals (Helm & Witkowski, 2012). It grows into a large tree and is quite often regarded a community-dominant species (Kgomoamagodi, 2008; Ngorima, 2006). It provides valuable shade and is a favourite food of a large variety of birds, mammals and insects (Hal, 2014; Helm & Witkowski, 2012; Jacobs & Biggs, 2002; Morris, Humphreys & Reynolds, 2006; Palgrave, 2002). For its large size, marula produces a large area with a cool sub-canopy environment – thus providing a good habitat for other species of fauna and flora.

According to Belsky, Amundson, Duxbury, Riha, Ali and Mwonga (1989), in arid and semi-arid areas, sub-canopy environments are key resource areas, being characterised by higher moisture and nutrient levels than open environments. These environmental conditions are good to different sub-canopy plants, grasses and forbs. Removal of this large dominant species can, thus, result in the loss of other important sub-canopy species, such as mistletoes which grow on marula branches and form deformities called wood roses that are often used by rural curio traders (Dzerefros, 1996).

The marula leaves are browsed by domestic animals and game, such as impala, zebras and kudu. Marula is also the host plant of various butterfly and moth species. The larvae of some of these species are a popular food in southern Africa (Hal, 2013; Helm & Witkowski, 2013; Kroon, 1999; Morris *et al.*, 2006; Pegg, 2014). The larvae of the mopane worm (*Imbrasia belina*) occur on marula trees which could mean that intercropping marula trees in mopane stands can alleviate the defoliation pressure of mopane moth and would also benefit the community as they could harvest the fruits of marula for food, *buganu* production and

selling of its other products (Lawes *et al.*, 2004; Palgrave, 2002). In addition, Xaba and Moll (2011) claim that some moths, including the African moon moth (*Argema mimosae*, family *Saturniidae*), breed on the marula tree – thus the tough silk pupa cases of the moon moth are used traditionally by the Swazi and Zulu people for anklet rattles by tribal dancers.

The bark of the marula tree is grey in colour and usually peels off in flat, round disks, exposing the underlying light yellow tissues. The bark is utilized by elephants and rhinoceros and the fruits, which are rich in vitamin C, are eaten by animals, such as elephants, warthogs, porcupine, monkeys, baboons, millipedes, domestic cattle and goats (Helm & Witkowski, 2013; Kgomoamagodi, 2008; Pegg, 2014; Palmer & Pitman, 1972; Pooley, 1993). The water-filled holes in the trunks of marula trees are important breeding grounds for mosquitoes (Pooley, 1993).

These interrelationships are also reported to control the population characteristics of marula (Gadd, 2002; Hamidou *et al.*, 2014; Kgomoamagodi, 2008; Pegg, 2014). Studies by Walker (1986) and Gadd (2002) showed that over-browsing destabilises the population structure of marula. It results in the absence of immature trees and little or no evidence of successful regeneration and recruitment. This highlights the impact of browsing by animals in the control of marula seedlings (Haig, 1999; Lawes *et al.*, 2004). Marula seedlings are also susceptible to fire which also impact on its regeneration potential (Helm *et al.*, 2011a; Jacobs & Biggs, 2002).

3.2.3 Marula tree population densities

Only coincidental data exist on the densities of marula trees based on studies on other woody species for vegetation mapping or characterization purposes. However, Shackleton (2002) undertook a detailed inventory of woody biomass based on random replicated transects in three protected areas along a rainfall gradient in the central lowveld of South Africa. This study reports the highest absolute and relative abundance of mature marula trees at intermediate rainfall range of 500 – 850mm as being 7.5 trees per hectare. Another study by Lombard *et al.* (2000) in the Gottenburg communal lands in the Bushbuckridge region showed an average density of eight mature trees per hectare. In the Luangwa valley in Zambia, Lewis (1987) observed a mean density of 14.8 trees per hectare for trees above

7.6m. In the Lebombo Mountains of Mozambique, Bandeira *et al.* (1999) reported a density of 37.5 stems per hectare for individual trees taller than 1.5m. In addition, Helm *et al.*, (2011a) cites mean marula population densities per plot in the range of 4 to 15 trees.

3.2.4 Growth rate and fruit yield from the marula tree

Marula grows in height at a rate of 70cm per year and begins to flower after four years (Johnson & Johnson, 1998). In the wild environmental conditions, it is reported that a 15cm diameter marula tree can increase in girth by an annual rate of 3.5mm while a 30cm diameter marula tree grows at an annual rate of 2.5mm (Helm *et al.*, 2011b; Shackleton & Shackleton, 2005). However, when planted in the right environmental conditions, marula can increase in height by about 1m per annum with a growth range of 0.3 to 2.0m – implying that, under cultivated land, the growth rate of marula can be accelerated such that four-year-old marula trees with height range of 3 and 6m, and circumferences of 40 – 58cm can yield fruits amounting to 27kg (Mn'gomba, Sileshi, Jamnadass, Akinnifesi & Mhango, 2012; Shone, 1979). The growth rate of marula trees is positively linked with rainfall amount and plant size (Helm *et al.*, 2011a). Furthermore, (Helm *et al.*, 2011a) observed a high growth rate directly after germination and decreased as the trees mature. Studies by Nerd & Mizrahi (1993) and van Wyk & Gerickle (2000) reported 12-year-old marula trees yielding an amount of 500kg of fruits per annum. In addition, Helm *et al.* (2011a) reports a high temporal variability in fruit production which is marginally linked to rainfall and also that marula seeds hardly persist for more than one year – therefore, marula relies mostly on the current season's fruit crop for input of new germinant.

Although other researchers have observed marula trees propagated from seeds to have a long vegetative juvenile phase, there are mixed reports regarding the time these trees take to start fruiting. Some marula trees have been reported to start fruiting at the age of eight to ten, and some female trees have been seen to take a while and start fruiting at the age of 19 years (Akinnifesi *et al.*, 2006; Emmanuel, Shackleton & Baxter, 2005; Helm *et al.*, 2011b; Moganedi, Colpaert, Breyne, Sibara & Goyvaerts, 2007; Nyoka, Chanyenga, Mngómba, Akinnifesi & Sagona, 2015). The differences in time to first fruiting could depend on both genetic and environmental factors as marula trees exhibit wide genetic variations (Kadu, Imbuga, Jamnadas & Dawson, 2006). Furthermore, Moganedi *et al.* (2007) reported grafted

marula trees in South Africa that started fruiting after four years of planting although they observed some phenotypic variations in the flowering time and other traits.

Morphological and molecular studies have also confirmed growth variations among marula provenances but the effects of variations in scion and rootstock growth on the overall tree growth and fruit yield have remained uncertain (Chirwa, Bwanali, Meke, Sagona, Munthali & Mwabumba, 2007; Helm & Witkowski, 2012; Kadu *et al.*, 2006; Rukuni, Maruzane, Zirobwa & Shumba, 2001). Although grafting is desirable to achieve fruiting precocity and dwarfing, graft failure has been reported in marula (Mogamedi *et al.*, 2007). The main cause of graft failure has also remained vague and complex as it is often linked to a number of factors, including genetic constitution, graft incompatibility and the environment (Usenik, 2000). Marula trees can also be planted successively from truncheons of about 100 to 150mm in diameter and about 200cm long (Orwa, Mutua, Jamnadass & Simons, 2009).

3.2.5 Pests and diseases

One of the most serious challenges in marula propagation is its susceptibility to a variety of pests and diseases, including insect pests and pathogenic fungi. *Ascomycetes psyllid* mites are the major pest problem affecting both wild trees and nursery stock. According to Orwa *et al.* (2009), severe infections have been observed on wild trees but the harvests do not seem to be significantly affected. They also observed that aphids, white flies and thrips can also become widespread in the nursery, although they claim spraying with dichlorophos or malathion can control these pests.

Other potential nursery problems seem to arise from the susceptibility of marula to continuous root disturbance and mortality due to excessive root pruning at shallow depth. The marula trees are susceptible to sap-stain fungi and other more harmful fungal attacks. Termites often attack the wood (Orwa *et al.*, 2009). Powdery mildew can be prevalent under humid conditions and can quickly spread to all seedlings in a nursery unless sprayed with copper oxychloride. Marula fruits are also susceptible to Natal and Mediterranean fruit flies (Graaf, 2007; Magagula & Ntonifor, 2014).

3.2.6 Marula fruit production

The amounts of fruits that can be produced by a single tree in one season vary from as little as 2000 to as many as 70000, with varying ratio of number of fruits to mass of fruits (Arnold & Ruiz, 1998; Nyoka *et al.*, 2015; Palmer & Pitman, 1972; Roodt, 1988; Shone, 1979). Comparatively, Shackleton (2002) reported on fruit yield from 64 marked trees of various sizes and found the mean mass of fruit produced in the first season as 36.8kg or ± 7.8 kg per tree. On the contrary, in the second season, hereported a wide difference in fruit production as there were only a few fruits produced per tree – posing a dire challenge to sustainable commercialization initiatives (Boffa, Yameogo, Nikiema & Knudson, 1996). Data by Todd (2001) for 122 trees surveyed in the 1999 to 2000 season produced a mean yield of 17.4 kg of fruits per tree.

Marula trees are dioecious in nature, meaning that the trees produce male and female plants as separate entities (Dlamini, 2011; Kgomoamagodi, 2008; Morris *et al.*, 2006; Nghitoolwa, Hall & Sinclair, 2003; Peters, 1988). This dioecious nature provides an impetus for people to deliberately eliminate the male trees which do not produce fruits (Nghitoolwa *et al.*, 2003; Ngorima, 2006). Investigation of adult trees (40 - 80cm in girth) in Namibia showed that the number of female trees was more than the number of male trees (Nghitoolwa *et al.*, 2003). This casts a potentially negative impact on the natural flow of pollen, which will obviously lead to a decline in fruit production. Clearly, the management challenges posed by marula populations of wooded farmland are those associated with sparse distribution and pollen flow to the female trees (Nghitoolwa *et al.*, 2003).

The implication is that, for commercial marula production, approaches to balance between male and female marula trees are essential and ought to be studied as the exact male-female ratio for proper pollen flow is not known. In addition, marula trees occur in patches which necessitate the evaluation of the maximum distance required between individual trees and clumps for effective pollen flow (Lewis, 1987). Culling/replacement of male trees should be planned with regard to avoiding intervals so large that pollen flow is seriously attenuated (Nghitoolwa *et al.*, 2003). Within patches, Nghitoolwa *et al.* (2003) stated that pollen flow is determined by the number of trees per clump, relative numbers of and positions of male from female trees, and frequency and synchrony of flowering. Bees, as the

main pollinators of marula trees, can pollinate effectively within a distance of 1500m under forest conditions (Roubik, 1999; Roubik, 2002).

3.2.7 Ecological impact of marula harvesting and consumption

3.2.7.1 *Impact of fruit harvesting on the marula trees*

The harvesting of marula products has always been an integral part of rural livelihoods in Swaziland, offering goods for both household consumption and income generation (Dlamini, 2011). In Swaziland, marula is traditionally harvested almost exclusively by women who pick up the fruits from the ground when ripe (Dlamini, 2011; Lombard, Allanic & Shilote, 2000; Swazland Indigenous Products, 2012). Lombard *et al.* (2000) and also Neumann and Hirsch (2000) purport that the harvesting of marula fruits from the ground does not pose any direct environmental risk. However, increased picking up of the fruits and seeds by harvesters can impose an adverse impact on the marula species as the ecological role it plays as food for animals, germination and distribution of seeds, sustenance of the species and its natural cycle are affected (Helm *et al.*, 2011b; Lombard *et al.*, 2000; Ngorima, 2006). This argument has also been confirmed by Shackleton, Griffin, Banks, Mavrandonis and Shackleton (1994), Shackleton, Sullivan, Cunningham, Leakey and Laird (2001) and also Shackleton *et al.* (2002) who stress that the collection of marula fruits for human use could potentially impact on the regeneration rates of the species.

Several studies have observed that marula seeds germinate easily when on the ground and new marula trees can be grown by vegetative propagation through the use of truncheons in order to replace stocks if fruit harvesting reduces recruitment in the long term (Hamidou *et al.*, 2014; Johnson & Johnson, 1998; Maruzane, Tapfumaneyi & Matarirano, 2002). However, care must be ensured to maintain genetic diversity by using materials of very different origins (Dlamini, 2011; Hamidou *et al.*, 2014; Leakey & Newton, 1994; Mbuya, Msanga, Ruffo, Birnie & Tengnas, 1994; Photfuetsile, Jaenicle & Muok, 2002). This care would mean putting in place an early-warning system that can detect shifts/changes in population characteristics in order to put appropriate intervention measures in place before fruit supplies diminish with consequential negative implications on rural livelihoods and income generation (Photfuetsile *et al.*, 2002). This way, Shackleton (2002) proposes that, in

areas where there is increased marula harvesting, it is necessary to implement a simple and replicable monitoring system of plant densities, recruitment and size profile, and also put in place a rational harvesting strategy to ensure that an acceptable proportion of fruits remain unharvested each year as a means of promoting regeneration and recruitment of the marula species. Studies on other important fruit species have indicated a decline in recruitment and altered size structure profile over long-term due to increased harvesting (Boot & Gullison, 1995; Hamidou *et al.*, 2014; Helm *et al.*, 2011a; Helm *et al.*, 2011b; Jacobs & Biggs, 2002; Neumann & Hirsch, 2000; Pegg, 2014).

Nevertheless, the diverse uses of marula products complicate the identification and estimation of potential environmental and socio-economic impacts of marula harvesting because of synergistic effects (Shackleton & Shackleton, 2005; Shackleton, Botha & Emmanuel, 2003; Shackleton *et al.*, 2002). This is because people have been harvesting marula fruits for many years, yet no studies have been carried out on the impacts that result from increased human population, growing consumption levels, technological advancement or the increased trade of marula products.

Generally, it has been established that the rate at which man's actions affect the environment and/or resources increases with an increase in population growth, development of industry (technology) and changes in man's consumption patterns (Botkin & Keller, 2012; Chertow, 2001; Harper, 2012). To identify the potential areas of impact resulting from the continued harvesting of marula and its products, Shackleton *et al.* (2002) propose a systematic and ongoing assessment in areas where there are high rates of marula harvesting.

The impact of technological advancement and increased harvesting of marula products on the tree species is demonstrated in the study by Bishop and Scoones (2007) on basket production in two Ngamiland sites (Ogxe and Wabe) in Botswana. The study demonstrated how the degree of resource depletion depends on the harvesting technique. In Wabe, for example, harvesters were non-selective in their cutting and used destructive tools (hoes and axes) which increased the harvesting pressure and threatened the supply of palms resources, thus leading to geographical shift in palm production due to resource depletion (Neumann & Hirsch, 2000).

To exemplify the geographical shift in resource production is the extraction of palm hearts in the 1970s in Brazil, which shifted production to the Amazon River estuary where açai grows in dense natural stands. This shift was followed by a pattern of 'cut and run' that continued in the new extraction zone, whereby processing factories move from site to site as the surrounding resources were depleted. As the shortages in resource supply were occurring, the average size of marketed palm hearts declined, at the same time, over a period of 20 years as an evidence of continuing ecological degradation (Neumann & Hirsch, 2000). Considering these case studies, the potential depletion of marula can, thus, force people to search for marula products from neighbouring regions where it is still abundant. Alternatively, they may have to close down their enterprises, resulting in a shifting of factories to other geographical locations or a change in business options altogether.

3.2.7.2 Impact of marula commercialization on its sustainability

The commercialization of wild fruit trees plays a substantial role in food security, nutrition and poverty alleviation, especially among rural communities. Therefore, Jama, Mohamed, Mulatya and Njui (2008) state that the commercialized exploitation of indigenous fruits has the added advantage of providing food, vitamins, minerals and income to rural communities. The commercialization of marula in southern Africa started when the liqueur Amarula was produced in South Africa (McCullum, 2000; Strong, 2010). Large-scale sustainable commercialization of marula products would, however, mean planting marula trees in plantations for mass production. This could bring with it a number of threats to subsistence users, the resource base and to the institutions regulating the marula resource use (Khan, 2002; Lombard *et al.*, 2000). It would mean that most of the forests have to be converted into a monoculture of marula plantation, which would lead to a host of other environmental challenges, such as pest control, loss of biodiversity, and reduced production of other food sources.

These threats would also influence farmers' choices of commercializing such fruit trees as exemplified by the following cases: In Uganda, for example, Okullo (2005) reported the challenge of fear among farmers in regard to commercialization of wild fruit trees in that the fruits would attract birds that can damage other crops. In the same vein, Leakey and Simons (1998) reported the challenges of inconsistency in the product quality and limited access to

market places. Furthermore, farmers do not prefer to plant indigenous trees in their fields, but would rather protect those that grow naturally for their own individual use (Muok, Owuor, Dawson & Were, 2000; Shackleton *et al.*, 2001).

3.2.7.3 The implications of expanding markets for sustainable marula harvesting

The expansion of market for NTFPs has been seen to have adverse economic and ecological impact on the availability and sustainability of the resource due to overexploitation (FAO, 2011; Karki, 1995; Mabaya, Jackson, Ruethling, Carter & Castle, 2014). In the case of marula, the marketing of its products takes many forms, ranging from household level trade in marula brew to international markets for Amarula liqueur and the use of its kernel oil in personal care products and food. However, even if the marketing of marula products brings a suite of opportunities for rural development and social uplifting, the expanded marketing comes with a number of challenges and threats for subsistence users, the resource base, and traditional cultures and customs (Shackleton *et al.*, 2003; Shackleton *et al.*, 2002).

One of the most common ecological concerns related to market expansion for NTFPs is the creation of new or expansion of existing market demands that might lead to overharvesting and resource depletion (FAO, 2011; Mabaya *et al.*, 2014; Neumann & Hirsch, 2000; Osman-Elasha *et al.*, 2009). On the contrary, Jankari (2004) purports that the absence of a well-organized market for NTFPs can lead to the underutilization of the product and, hence, has little ecological impact. The impact of market expansion for marula would include the potential reduced reciprocity within the community in the form of decreased social interactions and good neighbourliness associated with the free exchange of marula products, and a decline in respect for traditional systems (Wynberg *et al.*, 2002b).

Market expansion also has the propensity of increasing privatization of marula and, thus, leading to the exclusion of certain groups of people from deriving benefits from marula (Mabaya *et al.*, 2014). This implies that expanded marketing will draw the marula resources into trade and away from the important subsistence users. In the north-central regions of Namibia, for example, Wynberg *et al.* (2002a) reported that some households do not have direct access to marula fruits and related products due to competition as the markets for marula expanded, thereby leading the deprived households to rely on the goodwill of their

friends and neighbours who give them a share of the resource. In contrast, they reported that, in South Africa, marula is more freely available. This seems to suppose that, as the markets for marula trade expand, one needs to watch carefully for the potential negative impacts of market expansion on the subsistence users, social structures, and cultural traditions to avoid people from being deprived of accessing them. This can be exemplified by the case in Botswana where the expansion of the distribution of marula products to airlines, supermarkets, safari and lodges by Wild Fruits of Africa has affected the niche market entrepreneurs (Mabaya *et al.*, 2014).

The expansion in marula market will inevitably shift the harvesting from small-scale to large-scale as demonstrated above. Shackleton and Shackleton (2005) and also Shackleton *et al.* (2001) point out that, if not carefully planned and managed, this can produce undesirable results, especially at the community level and for the more marginalised households. Small-scale enterprises will typically maintain activities in the household, involve local labour, be based on simple technologies, have low capital requirements and be accessible to the most socially disadvantaged groups (FAO, 2003; Shackleton *et al.*, 2002; Mabaya *et al.*, 2014). However, the growing of industry could involve a different and more entrepreneurial group of people and marginalise the long-established producers, introduce new technologies with potentially negative impacts on women and the poor, and remove benefits and control from the community level.

Due to the seasonal nature of marula, scaling up the market is unlikely to increase monetary benefits at the household level, but will increase the spread of benefits amongst the community, with the involvement of more households. In addition, increased market could also result in the possible monopolisation of the resource and trade by particular households or elites within the community, particularly if technological innovation makes processing faster, more efficient and more profitable. Expanding markets could also increase the drive to domestication of marula, which, if not done carefully, could then induce shifts in benefits from the deserving poor to the richer farmers or to large companies (Mokgolodi, Ding, Setshogo, Ma & Liu, 2011).

Another scenario to exemplify the impact of expanding market is highlighted in a study by Hanson (1992), which details the rise and decline in the importance of gum Arabic trade in

the Senegal River area from the late 18th Century to the 20th Century resulting from interrelated factors, such as unsustainable harvesting, repressive labour conditions and shifts in the world market. In fact, the increased market demand for gum Arabic led to, among other things, increase in labour demand – met by slavery – and, most importantly, destruction of the resource by overharvesting (FAO, 2011; Hanson, 1992; Unanaonwi, 2009). Another study by Neumann and Hirsch (2000) in the Amazon estuary in Brazil, observed that harvesting palm tree hearts to meet an increased demand for export in the 1950s led to the collapse of the palm heart industry in southern and eastern Brazil by the end of the 1960s due to increased pressure of harvesting.

3.3 Part II: Socio-economic aspects of marula

3.3.1 Introduction

There is a considerable body of literature from a range of disciplines (including sociology, social sciences, psychology, economics and philosophy) that focus on understanding the ways in which people value the environment (Bille, Shikongo-Nambabi & Cheikyoussef, 2013; Harper, 2012; Massey *et al.*, 2010; O'Brien, 2005; Silvis & van der Heide, 2013; UNEP and IISD, 2004). One of these ways is through the harvesting and use of environmental resources, such as products from trees which offer countless socio-economic services. In fact, wild trees, including marula, offer a number of economic and social services to rural communities in southern Africa and Swaziland, in particular (Bille *et al.*, 2013; Shackleton, Campbell, Lotz & Shackleton, 2007). These services include, but not limited to, the provision of fuel wood, food, cultural functions, and income to derive livelihoods and improve the well-being of the local population (Awodoyin, Olubode, Ogbu, Balogun, Nwawuisi & Orji, 2015; Shackleton *et al.*, 2007).

Ecosystems provide more than just goods for human beings; they also provide important life-supporting services and cultural and spiritual values (Nwongwu, 2006; UNEP and IISD, 2004). People endow trees and woodlands with all kinds of meanings attached, often beyond their apparent usefulness (O'Brien, 2005). Despite these important values offered by forest resources, O'Brien (2005) claims that the social element of sustainability has not been given the same prominence in forestry as the economic and environmental elements,

although it is becoming more important as managers realize that the majority of natural resources management issues are fundamentally social and political in nature.

The rural population of Swaziland is mainly preoccupied with subsistence farming, but because of the relatively low rainfall, especially in the Lubombo Region, and sometimes poor harvest, a majority of the households cannot survive on subsistence farming alone (Dlamini, 2012). In addition, although formal and informal employment do contribute to some degree to rural livelihoods in Swaziland, unemployment rates are high, thus not all households manage to get an income through employment (Mafusire & Leigh, 2014; Ministry of Economic Planning and Development, 2005; World Bank Group, 2011). In particular, those households that do not have the option of improving their lives through employment are, to a large extent, dependent on the available natural resources. Marula is, therefore, regarded as an important natural resource in the country that contributes to household income and livelihoods. Its uniqueness lies in the fact that there are so many uses of the tree and its fruits (Bille *et al.*, 2013; Den Adel, 2002; Mokgolodi *et al.*, 2011). From the shade of the tree to the burning of the empty nuts as a source of fuel, people are using all of its products. The importance of marula, indeed, stretches from the social, to the cultural, economic, research and nutritional aspects of people's lives (Bille *et al.*, 2013; Hal *et al.*, 2014; Mabaya *et al.*, 2014; Mariod & Ibrahim, 2012; Nyoka *et al.*, 2015).

3.3.2 Uses of marula and its contribution to human health

Marula fruits (Image 2) have a number of uses. They are either eaten fresh or fermented to produce Amarula beer (Botelle, 2001; Hal *et al.*, 2014; Hal, 2013; Hamidou *et al.*, 2014; Maroyi, 2013; Masarirambi, Mhazo, Dlamini & Motukumira, 2009; Shackleton *et al.*, 2002). The fleshy juicy mesocarp is pleasantly acidic, sour-tasting, tart, thirst-quenching, refreshing, and energy-boosting (Bille *et al.*, 2013; Hall, 2002; Hall *et al.*, 2002; Mn'gomba *et al.*, 2012; Morris *et al.*, 2006).

It is also very rich in vitamin C, even when fermented (Hal *et al.*, 2014; Hal *et al.*, 2012; Hal, 2013; Mn'gomba *et al.*, 2012; Shone, 1979). In fact, the marula fruit contains four times as much vitamin C as an orange (Bille *et al.*, 2013; Dlamini & Dube, 2008; Hal, 2013). According to Taylor, Mateke and Butterworth (1996), the high vitamin C content of the fruit provides

people, especially children, with important nutritional requirements. Nutritionally, marula juice is said to increase nutrient absorption in the gut, thins the blood and acts as an aphrodisiac as it is essential for sperm production (Den Adel, 2002; Hall *et al.*, 2002; Hall, 2002; Marula Natural Products, 2012; Shackleton *et al.*, 2002). Marula fruits also have powerful alcoholic properties, partly, due to the 29 different yeasts present in the skin (Dlamini & Dube, 2008; Swazi Indigenous Products, 2012; Swazi Secrets, 2009; SyBille, Suarez & Beckett, 2012).



Image 2: A picture of a marula fruit

Source: Picture taken by the A.F. Murye on 30 December 2013

Marula fruits are also good for making the collagen protein, which is involved in the building and maintenance of the health of cartilage, joints, skin and blood vessels and it acts also as an anti-aging agent (Hall, 2002; Gruenwald, 2006). Marula fruits also neutralize pollutants and are necessary for antibody production in the body (Den Adel, 2002; Hal *et al.*, 2014;

Taylor *et al.*, 1996). The skin of marula fruit can be boiled and drunk or burnt and used as a substitute for coffee, and the fruit can be used for making chutneys and pie fillings (Hal, 2013; Marula Natural Products, 2012; Mawoza, Ojewole, Chiwororo & Owira, 2010).

Biomedical literature has indicated the presence of medically important chemical constituents in the marula plant notably: polyphenols, tannins, coumarins, flavonoids, triterpenoids, and phytosterols (Bille *et al.*, 2013; Mawoza *et al.*, 2010; Todorov & Dicks, 2009). Furthermore, several pharmacological studies have shown that marula possesses antidiarrhoeal, antidiabetic, anti-inflammatory, antimicrobial, antiplasmodial, antihypertensive, anticonvulsant, antinociceptive, and antioxidant properties (Hal *et al.*, 2014; Mawoza *et al.*, 2010; Todorov & Dicks, 2009). These properties seem to support the ethnotherapeutic uses of marula in traditional medicine. As traditional medicine in southern Africa, the green leaves of the marula tree are eaten or drunk to relieve heartburn (Hall *et al.*, 2000). The stem and bark contain antihistamines and are also used for cleansing by steeping in boiling water and inhaling the steam (Ojewole, 2003; Mawoza *et al.*, 2010). It is also used as a malarial prophylactic (Marula Natural Products, 2012; Mawoza *et al.*, 2010; Ojewole, 2003). A piece of the bark can be crushed into pulp, mixed with cold water and drunk in the treatment of dysentery, diarrhoea, rheumatism, gangrenous rectitis, insect bites, burns and a variety of ailments (Hall *et al.*, 2000; Mawoza *et al.*, 2010; Shackleton *et al.*, 2002). The bark can also be crushed into powder and mixed with milk or sorghum or millet water and drunk to reduce fevers (Hall *et al.*, 2000).

Experiments on rats have shown marula bark extracts to be controlling diabetes, indicating that marula bark extracts possesses hypoglycaemic activity which is good for the control and management of type-2 diabetes mellitus in adults in some African communities (Abdalbasit & Ibrahim, 2012; Ojewole, 2003; Mawoza *et al.*, 2010). Furthermore, the bark is used as an anal suppository powder for treating haemorrhoids. Holtzhausen (1980) states that tablets can be made from the bark of marula tree which can be used for the prevention of ulcers. According to Shackleton *et al.* (2002) and Wynberg *et al.* (2002a), marula roots can be boiled and the steam used as a decoction or infusion to treat menstrual pains, coughs, bilharzia,

body weakness, eye sore, heart pains and as an antiemetic in treating of nausea, vomiting and motion sickness.

3.3.3 Use of marula wood and leaves

Marula tree wood is quite often carved into different products, such as spoons, plates, and decorative animal figures (Shackleton *et al.*, 2008; Shackleton & Shackleton, 2004). The inner bark can be used to make ropes and the whole bark is used to make a light brown dye and bitter tincture (Duke, 1989; Marula Natural Products, 2012). In addition, Marula Natural Products (2012) postulates that large saturnalia caterpillars, as well as larvae of the cerambycid wood-boring beetle, are gathered from these trees for roasting by certain tribes in the southern African region. The larvae of the mopane worm (*Imbrasia belina*) also occur on marula trees and are collected and eaten by people. Marula wood does not burn well, but has traditionally been used for making charcoal (Hall, 2002). The wood is also used in the construction of kraals, fencing, making beehives for honey, and bowed into mortars for pounding grains and carved into drums and utensils (Lawes *et al.*, 2004; Shackleton & Shackleton, 2002). Marula wood is also used for making furniture, panelling, flooring and laminated products, and other artefacts, such as shoe heels, plates and bowls, because its wood does not crack easily (Lawes *et al.*, 2004; Shackleton *et al.*, 2002; Shone, 1979). The leaves are said to be used in compost-making and the leaves and leafy stems/branches are used as animal feed (Hall *et al.*, 2000; Shackleton *et al.*, 2002). Finally, marula trees are ecologically used by two parasitic mistletoe species as their host, thus accounting for the infection of *Erianthemum dregei* and *Pedistylis galpinii* (Dzerefos, Shackleton & Witkowski, 1999; Dzerefros, 1996).

3.3.4 Use of the marula seeds

Marula seeds can be eaten fresh, dried or ground and added into soups, stews and vegetables, making them reputable in giving flavours in foods (Den Adel, 2002; Emmanuel *et al.*, 2005; Kgomoamagodi, 2008; Maroyi, 2013; Munondo, 2005; Sybille *et al.*, 2012). The fresh seeds can also be added to boiled meat and eaten or added to porridge to add flavour (Kgomoamagodi, 2008; Shone, 1979). In Phalaborwa, South Africa, marula nuts are a subsistence food for people during the winter season when mixed with spinach, meat or

green mealies (Kgomoamagodi, 2008; Munondo, 2005). Marula seeds are rich in magnesium, phosphorus and potassium, which make it an important diet ingredient (Arnold & Ruiz, 1998; Hal *et al.*, 2014). Other important nutritional components include trace elements such as iron, calcium, copper, zinc, thiamine and nicotinic acid – explaining why it is an important diet for pregnant women, children and boosting manhood in men (Abdalbasit & Ibrahim, 2012; Arnold & Ruiz, 1998; Hal, 2013).

Among the Venda communities, marula seeds are ground and shaped into meat-like cakes which can then be stored as “Venda biltong” for future use (Shone, 1979). In Namibia, marula seeds are turned into oil or snacks. The oil was also used to preserve and soften the traditional skin shirts that were commonly used in southern Africa (Shackleton *et al.*, 2002). The oil is also used as a meat preservative among the Venda (Duke, 1989; Maroyi, 2013; Shone, 1979).

3.3.5 Use of marula oil

According to Marula Natural Products (2012), the soft kernel of the marula fruit can be processed into high-stability lipid and oleic acid. Marula seeds contain non-drying oil, which is rich in protein and is used in combating stretch marks due to its anti-aging properties (Abdalbasit & Ibrahim, 2012; Glew, Vanderjagt, Huang, Chuang, Bosse & Glew, 2004; Gruenwald, 2006; Mawoza *et al.*, 2010; Wynberg *et al.*, 2002b). Due to its exceptional chemical stability and slow oxidizing properties, marula oil has also been used to make several medicines, insecticides and cosmetic and skin care products (Duke, 1989; Hal, 2013; Hall *et al.*, 2000; Lombard *et al.*, 2000; Mawoza *et al.*, 2010; Shone, 1979). Marula oil has also been successfully refined to obtain products such as iodine, free fatty acids and loviond colour (yellow and red) that have been used for making soaps and peroxides (Elijah, Abdulkadir & Adisa, 2012; Hall, 2002; Hall *et al.*, 2002; Shackleton *et al.*, 2001). However, marula oil has low content of vitamin E as compared to other nut oils due to its low level of B-tocopherol (Eromosele & Paschal, 2003; Shone, 1979).

Marula oil is very stable to oxidative rancidity. The oxidative stability has been utilized for a long time by communities in the southern African region to preserve meat due to its exceptional resistance to oxidative rancidity, which is an effect of its fatty acid composition

(Abdalbasit, Bertrand, Yousif & Siddig, 2010; Burger, De Villiers & Du Plessis, 1987; Elijah *et al.*, 2012; Enweremadu & Rutto, 2015; Palmer & Pitman, 1972). In fact, marula oil is said to be ten times more resistant to oxidation than olive oil, making it one of the most stable natural oils (Burger *et al.*, 1987; Elijah *et al.*, 2012). Nevertheless, the oil is subject to hydrolytic rancidity (the triglycerides are attacked by moisture and enzymes to create free fatty acids and glycerol).

Marula oil has also been found to possess a high percentage of mono-unsaturated oleic acid, which is a useful natural alternative to sunflower oil for the production of biodiesel (Elijah *et al.*, 2012). Furthermore, its oil properties, such as its high oleic acid content, high saponification value, high viscosity, high anti-wear and friction reduction make it prospective oil for engine crank case bio-lubricant (Elijah *et al.*, 2012; Enweremadu & Rutto, 2015). The only shortfall to marula oil, when used in engines, is that its higher viscosity lacks durability when used directly as fuel in compression ignition engines, as compared to that of diesel.

3.3.6 Cultural practices associated with marula

Due to its multiple uses and significance in the landscape, several African cultures have specific beliefs and ceremonies associated with the marula tree, such as the first fruit ceremony in the *Tsonga* and *Zulu* cultures (Helm *et al.*, 2011a; Nwongwu, 2006; Shackleton *et al.*, 2001; Shackleton *et al.*, 2002). For example, when the Tsongas and Zulus present their kings or chiefs with the first marula brew of the season, the brew is not supposed to cross a river to avoid it losing its strength and potency (Marula Natural Products, 2012; Nwongwu, 2006; Shackleton *et al.*, 2002). In a study in the Bushbuckridge region of South Africa, Shackleton and Shackleton (2002) noted that 74 % of the households in their study were producing between 138 and 311 litres of marula brew each season. This entails the harvesting of more than 1200kg of marula fruit per season. Much of this beer was shared with friends and neighbours – thus playing an important role in building and maintaining social ties amongst community members.

In Swaziland, marula fruits are brewed into *buganu* which is presented to His Majesty the King and Her Majesty the Queen Mother to mark the beginning of the marula season

(Swaziland Indigenous Products, 2012). *Buganu* is also used in other cultural festivals, such as in traditional marriages and rituals (Marula Natural Products, 2012).

The marula stones are also used as divination pieces, game counters or as kindling (Shackleton *et al.*, 2005; Ngorima, 2006; Nwongwu, 2006). Culturally, the nuts are used as necklaces to ward off evil spirits and illness (Nwongwu, 2006; Palmer & Pitman, 1972; Shackleton & Shackleton, 2002; Wynberg *et al.*, 2002b). People in southern Africa are also reported to have used marula for determining the sex of their unborn children when the woman is pregnant (Shackleton *et al.*, 2002; Ngorima, 2006; Nghitoolwa *et al.*, 2003). The Venda believes that marula is a tree that can be used to determine the sex of unborn babies. This ritual is done by making an expecting mother to drink an infusion of the male or female tree bark which is believed to help in determining the sex of an unborn child. Amongst the Venda (Marula Natural Products, n.d.) purports that, a woman seeking a baby boy will take in an infusion from the bark of the male tree or if she wishes to have a baby girl, she takes an infusion from the female tree. If the child is born of the opposite sex than that wished for, then he/she is said to be a very special child in being able to defy the spirits. The significant cultural value of marula, therefore, is that the species plays an important role in a range of socio-cultural practices and is important in building social capital amongst rural Swazis (Bennett, 2010; Bhuiyan *et al.*, 2012; Hunter *et al.*, 2007).

The Tonga people call marula the “food of kings”. Perhaps this is because the kernel of the marula, though small, is tasty and a rich source of protein in the local communities hence they call the nut the “food of kings (Marula Natural Products, n.d.)”. Analyses show the marula kernel has up to 3,100 kJ per 100gm, with a high protein and fat content (Bille *et al.*, 2013; Hal, 2014). During the celebration of their annual feast of the first fruits, the Tonga pour fresh marula juice as offering over the tombs of their dead chiefs (Marula Natural Products, n.d.). Amongst the Venda, the feast of the first fruits is considered as time for festivities and marula trees play a crucial role in creating social ties as people gather and sit under its shade to prepare marula brew, taste it for quality, and discuss several other social issues.

The Xikha marula festival (like the *Buganu* Ceremony) is normally held in honour of the marula fruits throughout southern Africa, to celebrate the harvest from the fields in

February (Marula Natural Products, n.d.). At the end of the marula harvesting season, women make marula brew, and gather at the chief's kraal, sing, and present the chief with a calabash full of marula brew. They sing special songs and praises known as "chembe" thereby creating cohesion among members of the society. During such a festival, everyone is allowed to drink the brew, and thus, giving the people a sense of oneness, togetherness and belonging.

Ngelengele (Banishing the Worms) is another traditional ritual practice whereby the Zulu women first notice that worms are emerging from the fully-ripened marula fruit on the ground. As they pick marula fruit from the ground to prepare for the Xikuha Marula Festival, the emergence of the worms is believed to be a sign that the planting season is about to begin. As the people move from homestead to homestead celebrating the marula, it is believed that the process chases away the worms from the fields (Marula Natural Products, n.d.). In fact, this ritual belief is probably supported by some scientific explanation that, as the fruit on the ground ripens, the worms are attracted to the sugars of the fruit, and their presence alerts the women to the threat of worms for their crops. They then use the marula fruits to spread around the areas, and then the worms actually disappear.

The Sacred Tree tradition is also another practice by the northern Sotho people who believe that the marula tree was given to the people by the spirits and is, therefore, a sacred tree. In this believe, marula must be dealt with in the way their ancestors did. Often the marula tree will be the only one left standing in field once the field has been ploughed. Normally, during the "First Fruits" ceremony, a ritual of slaughtering a goat or black bull will take place. This ritual is known as *umsebenzi* in Zulu. This takes place at a specifically selected marula tree, where an offering of marula brew in a clay pot is made to the ancestors at a ceremony where the local traditional spirits, spirit mediums (*izangoma*) and traditionalists in the community are involved).

Marula is widely acknowledged to possess powerful aphrodisiac as such, it is considered as a tree of marriage amongst the Zulus (Marula Natural Products, 2012; Ngorima, 2006; Shackleton & Shackleton, 2002). The Marriage Tree traditional believe is composed of a whole range of beliefs that are developed around the marula tree (known to the Zulu as the marriage tree) since it is a symbol of fertility and used in a cleansing ritual before marriage

(Marula Natural Products, n.d.). The (Marula Natural Products, n.d.) went on to say that as the marula tree is dioecious (meaning there are separate male and female trees), it is not by coincidence that the marula female tree is one of the most prolific fruit producing-trees in Africa.

Marula is believed to be a sangoma dice among the Shangaans. The marula stone is used as dice by the Shangaan diviners, who cast their "bones" to foresee the future or help their clients with a variety of problems or diseases (Marula Natural Products, n.d.). The marula is also a considered traditionally as fertility fruit by the Shangaans. Local lore has it that by eating the marula fruit women are more likely to become pregnant. It is probably not a coincidence that when migrant men come home to their rural villages and their wives greet them with marula brew, that when they leave in January for work, that many of the women are pregnant).

Marula is also considered the "Elephant Tree". It is believed that marula is loved by elephants because of the taste of its fruits. Therefore, it is commonly regarded as the elephant tree (Marula Natural Products, n.d.). The Ndebele communities in Zimbabwe believe that marula can be used for spirits. The Ndebele use an infusion of marula roots and leaves to traditionally wash the body of a person to prevent malevolent spirits from possessing a member of the family. Even traditional healers have been known to fortify themselves by bathing their bodies in a decoction of the marula bark before treating infectious diseases (Marula Natural Products, n.d.). Finally, marula is taken as fire water (a local alcoholic beverage in South Africa). The overripe marula fruit is used to brew this very tasty, potent alcoholic beverage also known locally in South Africa as "Mampoer".

3.3.7 Contribution of marula to household socio-cultural, economic and food security

The harvesting, utilization and marketing of indigenous fruits and nuts, such as those of marula have been central to the livelihoods of the majority of rural communities throughout Africa and can make a difference during periods of famine and food scarcity (Akinnifesi, Kwesiga, Mhango, Chilanga, Mkonda, Kadu, Kadzere, Mithofer, Saka, Sileshi, Ramadhani & Dhliwayo, 2006; Akinnifesi, Ajayi, Sileshi, Kadzere & Akinnifesi, 2007; FAO, 2011; Leakey *et*

al., 2005; Mithöfer & Waibel, 2003). Several studies demonstrate the contribution of natural products, including marula, to household food security, income generation, medicinal value, cultural and spiritual values in the southern African region (Akinnifesi *et al.*, 2007; Hunter *et al.*, 2011; Mahdi & Schmidt-Vogt, 2009; Mokgolodi *et al.*, 2011; Ngorima, 2006; Nwongwu, 2006).

A survey by Den Adel (2002) in north-central Namibia, for instance, found 100% of the 57 households interviewed to be using marula to make marula wine, juice, cooking oil, and kernel 'soup', and they also mix the kernels with other food ingredients. He also observed that 97% to 98% of the households eat marula fruits, marula kernels and marula cake, and use marula wood as a source of fuel. In the Bushbuckridge region of South Africa, Shackleton and Shackleton (2002) found marula products to form an integral part of the livelihoods of residents in the area, many of whom were living below the poverty line and were dependent on natural resources to meet a wide range of basic needs.

Furthermore, Shackleton and Shackleton (2002) found one third of the 102 households interviewed to be selling marula fruit to Mirma/Distel (Amarula Cream producers) and the Mine Workers Development Agency Marula Project, and about half of all households to be selling kernels to the latter. In their study, 13% of the 102 households sold marula beer in the nearby town of Thulamahashe. In their study, the income generated per person per season on average, ranged from R38 – R335 across the sample villages for fruit sellers, R119 – R325 for kernel sellers and an average earning of R941 for marula beer sellers. These incomes, although relatively low and highly seasonal are a crucial injection of cash at a critical time of the year when households often experienced shortages after the festive season when income is generally low (Akinnifesi *et al.*, 2007; FAO, 2011; Mokgolodi *et al.*, 2011; Ngorima, 2006).

The money earned is used, particularly, to pay for school fees and for buying school uniforms and books and for the much-needed food security during periods of hunger (Akinnifesi *et al.*, 2004; Akinnifesi *et al.*, 2006; FAO, 2011). The South African communities collectively harvest approximately 2000 tons of marula annually and collectively earn an income ranging from USD126420 to 180000, representing more than 10% of average household income in the communities (Ham, 2005; Phytotrade Africa, 2005).

Based on these studies, one can confidently say that marula is an intricate part of people's lives and contributes significantly to the livelihoods and well-being of rural communities in southern Africa. This confirms the people-ecosystem linkages (Harper, 2012; Silvis & van der Heide, 2013; UNEP, 2004a; UNDP & UNEP, 2009; UNEP and IISD, 2004; UNEP, 2004b; MEA, 2005; World Bank, 2004; World Resources Institute, 2007).

3.3.8 Impact of management practices on marula harvesting

The harvesting of non-timber forest products at commercial levels can enhance the ecosystem and improve the productivity of individual species (Akinnifesi *et al.*, 2007; Wynberg *et al.*, 2002b). Furthermore, Peters (1995) asserts that commercial harvesting could even improve the genetic composition of a forest ecosystem over time when harvesters manage the resource by selectively favouring the most vigorous and productive individuals. Reporting their findings on the effects of different management practices on fruit yields in Ilha das Oncas (Brazil), Neumann and Hirsch (2000) state that alternative land-use practices (pruning and thinning) that permit fruit harvest increase the productivity of the cut stems, indicating that harvesting can be carried out without reducing the fruit harvest and possibly even increasing yield.

In their study in the Bushbuckridge region, Shackleton and Shackleton (2002) point out that, in terms of the management of the marula resource, there were no rules governing the harvesting of marula fruit, but the felling of marula trees was not permitted – a customary regulation that applies to all fruit trees. However, they note that this rule was not enforced in the Bushbuckridge and the perception was that cutting for firewood was impacting negatively on the resource base. In regard to conservation efforts, they found 30% of the 102 households sampled to have planted a marula tree in their yard or field and half of respondents had protected and nurtured self-seeded seedlings.

Many management requirements and practices are necessary for marula sustainability. The understanding of specific soil water, aeration and fertility requirement of fruit tree species is vital when introducing indigenous fruit trees such as marula to new locations. Studies in Peru, for instance, propose that the application of NPK fertilizer, weeding and timely pruning of unnecessary shoots have improved performance of peach palm (*Bactris gasipaes*)

(Cornelius, Arevalo-Lopez, Clement, Ricse-Tembladera, Sotelo, Ugarte-Guerra, van Leeuwen & Weber, 2006). In addition, experiments in Malawi showed that the management of miombo indigenous fruit trees differ from exotics. For instance, the nutrient and water requirements of mango (*Mangifera indica*) differed from those of *U. kirkiana*, *S. Birrea* and *V. Infausta* under same experiment (Akinnifesi *et al.*, 2007). Fertilizer application, manure and irrigation did not seem to increase the growth and survival of *U. Kirkiana* and *S. birrea* either – contrary to the widely-held assumptions that indigenous fruit trees could be managed as cultivated tree crops.

It would appear that single factors, rather than a combination of factors, may be more important at strategic periods – for instance, a light irrigation during periods of extended droughts or dry season. Additionally, Akinnifesi *et al.* (2007) purport that timeliness in the application of irrigation and fertilizer can help synchronize nutrient supply necessary for phonological development. The application of lime also seems to be an important factor for fruit tree growing in acidic soils as a pH amendment. In Botswana, the application of fertigation has showed varied effects on *V. infausta*, *S. birrea* and *S. Cocculoides* (Mateke, 2003). These practices and studies suggest a good basis for any agro-forestry intervention aimed at the sustainability of marula.

3.3.9 Domestication prospects of marula

The domestication of marula in southern Africa started in the 1990s (Akinnifesi *et al.*, 2006; Akinnifesi *et al.*, 2007; Kwesiga, Akinnifesi, Ramadhani, Kadzere, Sakaf, Shumba, Lusepani & Hangula, 2000; Mokgolodi *et al.*, 2011). The process of domestication involves a long-term iterative and integrated strategy for tree selection and improvement, for the promotion, use and marketing of selected products and their integration into agro-forestry practices (Akinnifesi *et al.*, 2007). Several initiatives and programmes for the domestication of marula have been going on in southern Africa and Israel (Kwesiga *et al.*, 2000; Leakey, Tchoundjeu, Smith & Ukafor, 2004; Leakey, Shackleton & Plessis, 2005; Taylor *et al.*, 1996). These were a consequence of the realization of the important contribution marula makes to household income generation, health, nutrition, food security and people's general livelihoods (Mokgolodi *et al.*, 2011). In fact, an impact analysis of indigenous fruits in southern Africa indicated that such fruits could reduce the vulnerability of rural households to income

generation opportunities and poverty and can make a difference during periods of famine and food scarcity (Akinnifesi *et al.*, 2007; Akinnifesi *et al.*, 2006; Leakey *et al.*, 2004; Mithöfer & Waibel, 2003). Therefore, research has been on-going in the region on how to develop long-term domestication strategies, germplasm collection and tree genetic improvement, propagation systems and field management, harvesting and post-harvest technology, economic analysis and market research (Akinnifesi *et al.*, 2007; Leakey *et al.*, 2005; Mn'gomba *et al.*, 2012; Mokgolodi *et al.*, 2011; Nyoka *et al.*, 2015).

The importance of marula to rural communities has been demonstrated by the selective removal of non-fruiting male trees from arable lands and the retention of fruit-bearing female trees (Brigham, Chihong & Chidumayo, 1996; Ngorima, 2006). This has been due to the important provisional function that marula provides to these people. In fact, the collection and management of semi-domesticated trees on farm and in homestead has been indicated as an effective way of reducing sunk costs (emanating from long distance travelling and time consuming efforts to find marula) and providing households with improved species diversity in terms of desired fruit and tree traits (Akinnifesi *et al.*, 2007; Kruse, 2006). At homestead level, marula trees are quite often preserved and seedlings are frequently nurtured (High & Shackleton, 2000). Observations by Erkkila and Siiskonen (1994) confirm the purposeful cultivation of marula at household levels from seed or truncheons. However, national tree seed and/or seedling centres often do not stock indigenous tree species, such as marula, for sale in the way they stock exotic species, such as mangoes, for the reason that there is little demand for them (Jama *et al.*, 2008).

Farmers are, therefore, forced to plant only tree seedlings that are available in local government or private tree nurseries, rather than what they would have chosen (Jama *et al.*, 2008). This seems to limit the chances of local farmers to domesticate wild fruit trees, such as marula. Some farmers in rural communities for example in Namibia and Zimbabwe are also reported to be planting marula trees from truncheons (Du Plessis, Lombard, & den Adel, 2002; Ngorima, 2006). While there is limited extension materials developed from research on indigenous fruit trees, the provision of improved germplasm may enhance the planting of indigenous fruit trees through efforts of expanding the markets for farmers,

which can increase returns and encourage domestication (Akinnifesi *et al.*, 2007; Cooper, Leakey & Rynolds, 1996; Muok Owuor, B, Dawson & Were., 2000).

3.4 Part 3: Policy and legal framework regulating marula harvesting

The management, use and conservation of marula takes place within the context of several international policies and agreements, all of which, to varying extents, play a role in determining the costs and benefits accrued by households (Wynberg & Laird, 2007; Wynberg *et al.*, 2002a). These policies and agreements on natural resource use are courses of action for dealing with particular resource use issues in the form of a statement or commitment to proper performance (Murphy, 2015; Robinson, Alberts & Meshack, 2013). In most cases, these policies and legal frameworks directly address issues of conservation or sustainability of natural resources, mainly to improve rural livelihoods or to promote broader economic growth in a region (FAO, 2011; Robinson & Lokina, 2011; Robinson *et al.*, 2013). Nevertheless, other natural resource policies and legal frameworks explicitly regulate specific aspects of the resource trade and use – including aspects of quality control, safety and efficacy standards, transportation, taxation, and trade (FAO, 2011; Pierce & Burgener, 2010).

In sub-Saharan Africa, many development organizations and donor agencies have supported large-scale land transfer by governments from tribes, clans and community groups to individuals or public institutions (Robinson *et al.*, 2013). Therefore, traditional common property regimes have become scarce as privatization, land titles and formal rights are promoted, leaving approximately two per cent of all forests in the region to community control and nearly all of what remains under government management (Agrawal, 2007). This has had an impact on local community access to forest resources, such as marula, and has had disproportionate negative effects on the more vulnerable populations and poorer households within communities (FAO, 2011). In addition, arbitrary access prohibition in designated reserves is said to inadvertently cause severe environmental degradation in adjacent natural areas that were previously managed sustainably (Robinson & Lokina, 2011; Wynberg, Hauck, Mbatha & Raemaekers, 2011). Therefore, the proper management of natural resources, such as marula, hinges on the existence of a legal framework that defines

land ownership, rights to land, access, and support systems (Rukuni & Kambanje, 2011; Murye, 2015).

3.4.1 Legal framework regulating marula harvesting in southern Africa

Forest laws in most countries in southern Africa focus exclusively on timber resources and pay no or limited attention to non-timber forest products, such as harvesting marula products (FAO, 2011; Shumsky, Hickey, Johns, Pelletier & Galaty, 2014; Wynberg *et al.*, 2011). However, these non-timber forest products have, of late, gained popularity and have been incorporated into forest laws, as a result changing international policy trends that resulted from direct pressure of international agencies, such as large conservation organizations and finance institutions, including the World Bank, to diversify forest management and make it more sustainable (Laird, Ingram, Awono, Ndoye, Sunderland, Lisinge & Nkuinkeu, 2010).

Across southern Africa, the policies and laws that govern the management of marula vary greatly from country to country (FAO, 2011; Laird, Wynberg & McClain, 2011; Shumsky *et al.*, 2014; Wynberg *et al.*, 2002b; Wynberg & Laird, 2007). In South Africa, for example, the regulation of natural resources is mainly based on a concurrent system between the national and provincial governments. This would typically mean that both national and provincial spheres of government are empowered to pass and implement legislation relating to specific functional areas, such as agriculture, nature conservation and soil conservation (Wynberg *et al.*, 2011; Wynberg *et al.*, 2002b). The Namibian policy framework defers greatly from that of South Africa as its system is far more centralized with some kind of decentralization that sets out government functions to thirteen Regional Councils that actually lack legislative and executive capacity and poorly defined powers (Hall *et al.*, 2002; Benkenstein, Hengari & Mbongo, 2014). The policy and legislative frameworks in both South Africa and Namibia tend to pose some tension between democracy and decentralization, on the one hand, and command and control on the other through retention of centralized political control (Wynberg *et al.*, 2002b). In fact, (Wynberg *et al.* (2002b) observe that in these two countries, marula falls into private land, title deed land and communal lands (which are managed through customary law that is understood by the communities), yet the

statutory law which is mostly not understood and implemented by communities also does apply on the communal lands.

Customary laws constitute a central component of marula use although quite often undermined by efforts to establish statutory controls over non-timber forest products (Arnold & Ruiz, 2001; Michon, 2005; Wynberg *et al.*, 2011). In addition to customary laws, strong cultural taboos have been used in many African countries, including South Africa, Swaziland and Namibia, to protect wild fruit trees on communal lands (Willey, 2008; Wynberg *et al.*, 2002b; Wynberg & Laird, 2007). These customary controls are meant to protect wild fruit trees from being cut and from the manner in which they are harvested (Wynberg *et al.*, 2011).

In Namibia, for instance, clear rules exist that are related to the marula season, including a prohibition on the carrying of knives or weapons during the time of *Omaongo*, a closure of the traditional court, and the giving of a part of *Omaongo* to traditional authorities. In that country, the rules for marula harvesting and marula tree cutting are actually stronger than those for other fruit trees (Wynberg *et al.*, 2002b).

Government laws, nevertheless, seldom specifically protect wild fruit trees, although such trees may be included as protected species at the national or provincial levels. In Namibia, marula has been included in the list of protected tree species. In fact, in 2001, Namibia promulgated the Forest Act (12 of 2001), which protects, among others, wild fruit trees. However, this Act does not provide restrictions for the use of marula fruits and anyone is entitled to collect them so long as the tree is not damaged (Wynberg *et al.*, 2002b).

In South Africa, Wynberg *et al.* (2002b) point out that efforts to specifically protect marula were initiated as early as 1941 due to shortages in timber during World War I and people resorted to cutting marula trees for timber. The South African National Forest Act (84 of 1998) and several ordinances lay out measures to protect trees, including indigenous fruit trees, such as marula. However, several loopholes do exist that may lead to misinterpretation of the law. For instance, the distinction between the protected tree and the products harvested from the protected tree itself gives a challenge, given that the

ordinances are outdated, and vary from province to province (Benkenstein *et al.*, 2014; Wynberg *et al.*, 2002b).

3.4.2 Legal framework regulating marula harvesting in Swaziland

The Government of Swaziland has enunciated several policies under the aegis of Agenda 21 and the Millennium Development Goals which cover, amongst others, environmental resources (land, water, air and biodiversity) (Murphy, 2015; Swaziland Environment Authority (SEA) and the Environment Programme (UNEP), 2005). However, the challenge in implementing these policies and legal framework in Swaziland is the dual nature of laws whereby land tenure is based on both customary and statutory law, which pose confusion in terms of jurisdiction (Manyatsi, 2004; Murphy, 2015). As such, section 252 (1) of the Swaziland constitution provides that the principles of Swazi law and custom should be recognized and adopted and shall be applied and enforced as part of the law of Swaziland (Dube & Magagula, 2012; Murphy, 2015).

Scrutinizing the Swaziland environmental laws yielded no specific policy or legal framework that regulates the harvesting of marula. In addition, the laws were found to be very old, not well coordinated and kept under different custodians (Murphy, 2015). For example, the Forest Preservation Act of 1910, the Private Forest Act of 1951 and the Plant Control Act No. 8 of 1981 are housed in the Ministry of Agriculture and have no mention of the regulation of marula harvesting (Government of Swaziland, 1910; Government of Swaziland, 1951; Government of Swaziland, 1981). The Swaziland Environmental Management Act of 2002 and the Swaziland Environment Act of 1992 are housed under the Ministry of Tourism and Environment and also do not refer, specifically, to the regulation of marula harvesting (Government of Swaziland, 2002; Government of Swaziland, 1992; Murphy, 2015; SEA & UNEP, 2005).

3.4.3 Role of land tenure in marula harvesting

The commercial trade on marula in southern Africa is influenced by a number of customary and government laws that comprise a diverse tenure systems, access rights and some levels of protection (Arquiza, Guerrero Gatmaytan & Aquino, 2010; Wynberg *et al.*, 2002b;

Wynberg *et al.*, 2011; Wynberg & Laird, 2007). The concept of tenure includes both the idea of ownership and a corresponding parcel of rights to a piece of land (Cronkleton, Bray & Medina, 2011). Although there are many ways of classifying tenure, the widely-accepted classification system that is put forward by Neumann and Hirsch (2000) comprise: state, private, communal and open access. These classes comprise four basic kinds of rights: use, transfer, exclusion and enforcement (Laird *et al.*, 2010; Neumann & Hirsch, 2000; Shumsky *et al.*, 2014). In fact, tenure security is a critical component of any strategy that aims at delivering fair and equitable benefits to communities from the trade of NTFPs, including marula (Cronkleton *et al.*, 2011; Wynberg *et al.*, 2002a). A consideration of tenure in the trade of marula in Swaziland is particularly significant since marula trees mainly grow and their products are harvested on the Swazi Nation Land (SNL) where ownership is vested in trust under His Majesty the King and access to land is granted by chiefs.

Swaziland has three basic land tenure types: land held in customary tenure or Swazi Nation Land (SNL); land held by freehold tenure or title deed land (TDL) and crown land (CL) (Mushala, 1992). Under the TDL, exclusive rights of access to a defined piece of land are recognized and the titles are held by individuals or corporate bodies, while CL is distinguished as land owned by Government or a section of Government. The selected study area, however, falls under the SNL tenure system.

Comparatively, the SNL has a more complex structure than the other two land tenure systems. The right for land allocation, according to Swazi custom, is given only to men (FAO, IFAD and WFP, 2014; Shukri & Nikoi, 2015). This means that, culturally, women are denied land despite their paramount role in agricultural production and natural resource harvesting, such as marula (FAO, IFAD and WFP, 2015; Shukri & Nikoi, 2015). One of the conditions for land allocation under the SNL is being a member of a local community. According to SWADE (2011), the SNL areas have a much greater population density and, in the context of a subsistence economy, also generate more employment, although more formal employment opportunities are found in the TDL areas. The SNL is an inherent part of Swaziland's cultural identity; hence, one can be entitled to inherit land under this system. The SNL may include land bought from TDL owners by a reigning monarch in trust for the

Swazi nation. Such land is quite often leased to private companies to attract capital and expertise to the SNL.

Land tenure, therefore is a major factor in accessing, harvesting and marketing of marula products. Equitable and sustainable harvesting of marula for both subsistence and cash can, therefore, be influenced by the tenure and regulatory controls (such as harvesting permits) and norms at the local and national policy and legislation level (Granich, Purata, Edouard, Perdo & Tovar, 2010; Novellino, 2010; Shumsky *et al.*, 2014). Such local regulations have the added benefit of fostering adaptive management since harvesters can adjust to new conditions more quickly and easily (Menzies & Li, 2010; Shumsky *et al.*, 2014).

The SNL land use is dominated by people who, generally, own livestock and practice subsistence crop production. Overgrazing and poor livestock management is predominant on the SNL, subsequently severe gully erosion and deteriorating rangelands are common occurrences (Mushala, 1992; Shukri & Nikoi, 2015). Observations are that 73% of the subsistence farmers on the SNL tenure earn less than USD200 per capita per year and that most homesteads derive income from three types of enterprises: off-farm employment, crop production, and livestock production (Shukri & Nikoi, 2015). These enterprises are supplemented by a variety of small-scale income generating activities, such as wild fruit harvesting, including marula.

According to Shukri & Nikoi (2015), the grazing land under the SNL remains under communal tenure and is an open-access. Ideally, all SNL belongs to the community and chiefs have the right to allocate land in their respective areas to all members. Cattle have an important role in Swazi society, thus there is a traditional tendency to accumulate as many cattle as possible, regardless of the environmental consequences, including browsing on marula seedlings and threatening regeneration potential (FAO, 2012; Shukri & Nikoi, 2015; SWADE, 2011). This has resulted in much of the communal grazing areas in Swaziland becoming degraded. The rights to graze stock, gather fruits and hunt for wild animals have traditionally been unrestricted (Shukri & Nikoi, 2015). The situation is intensified by the inability of residents of SNL to fence off their areas to keep out livestock.

In a majority of African countries, customary land tenure system is the most prevalent land use system amongst the rural communities (Willey, 2008). It is extensively used among the rural agrarian economies and is usually unique to its host community, since it draws from its norms and quite often leading to the misguided belief that user rights conferred to community members can be defined as statutory customary freeholds (Willey, 2008). Tenure security is immeasurable and largely it is what people perceive it to be. Nevertheless, tenure adapts contextually. Thus, tenure security acts as the assurance that a personal or group privilege to a resource is acknowledged by others and is deserving of protection should conflicting claims arise – a de facto right (FAO, 2012; Wynberg *et al.*, 2011).

An analysis of land and resource tenure is very critical in beginning an examination of the socio-political aspects of NTFP commercialization (Neumann & Hirsch, 2000). Tenure arrangements govern the most direct interactions between a society and living NTFPs resources – harvesting and management (FAO, IFAD and WFP, 2014). Tenure systems also provide the rules for governing, such as, who gets to harvest a resource, where they can harvest it, how much they harvest, and for whose benefit is it harvested (Neumann & Hirsch, 2000).

3.4.4 The role of property rights in marula harvesting and sustainability

One way that connects people with natural resources such as marula is the property rights system. This is important because, without controls on access to the resource, a problem of overharvesting swiftly emerges in cases of open-access, coupled with rapidly rising commercial value (FAO, 2011; Orellana, 2008). Property rights are essential factors in natural resource management (Heltberg, 2002; Shumsky *et al.*, 2014). In an attempt to take control over natural resource use, governments throughout the world have developed property rights in order to control natural resources that were previously managed by local users (Blanco, Agarwal & Elbow, 2006; Larson, 2002; Robinson & Lokina, 2011). However, in such an endeavour, the government's priorities are often more inclined to economic growth than natural resources protection (Larson, 2002). This has often led governments to leave out important factors that ought to be considered in natural resource management (Adhikari, 2002; FAO, 2012). A number of studies have revealed a tendency of governments

to forget, for example, that the livelihoods of local users residing close to a resource depend on the surrounding natural endowment (Robinson & Lokina, 2011). They also forget that local users that have been using the resources for long may be the ones who can manage them in a more effective way, given their indigenous knowledge about the resource (Adhikari, 2002; Udaye, 2000; Wynberg *et al.*, 2011). This way, they may drive the resource to depletion (Blanco *et al.*, 2006). A study by Browder (1995) demonstrated that not only long-term inhabitants are able to develop indigenous knowledge, but also newcomers can develop their own indigenous knowledge that eventually will allow them to manage the resource efficiently.

Debates on the relationship between property rights and the environment started as early as that detailed by Hardin (1968) who claimed that when resources are open to everyone, the users will compete with one another to use a greater share of the resource, which eventually will cause resource degradation (Adhikari, 2001; Blanco *et al.*, 2006; Stevenson, 1991). However, when property rights are well defined, users would take the consequences of their decisions into account, making it possible to structure the rights to natural resources in a different way from the open access regime (Adhikari, 2001; Libecap, 2009). Property rights can be classified into private (held by individual or a group), public (held by state), and common (held by a group of users, such as a community) (Blanco *et al.*, 2006).

However, this kind of property rights classification is very theoretical since, in the actual sense, few resources fall in any one of these categories (Berkes, 1989; Tedder, 2008). Nevertheless, Fuchs (2003) is of the view that rational decision-makers will only manage a resource sustainably and make investments and consumption decisions accordingly if they are reasonably certain that they will be the principal beneficiaries of the pursuit of sustainability. This explains the fact that once the users are more than just users but also owners, they will develop a sense of ownership such that they begin to manage the resource in a sustainable manner. This thesis is not oblivious of the fact that there are cases where owners of a resource may be responsible for the resource degradation. For example, they may quickly use the resource so as to earn cash and make financial investments at the expense of the resource base. In addition, the state may likely get inclined to achieving

short-term economic priorities instead of long-term environmental priorities (Miller & Spoolman, 2010).

Nevertheless, according to Hanna, Folke and Maller (1996), some types of property rights are better than others in some specific contexts. Generally, policies to formulate property rights regimes must take into consideration the ecological, cultural, geographical and economic contexts in which the property rights will be implemented (Adhikari, 2002; Blanco *et al.*, 2006; Cunningham, Garnette, Gorman, Courtenary & Boehme, 2009; Udaye, 2000; Wynberg, Hauck, Mbatha & Raemaekers, 2011).

Property rights take different forms, known as property regimes. Accordingly, Fuchs (2003) argues that these regimes are property arrangements that are characterized by different combinations of property rights relating to regulation of ownership, access and withdrawal. Observations by Berkes (1989) indicate that social systems and natural systems interact in various manners depending on the property regimes. Property rights can be classified into four regimes – open access, state property, private property and common property (Bromley, 2003; Fuchs, 2003).

Marula is a common property resource (CPR) or open access resource, except where the trees occur on individual plots or fields, or near to homesteads (Lombard *et al.*, 2000). In cases where the trees occur on individual properties, private rights are accorded to the tree and its fruits (Cunningham, 1997; Shone, 1979). These rights can also be extended to families where the plants grow or appear on their cultivated lands where they are given exclusive rights to the fruits from trees on these lands (Labuschagne & Boonzaaier, 1998). In many cases in South Africa, access to trees under “private” tenure is provided by owners to others in the community (Shackleton, 2002).

The CPRs are a subset of public goods in the sense that they are open to everyone but have finite benefits that may drive to their overuse, depletion or degradation. This implies that a common property is a resource whereby the exclusive title is in the hands of a group of individuals (Fuchs, 2003). In some communities, such as Swaziland, common properties are the only real asset for the poor; therefore, in public areas within villages of such communities, harvesting of fruits would never take place from trees situated close to

someone's homestead without prior consultation with the senior member in that household (Shackleton *et al.*, 2001). Furthermore, Shackleton *et al.* (2001), however, maintain that fruits from trees in the commonage may be gathered and consumed by anybody, including those from outside the village in the case of more distant trees. This indicates that there is always an overlap and shared rights to many common resources in the communal lands. This could have potential of resulting in competition and conflict under circumstances of commercialisation.

In the Caprivi area in Namibia, for example, Shackleton *et al.* (2001) report that tenure arrangements are different from most other communal areas in southern Africa in that, women are given individual tenure rights over specific trees within the common property. This kind of tenure arrangement is viewed by Lombard *et al.* (2000) to have a synergistic effect of increased privatisation of trees and loss of access by usual users to trees on neighbour's plots as the incentive for owners to make use of their own resource increases as a result of commercial ventures. This could imply that livelihoods can get threatened when the neighbours are deprived of accessing these common properties, for example, food provision which can compromise people's nutritional status (Khan, 2002). This has a propensity for conflict.

3.5 Summary

In Part I, this chapter explored the environmental aspects that are important in the growth and survival of marula trees. The most important environmental factors reviewed included marula distribution, altitude, rainfall, temperature, soils, ecosystem function in relation to other species, marula tree densities, growth rates, pest and diseases, fruit production, ecological impact resulting from harvesting, commercialization, and expanding market for selling marula. Part II of the chapter scrutinized literature associated with the socio-economic aspects of marula and the following were considered: uses of the marula fruits; wood, bark, leaves, and roots; seed oil; medicinal use; cultural practices associated with marula; contribution of marula to household income; impact of management practices; and domestication prospects for sustainability of marula. Part III dealt with issues pertaining to policy and legal framework associated with marula, the role of land tenure and role of property rights in marula harvesting and sustainability. The literature search highlighted the

important environmental factors that control the growth and survival of marula trees; the significant contribution of marula to household economic and social well-being. It also revealed that policy intervention plays a vital role in the sustainability of marula harvesting. The next chapter presents the methodology used in the study.

CHAPTER 4: RESEARCH METHODOLOGY

4.1 Introduction

This chapter presents the methods used in the study. It sets off by giving some background information about the country and the location of the study area. The research design, target population, sample size and sampling procedure are also presented. The chapter goes further to present data collection methods for the socio-economic and vegetation surveys. Issues of validity and reliability, ethical consideration, data analysis and data handling are also addressed.

4.2 Geographic context of the study: Profile of Swaziland

The study was carried out in the Kingdom of Swaziland – a small landlocked country in southern Africa with an area of 17,363km² (Zwane, Masarirambi, Magagula, Dlamini, & Bhebhe, 2011). The country is bordered by the Republic of Mozambique to the east and the Republic of South Africa to the north, west and south. Administratively, Swaziland is divided into four regions, i.e. Hhohho, Manzini, Shiselweni and Lubombo (the latter is also the region where the study was conducted) (Figure 4.1). In addition, Swaziland is divided from the west to the east into four physiographic zones distinguished by their elevation and relief (Boycott Forrester, Loffler & Monadjem, 2007; United Nations, 2002). These regions are:

(i) The *Highveld*, to the west, which comprises mountains with numerous rivers, waterfalls and gorges with an altitude of 1,850m above sea level (Remmelzwaal & Masuku, 1994; United Nations, 2002) and the highest peak is at Emlembe at a height of 1,862m above sea level (, 2002). The climate of the Highveld is temperate with warm, wet summers and cool to cold winters.

(ii) The *Middleveld*, which incorporates fertile soils and valleys and extends slightly into the Highveld and Lowveld (, 2002). The climate of the Middleveld is ideal for growing various crops and much of the agricultural activities in the country take place in this region.

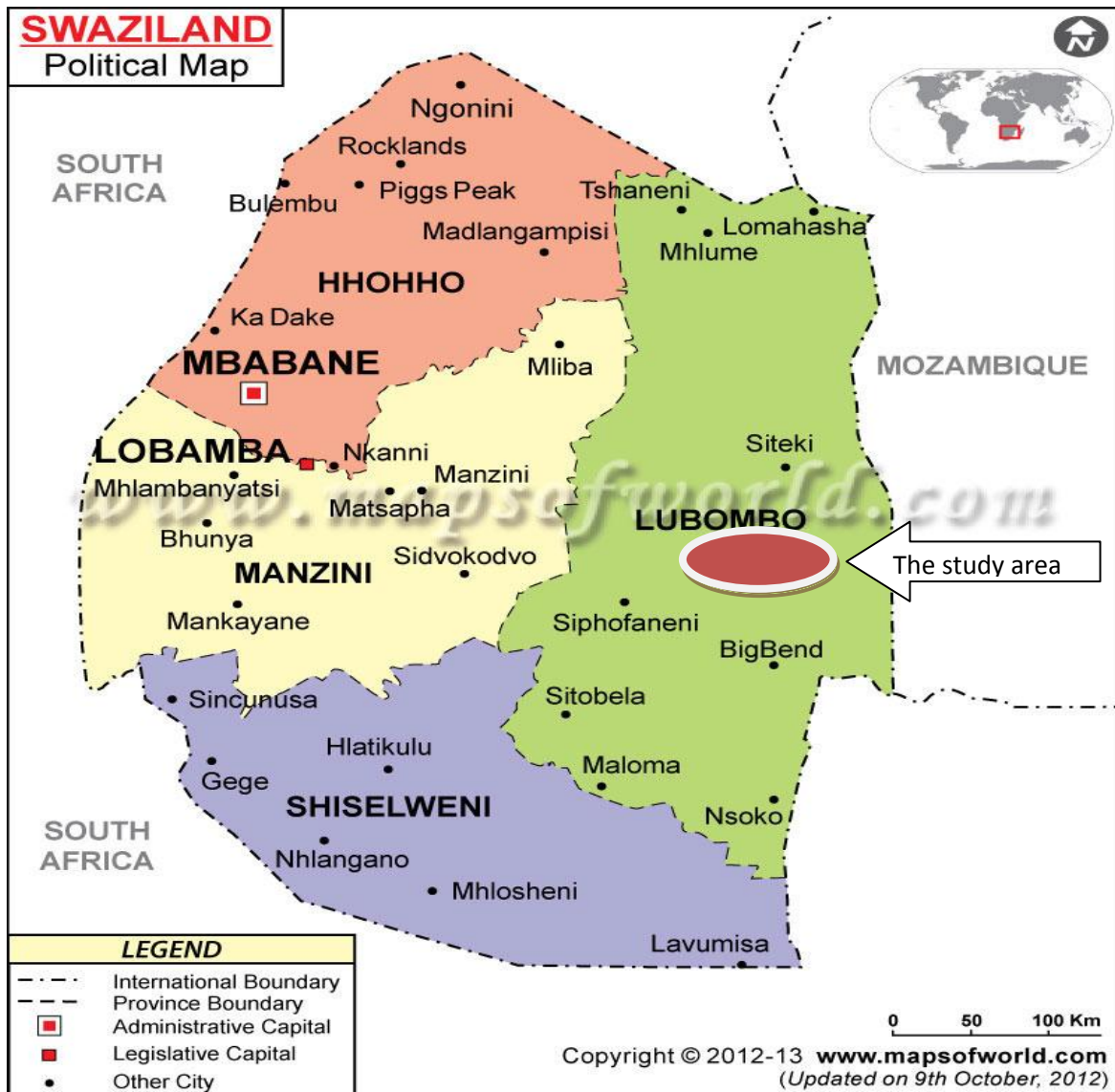


Figure 4.1: A map of Swaziland showing the four administrative regions of Swaziland and the study area

Source: Maps of World (2012)

(iii) The *Lowveld* is at an altitude of 300m above sea level with the lowest point at the Usuthu River at 21m above sea level (United Nations, 2002). It has a subtropical climate which is, generally, semi-arid. Two of the country's major crops (sugar cane and citrus) are grown in these areas.

(iv) The *Lubombo escarpment* is mountainous and is the dividing line between Swaziland and Mozambique. The climate of the Lubombo plateau is subtropical and mixed farming is

the major activity taking place in this region. In general, the country experiences hot and wet summer temperatures and cold and dry winter temperatures (Southern African Regional Universities Association (Urquhart & Lotz-Sisitka, 2014).

According to Lotz-Sistika and Urquhart, (2014), Swaziland had a population of 1,230,985 in 2012. The life expectancy has significantly declined from 60 in 1990 to just 49 years in 2013, driven by the high prevalence of HIV and AIDS, high unemployment rate (over 50%) and the impact of poverty (69% of the population live below USD 2 per day) (African Economic Outlook, 2012; Lotz-Sistika & Urquhart, 2014; World Bank Group, 2011). Currently, Swaziland has more than 200,000 people living with HIV and AIDS and about 130,000 children are orphaned and vulnerable (Lotz-Sistika & Urquhart, 2014).

Swaziland is traversed by rivers and streams, making it one of the well-watered countries in southern Africa (Zwane *et al.* 2011; World Bank Group, 2011). Rainfall in Swaziland varies from one ecological zone to the other (Dlamini, 2012). The higher altitudes receive an annual rainfall ranging from 1000 mm to 1600 mm, while the lower altitudes receive 500 mm to 600 mm per annum (Dlamini, 2012; World Bank Group, 2011). This gives the country a wide range of habitats and great variations in flora and fauna (Loffler & Loffler, 2005). In addition, there is a high inter-annual variation in rainfall, which results in periods of flash flooding or draught.

4.3 The study area

The study was carried out in Mpolonjeni Constituency (*Inkhundla*) in the Lubombo Region. The Mpolonjeni Constituency is located midway between Siphofaneni, Big Bend and Siteki (Figure 4.1). The study covered all four chiefdoms of the Mpolonjeni Constituency: KaNdzangu, KaNcgina, KaShoba, and Mpolonjeni Inkhundla. This site was purposively chosen due to its proximity to the two marula processing enterprises that buy and process marula fruits and seeds in Swaziland. Given that the landscape, geology, soils, climate and biodiversity of Swaziland vary significantly across the country (African Economic Outlook, 2012; Lotz-Sistika & Urquhart, 2014), many marula trees grow in this area, and hence it was prudent to site the research project in the area. In addition, due to its remoteness, high

poverty levels and frequent droughts, a majority of people in the area supplement their income by harvesting and selling wild fruits.

4.4 Research design

This study was interdisciplinary in nature (cutting across the natural and social sciences), embedded in an exploratory and descriptive approach and designed around two primary cross-sectional surveys: a socio-economic survey and a vegetation survey. Both quantitative and qualitative approaches to data collection and data analysis (Kothari & Garg, 2014; Onwuegbuzie & Leech, 2007) were employed. The use of quantitative techniques in this study called for a further observation of trends, attitudes and opinions of the people about the effects of commercial harvesting of marula on the rural poor communities, hence the use of qualitative techniques to collect such data. The qualitative techniques were used to explore the people's perspectives of the marula tree and its products so as to gain a better understanding of their views and to complement the data obtained through the quantitative approach.

4.5 Target Populations

Three populations were targeted for this study: i) the marula trees of the Lubombo Region; ii) the human communities of the Lubombo Region and iii) key informants from the following key stakeholder organizations: Swazi Secrets, Swaziland Marula, the Swaziland National Trust Commission (SNTC), Swaziland Environment Authority (SEA), and leaders of the women association that sells marula fruits and kernels to both Swaziland Marula and Swazi Secrets, respectively.

4.6 Sample size and sampling procedure

This section is addressed in two separate subsections. Subsection 4.6.1 details the sampling procedure and data gathering for the socio-economic survey, while subsection 4.6.2 presents the sampling procedure and data gathering for the vegetation survey.

4.6.1 Sampling procedure and data gathering for the socio-economic survey

The researcher purposively selected respondents from four chiefdoms within the Mpolonjeni Constituency, namely: Mpolonjeni *Inkhundla*, KaNcgina, KaNdzangu and KaShoba. Sampling the community for the socio-economic survey occurred in two phases: Firstly, a probability sampling method was used where 411 community members were randomly drawn from the target areas. Using a Microsoft Raosoft sample size calculator (Microsoft, 2010) and accepting a 5% confidence interval (error level) and a 96% confidence level (to increase reliability of the data), the sample size was calculated from the target population of 14,716 people living in the Mpolonjeni Constituency (Table 4.1).

Table 4.1: Sample breakdown and data collection methods for the study

Area/organization/key informants	Sample size	Respondents	Data collection method
Mpolonjeni Constituency	411	Community household members	Structured survey questionnaire
SNTC key informants	4	Environmental Education Officers	In-depth interviews
Swaziland Environment Authority key informants	4	Environment Officers and the Communications Officer	In-depth interviews
Swazi Secrets key informants	4	Managing Director and the Public Relations Officer	In-depth interviews
Swaziland Marula key informants	4	Managing Director and the Public Relations Officer	In-depth interviews
Women association that sells marula kernels key informants	4	Members of the association	In-depth interviews
Total	431		

Source: Developed by A.F. Murye (2013)

A multi-stage random sampling procedure (Al-Saleh & Al-Omari, 2002; Onwuegbuzie & Leech, 2007) was then used to: first, select the households to be included in the study (through assigning numbers to the households and then selecting every 3rd household for inclusion into the study sample), and then randomly select an adult individual participant from the selected household. However, for households where there was no adult respondent, the eldest child (of age not below 17 years) within that homestead was selected to participate in the study. A purposive sampling method (Tong, Sainsbury, & Craig, 2007) was then used to select 20 key informants from stakeholder companies and organizations to participate in the in-depth interviews. This approach generated a total sample size of 431 participants.

To gather the socio-economic data, two main research instruments were used, namely a structured questionnaire (Annex 1) for the 411 household members and an in-depth interview schedule (Annex 2) for the 20 key informants. A diary was also kept to record any other information that was not captured by the questionnaire and in-depth-interview schedule. The questionnaire was developed in a way that it focused particularly on quantifying the contribution of marula to household income and livelihoods. It also focused on the impact of marula harvesting on the availability and sustainability of the resource. Furthermore, it focused on the effect of marula depletion on the livelihoods of the people in the event that marula trees become depleted or over-consumed. The questionnaire was also focused on identifying the cultural practices and traditional beliefs attached to marula by the people of the study area.

The household questionnaire covered such aspects as: demographic information of the study population, socio-economic household information about livelihood activities, employment, income generated from marula harvesting and pattern of expenditure, education, use of marula by households as a resource, institutional arrangements, cultural practices and traditional beliefs related to the marula and coping strategies in case marula gets depleted or scarce. The questionnaire contained both close-ended and open-ended questions.

The in-depth interview schedule was designed to capture the views of key informants regarding the sustainability of marula. It focused particularly on the impact of harvesting

marula on a commercial basis, ascertaining whether marula was getting scarce or depleted, measures being taken to conserve marula, and existence of legal instruments governing the harvesting of marula. Data from in-depth interviews were recorded verbatim and content-analysed according to thematic areas.

4.6.2 Sample size and sampling procedure for the vegetation survey

All marula trees in the study area were targeted for the vegetation survey. The data collection process in this case involved a ground survey of the vegetation in order to collect biophysical information about marula. The woody vegetation characteristics, such as species composition, density, age structure and size structure were measured through the placement of randomly positioned transects across the sampled areas. The purpose of this exercise was to sample the representative woody vegetation characteristics of all the study areas and, hence, the three major land use types in the area were studied. These included (i) the arable fields – including homesteads and croplands, (ii) the grazing areas, and (iii) the Mkhaya nature reserve. Fifteen plots of 200m x 200m (an area of 40,000 m² per plot) were measured and used to collect the biophysical information of the vegetation. Five plots were established to represent each land use type.

A Point Centre Quarter (PCQ) method (Dahdouh-Guebas & Koedam, 2006; Ngorima, 2006) was used to assess the species composition, density, and size structure at points along transects across the sampled plots. A data table for PCQ samples was developed for capturing the data (Appendix 3). The transect directions were determined randomly by spinning a bottle at the centre of the plot whereby the head of the bottle pointed to the direction to take. A series of points were systematically located along each transect, 10m apart, and spatially captured with the aid of a GPS Arc View version 9.0. At every sampling point, four quadrants (90⁰) were created, using the transect line and a line perpendicular to it. Measurements and recording of species in each quadrant was done within a square area of 5m by 5m (25m²) around the sampling point.

All the marula trees of all sizes closest to the sampling points in each of the four quadrants were measured. The distance from the central point of each individual tree was determined. The diameter of the marula tree is a good indicator of the different tree size classes (young,

medium adult and old adult). The researcher adopted the diameter size class classification by Nghitoolwa *et al.* (2003) and Ngorima (2006) and classed all seedlings with diameters less than 10cm as seedlings and recorded as regeneration. Tree diameters above the basal swell (1.35m above ground level) were measured. This was to make it possible to measure the marula trees in all size classes, including seedlings, saplings and mature trees. The number of marula trees was also counted and the tree sex identified and recorded. The second part was to identify the other plant species within the sampling point in each of the four quadrants. The names of all selected species in the quadrants were noted for the determination of the species composition and resource interrelationships. All relevant data were recorded on a field sheet (Appendix 3).

The transect lines stretched out throughout the villages, across crop fields and grazing areas and the game reserve. Local people were used to assist in the field measurements. The names of plant species were identified in the field by using several authoritative sources (Boycott *et al.*, 2007; van Wyk & van Wyk, 2007; van Wyk & van Oudtshoorn, 2012). The measuring of individual marula trees in the different size classes was useful in determining marula tree population characteristics in the sampled areas. The diameter classes were grouped into 10cm intervals and the results presented in tabular form.

The PCQ method was chosen because it had the advantage of being plot less, so there was no need to demarcate the sampling area of certain size or shape. This made the method easy to use since the workforce was small, as only three assistants were employed to help the researcher during the survey. To determine the environmental requirements for the survival of marula, soil maps, geological maps and vegetation maps were used to identify the soil types, geology and vegetation type of the study area. Temperature and rainfall data for the area were obtained from the Meteorology Department in Swaziland.

4.7 Validity and reliability

Validity, according to Mwanje (2001) is the strength of the research conclusions, inferences or propositions, whereas reliability reflects a dependable measure. Good quality data were obtained by ensuring validity and reliability whereby the research instruments had to be developed from an extensive literature review and vetted for validity and reliability by the

research supervisors at the University of Free State and experts in the field of biodiversity conservation and forest management drawn from the University of Swaziland and the Forestry Department of the Ministry of Agriculture, Swaziland. The researcher also used standard methods, such as the PCQ method that has been used previously by other researchers such as Ngorima (2006), and also Okereke, Nnabude, Mbaekwe, Ekwealor and Nwanchor (2014). In addition, the researcher selected and trained research assistants from the Department of Environmental Health Sciences at the University of Swaziland. The research assistants were trained on how to use the questionnaire and ask questions in order to ensure the highest quality of the data. The questionnaire was also translated word for word from English to *siSwati* by two language experts (Appendix 4), given that the respondents were not adequately conversant with the English language. The *siSwati* version was then counter checked by a *siSwati* lecturer from the University of Swaziland for accuracy against the original English version.

Furthermore, research assistants were taught procedures and troubleshooting means and also provided with instruction sheets and guidelines on how to interview respondents. The questionnaire was pilot-tested at Ngculwini Inkhundla, which was not included in the study area, to identify the potential problems of the research instruments and research procedures. This gave room for necessary modifications of the instruments and logistics of data collection before the actual fieldwork started. The research assistants were closely supervised by the researcher who was part of the data collection team. All the data were checked daily by the research assistants (against each other) and counter checked by the researcher for any discrepancies and to ensure completeness and accuracy. All shortfalls such as missing data were immediately rectified by the research assistant, for instance by going back to the particular respondent's household and getting a response.

The combination of quantitative and qualitative approaches in this study allowed for triangulation through seeking similar patterns in the data and grouping them into thematic findings, thus further improving the validity and reliability of the results. In this way, the combination of data collection methods brought a more positive outcome to the study.

4.8 Ethical consideration

Ethics constitutes a set of rules of conduct or principles to which researchers ought to conform (Kothari & Garg, 2014). Therefore, ethical issues are an important aspect when conducting research and ought to be taken into consideration at every stage of the research process, beginning from its inception through to writing up of findings (Bouma & Ling, 2004; Gillis & Jackson, 2002; Scheyvens & Nowak, 2003). In adherence to these principles, the researcher sought informed consent from all the relevant authorities, such as Department of Forestry, regiment leaders (*Tindvuna*), Chiefs, and those listed in Table 4.1. Others were participating individuals and communities selected for the study sample. This was done by the researcher through holding meetings with the relevant concerned parties. The identities of the people participating in both the household survey and key informant interviews were not revealed save for the organizations of the latter in order to uphold their confidentiality, integrity, values and dignity. In addition, before the start of the interviews, participants were informed about their rights to (i) decline to answer any particular question(s); (ii) withdraw from the study at any time; (iii) ask any questions about the study at any time during participation; (iv) provide information on the understanding that their names would not be used unless permission is given to the researcher; and (v) access to the full or summary of the findings on request. Consent forms were provided and those who could read and write signed them, while those who were not able to read and write were requested to give a verbal consent. The researcher also sought permission to take pictures and notes where necessary.

The interviews were conducted in a respectful, polite, responsive, frank, sensitive and well-behaved manner. The interviewees were also provided with the researcher's addresses in case they needed to have any correspondence with him. During the vegetation surveys, no manipulation of the ecosystems was done. In addition, permission to access the fields, grazing areas and game reserve were arranged before embarking on the survey.

4.9 Data preparation

The data were checked for completeness and quality control to ensure that it was accurate, consistent with facts, uniformly entered, well completed and arranged to facilitate coding

and tabulation. Data cleaning was then done to check for treatment of missing values which, in the analysis, were left out to avoid unnecessary skewing of the findings. The data were then presented in the form of figures and tables.

4.10 Data analysis

Qualitative data were content-analysed and subjected to classification according to emerging thematic areas. Thematic analysis and interpretive descriptions were then used to find patterns, commonalities and conceptualizations. Analysis of quantitative data was done by using the Statistical Package for the Social Sciences (SPSS version 20) (Microsoft, 2010). Descriptive statistics (frequencies and percentages) were used to describe the categorical data, while inferential statistics (correlation tabulation) were used to determine relationships between the levels of harvesting with various socio-economic factors, such as income level, size of household, alternative livelihood activities, marital status, age, and levels of education of household members. Contingency tables as per chi-square analyses (Kothari & Garg, 2014) were used to analyse any significant differences in economic benefits, perceptions of impact and possible solutions to any problems associated with marula harvesting, as expressed by particular sub-groups of respondents. The tree population estimates were weighted relative to the size plots (200m by 200m) on the different land uses (crop fields, communal grazing areas, and Mkhaya Nature Reserve) within the study sites.

4.11 Limitations of the study

It was difficult to access certain households due to the presence of dogs and the strict culture of Swazis in accessing people's homes. These were overcome by the researcher using research assistants and a teacher who came from the study area. The vegetation surveys were done over two consecutive seasons and this did not yield much difference, especially in regard to tree diameters and regeneration of new trees. There were no rainfall and temperature data, specifically for Mpolonjeni Constituency, as the nearest weather station was located at Siteki. To overcome this, the Meteorological Department under the Ministry of Tourism and Environment advised and availed to the researcher, data from the Siteki station which is not very far from the study area. Furthermore, the Meteorological

Department does not take measurements of other important environmental factors governing the growth of marula, such as humidity and light intensity. These factors were therefore left out in this study. Finally, the study was confined to the Mpolonjeni Constituency only and the findings can, therefore, not be generalized to the entire country.

CHAPTER 5: RESULTS

5.1 Introduction

This chapter offers a descriptive analysis of the study results which are presented in figures, tables and narrative form. The chapter sets off by presenting the findings of the vegetation survey as well as the environmental characteristics of the study area. It then proceeds to the findings of the socio-economic survey which are presented in the following order: demographic and households' profile of the respondents, socio-economic data, legal framework governing marula harvesting in Swaziland, and sustainability strategies for marula harvesting. A discussion and interpretation of the results in the context of the study aims and objectives is presented in Chapter 6.

5.2 Findings of the vegetation survey and environmental characteristics of the study area

The researcher conducted a vegetation survey in the four chiefdoms under study to determine some pertinent marula population characteristics in addition to information on some relevant environmental factors that are necessary for the growth and survival of marula trees. These vegetation characteristics and environmental factors included ecosystem types, vegetation diversity, geology, soil types, temperature, rainfall, as well as diameter, sex and regeneration potential for marula trees.

5.2.1 Ecosystem of the study area

The four chiefdoms (Ndzangu, Ncgina, Kashoba and Mpolonjeni) that constituted the study area fall under the lowveld bushveld savannah. This ecosystem is characterised by a mix of indigenous forest, grass and thorn savannah. The ecosystem generally occurs at altitudes ranging from 200m to 400m and is typically split into the western and the eastern lowveld bushveld (Boycott *et al.*, 2007). These chiefdoms fall squarely on the eastern lowveld bushveld which occurs at the lowest altitudes that support Acacia woodland on the flatter

basaltic plains (Boycott *et al.*, 2007; Ministry of Agriculture and Cooperatives (MOAC), Forestry Section, 2002). The vegetation composition of the study area is shown in Table 5.1

Table 5.1: Some plant species identified alongside the marula trees in the study area

Tree species	<i>Senegalia nigrescens</i> , <i>S. tortilis</i> , <i>S. borleceae</i> , <i>S. burkei</i> , <i>Aloe marlothii</i> , <i>Ziziphus mucronata</i> , <i>Sclerocarya birrea</i> , <i>Spirostachys africana</i> , <i>Gymnosporia spp.</i> , <i>Dichrostachys cinerea</i> , <i>Euclea spp.</i> , <i>Ozoroa engleri</i> , <i>Grewia spp.</i> , <i>Bolusanthus speciosus</i> , <i>Combretum imberbe</i> , and <i>Balanites maughami</i> , <i>Ficus sycomorus</i> , <i>Trichilia emetic</i> , <i>Syzygium cordatum</i> , <i>Breonadia salicina</i> , <i>Vachellia robusta</i> , and <i>Bridelia micrantha</i>
Grass species	<i>Panicum maximum</i> , <i>Themeda triandra</i> , <i>Cenchrus ciliaris</i> , <i>Digitaria ariantha</i> , <i>Eragrostis spp.</i> , and <i>Urochloa mossambicensis</i>
Invasive plant species	<i>Chromolaena odorata</i> , <i>Lantana camara</i> , <i>Melia azadirach</i> , and <i>Psidium guajava</i>

Sources: The tree, grass and invasive species were identified by the researcher using Boycott *et al.* (2007); Van Wyk and Van Wyk (2007); Van Wyk and Van Oudtshoorn (2012).

Table 5.1 shows that, at least, 17 species of trees were identified, six of grasses, and four of invasive plants. The table indicates richness in species diversity in the study area. This shows that there was definitely an interrelationship amongst the species in terms of inter-specific competition, for instance, for light, minerals and water among the marula trees and the other plant species. The most common tree species across the study area was *Senegalia nigrescens* and marula was sparsely distributed across the ecosystem (also see Image 3). This finding is fairly consistent with Loffler and Loffler (2005) who purport that the eastern lowveld is dominated by dry *Acacia woodlands*.



Image 3: An example of the dominant vegetation (*Senegalia nigrescens*) in the study area

Source: Picture taken by A.F. Murye, 27th December 2013

5.2.2 Soils of the study area

The study area is mainly dominated by loamy soils. Table 5.2 shows the major soil types which are mainly dominated by vertisolic, pseudopodzolic and fersialitic soils. These soils are generally characterized as moderately weathered and shallow soils that show a wide range of characteristics ranging from neutral to basic soils. This observation is in agreement with that of Loffler and Loffler (2005) who described the soils of the lowveld of Swaziland as being generally weathered with shallow and wide ranging soil characteristics. This is also in line with Remmelzwaal and Masuku (1994) who said that the vertisolic soils occur mainly in the Lowveld of Swaziland on basalt and dolerite. These soils are generally characterized by poor drainage, poor permeability, and high clay content and strong development of cracks in the dry season – a characteristic that does not favour much the growth of marula (Haque & Lupwayi, 2003; Remmelzwaal & Masuku, 1994).

The pseudozolic/duplex soils have contrasting soil horizons; thus, have light textural topsoil clearly or abruptly overlying heavy textured subsurface horizons. These soils are reported to have hydromorphic properties (Rommelzwaal & Masuku, 1994). The fersialic soils are generally at an advanced state of weathering and soil-forming process. These soils are dominated by kaolinite and are said to have a low cation exchange capacity (CEC) of 20me/100g and base saturation of about 50% (Haque & Lupwayi, 2003; Rommelzwaal & Masuku, 1994). These raw mineral soils are very shallow and include bare rocks and debris that are broken down mainly by physical processes and are very common countrywide.

Table 5.2: Dominant soils of the diferent chiefdoms of the study area

Ndzangu	Ncgina	Kashoba	Mpolongeni	Mkaya Game reserve
Vertisolic, Pseudopodzolic, and Fersialitic	Vertisolic, and Ray mineral soils	Vertisolic, and Pseudopodzolic	Vertisolic, Fersialitic, Ray mineral soils, and Pseudopodzolic	Vertisolic, Pseudopodzolic, Fersialitic and Ray mineral soils

Source: Boycott *et al.* (2007), Murdoch (1968), and Ministry of Agriculture and Cooperatives, (2002)

5.2.3 Geology of the study area

Geologically, the study area sits on the post-Karoo (Murdoch, 1968). This has been confirmed by Boycott *et al.* (2007), who claim that the geology of Swaziland is a miniature of the geology of the southern African region. The tall mountains and valleys in Swaziland actually are a result of erosion by rivers flowing to the sea. According to them, the escarpment that these mountains form extends deep into Mpumalanga to the north and goes as far as the Kwazulu-Natal’s Drakensberg Mountains in the south. Geologically, the escarpment is believed to be a single feature (Boycott *et al.*, 2007; Olson, 1973, Nixon, 1986).

The flat landscape of the lowveld where the study area falls is believed to have eroded down from the plateau and to have resulted in the formation of an area of sedimentary and

volcanic rocks that form part of the Karoo Super Group, which is thought to have been formed between the Permian and Jurassic periods (Boycott *et al.*, 2007). To the east of the study area are the Lebombo Mountains, which contribute immensely to the soils of the study area through erosion and deposition processes. The Lebombo Mountains have been formed more than 180 million years ago, when basalts and rhyolites filled the rifts in the original continent of Gondwanaland before the continental drift. Over time, the surrounding basalt eroded away, leaving what was once a rhyolite filled rift as blue grey tall mountains and the eroded basalt deposited down at the study area.

5.2.4 Gender of marula trees in the study area

Marula trees are deciduous, meaning the male and female flowers develop on different trees and rarely on the same tree. Being a dioecious tree, it is easy to distinguish between the female trees and male trees as shown in Images 4 and 5 respectively. The dioecious nature of marula has been alluded to by several authors, such as Dlamini (2011), Kgomoamagodi (2008), Morris, Humphreys and Reynolds (2006); Nghitoolwa *et al.* (2003) and Peters (1988).

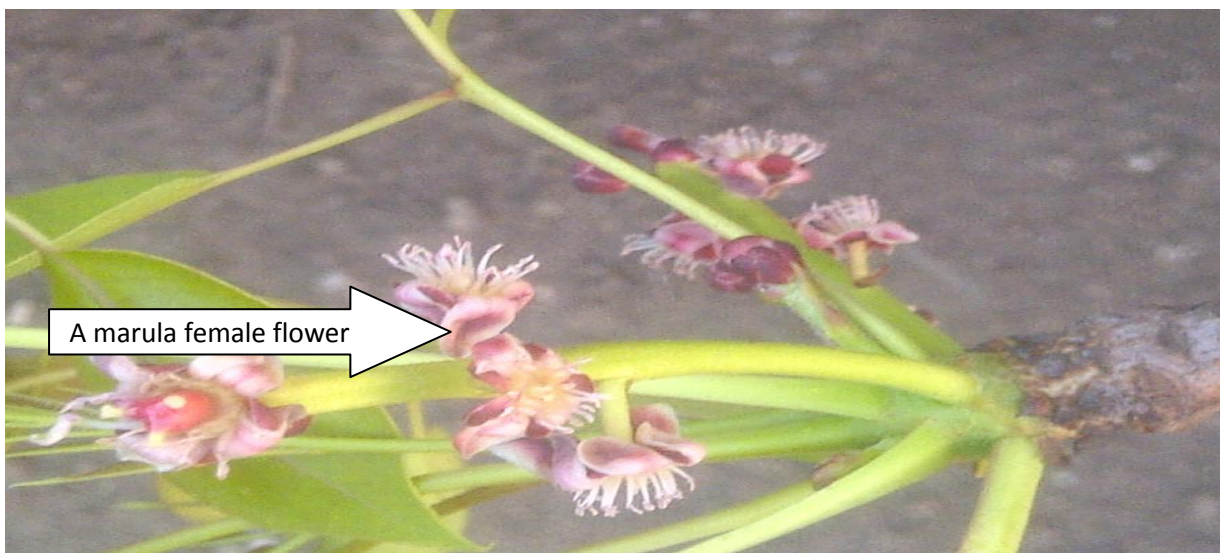


Image 4: A picture of marula female flowers

Note the large size of flower, stigma, inflorescence, and the beginning of fruiting in the front flower.

Source: Photo taken by A.F. Murye, 18th, September 2015



Image 5: A picture of marula male flowers

Note the small size of flowers, anthers, and the inflorescence which differ from the female flower. Source: Picture taken by the A.F. Murye, 18th September 2015

Table 5.3 shows the marula tree gender distribution and number of trees found in the sampled plots. A total of 344 adult trees were counted in all the plots in the different land uses (agricultural fields, grazing areas, and Mkhaya Nature Reserve). The plots were chosen from the different land uses and trees in each plot were identified, counted and recorded by sex in the year 2014. Out of the 344 trees, 80 were male and 264 were female, giving a male: female ratio of 1:3.3.

Male trees carry the pollen bearing flowers and female trees carry the stigma and ovaries that ultimately develop into fruits. The low number of male trees in both the grazing areas and agricultural fields is of concern as it may have an adverse effect on successful pollination and the resultant low fruit harvest. It was not readily clear as to why the number of male trees was low. However, normal practice is that people tend to cut down non-fruiting trees from their fields in favour of the fruiting ones as they consider them to be useless. In Namibia, Nghitoolwa *et al.* (2003) found that the management challenges posed

by the marula populations are those associated with sparse distribution and disruption of pollen flow to the female trees.

Table 5.3: Marula tree gender and number of trees per plot under the different land uses

Plot	Grazing land				Agricultural field				Mkhaya Nature Reserve (Mkhaya)			
	Male		Female		Male		Female		Male		Female	
	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
P 1	3	3	16	16	0	0	3	3	12	12	11	9
P 2	6	6	5	5	4	4	9	9	2	2	0	0
P 3	1	1	7	7	1	1	23	23	0	0	1	1
P 4	10	10	30	30	3	3	21	21	0	0	0	0
P 5	1	1	4	4	6	6	10	10	1	1	0	0
Total	21	21	62	62	14	14	65	65	15	15	12	10

In the Mkhaya Nature Reserve, this was the opposite as there were more male trees than female trees. The immediate explanation for the high number of male trees compared to female ones in the Mkhaya Nature Reserve is the protection given to the Mkhaya Nature Reserve. This could have prevented potential cutting of male trees.

5.2.5 Regeneration potential of marula trees

Table 5.4 shows the regeneration potential of young marula trees in the study area. During data collection, all marula trees having a diameter less than that of an HP pencil were considered as regeneration (young marula trees). Table 5.4 shows that there was more regeneration of young marula trees in the plots of the Mkhaya Nature Reserve during the study period as 143 and 206 young marula trees were counted in 2014 and 2015, respectively, thus indicating a big increase in the number of seedlings. In the plots in the grazing areas, 59 and 58 young marula trees were counted in 2014 and 2015, respectively, indicating a kind of static regeneration potential. In the agricultural fields, there was very little regeneration observed as only 24 and 17 young marula trees were counted in 2014

and 2015, respectively, indicating a negative regeneration potential. These observations in grazing areas and agricultural fields show that the sustainability of marula is under threat.

Table 5.4: Regeneration of marula trees per plot under the different land uses counted in 2014 and 2015

	Grazing land		Agricultural field		Mkhaya Nature Reserve	
Plot	Year					
	2014	2015	2014	2015	2014	2015
Plot 1	11	8	0	0	71	71
Plot 2	11	11	0	0	7	52
Plot 3	7	7	11	0	38	43
Plot 4	4	4	12	17	17	27
Plot 5	26	28	1	0	10	13
Total	59	58	24	17	143	206

During the field survey, some of the plots in the agricultural fields did not have any young marula trees growing as the plots were already ploughed during the time of the data collection. This casts doubt on the sustainability of the marula species as one only finds a few old marula trees left and sparsely distributed in the agricultural fields. In the grazing areas, most of the young marula trees were being destroyed by grazing animals. Much as the animals (goats and cattle mainly) are good dispersers of marula seeds and that the rumens of these animals enhance germination of marula seeds, once the seeds are deposited on the ground with animal dung, they germinate and the seedlings are at once eaten by the animals as they graze (Hamidou *et al.*, 2014; Jacobs & Biggs, 2002; Pegg, 2014).

5.2.6 Tree diameter

All marula trees with diameter above 10cm at breast height (130cm) were measured and recorded (Image 6).



Image 6: Measurement of marula tree diameter at breast height (130cm from the ground)

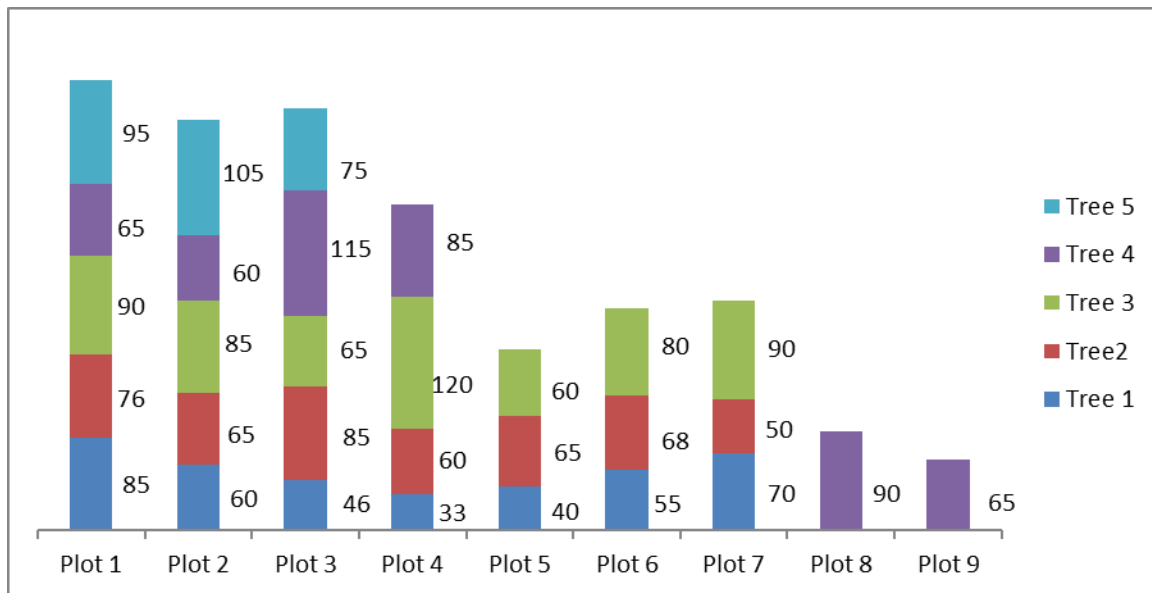
Source: Photo taken by author in December 2013

The diameters were then displayed in Figure 5.1. All marula trees with trunk diameter less 10cm size were counted and recorded as regeneration (seedlings). Measurements of marula tree trunk diameters were carried out in all the plots in the three different types of land uses (agricultural fields, grazing areas, and Mkhaya Nature Reserve). This was in order to determine the girth of the marula trees in the three different land use areas for purposes of determining the different tree size classes so as to gauge the potential marula sustainability.

Figure 5.2.1 shows the tree diameter sizes at breast height (dbh). It reveals that the diameter of all trees in all the plots in the grazing areas were above 33cm, which agrees fairly well with Nghthoolwa *et al.* (2003) who found marula trees in all the villages under their study falling in the large class size of 20cm and 50cm. The largest tree in the grazing areas was found on plot 3 and had a diameter of 120cm, which is way above that reported by Munondo (2005) in his study in Zimbabwe where he found the largest tree to have a diameter of 70cm. The smallest marula tree was found on plot 4 and had a diameter of 33cm. The majority of the trees in the grazing areas had diameters ranging from 60cm to 120cm. This deviates from the findings of Ngorima (2006) and Munondo (2012) who reported that the majority of the marula trees had diameters of 20cm and 50cm in their respective studies in Zimbabwe.

This indicates that all the mature marula trees in the grazing areas had large diameters and are old. Although Figure 5.2.1 indicates a total count of 30 adult marula trees in the sample plots in the grazing area in 2014, there were 59 juvenile trees recorded in the same plots in 2014 (Table 5.2.4) and 58 in 2015. The same plots were visited in the following year (2015) to ascertain any changes in regeneration and only 58 young marula trees were recorded during that time. Therefore, the lower-class size was rarely represented as also observed by Munondo (2005) in Zimbabwe.

This finding could imply that there is little potential for sustainability of marula in the grazing areas given that the trees are old and there is little regeneration and recruitment of young members. The probable cause of the unsuccessful regeneration of marula trees is the continuous harvesting of the fruits and seeds by the growing number of harvesters. In addition, livestock continuously browse on the seedlings that germinate and eat the fruits. Marula seeds were found around kraals in homesteads, which is an indication of livestock consuming marula fruits and releasing the seeds together with their faeces around the kraals. This indicates a continuous removal of seeds from the grazing areas, thus impacting on the seed bank in the grazing areas. This finding agrees quite well with those of Helm and Witkowski (2013); Kgomoamagodi (2008); Pegg (2014); Palmer & Pitman (1972) as well as Pooley (1993) who purport that marula seedlings are fed upon by animals.



N=30

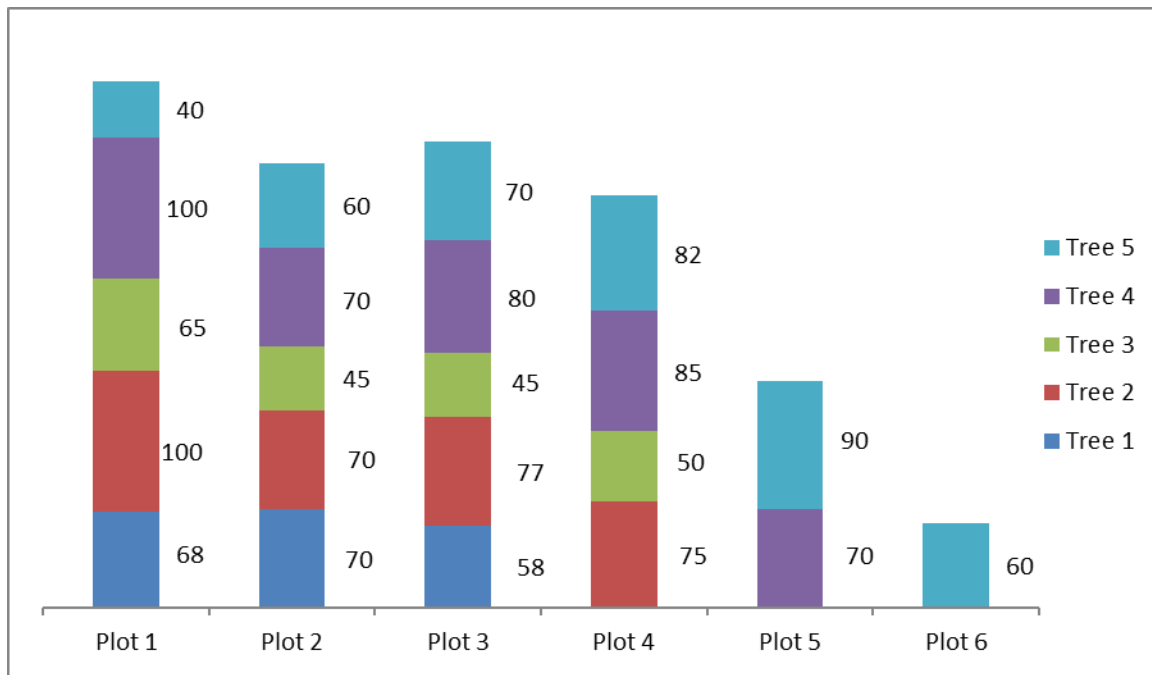
Figure 5.1: Marula tree diameter (cm) at breast height (130cm from the ground) in the plots of the grazing areas

The germination of marula seeds is normally enhanced by animals when they are eaten and passed out together with faeces (Hamidou *et al.*, 2014; Jacobs & Biggs, 2002; Pegg, 2014). Although the seeds germinate around homesteads, the seedlings are, unfortunately, ploughed under when the fields are prepared for the next crop planting season. In addition, the animals also avidly graze on the growing seedlings. This concurs with Helm *et al.* (2011b), Lombard *et al.* (2000) and Ngorima (2006) who claim that marula plays a role as food for animals and is continually removed due to animal grazing. This scenario definitely poses a threat to the sustainability of the marula tree species in the grazing land.

In the agricultural field, the largest marula tree diameter was 100cm, while the smallest was 45 cm (Figure 5.2). This shows that most of the marula trees in the agricultural fields were in the larger class sizes and are old. This is consistent with findings by Ngorima (2006) and Shackleton (2002) who found mainly large class marula trees in the arable agricultural fields in their studies in Zimbabwe and South Africa, respectively.

During the data collection process in 2014, there were only 24 marula seedlings regenerating in the agricultural fields (Table 5.4). When visited in the following year, only 17 young marula seedlings were recorded. The immediate explanation to the decrease in the

number of marula seedlings in the following year is probably the regular ploughing under of marula seedlings during land preparation for crops. Secondly, the removal of seedlings through grazing by animals during the winter season, when animals are left to roam about the agricultural fields, could be another reason. Some of the agricultural fields were found ploughed already when visited the following year (2015) and no single marula seedling was found growing on those fields.



N=22

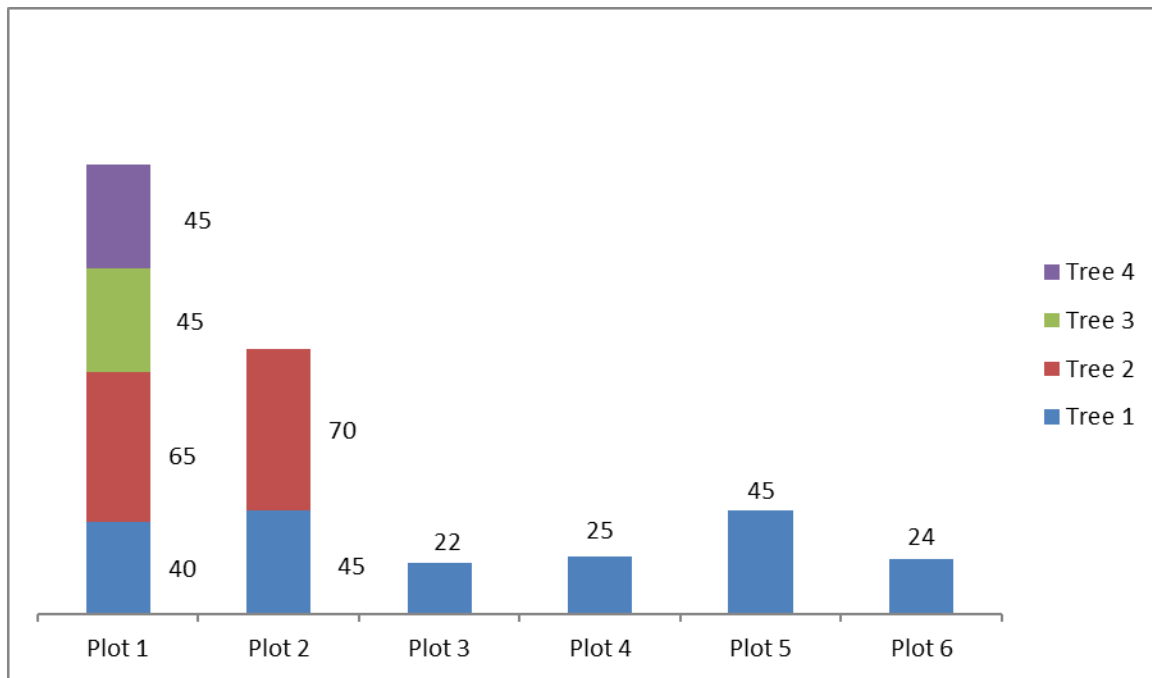
Figure 5.2: Marula tree diameter (cm) at breast height (130cm from the ground) in the plots of the agricultural fields

The general observation was that all the trees found in the study plots in the agricultural fields were of large class and old – some of which had already stopped bearing fruits. The major causes for this situation were said to be: the ploughing of fields for crops, which continuously remove the seedlings; the total harvesting of the marula fruits and seeds by people for trade, which impacts adversely on the marula seed bank; and the grazing on fruits and seedlings by livestock, which also destroys the growing seedlings and impacts negatively on the seed bank as well. This however, does not eliminate the possibility of other causes that can impact on the seed bank. As highlighted by Helm *et al.* (2011a), there are significant gaps in our understanding of the reproductive biology of marula, particularly

those factors that limit fruit and seed production, seed fate and the persistence of the seed bank. Like in grazing areas, the overall picture in agricultural fields was not promising in as far as the regeneration potential and sustainability of the marula tree species are concerned.

The lack of recruitment of new marula trees in agricultural fields and grazing areas can impact adversely on the natural marula cycle as the gradual death of the existing older trees that reach the end of their life cycle will lead to a situation where there is no source of new seeds and, hence, no new seedling recruitment (Jacobs & Biggs 2002). This process, which is claimed to have led to the extinction of marula in some parts of the Kruger National Park in South Africa (Jacobs & Biggs, 2002) could be currently taking place in the agricultural and grazing areas of the study area. It has been reported by Stewart and Veblen (1982) that when most of the mature trees of a population are the same age, they will tend to senesce and die at about the same time – a situation that ought to be avoided for marula in Swaziland.

Only ten adult marula trees were counted in the plots in the Mkhaya Nature Reserve (Figure 5.3). This could probably be due to competition by the many other tree species (Table 5.1). Although the species diversity was not high in agricultural fields and grazing areas, there was a high level of species diversity in the Mkhaya Nature Reserve. The largest marula tree trunk observed in the Mkhaya Nature Reserve was 70cm and the smallest was 22cm, which is similar to that observed by Munondo (2005) in Zimbabwe where he reported the same marula tree diameter sizes for the majority of the trees. The good news is that there was a very high level of regeneration potential of marula trees in the Mkhaya Nature Reserve as a total of 143 marula seedlings were recorded in the study plots in 2014 and then 206 seedlings recorded in 2015 (Table 5.4).



N=10

Figure 5.3: Marula tree diameter (cm) at breast height (130cm from the ground) in the plots of the Mkhaya Nature Reserve

It was not immediately possible to ascertain the reason for the very few numbers of adult marula trees in the study plots of the Mkhaya Nature Reserve. However, one possibility could be the large diversity of tree species which could be imposing some kind of competition over resources such as space, sunlight, water and mineral resources. Nevertheless, the high level of regeneration is believed to compensate for this shortfall in the near future and is a promise for sustainability of the marula species in the Mkhaya Nature Reserve. The observed high level of regeneration in the Mkhaya Nature Reserve could be attributed to the limited access to the reserve by marula fruit harvesters and, probably, the low level of herbivory pressure from ungulates and elephants due to presence of other vegetation species on which they can graze. A few individuals indicated in the socio-economic survey that they do collect marula fruits and seeds from the Mkhaya Nature Reserve. Although antelopes and other ungulates do feed on marula fruits, they pass the seeds together with their faeces within the Mkhaya Nature Reserve and help disperse marula to new areas, thus promoting sustainability of marula within the Mkhaya Nature Reserve. This has also been alluded to by Helm and Witkowski (2013); Hamidou *et al.* (2014)

and also Jacobs and Biggs (2002) who said as ungulates eat and release marula seeds through their faeces, they enhance the germination and distribution of the seed.

5.2.7 Temperatures requirement for marula

Temperature is an important environmental factor in the growth and survival of marula. Temperature records for the study area were obtained from the meteorological Department and analysed. Table 5.5 shows the minimum monthly average temperatures for the study area for the years 2007 through to 2014. There are gaps in data for the months of August and September 2010; July and December 2011; January and December 2012; October, November and December 2013; and April, May, July, August, September, November, and December 2014. The reasons put forward at the Meteorological Department for the missing data were that the equipment was faulty and the person responsible for taking records did not do the recording in those months.

Table 5.5: Monthly average minimum temperatures (⁰C) for the study area for the years 2007 to 2014

Year	Months and temperatures (⁰ C)											
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
2007	7.7	12.6	13.9	9.5	8.6	7.5	5.5	7.1	6.7	14	12.4	3.8
2008	17.3	17.1	16.1	14	14.1	12.1	12.3	13.2	13.3	15.1	17.1	18.1
2009	28	19.1	25	14.4	13.1	12.9	13.3	16.1	14.4	14.8	14.3	-
2010	18	19.1	18.1	16.4	15	11.1	12.1	-	-	15.4	16.1	18.1
2011	18	17	18	16	12.4	11.6	-	17	10.2	13	17	-
2012	-	18.3	17.3	13	13.5	9.2	10.5	13.1	15.5	17.1	16.2	-
2013	19	18.1	17.1	15.1	14.1	12.5	12	13.4	14.1	-	-	-
2014	19.1	18.4	17.2	-	-	12.7	-	-	-	13.6	-	-

Source: Raw data from Ministry of Natural Resources and Energy, Meteorological Department (2015).

To cover for the missing data, the annual averages of the valid monthly data were computed and presented in Figure 5.4. The monthly average minimum temperatures presented in

Table 5.5 are very conducive for marula as these months are frost-free as alluded to by Gadd (2002); Hall *et al.* (2002); and Jacobs and Biggs (2002). Figure 5.2.8 shows a fluctuating temperature pattern. The lowest temperatures experienced during this period were in 2007 with an average minimum temperature of 9.11⁰C, rising gradually over the years to 16.85⁰C in 2009, dropping slightly to 14.37⁰C in 2012, and rising to 16.20⁰C in 2014. These temperatures are conducive to the survival and growth of marula trees as they thrive well in frost-free areas with a minimum temperature of 10⁰C (Coetzee *et al.*, 1979; Hall *et al.*, 2000). The data in Figure 5.4, thus, rule out the possibility that marula could be getting scarce due to changes in temperature, and, specifically, a drastic drop in temperature.

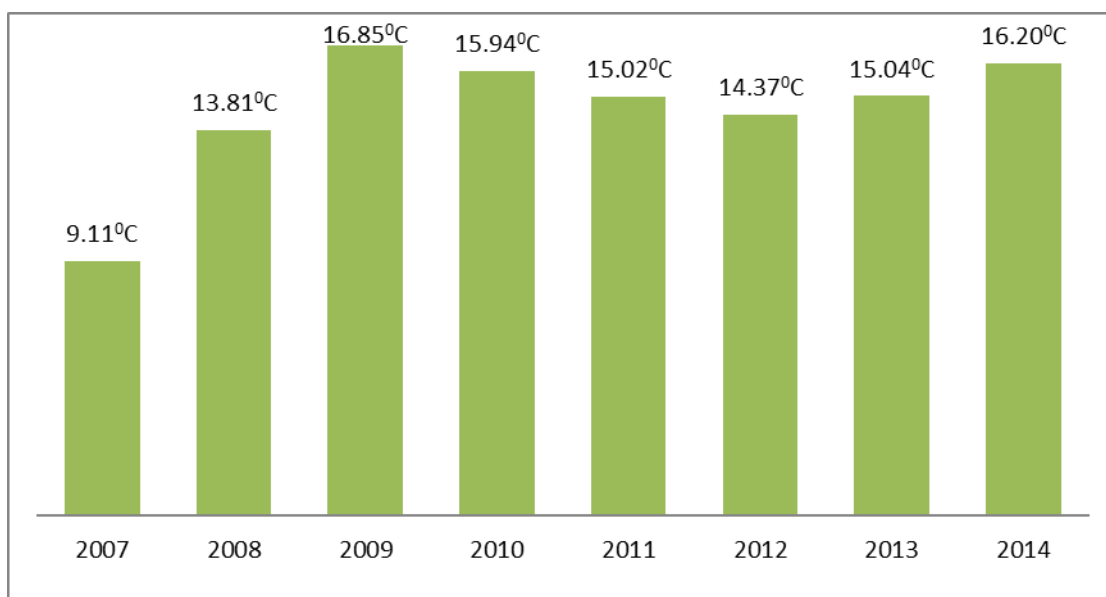


Figure 5.4: Annual average minimum temperature for the study area for the years 2007 to 2014

Source: Raw data from Ministry of Natural Resources and Energy, Meteorological Department (2015)

Table 5.6 depicts the monthly average maximum temperatures (°C) for the study area. It shows that the maximum temperature ranges were consistently within the maximum tolerable temperatures for marula. The highest temperatures observed during the period 2007 to 2014 were 29.1⁰C in May 2009, 30⁰C in March 2011, and 30.1⁰C in January 2013. According to Coetzee *et al.* (1979) and Hall *et al.* (2000), the maximum possible temperature that can be tolerated by marula is 40⁰C. Marula seeds germinate between temperatures of 27⁰C and 37⁰C (Lewis, 1987; Moyo, Kulkarni, Finnie & Van Staden, 2009). The findings

regarding minimum and maximum temperature requirements for marula in this study were, therefore, within the range of 10⁰C to 40⁰C as they are consistent with those reported by Coetzee *et al.* (1979) as well as those by Hall *et al.* (2000).

Table 5.6: Monthly average maximum temperatures (⁰C) for the study area for the years 2007 to 2014

Year	Months and temperatures in (⁰ C)											
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
2007	11.9	19.7	21	14.1	16.7	13.2	11	14.7	13.2	18.1	18.5	4.3
2008	26.7	28	28	22	23.2	21.3	23.3	24.6	26.1	27.5	26.1	29.1
2009	28.1	35.5	25	22	29.1	22.5	22.1	22	25.1	23.5	22.8	-
2010	27.1	28.1	27	25	24.1	22.1	21.1	-	-	25.1	26.2	26.2
2011	25	27	30	24.5	24.5	22.5	-	23.1	21.7	25.3	26	-
2012	-	28.5	26	23.2	23.1	19	22.1	23.4	23.3	22.2	25.3	-
2013	30.1	28.1	26.4	25	24.1	23.1	21.3	25.1	26.1	-	-	-
2014	28.1	26.8	26	-	-	23.7	25.6	-	-	23.2	-	-

Source: Raw data from Ministry of Natural Resources and Energy, Meteorological Department (2015).

The annual average maximum temperatures for the valid data for the period 2007 to 2014 were computed to close the gap left by the missing data and plotted in Figure 5.5. On average, 2007 was the coolest year with an annual average maximum temperature of 14.73⁰C and 2013 was the warmest year with an annual average maximum temperature of 25.48⁰C. It can be seen from Figure 5.5 that the annual average temperatures were still within the 10⁰C to 40⁰C temperature range for marula survival and growth, which agrees quite well with Coetzee *et al.* (1979) and Hall *et al.* (2000). Again, this rules out the possibility that marula could be getting scarce due to changes in the permissible temperature range for marula.

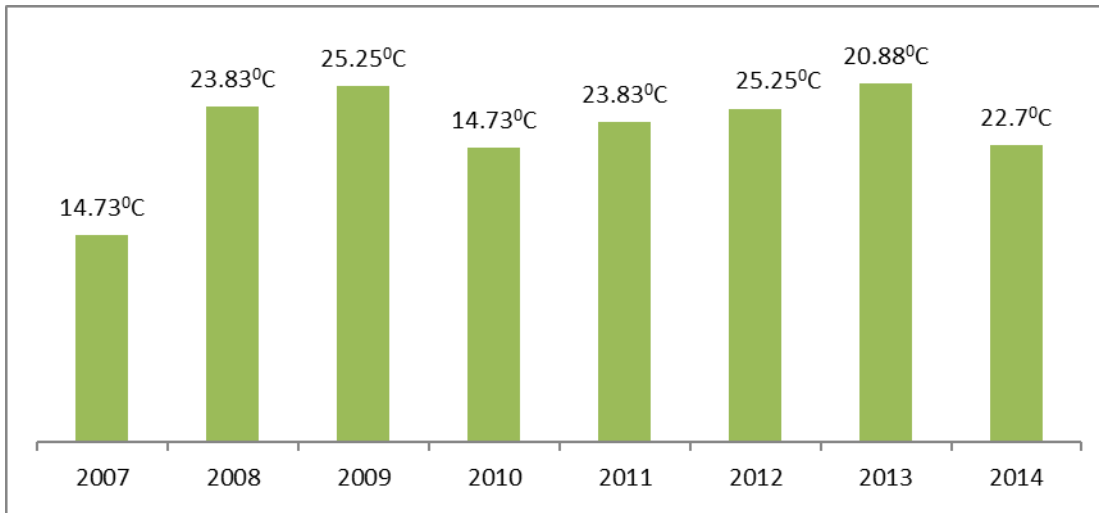


Figure 5.5: Annual average maximum temperatures for the study area for the years 2007 to 2014

Source: Raw data from Ministry of Natural Resources and Energy, Meteorological Department (2015).

5.2.8 Rainfall requirement for marula

Rainfall is an important environmental factor in the growth and survival of marula trees. The rainfall records for the study area were also obtained from the meteorological Department in 2015 and presented in Table 5.7. Table 5.7 shows that there were no monthly rainfall data for the years 2006, 2007, and 2011. Again, data were missing for the month of January 2012. There was no immediate explanation as to why data missed during those periods from the Meteorological Department. The year 2010 was the driest of all receiving a maximum average monthly rainfall amount of 231mm in April, 147.1mm in November and 178.8mm in December. Rainfall in the study area has been erratic (Table 5.7). Apart from the normal rainfall pattern in Swaziland where summers receive much more amounts of rainfall than the winter seasons, over the period 2004 to 2014, the study area has been receiving irregular amounts of rainfall.

Table 5.7: Total monthly rainfall (mm) for the study area for the years 2004 to 2014

Year	Months and total monthly rainfall (mm)											
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
2004	296.1	32.7	126.4	41.6	0	21.7	37.1	3.2	27.3	50.6	153	117.6
2005	161.5	77.3	38.8	45.8	28.9	4.2	1.6	6.3	19.2	5.3	-	-
2006	-	-	-	-	-	-	-	-	-	-	-	-
2007	-	-	-	-	-	-	-	-	-	-	-	-
2008	283.3	21.4	46.8	84.2	29.7	27.1	0	5	33.4	18.9	82.2	66.3
2009	118.9	166.7	43.4	23.1	3.6	14.3	1.7	93.5	23.2	120.9	19	44.3
2010	5.7	28.1	73.3	231.5	4.8	10.7	18.4	0.3	0.6	61.3	147.1	178.8
2011	-	-	-	-	-	-	-	-	-	-	-	-
2012	-	91.8	11	22.7	8.8	0.3	0	0	278.2	156.6	21.1	55.9
2013	305.1	88.3	117.7	0	0	5.7	20.5	7.5	17	120.3	49.6	232.7
2014	77.8	45.6	206.3	75.3	3.1	0	2	5.1	4.2	79	107.8	96.6

Source: Raw data from Ministry of Natural Resources and Energy, Meteorological Department (2015).

Table 5.7 shows that, over the period 2004 to 2014, the month of January, for example, received substantial amounts of rainfall only in 2008 (283.3mm), 2009 (118.9mm) and in 2013 (305.1mm). The month of February received a large amount of rainfall (166.7mm) only in the year 2009 and the rest of the years received very little amount in the month of February. The month of March received large amounts of rainfall only in the years 2004 (126.4mm) and 2013 (117.7mm) and the rest of the years were receiving very little amount in March. The months of April received a maximum of 231.5mm in the year 2010. June July and August were the driest months over the period under study as the area received 37.1mm, 27.1mm and 93.5mm in 2004, 2008 and 2009, respectively. The month of September received substantial rainfall amounts of 278.2mm in 2008, while October received 120.9mm in 2009 and 120.3mm in 2013. The month of November received 153mm in 2004 and 147.1mm in 2010 and the month of December received large amounts of rainfall only in 2004 (117.6mm), 2010 (178.8mm) and 2013 (232.7mm).

Marula grows in areas with humid to sub-humid environmental conditions that have a wide range of annual rainfall amounts ranging from as little as 200mm to as much as 1500mm

(Bandeira *et al.* 1999; Peters, 1999; Shone, 1979). However, Table 5.7 shows varying amounts of rainfall received and largely skewed below the minimum amount of 200mm (Bandeira *et al.* 1999; Peters, 1999; Shone, 1979). Given this scenario, one is geared at concluding that the amount of rainfall could negatively impact on marula growth. Marula usually flowers in September and the fruits are ready by February.

However, Table 5.7 shows that, over the years (save for the year 2012), the study area was receiving very little amount of rainfall, compared to the minimum required. In fact, it received as little as 0mm in 2012 and, over the years, ranged between 4.2mm and 33.4mm, which is way, lower than the 200mm minimum required amount of rainfall. In addition, the development period for the fruits (October to January) has generally received little amounts of rainfall (save for November and December 2004, October 2009, November and December 2010, and October and December 2013). This could have reduced the fruit yield over the years – as was also reported in the household surveys.

The average annual rainfall for the period 2004 to 2014 was computed from Table 5.7 and graphically presented in Figure 5.6. It shows that the years 2004 and 2013 received the highest average annual rainfall amount of 75.61mm and 80.37mm, respectively. Furthermore, it shows that from 2004 through to 2014, the study area has been receiving less average amount of annual rainfall as compared to the 550mm to 650mm it has been receiving as reported for the same area by Loffler and Loffler (2005).

This could have been a result of climate change, which was not part of this study although it was reported by respondents to the household socio-economic survey interviews. Figure 5.6, therefore, shows that the study area has been experiencing prolonged dryness over the years 2004 to 2014. Indeed, this could have contributed to the decline in the number of marula trees as it could have negatively contributed to the little regeneration of seedlings in the grazing and agricultural fields. The explanation for the high number of regeneration in the Mkhaya Nature Reserve in this regard could have, therefore, been a result of a good microclimate resulting from the thick vegetation cover. The next section presents the socio-economic data.

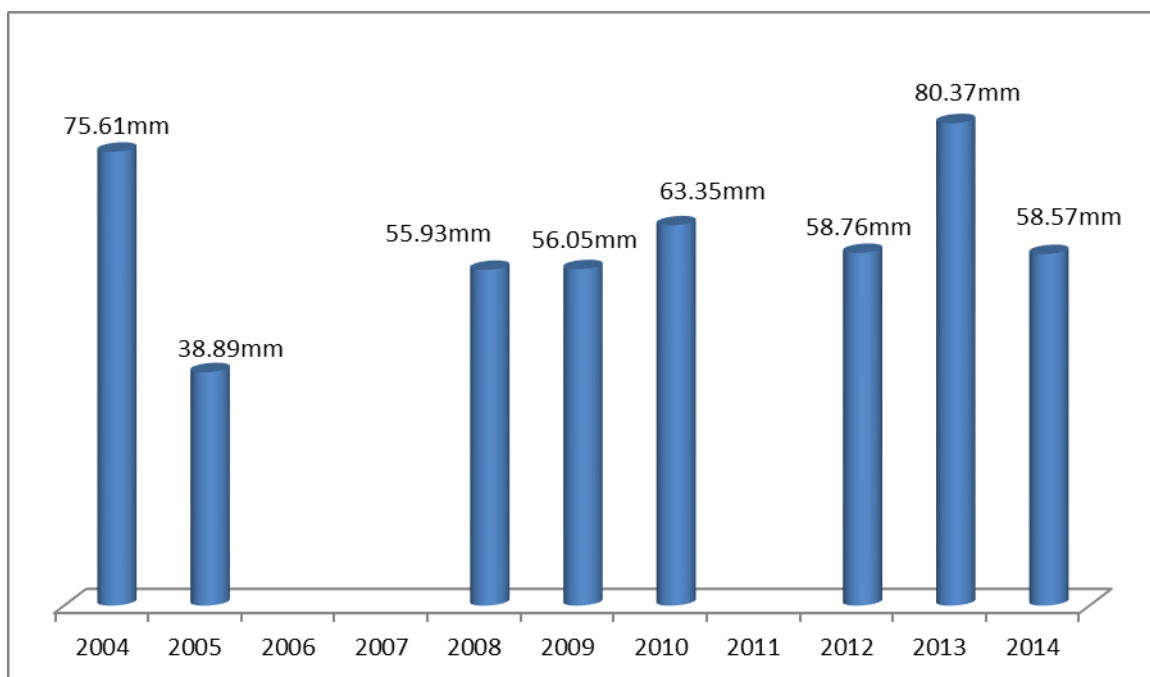


Figure 5.6: Average annual rainfall (mm) for Siteki for the years 2004 to 2014

Source: Raw data from Ministry of Natural Resources and Energy, Meteorological Department (2015).

5.3 Findings of the Socio-economic Survey

The socio-economic data were collected using a filter interview schedule (Appendix 1). This means that the respondents were to answer questions that were relevant to their situation and skip those that were not applicable. Therefore, throughout the presentation of the results for the socio-economic survey, the N value of the respondents is bound to vary from one question to the other. In the data analysis, the skipped questions were captured as “Not Applicable” and were not included in the analysis as they would skew the findings.

5.3.1 Demographic and household profile of the sampled population

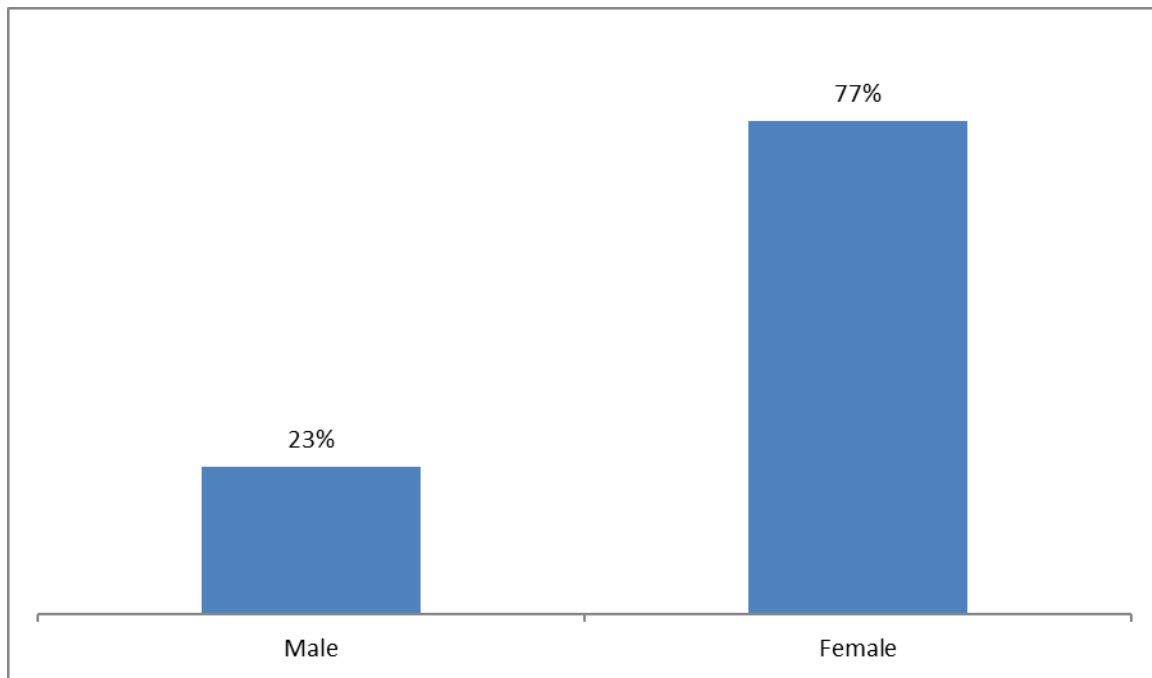
Several demographic factors, such as gender, age, marital status, parenthood and education were considered in the study. The sample size for the quantitative household surveys comprised of 411 households. In addition, 20 key informants were selected from different relevant organizations to participate in in-depth interviews.

5.3.1.1 Gender distribution

Gender was viewed as an important demographic element to ascertain what role it plays in marula harvesting. In Swaziland, decision-making at household level is vested in the man. This suggests a direct relationship between power and gender in regard to access, distribution and use of resources which are unequally distributed between women and men. An understanding of the unequal power relations between women and men was necessary in this study in order to get an insight of the basic challenges brought by gender in regard to marula harvesting. This is critical, especially in the context of Swaziland where women do not own land as per cultural dictates (Shisana & Davids, 2004). Thus, gender was considered as an important demographic and cultural factor that discriminates between the roles, responsibilities, constraints, opportunities and needs played by women and men in the study area.

Figure 5.7 shows the gender distribution in the sampled households. Out of the 411 households, 77% (n=316) of respondents were females and only 23% (n=95) were males – thus suggesting a much-skewed gender distribution in the marula enterprise in favour of females. The reasons for this skewed gender distribution could be linked to, among others, labour migration, which could be contributing to a large number of female-headed households in the study area. Being a remote area, most of the men and young adults were reported to have gone to the urban areas and neighbouring countries in search for jobs.

Labour migration is not new in Swaziland. Several authors, such as Adams, 1989; Booth (1986), Kowet (1978) and Leliveld (1997) claim that, since the turn of the 19th Century, labour migration from Swaziland to South Africa have become a major feature of the economy of Swaziland. This makes many households economically worse off and more vulnerable, consequently forcing the female *de-facto* heads of households to resort to relying on natural capital, such as harvesting marula fruits to meet their household needs (Krantz, 2001; NADAL *et al.*, 2007).



N = 411

Figure 5.7: Gender distribution of the respondents to the questionnaire of the survey

This seems to agree fairly well with Shackleton *et al.* (2007) who claim that female-headed households are commonly considered to be the “poorest of the poor.” As much as this has been questioned and qualified by other observers (Campbell, Jeffrey, Kozanayi, Luckert, Mutamba, & Zindi, 2002; Chant, 1997), evidence from South Africa shows that female-headed households are, indeed, a particularly vulnerable group with a poverty rate of 60%, being double that of male-headed households (Gelb, 2003; Tibesigwa, Visser, Twine & Collinson, 2014).

Another possible reason for the high proportion of females in the sample may relate to the custom of polygamy - a practice that is common in Swaziland (Buseh, Glass, & McElmurry, 2002; Jele, 2004; Manson, 2008; Poulsen, 2006). Some of the female respondents in the study lamented during the interviews that “their men were gone away with another wife”. In addition, traditionally in Swaziland it is mostly the women who engage in marula collection and selling (B.M. Dlamini, UNISWA, Luyengo, 31 December 2013, per. com.). This agrees quite well with Ntiwane (2015) who reported that marula fruits are typically collected by rural women who then prepare a fermented and quite potent alcoholic beverage from the crushed fruits (*huhlaba*). An extreme gender skew in favour of females

was observed by Mwema, Lagart and Mutai (2013) in a study in Kenya where they found that, out of the 120 households that participated in their study on trade in indigenous fruits, only 2% were males and the bulk majority was composed of females. Furthermore, similar to the finding in this study, Maroyi (2013) in a study in Zimbabwe found contrasting results where 56% of his population was female and 44% were male.

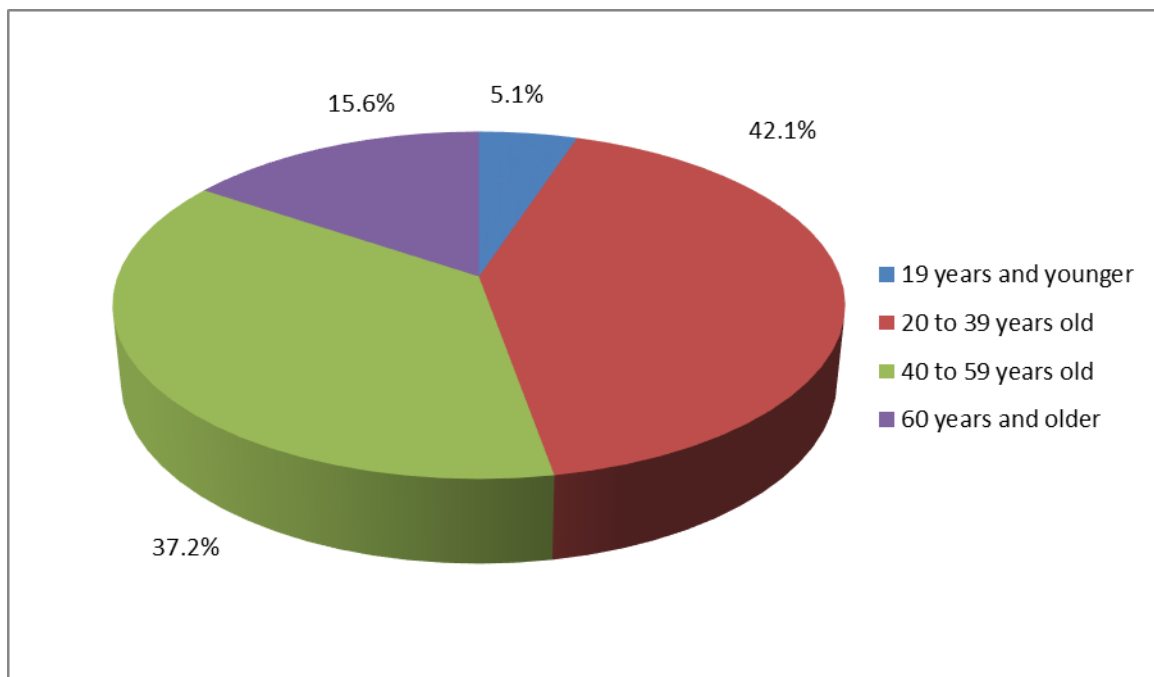
In support of the finding in this study, Singhal, (2005) observed in India that women play a dominant role in harvesting of non-wood forest products (NWFPs) and that, out of the total collection of NWFPs, 80% of the products were collected by women alone. Singhal (2005) attributed his finding to the fact that women are the major players in most small businesses which are less labour intensive. In addition, women play a central role in household economies of local communities as well as in non-destructive harvesting of NWFPs (Singhal, 2005). This concurs with a study in Zambia by Lwando, (2013) who reported that, although men and women play critical roles in managing natural resources, it is the women's roles in a wide range of activities that make them the daily managers of natural resources. This would suggest that, for sustainable harvesting of marula, efforts should be focused on involving and training women through participatory resource management approaches.

5.3.1.2 Age group distribution

Figure 5.8 shows that the largest proportion (42.1%; n=173) of the respondents constituted the age group 20 to 39 years as compared to those between the age groups 40 to 59 years (37.2%; n=153), 19 years and younger (5.1%; n=21), and 60 years and older (15.6%; n=64). Out of the 5.1% (n=21) respondents of the age group 19 years and younger, 81% (n=17) were school goers, while 19% (n=4) were not school goers but were engaged in small-scale businesses, such as hair dressing, selling snacks at the market places, and doing household chores.

The age group of 60 years and older was made up of elderly people who are mainly pensioned, and/or receiving elderly grants from the government, receiving help from their children and relatives who are still active and probably working, and/or engaging in marula harvesting to augment the meagre income they receive. Some of the elderly participants complained of being sickly and, therefore, unable to go to distant places to collect marula

fruits. In general, the majority of respondents in the age groups 20 to 39 years and 40 to 59 years are still active and, probably, have much more responsibilities of looking after their nuclear and extended family members when compared to other groups, hence leading them to engage more in marula harvesting to meet the several demands for their households. The average age of the respondents in this study was 41 years, which agrees fairly well with Ngorima (2006) who found similar results in Zimbabwe with majority of the people who participated in marula trade being of an average age of 49 years.



N = 411

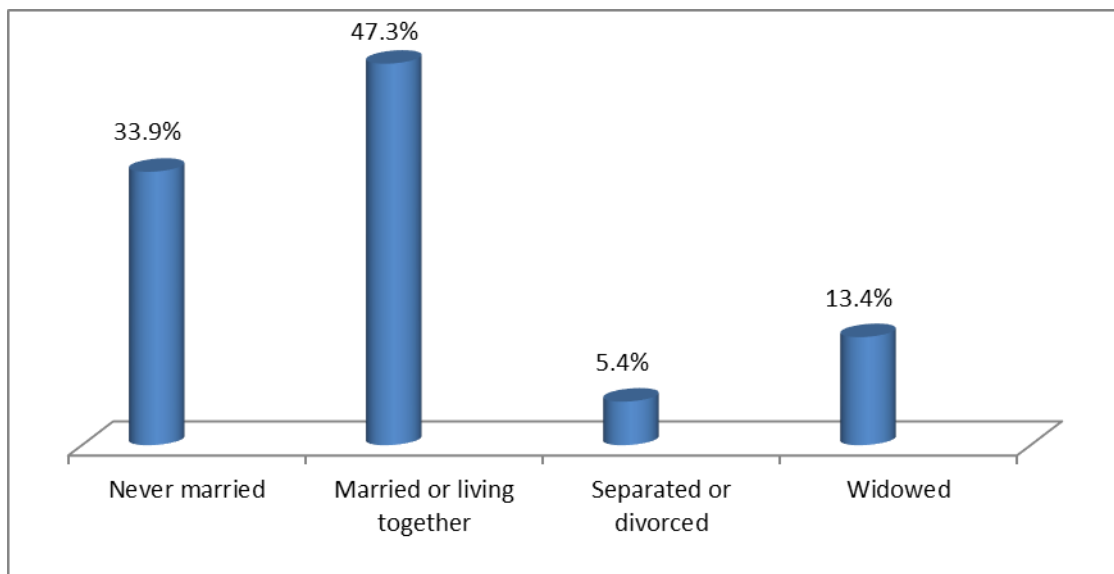
Figure 5.8: Age distribution of the respondents to the questionnaire of survey

5.3.1.3 Marital status

Figure 5.9 shows the marital status of the respondents. Among the 410 respondents who responded to the question on marital status, the largest proportion (47.3%; n=194) were married or living together.

The rest were either never married (33.9% n=139), separated or divorced (5.4%; n=22), or widowed (13.4%; n=55). The group that was never married comprised school going children and children who were not yet married, but living in the households. Households that have,

at least, two adults generally have greater opportunities to avoid poverty compared to households with one adult as the second one on average, will add more to potential income than to needs (Cancian & Reed, 2008). Those married or living together may actually accrue some benefits through the marriage or relationship, although the implications of living together for exclusively poverty measures as well as for actual economic gains and well-being are complex and may, in a way, compromise the economic status of the bread winner in that relationship.



N = 410

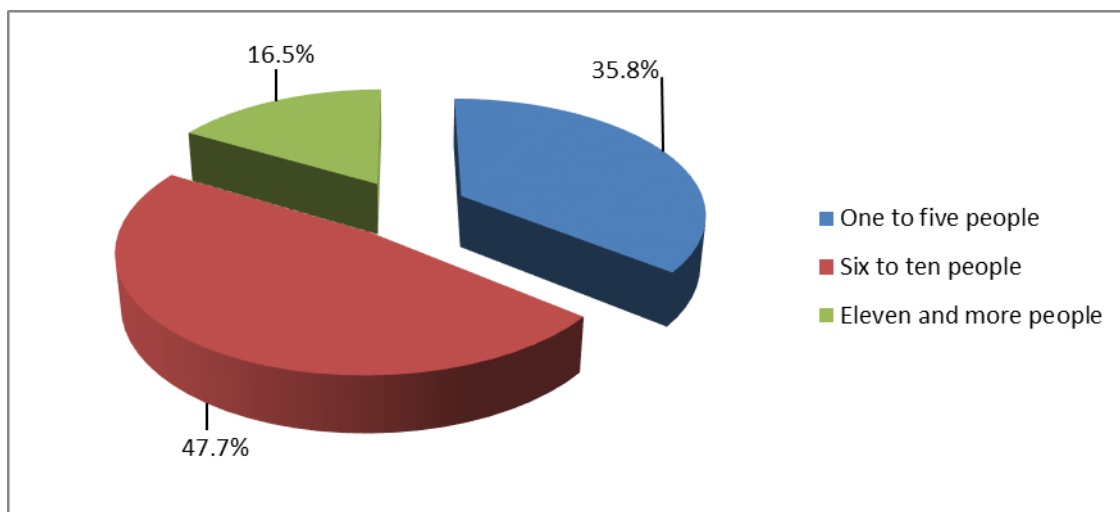
Figure 5.9: Marital status of the respondents to the questionnaire of the survey

5.3.1.4 Number of people living in a household

Throughout this thesis, the author refers to a household as an entity that comprises either one person living alone or a group of people, who may or may not be related, living (or staying temporarily) at the same address, with common housekeeping, who either share at least one meal a day or share common living accommodation (that is, a living room or sitting room). Figure 5.10 shows that most of the households had, at least, 6-10 people living in the household (47.7%; n=196) as compared to those households having 1-5 people (35.8%; n=147) and those with 11 and more people (16.5%; n=68). This finding is not surprising as it is a reflection of typical Swazi families, which normally have large numbers of people due to several factors. These include extended family relationships and people taking over the

responsibility of looking after their grandchildren who are left under their custody by their children who have migrated to urban areas or neighbouring countries in search for jobs and/or orphaned children after the death of the parents due to HIV and AIDS or other causes (Zwane, 2016).

The average household size in the study area was seven people which correlates fairly well with the average regional household sizes (of 6, 4.9, 7.0, 5.0, and 5.2 people) in similar rural areas in Swaziland, South Africa, Zimbabwe, Namibia and other developing countries around the world respectively (Bongaarts, 2001; Hlongwana, Mabaso, Kunene, Govender & Maharaj, 2009; Ngorima, 2006; Oldewage-Theron, Dicks, & Napier, 2006; Katjujanjo, Titus, Zauana, & Boerma, 1993). Given the rural and poverty stricken nature of the study area, this is a large household size for a typical poor rural household head to cater for. When the number of people in a household is large, the demands for resources are also higher and this has a positive influence on a household wanting to earn an extra income from natural capital and harvesting marula during the marula season is one readily available option. In the absence of other livelihood assets, such households find themselves in a vulnerable state and will tend to harvest much more natural resources such as marula as compared to households with less number of people (Bennette, 2010; Botkin & Keller, 2012; Tibesigwa *et al.* 2014; Casse *et al.*, 2004; Hunter, Twine & Patterson, 2007).



N=411

Figure 5.10: Household sizes of the respondents to the questionnaire of the survey

It can, therefore, be speculated that the larger the number of people living in a household, the more likely they are inclined to supplement their income through harvesting and selling marula. This is in line with findings of a study in Kenya by Mwema *et al.* (2013) where household size was found to be positively associated with the decision to participate in the trade of indigenous fruits. According to Mwema *et al.* (2013: p.9), “an additional one member into the family increased the odds of the household harvesting indigenous fruits for trade”. In this context, it is very likely that a household would seek other income generating activities to boost income and harvesting of marula fruits is one of those readily available alternative livelihood assets. Household size is, therefore, an important factor in marula resource harvesting and sustainability.

5.3.1.5 Level of education of the study population

Table 5.8 shows the distribution of the educational level amongst the study population. It shows that 21.2% (n=87) of the respondents never attended school, while 19.3% (n=79) did not complete primary school and 9.5% (n=39) completed primary school. Furthermore, the findings reveal that 21% (n=86) did not complete secondary school, while 15.5% (n=64) completed secondary school, 6.3% (n=26) did not complete tertiary education, and only 7.1% (n=29) completed tertiary education and above.

Table 5.8: Education level of the respondents to the questionnaire of the survey

Level of Education	N	%
Never attended school	87	21.2
Did not complete primary school	79	19.3
Completed primary school	39	9.5
Did not complete secondary school	86	21
Completed secondary school	64	15.5
Did not complete tertiary education	26	6.3
Completed tertiary education and above (degree or diploma or higher certificate)	29	7.1
Total	410	100

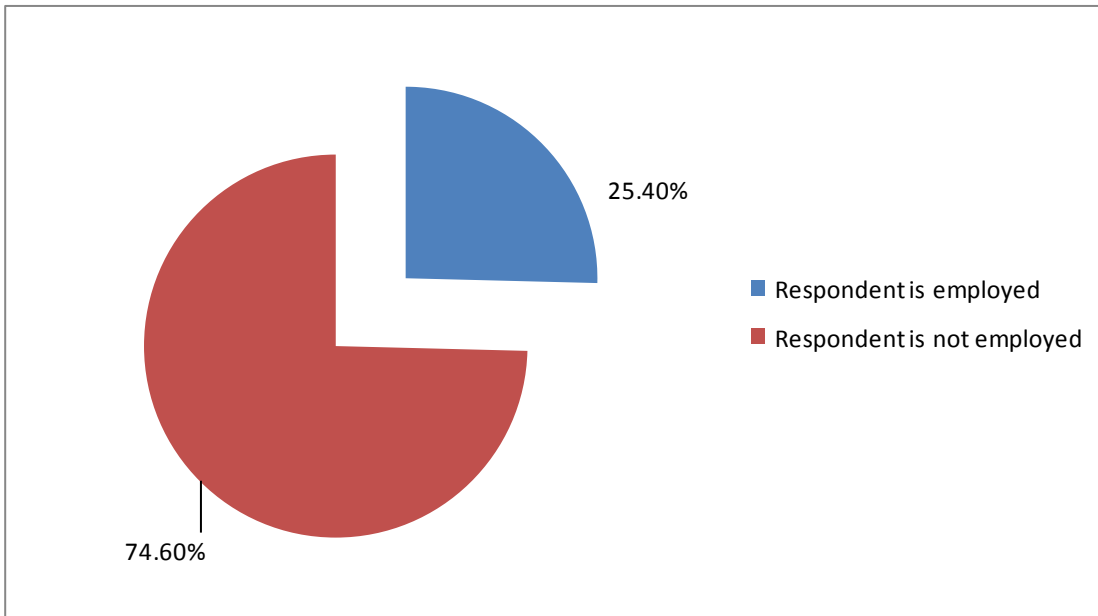
The majority of respondents, therefore, have very low levels of education and are not able to secure any formal employment, thus rendering them economically vulnerable. Education has been found by various studies to be a significant negative determinant of extraction of indigenous fruits and other non-timber forest products for either food or income generation (Adhikari, Di Falcon & Lovett, 2004; Gunatilake, 1998; Coulibaly-Lingani, Tigabu, Savadogo, Oden & Ouadba, 2009). The more one is educated, the more the options of income generation one will have, and thus the less one is inclined to resort to harvesting natural resources, such as marula for purposes of income generation.

Illiteracy is strongly linked with unemployment and poverty, which in turn are in an intricate linkage to ecosystems services (Dovie, *et al.*, 2002; WWF, 2004). People with a low education level tend to earn their living through harvesting natural resources, donations or gifts and/or dependency on subsistence agricultural practices (Morrisroe, 2014; United Nations, 2004; UNEP & IISD, 2004). Unfortunately, excessive dependency on harvesting natural resources has a strong link with resource depletion and environmental degradation (Harper, 2012; Maynards, James, & Davidson, 2010). This, in turn, has a negative synergistic impact on natural capital, such as marula and soil, thus pushing the rural poor more and more into a state of poverty and vulnerability.

5.3.2 Socio-economic data

5.3.2.1 Employment status among the study population

To determine the employment status of the respondents, school-going children and people who were already pensioned were excluded from the analysis, thus bringing the total number of respondents on this item to 331. Figure 5.11 shows that the study population was composed mainly of individuals who are not employed (74.6%; n=247) with only a minority (25.4%; n=84) being employed. Individuals who are employed are busy and already have a source of income, which means that they are less likely to engage in harvesting marula fruits for sale. In a study conducted by Belaya & Hanf (2011) in Russia, it was found that 56% of the sample were employed and did not engage in harvesting indigenous fruits for sale, which seems to agree fairly well with the findings of this study.

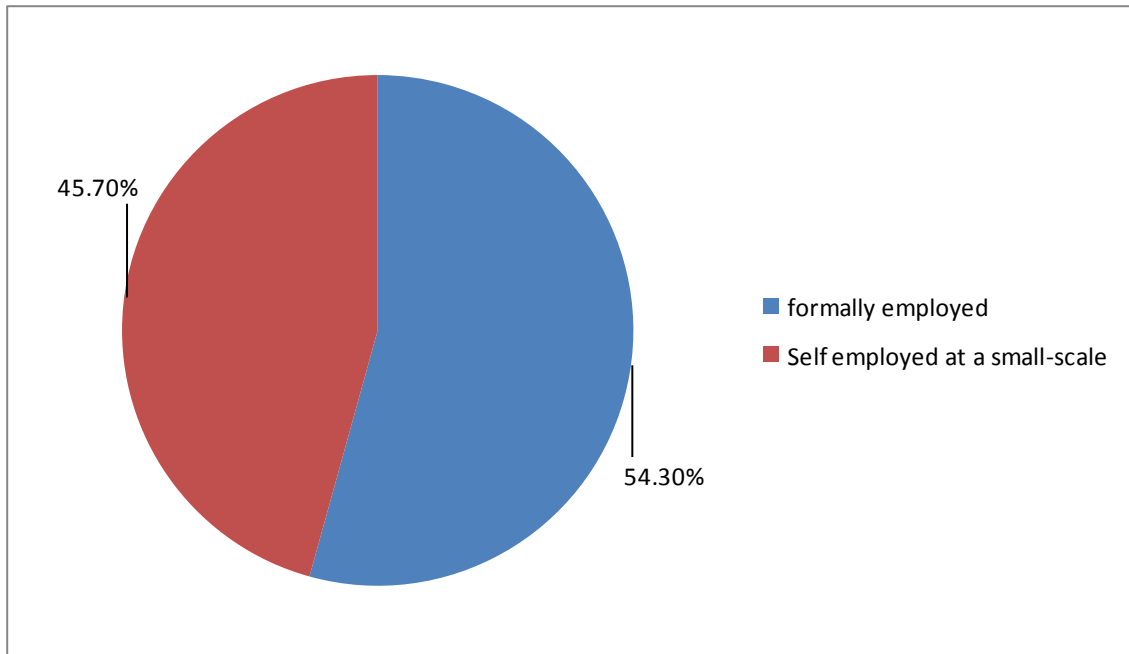


N=331

Figure 5.11: Employment status of the respondents

On further interrogation, it transpired that, for those who indicated that they were employed (Figure 5.12), a good proportion (54.3%; n=46) were formally employed and the rest 45.7% (n=38) were self-employed at small-scale levels. Those formally employed mentioned the following occupations in which they were engaged: government employee, teacher, engineer, police officer, school secretary, electrician, school cook, warder, part-time sugar cane cutter, security guard, doing part-time labour within the community, and cashier in the nearby town of Siteki.

The proportion that was self-employed mentioned the following occupations: barber, local beer brewer, dress maker, carpenter, handicraft maker, seller of snacks and other items in the market, and taxi owner. This finding indicates that the respondents were mainly low-income earners. This is in agreement with Mwema *et al.* (2013) who also found a very low likelihood of high and middle income earners (29% and 22%, respectively) out of the 120 households participating in trade of indigenous fruits in Kenya. The low-income earners take up trade in indigenous fruits as a coping strategy to provide not only food, but the much-needed income to purchase household items and cater for other several needs, such as paying for school fees.



N=84

Figure 5.12: Occupation of the employed respondents to the questionnaire

The unemployed respondents indicated other sources of income as presented in Table 5.9. The majority (73.2%; n=255) depended on subsistence crop production, while (36.6%; n=127) relied, to a very low level, on rearing animals/breeding cattle, goats and chickens. Others sourced income from selling marula (50.4%; n=173), harvesting and selling other wild fruits and seeds except marula (54%; n=54). Some (12.4%; n=37) relied on other sources, such as collecting Mopani worms, wild fruits (for example wild berries and guava) and wild vegetables [like *Amaranthus (umbidvo)*, Black Jack (*Imbuya*) and okra (*ligusha*)], and being housewives who depend on their husband's income.

The finding of this study indicates that unemployed respondents mainly relied on subsistence crop production, animal rearing, and natural capital for sustaining their livelihoods. In some situations, as observed by Campbell *et al.* (2002) as well as Shackleton and Shackleton (2004), in the dry woodlands of southern Africa, the trade in natural products may be one of the few accessible local income-generating options available to the rural poor, and to women in particular. The finding in the current study agrees fairly well with that of Bwalya (2011) who found subsistence agriculture to be a major occupation for over 90% of the 279 households interviewed in Lukangaba and Mwewa forest reserves in

Zambia who grew crops in their village gardens or small farms as a means of livelihood. In line with the findings of this study, Ngorima (2006) observed 100% of households in his study in Zimbabwe as being engaged in other activities, such as crop production, animal rearing and harvesting of non-timber forest products. The finding of this study on marula harvesting also reflects the poverty-stricken nature of the study population and the imminent dependency on natural capital, such as marula harvesting, for household income generation and for sustaining their livelihoods.

Table 5.9: Sources of livelihood in the study area

Source of income	Yes		No		Total	
	N	%	N	%	N	%
Subsistence crop production	255	73.2	94	23.8	349	100
Rearing animals/breeding cattle, goats and chickens	127	36.6	219	63.4	346	100
Harvesting and selling marula	173	50.4	171	49.6	344	100
Harvesting and selling other wild fruits and seeds (except marula)	54	16	285	84	339	100
Other (such as collecting Mopani worms, wild vegetables)	37	12.4	261	87.6	298	100

Furthermore, the findings of this study agree quite well with those from a study by Shackleton and Shackleton (2002) in the Bushbuckridge area that approximately one quarter of households across all villages were owning cattle and/or goats. Farming was reported as one strong livelihood coping strategy within a diverse livelihood base with the cash earned from the sale of agricultural goods serving as one source of supplementary income in times of need.

The annual crops mainly grown were maize, beans, vegetables (such as spinach, tomatoes, pumpkins and onions) and some perennial crops, such as oranges, sugarcane, indigenous mangoes, guavas and pawpaw. These findings are fairly consistent with those from other studies, for example one by Shackleton and Shackleton (2002) and another by Shackleton, Dzerefos, Shackleton and Mathabela (2000) where they reported that an average of 50% of

the households interviewed possessed fields and most were cultivating the fields on a regular basis for crop production. It is clear from the findings in Table 5.9 that marula harvesting features as an important source of income in the study area.

The finding shown in Table 5.9 also shows that, the unemployed respondents earned their living through subsistence crop farming and/or animal rearing. Hence, during the marula season, the majority of the people in the area view it as an opportunity to harvest and make an extra income to cater for the multiple needs that the households face, ranging from payment of school fees to buying of medicines and food. This finding indicates that during the marula season, the harvesting, processing and selling of marula products certainly offers an opportunity that is widely viewed as an available option to generate cash income by the rural dwellers in the study area. Thus, they view marula as a means to cope with economic hardship.

The respondents who were employed were asked to indicate whether they earned an extra income for their households from other sources. The findings in Figure 5.13 show that the majority of the respondents (63%; n=53) indicated that they did not earn an extra income for their households from other sources. Only a small percentage (37%; n=31) indicated that they did so. On further interrogation, it was revealed that they earn this income from harvesting and selling wild fruits (including marula) and selling some domestic animals when need arises.

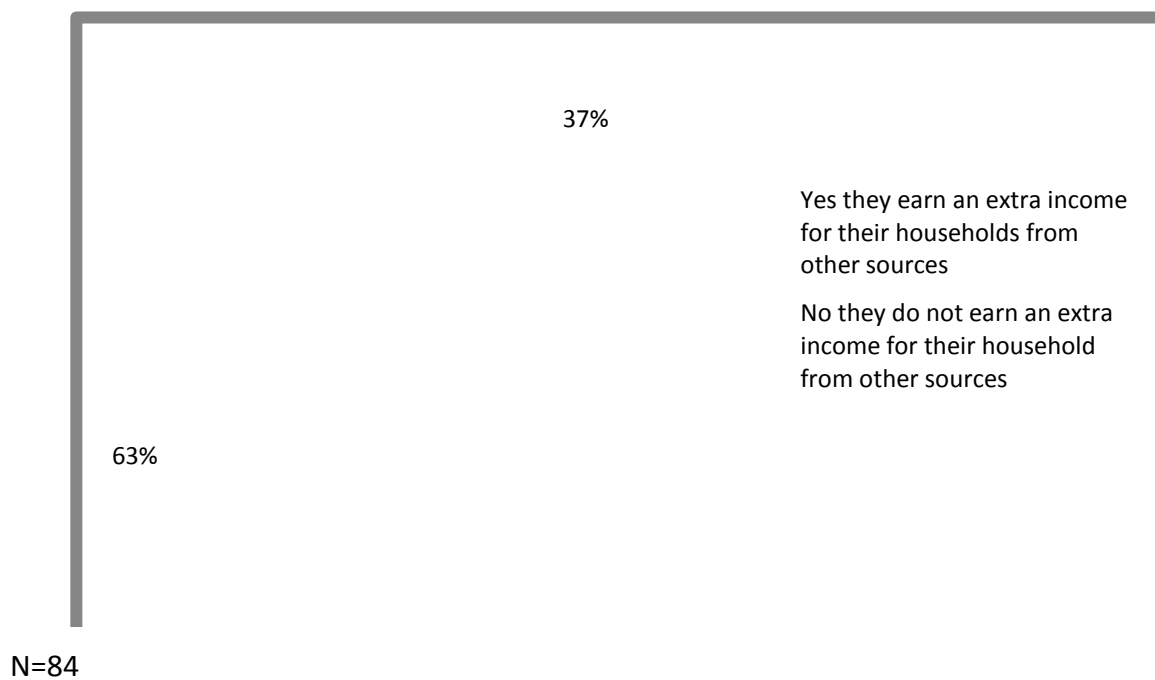
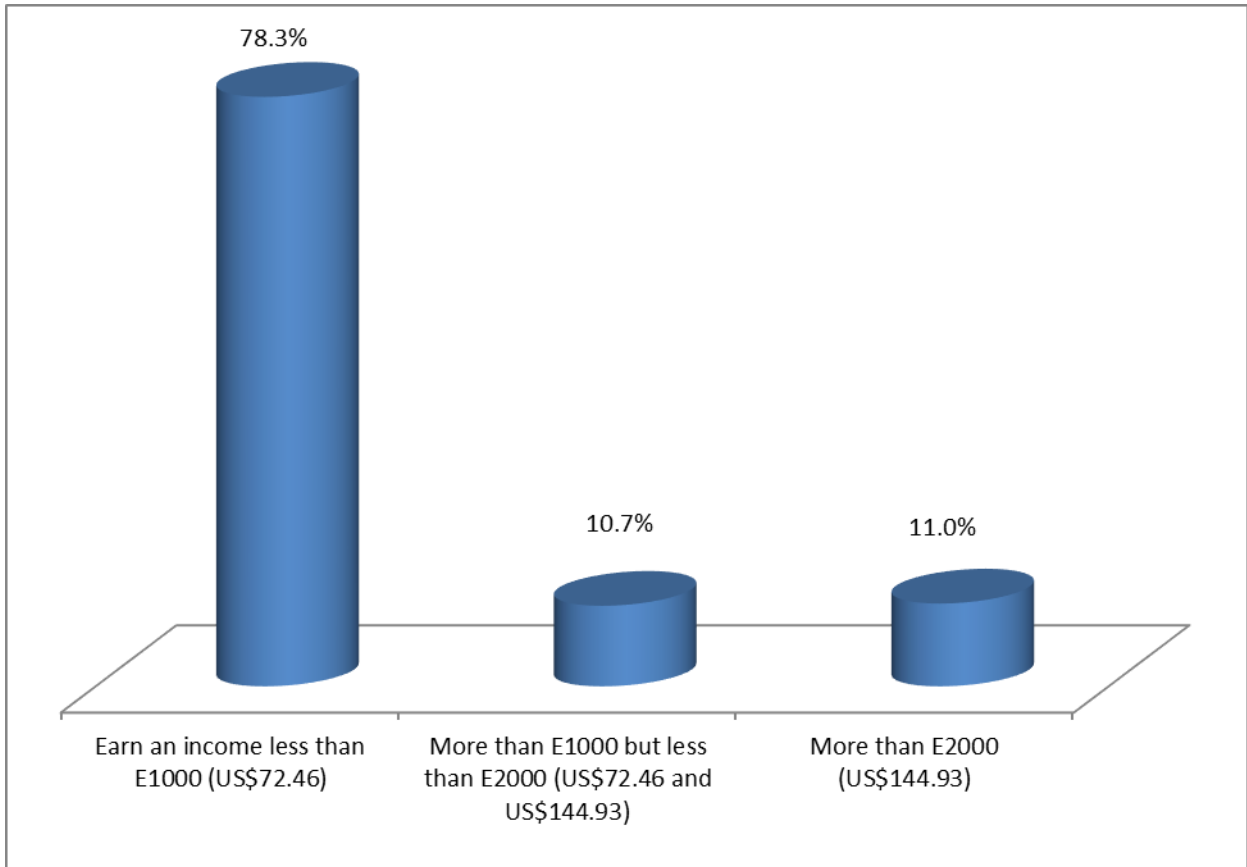


Figure 5.13: Whether the employed respondents earn an extra income from other sources

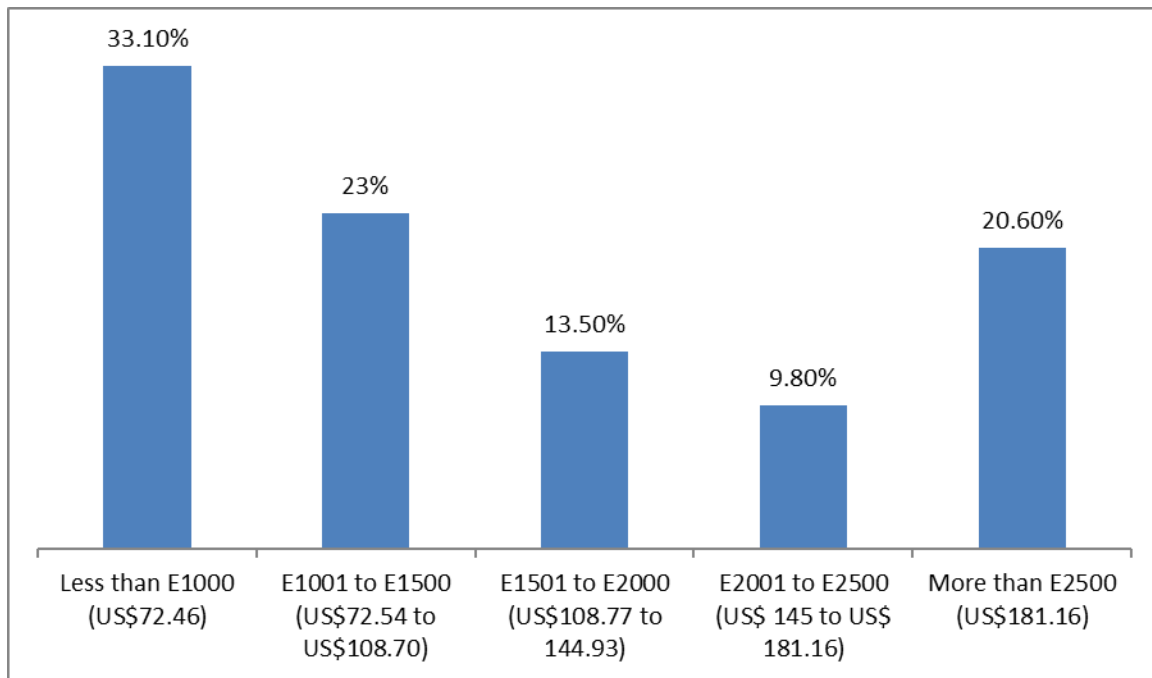
The monthly income of the respondents was used to assess their economic status. Excluding the scholars, Figure 5.14 shows that the majority of the respondents (78.3%; n=309) earned a monthly income of less than E1000 (US\$ 72.46). However, only 10.7% (n=42) of the respondents earned between E1000 and E2000 (US\$ 72.46 and 144.93) and only 11% (n=43) earned a monthly income of more than E2000. This finding reflects the poverty-stricken nature of the people in the study area as the majority earned a meagre monthly income and, thus, grabbed the marula season as an opportunity for earning an extra income to meet household needs.



N=394

Figure 5.14: Personal monthly income of the respondents

Respondents were asked to indicate their total monthly household income in order to gauge the economic status of their households. Figure 5.15 shows that 33.1% (n=125) of the respondents earned a total monthly household income of less than E1000 (US\$72.46) and 23% (n=87) earned a total monthly income of between E1001 and E1500 (US\$72.54 and US\$108.70). Furthermore, 13.5% (n=51) of the households earned a total monthly income of E1501 to E2000 (US\$108.77 to US\$144.93), while 9.8% (n=37) earned E2001 to E2500 (US\$145 to US\$181.16) and 20.6% (n=78) earned more than E2500 (US\$181.16). This indicates that most of the households receive a very little income per month and, therefore, would grab any available opportunity to generate an extra income and marula is one of the readily available sources.

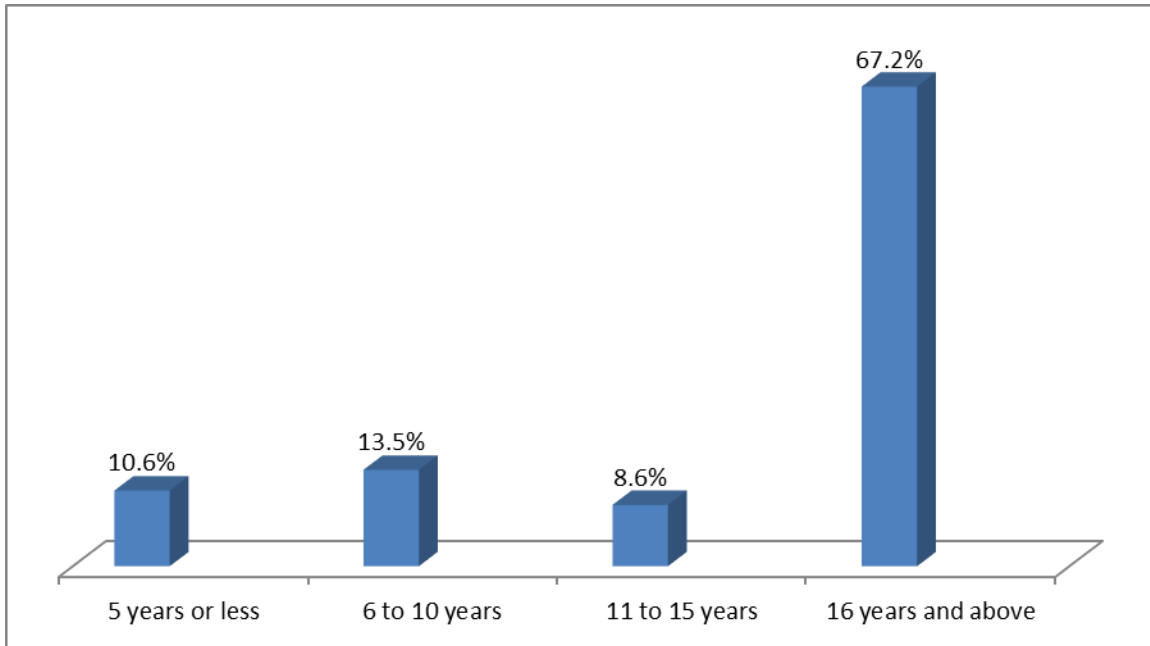


N=378

Figure 5.15: Total monthly income for the household of the respondents

5.3.2.2 Residence period in the area

The respondents were asked to indicate the length of time they have been residing in the study area. Figure 5.16 shows that the majority of the respondents have lived in the area for a very long time. Out of the 405 respondents, 67.2% (n=272) indicated that they had lived in the area for 16 years or more, while 8.6% (n=35) had lived for 11 to 15 years, 13.5% (n=55) lived for between 6 to 10 years, and 10.6% (n=43) for five years or less. These findings show that all the respondents were residents of the study area and, computing from Figure 5.15; three quarters (8.6% + 67.2%) of them have lived in the area for more than 10 years. A fairly similar case was observed by Ngorima (2006) where 88% of the households that participated in his study were residents of the area. It was reported that most of the respondents in this study lived in the area since birth; although in some situations (women in particular) respondents indicated that they came to the study area after getting married to men from the area.



N=405

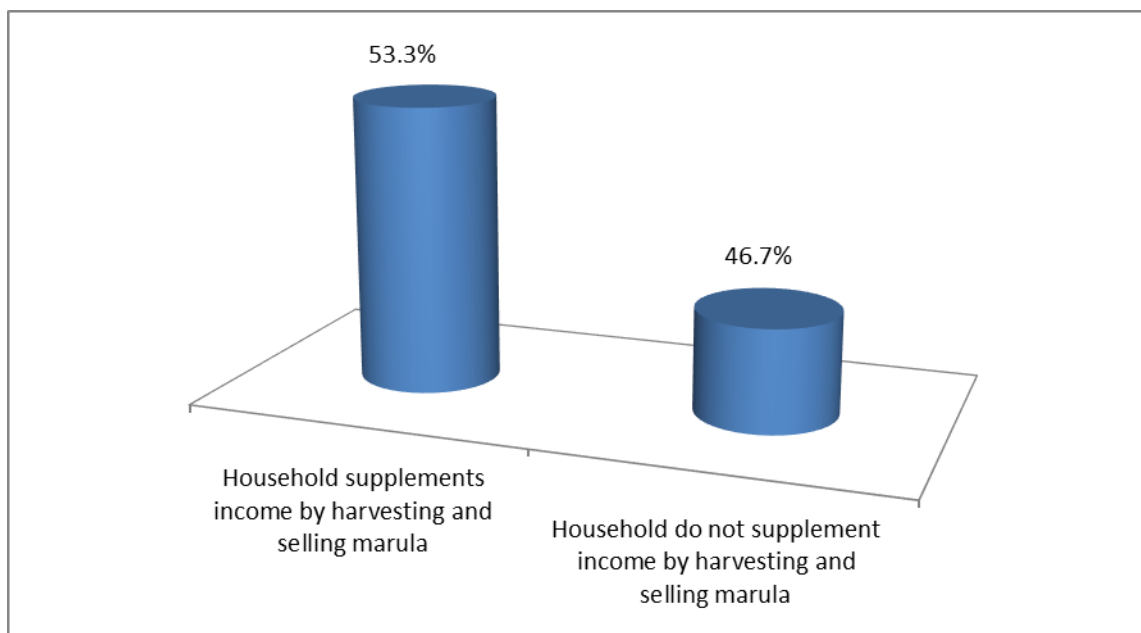
Figure 5.16: Length of time the respondents resided in the study area

The number of years the people have lived in an area enable them to have a better understanding of the environment in which they live and with which they interact. This was very useful in enabling the researcher to gauge the perception of the respondents about the availability or scarcity of marula in the study area. The average time spent by the respondents in the study area was computed as 23 years. This is contrary to a 40-year average time period spent by respondents as found in a study conducted in Namibia by Den Adel (2002) on marula harvesting. In general, the majority of respondents in this study have lived in the study area long enough to have a better perception of whether or not marula trees and their products were getting scarce/depleted.

5.3.2.3 Participation of respondents in marula harvesting for supplementing household income

Respondents were asked to indicate whether they supplemented their household income by harvesting marula. The findings, as revealed in Figure 5.17, show that 53.3% (n=219) of the respondents supplemented their household income by harvesting and selling marula and 46.7% (n=192) did not. This indicates that a substantial proportion of households in the study area depend on marula as a source of income. These findings echo those by Ngorima

(2006) who found that all the households that participated in his study on marula sustainability in Zimbabwe collected marula fruits for several uses, but mainly for income generation and use in brewing *Mukumbi* brew (an equivalent of *Buganu* in Swaziland). These findings emphasize the importance of marula to the community in Mpolonjeni constituency such that the scarcity/depletion of marula could eliminate a fundamental source of income to the households of the poor members of the community. This could significantly affect the livelihoods options of the poor households that heavily depend on marula.



N=411

Figure 5.17: Households that supplement their income by harvesting and selling marula

Studies have shown that deepening poverty is a major force that leads people to degrade the environment and overexploit natural resources in an unsustainable manner to the extent of depletion and extinction (Campbell *et al.*, 1997; Cunningham, Cunningham & Saigo, 2005; Harper, 2012). As a poverty-stricken area, a good number of households depend on the ecosystems around them for livelihood options. The majority of people in the study area use the earnings from marula to cater for many needs, including purchasing of electricity, medicines, and food, and paying school fees. The depletion of marula could, therefore, adversely affect their households' income base and exacerbate poverty in the area which, in turn, will push the vulnerable households to extreme poverty.

The respondents were asked to indicate who was responsible for collecting marula in the household. According to the findings in Table 5.10, marula is mainly collected by the respondents (47.2%; n=137) and children within the household (46.9%; n=136). Other members of the household did participate in marula collection but at a very low level and only 1% (n=3) of the fathers in the households were found to participate in marula harvesting.

Table 5.10: Person responsible for collecting the marula fruits and seeds in the household

Person responsible for collecting marula	Yes		No		Total	
	N	%	N	%	N	%
Respondent	137	47.2	153	52.8	290	100
Spouse	56	19.4	233	80.6	289	100
Children in the household	136	46.9	154	53.1	290	100
Mother	46	15.9	244	84.1	290	100
Father	3	1.0	288	99.0	291	100
Grand Parent(s)	11	3.8	280	96.2	291	100
All members in the household	35	12	254	88.0	292	100

On further discussion with the respondents, who indicated that the children in the household were responsible for collecting marula, it transpired that the children help in the collection process as the heads of household go about doing other chores in the household or in the fields. This finding seems to be in agreement with that of Mwema *et al.* (2013) in Kenya that wild fruits were mainly collected by children and attributed this to the fact that children play a role in assisting their parents in collecting and selling of the fruits in the market. Another reason given by the respondents was that they encouraged the children to collect marula so that they can sell their products to earn an income that can be used for paying the children's school fees and buying other items, such as school uniforms, stationery, medicines and food.

5.3.2.4 Use of marula and its products by households in the study area

Respondents were asked to indicate their households' use for marula and its products. The findings are summarised in Table 5.11. The majority (76.4%; n=216) of the respondents indicated that households used marula for brewing *buganu*, and as a source of food (67.5%; n=191) and for sale as kernels (51.9%; n=147) to earn an extra income. The findings concur with observations by Marula Natural Products (2012) and Mabaya *et al.* (2014) who have highlighted different uses of marula. The respondents also indicated that they use marula for medicinal purposes (12.5%; n=35) which is also in agreement with several authors (Duke, 1989; Elijah *et al.*, 2012; Hal, 2013; Hall, 2002; Hall *et al.*, 2000; Lombard *et al.*, 2000; Mawoza *et al.*, 2010; Shone, 1979; Shackleton *et al.*, 2001).

Table 5.11: Uses of marula amongst the respondents in the study area

Use of marula	Yes		No		Total	
	N	%	N	%	N	%
Carving	24	8.6	256	91.4	280	100
Brewing <i>buganu</i>	216	76.4	66	23.6	282	100
Selling kernels	147	51.9	136	48.1	283	100
Medicinal purposes	35	12.5	245	87.5	280	100
Animal fodder	28	10	251	90	279	100
Fencing	6	2.1	274	97.9	280	100
Cultural practices	70	24.8	212	75.2	282	100
Spiritual practices	34	12.2	244	87.8	278	100
For food	191	67.5	92	32.5	283	100
Kernel oil for cooking and body care	65	23.5	212	76.5	277	100
Other (the stones and green seeds are used for playing games such <i>Sintjuba, inketo</i>)	3	1.5	203	98.5	206	100

Furthermore, the findings also show that marula is being used for carving artefacts, as animal fodder, for fencing around the homesteads, for cultural practices (especially the *Buganu Ceremony*), for spiritual purposes including its use in chasing away Gremlins

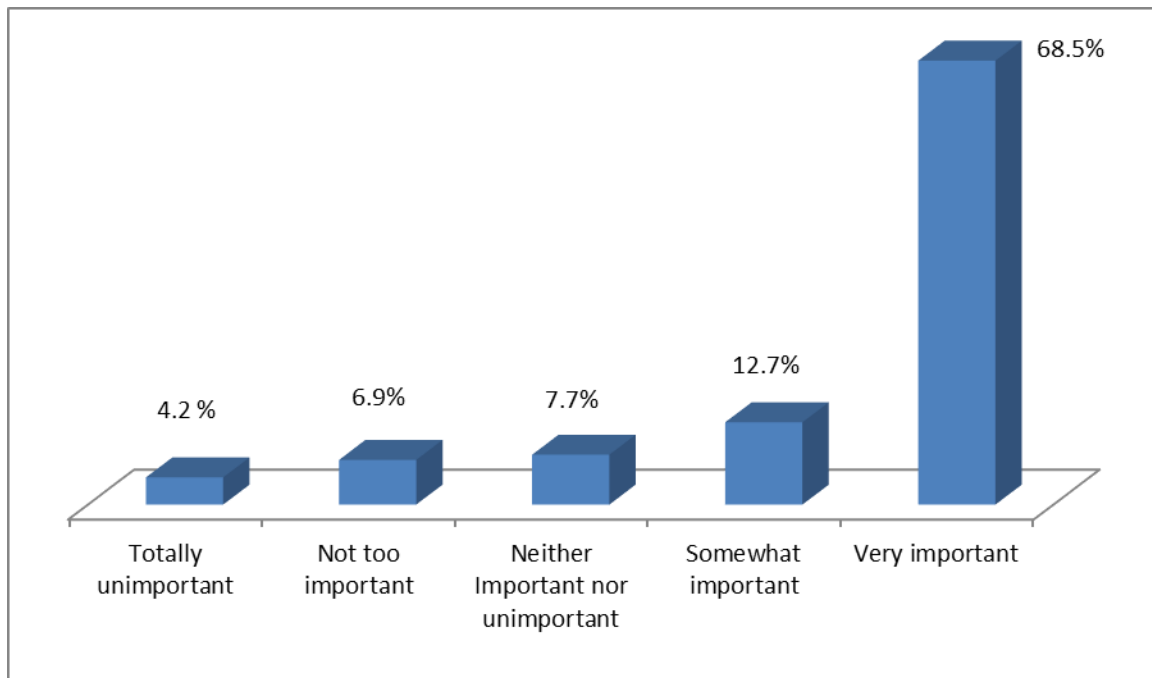
(*tokolosi*), for divination, and for “washing away” evil spirits. These findings agree quite well with those of Nwongwu (2006) and O'Brien (2005) who reported similar uses of marula.

Another use of marula was for playing games, such as *intjuba* and *inketo*. These findings were also cited by Nwongwu (2006), Palmer and Pitman (1972), Shackleton and Shackleton (2002) and also Wynberg *et al.* (2002a). The respondents also indicated that they use the marula kernel for pressing out the oil for cooking and for body care purposes (as home-made body lotion), which is in concert with other authors, such as Abdalbasit and Ibrahim (2012), Glew *et al.* (2004), Gruenwald (2006); Ojewole *et al.* (2010) and Wynberg *et al.* (2002a).

5.3.2.3 Importance of marula as a source of household income

The respondents who supplement their household income through harvesting and selling marula (see Figure 5.17) were asked to indicate if marula was indeed an important source of their household income. Out of the 219 respondents who do supplement their household incomes by harvesting marula, the findings (Figure 5.18) show that the majority of the respondents (68.5%; n=177) considered marula as a very important source of household income. Only 12.7% (n=33) viewed marula as somewhat important in augmenting their household incomes, while 7.7% (n=20) considered it as neither important nor unimportant, 6.9% (n=18) viewed it as not too important and 4.2% (n=11) regarded it to be totally unimportant.

On further interrogation, those who did not consider marula as very important or somewhat important indicated that marula produces fruits only seasonally and, therefore, they had to find other sources of income since relying only on marula would push them to the edge in as far as household income is concerned during off season. A majority of the respondents viewed marula as a very important source of household income, thereby confirming the crucial role that marula plays as a source of household income for households in the study community.



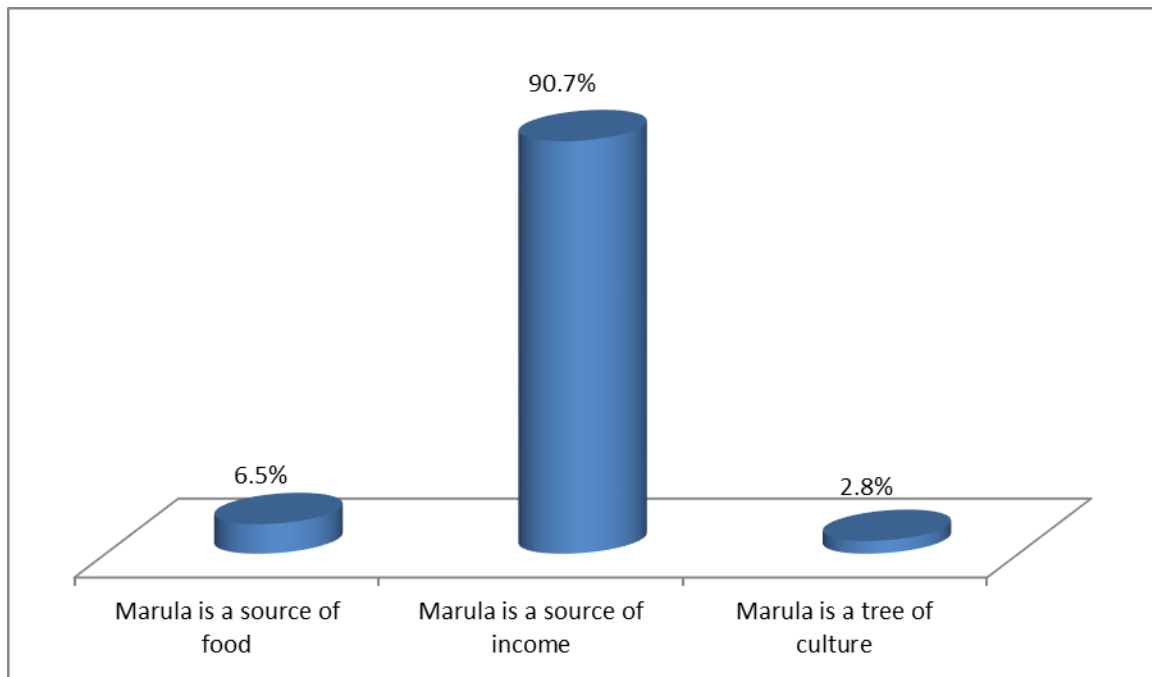
N=219

Figure 5.18: Importance of marula as a source of household income

On-site observations showed that the households of those respondents who viewed marula as a very important source of income were poverty stricken and any depletion/scarcity of marula would adversely impact on their livelihoods. Shackleton *et al.* (2000) observed similar findings where they reported the importance of marula fruits and their products featuring prominently in household income generation. These findings contextualize the importance of marula amongst the poor households in the Mpolonjeni constituency.

In general, even though the marula tree and its products will not be able to solve the challenges of poverty in the study area, they do have a key role to play in meeting a number of livelihood needs, including food, medicine, electricity, school fees for children and cash for the household. Various studies globally have left no doubt that biodiversity and natural products contribute to the well-being and, sometimes, the very survival of millions of poor rural households (Arnold, 2008; Belcher, Ruiz-Pe´rez, & Achdiawan, 2005; Fisher, 2005; Godoy, Wiljie, Overman, Cubas, Cubas, Demmer, McSweeney & Brokaw, 2000; Narendran, Murthy, Suresh, Dattaraja, Ravindranath & Sukumar, 2001; Scherr & McNeely, 2008).

Figure 5.19 shows that, out of the 210 respondents who considered marula as a very important or somewhat important source of household income, the majority (90.7%; n=190) gave the reason for importance as being a source of income for the household, while 6.5% (n=14) cited marula being a source of food and a few others (2.8%; n=6) considered marula as a tree of culture. This further confirms the important role marula harvesting and sale plays in contributing to household income in the community.



N=210

Figure 5.19: Reason why marula is important or somewhat important as a source of household income

Marula products may be harvested for subsistence purposes and/or as commodities to be offered for sale in the marketplace in raw (fruits) or processed (marula brew, kernels and oil) forms. The use and sale of marula products in the study area play an important role of gap filler or as the sole source of additional income and, therefore, providing a significant fall back option or safety net as observed by McSweeny (2004) and also Coomes, Barham and Takasaki (2004). Natural product markets have been shown to be significant in assisting rural households to realize some, if not all, of their cash requirements (Arnold and Townson, 1998; Marshall, Newton & Schreckenber, 2003; Marshall, Newton & Schreckenber, 2006; Narendran *et al.*, 2001; Ndoye, Perez & Eyebe, 2016). These natural products are,

particularly, crucial for the most marginalized and vulnerable segments of society (Beck & Nesmith, 2001; Cavendish, 2000; Reddy & Chakravarty, 1999).

Respondents were asked to indicate the areas from which they collect marula products and the findings are presented in Table 5.12. Out of 302 respondents, the majority (69.5%; n=210) said that they collected marula from their agricultural fields where they grow crops, while a minority (30.5%; n=92) said they did not. Out of the 301 respondents who responded to whether they harvested marula fruits from around the homesteads, 51.8% (n=156) agreed, while 48.2% (n=145) disagreed. Only 30% (n=88) of the respondents collected marula from the grazing areas, while 70% (n=214) did not, while 5.6% (n=17) collected marula from the Mkhaya Nature Reserve.

The findings show that marula fruits are mainly collected from around the agricultural fields, homesteads and grazing areas. They are in agreement with those of Den Adel (2002) who found, in a study in North-Central Namibia, that 78% of the 120 households interviewed collected and processed fruits in their own agricultural fields.

Table 5.12: Areas from where marula fruits and seeds are collected

Place where marula is collected	Yes		No		Total	
	%	N	%	N	N	%
Around the homestead	51.8	156	48.2	145	301	100
In the agricultural fields	69.5	210	30.5	92	302	100
In the grazing areas	30	88	70	214	302	100
In the Mkhaya Nature Reserve	5.6	17	94.4	285	302	100
In other places (mostly neighbouring chiefdoms)	1.4	4	98.6	282	286	100

Those who did collect marula from the Mkhaya Nature Reserve were people whose homesteads were adjacent to the Mkhaya Nature Reserve and or employees of the Mkhaya Nature Reserve. It should be noted, however, that the collection of marula from the Mkhaya Nature Reserve is unlawful. These findings clearly show that the most exploited areas for marula were agricultural fields, followed by areas around homesteads and then grazing

areas. This seems to pose a threat for marula sustainability in these areas as the seeds are continually removed, thus affecting the potential for regeneration.

Table 5.13 shows the amount of marula fruits, measured by using a 20-litre bucket (Image 7) collected by individual households per day and the places from where they collect the fruits.



Image 7: A 20 litre bucket full of marula fruits

Source: Picture taken by A.F. Murye 25 February 2015

Table 5.13 shows that, out of the 181 respondents who collected the marula fruits from around their homesteads: 30.4% (n=55) harvested more than two 20 litre buckets full of marula fruits per day during the marula season, while 26% (n=47) harvested two 20 litre buckets, 22.1% (n=40) harvested only one 20 litre bucket, 19.3% (n=35) harvested only half a 20 litre bucket, 2.2% (n=4) harvested smaller amounts (one full grocery plastic bag, and less than 10 litre container).

For the 209 respondents who collected marula from the agricultural fields: the majority (63.2%; n=132) of the households collected more than two 20 litre buckets full of marula fruits per day, while 19.1% (n=40) collected two 20 litre buckets, 12.4% (n=26) collected one 20 litre bucket, 2.4% (n=5) collected half a 20-litre bucket, and 2.9% (n=6) collected smaller amounts per day (1 grocery plastic bag and less than a 10-litre container).

Table 5.13: Amount and places where marula fruits and seeds are collected by the households per day

Amount of marula fruits collected per day	Areas where marula is collected				
	Around the homestead	In the agricultural fields	In the grazing areas	In the Mkhaya Nature Reserve	Other (all the areas, nearby villages, neighbours)
Half a 20-litre bucket	19.3%	2.4%	17.2%	26.0%	18.4%
One 20 litre bucket	22.1%	12.4%	23.3%	12.0%	5.3%
Two 20 litre buckets	26.0%	19.1%	14.7%	22.0%	26.3%
More than two 20 litre buckets	30.4%	63.2%	40.5%	20.0%	13.2%
Other (1 grocery plastic bag, less than 10 litre containers)	2.2%	2.9%	4.3%	20.0%	36.8%
Total	100%(n=181)	100%(n=209)	100%(n=295)	100%(n=50)	100%(n=38)

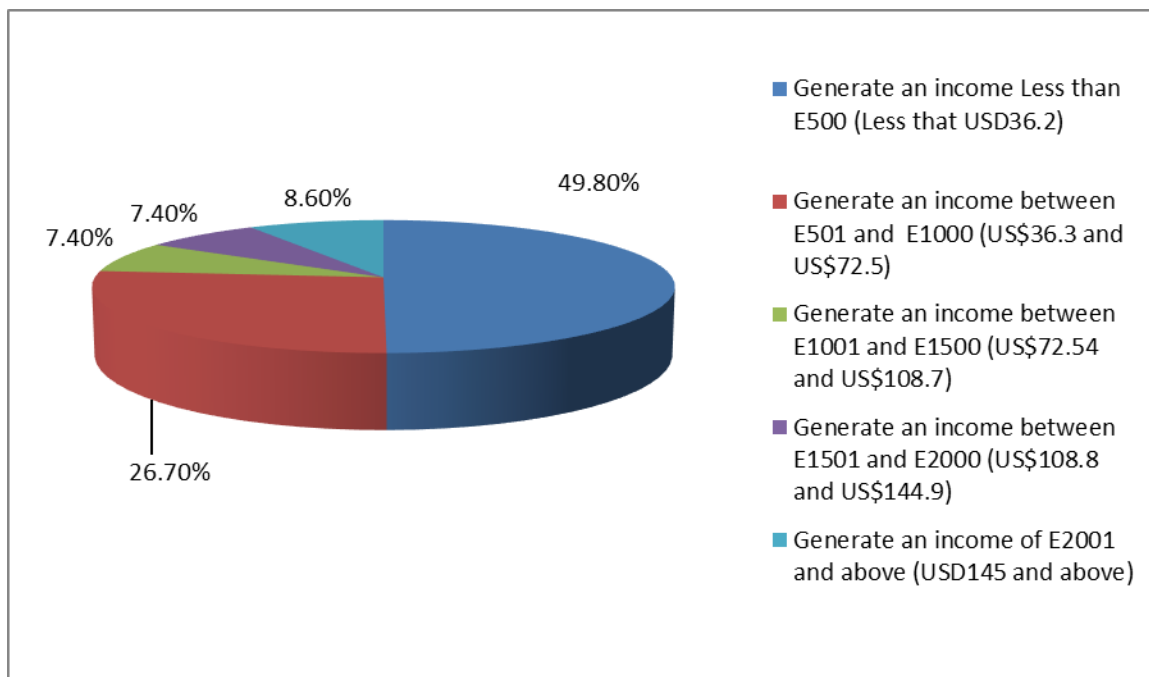
Out of the 295 respondents who collected marula from the grazing areas: 40.5% (n=120) collected more than two 20 litre buckets full of marula fruits a day, 23.3% (n=68) collected one bucket, 17.2% (n=51) collected one half of a 20-litre bucket, 14.7% (n=43) collected two 20 litre buckets, and 4.3% (n=13) collected smaller amounts. These amounts collected are double what were reported in two other studies by McHardy (2002) and Den Adel (2002) where, on average, each household was gathering a 10-litre bucket full of marula fruits per day from the grazing areas over a period of 50 days during the marula season. A small proportion of the respondents indicated that they harvest marula from the Mkhaya Nature Reserve. Out of the 50 respondents, while 26% (n=13) harvested a half of a 20-litre bucket

of marula fruits, 22% (n=11) collected two 20 litre buckets, 20% (n=10) harvested more than two 20 litre buckets, 20% (n=10) harvested smaller amounts and 12% (n=6) collected one litre.

Only 38 of the respondents collected marula from other places, such as from neighbouring villages. Out of these, 36.8% (n=14) collected smaller amounts of marula fruits, 26.3% (n=10) collected two 20 litre buckets, 18.4% (n=7) collected a half of a 20-litre bucket, 13.2% (n= 4) collected more than two 20 litre buckets and 5.3% (n=2) collected one 20 litre bucket. These amounts collected from the different areas were then processed and sold.

Figure 5.20 shows the total income earned by the households that supplement their income through harvesting and selling marula. It reveals that almost half of the respondents (49.8%; n=109) generated an income of less than less than E500 (US\$36.2) per season (from January to March) from marula harvesting, while 26.7% (n=59) generated an income of between E501 and E1000 (US\$36.3 and US\$72.5). The findings also show that 7.4% (n=16) indicated that they generated an income of between E1001 and E1500 (US\$72.54 and US\$108.7) while 7.4% (n=16) generated an income of between E1501 to E2000 (US\$108.8 and US\$144.9) and 8.6% (n=19) indicated that they generated an income of E2001 and above (US\$145 and above). These findings are in agreement with Shackleton *et al.* (2000) who found that households accrued earnings from marula ranging from US\$ 87 to 149 per season.

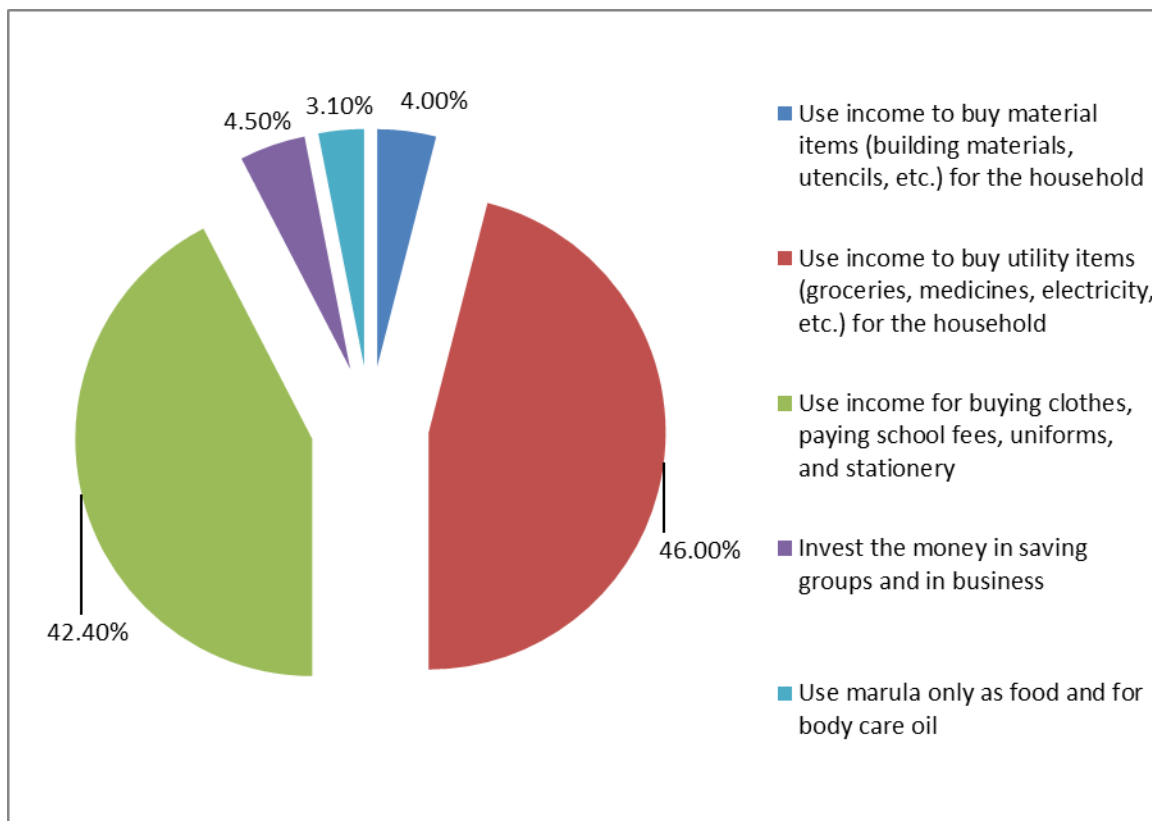
In further agreement with these findings, Shackleton and Shackleton (2004) reported that women in Bushbuckridge, South Africa, trading in marula products, earned an average income of E500 (US\$ 36.23) per season. The importance of marula in household income generation has also been highlighted by Mokgolodi *et al.* (2011), who have emphasized the important role the marula tree plays in the lives of tens of thousands of rural producers, their families and communities in southern Africa. The findings of this study agree well with the report by Mokgolodi *et al.* (2011) that indicated that women were extracting marula in Namibia for personal use or to sell locally and that, by 2010; some 2000 women were accruing over US\$ 60,000 annually from marula.



N=219

Figure 5.20: Total income generated by households from harvesting and selling marula per season

The findings presented in Figure 5.21 show that the respondents generate varying amounts of income from marula harvesting, thus underscoring the important role that marula plays in contributing to household income. Much as the income might look small, the value attached to it is great as demonstrated by the different uses of the income the households derive from harvesting marula.



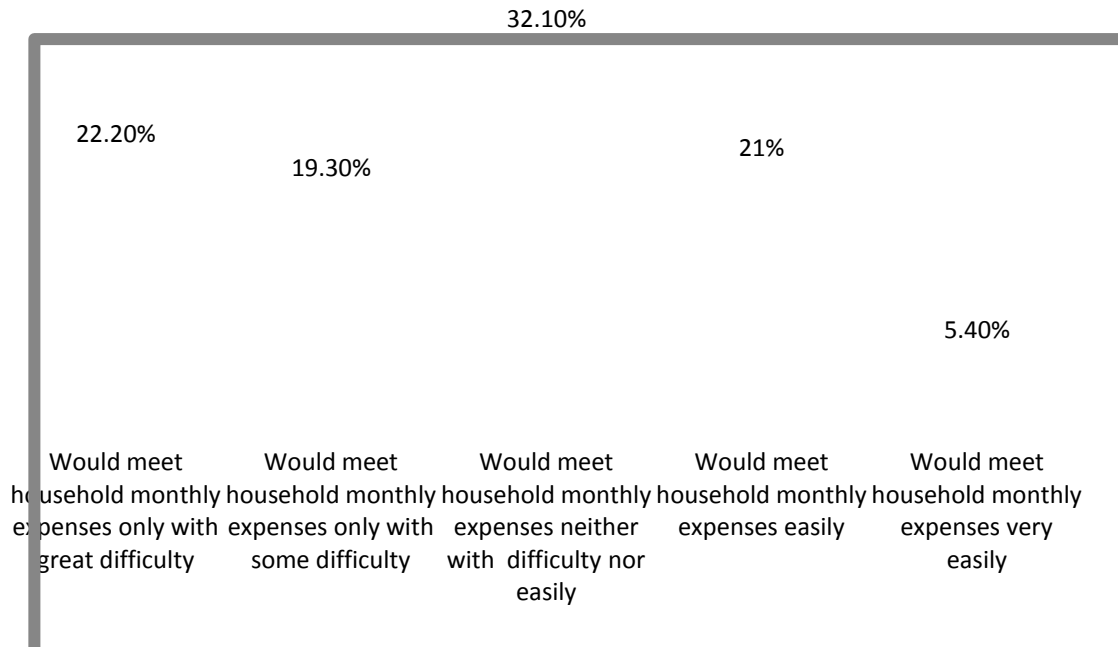
N=224

Figure 5.21: Use of the income earned from harvesting and selling marula by households

With regard to the uses of the income earned by households in the study area from selling marula, out of the 224 respondents who studied, a substantial proportion (46%; n=103) indicated that they use the income for buying essential consumable items, such as groceries, medicines and electricity for the household. However, 42.4% (n=95) indicated that they use the income for buying stationery, clothes and uniforms for their children, and paying school fees, while 4.5% (n=10) indicated that they invested the money earned in some local saving groups and in small-scale businesses. Others (4%; n=9) said that they use the income for buying material things, including building materials and utensils for the household use and only 3.1% (n=7) of the respondents indicated that they do not harvest marula for sale but only for household consumption as food and locally making body care products (pressing out the oil at home) for private use. Thus, the findings show that most of the income earned from marula harvesting is used for buying utility products such as groceries, medicines, electricity; and buying clothes, paying school fees, and buying school uniforms and stationery.

These incomes, though relatively low and highly seasonal, constitute a crucial injection of cash at a time of the year when households often experience shortages of cash after the Christmas season; especially when schools open and school fees, uniforms and stationary are needed for school going children. This is a similar finding to that of Mabaya *et al.* (2014) as well as Shackleton and Shackleton (2002) who reported that hundreds of local rural people in Botswana and South Africa, primarily women, harvested marula fruits and used the income to pay for healthcare, school uniforms and fees and improving their buildings. Similar findings were also observed by Wynberg *et al.* (2002a) in South Africa and Namibia where they reported that, although not a large amount, the timing of the marula season at the beginning of the school year makes the extra income extremely important for payment of school fees, clothing, and the purchase of food and household goods, particularly in areas with high levels of poverty.

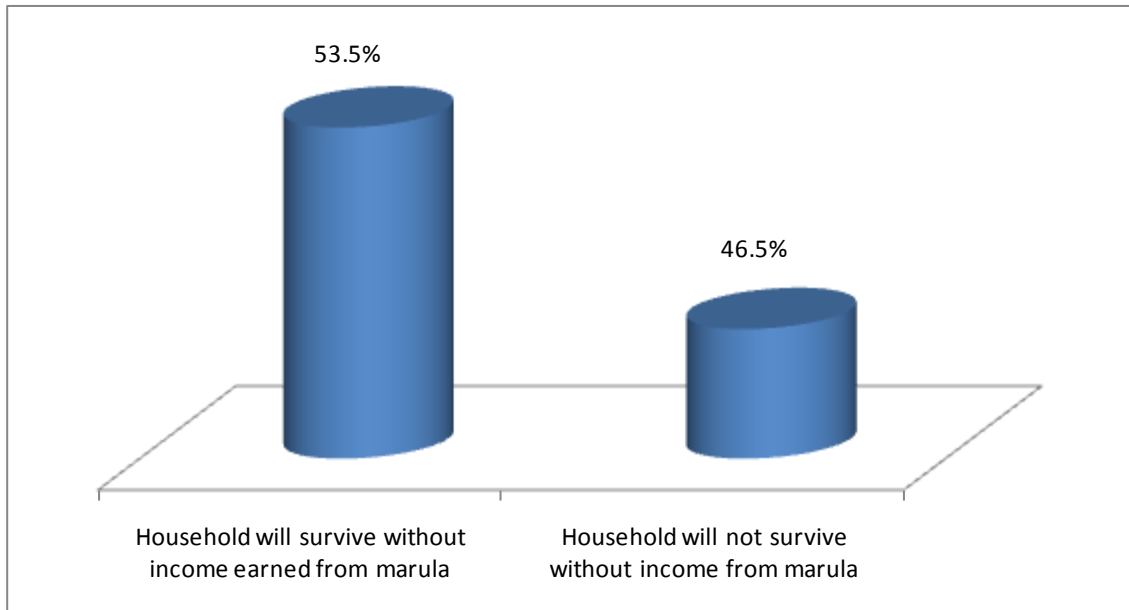
Respondents were asked to indicate whether their households can meet their monthly expenses on the total income that the households make per month. Figure 5.22 shows that 22.2% (n=90) of the households indicated that they would meet their monthly expenses only with great difficulty, while 19.3% (n=78) indicated that they would do so with some difficulty and 32.1% (n=130) indicated that they would do so neither with difficulty nor easily. However, 21% (n=85) indicated that they would meet their monthly expenses easily and 5.4% (n=22) said they would meet their monthly expenses very easily. The inference here is that the majority of households would suffer as they would have lost an incredible source of income when marula gets scarce/depleted.



N=405

Figure 5.22: Whether household would meet their monthly expenses without the supplementary income from marula harvesting and selling

Respondents were asked whether their household would survive without the supplementary income generated from marula harvesting and selling. Out of the 376 respondents studied, the findings in Figure 5.23 show that 53.5% (n=201) said that their households will survive without income from marula, while 46.5% (n=175) said their households will not survive. Those who said their households will survive had other sources of income, such as poultry production, cattle keeping, goat rearing, crop production and carpentry.



N=376

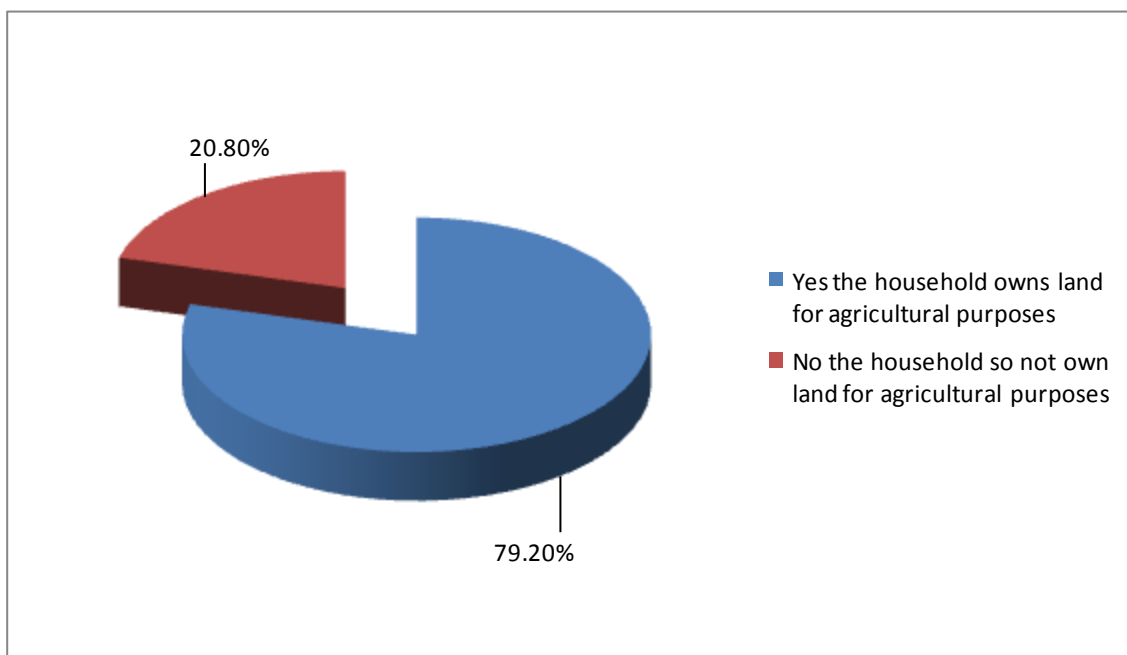
Figure 5.23: Survival of household without the supplementary income from harvesting and selling marula

On-site observations indicated that the 46.5% (n=175) of the respondents who indicated that their households will not survive without the income from marula were people from extremely poor households with little other options to turn to for income generation. Marula scarcity/depletion would, therefore, render them especially vulnerable to extreme poverty as their only fall-back option would have been lost. The sustainable livelihood framework views such natural assets as fundamental in mitigating rural poverty and their depletion would push the beneficiaries to an extreme state of vulnerability (Bennett, 2010). The interaction between people and the ecosystems in mitigating poverty has also been emphasized by a number of authors who view such natural capital as critical in eradicating extreme poverty, especially amongst rural poor communities (Harper, 2012; Silvis & van der Heide, 2013; UNEP, 2004; UNDP&UNEP, 2009; UNEP & IISD, 2004; Millenium Ecosystem Assessment [MEA], 2005; World Bank, 2004; World Resource Institute [WRI], 2007).

The findings in this study concur with previous ones in Kenya by Mwema *et al.* (2013) who observed that low income earners take up trade in indigenous fruits as a coping strategy to provide not only food, but also the much-needed income to purchase household items. Hence, depletion of marula would have an adverse impact on income generation for the

poor households in the area, leading to a downward spiral of difficulty in affording basic needs, deplorable livelihoods and well-being, and abject poverty.

Respondents were asked to indicate whether their households own land for agricultural purposes. Figure 5.24 shows that the majority (79.2%; n=320) of the households owned land for agricultural purposes, while the minority (20.8%; n=84) did not as they were only given a small piece of land enough for the homestead by the chief of the area through the *khonta* (land allocation) system. On further interrogation, as to how they survived without land for agriculture, they indicated that they grow vegetables and other crops around the homestead. While some said that they were employed, others said that they rented land to grow crops on a yearly basis from those who own land or they would just buy food from the market.



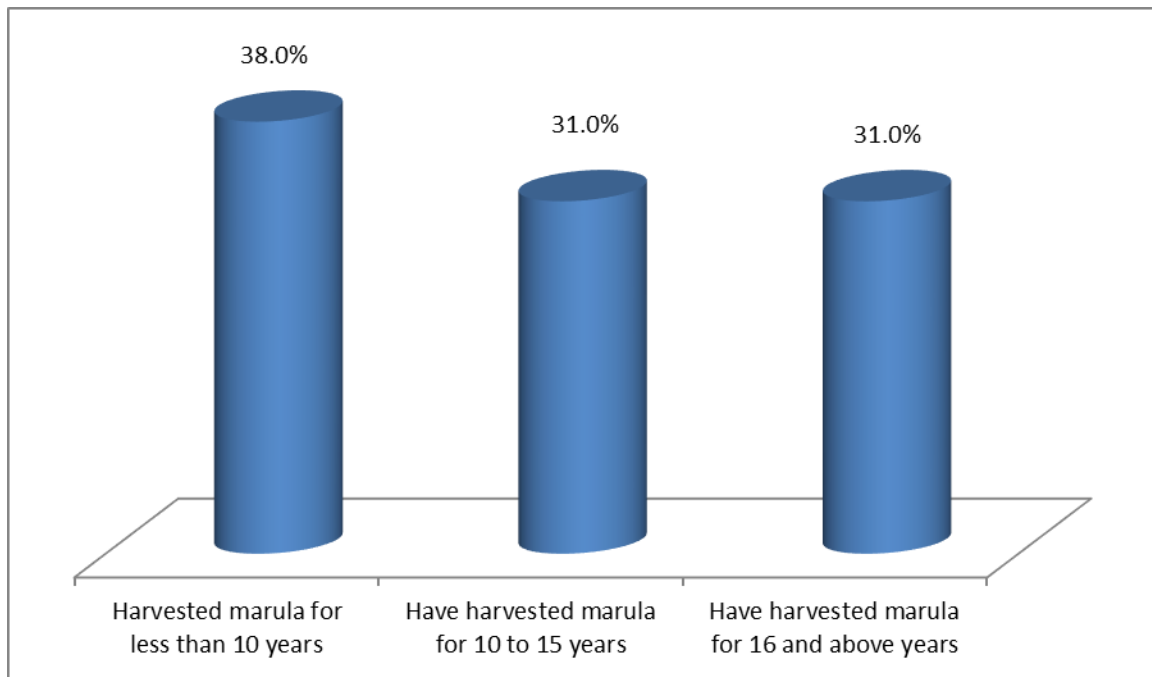
N=320

Figure 5.24: Ownership of land for agricultural purposes by the household of the respondents

5.3.2.4 Changes in consumption patterns of marula

To determine changes in the consumption patterns of marula, respondents were first asked to indicate the number of years they have been involved in marula harvesting. The reason

behind this was that, those respondents who have been engaged in marula harvesting for many years, would be in a position to tell whether marula is becoming scarce or not. According to the findings, as shown in Figure 5.25, out of the 219 respondents who supplement their households' income by harvesting marula, 38% (n=83) have been harvesting marula for less than 10 years, while 31% (n=68) have harvested marula for 10 to 15 years and 31% (n=68) have been doing so for sixteen years and above.



N=219

Figure 5.25: Number of years that the respondent was involved in marula harvesting and selling

These findings suggest that the 38% (n=83) who have been involved in marula trade for less than 10 years joined the enterprise of harvesting and selling marula after the introduction of the marula processing companies in 2004. The introduction of the marula enterprises could have attracted more people to join the marula trade. This is a very significant number of harvesters added and this extra number has increased the burden on marula resources.

The increase in numbers of harvesters in the study area agrees fairly well with the increase in the number of basket makers in the case of the introduction of basketry in Botswana in the 1970s (Neumann & Hirsch, 2000) which contributed to the collapse of the basket

industry due to resource depletion. Furthermore, in Zimbabwe, Terry and Cunningham (1993) reported that a weaving club that was started in 1986 with 20 members expanded to 500 people by 1988 due to the expansion in market demand and this contributed to the collapse of the weaving club. This means that the introduction of a commercial market economy to natural products, such as marula, tends to attract more entrepreneurs to the enterprise which, in turn, leads to overharvesting and, subsequently, to depletion of the resource base.

Figure 5.26 presents the views of the respondents as to how the number of people harvesting and selling marula has changed over the years. It shows that 83.6% (n=344) of the respondents have noted an increase in the number of people harvesting and selling marula as compared to the 11.9% (n=49) who opined that the number of people harvesting and selling marula has decreased, and the 4.5% (n=19) who believe the number has remained the same.

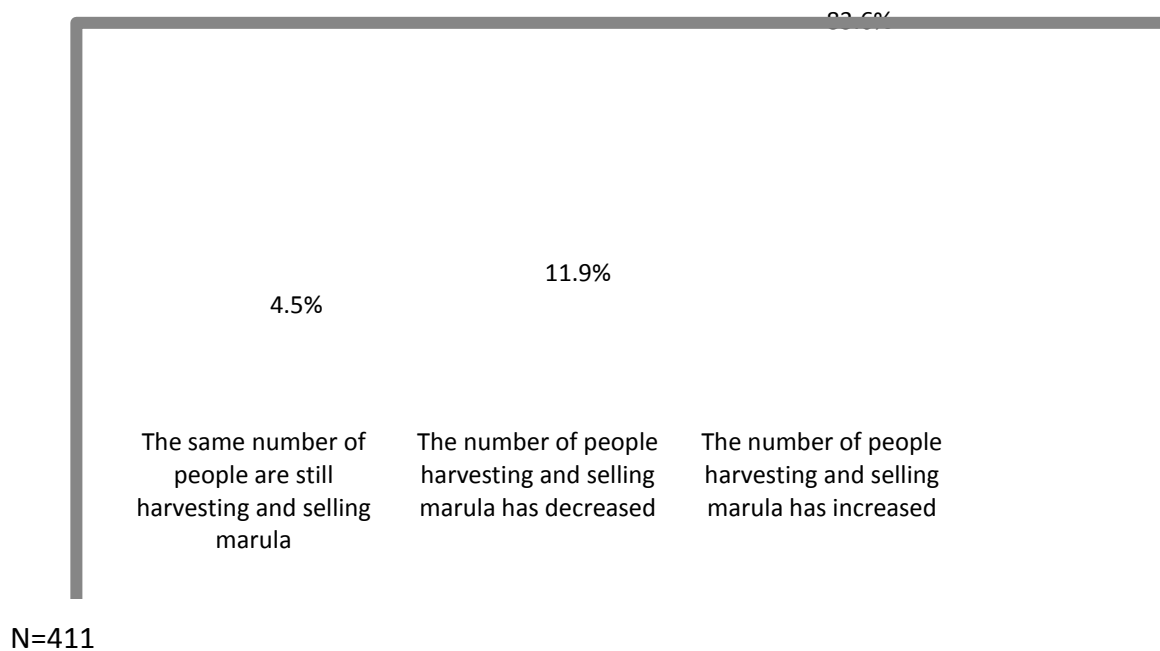


Figure 5.26: Change in the number of people harvesting and selling marula over the period 2004 and 2015

Those who considered the number of marula harvesters to have increased over the past few years attributed the increase to the introduction of marula companies in the year 2004. This

is in agreement with Mabaya *et al.* (2014) who contend that the introduction of market opportunities for any forest product is always accompanied by an increase in the number of people trading in that forest product. Similarly, the introduction of marula market in the Bushbuckridge and Thulamahashe areas was accompanied by an increase in roadside marula stalls which sold marula products during the 2000/2001 marula season (Shackleton *et al.*, 2001). Shackleton (2002) points out that, such roadside vendors were rarely seen a few years before the introduction of the marula markets. A similar trend has been observed in Namibia as the introduction of markets led to marula products being harvested for market purposes other than for home consumption as it was in the past (Nghitoolwa *et al.*, 2003).

Figure 5.27 shows responses on the current availability of marula. It reveals that 53.8% (n=171) of the respondents were of the opinion that marula is becoming less available than before, while 28% (n=89) opined that, there is more marula than before and 18.2% (n=58) said that marula availability is the same as before. Those who said marula availability is declining attributed the decline to the number of harvesters that has grown and created competition. Once a communal resource is exposed to an improved market, it tends to attract many harvesters, which lead to overexploitation and depletion of the resource (Helm & Witkowski, 2013; Harper, 2012). The findings in this study are in agreement with those reported by Shackleton and Shackleton (2002) where more than one-third of their respondents in the Bushbuckridge area in South Africa opined that there had been a decrease in marula following the introduction of improved market for marula products. The impact of market expansion on the depletion of natural resources can further be demonstrated by the case in western Zimbabwe where Terry and Cunningham (1993) reported that a weaving club that was started in 1986 with 20 members expanded to 500 people by 1988, thus resulting into a diminished availability of the resource that was once considered locally as unlimited.

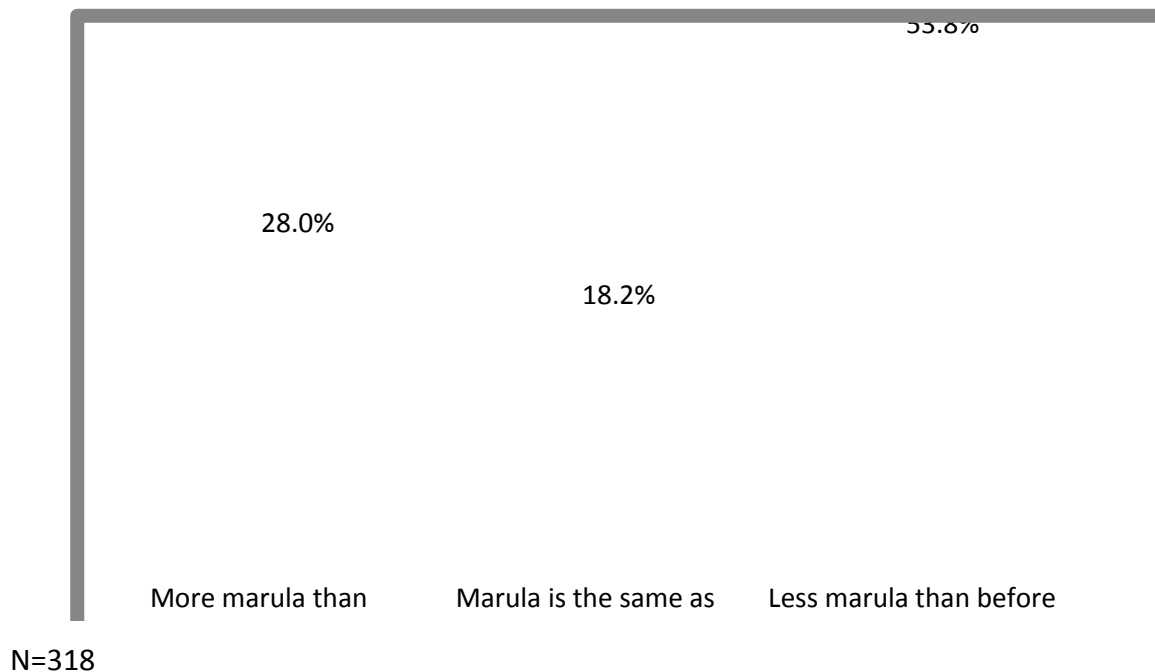
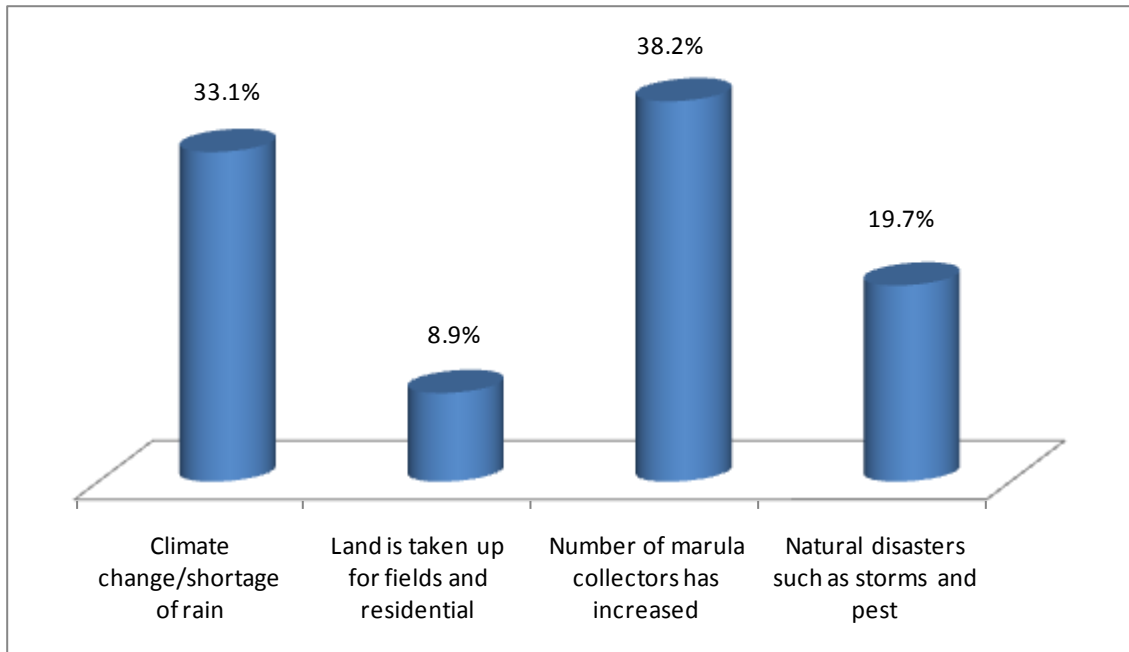


Figure 5.27: Current availability of marula fruits and seeds in the study area

The findings in Figure 5.28 also show that 38.2% (n=65) of those who said that marula fruits and seeds were becoming less available attributed this to the rising number of harvesters. This agrees well with a study in Ngamiland by Neumann and Hirst (2000) on mbare palms (*Hyphae neventricosa*) – a source of fibre that became scarce within a few years of the start-up of a basket-making industry. About 40% of the basket makers had engaged in harmful harvesting techniques involving whole-scale cutting of the trees rather than selective leaf harvesting that would allow continued growth. Similarly, Cunningham (1990) concluded in a study in the Maputoland area of north eastern South Africa that rising market demand can undermine resource conservation role. Figure 5.28 further shows that 33.1% (n=57) of the study respondents attributed the perceived decline in marula fruits and seeds to climate change or shortage of rain.



N=171

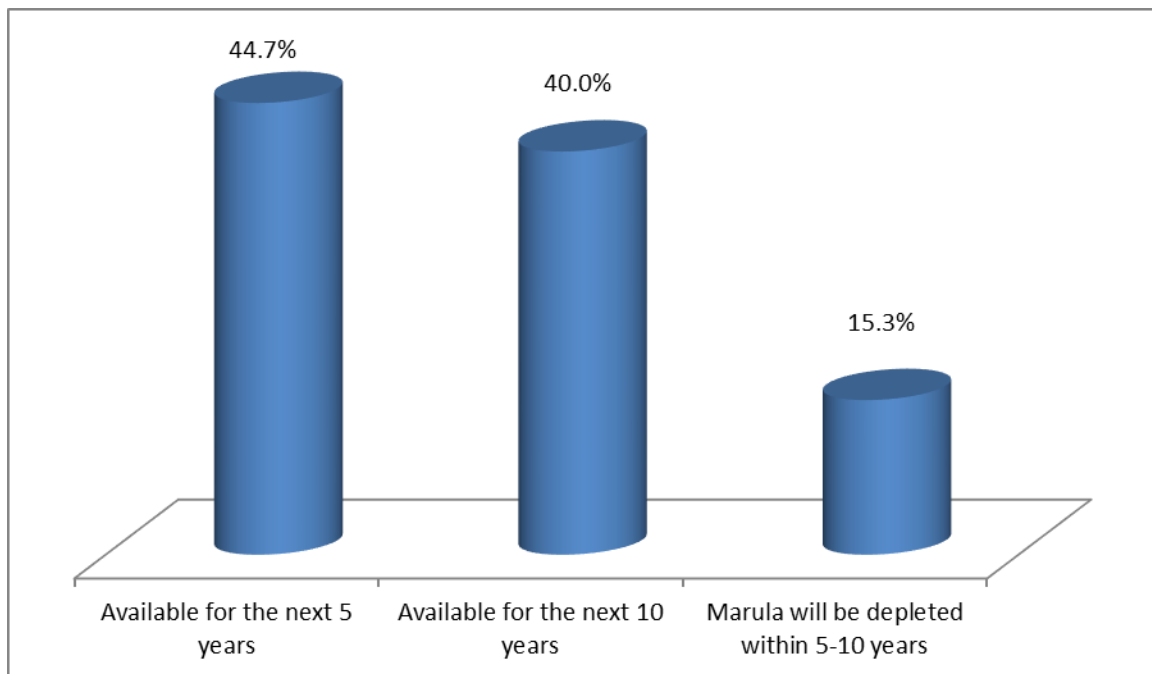
Figure 5.28: Reasons why marula fruits and seeds are perceived to be less than before in the study area

The Swaziland Indigenous Products (2012) observed that the factors currently threatening the continued productivity and biodiversity in Swaziland are largely a result of socio-economic changes without appropriate adaptation, exacerbated by repeated droughts and, possibly, climate change, which are interlinked and, in some cases, form negative synergies. Some 8.9% (n=15) of the respondents attributed the decline in availability of marula to the fact that land is being taken up for agricultural fields and residential areas, while 19.7% (n=34) pointed to natural disasters, such as storms and pests.

Infestation of marula trees and fruits by pests in the study area has also been reported to be occurring. This was confirmed by the Swaziland Minister of Tourism and Environmental Affairs when he pointed out that marula is commonly being affected by worms (Ntiwane, 2015). According to the Minister, the worms make the marula trees dry out in a very strange way, leaving them with no leaves and yielding no fruits, which disturbs the production of marula fruits. The impact of the pests on the marula tree not only affects the popular *Buganu* Ceremony, but also the production of various products by local companies – the Swazi Secrets and the Swaziland Marula.

Some respondents indicated worries on the pest situation, alluding to the fact that some of the trees are no longer yielding fruits due to the impact of pests. This worry was also echoed by the spokesperson for the Swazi Secrets marula company. Besides, storms frequently occur annually in Swaziland and when they do, marula trees fall down.

Figure 5.29 shows the findings, based on 313 respondents who answered the question with regard to expected availability of marula over the next five to ten years if harvesting and selling were to continue at the current rate. They reveal that 44.7% (n=140) of the respondents said that marula will still be available in the next five years, while 40.0% (n=125) said that it will be available for the next 10 years, and 15.3% (n=48) indicated that it will be depleted within the next 5 to 10 years. These responses indicate that the respondents were aware that, with increased harvesting, marula will get exhausted in the near future. This seems to concur fairly well with Helm and Witkowski (2013) who reported that marula, a keystone tree species in southern Africa and heavily utilized by people and herbivores, is declining at an unprecedented rate in the Kruger National Park and other areas.



N=313

Figure 5.29: Expected availability of marula fruits and seeds in the next five to ten years in the study area

Out of the 196 respondents who responded to whether it is the marula trees in general that are getting scarce or only parts of the marula trees, the majority (61.7%; n=121) were of the view that all the marula trees in general are becoming scarce (Table 5.14).

Table 5.14: Respondents' opinion on the scarcity of marula trees and their products in the study area

Parts of marula getting scarce	Yes		No		Total	
	N	%	N	%	N	%
All the trees in general are becoming scarce	121	61.7	75	38.3	196	100
Bark only are becoming scarce	13	6.7	183	93.3	196	100
Leaves only	5	2.6	190	97.4	195	100
Fruits only	94	48.5	100	51.5	194	100
Seeds only	55	28.4	139	71.6	194	100
Wood only	12	6.2	182	93.8	194	100
Roots only	7	3.6	187	96.4	194	100

However, 48.5% (n=94) were of the view that it is the marula fruits only that are becoming scarce. There was a general view that the parts of the marula tree are not getting scarce, as cutting of any part of the marula tree is prohibited by Swazi traditional law and customs³. Some of the respondents (28.4%; n=55) had the view that the seeds are also getting scarce. Generally, in regard to the wood, roots, leaves and bark, the majority of the respondents (Table 5.14) opined that they are not becoming scarce.

Table 5.15 shows opinions on the demand for marula around the village, in the region, in Swaziland and overseas. According to the respondents, there is a big demand around the villages (94.8%; n=312), in the region (94.1%; n=304) and in Swaziland (94.0%; n=283). However, the respondents seem to have had a narrow understanding of the demand for marula overseas as the majority of them (63.6%; n=83) said that there was no demand for marula overseas and only 36.1% (n=30) said there was.

³Nhleko, V., 31st December 2013, Mpolonjeni High School, Pers. Com.

Table 5.15: Areas where there is demand for marula products

Area of demand	Demand for marula		No demand for marula		Total	
	N	%	N	%	N	%
Village	312	94.8	17	5.2	329	100
Region	304	94.1	19	5.9	323	100
Swaziland	283	94.0	18	6.0	301	100
Overseas	30	36.1	53	63.9	83	100

Since majority of the respondents had low level of education, their perceptions for the demand of marula overseas could be unrealistic, since they were simply based on what they know about the demand of marula within their communities and Swaziland at large. However, the demand for marula overseas was echoed by His Majesty King Mswati III, at the *Buganu* Ceremony held at the Hlane Royal Residence in 2013, when he stated that marula tree products are now demanded all over the world. He also expressed pride in the fact that, in various overseas countries that he had visited, he saw marula products branded ‘Swazi Secrets’ on sale (Jele, 2013).

Marula products are marketed internationally, including the UK and USA (Mander, Cribbins & Lewis, 2002). The CEO of Swazi Secrets informed the researcher that there was a great demand for marula oil in European countries⁴. This overseas demand provides an impetus for marula demand locally which, in turn, encourages more people to harvest marula, thereby leading to a synergistic adverse impact on the marula resource base. This demand can contribute significantly to the economic empowerment of rural communities, especially poor women (Abdalbasit & Ibrahim, 2012; Mawoza *et al.*, 2010; Shackleton & Shackleton, 2002).

5.3.2.5 Strategies for sustaining marula

The 48 respondents who opined that marula will be depleted within the next five to ten years were asked to suggest strategies for sustaining the harvesting of marula. The strategies that were proposed during the household surveys are presented in Table 5.16 and

⁴ CEO of Swazi Secrets, 24th January 2013, Mphaka, Pers. Comm.

include the following: people should not collect all the marula fruits and seeds but should leave some for seedlings (regeneration purposes) (24.4%; N=12); people should stop cutting down the marula trees (26.7%; N=13); those cutting marula trees should be charged (2.2%; n=2); chiefs should not allocate people land to build on in places where marula grows (2.2%; n=1); people should avoid setting up wild fires that destroy marula (2.2%; n=1); people should leave everything regarding the sustainability and harvesting of marula to God (4.4%; n=2), and people should conserve marula trees (4.4%; n=2).

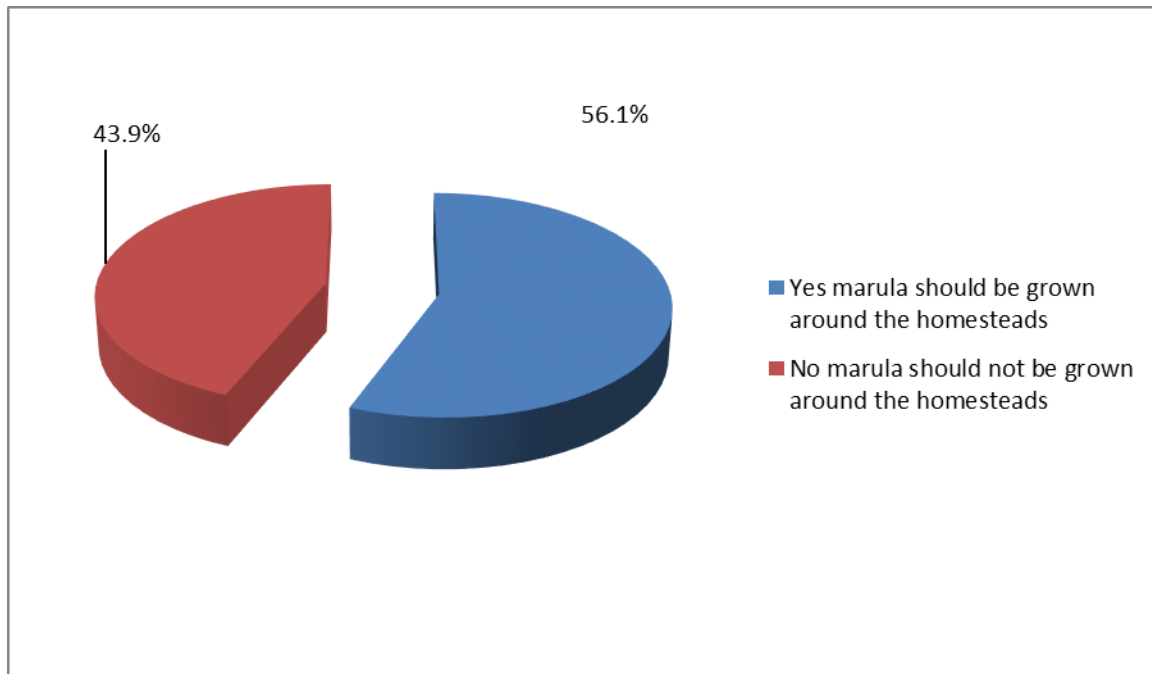
Table 5.16: Strategies for sustaining marula trees and their products in the study area

Strategy	Response percentage			
	N	Yes %	No %	Total %
Plant more marula trees to replace old ones	16	33.3	66.7	100
People should stop cutting down the marula trees	13	27.1	72.9	100
People should not collect all the marula fruits but should leave some for seedlings	12	25.0	75.0	100
People should conserve marula trees	2	4.2	95.8	100
People should leave everything regarding the sustainability and harvesting of marula to God	2	4.2	94.8	100
Those cutting marula should be charged	1	2.1	97.9	100
Chiefs should not allocate people land to build on in places where marula grows	1	2.1	97.9	100
People should avoid setting up wild fires	1	2.1	97.9	100

NB: The total number of respondents who answered the question N=48

Much as these strategies have been proposed by those who viewed marula as becoming depleted within the next five to ten years, there is a challenge of leadership to start implementing them amongst the communities as there seems to be no government body or non-governmental organization helping in conservation activities in the area. In addition, there is no policy and no regulations to govern access to and harvesting of marula products.

All the 411 respondents were asked to indicate whether they would want marula planted around their homesteads. The findings in Figure 5.30 show that 56.1% (n=231) agreed, while 43.9% (n=180) disagreed.



N=411

Figure 5.30: Opinion of the respondents about the planting of marula trees around the homestead

The reasons for supporting marula to be grown around the homesteads are presented in Table 5.17. They include the following: marula provides shade, acts as wind breaker and makes it easy to collect the fruits (14%; n=32); when marula is planted around the homestead, it will be easy to collect even by those with knee problems (3.1%; n=7); it will obviate travelling long distances to harvest marula (34.1%; n=78); it would be good for people's businesses as marula trees will be near to their homesteads (10%; n=23).

The planting of marula in the fields around the homesteads was also reported by Shackleton and Shackleton (2002) where 30% of their study households had planted, at least, a marula tree in their yard or field and half of respondents had protected and nurtured self-seeded marula seedlings.

Table 5.17: Reasons for supporting the growing of marula trees around the homesteads⁵

Reason for wanting marula grown commercially	N	Yes %	No %	Total %
When marula is planted in the homestead, it will be easy for even people with knee problems to collect and avoid long distance travelling	112	48.1	51.9	100
For shade, wind breaker, and easy to collect the fruits	53	22.7	77.3	100
It would be good for their businesses as the marula trees will be near their homesteads	23	9.9	90.1	100
It gives income, brew, jam, cooking oil, etc.	18	7.3	92.7	100
To monitor the trees, collect fruits easily at any time, and spend less time travelling to points of collection	7	3.0	97.0	100
So as to earn a living by harvesting marula	4	1.7	98.3	100
Marula has become scarce in the fields because the number of people collecting is increasing	2	0.8	99.2	100
Easy to collect and irrigate during dry spells	2	0.8	99.2	100
It provides natural products	2	0.8	99.2	100
So that those who depend on marula can earn an income	2	0.8	99.2	100
I do not have marula trees around my homestead so planting would be a good idea	2	0.8	99.2	100
To avoid fighting over marula collection	2	0.8	99.2	100
Just want marula trees to be there (bequest value)	1	0.4	99.6	100
Marula provides different kinds of products that are very useful to people	1	0.4	99.6	100
Because I want to start collecting marula this year and start selling to meet my financial needs	1	0.4	99.6	100
To make <i>buganu</i> as required during the marula ceremony	1	0.4	99.6	100

NB: The total number of respondents who answered the question N=233

⁵ The N value in each row reflects the total number of respondents who chose the option in that row.

The sustainability implication of this finding is that planting of marula would provide a good basis for an agro-forestry intervention, thus contributing towards sustaining the marula species. This would also allow for continued harvesting of marula, thereby enabling it to continue playing its important role in supporting livelihoods.

Table 5.18: Reasons for not supporting the growing of marula trees around the homesteads⁶

Reason for not wanting marula grown around the homesteads	N	Yes %	No %	Total %
Many marula trees surrounding the homestead	27	18.8	81.2	100
Marula will make the yard dirty because of falling leaves and fruits	27	18.8	81.2	100
None of the family members are interested in marula as they consider marula as being not useful and they do not collect their fruits	19	13.2	86.8	100
Marula trees will take up land for agriculture	13	9.0	91	100
Because thieves will hide amongst the marula trees	11	7.6	92.4	100
I am a Christian and do not use marula	10	6.9	93.1	100
Marula will bring social disorder and people will collect marula without permission	8	5.6	94.4	100
Marula trees will become a hiding place for snakes	8	5.6	94.4	100
People might steal marula fruits as they will wake up early and collect all marula	4	2.8	97.2	100
Better plant other fruits instead of marula as not everyone benefits from marula	3	2.1	97.9	100
Lack of fertile land to plant marula	3	2.1	97.9	100
Marula fruits smells bad and we do not want it planted around our homesteads	2	1.4	98.6	100
Animals will eat the marula	2	1.4	98.6	100

NB: The total number of respondents who answered the question N=137

⁶ The N value in each row reflects the total number of respondents who chose the option in that row.

This sentiment was also echoed by Shackleton *et al.* (2003) in the Bushbuckridge lowveld of South Africa where they found marula being frequently maintained in homesteads and fields. High and Shackleton (2000) also allude to the maintenance of marula trees around homesteads. Those who opposed the growing of marula around the homesteads were mainly people who did not supplement their household incomes through harvesting and selling of marula. The reasons for opposing the growing of marula around the homesteads are presented in Table 5.18. These included those based on religious conviction.

In Table 5.18 almost 7% of the respondents (n=10) pointed out they were Christians and do not use marula. Similar sentiments to this were observed in the Bushbuckridge by Shackleton and Shackleton (2002) where respondents indicated that they ceased using marula products because they had become Christians and their church (mainly the Zionist Christian Church or ZCC) prohibited the use of alcohol or traditional medicines. Others (13.2%; n=19) indicated that none of the family members are interested in marula, while 18.8% (n=27) claimed that marula trees would make their yards dirty because of falling leaves and fruits. Some respondents (1.4%; n=2) claimed that marula smells bad and would not want it to be planted around their homesteads, yet others (18.8%; n=27) said there are too many marula trees around their homesteads.

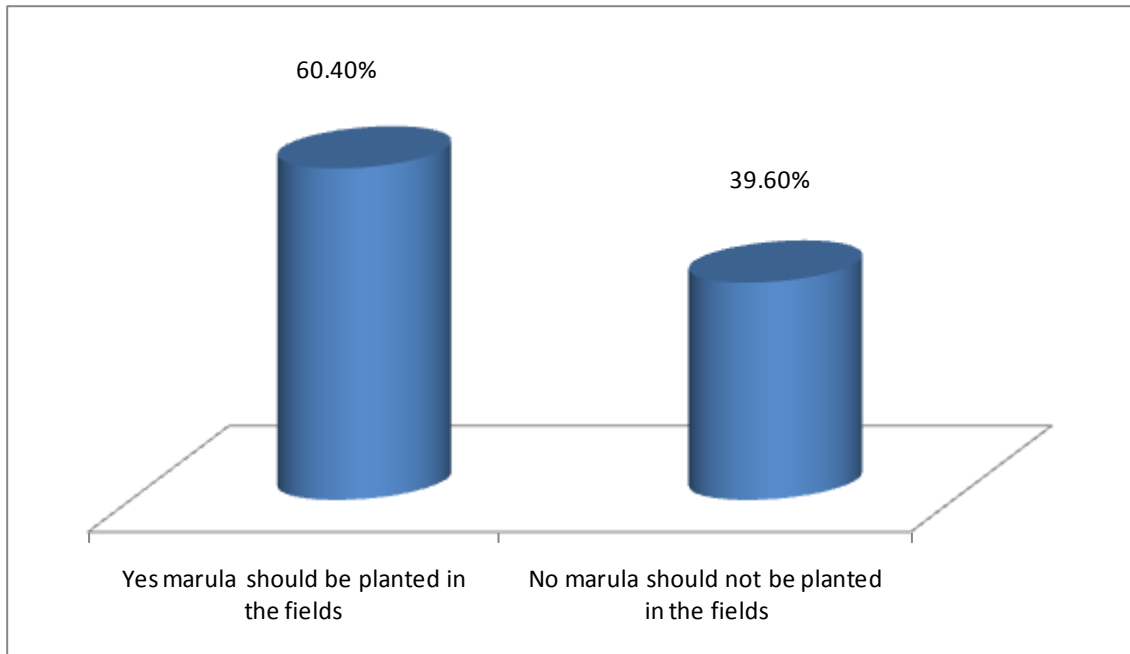
As much as growing of marula around the homesteads was proposed by the majority of the respondents, there was no sign of any attempts by the communities around the study area to plant marula trees around their homesteads. It was also observed that throughout the agricultural fields, grazing areas and Mkhaya Nature Reserve, there was no planting of marula trees except the natural regeneration of seedlings in the Mkhaya Nature Reserve. However, it was observed on the ground that people in the homesteads tended to leave the old fruit-bearing marula trees in their fields but not the young ones that would, otherwise, replace the old ones when they cease to reproduce or die. This seems to threaten marula sustainability as there is no regeneration of new marula trees in both the agricultural fields and the grazing areas due to constant ploughing of the fields, collection by harvesters, and grazing by animals. This concern was also pointed out by the CEO of Swazi Secrets⁷. The selective leaving of old fruit-bearing marula trees seems to indicate the importance

⁷ CEO of Swazi Secrets, 24th January 2013, Mphaka, Pers. Comm.

attached to marula as a source of income, and considerations pertaining to culture and spirituality. This observation concurs with that of Brigham *et al.* (1996) who reported that the importance of marula to rural communities is demonstrated by the selective removal of the non-fruiting male trees from arable lands and the retention of fruit-bearing female trees.

Much as this is the case, observations revealed that most of the fruit-bearing marula trees were very old and there was no recruitment of new young marula tree members mainly in the agricultural fields and grazing areas as supported by the findings of the vegetation survey. This indicates that the marula species is threatened by agricultural practices, harvesting of marula products for trade and grazing on marula by herbivorous domestic animals. This seems to contradict the observation by High and Shackleton (2000) that, at homestead level, marula trees were quite often preserved and their seedlings frequently nurtured in the fields.

Respondents were asked to indicate whether they want marula to be planted commercially in the agricultural fields. The findings, as shown in Figure 5.31, reveal that, out of the 231 respondents who preferred marula to be planted commercially, the majority (60.4%; n=149) were of the opinion that marula should be planted in the agricultural fields while a minority (39.6%; n=91) disagreed. Some of the reasons given by the latter were presented earlier in Table 5.18 and include: marula trees will take up land for agriculture; marula trees will become a hiding place for snakes; other fruits are better than marula as not everyone benefits from marula; and thieves will hide amongst marula trees.



N=231

Figure 5.31: Opinions of the respondents on whether marula should be planted commercially in the agricultural fields

Asked to indicate where marula should be planted, Table 5.19 shows findings on responses on where marula should be planted. They suggest that, for marula sustainability, the preferred areas are agricultural fields (61%; n=130) and fields around homesteads (57.1%; n=121). Only a few respondents (26%; n=54) suggested that marula should be planted in grazing areas and Mkhaya Nature Reserve 25% (n=50).

Table 5.19: Places where marula trees should be planted in the study area

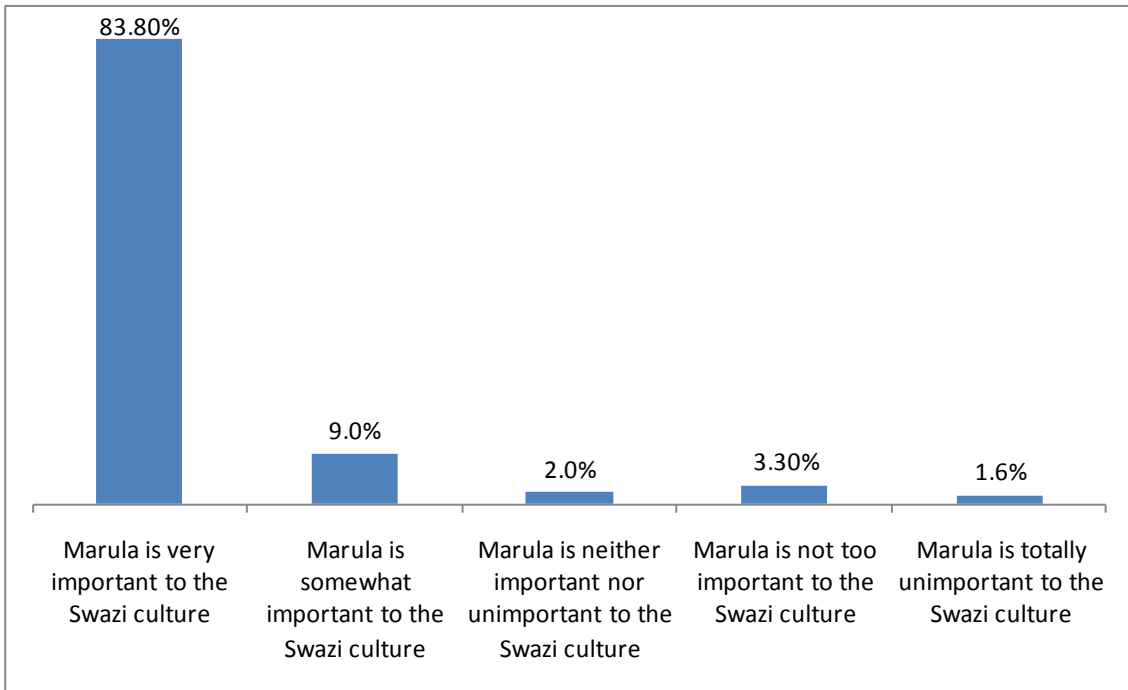
Place where marula should be planted	Yes		No		Total	
	N	%	N	%	N	%
In the fields around the homesteads	121	57.1	91	42.9	212	100
In the agricultural fields	130	61	83	39	213	100
In the grazing areas	54	26	154	74	208	100
In the Mkhaya Nature Reserve	50	25	150	75	200	100

One important reason that respondents gave for not opting for marula to be planted in grazing areas was that these areas were communal and there is no control over them (there is free access) as compared to agricultural fields and fields around homesteads where there is control and possibility of fencing the trees off if need be. Those who opposed the planting of marula in the Mkhaya Nature Reserve had fears of the restricted access to the reserve. Preference for planting of marula trees around homesteads was based on the argument that this would minimize the distance taken to travel to other places to look for marula – an exercise that is time-consuming and labour intensive, and that, being within vicinity, they were easily accessible from homesteads.

These findings concur fairly well with those of Shackleton and Shackleton (2002) where respondents felt that marula should be planted in the fields and around the homesteads. One complaint put forward by those who opposed planting marula trees in the fields around homesteads was the growing incidence of theft of marula fruit from the fields and, to a lesser extent, from houses in the homesteads. This could be a reflection of the improved market for marula products that has attracted many new harvesters and, thus, competition.

5.3.2.6 The role of marula in the Swazi cultural practices

Respondents were asked to indicate whether or not marula is important in Swazi cultural practices. Out of the 365 respondents who answered the question, the majority 83.8% (n=306) said that marula is very important in the Swazi culture (Figure 5.32). Only 9% (n=33) considered marula as somewhat important in Swazi culture, while 2.0% (n=8) said it is neither important nor unimportant, 3.3% (n=12) said it is not too important and 1.6% (n=6) said it is totally unimportant to Swazi culture. Those who said marula is very important indicated that it is, particularly, very important in the *Buganu* Ceremony. This opinion is in line with observations of several authors regarding the importance of marula in African cultures and festivities (Helm *et al.*, 2011a; Nwongwu, 2006; Shackleton *et al.*, 2001; Shackleton *et al.*, 2002).



N=365

Figure 5.32: Importance of marula in the Swazi culture

Respondents were asked to indicate the importance of the marula tree and its products to cultural festivities and culture. Out of the 326 responses obtained, (Figure 5.33), 66.6% (n=217) considered the marula tree and its products as very important to cultural festivities and practices, while 19.6% (n=64) considered these to be somewhat important. However, 2.8% (n=9) considered these to be neither important nor unimportant, 6.7% (n=22) regarded them to be unimportant and 4.3% (n=14) said they were totally unimportant for cultural festivities and practices.

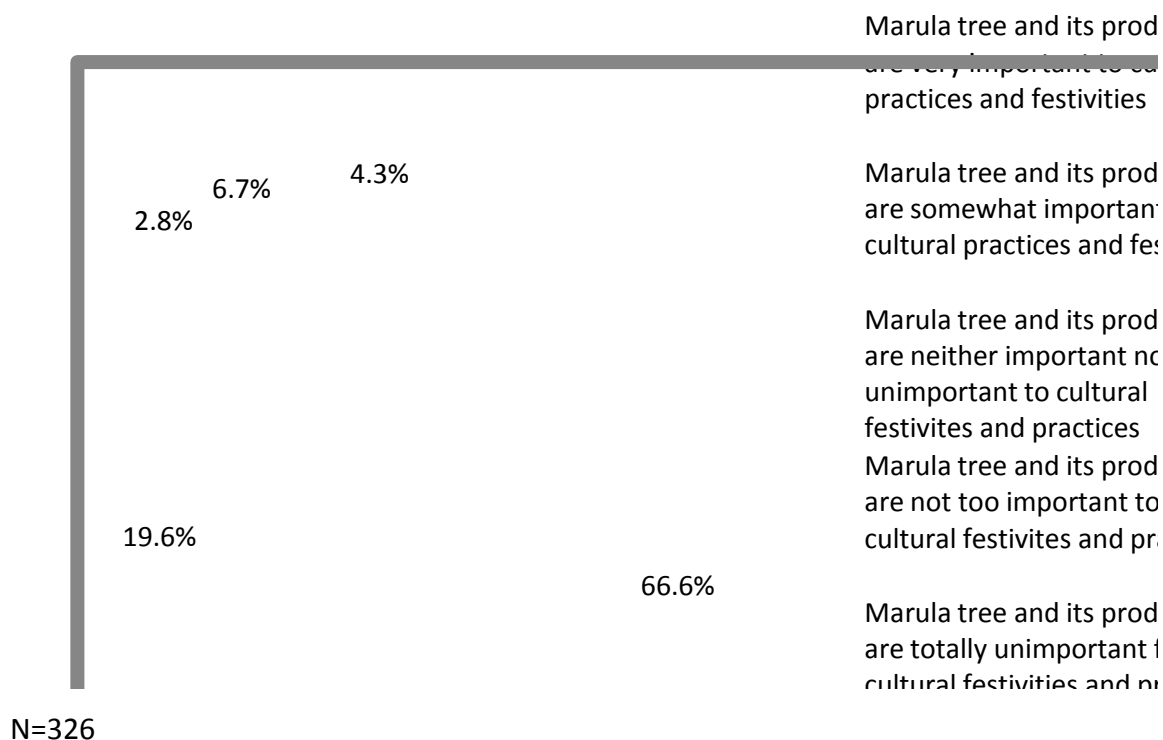
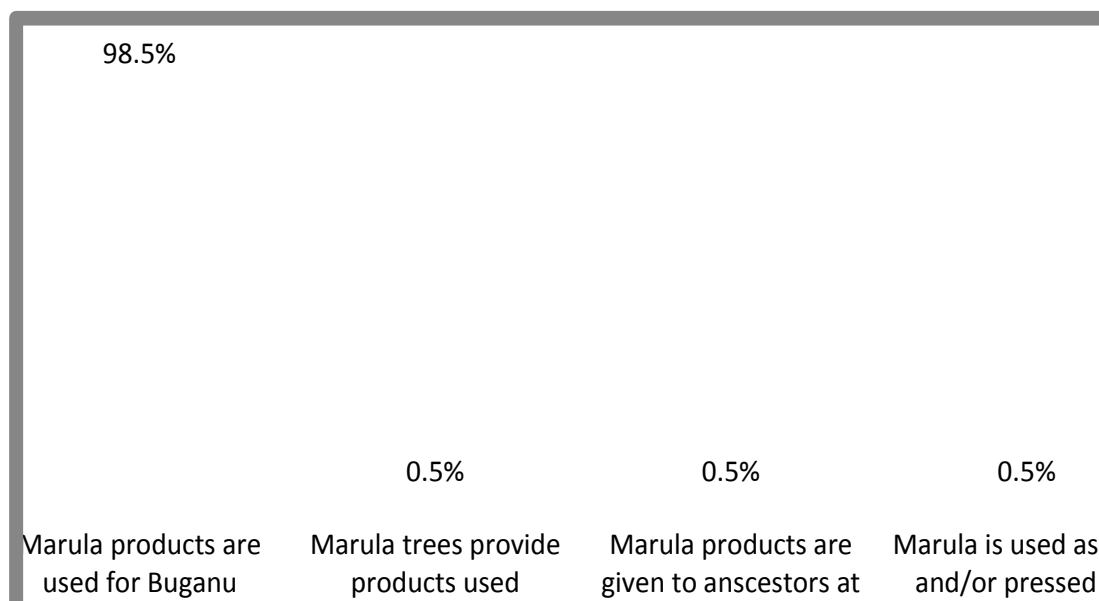


Figure 5.33: Importance of marula and its products for cultural festivities and practices in Swaziland

Figure 5.34 indicates the findings reflecting responses on various cultural practices that are associated with the marula tree. The majority (98.5%; n=372) of the respondents indicated that the *Buganu* Ceremony was the most important cultural ceremony associated with marula. Several authors have reported on the importance of marula to cultural festivals and practices in Africa (Marula Natural Products, 2012; Nwongwu, 2006; Shackleton *et al.*, 2002).

Other respondents to the study (0.5%; n=2) indicated that marula trees provide products that are used traditionally (such as *sangoma* dice, for chasing away evil spirits, and as game counters). These views agree fairly well with those of other researchers who reported that, culturally, the nuts of marula are worn as necklaces to ward off evil spirits and illness (Nwongwu, 2006; Palmer & Pitman, 1972; Shackleton & Shackleton, 2002; Wynberg *et al.*, 2002a). A small proportion (0.5%; n=2) of the respondents said marula is given to ancestors at the kraal to get blessings from them, and others (0.5%; n=2) said marula is used as food and/or pressed locally for cooking oil and for body care lotion – especially for getting rid of stretch marks due to aging or after a woman has given birth.

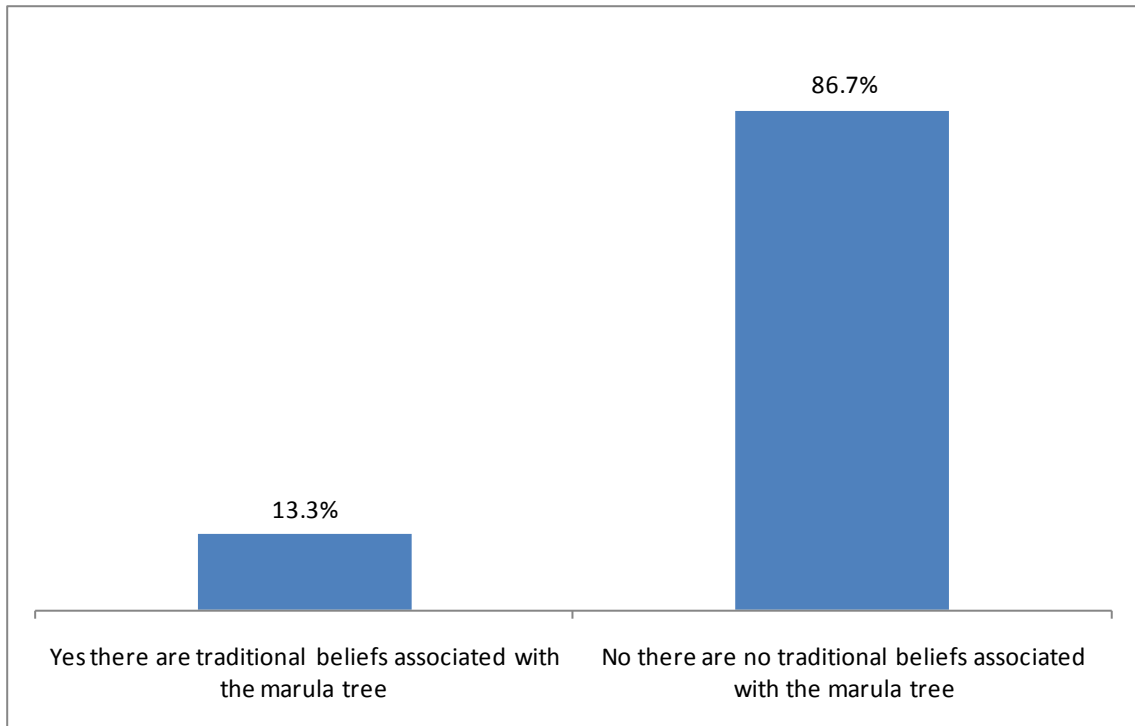


N=378

Figure 5.34: Cultural practices associated with marula trees and their products in Swaziland

Several authors have pointed out that marula seeds contain non-drying oil, which is rich in protein and is used in combating stretch marks due to its anti-aging properties (Abdalbasit & Ibrahim, 2012; Glew *et al.*, 2004; Gruenwald, 2006; Mawoza *et al.*, 2010). These findings concur with those of several authors who claim that marula is used in a wide range of cultural practices, such as marula stones being used as divination pieces, game counters or as kindling (Shackleton, Guthrie & Main, 2005; Ngorima, 2006; Nwongwu, 2006). The findings, therefore, point to the significant cultural value of marula as it plays an important role in a range of socio-cultural practices and is important in building social capital amongst rural Swazis (Bennett, 2010; Bhuiyan *et al.*, 2012; Hunter *et al.*, 2007, NADAL *et al.*, 2007).

Respondents were asked to indicate whether there are traditional beliefs associated with the marula tree. According to the findings presented in Figure 5.35, only 13.3% (n=38) of the 286 respondents indicated that there are indeed traditional beliefs associated with the marula tree, while 86.7% (n=248) who disagreed.



N=286

Figure 5.35: Opinions of the respondents on whether there are traditional beliefs associated with the marula trees in Swaziland

The former mentioned that marula is traditionally associated with the *Buganu* Ceremony and that the bark and roots of the marula tree are believed to be used as traditional medicine for relieving stomach ache, healing wounds and treating kidney problems.

The respondents indicated that Swazis believe that marula brew aids in digestion and in cleaning of the stomach. They also said that the roots of the marula tree are used traditionally in protecting homesteads from Gremlins (*tikolosi*). It is also believed that the fruits can be used for making brew that is used for inviting ancestors who have forsaken their descendants to come back home. The brew is also used for other traditional practices, such as for making a donation to the chief and *indvuna* – a tradition referred to as *kuhlehla*. The marula brew is also believed to be very potent and can sexually boost men. The leaves can also be dried for mixing with snuff or rubbed on the feet of athletes to boost their speed. These findings confirm observations from literature that different natives in southern Africa have used different plant species, including marula, to traditionally treat several diseases and wade away evil spirits, especially among rural populations where western

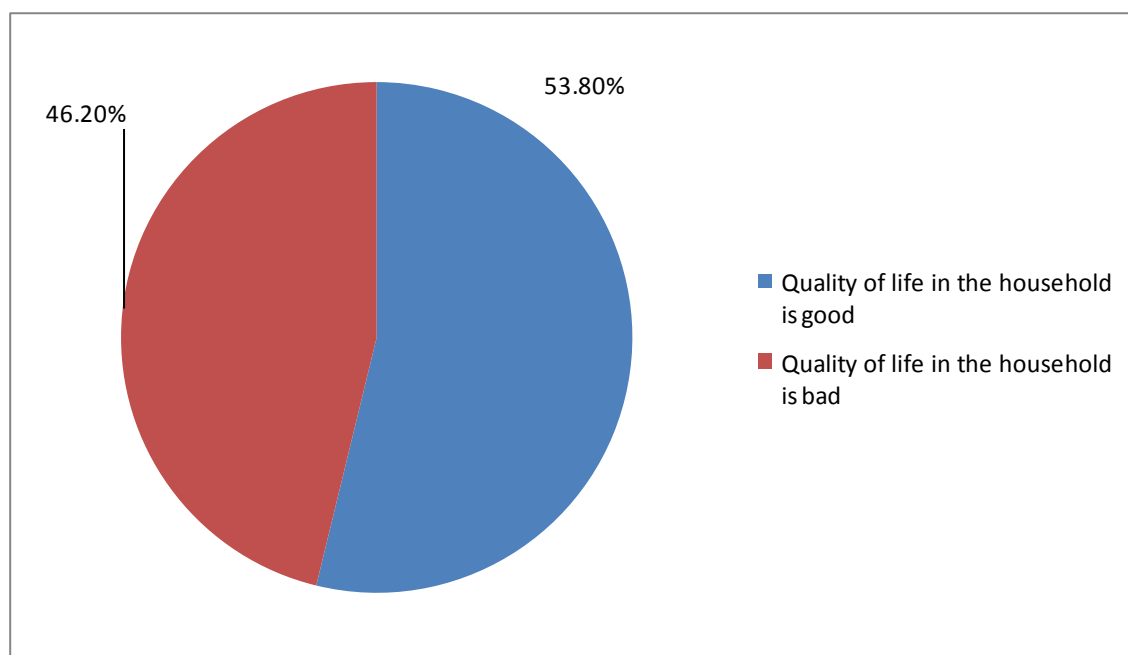
medicine is either not accessible or not affordable (McGaw, Jage, Grace, Fennel & Van Staden, 2005; Lewu & Afolayan, 2009).

The Swazi beliefs associated with marula that were highlighted by this study are similar to those reported by (Marula Natural Products, n.d.) as ranging from its use as a food source; to magical qualities, such as a healing ingredient; to its virility/fertility properties; and to the many uses of its bark, leaves, fruit, nut and kernels. Marula Natural Products, n.d. further reported the traditional customs associated with the marula in southern Africa, including the *Xikuha* (feast of first fruits), marula festival, *Ngelengele* (the banishing of worms), the sacred tree, the tree marriage, the tree for determining the sex of unborn babies, the *Sangoma's* (witch doctor's) dice, the fertility fruit, the elephant tree, the tree for preventing evil spirits, the King's nut, and the "fire water tree"(which is associated with the potent marula brew called "Mampoer" in South Africa – named after chief Mampuru of the ancient Sekukuniland).

The findings pertaining to respondents' views on the quality of life in their households are summarized in Figure 5.3.30. They reveal that 53.8% (n=221) of respondents indicated that the quality of life in their households was good while 46.2% (n=190) indicated that it was bad. The 46.2% who viewed the quality of their life as bad can be linked to the poor economic status of the majority of the respondents in the study area as highlighted earlier in Figures 5.14 and 5.15.

Those who said the quality of life in their households was good provided various reasons for this (Table 5.20). They indicated that they: had adequate and secure livelihood (64.7%; n=143), good health (94.2%; n=208), healthy natural environment (71.7%; n=158), good social relations in the area (74%; n=164), could provide for their households (89.2%; n=192), had food security (83.4%; n=184), had access to natural and other resources, such as land (48.9%; n=108), and had other factors, such as security and help received from working relatives.

5.3.2.7 Quality of life in the households of the respondents



N=411

Figure 5.36: Opinions of the respondents about the quality of life in their households

Table 5.20: Reasons why the quality of household life is good

Reason for good household life	Yes		No		Total	
	N	%	N	%	N	%
Because of good health	208	94.2	13	5.8	221	100
We can provide for the household	197	89.2	24	10.8	221	100
Food security	184	83.4	37	16.6	221	100
Good social relations in the area	164	74	57	26	221	100
A healthy natural environment	158	71.7	63	28.3	221	100
Adequate and secure livelihood	143	64.7	78	35.3	221	100
Access to natural and other resources such as land	108	48.9	113	51.1	221	100
Other factors such as security and help received from working relatives	69	31.1	152	68.9	221	100

Those who said their household quality of life was bad attributed this to: poor health (88.1%; n=167), poor social relations in the area (69.4%; n=132), inability to provide for the household (69.6%; n=132) and food insecurity (63.4%; n=120).

Table 5.21: Reasons why the quality of life is bad

Reason for bad quality of life	Yes		No		Total	
	N	%	N	%	N	%
Poor health	167	88.1	23	11.9	190	100
Inability to provide for the household	132	69.6	58	30.4	190	100
Poor social relations in the area	132	69.4	58	30.6	190	100
Food insecurity	120	63.4	70	36.6	190	100
Lack of access to natural and other resources such as economic and land	95	50	95	50	190	100
Inadequate and insecure livelihood	87	45.6	103	54	190	100
A degraded natural environment	83	43.7	107	56.3	190	100
Other factors, such as insecurity and lack of help received from working relatives	34	17.7	156	82.3	190	100

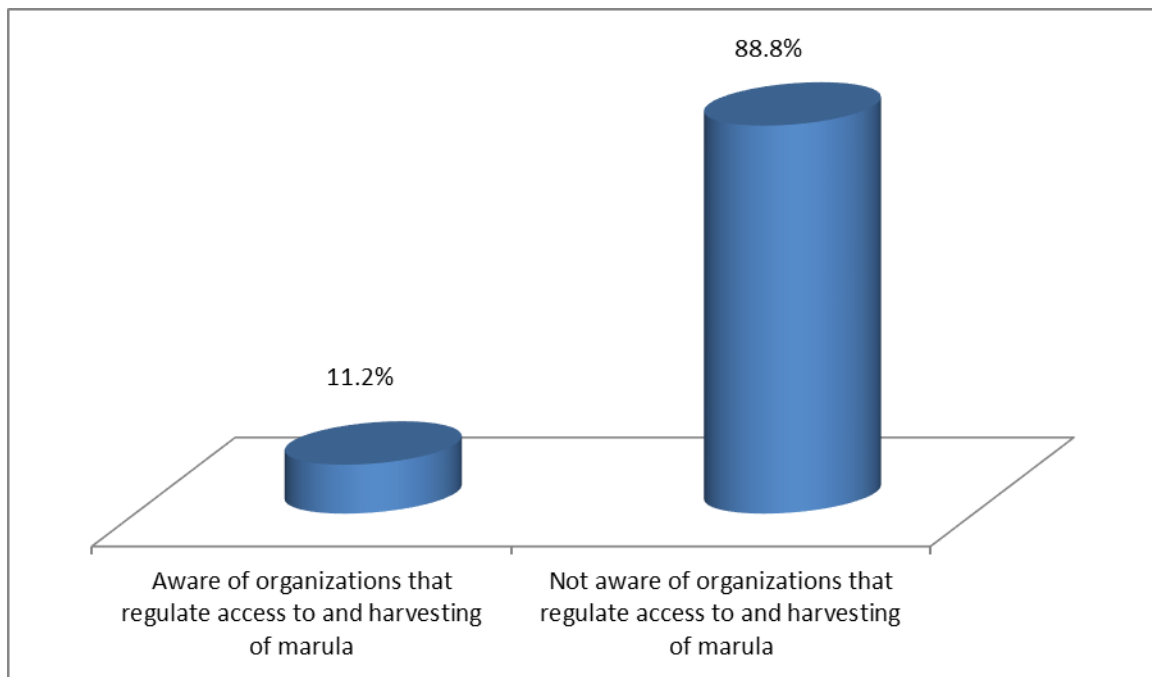
5.4 Legal framework governing the harvesting of marula in Swaziland

5.4.1 Policy interventions to sustain marula availability and harvesting

Scrutiny of Swaziland's laws on the environment yielded no specific policy or legal framework that regulates the harvesting of marula. In addition, the laws were found to be very old, not well coordinated and kept under different custodians. For example, the Forest Preservation Act of 1910, the Private Forest Act of 1951, and the Plant Control Act No. 8 of 1981 are outdated and housed in the Ministry of Agriculture, and have no mention of the regulation of marula harvesting (Government of Swaziland, 1910; 1951; 1981; SEA & UNEP, 2005). The Swaziland Environmental Management Act of 2002 and the Swaziland Environment Act of 1992 are housed under the Ministry of Tourism and Environment and do not refer specifically to the regulation of marula harvesting (Government of Swaziland, 2002; 1992; Murye, 2015; SEA & UNEP, 2005). As in neighbouring countries, the common knowledge among the respondents in the study area is that Swazis are traditionally not

allowed to fell marula trees, especially female trees; the implication being that people can cut down the pollen-bearing male trees.

Respondents were asked to indicate whether there are organizations that regulate access to, and harvesting of, marula. Figure 5.37 shows that, out of the 267 respondents, only 11.2% (n=30) claimed to be aware of organizations that regulate the access to, and harvesting of, marula. However, 88.8% (n=237) of the respondents were not aware.



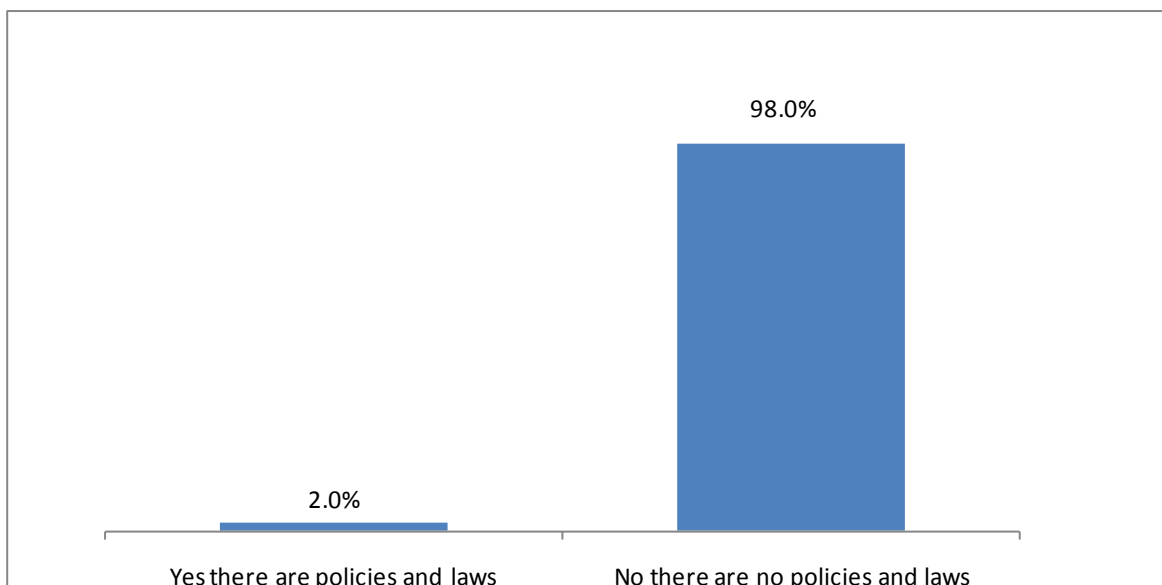
N=267

Figure 5.37: Awareness of the respondents about organizations that regulate the access to and harvesting of marula products in Swaziland

Those who said they were aware of organizations that regulate access to and harvesting of marula mentioned the Queen Mother's companies (Swazi Secrets and Swaziland Marula), Women Marula Association (WMA), the Swaziland Environment Authority (SEA) and the Ministry of Agriculture (MoA). The fact that only a few were aware of these implies that, although these institutions are in place, the majority of the respondents do not know their role in the area. This could be because of the low level of education amongst the majority of the respondents.

Respondents were asked to indicate whether they know of any government policies and/or laws that regulate access to, and harvesting of, marula in the country.

The findings (Figure 5.38) indicate that, out of the 408 respondents who answered the question, a large majority (98%; n=400) were not aware. It also transpired that, traditionally and culturally, the cutting of marula trees in Swaziland at large was not allowed. Although people tend to seldom cut down non-fruiting male marula trees from their fields, at least all the respondents in the study area were aware of this fact as they all said “nobody is allowed to cut down marula trees, otherwise the traditional authorities (chiefs) will charge the violator”.



N=408

Figure 5.38: Responds knowledge of government policies and/or laws that regulate the access to and harvesting of marula products in Swaziland

This seems to fairly agree with Ngorima’s (2006) observation in Zimbabwe where 62.8% of his study respondents indicated that the source of natural resources conservation rules and regulations was the traditional leadership and 18% said that the source of the rules was the local traditional culture. The control of marula tree cutting by means of traditional rules has also been highlighted by Arnold and Ruiz (2001), Michon (2005) and also Wynberg *et al.* (2011) who emphasize the application of customary law and strong cultural taboos in many African countries in the protection of wild fruit trees on communal lands.

These findings indicate that there is a general reliance on traditional authority for marula conservation, which is indicative of the strong traditional authority background of Swaziland. A similar finding was reported by Shackleton and Shackleton (2002) who observed a situation in the Bushbuckridge region whereby traditional rules and norms were used by the *Indvuna* and his advisers against felling of marula trees (especially female trees). Some of these regulations included rules and norms such as: marula fruits must not be collected before the 1st of December; fruits must only be collected from the ground and not from the tree; and marula fruits must not be sold (Shackleton & Shackleton, 2002). Some of the respondents lamented that, in the past, marula was not sold for cash and it yielded a lot of fruits while, nowadays, people are selling marula for cash – something that has made the gods very angry. They linked this sentiment to the low yields of marula fruits.

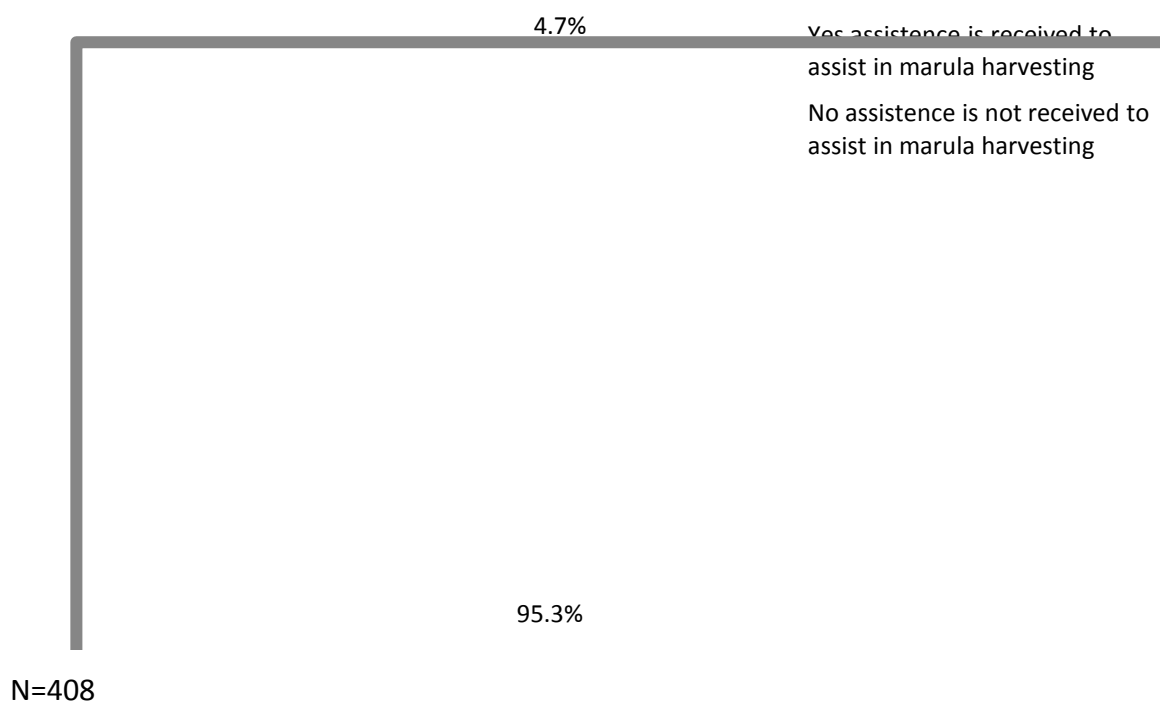
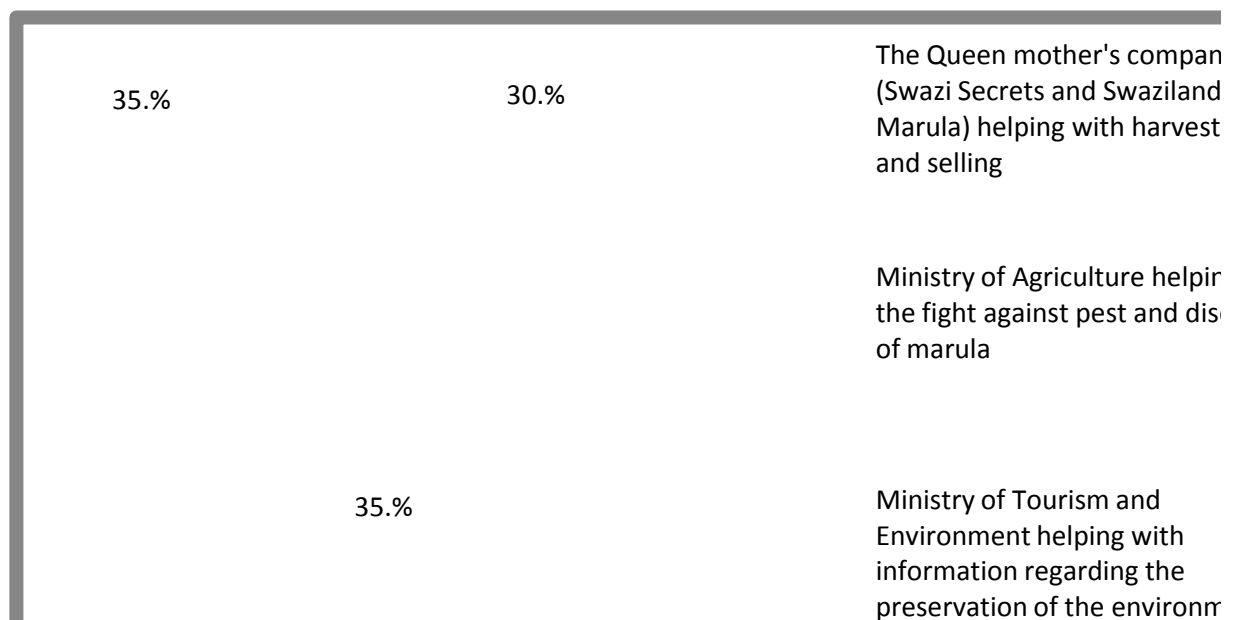


Figure 5.39: Assistance received from the government of Swaziland for harvesting and selling marula products

According to Figure 5.39, the majority (95.3%; n=389) of the respondents did not get any assistance from government officials in marula harvesting and only a few (4.7%; n=19) did. The latter claimed that officials from the Department of Forestry, in particular, provided

them with useful information, especially in regard to conservation and sustainability of marula.

As for which government ministries/departments assisted members of the community, 35% (n=143) indicated that the Ministry of Agriculture as having helped in the fight against pests and diseases of marula (Figure 5.40). This was also highlighted by Her Majesty the Queen Mother, while addressing the women regiment (Lutsango) at the Hlane Royal Residence during the 2013 *Buganu* Ceremony (Jele, 2013). In addition, another 35% (n=143) of the respondents indicated that the Ministry of Tourism and Environment was helping them with information regarding the preservation of the environment.



N=408

Figure 5.40: Government departments assisting the community in the study area

The Queen Mother’s companies (Swazi Secrets and Swaziland Marula) were viewed by 30% of the respondents (n=122) to be helping them with the harvesting and selling of marula. The introduction of these companies was purported to have improved the demand and market for marula, thereby improving respondents’ household income generation through marula harvesting and selling – something they did not experience before. The respondents indicated that, in the past, they only sold marula brew (*buganu*) and kernels had no market

other than being a source of food and for processing its oil for body care products at home. The introduction of these companies was considered as a great help which enhanced household income generation and poverty reduction efforts. The next section presents the findings from the vegetation survey.

5.5 Summary

The socio-economic findings in this chapter show that marula plays a fundamental role in the livelihoods of the people in the study area. Marula is harvested by people of all ages and marital status. However, it is mainly the females who engage in the marula enterprise. The majority of the respondents have very low level of education and are mainly unemployed, which renders their households vulnerable to extreme poverty. It has been reported in this chapter that marula is a very important source of food, income, medicine, and other products for many households in the study area. Marula also plays a crucial role in Swazi culture (especially the *Buganu* Ceremony), traditional practices, and spirituality.

The chapter indicated that there are no formal policies and regulations that govern access to, and harvesting of, marula in Swaziland, save for unwritten traditional rules that prohibit the cutting down of marula tree. The Queen Mother's projects (Swazi Secrets and Swaziland Marula) were reported to be assisting the local populace (especially women) in the marula trade. The number of people harvesting marula has increased as of 2004 when the marula enterprises were introduced in Swaziland. The majority of the respondents were of the opinion that marula is getting scarce and could become depleted within the next 10 years if harvesting continues at the current increased rate. If this were to happen, the most vulnerable households would be adversely affected as their major source of natural capital will have been removed. To sustain marula, it was proposed that it should be planted around homesteads and agricultural fields in an agro-forestry manner. A majority of the respondents did not prefer planting marula in the grazing areas as they feel it would be difficult to control access and animals from grazing on them.

Marula was also found to play a very important ecological role in the study area as it offers several ecosystems services to people, animals and other plant species. Marula is a dominant tree species and supports the survival of many other vegetation species. The soils

and temperatures of the study area did not seem to adversely affect the survival of marula trees. However, over the study period, rainfall has been variable and could have had a significant effect on marula fruit yields. It was also seen that marula is regenerating very well in the Mkhaya Nature Reserve but the regeneration in the agricultural fields and grazing areas was very little, which throws into question the sustainable harvesting potential of marula in the area. The marula trees in both agricultural fields and grazing areas were very old and need replacement through planting if marula is to be sustained in the study area.

CHAPTER 6: DISCUSSION AND INTERPRETATION OF THE RESULTS

6.1 Introduction

This chapter provides a critical discussion and interpretation of the findings presented in Chapter 5 in the context of the aims and objectives of the study. The aims of the study were twofold: to determine the role played by marula in the livelihoods and poverty alleviation among rural people in Swaziland and identify policy interventions that would facilitate means of sustaining the current marula tree population for its continual availability for harvesting by the local communities.

Using the two theoretical frameworks presented in Chapter 2, this chapter places the findings of Chapter 5 into the context of the research objectives and research questions which were the original motivation for the study (see Chapter 1). This is done in order to establish whether the theoretical and methodological approaches employed in the study could provide new insights and opportunities for interpreting the observed results and gain a clearer understanding of the research problem. Since a simple random sampling method was used in this study, a Chi-square test for independence was used to determine whether there was a significant statistical association between the categorical variables under study. An association was regarded as statistically significant when the alpha value was smaller than 5% ($p < 0.05$). Correlation tests that turned out to be statistically insignificant ($p > 0.05$) are not reported in this chapter.

6.2 Findings relating to objective one

Objective one was to determine the contribution of marula harvesting to rural livelihoods and poverty alleviation in Swaziland. This objective was broken down into the following questions:

- To what extent, if any, does the harvesting of marula contribute to rural livelihoods in Swaziland?
- What are the socio-demographic factors that drive the Swazi people to get involved in marula harvesting for household income generation?

This section assesses the role of marula harvesting in the livelihoods of rural Swazi people and in alleviating poverty among the rural poor in Swaziland. As noted in Chapter 2, people are in intricate linkages with the ecosystems around them (Harper, 2014; MEA, 2005; Hugo, 2010). The livelihoods and food security of the poor in particular often depend directly on ecosystems and the diversity of goods and services derived from these ecosystems (Haines-Young & Potschi, Harrison & Pearce, 2000; 2009; Silvis & van der Heide, 2013; MEA, 2005; UNDP & UNEP, 2009). Furthermore, the sustainable livelihood framework considers poor people and their activities as operating in the context of vulnerability and that, within this vulnerability context, the poor have access to natural capital, economic capital, physical capital, human capital, and social capital (Bennett, 2010; DFID, 2003; Hayes & Perks, 2012; Hunter *et al.*, 2007; Krantz, 2001; Ladefoged *et al.*, 2009).

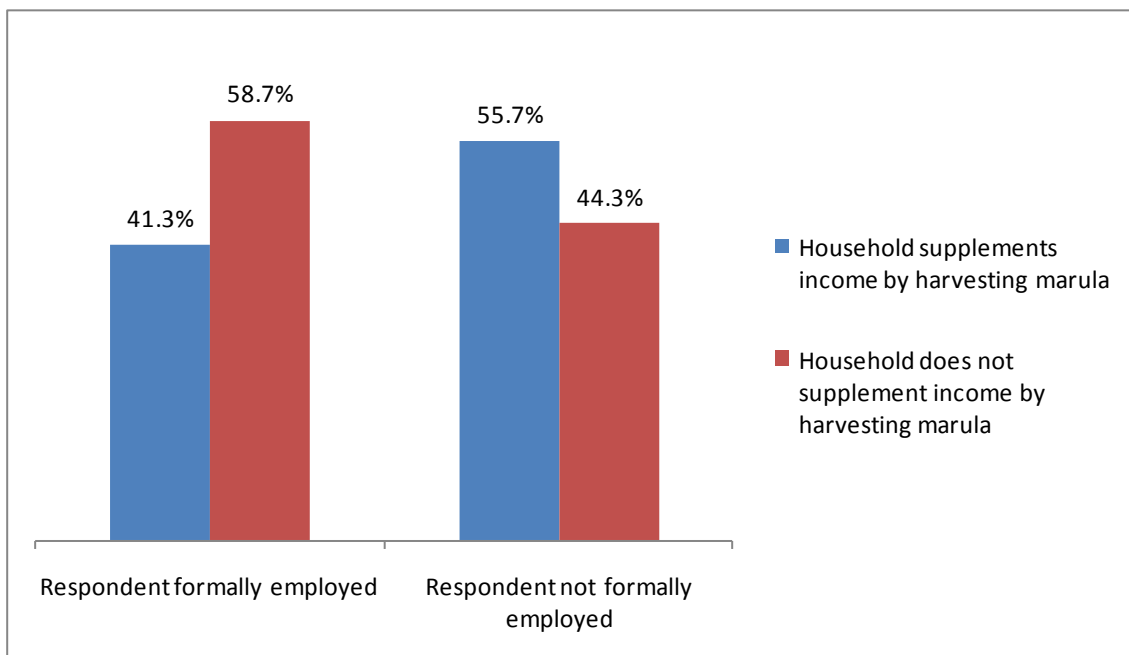
According to Shackleton *et al.* (2006), the income from indigenous fruit trees, such as marula, must be related to the national benchmark of poverty for it to be useful in national-level planning. Swaziland has a high proportion (69%) of people living on an income of less than US\$ 2 per person per day (Population Reference Bureau, 2015). At the average 2015 exchange rate [1US\$ = E13.80 (Swazi Emalangeni)], this would translate to a meagre income of E27.60 per person, per day.

6.2.1 Employment status and dependence on marula for household income

Chapter 5 (Figure 5.17) has shown that a relatively large proportion (53.3%) of households in the study area depend on marula harvesting as a source of income. This relatively high level of dependency on marula seems to have been driven by the low employment opportunities in the area, as 74.6% of the respondents indicated that they were not employed (Chapter 5, Figure 5.11).

With regard to the extent to which lack of employment influenced the respondents to harvest marula for household income generation, Figure 6.1 shows that there is a statistically significant correlation ($p=0.025$) between the employment status of the respondents and the harvesting of marula for household income generation. More

specifically, Figure 6.1 shows that the respondents who are not formally employed⁸ (55.7%) are proportionately more inclined to supplement their household income by harvesting marula compared to those who are formally employed⁹ (41.3%). In contrast, a large proportion of those who are employed (58.7%) do not supplement their household income by harvesting marula, compared to 44.3% of those who are not formally employed. Although a large number of those who are formally employed are inclined to not harvest marula for household income generation, marula is, nevertheless, still harvested as a source of household income by a small proportion of those who are formally employed (see Figure 6.1). This means that being formally employed does not entirely stop people from harvesting marula for household income, and, thus, confirms the important contribution of marula to households' income generation in the study area.



N=402; p=0.025

Figure 6.1: Employment status and supplementation of household income through harvesting and selling of marula products

⁸ "Not formally employed" means a person who has no job, excluding people who are self-employed (See page 5).

⁹ "Formally employed" means a person working for an employer and getting a salary, but it also includes people who are self-employed and earning an income (see page 5).

The immediate explanation for the 58.7% of the formally employed respondents who were not engaging in marula harvesting for income generation could probably be that this group of people is busy at work and, perhaps, had a good salary compared to those with no formal employment. The few formally employed respondents who also engaged in marula harvesting were probably getting low salaries and marula was, therefore, a readily available safety net to earn an additional income. This explanation would support a similar finding by Mwema *et al.* (2013) in Kenya. As indicated in Chapter 5 (Figure 5.12), some of the respondents who reported that they were formally employed occupied low salaried jobs (such as school cook, part-time sugar cane cutter and security guard). Those who were self-employed¹⁰ reported that they were engaged in relatively low income generating activities, such as owning a barber shop business, handicraft, carpentry work, brewing local brew, crop production and animal rearing. Elsewhere in Africa, Mwema *et al.* (2013) also reported a lower likelihood of the high and middle income earners engaging in indigenous fruits trade in Kenya.

The global economic meltdown that started in 2010, coupled with the reduction in SACU revenue to Swaziland in 2011, strained the economy of Swaziland to such an extent that it compelled rural dwellers to explore other income generating opportunities, of which marula harvesting was a readily available option (Dlamini, 2013; World Bank, 2010). This could have been one of the reasons why some of the formally employed members of the community in the study area resorted to supplementing their household income through marula harvesting. This finding is supported by Mahlali (2011) who found that the majority (60%) of the participants in the marula harvesting enterprise in the Bushbuckridge area of South Africa were self-employed people. Clearly, these findings demonstrate the important contribution of marula to household income generation in the region, regardless of the economic and employment status of households.

The data in this study confirmed that the community members in the Mpolonjeni constituency have access to natural capital in the form of marula which is viewed as an important income generation safety net for a substantial proportion of households. This finding is in concert with several scholars, such as Casse, Milhoj, and Randriamanarivo

¹⁰ "Self-employed" in this context refers to a person who is working for him/herself and who is not being paid a salary by an employer e.g. a business man.

(2004), Hunter *et al.* (2007; 2011), Mahdi and Schmidt-Vogt (2009) and also Paumgarten (2005), who all maintain that, in developing countries, including Swaziland, natural capital provides an important livelihood fall-back option for the poor in circumstances where, for example, the household has no other option to generate an alternative income in cases of failed crop harvests, outbreaks of natural disasters, or when the breadwinner in a household dies.

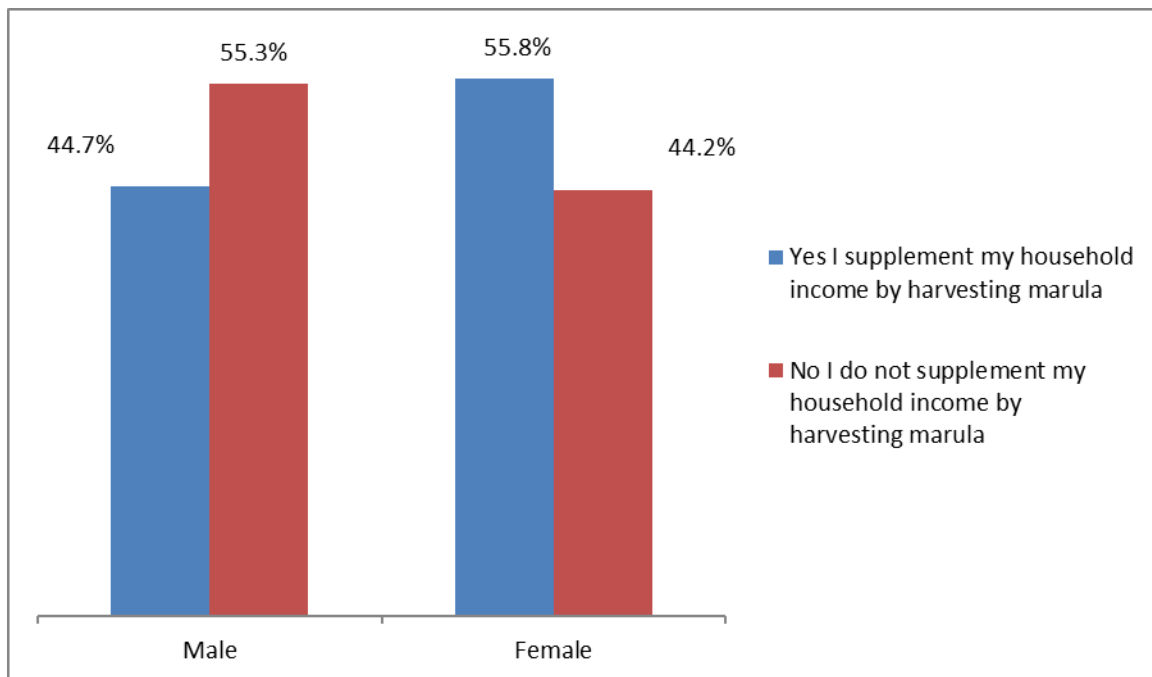
Marula harvesting in Swaziland comes at a time when everyone is looking for cash to pay school fees for children and other pressing household needs also need to be considered. In fact, Den Adel (2002), Campbell *et al.* (2002), Ngorima (2006) and Shackleton & Shackleton (2004) all emphasised the important role marula harvesting and selling play across southern Africa in providing for school fees and other household needs during difficult economic periods, especially after the Christmas and New Year festivals. This further confirms the important role of marula in poverty alleviation.

6.2.2 Gender of marula harvesters and marula harvesting

Figure 5.1 in Chapter 5 showed that the majority (77%) of the respondents were females. To establish whether gender determines an individual's decision to engage in supplementing household income through harvesting marula, a Chi-square test was conducted. The result confirmed a statistically significant association ($p=0.05$) between gender and the supplementation of household income through the harvesting of marula (Figure 6.2). Figure 6.2 shows that female respondents were proportionately (55.8%) more inclined to harvest marula for purposes of household income generation than male respondents (44.7%). This observation is in concert with that of Shackleton *et al.* (2007) as well as Sunderland, Harrison and Ndoye (2004) who found the proportion of females engaging in the mat, broom and marula beer enterprise to be significantly higher than that of males.

Shackleton *et al.* (2007) and also UNESCO & UNICEF (2015) point out that female-headed households are commonly considered to be the poorest of the poor. This confirms the observation of the current study where female-headed households in the study area were found to be more likely to be in a potential state of vulnerability and, hence, more inclined to view marula harvesting as a fundamental cash safety net. In line with this observation,

evidence from South Africa indicates that, with a poverty rate of 60%, female-headed households are proportionately twice as vulnerable as male-headed households (Clarke, Woodley & Lewis, 2011; Flatø, Muttarak, Pelsler, 2017; Gelb, 2003; Makdoh, Lynser & Pala, 2014; UNESCO & UNICEF, 2015).



N = 411; p=0.05

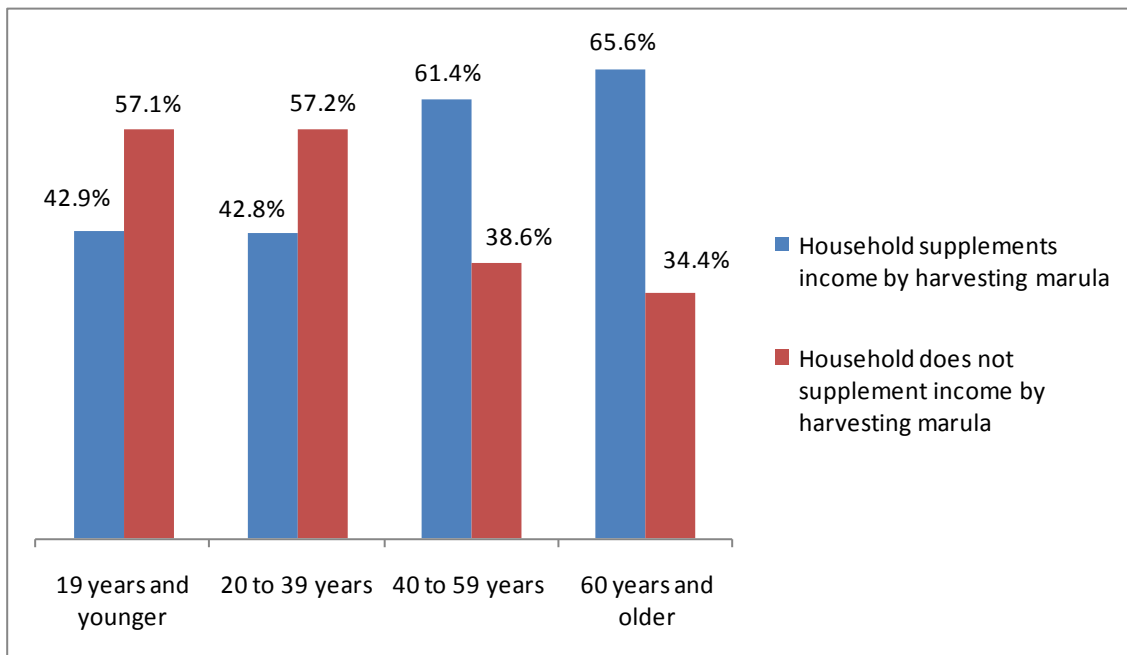
Figure 6.2: Male and female respondents and supplementation of household income through harvesting and selling marula products

6.2.3 Age and the harvesting of marula for supplementing household income

Figure 6.3 shows that, proportionately, respondents in the age group 40 to 59 years (61.4%) and those in 60 years and older group (65.6%) were more likely to engage in marula harvesting for household income generation as compared to those in the age groups 20 to 39 years and 19 years and younger. A Chi-square test confirmed a statistically significant difference (p=0.001) between age groups and marula harvesting for household income generation.

The immediate explanation to this finding is probably that those in the younger age group are still either dependent on their parents or school-going and, as such, their engagement in marula harvesting is relatively limited. Since the marula season coincides with the beginning

of the school year (Mabaya *et al.*, 2014; Shackleton & Shackleton, 2002; Wynberg *et al.*, 2002a), it is expected that people in the 19 years and younger age group and probably some of those in the age group 20 to 39 years were busy at school. The latter age group is expected to be engaging in activities, such as farming or selling things in the market other than going to the forests to scout for marula.



N = 411; p=0.001

Figure 6.3: Age of respondents and supplementation of household income through harvesting and selling marula

The older age groups are expected to have much more responsibilities, probably due to large family sizes and yet their abilities to engage in physically demanding activities, such as farming are reduced due to age-related health issues. It can be argued that those 60 years and older are proportionately more involved in marula harvesting than any of the other age groups because they have much more time on their hands since they are mainly retired persons. The 40-59 age group probably has larger households than the younger groups, which prompts them to supplement their household income. Therefore, they had to engage more in marula harvesting as an alternative for income generation to support the family. This observation confirms a claim by Nkuni (2004) who points out that the likelihood of the older aged people to get jobs and also engage in labour-intensive work has declined. This is

because of ill-health that prevented some of the old people from exploiting physically challenging sources of income, such as farming. However, some of the people in the old group are expected to be getting pension from former employment, support from relatives, and government support through the elderly social grants, or are being taken care of by their children or relatives. Such kinds of support are quite often very meagre and sometimes unreliable, which forces the older people to engage in marula harvesting. In fact, the elderly social grant in Swaziland was barely increased from E220 (US\$15.94) to E240 (US\$17.39) per month effective from April 1, 2015 (Dlamini, 2013). The finding in this study, thus, emphasises the important role marula plays as a safety net for household income generation and the fact that when it gets scarce or depleted, poor households would be adversely affected.

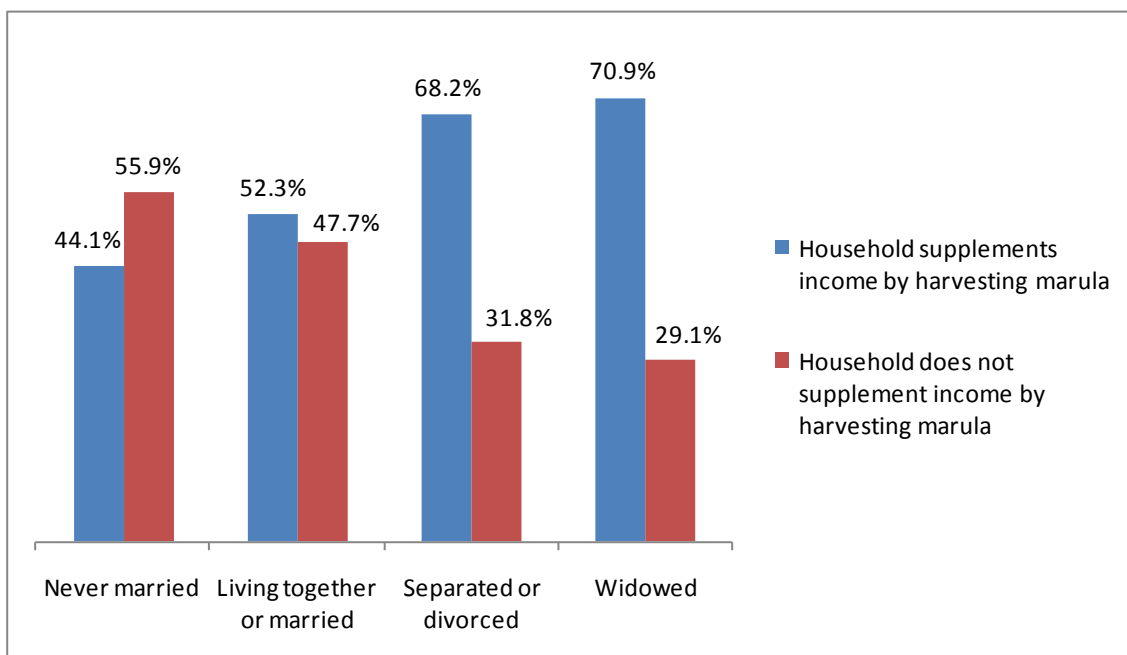
One other possible explanation for the statistically significant correlation in Figure 6.3 relates to the fact that the age groups 40 to 59 years and the 60 years and older have added household responsibilities that do not necessarily apply the case for the 19 years and younger age group who might be having fewer household responsibilities. It is common in Swaziland for many parents and grandparents to be left with an extra burden of taking care of grandchildren who are either brought to them by their own children who had children at teenage. These could be children left home as parents migrate in search of jobs in urban areas, or orphaned children from diseased relatives who died of HIV and AIDS or other causes (Makadzange & Dolamo, 2011; Open Society Foundations Education Support Program [OSF ESP] & Open Society Initiative for Southern Africa [OSISA], 2012).

According to Zwane (2016), 81.42% of elderly people in Swaziland care for their grandchildren, 59.32% care for their own children while 16.9% care for their relatives, which is an additional burden on their basic needs in life. The responsibility of taking care of the elderly and orphaned people in Swaziland is mainly shouldered by the people in the age group 40 to 59 and 60 years and older, thus giving them an extra financial burden. The latter is confirmed by Makadzange and Dolamo, (2011) and also Dlamini (2013) who point out that the elderly are often the only remaining carers for children orphaned in the HIV pandemic. This extra burden adds to the odds of needing an extra income for household livelihood. In addition, the finding in Figure 6.3 further suggests that any depletion/scarcity

of marula would have an adverse impact on the livelihoods of a number of households as harvesting and selling marula appears to be the only significant safety net for income generation in the study community.

6.2.4 Marital status of respondents and supplementation of household income through harvesting of marula

The marital status of respondents was investigated to establish how it influenced an individual’s decision to engage in marula harvesting to supplement household income. Figure 6.4 shows that there is a statistically significant correlation between marital status and marula harvesting for household income generation ($p=0.005$). Those respondents who are separated or divorced (68.2%) and those who are widowed (70.9%) are more inclined to supplement their household income by harvesting marula, compared to those who are married or living together (52.3%) and those who were never married (44.1%).



N=411; $p=0.005$

Figure 6.4: Marital status of respondents and supplementation of household income through harvesting and selling marula products

A probable explanation for this observation is that the people who are separated or divorced and widowed have lost an important provider who could potentially bring an

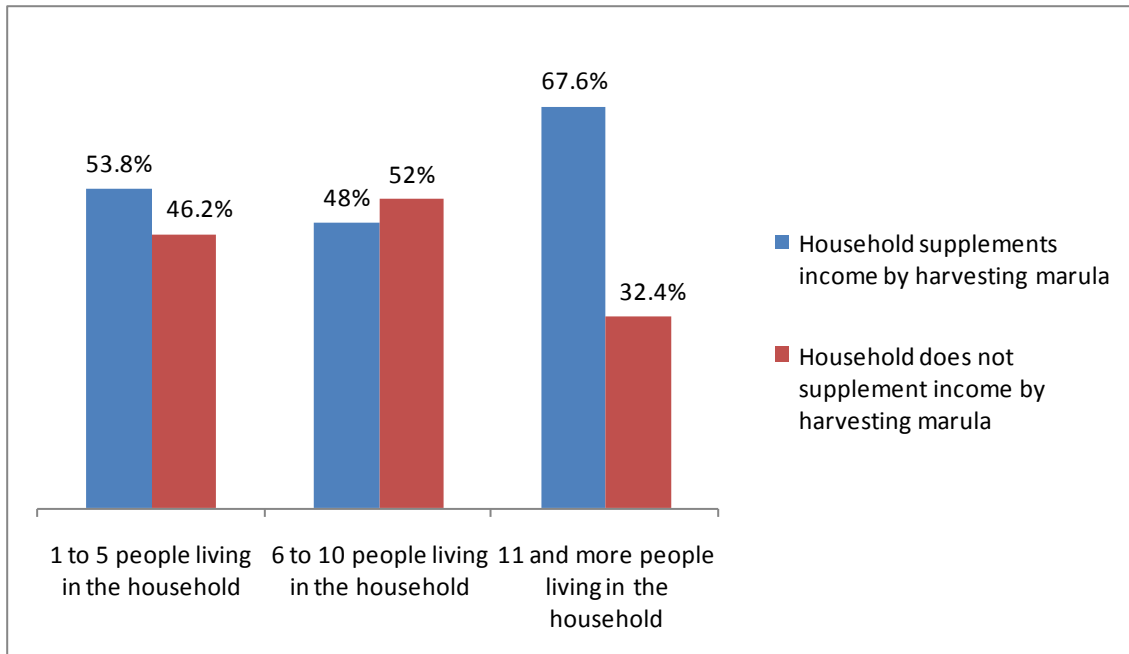
income into the household. Mwema *et al.* (2013) reported that, when two people live together, the odds of income generation are increased; hence both will tend to scout for an income. This confirms the finding in Figure 6.4.

The households of widowed, divorced or separated respondents are usually burdened by being single parents, guardians or grandparents who have to cater for all the needs of the household. This also makes these groups more vulnerable in the event of overconsumption or collapse/depletion of the marula resource. The likelihood of the latter happening is propelled by the entry of a growing number of harvesters to the marula environment, as well as the occurrence of erratic rainfall as was found in Chapter 5 (Figures 5.26 and 5.6 respectively). Marital status has, therefore, been identified as one of the drivers that influence the respondents' decision to partake in harvesting marula to supplement household income.

6.2.5 Household size and supplementation of household income through harvesting of marula

Another factor that could drive people to harvest natural resources, such as marula, for household income generation is the number of people living in a household. In this case, one would be tempted to argue that households with a larger number of people would be more inclined to engage in marula harvesting than those with fewer members. The average household size in this study was seven members, as indicated in Chapter 5, sub-section 5.3.1.4. Almost half of the households (47.7%) had six to ten members living there and the other half comprised households with one to five members (35.8%) or 11 and more members (16.5%) (See Figure 5.2.4, Chapter 5).

Figure 6.5 shows the correlation between household size and the supplementation of household income through marula harvesting.



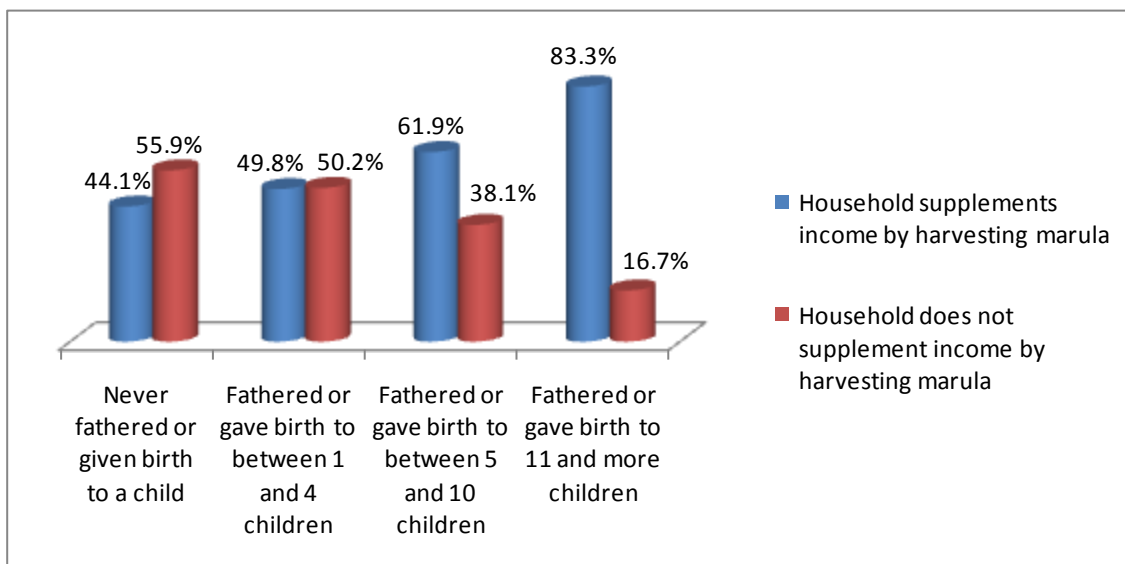
N=411; p=0.019

Figure 6.5: Household size and supplementation of household income through harvesting and selling of marula products

Households with 11 and more members are proportionately more inclined (67.6%) to supplement their household income by harvesting marula than those with one to five members (53.8%) and those with six to 10 members (48%). A statistically significant relationship ($p=0.019$), therefore, exists between household size and the need to harvest marula in order to supplement household income, which confirms that household size is a driver in marula harvesting to supplement household income in the study area. The same observation was also made by Ngorima (2006) and further confirmed by studies in Ethiopia and Burkina Faso where dependency on NTFPs was found to be significantly related to household size (Kamanga, Vedeld & Sjaastad, 2009; Coulibaly-Lingani *et al.*, 2009; Mamo, Sjaastad & Vedeld, 2007; Völker & Waibel, 2010, 2010).

6.2.6 Number of children respondents had fathered/ given birth as push factor for marula harvesting and the supplementing of household income by harvesting marula

The decision to engage or not in marula harvesting for income generation might also be influenced by the number of children an individual has. Figure 6.6 points at a direct and statistically significant correlation ($p=0.023$) between the number of children one has and the supplementation of income by marula harvesting. As confirmed by Sutherland, Pullin, Dolman and Knight (2004), this current study has observed that, the more children a respondent has, the greater the likelihood that such a household will depend on marula harvesting to supplement its income.



N=411; $p=0.023$

Figure 6.6: Number of children a respondent has fathered or given birth to and the supplementation of household income through harvesting marula products

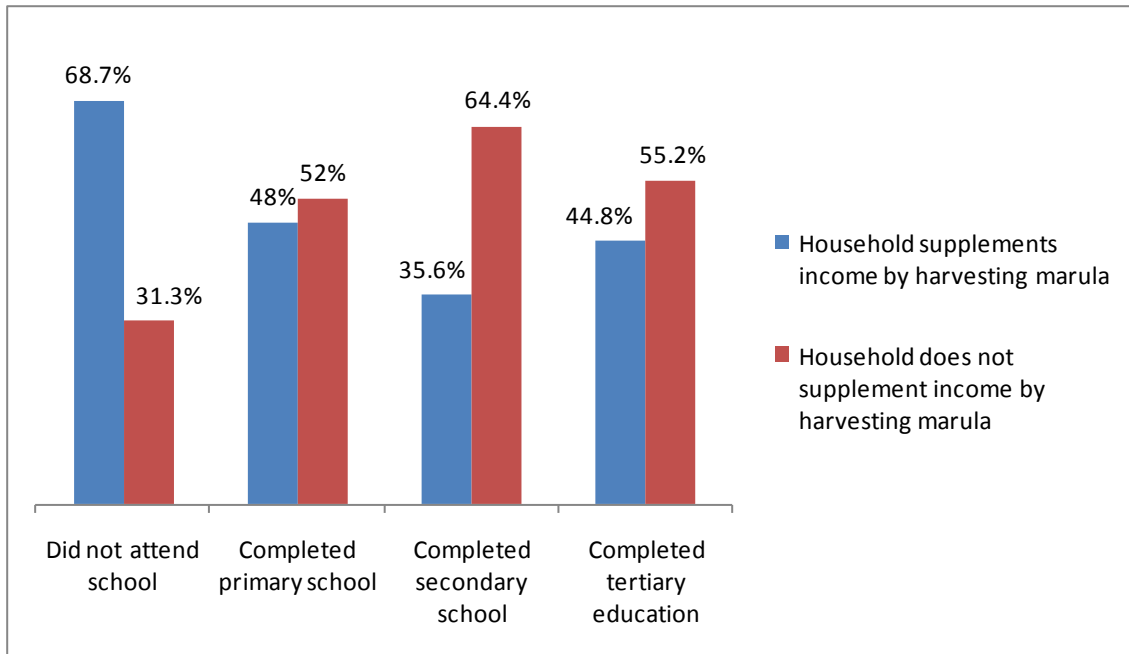
Proportionately, individuals who have 11 and more children (83.3%) are almost twice more likely to harvest marula for an income than those who never had a child (44.1%). It is common in Swaziland for young individuals (roughly in the 15 to 25 years age group) to have children of their own before they get married. This is also one of the main factors contributing to the high level of school dropout, especially among girls (Mngadi, 2007; UNICEF, WHO, & World Bank, 2013).

Figure 6.6 confirms that having more children had a bearing on the respondent to decide on marula harvesting for purposes of household income generation and, thus, serves as driver in marula harvesting for household income generation. This correlation further demonstrates the complex, multiple and reciprocal relationships that exist among population (fertility), environment (marula harvesting) and development (rural livelihoods and poverty) factors in the study area (see Chapter 2 subsection 2.1).

6.2.7 Level of education and supplementing of household income by harvesting marula

Chapter 5 (Table 5.8) attested to the low educational status of the respondents. As many as 21.2% of the respondents never attended school, while 15.5% completed secondary school and only 7.1% completed tertiary education. Figure 6.7 shows a statistically significant correlation ($p= 0.000002$) between educational status and the harvesting of marula for household income.

Figure 6.7 reveals that almost seven out of every 10 respondents (68.7%) who never attended school supplemented their household income by harvesting marula – a proportion that dropped to 48% for respondents who completed primary school and even further to 35.6% in the case of those who completed secondary school. It is interesting to note that 44.8% of those who completed tertiary education also supplemented their household income by harvesting marula. However, the general trend indicates that the lower the educational status of respondents, the more they depend on marula harvesting for an income.



N=410; p=0.000002

Figure 6.7: Level of education and supplementation of household income through harvesting and selling marula products

Respondents who completed tertiary education appear to be the exception to this, as proportionately more of this group (44.8%) are engaged in marula harvesting than those who only completed secondary education (35.6%). This state-of-affairs could probably be ascribed to the lack of employment opportunities for tertiary graduates in the area as a result of the high unemployment rate in Swaziland, which currently stands at 40.6% (Kingdom of Swaziland, 2013; Central Intelligence Agency [CIA], 2016). As such, these tertiary graduates find themselves unemployed and/or probably getting low paying jobs and, thus, have to resort to harvesting marula as a safety net to supplement their household income. In addition, the proportions for the “completed tertiary education” group in Figure 6.7 could have been impacted by the relatively low number of respondents (n=29) in the sample.

Education empowers individuals to increase their well-being and contributes to broader social and economic gains. The Educational, Scientific and Cultural Organization (UNESCO) (2002) put it vividly clear that education is widely recognized as an important remedy for addressing the sustainability crisis facing human society. On the importance of education for

the sustainability of natural capital, such as marula resources, the World Bank (2003) observed that people's education is fundamental as it opens up a world of opportunities, reduces the burden of disease and poverty and gives the individual a greater voice in society. The World Bank (2003) further recognizes that education also opens doors for national economic and social prosperity, encouraged by a dynamic workforce and well-informed citizenry that is capable of competing and cooperating in the global arena and, thus, reducing the chances to engage in household income generation from natural capital (marula, in the case of this study).

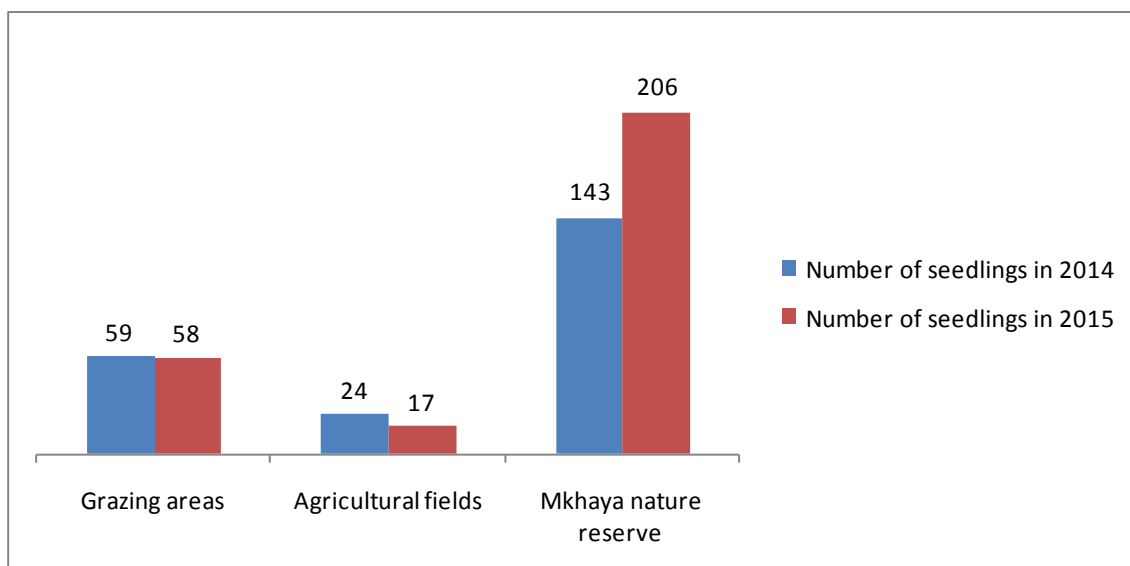
Goal two of the MDGs recognizes the role of education in driving the agenda for sustainable development. The 2015 Sustainable Development Goals (SDGs) otherwise referred to as Global Goals, further build on the MDGs. The role of education in development has also been recognized by the SDGs and its broader sustainability agenda that goes much further than the MDGs, and aims at addressing the root causes of poverty and calls for a universal need for development that works for all people. Specifically, Goal Four of the SDGs calls for nations to ensure inclusive and equitable quality education and promotes lifelong learning opportunities for all (Lunn *et al.*, 2015; Wolfgang, 2016). This further confirms the important role of education in the use of natural capital in eradicating poverty and achieving sustainable development among communities, especially among rural women.

According to UNESCO and UNICEF (2015), in sub-Saharan Africa, only 23% of poor rural girls finish primary school, thus confirming the finding that the majority of the people collecting marula had a low level of education and were mainly females (Figure 6.2). Prior to the development of the SDGs, the World summit of 2002 in Johannesburg, South Africa, reemphasized the critical role of education in achieving sustainable development, and the summit culminated in the United Nations declaration of 2005 to 2014 as the Decade of Education for Sustainable Development (United Nations, 2002) - something which most countries in sub-Saharan Africa could not achieve due to several reasons (Bello & Suleman, 2011; Lunn *et al.*, 2015; Wolfgang, 2016).

6.3 Findings relating to objective two

The second objective of the study was to examine the current population structure of marula trees in the study area in order to determine the regeneration and recruitment of new marula seedlings in three different types of land use (agricultural fields, grazing areas and the Mkhaya Nature Reserve). This objective was aimed at answering the following research question: “Are the current population of marula trees and the level of regeneration sufficient to ensure the future sustainability of marula in the light of existing commercialization and harvesting practices”?

The vegetation data presented in Chapter 5 (Table 5.4) show that marula is hardly regenerating in the agricultural fields and in grazing areas, as there were only 24 young marula trees counted in all the plots in the agricultural fields and 59 in all the plots in the grazing areas under study in 2014. In 2015, there were only 17 young marula trees counted in all the study plots in the agricultural fields and 58 in all the study plots in the grazing areas. Nevertheless, Table 5.4 in Chapter 5 shows a high level of regeneration of marula trees in the Mkhaya Nature Reserve, as 143 seedlings were counted in all the plots under study in 2014 and 206 seedlings counted in 2015 (also see Figure 6.8).



N=507 seedlings

Figure 6.8: Number of marula seedlings found in the different land use plots in the years 2014 and 2015

The available data thus suggest a decline (downward trend) in the number of new marula trees in the agricultural fields and in the grazing areas, but an upward trend in the Mkhaya Nature Reserve. The immediate explanation for this observation is that the agricultural fields are subjected to frequent ploughing, thus any new marula seedling growing is ploughed under. In addition, most people harvest marula fruits and seeds from both the agricultural fields and grazing areas, which removes the seeds that could have germinated into young marula seedlings that would replace the old mature marula trees. Animals also feed on marula fruits and seedlings. This seems to agree fairly well with findings of other researchers who observed that marula is utilized by elephants and rhinoceros, warthogs, porcupines, monkeys, baboons, millipedes, domestic cattle and goats (Helm & Witkowski, 2013; Kgomoamagodi, 2008; Pegg, 2014; Palmer & Pitman, 1972; Pooley, 1993).

The browsing on marula by animals is claimed to be controlling the population numbers of marula trees (Gadd, 2002; Hamidou *et al.*, 2014; Kgomoamagodi, 2008; Pegg, 2014). Studies by Walker (1986) and Gadd (2002) show that overbrowsing on marula trees destabilises the population structure of the marula, which has been found to be occurring especially in the grazing areas and also in agricultural fields of the study area. Continuous browsing can result in the absence of immature trees and little or no evidence of successful regeneration and recruitment, which is what is currently obtaining in the study area. The finding in this study has underlined the impact of browsing by cattle and goats on marula seedlings in the agricultural fields and the grazing area, which the data has shown to be impacting negatively on the marula seedlings in the study area. This observation is similar to that of Haig (1999), Hamidou *et al.* (2014), Lawes *et al.* (2004) and Pegg (2014).

The occurrence of occasional fires in the grazing areas was also reported by the women's association during in-depth interviews. Such fires are claimed to be affecting the regeneration potential of the marula seedlings, as the upcoming and old trees are burnt down by the fires, thus impacting the recruitment of young trees as noted by Helm *et al.* (2011a) and Jacobs and Biggs (2002). In the present study, the decreased regeneration of marula trees in both the grazing areas and agricultural fields could also be associated with such factors as continued harvesting of fruits and seeds, persistent decline and extremely variable annual rainfall in the study area, occasional wild fires, and the eating of the fruits

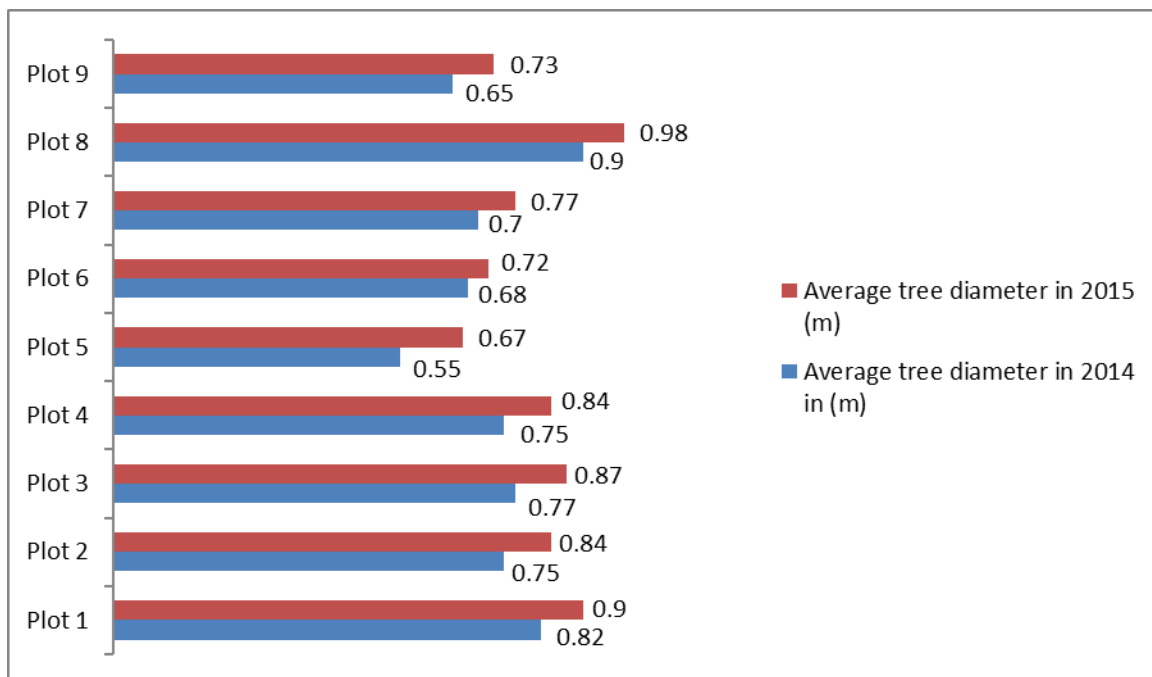
and browsing of seedlings by animals. This finding is in line with that of Helm *et al.* (2011a). Marula has a very small persistent seed bank due to the high demand for and continuous harvesting of its fruits and seeds. This could also have been one of the prudent explanations for the decreased regeneration in the agricultural fields and grazing areas, which is in concert with findings by Helm *et al.* (2011a).

Figure 6.8 further shows that there was a high potential for the regeneration of marula trees in the Mkhaya Nature Reserve, as in 2014 there were 143 marula seedlings counted compared with the 206 seedlings that were counted in 2015. The absence of fire and of continued harvesting of the marula products in the Mkhaya Nature Reserve could have been responsible for the good regeneration. This agrees quite well with findings by Helm *et al.* (2011) who observed that in the absence of harvesting, the potential of marula regeneration is enhanced due to the uniqueness of the marula plant. Marula is extremely well adapted to the effects of fire due to its thick bark, extensive re-sprouting ability, and fast growth rates (Helm *et al.*, 2011). In addition, marula has a high allocation of root mass, levels of storage, chemical defence, and very drought tolerant seedlings.

To determine the different size class groups, the marula tree diameter at breast height (130cm) was used as demonstrated in Image 6, and shown in Figures 5.1, 5.2 and 5.3 (Chapter 5). Figure 6.9 shows that, in the grazing areas, the average largest marula tree diameter was 0.98m and the smallest diameter was 0.55m. The profile of the marula tree size class in the grazing areas indicated old class size, thus suggesting an unstable marula tree population in the grazing areas. This finding is in agreement with studies of Munondo (2005; 2012) in Zimbabwe who reported that younger marula tree classes were scarce and that the mortality of marula seedlings and saplings was relatively high. However, the finding in the present study does not support those by Shackleton and Shackleton. (2004) that obtained size classes that indicated stable populations of marula in their study in Makhatini and Bushbuckridge in South Africa.

Figure 6.9 shows that in the grazing areas, the smallest average stem diameter (0.55m) was seen to be almost twice as big as the 61cm circumference (0.31m diameter) observed by Shackleton and Shackleton (2004), the 28.3cm circumference (0.14m diameter) observed by Shackleton (2002), and the 42.8cm circumference (0.21m diameter) observed by Shackleton

(2003) in South Africa. The present study found that the smallest average marula tree stem diameter size was more than double the smallest average stem size diameters of 7.1cm (0.071m), 15.7cm (0.157m) and 21cm (0.21m) observed in different places in South Africa and which are considered as the average sizes at sexual maturity for marula (Helmet *al.*, 2011a; Shackleton, 2004). This is an indication that the marula trees in the grazing areas are of an old age size class, which correlates well with the findings by Gadd (1997), Jacobs and Biggs (2002), and also Walker, Stone and Henderson (1986).



N = 30 marula trees

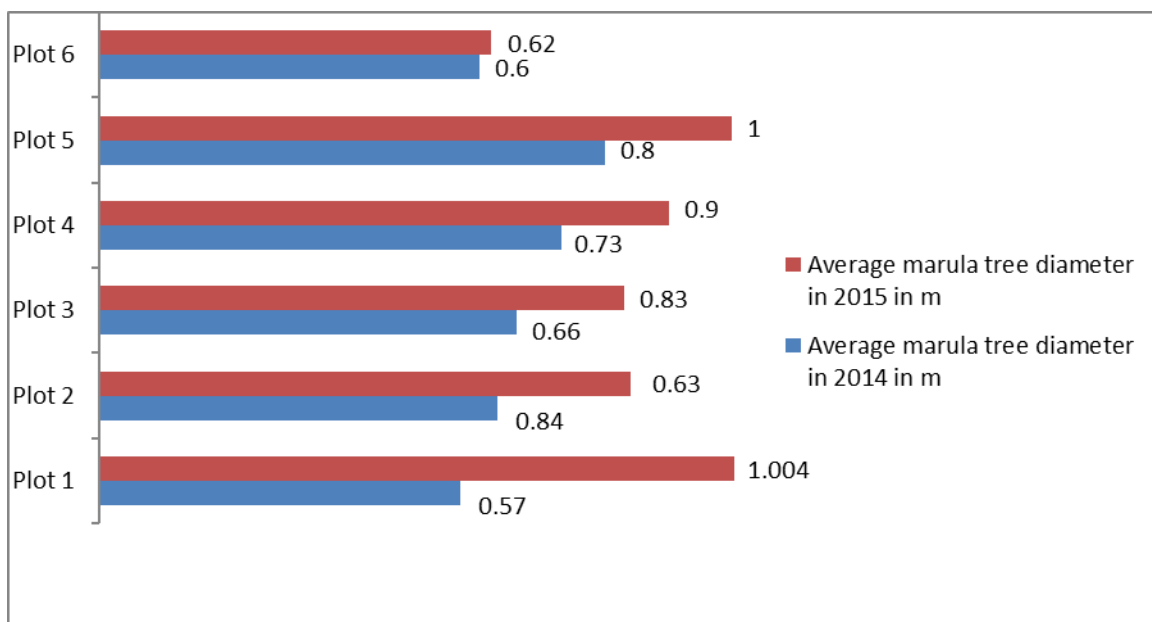
Figure 6.9: Average diameter of the marula trees at breast height (130cm height from the nground) in the plots of the grazing areas

The probable explanation for the old age structure depicted in these grazing areas is a result of browsing and grazing of the seedlings by cattle and goats, an observation that is in agreement with findings by Helm and Witkowski (2013) and also Helm *et al.* (2011a). In addition, the continuous harvesting of marula fruits and seeds by the increasing number of harvesters could have adversely affected the meagre seed bank of marula (Chapter 5, Figure 5.26), as confirmed by several previous studies (Helm & Witkowski, 2013; Kgomoamagodi, 2008; Pegg, 2014; Palmer & Pitman, 1972; Pooley, 1993). Furthermore, the animals feed on

the fruits and disperse the seeds away from the grazing areas, similar to what has been observed by Jacobs and Biggs (2002) in the Kruger National Park.

All the trees in the grazing areas were very old, and no other tree size classes are found in the grazing areas, apart from the scarcely regenerating seedlings which hardly grow to mature trees due to destruction by browsing and sporadic fires. This poses a threat to the sustainability of the marula tree species in the grazing areas. The absence of other tree size classes can be attributed to over-grazing by domestic stock, as also confirmed by IFAD (2016) and increased harvesting of marula fruits and seeds by people. Marula seeds do germinate around cattle and goats' kraals, but are eaten by animals or ploughed under during land preparation for crop production. The implication of this finding is that the marula tree population in the grazing areas is of the same age class with no younger size classes, thus posing a threat to the sustainability of the marula tree species as the old trees can senesce and die at roughly the same time (Stewart & Veblen, 1982).

Figure 6.10 shows the average marula tree diameter sizes in the agricultural fields. The average smallest stem diameter was 0.57m and the largest diameter was 1.004m.



N = 23 marula trees

Figure 6.10: Average diameter of marula trees at breast height (130cm from the ground) in the agricultural fields

A marula tree of average stem girth of 2.4m (diameter of 1.2m) is considered to be 183 years in age (Haig, 1999; Jacobs & Biggs, 2002). This compares well with the marula tree sizes and probably ages in the agricultural fields and also in the grazing areas (Figures 6.9 and 6.10). The size class profile in the agricultural fields (Figure 6.10) indicated an extremely unstable marula tree population - a finding that differs from Shackleton *et al.* (2004) who observed a stable population with all class sizes represented. The smallest average stem diameter found in the agricultural fields was 0.57m, which is almost double the 7.1cm (0.071m) and 15.7cm (0.157m) observed by Helm *et al.* (2011a), the 61cm circumference (0.31m diameter) observed by Shackleton and Shackleton (2004), the 28.3 cm circumference (0.14m diameter) observed by Shackleton (2002) and the 42.8cm circumference (0.21m diameter) observed by Shackleton *et al.*, (2003) in South Africa.

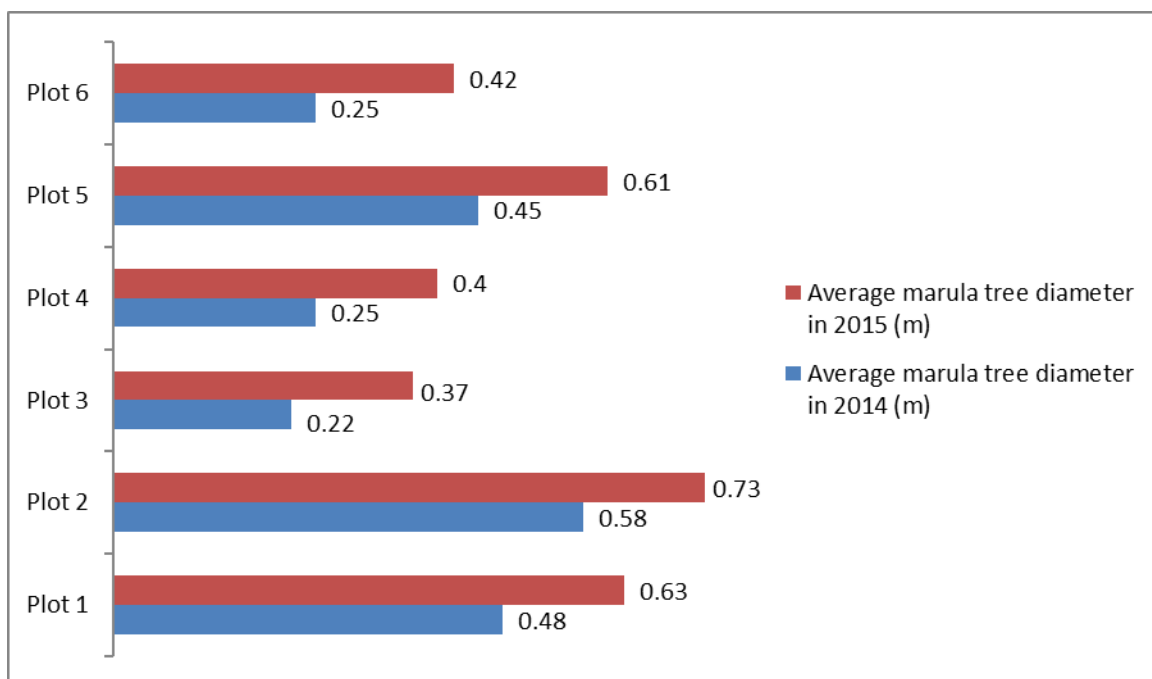
This study found that the smallest average marula tree stem diameter size was almost double the smallest average stem size diameter of 0.21m, which is considered as the average size of sexual maturity of marula (Shackleton & Shackleton, 2004). This is again an indication of the old age size class structure of marula trees in the agricultural fields, thus threatening sustainability of the marula species in the agricultural fields. This finding is supported by several authors (Gadd, 1997; Jacobs & Biggs, 2002; Walker *et al.*, 1986) who revealed a lack of immature trees in their respective study areas.

The lack of recruitment of new marula trees and the gradual death of the existing mature trees as they reach the end of their life cycle, may lead to a situation where there is no source of new seeds and therefore no new seedlings to be recruited into the existing population – something that may lead to the extinction of the species all together. This observation is confirmed by Jacobs and Biggs (2002) who, too, maintain that such a situation could lead to the extinction of marula trees. One danger of such a situation is that when most of the mature marula trees of a population are the same or nearly the same age, they will tend to senesce and die at about the same time (Stewart & Veblen 1982). This scenario could also happen in both the agricultural fields and grazing areas of the study area and in Swaziland at large.

On-site observations showed that the majority of the trees in the agricultural fields were very old and some of them stopped bearing fruits. Although this observation is not based on

scientific evidence, during in-depth interviews with members of the women’s association that sells marula kernels, one of the respondents remarked that “we used to harvest a lot of marula fruits in this area, but nowadays, some of the trees no longer bear fruits, like this marula tree under which we are seated, and that one in front of that house over there used to bear fruits when we were young, but now they are old and do not produce fruits anymore”.

Figure 6.11 shows the average marula tree diameters in the Mkhaya Nature Reserve. The size class profile in the Mkhaya Nature Reserve indicated the existence of all the different marula tree size classes, thus suggesting some level of stability of marula tree population. This is in agreement with similar findings by Shackleton and Shackleton (2004) who obtained a stable marula population with all size classes represented.



N = 12 trees

Figure 6.11: Average diameter of marula trees at breast height (130cm from the ground) in the Mkhaya Nature Reserve

In the Mkhaya Nature Reserve, the smallest average stem diameter (0.22m) was seen to be close to the 7.1cm (0.071m) and 15.7cm (0.157m) observed by Helm *et al.* (2011a), the 61cm circumference (0.31m diameter) observed by Shackleton (2004), the 28.3cm

circumference (0.14m diameter) observed by Shackleton (2002) and the 42.8cm circumference (0.21m diameter) observed by Shackleton *et al.* (2003) in South Africa.

The observation in this study is an indication of the potential regeneration capacity the Mkhaya Nature Reserve has for marula sustainability. In general, all stem size classes were represented in the Mkhaya Nature Reserve, which correlates well with previous population size structural studies on marula (Gadd, 1997; Jacobs & Biggs, 2002; Walker *et al.*, 1986). The significantly higher regeneration rate in the Mkhaya Nature Reserve could have been due to the low level of ungulates (which could have contributed to a low level of grazing), absence of cattle and goats (which could have reduced the level of grazing and browsing), low level of harvesting by human beings, and the high species diversity which probably offered an alternative fodder for grazing and browsing by the few ungulates, and thus leading to the marula seedlings being spared.

As indicated in Chapter 5, environmental factors, such as geology, soil and temperature did not seem to have affected the potential recruitment and sustainability of the marula tree population in the study area. However, the amount of rainfall was found to have decreased over the years and, thus, could have affected the potential germination, maturity and recruitment of new marula trees into the existing population (Dlamini, 2011; Moyo *et al.*, 2009).

In addition, although the impact of temperature on the marula seed germination was not determined in this study, it is highly unlikely that the variability in temperature (Chapter 5, Figures 5.4 and 5.5) could have had a negative impact on the seed germination, since the temperatures were within the normal range for marula. A similar observation was recorded by Hall *et al.* (2000). Nevertheless, the impact of increased marula harvesting in the agricultural fields and the grazing areas seems to have been the dominant factor impacting negatively on the regeneration potential in these areas. In the Mkhaya Nature Reserve, however, there was little or no harvesting of marula fruits and, therefore, it is expected that seeds were lying on the ground and germinating to new trees. Due to the cross-sectional nature of the current study, the impact of these and other environmental factors on marula regeneration needs further interrogation over a long period of time.

6.4 Findings relating to objective three

Objective three set out to assess how depletion or scarcity of marula may affect the income, livelihoods and cultural practices of rural households in the study area. This objective was geared at answering the following research question: “How will marula depletion or scarcity affect the livelihoods and well-being of the rural populations who depend on it”?

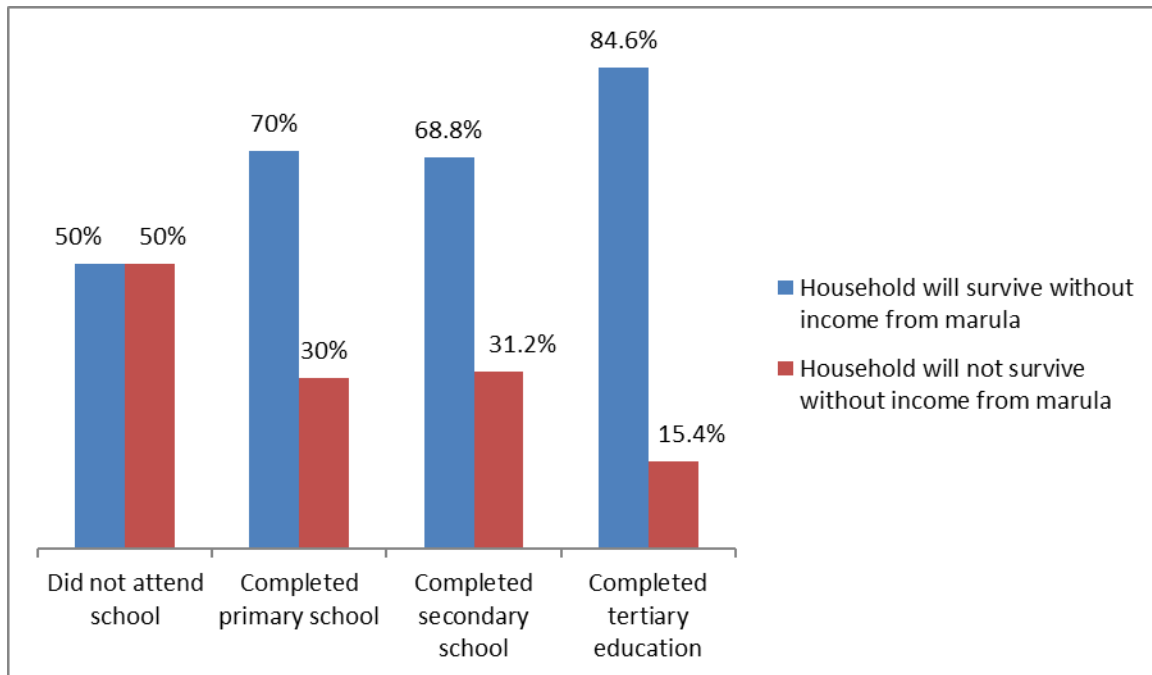
6.4.1 Impact of marula depletion on livelihood of households

In Chapter 5, Figure 5.27 showed that 44.7% of the respondents were of the opinion that marula will still be available in the next five years, 40% opined that marula will be available for the next ten years, and 15.3% were of the opinion that marula will be depleted within the next five to ten years. Against this background, and based on the discussion under objective one, it can be interpreted that most of the respondents are not aware of the looming potential of marula depletion/scarcity in the area. If depletion were to occur, it will adversely affect the poor rural households that depend on marula for income and food. Observations around the households during the socio-economic interviews showed glaringly that the poor households were food insecure and it was obvious that marula played a big role as a source of food. Kirkland, Kemp, Hunter and Twine (2013) as well as Tibesigwa *et al.* (2014) made a similar observation in their respective studies in South Africa.

6.4.1.1 Education level and the impact of marula depletion on household survival

The relationship between educational status and well-being or income is widely documented (Feinstein, Sabates, Anderson, Sorhaindo & Hammond, 2006; Sabates & Hammond, 2008). In this regard, the data in this present study revealed a statistically significant relationship ($p=0.009$) between the respondents' level of education and the survival of households without the income from harvesting marula (Figure 6.12). Figure 6.12 shows that, among those respondents who indicated that they supplement their household income through harvesting marula, the households of those who did not attend school are proportionately (50%) more inclined to not survive in the event that marula becomes scarce or depleted, compared to households of respondents who completed only primary school (30%), secondary school (31.2%) or tertiary education (15.4%). This correlation supports

earlier observations in Table 5.8 (Chapter 5) and Figure 6.7 and also confirms that low(er) levels of education not only increase the dependency on marula, but also cause such households to be more vulnerable compared to households where respondents have a higher level of education.



N=219; p=0.009

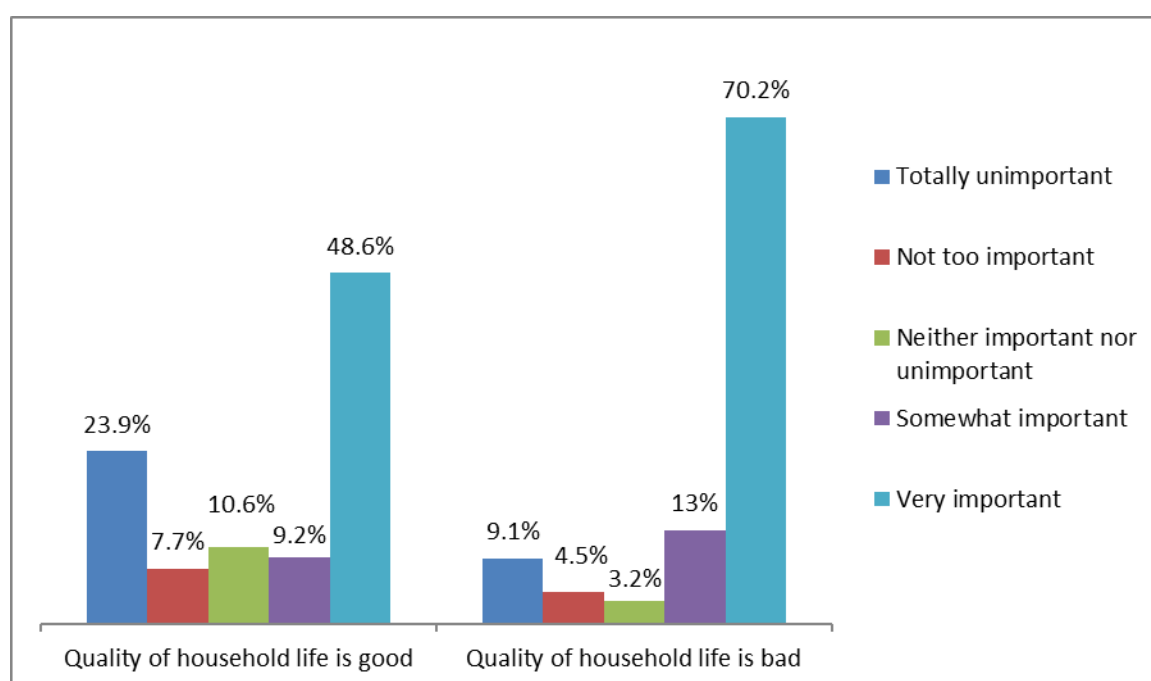
Figure 6.12: Highest level of education and survival of households without the income from harvesting and selling marula

Scholars argue that vulnerability and poverty comprised, among others, economic, social, cultural, political and environmental factors (Mavrotas, Murshed & Torres, 2011; Philip & Rayhan, 2004; Seaman, Swandon, Acidri & Petty, 2014). Generally, poverty impacts disproportionately on vulnerable households whose members have lower levels of education or none, and is further mainly associated with deprivation of health, education, food, knowledge, influence over one’s environment and many other things that make the difference between truly living and merely surviving (Philip & Rayhan, 2004). The potential depletion or scarcity of marula therefore, would render households of the less educated in this study more vulnerable, which would then expose them to other hazards, such as loss of livelihood, health hazards, economic down-turns, natural catastrophes, man-made violence, thus rendering their economic survival impossible.

6.4.2 Importance of marula harvesting to the household and the quality of life in the household

In Chapter 5 (Figure 5.36), 53.8% of the respondents said the quality of life of their households was good, while 46.2% said that it was bad. The findings in Figure 6.15 confirm a statistically significant correlation ($p = 0.0001$) between the importance of marula to the household and self-reported household quality of life.

Figure 6.15 shows that the respondents who reported their household qualities of life to be “bad” were proportionately (70.2%) more inclined to view marula as an important source of household income than those who described their quality of life as “good” (48.6 %). This emphasizes the important contribution of marula to household income and nutrition and the adverse impact its scarcity or depletion would have on many households in the study area and, particularly, on the already vulnerable households. Similar findings by other scholars emphasised the important contribution of the harvesting of wild fruits (such as marula) to rural poor households’ food security, income and quality of life (Ibnouf, 2009; Kajembe, Mwenduwa, Mgoo & Ramadhani, 2000; Mariod & Ibrahim, 2012; Ngorima, 2006).



N=296, $p = 0.0001$

Figure 6.13: Importance of marula and household quality of life in the study area

Although marula is a very important resource for the livelihoods of large proportions of households in the study area, it is a particularly important resource for the economically deprived and vulnerable households. Any potential scarcity or even depletion of marula would, thus, have dire economic consequences for many poor households in the study area who already consider their quality of life as bad.

6.4.3 Perceptions of respondents on why marula is becoming scarce or depleted

Figure 5.27 in Chapter 5 showed that 53.8% of the respondents noted that marula is becoming less available than before. One of the main reasons for marula becoming scarce or depleted was the increase in the number of people harvesting marula (Chapter 5, Figure 5.28). The total impact on resource use/harvesting is a product of population (P) x Affluence (A) X Technology (T) (Botkin & Keller, 2012; Harper, 2012; Harrison & Pearce, 2000). This implies that the larger the number of people (i.e. increase in population) who are harvesting a resource, the greater the competition for the resource which then may lead to overharvesting. In the context of the current study, the demand for marula is driven by the commercialization of marula products in the country, which in turn has attracted more people to engage in harvesting marula for purposes of earning an extra income and livelihood.

The increase in the number of people attracted to the harvesting of marula – underpinned and fueled by the availability of a commercial market and growing market demand has, no doubt, intensified the competition for marula. This has led to overharvesting of the marula fruits, as during the field vegetation survey, the fruits were found to have been all harvested with no single fruit left for regeneration purposes. This observation was also echoed by members of the women’s group and the key informants from Swazi Secrets during the in-depth interviews. Overharvesting, of course, is a precursor for scarcity or depletion of the resource or the species as a whole. Forest resources, such as marula, have a maximum sustainable yield beyond which they will be unable to replenish themselves (Botkin & Keller, 2012; Harper, 2012; Harrison & Pearce, 2000; Miller & Spoolman, 2016). As indicated in Chapter 5 (sub-section 5.1.4 and paragraph 6.3), this impact is already visible in the form of low regeneration of new marula seedlings in the agricultural fields and grazing areas, and the absence of marula trees in the other younger size classes in those areas.

Applying the equation $I = P \times A \times T$ to this study, the increase in the number of marula harvesters is taken as the immediate indicator for (P), the measures of the amount of marula harvested is taken as the indicator for (A), and since no technology is used in marula harvesting at the moment as the fruits are picked up by hand once fallen to the ground, the impact of technology (T) in this case seems negligible and can, thus, be left out of the equation. Therefore, the impact of marula harvesting on the resource (marula) is mainly determined by the increasing number of people (P) harvesting it, as well as the amount of marula harvested (A), thus, $I = P \times A$. This implies that, as the number of harvesters increases, the amount of marula harvested also increases (unless it is controlled in one way or another); subsequently the impact on marula as a resource would also increase. This is in agreement with the generally accepted standpoint which emphasizes that a single one of the three factors (population, affluence, and technology) can be a dominant cause of rising environmental impact (Botkin & Keller, 2012; Chertow, 2001; Harper, 2012; Harrison & Pearce, 2000).

The findings of this study clearly suggest that the increase in the number of marula harvesters and the amount of marula harvested are two pertinent factors that may drive marula to scarcity or depletion in Swaziland. This argument is supported by several observers who point out that the introduction of market opportunities for any forest product is always accompanied by an increase in the number of people trading in that forest product (Mabaya *et al.*, 2014; Nghitoolwa *et al.*, 2003; Shackleton *et al.*, 2001). Increased marula harvesting in Swaziland is already causing negative consequences: on the one hand, the more the people who are harvesting marula, the greater the impact of harvesting on the marula species; on the other, the greater the impact of harvesting on the marula species, the worse the impact on the people harvesting/depending on marula in the form of scarcity or depletion of the resource.

6.5 Findings relating to objective four

Objective four of this study set out to identify the environmental factors and socio-economic conditions that might contribute towards and propel the depletion of marula. This was to answer the question: “Which biophysical and socio-economic factors impact upon the sustainability of marula trees and harvesting of its products in Swaziland”?

6.5.1 Environmental factors

The study found interspecific competition (over resources such as water, mineral nutrients, space, and sunlight) between marula and other floral species (Table 5.1, Chapter 5) to be one of the environmental factors influencing the growth and survival of marula trees in the study area. Also, browsing by domestic animals and other ungulates, as well as the increased harvesting by the local people as presented in Chapter 5 (Figure 5.28), were found to be limiting the regeneration and expansion of the marula population. This is in conformity with observations made in Chapter 5 subsection 5.2.4, Chapter 6 section 6.3, and several other studies that claim that ungulates eat marula and affect the regeneration and distribution of the marula population (Chantal & Witkowski, 2012; Hamidou *et al.*, 2014; Helm & Witkowski, 2013; Jacobs & Biggs, 2006; Jama *et al.*, 2008; Pegg, 2014). The removal of seeds from the grazing areas and agricultural fields was, therefore, found to be impacting on the small marula seed bank and, thus, adversely affecting the potential regeneration of new marula trees in the study area. This seems to call for, among others, the control of domesticated animals from roaming in the agricultural fields and/or the deliberate protection of growing marula seedlings in the agricultural fields during ploughing.

The soils of the study area were found to be generally characterized as moderately weathered and shallow with a wide range of chemical characteristics, ranging from neutral to basic and with physical characteristics, such as poor drainage, poor permeability, and high clay content. These characteristics do not favour the growth of marula (Haque & Lupwayi, 2003); in fact, they may be hampering the growth and productivity of marula in the study area. This finding, nevertheless, is not supported by other researchers whose studies on marula were based in areas located on granite, sandy and clay soils - soil types that all support the growth of marula (Den Adel, 2002; Helm, 2011b; Mng'omba, Sileshi, Jamnadass, Akinnifesi & Mhango 2012).

This current study found a female-biased gender ratio for marula trees in both the agricultural fields (4.6 female trees to 1 male tree) and the grazing areas (3 female trees to 1 male tree). These observations in the agricultural fields and in the grazing areas are in contrast to those observed by Helm *et al.* (2011a) in the low altitude savannas of South Africa. The low ratio of male trees to female trees in the agricultural fields and in the grazing

areas may be attributed to the selective protection of the fruit-bearing female marula trees at the expense of the non-fruit-bearing male trees. The low male to female ratio in both the agricultural fields and the grazing areas may be affecting the natural flow of pollen grains, thus probably impacting on the successful pollination and resultant fruit production – an observation also highlighted by Hall *et al.* (2002), Helm *et al.* (2011b) and Nghitoolwa *et al.* (2003).

However, in the Mkhaya Nature Reserve, an almost male biased ratio (1 male tree to 0.8 female trees) was found (see Table 5.3). This high male to female tree ratio correlates well with studies by Helm *et al.* (2011b) and Todd (2001) who observed similar ratios of 0.91 male trees to 0.84 female trees in their respective study areas. There are few elephants, white rhinos, giraffes, buffalos, hippos and other ungulates in the Mkhaya Nature Reserve (Boycott *et al.* 2007) and, as such, it represents a fairly undisturbed natural ecosystem. The immediate explanation to the high male to female ratio observed at the Mkhaya Nature Reserve can probably be found in the fact that since the harvesters are not allowed to harvest marula from the Mkhaya Nature Reserve, and also the fires are rare in the Mkhaya Nature Reserve, the male trees are protected from being cut or seedlings in general are not being burnt down by fires, thus resulting in their larger numbers. According to Helm, Witkowski, Kruger, Hofmeyr, & Owen-Smith, (2009) and also Helm and Witkowski (2013), marula is resistant to fire when it has grown to 7cm diameter. This could explain mortality of seedlings before they reach such diameter in both the agricultural fields and the grazing areas where occurrence of occasional fires was reported by the respondents.

This current study found the marula tree size class distribution to be skewed to the older size class (refer to section 6.3) in both the grazing land and the agricultural fields – a finding that deviates from that of previous studies (Helm *et al.*, 2009; Munondo, 2012; Nghitoolwa *et al.*, 2003; Ngorima, 2006; Shackleton *et al.* 2003). It further emphasizes the need for planting of marula in agro-forestry systems in the study area, and also calls for the deliberate nurturing of growing marula seedlings in the agricultural fields by community members.

During in-depth interviews with different key stakeholders, climate change was mentioned as one of the factors affecting marula in Swaziland (see section 6.4). Data on temperatures

in the study area revealed that they did not seem to have affected the survival of marula trees as the temperatures were within the normal range (10⁰C to 40⁰C) for marula survival as indicated in the literature (Coetzee *et al.*, 1979; Hall *et al.*, 2000). It should be noted that the effect of temperature on marula seed germination was not scientifically proven in this study. However, the study did find the data on the amount of rainfall to be very erratic over the period under study (2004 to 2015) (see Table 5.7) and skewed to the extreme lower side, which seems to suggest that the low amount of rainfall could have affected the survival of marula seedlings, as the average amount of rainfall received in Swaziland under normal circumstances ranged between 550mm to 650mm annually (Loffler& Loffler, 2005).

6.5.2 Socio economic factors influencing participation in harvesting marula

Several socio-economic factors were found to impact on the sustainability of marula and its products. The agricultural fields and grazing areas were the most exploited for marula harvesting by the people in the study area (Table 5.12). This confirms the field observation that the level of marula regeneration was low in both the agricultural fields and grazing areas due to constant removal of seeds during harvesting. The respondents indicated that marula was used for several purposes, ranging from source of food to cultural and spiritual considerations, to source of income (Chapter 5, Table 5.11). All these socio-economic factors interlock to contribute to the intense harvesting of marula in Swaziland. This pattern is, in fact, well established in several places across southern Africa where a wide range of uses of marula have led to the increased exploitation of the resource (Duke, 1989; Elijah *et al.*, 2012; Hal, 2013; Hall, 2002; Hall *et al.*, 2000; Lombard *et al.*, 2000; Mawoza *et al.*, 2010; Shone, 1979; Shackleton *et al.*, 2001). The current study, therefore, maintains that these multiple uses of marula, in combination with the introduction of commercial marula companies in Swaziland, encouraged people to harvest large amounts of marula. The commercialized harvesting of marula is, therefore, considered an important contributing factor that may accelerate the depletion of this resource in Swaziland.

6.6 Findings relating to objective five

The fifth objective of this study was to identify the strategies, if any, that rural households have put in place in order to prevent marula from becoming scarce or depleted. Studies

have shown that, in times of crisis, coping strategies may include replacing previously purchased or locally produced goods with wild equivalents, or engaging in temporary sale of natural products, such as marula and handcrafts, to supplement household income (Dovie *et al.*, 2002; Shackleton & Shackleton, 2004). This livelihood “safety net” is, particularly, important in the case of poor and vulnerable rural households for which marula plays a significant role in meeting household needs. Marula’s role as a livelihood safety net has also been voiced by Hunter *et al.* (2007) as well as Shackleton & Shackleton (2004).

In Chapters 3 and 5, it was argued that marula plays a vital role in improving the nutritional status (Vitamin C and vital minerals) of rural communities, especially among children and the elderly who are the main dependency groups (Helm & Witkowski, 2013; Jama *et al.*, 2008; Kgomoamagodi, 2008; Pegg, 2014; Palmer & Pitman, 1972; Pooley, 1993). Therefore, to continue providing this ecological service, it was emphasised by all the key informants and confirmed by the socio-economic survey, that planting of marula in the fields around the homesteads is one way to ensure the reliable supply of marula products, while at the same time reducing harvesting pressure in the agricultural fields and grazing areas. In addition, some of the key informants suggested that a restriction on the access of animals to the agricultural fields could be one strategy for reducing the browsing of growing marula seedlings in those agricultural fields.

The current study could not identify any existing strategies that have been put in place in the study area to prevent marula from becoming depleted or scarce. The respondents nevertheless suggested the following strategies to be put in place: community members should plant marula in the fields around the homesteads so as to replace the current old marula trees when they die out; local authorities should stop people from cutting down marula trees; local authorities should engage and educate the community not to collect all the marula fruits, but leave some for seedlings, and educate members of the community on the conservation of marula trees. Other strategies were presented in Chapter 5 (Tables 5.16 and 5.17).

Some of the respondents seemed to be ignorant of the possible scarcity or depletion of marula. One of the male respondents in the in-depth interviews reacted in this regard as follows: “You mean marula will get depleted? I did not think it would”. However, the key

informants from SNTC and SEA clearly pointed out that, in order to sustain marula, it should be planted or perhaps people should put in a deliberate effort to protect seedlings in their agricultural fields. Contrary to the view of these two key informant organizations, the key informants from the Swazi Secrets were of the opinion that marula should only be protected in the wild and were against the idea of planting marula in any place. They opined that once marula plantations were put in place, this would impact on other biological species as the affected places will be converted to monoculture plantations of marula trees and, probably, the other species will be cleared off. The deliberate protection of marula seedlings in the agricultural fields and in the fields around homesteads, nevertheless, seems like the most viable option. In addition, the dedicated planting of marula in an agro-forestry system (not on commercial scale) would alleviate the pressure on marula and enhance its population size and structure, thus increasing the sustainable utilisation of the marula species and the economic sustainability of the commercial marula enterprises as a whole.

6.7 Findings relating to objective six

Objective six of the study was to explore the cultural and spiritual beliefs associated with marula, and relates to the following question: “What cultural practices and spiritual beliefs are associated with marula harvesting”? The study found marula to be playing a major role in Swazi culture (Figures 5.32 and 5.33, Chapter 5). In regard to cultural practices, it was found that marula is considered to be a very important tree in the Swazi culture as demonstrated by its use in several Swazi cultural practices, including the *Buganu* Ceremony, festivities at the community level, and spiritual ceremonies. For instance, during the *Buganu* Ceremony held at the Hlane Royal residence on Saturday 5th March 2016 (where the author was in attendance), His Majesty King Mswati III told the gathering that the *Buganu* Ceremony was an important cultural event that enjoys recognition even beyond the country’s borders. The annual *Buganu* Ceremony is also an important tourist attraction as observed by the researcher during the *Buganu* Ceremony held at the eBuhleni Royal Residence on Saturday 20th February 2016. During the *Buganu* Ceremony, people from all walks of life bring merchandize to sell as thousands of people gather at the Royal Residence, thus boosting the economic status of many households and also strengthening social ties among the Swazi nation (Image 8).



Image 8: Women displaying merchandise during the Buganu Ceremony in eBhuhleni Royal residence in 2012

Source: Picture taken by Mr S. Sukati, Swaziland National Museum, 18th February 2012

According to the staff of the Swaziland National Museum (SNM), the *Buganu* Ceremony is a relatively new event that has been pioneered by His Majesty King Mswati III. This is a modification of what was happening in the past where women would brew Buganu and invite their neighbours to enjoy the drink with their husbands – a tradition that serves to create social cohesion within the community. During this event the household slaughters an animal to be consumed during the traditional event known as *Intfutfu* – meaning to emit smoke and prepare a meal for the gathering. This occasion is normally held before the household hands its gift of the Buganu brew to the chief of the area.

While brewing the Buganu, all marula fruits are supposed to be brewed next to the tree from which they fell. This is a practice to identify the best marula trees and also to assure the quality of the brew. After the *Intfutfu*, the Buganu brew is then presented to the chief of the area who, in turn, summons the whole chiefdom to the royal kraal (*Umphakatsi*) to

celebrate a festive event known as *Ummemo*, thus further strengthening social integration within the chiefdom as a whole. During this occasion, many animals are slaughtered and the people have time to interact and share their experiences, family issues and issues related to funerals, among others. This further creates social cohesion and ties within the chiefdom.

The important cultural practices, festivities and spiritual ceremonies identified in this study include the use of marula as a traditional healer's (*sangoma*) dice, game counters, wadding away evil spirits, honouring of ancestors and bringing blessings to the family, use of its oil by women after giving birth to remove stretch marks, building social ties, traditional medicine, and protection of the home against Gremlins (*tikolosi*). The brew is also given to the chief and community leaders (*Tindvuna*) – a tradition known as *Kuhlehla*. The marula leaves are also used by athletes for “boosting” speed (Chapter 5, Figure 5.33). Several authors have reported these cultural practices and beliefs associated with marula in other countries in sub-Saharan Africa (Abdalbasit & Ibrahim, 2012; Lewu & Afolayan, 2009; McGraw, Jage, Grace, Fennel & van Staden, 2005; Mawoza *et al.*, 2010).

During in-depth interviews with the women's association members and the staff of the SNM, the latter pointed at other activities during the *Buganu* Ceremony. Firstly, the women regiment (*Lutsango*) arrives at the arena on the Friday before the main event on Saturday (Image 9).



Image 9: Women arriving at eBhuhleni Royal residence with marula brew for the annual Buganu Ceremony

Source: Picture taken by S. Sukati, Swaziland National Museum, 17/02/2012

On the Friday night, the women hand over their gifts to Her Majesty the Queen Mother (Image 10). At the same night and during Saturday morning till mid-day, a lot of teaching and discussions take place among the women and with representatives of resource persons from, among others, the Ministries of Health, Agriculture, Tourism and Environment, and several local NGOs.



Image 10: Women handing over marula brew to Their Majesties at eBuhleni Royal residence in 2012

Source: Picture taken by S. Sukati, Swaziland National Museum, 17/02/2012

The teachings are based on current issues and challenges, including health issues, such as HIV and AIDS and TB. They also cover family matters, such as how to keep one's marriage intact, raising children, climate change and how to cope with it, and sharing of many other community and cultural lessons. Some women the researcher interacted with at the 2016 *Buganu* Ceremony at eBuhleni Royal residence indicated that many marriage relations have been saved and or restored through participation in the *Buganu* Ceremony. In addition to the Buganu brew, many other gifts are brought to Their Majesties during the *Buganu* Ceremony; including the first crop harvest (Images 11 and 12).



Image 11: Women bringing their various gifts including the first crop harvest to Their Majesties during the Buganu Ceremony in 2012

Source: Picture taken by S. Sukati, National Museum, 17/02/2012

On the Saturday of the main *Buganu* Ceremony, thousands of people gather from across the country and beyond the borders of Swaziland to celebrate with Their Majesties. This boosts business around the area where the celebration is taking place, as many entrepreneurs bring different merchandise to sell to Swazis and tourists who come to join Their Majesties in the celebrations. In addition, many local people bring cooked food and or roast meat around the venue to sell to the people who come to witness the occasion. Others bring Buganu also to sell to the gathering at around E5 (US\$0.36) per litre and earn some income for their households. This shows that, apart from the direct provisional value (economic, healthcare, food and nutrition) marula offers to the rural households, it also indirectly contributes towards the economic improvement of many households in Swaziland through sales of other merchandise in the marula associated ceremonies and festivities.



Image 12: Women bringing gifts to Their Majesties during the Buganu Ceremonies at Hlane Royal residence in 2016

Source: Picture taken by A.F. Murye, 20/02/2016

6.8 Findings relating to objective seven

The purpose of objective seven was to identify policy interventions that are required to sustain marula availability and harvesting in Swaziland. This was to answer the following research question: “What policy interventions are required to sustain marula availability and harvesting in Swaziland”?

This objective specifically looked into relevant government policies, awareness of the people harvesting marula of the existence of such policies, and the implementation of such policies by the relevant authorities. The findings suggest that, apart from the general policies that govern floral resources in Swaziland, there was no specific policy or legal framework that regulates the harvesting and sustainability of marula in the country. In addition, the policies and legal frameworks were old and outdated, lacking coordination, and kept under different custodians. This has been discussed in more detail in Chapter 5, sub-section 5.4.1.

A detailed scrutiny of the legal framework in Swaziland revealed gaps between the objectives of government policies and the socio-economic realities/status of the people on the ground, although Swaziland is a party and signatory to many regional and international conventions and agreements governing the utilization of floral resources (Dlamini, 2007; Murye, 2015; SEA & UNEP, 2005). These findings are consistent with findings in a study by Ifegbesan (2009) who observed similar policy gaps in South Africa and Nigeria.

Although the forest policies of Swaziland emphasize sustainable management, being a low-middle income country, there is huge pressure on the forest resources in the form of exploitation of wood and non-wood products (such as wild fruits, and especially marula in the context of this study). The pressure on marula has been mounting in recent years due to, among others, the introduction of the commercial marula processing companies that encouraged more people to exploit marula resources. The simultaneous need of marula companies for marula products and the need of communities to alleviate poverty through harvesting and selling marula, call for concerted efforts from the relevant government department (Forestry Department and/or SEA) to formulate a policy or update the current floral policies so as to address this concern if marula is to be sustained in the country.

Asked whether the respondents had knowledge of the existence of a body/organization that regulates access to and harvesting of marula in Swaziland, the findings (Figure 5.37) indicate that, out of the 267 respondents who responded to this question (question 52), the majority (88.8%) had no knowledge. Consistent with Murye (2015), this finding indicates the absence of an institutional structure to regulate the access to and harvesting of marula in the area. However, during in-depth interviews with all the key informants (Chapter 4, Table 4.1), it transpired that marula falls under the list of prohibited tree species that are not supposed to be destroyed. Nevertheless, the key informants from the SEA and those from the SNTC lamented the lack of full implementation and enforcement of the prohibition due to factors, such as a lack of resources (financial, material and human), lack of knowledge about the existence of policy by both recipients and beneficiaries of policies, inadequate organizational structure, and unavailability of policy documents to the community. These opinions tie in well with the findings of Murye (2015) reflecting similar challenges as impediments to the strengthening and implementation of environmental policies and laws

in Swaziland. Elsewhere in South Africa and Nigeria, similar challenges have also been reported by Ifegbesan (2009). All the forest policies scrutinized emphasize community participation in forest resources management and also highlight customary rights in the use of forest resources, especially in the Swazi Nation Land.

It transpired from in-depth interviews that the customary rights are mainly vested in the Chief of the area. As for the protection of marula, it was reported that the customary laws, which are generally unwritten, do apply in the area as the local authorities can take any offender who cuts down marula trees to task and one can get heavy fines. However, these laws do not prescribe marula harvesting limits or quotas and do not stipulate any conditions to assist in its sustainability. This is a gap that needs to be addressed, probably through awareness campaigns and education of the community and, especially, the local authorities on the need of prescribing marula harvesting limits and quotas as part of a wider strategy to ensure the sustainability of the resource.

The key informants from the SEA alluded to the fact that Swaziland's policies are not frequently revised from time to time, yet the country's population is growing and the land use is also changing fast due to a growing demand for land and, especially, competition for land across sectors (agricultural, residential, and industrial). This confirms the findings from the desk study conducted to scrutinize the environmental laws of Swaziland as highlighted in Chapter 5 sub-section 5.4.1. According to Dlamini (2007), Ifegbesan (2009) and Murye (2015), the potential elements that could enhance or support forest policy implementation are: more effective forestry organizations, reliable forestry data, and appropriate guidelines for policy implementation, adequate and skilled personnel, budgetary support, efficient management plans and harmonization of land-use policies.

The findings from both the socio-economic survey and the in-depth interviews showed that many of the people in the study area were not aware of the government's policies and objectives in regard to forest resources management and marula in particular. Following informal discussions with the respondents of the household survey, only a few of them were aware of the role the Department of Forestry plays in forest management in the area (Figure 5.40). The Women's Association, for instance, believed that government is only responsible for controlling forests in the Mkhaya Nature Reserves in the country. Scrutinizing the

Swaziland forest policies revealed that most of the policies do not emphasize the socio-economic contribution of forests to communities; yet, many people in Swaziland rely on this natural capital for their livelihoods.

In addition, it looks like not much effort have been exerted on redressing poverty that drives many rural people to depending heavily on forest resources, especially marula in this context. The forest policies seem not to have integrated the livelihood challenges of rural people into any conservation initiatives as alluded to during discussions with respondents residing adjacent to the Mkhaya Nature Reserve. All the key informants and the survey respondents pointed to the following factors that could be negatively impacting the sustainability of marula in the country: lack of community participation in forest management activities, high level of poverty, high rate of population growth, lack of proper management approaches to marula resources, poor institutional capacity, low level of education amongst the rural communities and lack of awareness regarding the sustainability of marula harvesting amongst the community members.

6.9 Summary

This chapter has shown that marula plays a crucial role in the livelihoods and well-being of the people in the study area. The main findings of the study are summarized below:

A substantial proportion of households in the study area depend on marula harvesting as a source of income, nutrition, culture, medicine and spiritual enrichment. Essentially, gender, age, lack of employment, low level of education, household monthly income, number of people living in a household and number of children one has were found to be the factors that drive the poor rural people to harvest marula for livelihood. The findings also showed that, driven by the introduction of marula enterprises in the country, the number of people harvesting marula has increased and that this increase could be one of the most important factors driving marula to scarcity or depletion.

The current marula tree population in the agricultural fields and grazing areas is not stable as only old trees are found with no other younger marula tree size classes, and the prevalence of marula trees is mainly skewed to the female gender. The data, however, showed that the marula tree population in the Mkhaya Nature Reserve was stable and its

potential for regeneration within the Mkhaya Nature Reserve is very high, except that the marula population was slightly skew towards the male gender. The study found interspecific competition of marula trees with other floral species, browsing of marula by domestic animals in the agricultural fields and grazing areas, increased harvesting of marula fruits by people, low and erratic amount of rainfall received, and the soil types as some of the environmental factors that affect the growth and survival of marula in the study area.

The study also revealed that the scarcity or depletion of marula would impact heavily on the poorer households in the study area. The findings showed that households headed by the elderly, females, divorced, separated and widowed, low income earners, and those with a low level of education and relying on marula harvesting for household income and livelihoods would be adversely affected in the event that marula become scarce or depleted.

Several strategies have emerged in this study that could be put in place to sustain the availability and harvesting of marula products. Among these are the planting of marula in the agricultural fields in an agro-forestry system, the deliberate protection of marula seedlings in the agricultural fields, the control of domestic animals from roaming in the agricultural fields, and the setting of harvesting quotas. The study did not find any coping strategies put in place by the study population in the event that marula become scarce or depleted.

Marula plays a substantial role in the culture of Swazis. It is regarded as a very important tree in the culture of Swazis as it features in many cultural practices, including the *Buganu* Ceremony, and several other Swazi traditional festivals such as the *Intfutfu*, *Ummemo* and *Kuhlehla*. Spiritually, marula is also used as *sangoma dice*, in wadding away evil spirits (*tikolosi*), and in boosting the speed of athletes.

Finally, the findings point at a need for formal policies that specifically address marula harvesting and its sustainability. However, it was found that countrywide, unwritten customary laws are used to protect the marula trees. The next chapter presents the conclusions, recommendations and the novelty of the study.

CHAPTER 7: CONCLUSIONS, RECOMMENDATIONS AND SUMMARY OF THE STUDY

7.1 Introduction

The objectives of this study were two-fold: to determine the role that marula plays in the livelihoods of and poverty alleviation among the rural population in Swaziland and identify policy interventions that will facilitate means of sustaining the marula tree population for its continual availability for harvesting by local communities. It was necessary to explore this because Swaziland, like many other developing countries, continues to fight the battle for economic growth and poverty alleviation, especially among impoverished rural communities. Several factors accelerated the dependency of rural households on marula harvesting to earn an income and fight poverty to sustain their livelihoods and well-being. These include the global economic meltdown that started in 2008, the reduction in SACU revenue to Swaziland as of 2011, and the environmental challenge of global climate change. The study has unlocked detailed insights and understanding of the socio-economic contribution and environmental aspects of marula harvesting in the Lubombo Region of Swaziland. This final chapter provides the major findings of the study, the implications of the findings, suggestions for future research, the contribution of the study to the existing knowledge base (i.e. the novelty of the study), and a summary of the study.

7.2 Conclusions

This section presents the conclusions of the study drawn from the findings presented in Chapters 5 and 6.

Conclusion 1: Marula makes a substantial contribution to the economies and livelihoods of rural households in Swaziland

The data presented in Chapter 5 (section 5.3) and Chapter 6 (section 6.2) underscored the economic contribution of marula to the economies and livelihoods of households in the study area. Clearly, marula plays a crucial role in the livelihoods and income generation activities among rural populations, especially in poverty stricken households. There are limited job opportunities in the study area and, therefore, marula plays a crucial role as an

income safety net. The findings presented in Chapter 6 (section 6.2) confirmed that a relatively large proportion of households depend on marula harvesting as a source of income. In addition, the findings (in Chapter 6 Figure 6.1) indicated a statistically significant association between the employment status of respondents and the harvesting of marula for household income. Not only did the findings confirm the important contribution of marula to the study community in the form of economic survival of households, but marula also plays an important role as a source of food to poor households. In fact, most of the respondents in this study recognised marula as a very important resource which plays a fundamental role of fulfilling their immediate needs of purchasing items such as food, medication, electricity, paying children's school fees to sustain their livelihoods (see Chapter 6 subsection 6.4.2).

The findings presented in Chapters 5 and 6 also confirmed that marula provides a range of products which are sold to both the domestic and international markets and, thus, boosting the economic status of many households. The marula tree is used locally as animal fodder, materials for fencing, and carving artefacts which are sold to meet a number of subsistence and economic needs of rural households. The marula oil is used in making a range of products - body lotion, toilet soap, bio-oil, cooking oil, snacks - which are also sold locally and abroad. This not only boosts local household economies, but also the national economy. However, although marula harvesting can improve the food, financial and well-being of all beneficiaries, the benefits accrued from the enterprise are, unfortunately, used to only achieve short-term needs of households¹¹. This is because most of the people engaging in marula harvesting come from households that live on a hand-to-mouth basis as their livelihood options are limited by a general lack of access to resources that are necessary for meeting most of the basic needs.

The role of marula in income generation, household food option, and the various products it provides to rural households as identified in this study, therefore, confirms its important contribution to households in Swaziland. Hence, marula is a vital natural capital that provides an important livelihood fall-back option for the impoverished rural households in Swaziland.

¹¹ Chapter 5 Figures 5.3.15 and 5.3.16

Conclusion 2: Marula plays a fundamental role in cultural practices and festivities in Swaziland and is paramount in creating social ties and cohesion among the Swazi nation

Marula plays a crucial role in the culture and traditional practices and festivities in Swaziland¹². This includes the role it plays as divination pieces, enhancing people's spirituality, use as game counters or kindling, use as sangoma dice, wading out evil spirits, attracting blessings from ancestors, boosting athlete's speed, use as brew consumed by the community during festivals, offering as gifts to chiefs, and use in traditional medicine. Chapters 3 and 6 have also alluded to the important role marula plays in a wide range of socio-cultural practices in the southern African region as well as the important role it plays in building social ties and cohesion amongst rural populations. Hence, we can conclude that marula is an important tree of culture and plays a fundamental role in the Swazi cultural and traditional practices and festivities as well as in creating social integration among the Swazi nation.

Conclusion 3: The increased harvesting of marula fruits and seeds has a detrimental impact on the sustainability of marula tree species in Swaziland

Increased harvesting of marula in the study area is already showing detrimental impacts on the marula tree species. The data on the field vegetation survey and the researcher's personal observations during the vegetation survey revealed that the harvesters neither left any marula fruits under the trees for purposes of regeneration, nor planted or nurtured any seedlings in their agricultural fields. Consequently, the marula population in both the agricultural fields and grazing areas now consists of primarily old female trees. The marula tree gender ratio is also skewed in favour of the female gender. Unfortunately, male trees are not regarded as essential as they do not produce fruits but are chopped down and used for other purposes, such as wood carving. Removal of the male trees has a negative effect on the availability of pollen during the flowering and fruiting seasons. In addition, marula is becoming scarce in both the agricultural fields and grazing areas¹³. The increase in the number of marula harvesters appears to be one of the main reasons for marula scarcity and depletion in the study area. This is propelled by the multiple domestic and international

¹² See Chapter 5 Figures 5.3.27, 5.3.28, 5.3.29, 5.3.30 and also Chapter 6 section 6.7

¹³ See Chapter 5, subsection 5.3.2.4 and specifically Table 5.3.7 and Figures 5.3.22, 5.3.23 and 5.3.24)

uses of marula, as well as the introduction of a marula commercial market through the establishment of marula companies. The increased harvesting and commercialisation of marula is, therefore, impacting adversely on the marula resources and is driving the latter fast to depletion or scarcity. This situation is compromising the sustainability of marula in the country and ought to be corrected.

Conclusion 4: The current level of commercialized harvesting of marula in Swaziland is unsustainable and requires official monitoring and control of the harvesting process.

The harvesting of marula fruits and seeds for household income and livelihoods has a negative impact on the marula seed bank (Chapter 6, section 6.3). This casts a threat of marula scarcity/depletion and may negatively affect the sustainability of marula harvesting in Swaziland. It also emphasizes the need for planting, nurturing and/or protecting marula seedlings in the agricultural fields and grazing areas in order to ensure sustainability of marula harvesting in the country. The old-age structure of marula trees in both the agricultural fields and the grazing areas is evidence of the negative impact of increased harvesting and removal of the meagre marula seed bank and, thus, resulting in reduced regeneration of marula trees.

In addition, the expansion of human population and the need for more land to cater for residential areas, agricultural fields and grazing areas is leading to clearing of large areas of land and the consequential removal of trees, including marula. The continued and frequent removal of marula fruits and seeds from the agricultural fields and grazing areas and the clearing of land due to increase in population is leading to a situation where the only existing marula trees will no longer bear fruits and seeds that would grow to new seedlings as a result of old age and land clearance. This situation, if not controlled and turned around, will cause scarcity/depletion and local extinction of marula in the agricultural fields and grazing areas of Swaziland. The current pattern and levels of commercialized harvesting of marula is, therefore, not sustainable and requires the intervention of relevant authorities by way of official monitoring and control of the harvesting process. Furthermore, the growing human population and the consequential demand on the land ought to be controlled.

Conclusion 5: Environmental factors impact negatively on the regeneration, growth and sustainability of marula harvesting in the study area

Marula grows best in soils that are well-drained, especially sandy textural class soils and, occasionally, on sandy loam and loam soils. The shallow and rocky soils of the study area are, thus, hampering the optimal growth of marula. The marula trees grow best in an annual average rainfall amount of 850mm. On average, an annual rainfall amount of 60.94mm¹⁴ was received in the study area during the period 2004 to 2015 (from the time of establishment of marula companies in Swaziland) which is way below the average requirement for marula growth. The area still continues to receive low annual rainfall amounts and is negatively impacting on the germination, growth, fruiting and, therefore, the sustainable harvesting of marula fruits in Swaziland. During the same period of time, there was an increase in marula harvesting. Therefore, socio-economic and environmental factors combined have impacted negatively on the sustainability of marula harvesting.

Conclusion 6: Distinctive socio-demographic attributes are driving rural people in Swaziland to harvest marula beyond its sustainability thresholds to support their livelihoods

The findings presented in Chapter 6 (section 6.2) showed that marula harvesting is a fundamental source of income for the livelihoods of many rural households in Swaziland. They also showed that several socio-demographic factors play a role in influencing the decisions of households to engage in marula harvesting to sustain their livelihoods. There were statistically significant associations between six socio-demographic factors and the harvesting of marula to supplement household income. These factors are as follows: low level of education, gender, age, marital status, household size and number of children. All these factors interlock and influence households' dependence on marula for their livelihoods.

The low levels of education of a substantial proportion of respondents suggest greater probability for many households to engage in marula fruit harvesting to earn a living. This implies that those households headed by respondents with lower education levels proportionately tend to participate more in marula fruit harvesting than those households

¹⁴ See Chapter 5 Figure 5.2.6

headed by respondents with higher levels of education. The influence of education on the likelihood of individuals engaging in harvesting marula fruits for household survival has also been documented in other studies and it has been shown that the more educated an individual is, the less the desire of that individual to engage in wild fruit harvesting. This is because more educated individuals tend to have higher income earnings and are more likely to have more buying power than individuals who are less educated.

In this study, the low level of education amongst respondents suggests increased probability of individuals harvesting marula fruits for household survival. This is because the majority of the surveyed household members have low levels of education with the majority having not attended school and the others having completed only primary and secondary school levels¹⁵. It is well documented that higher levels of education are necessary to get one into higher income opportunities, which are highly correlated with less likelihood to engage in harvesting marula fruits for a living. Therefore, the relatively large percentage of households with “no to low” level of education in this study sample emphasizes the fundamental role that education plays in the probability of individuals harvesting marula fruits for their households’ survival.

In Swaziland marula is mainly harvested by women. This emphasizes the effect of gender on marula fruit harvesting as there was a statistically significant association between the gender of respondents and marula harvesting. The women in the study area, being the main custodians of the household, are more inclined to engage in marula harvesting to take care of the many demands of the household, as the men are mainly away¹⁶. Gender, therefore, has been identified by this study as one of the major factors driving individuals to harvest marula for household survival.

Age has also been identified to have a significant influence on the harvesting of marula fruits. The findings presented in Chapter 6 reflected the formidable role that marula plays in the economies and survival of many rural households, especially those headed by older people. The findings suggest that there is a statistically significant linear association between age and marula harvesting for purposes of supplementing household income and

¹⁵ Chapter 5 Table 5.3.1 and Chapter 6 Figure 6.7

¹⁶ See Chapter 6 subsection 6.2.2

food. Furthermore, they revealed that the majority of the households in this study that claimed that their households would not survive without the income from marula belong to the two age groups of 40-59 years and 60 years and above¹⁷. Thus, it is concluded that marula is of great significance in the livelihoods of the aged in particular.

Marital status has an influence on marula harvesting among rural communities in Swaziland. The findings showed that marula plays a pivotal economic role in households headed by the widowed, divorced and separated respondents. This is because these groups of people have lost a partner in their lives who would, otherwise, be contributing towards the economic well-being of the household. Marital status can, therefore, be considered an important socio-demographic driver in the harvesting of marula.

Household size has a significant influence on marula fruit harvesting, with larger households being more dependent on marula for their livelihoods than smaller households. The significant effect of household size on marula harvesting is attributed to the fact that larger households have added responsibilities and demands for income and food to survive. The effect of household size on marula harvesting is also enhanced by other factors, such as human population density, competition over marula resources and the short season of marula availability for harvesting (only between the months of January and March).

The findings also revealed a statistically significant correlation between the number of children one has fathered or given birth to and the individual's engagement in harvesting marula for survival. The majority of respondents who had many children engaged in marula harvesting as a source of income and subsistence. The significant effect of the number of children per respondent is attributed to the fact that a larger number of children bring about added responsibilities and demands for income, food and the general survival and well-being of the household. The number of children one has fathered or given birth to is, thus, an important factor in driving people to harvest marula as source of livelihood.

¹⁷ See Chapter 6 subsection 6.2.3

Conclusion 7: The depletion of marula will deepen the existing poverty levels of the respondents and lead to the deterioration of quality of life, especially in those impoverished households that are proportionately more dependent on marula.

Marula is an important source of food and is also a crucial economic safety net for a large proportion of rural households in Swaziland¹⁸. It was glaringly clear that the majority of the households in the study area are poverty stricken and the dependency on marula harvesting is the only viable alternative source of income. Complicated by the several socio-demographic factors highlighted in conclusion 6, the depletion of marula will deepen the existing poverty levels of the respondents and it is, therefore, necessary to develop strategies for sustaining its harvesting in Swaziland. Apart from deepening the level of poverty in the study area, the depletion of marula will also impact adversely on the quality of life of those who depend on marula harvesting. The depletion or scarcity of marula will, therefore, have detrimental impacts on impoverished rural households in Swaziland.

Conclusion 8: There are insufficient policy and legal frameworks for the protection of marula in Swaziland.

There are no specific policies or legal frameworks that regulate the access to, harvesting of, and sustainability of marula in Swaziland. The floral policies and legal frameworks that currently exist in the country are old and outdated, lack coordination, overlap and are kept under different custodians, which complicate implementation due to conflicting jurisdictions and roles for implementers. In addition, there are gaps between the objectives of government policies governing the utilization of floral species and the socio-economic realities/status of the people on the ground in terms of participatory management. Although Swaziland is a party and signatory to many regional and international conventions and agreements that govern the utilization of floral resources, the current floral policies are wanting and ought to be reviewed and/or updated to include marula in particular. Currently, there are only unwritten customary laws that are implemented by traditional authorities to control against the destruction of marula trees in Swaziland.

Marula falls under the list of protected tree species that are not supposed to be destroyed in Swaziland. However, the lack of implementation and enforcement of the prohibition due

¹⁸ Chapter 5 Table 5.3.4 and Chapter 6 section 6.5

to lack of resources (financial, legal, material and human), lack of knowledge about the existence of the floral policies by both recipients and beneficiaries of policies, inadequate organizational structure, and unavailability of policy documents to the community are the fundamental impediments towards the regulation and sustainability of marula.

7.3 Recommendations

Based on the aforementioned conclusions drawn from the data, the following recommendations can be made:

Recommendation 1: Stabilize the marula population structure by planting marula trees and nurturing seedlings in the agricultural fields and also leaving some fruits in the fields during harvesting for purposes of regeneration.

People in rural areas should be encouraged and assisted by the Forestry Department, SEA, and also traditional leaders, to start planting marula trees in their agricultural fields to replace the current old trees. They should also begin to nurture seedlings in their agricultural fields in a kind of agro-forestry system. The marula fruits should not be harvested to totality in the agricultural fields and grazing areas, but some fruits and/or seeds should be deliberately left behind for purposes of producing seedlings. Such practices will encourage regeneration and stabilize the marula population structure.

Recommendation 2: Develop programmes to educate and train rural communities on the importance of conserving and sustaining marula trees and products in Swaziland.

The Department of Forestry, in consultation with the SEA and SNTC, should develop training programmes that can be implemented through organized workshops and seminars to capacitate rural communities on issues of marula conservation and sustainability. The Department of Forestry should also develop and strategically disseminate printed and electronic materials about the conservation and sustainability of marula trees in Swaziland. These materials can be disseminated to rural communities through the media, *Tinkhundla* offices, churches, chiefs, and community meetings and festivities, such as during the Buganu Ceremony. Since the marula gender ratio in the agricultural fields and the grazing areas is skewed more to the female gender as mentioned before, the communities should be

educated and made aware of the importance of also protecting the male trees. Finally, the Department of Forestry, SNTC, and the SEA should carry out aggressive awareness campaigns on the protection, access to and control of marula.

Recommendation 3: Revise the existing floral policies and legal frameworks in Swaziland so as to fill the existing gap on the access to and control of marula harvesting.

The Department of Forestry should establish a task team to revise the current policies and legal frameworks governing the management of floral resources in Swaziland. This should be done in order to mainstream marula resources into these policies and legal frameworks.

Recommendation 4: Revisit the policies on rural development in order to encourage and strengthen the creation of employment opportunities in the rural areas.

The Government of Swaziland, specifically the Deputy Prime Minister's Office and the Ministry of *Tinkhundla* Administration, should revisit and realign rural development policies towards encouraging job creation in the rural areas of Swaziland. The Ministry of Education should widen the base and access to quality educational opportunities in the rural areas through provision of Adult Education programmes which will increase the chances of rural dwellers in getting good employment opportunities. This would empower rural communities and minimize overdependence on natural forest products, thus relieving the harvesting pressure on marula.

Recommendation 5: Establish the maximum sustainable yield of marula in order to set quotas for harvesting per individual/ household.

To manage the harvesting of marula, there is need to know how much marula can be safely harvested without depleting it and without, otherwise, negatively impacting on the environment. Therefore, there is need for the Department of Forestry to conduct studies to establish the Maximum Sustainable Yield (MSY) of marula in order to set quotas for harvesting levels. The MSY is regarded here as the largest average marula yield that can be theoretically harvested from the fields over an indefinite period of time under constant environmental conditions. The Department of Forestry should form partnerships with research institutions, such as the University of Swaziland to conduct such studies.

Recommendation 6: Address gaps in the existing knowledge base of marula biology in Swaziland.

The Department of Forestry, in collaboration with research institutions in Swaziland, should conduct longitudinal research studies to:

- Determine the population biology and socio-ecological aspects of this species as a sustainable resource is strongly recommended.
- Establish the maximum distance the marula pollinators can travel in order to determine whether the current marula gender ratio is sufficient for effective pollination and subsequent fruit yield and sustained harvesting.
- Determine the impact of continued harvesting on the regeneration and re-sprouting potential and survival of marula in both the natural and disturbed environments.
- Determine the longevity and the onset of natural senescence of old marula trees under the presence or absence of harvesting or other adversaries, such as pests.
- Determine the effect of varying annual rainfall on the survival and growth of marula trees and fruit yield in the presence of continued harvesting.
- Determine the extent to which retirees in the area are engaging in marula harvesting, thus leading to the large number of tertiary graduates engaging more in marula harvesting than those who only completed secondary education¹⁹. This is to ascertain the observation that, over the years, the population dynamics have been changing in the area as more and more people get retired and move back to rural areas where they then probably engage in harvesting natural capital, such as marula, for income generation and livelihood.

7.4 The novelty of this study

This study has revealed the environmental and socio-economic factors that influence the survival of marula trees in the study area. It successfully established the contribution of marula to rural households in Swaziland and that the depletion of marula in Swaziland could impact negatively on the impoverished rural households, an aspect that has not been

¹⁹ Chapter 6 Figure 6.7

documented before. It further established the gap in the floral policies and legal frameworks in the country in relation to marula harvesting.

The study identified key drivers for people to harvest marula. These include: low level of education, gender of household head, low employment opportunities, age of harvesters, marital status of harvesters, number of children a respondent has and number of people living in the household. These indicators could be used as entry points to successfully implement control measures and promote sustainability of marula in Swaziland. The study also exposed the looming threats of potential marula extinction in the agricultural fields and the grazing areas due to overharvesting, poor regeneration potential and age structure of the current marula tree population in the study area. With these revelations, the Department of Forestry, the SNTC and SEA should now be in a position to carry out awareness campaigns in rural areas with relevant information to encourage communities to plant and purposefully protect growing marula seedlings in their agricultural fields.

The findings of this study should revitalise research debates on marula tree species and the use of its products in Swaziland and, consequently, redirect the thinking of academics, policy makers and implementers, policy recipients and beneficiaries, and entrepreneurs in the marula enterprise so as to focus on the sustainability of marula and its products in the country. The findings should also redirect research on marula and its products in southern Africa. Such research should be conducted in an integrated manner, whereby issues of policy, use of marula products and environmental management are integrated into aspects of marula sustainability.

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APPENDIXES

Appendix 1: Socio-economic and cultural household survey questionnaire

To be answered by the head/an adult in the household

Dear respondent,

We are conducting a scientific research on the sustainability of harvesting marula in your community and are requesting you to participate in the study by taking a little of your time answering a few questions. We want to assure you that the information gathered during this study will be used only for the study purposes. Please also be informed that you are free to withdraw from the study at any stage if you so wish. However, your opinion is very valuable and we will appreciate your participation. The interview will take only a few minutes of your time.

HOUSEHOLD INFORMATION	HH
HH1. Village name _____	HH2. Chiefdom name _____
HH3. Household address	HH4. Name of head of household:
HH5. Name of respondent	HH6. RELATIONSHIP WITH HEAD OF HOUSEHOLD 1. HEAD OF HOUSEHOLD 2. SPOUSE 3. SON 4. DAUGHTER 5. Brother 6. Sister 7. Other (specify)
HH7. Number of people currently living in household	HH8. Number of household members HH8.1: _____ age ≤ 5 years old HH8.2: _____ age ≥ 60 years old HH8.3: _____ with at least secondary education HH8.4: _____ with disability
HH9. Interviewer name: Name _____	HH10. DATE OF INTERVIEW

HH11: Do you have any comments about the context of the interview? Particularly:

H11.1	Did other people interrupt?	[1] yes [2] No	Specify _____
H11.2	Was anyone else present during part of the interview?	[1] yes [2] No	Specify _____
H11.3	Any hesitation or unwillingness to answer?	[1] yes [2] No	Specify _____
H11.4	Any other comments about the interview?	[1] yes [2] No	Specify _____

SECTION 1: RESPONDENT'S DEMOGRAPHIC INFORMATION

1. Gender: Male [1] Female [2]
2. How old are you? _____ years old
3. What is your marital status?

Never married	1
Living together	2
Married	3
Separated	4
Divorced	5
Widowed	6

4. Now I would like to ask you about the births you have had during your life or children you have fathered. Have you ever given birth/fathered a child?
Yes [1] No [2] (*skip to Q7*)
5. How many children have you ever given birth to or fathered?
_____ children
6. How many of these children are alive? _____ children
7. Ideally how many children would you like to have in your life?

_____ children

8. How long have you been living in this area? _____ years

9. What is your highest level of education?

Never attended school	1
Did not complete primary school	2
Completed primary school	3
Did not complete secondary school	4
Completed secondary school	5
Did not complete tertiary education	6
Completed tertiary education (degree/diploma/ higher certificate etc.)	7
Other (Please specify)	8

SECTION 2: INVOLVEMENT OF HOUSEHOLD IN HARVESTING MARULA FOR IMPROVING LIVELIHOOD

10. Do you supplement your household income by collecting marula fruits and seeds?

Yes [1] No [2]

11. Who collects marula among the members of your family? (*Fieldworker: Probe for all possible answers*)

Member	Yes	No
11.1. Respondent	1	2
11.2. Spouse	1	2
11.3. Children	1	2
11.4. Mother of respondent	1	2
11.5. Father of respondent	1	2
11.6. Grandparent(s)	1	2
11.7. All the members of the family	1	2
11.8. Other (Please specify)		

12. How important is marula harvesting as a source of income for your household?

Very important	5
Somewhat important	4
Neither important nor unimportant(<i>skip to Q15</i>)	3
Not too important(<i>skip to Q15</i>)	2
Totally unimportant(<i>skip to Q15</i>)	1
Don't know (<i>skip to Q14</i>)	-9

13. If **somewhat important** or **very important**, briefly explain why?

Will your household be able to survive **without** the income that you earn from marula harvesting?

Yes [1] No [2] Uncertain [-9]

14. In which of the following places do you harvest marula? (*Fieldworker: Probe for all possible answers*)

Place of harvesting	Yes	No
14.1. Around the homestead	1	2
14.2. In our fields	1	2
14.3. In the grazing land	1	2
14.4. In the nature reserve	1	2
14.5. Other (please specify)	1	2

15. People use marula for many things. Please indicate if your household harvest and use marula for any or all of the following:(Fieldworker: *Probe for all possible answers*)

Household use of marula	Yes	No
15.1. Carving in artifacts	1	2
15.2. Brewing (<i>buganu</i>)	1	2
15.3. Get the kernels for selling	1	2
15.4. As a medicine	1	2
15.5. As a fodder for animals	1	2
15.6. Fencing material	1	2
15.7. For cultural practices	1	2
15.8. Spirituality/religious purposes	1	2
15.9. Source of food (e.g. relish or snack)	1	2
15.10. Press the oil from the kernels and use it for cooking and body care	1	2
15.11. Other (please specify)		

16.

17. In your opinion, does the marula play any important role in the Swazi culture?

Very important	1
Somewhat important	2
Neither important nor unimportant	3
Not too important	4
Totally unimportant	5
Don't know	-9

18. What cultural practices are associated with the use of marula in Swaziland?

19. How important is the marula tree and its product to cultural festivities and practices in your community?

Very important	5
Somewhat important	4
Neither important nor unimportant	3
Not too important	2
Totally unimportant	1
Don't know	-9

20. Please explain in detail why you chose [...] in Q19.

21. Are there any traditional beliefs associated with the marula tree in your community?

Yes	1
No	2(<i>skip to Q23</i>)
Uncertain	-9

22. If yes, what are these traditional beliefs associated with the marula?

23. How much/many marula fruits do your household collect per day from each of these places? (*Fieldworker: Probe for all possible answers*)

Place of collection	Half a 20 liter bucket	One 20 liter bucket	Two 20 liter bucket	More than two 20 liter buckets	Other (please specify)
23.1 Around homestead	1	2	3	4	5
23.2. In our fields	1	2	3	4	5
23.3. In the grazing land	1	2	3	4	5
23.4. In nature reserve	1	2	3	4	5
23.5. Other (Specify)	1	2	3	4	5

24. How much time does your household spend on an average day in collecting the total amount of marula you have indicated above?

_____ hours

25. How long does it take you to walk from your household to the places where you collect the marula?

_____ minutes

26. Which of the following changes do you make to the marula fruits or seeds before you sell? (*Fieldworker: Probe for all possible answers*)

Change done	Fruit	Seeds
26.1 Cleaning	1	2
26.2. Grading	1	2
26.3. Packaging	1	2
26.4. Cracking	1	2
26.5. None	1	2

27. Where do you sell your marula products?

Marula product	Place where it is sold
27.1. Fruits	
27.2. Seeds	
27.3. Leaves	
27.4. Bark	
27.5. Wood	
27.6 Marula Brew (<i>Buganu</i>)	

28.

29. Currently how much money does your household raise from selling marula fruits and/or seeds/ and/or *Buganu* per year?

Up to E500	1
E501-E1000	2
E1110-E1500	3
E1501-E2000	4
More than E2000	5

30. Who decides on the prices for the marula products? (*Fieldworker: Probe for all possible answers*)

Price decider	Yes	No
29.1. Only myself/ household	1	2
29.2. Only the marula processing companies	1	2
29.3. Only the broker	1	2
29.4. Other (please specify)	1	2

31. How long do you take to go from your household to the market where you sell the marula fruits/kernels? _____ minutes OR _____ hours

32. Is this market place accessible to you at ease?

Yes, easily accessible (<i>skip to Q33</i>)	1
No, only accessible with difficulty	2

33. What makes it difficult for you to access the market place?

34. If you have to use transport, how much do you pay for the return trip?

35. What do you use the money earned from harvesting and selling marula for?

36. Compared to **the past 5 years**, what do you think about the amount of marula available nowadays?

More marula than before	1
Marula is the same as before	2
Less marula than before	3
Uncertain/Don't know	-9

37. Please explain why did you say marula is **[more, the same, less]** as compared to the past 5 years in Q35?

38. From which areas, do you get good quality marula fruits (in terms of size and taste) (*Fieldworker: Probe for all possible answers*)?

Areas	Yes	No
38.1. Around the homestead	1	2
38.2. In the local fields	1	2
38.3. In the grazing areas	1	2
38.4. In the nature reserve	1	2
38.5. Other (please specify)	1	2

38 Is there a big demand for marula products in the following places? (*Fieldworker: Probe for all possible answers*)

Place	Yes	No	Don't know
38.1 Village	1	2	3
38.2 Region	1	2	3
38.3 Swaziland	1	2	3
38.4 Overseas	1	2	3

39 How long have you been involved in harvesting and selling marula products?

_____ years

40 Compared to the time you started harvesting and selling marula, how easy is it to find the fruits and seeds now?

Still abundant (<i>skip to Q42</i>)	1
Still adequate (<i>skip to Q42</i>)	2
Becoming scarce	3
Uncertain (<i>skip to Q42</i>)	-9

41 If marula is now becoming scarce, is it that the marula trees are becoming scarce in general, or only parts of the marula trees? (*Fieldworker: Probe for all possible answers*).

Scarcity of marula	Yes	No
41.1. All trees in general are becoming scarce	1	2
41.2. Bark only	1	2
41.3. Leaves only	1	2
41.4. Fruits only	1	2
41.5. Seeds only	1	2
41.6. Wood only	1	2
41.7. Roots only	1	2

42. When you think about the number of people who are now collecting and selling marula, how do you think the numbers have changed **since you started collecting and selling marula for the first time?**

The same number of people are still collecting and selling marula	1
The number of people collecting and selling marula has decreased	2
The number of people collecting and selling marula has increased	3
Uncertain of any change	-9

43 If the harvesting and selling of marula continues at the current rate, do you think it will still be available in **the next 5 or 10 years?**

Yes, at least for the next 5 years (<i>skip to Q45</i>)	1
Yes, at least for the next 10 years (<i>skip to Q45</i>)	2
No	3
Uncertain	-9

44 If no, what do you suggest should be done to ensure that there will still be enough marula trees in the future to collect from?

45 Do you want marula to be planted around the homesteads?

Yes	1
No	2
Uncertain	-9

46 Why do you say **[yes/no]** in Q45? _____

47 Would you want marula to be grown commercially so that you can harvest more to boost your household income?

Yes	1
No (<i>skip to Q49</i>)	2
Uncertain	-9

48 **If yes**, where do you propose marula to be planted and grown? Indicate for each of the following places whether you would like marula to be grown there (multiple answers possible)

Proposed area	Yes	No
48.1. In the fields around the homesteads	1	2
48.2. In the local fields	1	2
48.3. In the grazing land	1	2
48.4. In the nature reserves	1	2
48.5. Other (please specify)	1	2

49 To what extent do you agree with the following potential challenges for the commercial growing of marula in the country?

Potential challenges	Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Don't know
49.1 Climate change will affect the growth of marula	5	4	3	2	1	-9
49.2. The soils are not well drained to support marula growth	5	4	3	2	1	-9
49.3. The amount of sunlight in some areas is not enough to support marula growth	5	4	3	2	1	-9
49.4. The marula pollinators will not be enough	5	4	3	2	1	-9
49.5. The pruning and thinning on marula trees will be a challenging job	5	4	3	2	1	-9
49.6. Wild Fire will destroy the marula trees	5	4	3	2	1	-9
49.7. Lack of sufficient water supply to support marula growth	5	4	3	2	1	-9

Potential challenges	Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Don't know
49.8. Insect and pest attack on the marula trees will hinder production	5	4	3	2	1	-9
49.9. Lack of adequate space	5	4	3	2	1	-9
49.10. Some soils are not fertile enough to support marula growth	5	4	3	2	1	-9
49.11. The temperatures in the other areas in the country are not good for marula growth	5	4	3	2	1	-9
49.12. Human population pressure will hinder marula planting	5	4	3	2	1	-9
49.13. Turning to marula plantations will impact negatively on biodiversity	5	4	3	2	1	-9

50 Is there any other challenge (s) you foresee for the commercial growing of marula? Please tell me what the challenge(s) is/are.

51 How do you think this challenge(s) can be addressed?

SECTION 3: POLICY AND REGULATION OF MARULA HARVESTING IN SWAZILAND

52 Is there anybody (group) that regulates the access to and harvesting of marula?

Yes	1
No (<i>skip to Q55</i>)	2
Uncertain	-9

53 If **yes**, please briefly tell me about this group/body.

54 How does the group (in Q53) regulate the access and harvesting of marula?

55 Do you receive any assistance from government officials in Swaziland for collecting and harvesting marula products?

Yes [1] No (*skip to Q57*) [2]

56 If **yes**, tell me briefly from which government Ministries/Departments you receive assistance from.

57 Do you know of any existing government policies and/or laws that regulate the harvesting and use of marula in Swaziland?

Yes [1] No (*skip to Q59*) [2]

58 If **yes**, please tell me which ones.

SECTION 4: HOUSEHOLD ECONOMIC STATUS

59 What is your occupation, that is, what kind of work do you mainly do??

60 If you are unemployed, how do you earn your living? (*Fieldworker: Probe for all possible answers*)

Source of income	Yes	No
60.1 Subsistence crops production	1	2
60.2 Rearing animals/ breeding cattle	1	2
60.3 Harvesting and selling marula	1	2

60.4	Harvesting and selling other wild fruits and seeds (except marula)	1	2
60.5	Making and/or selling artifacts	1	2
60.6	Other (please specify)		

61 Is this occupation (mentioned in Q59) your main source of income, or do you also earn an income from other sources?

Yes I earn income from other sources	1
No I do not earn income from other sources (skip to 63)	2

62 If answered yes in Q61: What are these other sources of income?

63 How much is your personal income per month (from all sources)?

Less than E500	1
E501-E1000	2
E1001-E1500	3
E1501-E2000	4
More than E2000	5

64 How much is the total monthly income for your household?

Less than E1000	1
E1001 - E1500	2
E1501 – E2000	3
E2001 – E2500	4
More than E2500	5

65 Does your household have land that you use for agricultural purposes?

Yes [1] No [2]

66 Which of the following items does your household produce/rear for selling and earning a living? (*Fieldworker: Probe for all possible answers*)

Items household produces	Yes	No
66.1. Subsistence crops production	1	2
66.2. Rearing animals/ breeding cattle	1	2
66.3. Harvesting and selling wild fruits and seeds	1	2
66.4. Making and/or selling artifacts	1	2
66.5. Other (please specify)	1	2

67 Thinking of your household's total monthly or weekly income, is your household able to make ends meet, that is to pay your usual expenses?

Only with great difficulty	1
Only with some difficulty	2
Neither with difficulty nor easily (<i>skip to Q69</i>)	3
Easily (<i>skip to Q69</i>)	4
Very easily (<i>skip to Q69</i>)	5

68 If answer with **great difficulty** or **some difficulty** in Q67, what do you do to meet the shortfall in the household income?

69 What are the three most important sources of income for your household? (List in order of importance)

1 _____
2 _____
3 _____

70 How do you see the quality of life of your household? First tell me if the general quality of life of your household is GOOD or BAD

Good [1] Bad [2]

71 And then tell me why you think so. (*Fieldworker: Probe for all possible answers*)

The quality of life of my Household is GOOD because we have the following:			The quality of life of my Household is BAD because of:	
71.1 Adequate and secure livelihood	1		71.9. Inadequate and insecure livelihood	9
71.2 Good health	2		71.10. poor health	10
71.3 A healthy natural environment	3		71.11. A degraded natural environment	11
71.4 Good social relations in the area	4		71.12. Poor social relations in the area	12
71.5 Can provide for the household	5		71.13. Cannot provide for the household	13
71.6 Food security	6		71.14. Food insecurity	14
71.7 Access to natural resources	7		71.15. Lack of access to natural and other resources	15
71.8 Other (please specify)	8		71.16. Other (please specify)	16

SECTION 2: GENERAL QUESTIONS ON DISASTER EXPERIENCE, HEALTH, KNOWLEDGE AND PERCEPTIONS

72 I now want to ask you about organizations, groups or informal associations to which you are an active member(s). In the last 12 months, have you volunteered with, given time to or taken part in any group(s)?

More than once a week	1
Once a week	2
At least once a month	3
At least twice a year	4
Once a year	5
Less than once a year	6
Never volunteered nor taken part in any group(s)	7
I Don't know	-9

74 Which of the following groups have you volunteered with or taken part in?

(Fieldworker: Probe for all possible answers)

Groups	Yes	No
74.1 Schools	1	2
74.2 Youth / Children's Activities (outside school)	1	2
74.3 Environment/Conservation	1	2
74.4 Adult education	1	2
74.5 Sports/Exercise – in team, coaching or organizing	1	2
74.6 Religion	1	2
74.7 Politics	1	2
74.8 Health, Disability, Counselling and support services, Advice on welfare	1	2
74.9 Safety / First Aid	1	2
74.10 Animal protection	1	2
74.11 Justice and Human Rights	1	2
74.12 Local Community or Neighbourhood Groups	1	2
74.13 Hobbies/Recreation/Arts groups	1	2

74.14 Trade Union Activity	1	2
74.15 Other (please specify)	1	2

75. Thinking about **the past 5 years**, were you or any of your family members affected by the following natural disasters or calamities that affected lives and livelihood? (*Fieldworker: Probe for all possible answers. If NO skip to the next option*)

Natural disasters	1. Yes 2. No	Number of times	Number of deaths	Number injured
75.1. Flood				
75.2. Drought				
75.3. Storm				
75.4. Wildfire				
75.5. Pest on agricultural production				
75.6. Pest on marula				
75.7. Epidemic				
75.8. Accident				
75.9. Conflict/riot				
75.10. Other (specify)				

76 Of these disasters that you experienced in Q75, which one was the most damaging? (*Fieldworker: If the answer is “accident”, skip to Q78*)

77 What was affected in this disaster (the one chosen in Q75)?

Items	Not affected	Affected		Not applicable (in case that the respondents do not have these items)
		Partially	Totally	
77.1. House	1	2	3	-9
77.2. Furniture	1	2	3	-9
77.3. Personal vehicles	1	2	3	-9
77.4. Livelihood equipment	1	2	3	-9
77.5. Crops	1	2	3	-9
77.6 Marula harvest	1	2	3	-9
77.7. Livestock	1	2	3	-9
77.8 Other (specify)	1	2	3	-9

78 Does your household have any preparation in case a disaster strikes?

Yes [1] No [2] (*Skip to Q80*)

79 If your answer is “yes” in Q78, what are the preparation measures taken by your household? (*Fieldworker: Probe for all possible answers*)

Preparation measures	Yes	No
79.1 Food supply	1	2
79.2 Water supply	1	2
79.3 First aid kit	1	2
79.4 Medications	1	2
79.5 Generator/electrical backup/alternative power	1	2
79.6 Emergency plan including instructions for household members about where to go and what to do in the event of a disaster	1	2
79.7 Repaired or upgraded structural weaknesses of household	1	2
79.8 Disaster insurance	1	2
79.9 Other (specify)	1	2

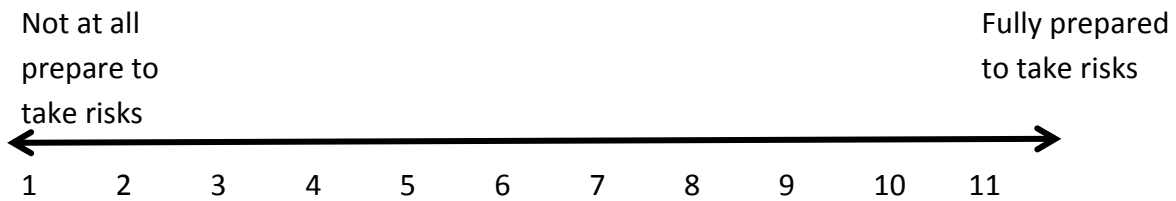
80 If the house that you live in were to be destroyed by a natural hazard, what would you do?

Rebuild your house in the same place as the old one with the same materials	1
Rebuild your house in the same place as the old one with stronger (permanent) materials	2
Rebuild your house somewhere else within your customary land that is less likely to be affected by the same hazard	3
Relocate and build or rent a house in a different community/town where we have close links	4
Other (specify)	5

81 Over the last twelve months how would you say your health as a whole has been?

Very good	1
Good	2
Fair	3
Bad	4
Very bad	5

82 How do you see yourself on a scale from 1 to 11: Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?



83 For this question and the following question, we would like to understand your perception and preference on longevity. Could you tell us until which age do you think you will live? _____ years old

84 If you were free to choose, until which age would you like to live? _____ years old

85 Word recall test

Now, I am going to read a list of words. We have purposely made the list long so it will be difficult to recall all the words. Most people recall just a few words. Please listen carefully as the set of words will not be repeated. When I have finished, I will ask you to recall aloud as many of the words as you can, in any order. Is this understood?

(FIRST READ OUT THE ENTIRE LIST OF WORDS SLOWLY AND CLEARLY. THEN REQUEST THE RESPONDENT TO RECALL THE WORDS TO THE BEST OF HIS/ HER ABILITY. GIVE THEM TWO MINUTES TO RECITE THE WORDS THAT THEY RECALL. TICK THE WORDS THAT ARE RECALLED CORRECTLY.). ALLOW TWO MINUTES TO RECALL THE FOLLOWING WORDS

Sl No	Words	Tick the word(s) which are recalled
1.	Bus	<input type="checkbox"/>
2	House	<input type="checkbox"/>
3	Chair	<input type="checkbox"/>
4	Banana	<input type="checkbox"/>
5	Sun	<input type="checkbox"/>

	6	Bird	<input type="checkbox"/>	
	7	Cat	<input type="checkbox"/>	
	8	Skirt	<input type="checkbox"/>	
	9	Rice	<input type="checkbox"/>	
	10	Monkey	<input type="checkbox"/>	
	Total Words recalled		<input type="checkbox"/> <input type="checkbox"/>	
	Total time taken		In Seconds <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	

Thank you for your time. I appreciate your support.

Alfred Francis Murye

Appendix 2: Data table for point centre quarter vegetation samples

Name of Focal Species _____

Constituency _____

Village _____ Chief _____

Date ____/____/____

Transect number _____ Land use _____

Samp ling Point	Coordinates		Altitude	Quarter No.	Focal species (Marula)			
	X	Y			Distance (m)	Diameter (at 130cm)	Sex	Regeneration
A				1				
				2				
				3				
				4				
B				1				
				2				
				3				
				4				
C				1				
				2				
				3				
				4				
D				1				
				2				
				3				
				4				
M=				N=	$\sum d =$			

Appendix 3: In-depth interview schedule

Dear participants,

We are conducting a scientific research on the sustainability of harvesting marula in the Lubombo region and are requesting you to participate in the study by taking a little of your time in an interview discussion. We want to assure you that the information gathered during this study will be used only for the study purposes. Please also be informed that you are free to withdraw from the study at any stage if you so wish. However, your opinion is very valuable and we will appreciate your participation. The interview will take only a few minutes of your time.

1. What cultural practices and traditional beliefs are associated with marula?
2. How do you think marula can be sustained in Swaziland?
3. Do you think the current commercialization of marula in Swaziland is a good practice? Why?
4. What measures have been taken to sustain marula in the country?
5. Are there laws or regulations in the country that govern the access to and harvesting of marula?
6. If any, are they being enforced? If not what are the hindrances?
7. How do you think marula depletion will affect livelihoods and culture in Swaziland?
8. Do you have anything else that you would want to tell us regarding marula?

Appendix 4: siSwati version of socio-economic and cultural household questionnaire

Kufanele kuphendvule lomdzala noma inhlioko yelikhaya

Lophendvulako,

Senta lucwaningo lwebuSayensi mayelalana nekuvunwa kwemaganu emphakatsini wakho. Sicele sikhashana sakho lesincane kutsi uphendvule lemibuto letawulandzela. Sifuna kukucinisekisa kutsi imininingwane letawutfolakal kulolucwaningo itawusentjetiswa kuloluhloko kuphela. Yati ke nekwekutsi ukhululekile kwala kwenta lolucwaningo kepha singatfokota kutfola umbono wakho.

IMINININGWANE YELIKHAYA		HH
HH1. Libito lesigodzi ____ _	HH2. Libito lesikhulu ____ _	
HH3. Likheli lelikhaya	HH4. Libito lenhloko yelikhaya:	
HH5. Libito lalophendvulako	HH6. BUDLELWANE NE NHLOKO YELIKHAYA 8. _____ I NHLOKO YELIKHAYA 9. _____ N GUMFATI NOMA INDVODZA 10. _____ Y INDVODZANA 11. _____ Y INDVODZAKATI 12. _____ N gumnakabo 13. _____ N gudzadewabo 14. _____ L okunye (Chaza)	
HH7. Linani lebantfu labahlala kulelikhaya	HH8. Linani lelihlala ekhaya HH8.1: _____ labaneminyaka lengaphansi kwesihlanu budzala HH8.2: _____ labaneminyaka lengetulu kwemashumi lasihlanu budzala HH8.3: _____ labafundze befika esecndari	

	HH8.4: _____ labakhubatekile
HH9 Locwaningako Libito _____	HH10. LUSUKU LOKWENTIWA NAGLO LUCWANINGO _____
HH11: Ute yini imibuto noma longakuphawula mayelana nalolucwaningo?	
H11.1	Kukhona yini labaphazamisile? [1] Cha [2] Yebo Chaza _____
H11.2	Kukhona yini lomunye lobekakhona makwentiwa lolucwaningo? [1] Cha [2] Yebo Chaza _____ -
H11.3	Kungabata noma kwala lokubekhona kuphendvula lemibuto [1] Cha [2] Yebo Chaza _____
H11.4	Kukhona yini lokunye kuphawula lokubekhona? [1] Cha [2] Yebo Chaza _____

SECTION 3:RESPONDENT'S DEMOGRAPHIC INFORMATION

11. Bulili: Mdvuna [1] Msikati[2]

12. Mingakhi iminyaka? _____

13. Ushadile yini?

Akashadi	1
Bahlalandzawonye	2
Ushadile	3
Behlukana	4
Badivosa	5
Wafelawa/ Umfelokati	6

14. Nyalo ngitobuta ngebantfwana lowababeleka emphilweni yakho noma abntfwana longubabe kubo. Unabo yini bantfwana?

Yebo [1] Cha [2](***Ndlulela kumbuto 7***)

15. Bangakhi bantfwana lonabo?

16. Bangakhi labasaphila? _____

17. Bangakhi bantfwana lofisa kubanabo emphilweni?

18. Sewunesikhatsi lesinganani kulenzawo? _____

19. Wafundza wagcinaphi?

Zange sewuye esikolweni	1
Azange ucedze ePrimary	2
Wacedza iPrimary	3
Azange ucedze eSecondari	4
Wacedza iSecondari	5
Awucedzanag imfundvo lephakeme	6
Wacedza imfunvo lephakeme (degree/diploma/ higher certificate etc.)	7
Lokunye (Chaza)	8

SECTION 2: INVOLVEMENT OF HOUSEHOLD IN HARVESTING MARULA FOR IMPROVING LIVELIHOOD

20. Niyawabutsa yini emaganu niwasebentise?

Yebo [1] Cha [2]

12. Abutswa ngubani?

Lilunga	Yebo	Cha
12.1. Lophendvulako	1	2

12.2.	Umfati/Indvodza	1	2
12.3.	Bantfwana	1	2
12.4.	Make walophendvulako	1	2
12.5.	Babe walophendvulako	1	2
12.6.	Batukulu	1	2
12.7.	Onkhe emalunga emndeni	1	2
12.8.	Labanye (Chaza)		

12. Kubaluleke ngani kubutsa emaganu lakhaya mayelana nekungena kwemali?

Kubaluleke kakhulu	1
kubalulekile	2
Kuyafana (<i>ndlulela kumbuto 15</i>)	3
akukabaluleki(<i>ndlulela kumbuto 15</i>)	4
Akukabaluleki nhlobo(<i>ndlulela kumbuto 15</i>)	5
Angati (<i>ndlulela kumbuto 14</i>)	-9

39. Uma utsi kumcoka kakhulu noma kumcoka chaza akfishane kutsi leni?

40. Lelikhaya lingaphila yini ngapahandle kwalemali leniyitfolo emaganwini?

Yebo [1] Cha [2] Angati [-9]

41. Niwabutsa kuphi lamaganu kunatinzawoletibaliwe? (*Funa timpdvulo letingito*)

Indzawo lakubutfwa khona emaganu	Yebo	Cha
41.1. Eceleni kwasekhaya	1	2
41.2. Emasimini	1	2
41.3. Emadlelweni	1	2
41.4. EHLane	1	2
41.5. Letinye tindzawo (Chaza)	1	2

42. Bantfu baseventisa emaganu kwenta lokunyenti. Niwasebentisa kwentani nine? (*Fieldworker: Probe for all possible answers*)

Umsebenti wemaganu ekhaya	Yebo	Cha
42.1. Kwenta umsebenti wetandla	1	2
42.2. Kuphisa	1	2
42.3. Kutsengisa tinganu	1	2
42.4. Kwacha umutsi	1	2
42.5. Kudla kwetimfuyo	1	2
42.6. Kubiyela likhaya	1	2
42.7. Kugcina lisiko tsite	1	2

42.8. Kugcina inkholo tsite	1	2
42.9. Kudla {nje ngemshibo noma lokunye}	1	2
42.10. Kukhokha emafutsa nipheke ngawo noma niwagcobise	1	2
42.11. Lokunye (Chaza)		

43. Ngekubuka kawakho lalaganu adlala indzima lemcola yini esikweni lemaSwati?

Lemcola kakhulu	1
Lemcola	2
Kuyafana	3
Lengasimcola kakhulu	4
lengasimcola	5
Angati	-9

44. Ngumaphi emasiko lahambisana nemaganu kaNgwane?

45. Simcola kanganani sihlahla semganu netitselo taso emasikweni labakhona emphakatsini wakini?

simcola kakhulu	1
simcola	2
Kuyafana	3
asimcola kakhulu	4
asimcola	5

Angati	-9
--------	----

46. Chaza kabanti lolokukhetse langenhla.

47. Kukhona yini inkholo lehambelana nemaganu emphakatsini wakini?

Yebo	1
Cha	2(<i>ndlulela kumbuto 23</i>)
Angati	-9

48. Nangabe tikhona ngutiphi?

49. Anganani emaganu leniwabutsako ngelilanga? (*Fieldworker: Probe for all possible answers*)

Indzawo lenibutsa kuyo	iHhafu yelibhake de 20L	Libhaked e 20L	Emabh akede lamabili	Emabhakede lendlulako kulamabili	Lokunye(Chaza)
23.1 Eceleni kwelikhaya	1	2	3	4	5
23.2. Emasimini	1	2	3	4	5
23.3. Emadlelweni	1	2	3	4	5
23.4. Ehlane	1	2	3	4	5
23.5. Lokunye	1	2	3	4	5

(Chaza)					
---------	--	--	--	--	--

50. Kunitsatsa sikhatsi lesinganani kubutsa Imaganu lachazwe langenhla?

51. How long does it take you to walk from your household to the places where you collect the marula?

_____ minutes

52. Niwentani lamaganu ngaphambi kwekutsi niwatsengise?

Umsebenti lowentiwako	Sitselo	Tinhlavu
26.1 Geza	1	2
26.2. Kuwahlukanisa	1	2
26.3. Pakisha	1	2
26.4. Gcoba	1	2
26.5. Kute	1	2

53. Niwatsengisa kuphi lamaganu?

Emaganu nalokwaxhiwe	Indzawo lapho kutsengiswa khona
27.1. Titselo	
27.2. Tinhlavu	
27.3. Emacembe	
27.4. Emagcolo	
27.5. Tigodvo	

27.6 Sinatfo(<i>Buganu</i>)	
-------------------------------	--

54. Kulamalanga lelikhaya lakha malini ekutsengiseni lamaganu nalenikwakha ngalamaganu ngemunyaka?

Emakhulu lasihlanu Emalangeneni	1
Emakhulu lasihlanu kuya enkhulungwaneni yeMalangeneni	2
Inkhulungwane kuya enkhulungwaneni nemakhulu lasihlanu Emalangeneni	3
Inkhulungwane nemakhulu lasihlanu kuya etinkhulungwaneni letimbili teMalangeneni	4
Ngetulu kwetinkhulungwane letimbili teMalangeneni	5

55. Ngubani loshoko kutsi abita malini lamaganu? (*Fieldworker: Probe for all possible answers*)

Loshoko kutsi malini	Yebo	Cha
29.1. Ngimi	1	2
29.2. Tinkapane letisebentisa lamaganu	1	2
29.3. Only the broker	1	2
29.4. Lomunye (Chaza)	1	2

56. Utsatsa sikhatsi lesinganani kuya lapho utsengisa khona? _____ imizuzuNOMA _____ emaHora

57. Ngabe kuhambeka kahle kuya leMakethe yemaganu?

Kuhambeka kahle	1
Kunebulakhuni	2

58. Yini leyenta kube nebulukhuni?

59. Uma usebentisa kwkuhamba ubhadala malini kuya nekubuya?

60. Lemali letfolakala masenitsengisile niyentani?

61. Uma ubuka iminyaka lesihlanu leyengcile ungatsini ngelinani leamganu kulamalanga?

Manengi kunakucala	1
Ayafana	2
Sekanciphile	3
Ayafana	-9

62. Cela uchaze kutsi usho ngani kulolokunganhla?

63. Ngutiphi tindzawo letinemaganu lakahle (bunandzi nebukhulu)

(Fieldworker: Probe for all possible answers)?

Tindzawo	Yebo	Cha
63.1. Eceleni kwelikhaya	1	2
63.2. Emasimini	1	2
63.3. Emadlelweni	1	2
63.4. Ehlane	1	2
63.5. Letinye (Chaza)	1	2

73 Ngabe adzingeka kakhulu emaganu kuletindzawo letilandzelako?

(Fieldworker: Probe for all possible answers)

Indzawo	Yebo	Cha	Angati
73.1 emumangweni	1	2	3
73.2 esifundzeni	1	2	3
73.3 kaNgwane	1	2	3
73.4 Ngensheya kwetilwandle	1	2	3

74 Sewunesikhatsi lesinganani uvuna noma utsengisa emaganu?

75 Mawuchatasanisa lesikhatsi lowacala ngaso kubutsa emagau nanyalo atfolakala kanjani/anganani?

Asesemanengi	1
Asatfolakala	2
Asayaswelakala	3
Angati	-9

76 Mangabe emaganu asayeswelakakala ngabe tihlahla setinciphile yonkhe indzawo noma kunciphe letitsite? (*Fieldworker:Probe for all possible answers*).

KuSwelakala kwemaganu	Yebo	Cha
41.1. Tonkhe tihlahla tiyeswelakala	1	2
41.2. emagcolo kuphela	1	2
41.3. Emacembe kuphela	1	2
41.4. Titselo kuphela	1	2
41.5. Tinhlavu kuphela	1	2
41.6. Tigodvo kuphela	1	2
41.7. Timpandze kuphela	1	2

42. Tinombolo tebantfu lababutsa emaganu ucabanga kutsi tishintje kanjani uma ucatsanisa nangalesikhathi ucala kubutsa?

Tiyafana	1
Tehlile	2
Tinyukile	3
Angati	-9

78 Umangabe lelizinga lekubutsa nekutsengisa emaganu lingashintji ucabanga kutsi atabe asekhon eminyakeni lesihlanu kuya kulelishumi letako?

Yebo lokungenani iminyaka lesihlanu(<i>Yendulela kumbuto 45</i>)	1
Yebo lokungenai iminyaka lelishumi(<i>Yendulela kumbuto 45</i>)	2
Cha	3
Angati	-9

79 Umangabe Cha, ubona kutsi lamiganu ingetiwa njani kuze itobakhona nakusasa?

80 Uyafisa yini kutsi emiganu ihlanyelwe eceleni kwelikhaya lakho?

Yebo	1
Cha	2
Angati	-9

81 Usho lani
lolokungenhla? _____

82 Ungavuma yini kutsi tihlahla temaganu tilinyelaw kutseniswa kuze uto khona kwacha imali yekuphilisa umndeni wakho?

Yebo	1
Cha (Ndulela kumbuto 49)	2
Angati	-9

83 Uma utsi yebo, ngukuphi lapho tingahlanyelwa khona? Khombisa laungafuna kutsi tihlanyelwe khona

Indzawo latingahlanyelwa khona	Yebo	Cha
48.1. Emasimini ladvute nelikhaya	1	2
48.2. Emasimini lakhweshile ekhaya	1	2
48.3. Emadlelweni	1	2
48.4. Ehlane	1	2
48.5. Letinye tindzawo (Chaza)	1	2

Uvumelana kanganani naletinkinga letilandzekako ngkuhlanyela emaganu ekutsengiswa eveni?

Tinkinga khona	letingaba	Ngiyavu ma kakhulu	Niyav uma	Angali ang'vumi	Ngiyala	Niyala kakhulu	Angati
49.1	Kugucuka kwesimo selitulu	5	4	3	2	1	-9
49.2.	Imihlabatsi ayilungeli kukhula emaganu	5	4	3	2	1	-9
49.3.	Lilanga kahle kuvumela kukhula kwemaganu kuletinye tindzawo	5	4	3	2	1	-9
49.4.	Tilwanyana letisita kuvutswa emaganu ateneli	5	4	3	2	1	-9
49.5.	Kutsena lamaganu kungaba lukhuni	5	4	3	2	1	-9
49.6.	Imililo inga bulalala letihlahla	5	4	3	2	1	-9
49.7.	Emanti ngeke anele kukhulisa letihlahla	5	4	3	2	1	-9

Tinkinga khona	letingaba	Ngiyavu ma kakhulu	Niyav uma	Angali ang'vumi	Ngiyala	Niyala kakhulu	Angati
49.8.	Tilwanyana netimfuyo tingabulala letihlahla	5	4	3	2	1	-9
49.9.	Indzawo ngeke yenele kulima letihlahla	5	4	3	2	1	-9
49.10.	imihlabatsi ayikavundzi kahle	5	4	3	2	1	-9
49.11.	Lizinga lekushisa kuletimye tindzawo nekekuvumele kukhula kwaletihlahla	5	4	3	2	1	-9
49.12.	Bantfu labanengi endzaweni banagvimbela kukhula kahle kwaletihlahla	5	4	3	2	1	-9
49.13.	Kulima emaganu kungakhinyabeta kuphila kwaletinye tihlahla netilwane	5	4	3	2	1	-9

84 Kukhona yini letinye tinkinga letingaba khona umakuhlanyelwa letihlahla kutsengiswa. Chaza letinkinga

85 Ucabanga kutsi letinkinga tingasombululwa kanjani?

SECTION 3: POLICY AND REGULATION OF MARULA HARVESTING IN SWAZILAND

86 Kukhona yini umuntfu noma licembu lelengamele kuvunwa kwemaganu?

Yebo	1
Cha (<i>ndlulela kumbuto 55</i>)	2
Angati	-9

87 Uma kungu yebo, chaza kafishane.

88 Lelicembu lelengamele kuvunwa kwemaganu likwenta kanjani loko?

89 Likhona yini lusito loluphuma kuhhulumende wakaNgwane mayelana nekubutfwa nekutsengiswa kwemaganu?

Yebo [1] Cha (*ndlulela kumbuto 57*) [2]

SECTION 4: HOUSEHOLD ECONOMIC STATUS

93 Usebenta kuphi, wenta msebenti mini esikhatsini lesinengi?

94 Uma ungasebenti uphila kanjani? (*Fieldworker: Probe for all possible answers*)

Indlela yekungenisa imali		Yebo	Cha
94.1	Ulimela kondla likhaya	1	2
94.2	Ufuyile	1	2
94.3	Ubutsa utsengise emaganu	1	2
94.4	Ubutsa utsengise letinye titselo tasendle	1	2
94.5	Wenta umsebenti wetandla	1	2
94.6	Lokunye (Chaza)		

95 Lomsebenti lowentako ngiwo yini lophila ngawo noma kukhona lenye indlele longenisa ngayo imali?

Yebo kukhona encenye langitfolo khona imali	1
Cha kute lapho ngitfolo khona imali (<i>ndlulela kumbuto63</i>)	2

96 Uma utsi yebo kumbuto 61, ngukuphi lapho utfola khona lenye imali?

97 Inganani imali loyitfolako ngenyanga yakho ?

Emakhulu lasihlanu Emalangenani	1
Emakhulu lasihlanu kuya enkhulungwaneni yeMalangenani	2
Inkhulungwane kuya enkhulungwaneni nemakhulu lasihlanu Emalangenani	3
Emakhulu lasihlanu Emalangenani	4
Emakhulu lasihlanu kuya enkhulungwaneni yeMalangenani	5

98 Inganani imali leniyakho lakhaya ngenyanga?

Ngephansi kwenkhulungwane	1
Inkhulungwane kuya enkhulungwaneni nemakhulu lasihlanu	2
Inkhulungwane nemakhulu lasihlanu kuya etinkhulungwaneni letimbili	3
Tinkulungwane letimbili kuya etinkhulungwaneni letimbili nemakhulu lasihlanu	4
Ngetulu kwetinkhulungwane letimbili nemakhulu lasihlanu	5

99 Likhaya lakho linayo yini indzawo yekulima?

Yebo [1] Cha [2]

100 Ngukuphi kulokulokulandzelako lelikhaya lakho likutsengisela kuphila?
(Fieldworker: Probe for all possible answers)

Umkhichito welikhaya	Yebo	Cha
66.1. kulimela kudla	1	2
66.2. kufuya	1	2
66.3. kuvuna sitsengise titselo tasendle	1	2
66.4. kwakha sitsengise umsebenti wetandla	1	2
66.5. lokunye (Chaza)	1	2

101 Uma ubuka umholo wenyanaga noma weliviki, liyakhona yini likhaya lakho kuphila?

kalukhuni	1
kalukhunyana	2
Kahle nje (<i>Ndlulela kumbuto 69</i>)	3
Kalula (<i>Ndlulela kumbuto 69</i>)	4
Kalula kakhulu (<i>Ndlulela kumbuto 69</i>)	5

102 Uma uphendvule watsi kalukhuni, kumbuto 67 wenta njani kuhlangubetana naloko?

103 Yini lokutsatfu lokumcoka lokungenisa imali ekhaya? (Kubhale ngebumcoka)

1

2

3

104 Uyibona injani imphilo ekhaya lakho? Cala ungitjele kutsi sihle noma sibi simo semphilo.

Kuhle [1] Kubi [2]

105 Shano kutsi ucabangelani kanjalo?*(Fieldworker:Probe for all possible answers)*

Simo semphilo ekhaya lami sihle ngoba sina naku lokulandzelako:			Simo semphilo ekhaya lami sibi ngoba:	
105.1	Impilo lekahle futsi levikelekile	1	71.9. imphilo lekabi futsi lengakavikeleki	9
105.2	Impilo lekahle	2	71.10. Impilo lengasikahle	10
105.3	Indza wo lekahle	3	71.11. Indzawo lengasikahle	11
105.4	Indza wo yekutijabulis a lekahle	4	71.12. Indzawo yekutijabulis lengekho kahle	12
105.5	Yakho na kundla likhaya	5	71.13. Angikoni kondla likhaya	13
105.6	Kudla kuhlala	6	71.14. Kudla akuhlali kukhona	14

kukhona			
105.7 Kutfol a umnotfo waphansi	7	71.15. kungakhoni kutfol umnotfo waphansi	15
105.8 lokunye e (Chaza)	8	71.16. lokunye (Chaza)	16

SECTION 4: GENERAL QUESTIONS ON DISASTER EXPERIENCE, HEALTH, KNOWLEDGE AND PERCEPTIONS

106 Nyalo ngifuna kukubuta ngetinhlango lapho ulilunga lelikhutsele khona.

Emunyakeni lowendlulile uke wasebenta yini enhlango weni letsite?

Ngetulu kwakanye ngeliviki	1
Kanye ngeliviki	2
Kanye ngenyanga	3
Lokungenani kabili ngenyanga	4
Kanye ngemnyaka	5
Ngaphansi kwakanye ngemnyaka	6
Ngisengakase	7
Angati	-9

75 Ngutiphi tinhlango lowatijoyina? (*Fieldworker: Probe for all possible answers*)

Tinhlango	Yebo	Cha
74.1 Tikolwa	1	2
74.2 Tinhlango talabasha	1	2
74.3 Temvelo	1	2
74.4 Imfundvo yalabadzala	1	2
74.5 Temidlalo	1	2
74.6 Tenkolo	1	2
74.7 Tepolitiki	1	2

74.8 Temphilo nenhlalakahle	1	2
74.9 Safety / First Aid	1	2
74.10 Tekuvikela tilwane	1	2
74.11 Imitsetfo nekumalungeleo ebantfu	1	2
74.12 Ummango nabomakhelwane	1	2
74.13 Tekutijabulisa	1	2
74.14 Tekutsengiselana	1	2
74.15 Lokunye (Chaza)	1	2

76. Uma ucabanga iminyaka lesihlanu leyendlulile wake noma umndeni wakho wahlaselwa tivunguvungu letatsikameta imphilo nekuphila kwenu?*(Fieldworker: Probe for all possible answers. If NO skip to the next option)*

Tivung'vungu	1. Yebo 2. Cha	Kangaph i	Labafa	Labalima la
75.1.Zamcolo				
75.2.Somiso				
75.3.Sangcotfo				
75.4.Umlilo				
75.5.Tilwanyana kulokulinyiwe				
75.6. Tilwanyana emiganwini				
75.7.Tifo				
75.8.Tingoti				
75.9.Umbango, kulwa				
75.10. Lokunye (Chaza)				

86 Kuletivunguvungu letake takwehlela ngutiphi lowalimala kakhulu?
(Fieldworker: If the answer is "accident", skip to Q78)

87 Yini leyalimala kuletiving'vungu letingenhla?

Timpahla	Akulimalanga	Kwalimala		Kute(<i>in case that the respondents do not have these items</i>)
		Kwalimala kancane	Kwalimala konkhe	
77.1.Indlu	1	2	3	4
77.2.Timpahla tendlu	1	2	3	4
77.3.Timoto	1	2	3	4
77.4.Timpahla tekuphila	1	2	3	4
77.5.Tivuno	1	2	3	4
77.6 Emaganu lavuniwe				4
77.7.Timfuyo	1	2	3	4
77.8Lokunye (Chaza)	1	2	3	4

88 Kukhona yini lelikulungisile likhaya lakho uma kungenteka kube netivunguvungu?

Yebo [1] Cha [2] (**Ndulela kumbuto 80**)

89 Uma utsi yebo, yini emalungiselelo lentiwe? (*Fieldworker: Probe for all possible answers*)

Emalung'selelo	Yebo	Cha
79.1 Kudla	1	2
79.2 Emanti	1	2
79.3 lusito lwekucala	1	2
79.4 Imitsi	1	2
79.5 Ingini yagesi (Generator)	1	2
79.6 Indlela yekuphutfuma nekutsi bantfu bente njani uma kuvela tivunguvungu	1	2
79.7 Kulungisa likhaya	1	2
79.8 Ushwayilensi wetivunguvungu	1	2
79.9 Lokunye (Chaza)	1	2

90 Uma lendlu lohlala kuyo beyingahlaselwa tivunguvungu yini longayenta?

Ngingakaha lendlu ifane nalebevele ikhona	1
Ngingakaha idlu lecinile	2
Ngingakaha kulenye indzawo lete letivunguvungu	3
Ngingatfutsa noma nihambe ngiyo casha kulelinye lidolobha	4
Lokunye (Chaza)	5

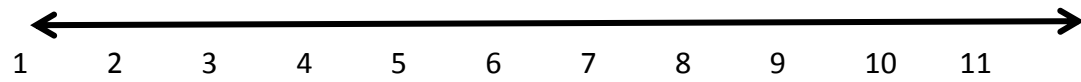
91 Emyakeni lowendlulile imphilo yakho nje iyonkhe ungatsi injani?

Kahle kakhulu	1
kahle	2
Semkhatsini	3
Kabi	4
Kabi kakhulu	5

92 Esklilni utikhantsa ulungele kanganani kubhekana nengoti?

Angikalungeli

Ngilingele



93 Kulemibuto lelandzelako sifuna kutfola kutsi ucabanga kutsi utiphila kanganani. Mawucabanga utawuphila uze ube nganani? _____ (Iminyaka)

94 Kube bewungatikhetsela bewungakhetsa kuphila kanganani? _____ (iminyaka)

95. Sivivinyo sekukhumbula emagama.

Nyalo ngitakufundzela emagama latsite. Siwente abamanengi lamagama ngamabomu, kutoba lukhuni kutsi uwakhumbule. Linyenti lebantfu likhumbula lamancane. Sitawucela ulalalelise ngoba lamagama ngeke aphindvwe Masengicedzile ngitawecela ungitjele lowakhumbulako noma nguyiphi indlela. Siyevana?

(FIRST READ OUT THE ENTIRE LIST OF WORDS SLOWLY AND CLEARLY. THEN REQUEST THE RESPONDENT TO RECALL THE WORDS TO THE BEST OF HIS/ HER ABILITY. GIVE THEM TWO MINUTES TO RECITE THE WORDS THAT THEY RECALL. TICK THE WORDS THAT ARE RECALLED CORRECTLY.) ALLOW TWO MINUTES TO RECALL THE FOLLOWING WORDS

SI No	Emagama	Thikha ligama lelikhunjuliwe
1.	Ibhansi	<input type="checkbox"/>
2	Indlu	<input type="checkbox"/>
3	Situlo	<input type="checkbox"/>
4	Bhanana	<input type="checkbox"/>
5	Lilanga	<input type="checkbox"/>
6	Inyoni	<input type="checkbox"/>
7	Kati	<input type="checkbox"/>
8	Siketi	<input type="checkbox"/>
9	iRayisi	<input type="checkbox"/>
10	Ingobiyane	<input type="checkbox"/>
	Inombolo yemagama lakhunjuliwe	<input type="checkbox"/> <input type="checkbox"/>
	Sikhatsi sesisonkhe	Imizuzwana <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

Ngiyabonga sikhatsi sakho. Ngiyabonga lusito lwakho.

Alfred Francis Murye