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Authors: Sinthumule, Ndidzulafhi Innocent, and Mzamani, Leonard Colbert Mbhoni

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Communities and Conservation: Marula Trees (*Sclerocarya birrea* subsp. *caffra*) Under Communal Management at Matiyane Village, Limpopo Province, South Africa

Ndidzulafhi Innocent Sinthumule[1] and Leonard Colbert Mbhoni Mzamani[2]

Abstract

Sclerocarya birrea subsp. *caffra* (Marula) is widely used throughout its natural distribution range by rural populations to meet livelihoods requirements. Every part of the tree, including the fruits, branches, stem and roots, provides goods and services of high cultural, social, and economic importance. Its usefulness and unique properties have encouraged local people to retain *S. birrea* in communal areas. However, there is a paucity of data quantifying the role of local communities in conserving *S. birrea*. This study quantifies the role of local communities in protecting *S. birrea* in 300 randomly selected households in Matiyane Village, Limpopo Province, South Africa. The study found that the majority of the respondents (92%; $N = 276$) are positive about the conservation of *S. birrea*. Most importantly, the respondents play a significant role in the protection of *S. birrea* in the village. Management strategies and factors responsible for the protection of *S. birrea* in communal land are discussed.

Keywords

conservation, communities, livelihoods, marula tree, village

Introduction

Sclerocarya birrea (Marula) is a widespread species distributed throughout the semiarid savannas of much of sub-Saharan Africa. Its natural habitat stretches from Senegal to Ethiopia in the north; southward to KwaZulu-Natal in South Africa; and eastward to Namibia, Angola, and the southern part of the Democratic Republic of Congo (Chirwa & Akinnifesi, 2008; Nghitoolwa, Hall, & Sinclair, 2003). As with mango, *S. birrea* is a member of the Anacardiaceae (cashew family). Three subspecies of *S. birrea* are recognized: *S. birrea* subsp. *caffra* (Sond.) Kokwaro; *S. birrea* subsp. *multifoliolata* (Engl.) Kokwaro; and *S. birrea* subsp. *birrea* (Chirwa & Akinnifesi, 2008; Nyoka, Chanyenga, Mng'omba, Akinnifesi, & Sagona, 2015; S. E. Shackleton et al., 2002). In southern Africa, the most important subspecies is *caffra* which is found in Zimbabwe, Botswana, Namibia, South Africa, and Swaziland. Within South Africa, it is common in the savanna areas of northern KwaZulu–Natal, Mpumalanga, and Northern and North-West Provinces (Chirwa & Akinnifesi, 2008; S. E. Shackeleton et al., 2002).

S. birrea subsp. *caffra* which is the focus of this study is a fast-growing dioecious and deciduous tree, reaching heights of 7 to 17 m (S. E. Shackleton et al., 2002). It has a single trunk circular in cross-section and which

[1]Department of Geography, Environmental Management and Energy Studies, University of Johannesburg, South Africa
[2]Department of Ecology and Resource Management, University of Venda, South Africa

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Corresponding Author:
Ndidzulafhi Innocent Sinthumule, Department of Geography, Environmental Management and Energy Studies, University of Johannesburg, Johannesburg, South Africa.
Email: isinthumule@uj.ac.za

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generally branches 3 to 4 m above the ground (Mokgolodi, Ding, Setshogo, Ma, & Liu, 2011; Nwonwu, 2006). The tree has a spreading crown (Nghitoolwa et al., 2003) and the leaves are 8 to 38 cm long, are elliptic in shape, and have smooth margins (Hall, 2002; Mokgolodi et al., 2011). *S. birrea* occurs on a wide variety of soil types such as the deep sands on granite and basaltic clays; it prefers well-drained soils in areas with a mean annual rainfall of 200 to 1,500 mm (Hall, O'Brien, & Sinclair, 2002; Lewis, 1987). Female trees usually flower between September and December and bear fruits annually from January to June (Hall, 2002; Nwonwu, 2006; Nyoka et al., 2015). The fruit size is variable but is roughly plum sized. *S. birrea* abscise before ripening, at which stage the skin color is green and the fruit is firm. The ripe fruits have a thick yellow peel and translucent whitish flesh (Chirwa & Akinnifesi, 2008; S. Shackleton & Shackleton, 2005; S. E. Shackleton et al., 2002).

A wealth of research on *S. birrea* has been conducted in protected areas, private land, and communal areas. However, a primary focus has been on the impacts of elephants on marula trees (Cook, Witkowski, Helm, Henley, & Parrini, 2017; Gadd, 2002; Jacobs & Biggs, 2002; C. V. Helm & Witkowski, 2013; C. V. Helm, Witkowski, Kruger, Hofmeyr, & Owen-Smith, 2009; Weaver, 1995). Research has also centered on the effects of fire on *S. birrea* population structure and density (Jacobs & Biggs, 2001; C. Helm, Wilson, Midgley, Kruger, & Witkowski, 2011). In communal areas, research on *S. birrea* has focused mainly on domestication of the species (R. Leakey, 2005; R. Leakey, Pate, & Lombard, 2005; R. Leakey, Shackleton, & Du Plessis, 2005), taxonomy and ecology (Chirwa & Akinnifesi, 2008; S. E. Shackleton et al., 2002), and commercialization and traditional uses of marula trees (Mokgolodi et al., 2011; Nwonwu, 2006; S. Shackleton, 2004; S. Shackleton & Shackleton, 2005; S. E. Shackleton & Shackleton, 2002; R. Wynberg et al., 2002). Uses of *S. birrea* include eating of the fresh fruit; it is also fermented to make a beer (Mojeremane & Tshwenyane, 2004; Nwonwu, 2006; C. M. Shackleton, Botha, & Emanuel, 2003; S. E. Shackleton et al., 2002; Sinthumule & Mashau, 2009; R. Wynberg et al., 2002;). "Amarula" cream liqueur (Distell Corporation), jams, wine, and fruit juice (R. Leakey, Pate, et al., 2005; Nwonwu, 2006; C. M. Shackleton et al., 2003) are further products made through processing of the fruit. The kernels can either be eaten or the oil extracted (Mojeremane & Tshwenyane, 2004; Nwonwu, 2006; C. M. Shackleton et al., 2003). The leaves of *S. birrea* are browsed both by wildlife and livestock (Cook et al., 2017; C. V. Helm et al., 2009; Jacobs & Biggs, 2002; Nwonwu, 2006) and the bark and leaves have medicinal uses (Gouwakinnou, Lykke, Assogbadjo, & Sinsin, 2011; Nwonwu, 2006; C. M. Shackleton et al., 2003; R. Wynberg et al., 2002). The wood is carved into utilitarian items such as spoons and plates, as well as decorative animal figures (Gouwakinnou, Lykke, et al., 2011; Nwonwu, 2006; S. Shackleton & Shackleton, 2005; S. E. Shackleton & Shackleton, 2002).

Because the species is widespread in the drier areas where drought is relatively frequent, Nyoka et al. (2015) noted that it forms part of the survival systems of the people. This is in line with findings in rural communities in sub-Saharan Africa where people have an almost inseparable connection with the environment for their livelihoods (Koziell & Saunders, 2001; Munyati & Sinthumule, 2014). This reliance on harvesting from the environment has often resulted in the decline in forest and environmental degradation (Coetzer, Erasmus, Witkowski, & Bachoo, 2010; Hosonuma et al., 2012), particularly in communal areas. This is what is defined by Hardin (1968) as the "tragedy of the commons." Yet, marula trees appear to be retained and the seedlings are nurtured by local communities in communal areas. However, there is a paucity of quantitative data regarding the role of local communities in conserving the *S. birrea*. This study uses Matiyane Village in Limpopo Province of South Africa as a case study to quantify the role of local communities in conserving *S. birrea*. The study begins by introducing the study area and explaining the methods employed in collecting and analyzing data. This is followed by the results, and the last part of the article provides discussion and implications for conservation.

Methods

Study Area

The Matiyane Village (22°44′37.38″S; 30°58′18.90″E) is situated on communal land falling under the Mhinga Tribal Authority. The land is state owned but administered by the Mhinga Tribal Authority. The village lies within the newly created (formed in 2017) Collins Chabane Local Municipality which is in the Vhembe District Municipality in Limpopo Province of South Africa (Figure 1). The village covers an area of 3.62 km^2 (Census, 2011). It forms a gateway to the Kruger National Park since it lies only 2.5 km away from Punda Maria gate of Kruger National Park. The main land uses in the village include subsistence agriculture, livestock farming, and human settlement (Chaminuka, Udo, Eilers, & van der Zijpp, 2014; Sikhweni & Hassan, 2014). The people in this village are highly dependent on their communal land for a range of goods and services that contribute to their everyday livelihood needs. These include collection of fuelwood, wild fruits, and herbs. People also harvest

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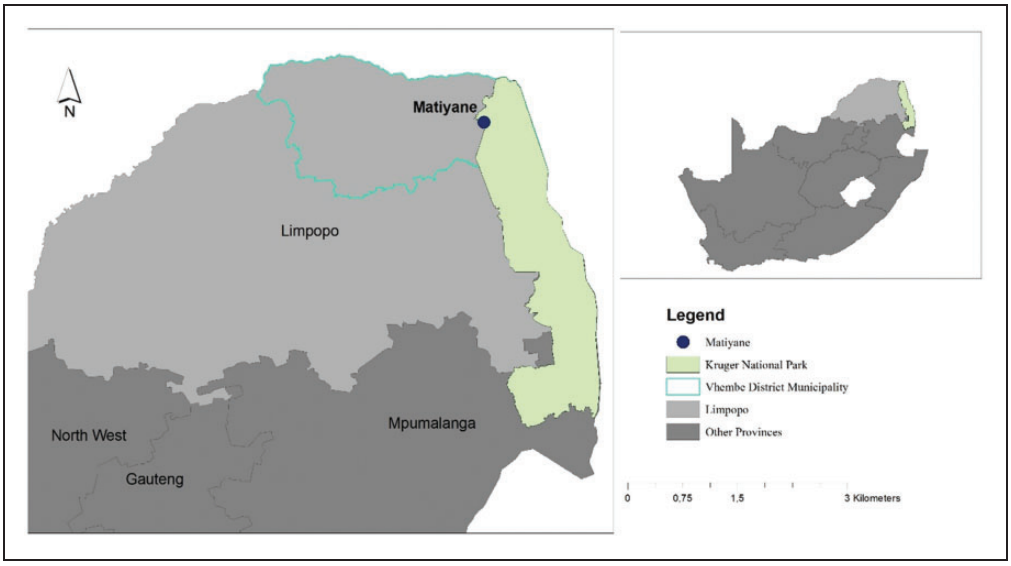


Figure 1. Location of the study area.

building and fencing wood, wild foods, wood for medicines, and craft materials. Livestock grazing comprises another important activity on the communal land.

The Matiyane Village is located in a semiarid area characterized by erratic summer rainfall. The average daily maximum temperature is approximately 28°C, and annual rainfall averaging approximately 450 mm (Shamuyarira, 2017) interspersed with long drought periods (Chaminuka, McCrindle, & Udo, 2012). The winter months in Matiyane village are from May to August and are frost free, warm and dry. Summer months are from September to April and are very hot and often balmy. With such a scenario, evaporation is high in relation to precipitation (Shamuyarira, 2017). The dominant type of soil particularly in the household sites and the crop fields is sandy loam. However, clay soil is also available next to water wells, natural dams, and along the Kruger National Park fence (Kgaphola et al., 2011). The area is dominated by mixed woodlands that include bushwillow (*Combretum erythrophyllum*), knob thorn (*Acacia nigrescens*), and marula (*S. birrea* subspecies *caffra*). Mopane trees (*Colophospermum mopane*) occur in more open areas used by livestock farmers as their grazing lands. According to the vegetation map and descriptions of Mucina and Rutherford (2006), the site is mainly located in Tsende Mopaneveld (Vegetation Unit SVmp 5) in the savanna biome. The savanna ecosystem comprises the largest biome in South (and southern) Africa (Mucina & Rutherford, 2006).

Matiyane Village has 3,073 people distributed across 809 (223.56 people per km^2) households. There are more women than men with 1,732 (56.36%) being females, whereas 1,341 (43.64%) are males (Statistics South Africa, 2011). The majority of Matiyane residents reside in electrified huts, while a few live in electrified modern houses. Despite the availability of electricity, the majority of residents still depend on firewood as their principal source of energy that contributes to deforestation (Kgaphola et al., 2011). The main sources of income include formal employment (mostly civil service and from the Kruger National Park), self-employment, subsistence agriculture, livestock farming, and resource gathering. Other important sources include grants from government (mainly pensions and child grants) and home-based microenterprises such as sewing and welding. Some households receive financial support (remittances) from nonresident household members (Chaminuka et al., 2014).

Data Collection

After permission to conduct the research was approved by village leaders, data were collected using two approaches: (a) interview-administered questionnaires and (b) observations. Households that took part in the survey were selected through a systematic random sampling approach. The rationale behind using systematic random sample was to reduce the potential for human bias in the selection of households included in the sample (Bernard, 2017). According to Walliman (2017), systematic random sampling is the method that requires selecting samples based on specific intervals. Thus, quantitative interviews were administered in every second household timed for when household heads were likely to be at home (e.g., during daylight hours and weekdays). However, in order to deal with nonresponses (e.g., adult household member not at home), a second attempt was made on weekends (Saturday and Sundays) and if still no response,

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households to the left alternating with the right of the original household were selected. This was done until 300 households were covered.

The questionnaire interview combined both closed- and open-ended questions, the latter primarily used to allow respondents to express themselves in their own words regarding communal management of marula trees. The questionnaire was designed to cover the socio-economic characteristics, knowledge and uses of marula trees by local people, as well as conservation strategies that are used to protect the species. The questionnaires were administered to the household head (male or female who assumed responsibility for the household) or any adult member of the household aged more than 21 years. The questionnaires were translated to vernacular (Tsonga or Shangaan) by two local interpreters who were also field assistants, except where respondents were fluent in English. The total response time was approximately 15 to 30 min. Questionnaires were pretested on 20 people in a nearby village not forming part of the selected sample (Walliman, 2017). Pretesting of questionnaires helped to clarify the wording in some questions.

Data Analysis

The data collected were arranged or tabulated in Microsoft Office Excel. The analysis of the data used Statistical Package for Social Sciences (SPSS; version 20). Descriptive statistics were used to summarize the questionnaire response data set. Where multiple responses were possible on an open-response question, data are presented as the percentage (%) of respondents giving each response and may sum to over 100%. Chi-square tests were applied using the SPSS for Windows (IBM SPSS Inc, Chicago, IL) to find out if the responses occurred with equal probability. Differences were considered to be significant at $p \leq .05$.

Results

Demography

The questionnaire sample consisted of 87 males (29%) and 213 females (71%) ($\chi^2 = 52.92$, $df = 1$, $p < .0001$). At the time of fieldwork, women were at home and as a result, they became respondents for most households. The number of people per household ranged from 1 to 11 (mean = 5.2, $SD = 2.14$). A total of 32.3% ($n = 97$) of respondents were between the ages of 21 and 30 years, 21.7% ($n = 65$) were between 31 and 40 years of age, 15% ($n = 45$) were between 41 and 50 years of age, 16.7% (50) were between 51 and 60 years, and 14.3% ($n = 43$) were older than 60 years ($\chi^2 = 33.47$, $df = 4$, $p < .0001$). Informants significantly varied in education: 28.7% ($n = 86$) had never attended school, 25% ($n = 75$) had attended primary school, and 42.6% ($n = 128$) had completed at least secondary education, whereas only 3.7% (11) had tertiary education ($\chi^2 = 93.68$, $df = 3$, $p < .0001$). The majority (74.3%; $n = 223$) of the respondents were unemployed, while 13.4% ($n = 40$) were self-employed. Only 12.3% ($n = 37$) were employed ($\chi^2 = 226.98$, $df = 2$, $p < .0001$) (Table 1). Those who were self-employed were involved in home-based micro-enterprises such as sewing, welding, selling of marula beer, and other products.

Knowledge and Importance of Marula Trees

All respondents (100%; $n = 300$) in Matiyane village reported that they know marula trees but most importantly they know that marula bear fruits annually from January to May. Nearly all respondents (98.3%; $n = 295$) reported that the marula tree is indigenous to South Africa, while the remainder stated that it is an alien plant species. Almost all of the informants (92%; $n = 276$) indicated that marula trees are an important species and has positive impacts on the lives and livelihoods of local communities. Thus, only 8% reported that it does not have any impacts on their lives. Informants varied in terms of the use of marula products and services: 24.7% ($n = 74$) reported that they enjoy drinking marula beer, 22.7% ($n = 68$) enjoy the shade of marula trees, while 22% ($n = 66$) enjoyed eating raw marula fruits. A further 9.3% ($n = 28$) stated that they produce jam, 7.4% ($n = 22$) enjoy eating the kernels as a snack, 4.3% ($n = 13$) enjoy marula juice, 1.7% ($n = 5$) use the marula tree for medicinal purposes, while just 0.7% ($n = 2$) reported using it to make sculptures. Those stating that they do not benefit from marula trees amounted to 7.4% ($n = 22$) ($\chi^2 = 192.18$, $df = 8$, $p < .0001$). The two people who stated that they make sculptures from marula trees indicated that they target

Table 1. Characteristics of Respondents in the Study Area.

Characteristics	Class	Percentage	χ^2
Age	21–30 years	32.3	
	31–40 years	21.7	
	41–50 years	15.0	
	51–60 years	16.7	
	>61 years	14.3	$\chi^2 = 33.47$
Gender	Male	29	
	Female	71	$\chi^2 = 52.92$
Education	None	28.7	
	Primary	25.0	
	Secondary	42.6	
	Tertiary	3.7	$\chi^2 = 93.68$
Employment	Unemployed	74.3	
	Self-employed	13.4	
	Employed	12.3	$\chi^2 = 226.98$

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the dry and male marula trees that do not bear fruits. Only 10% ($n = 30$) make an income from marula trees through selling of marula beers along the Punda Maria road going to Kruger National Park (Figure 2).

Conservation of Marula Trees

A high proportion of respondents (92%; $n = 276$) were supportive of the conservation of marula trees in the area. Strategies reported to be used to protect marula trees include the fact that the majority of respondents (87%; $n = 261$) do not cut marula trees for fuelwood despite residents still depending on fire wood as the main source of energy. A smaller percentage (13%; $n = 39$) reported that they use marula wood, not for cooking but rather to bake clay bricks in ovens. The wood was reported to be suitable since it burns slowly because of relatively high water content. Respondents reported that only the dry and male marula trees that do not bear fruits are harvested for this purpose. Nearly all respondent (99.3%; $n = 298$) indicated that as a strategy to protect the species, they do not cut its branches when harvesting fruits; rather, they wait for the marula fruits to drop from the trees on their own. Seventy-seven percent ($n = 230$) of the respondents (predominantly those >30 years) further indicated that traditionally, fruit trees like marula are protected from harm because they are a source of food. It was reported that the knowledge about the protection of fruit trees is passed from the older to the younger generation. When asked if there are any designated rangers or officials appointed by the traditional authorities who guard against the destruction of marula trees in the village, all respondents said no ($n = 300$, 100%).

The majority (82%; $n = 245$) of the respondents indicated that they had marula trees growing either in their own yards or agricultural fields. Out of 82% who had marula trees in their yards, 28% ($n = 69$) had planted them because of the value they attach to the species. In other words, planting of marula trees is a strategy that is used by some respondents to protect and increase the number of marula tree individuals in the area. When asked if they would vote for a councilor who promised to protect marula trees in their village, 72.6% ($n = 218$) said yes, 12.7% ($n = 38$) said no, and the remaining 14.7% ($n = 44$) said they did not know ($\chi^2 = 209.04$, $df = 2$, $p < .0001$). When asked if they were willing to donate money which would be used to protect marula trees in their village, 77.3% ($n = 232$) said yes and the remaining 22.7% said no. Of the 232 respondents who were willing to give a donation, 26.3% ($n = 79$) could donate R10 ($0.65), 19% ($n = 57$) could donate R20 ($1.30), 6% ($n = 18$) could donate R30 ($1.94), 5.3% ($n = 16$) could donate R40 ($2.59), 17% ($n = 51$) could donate R50 ($3.24), 3.3% ($n = 10$) could donate R100 ($6.48), and 0.3% ($n = 1$) could donate R200 ($12.95) ($\chi^2 = 137.29$, $df = 6$, $p < .0001$).

Discussion

This study provided an opportunity to quantify the role of local communities in conserving *S. birrea*. The results of this study showed that respondents had good knowledge about *S. birrea* and that the species has a positive impact on the lives and livelihoods of local communities.



Figure 2. Local communities selling marula beers along Punda Maria road going to Kruger National Park.

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The study recorded a variety of benefits that local communities obtain from marula trees, which include making of jam, juice, beer, and sculptures. The species is furthermore used for medicinal purposes and for providing shade. *S. birrea* has also been reported in Israel (Hillman, Mizrahi, & Beit-Yannai, 2008; Nerd & Mizrahi, 1993) eastern (Muok, Owuor, Dawson, & Were, 2000) and western Africa (Bantiono, Zongo, Nanema, & Traore, 2008; Gouwakinnou, Lykke, et al., 2011) to have a wide range of nutritional, cultural, medicinal, and economic significance. However, it is argued that *S. birrea* is relatively underutilized in eastern (Muok et al., 2000; Thiong'o, Kingori, & Jaenicke, 2000) and western Africa (Gouwakinnou, Lykke, et al., 2011) as compared with southern Africa. This study has also found that selling of marula beer along the highways served as the main source of income for local residents. This results corroborate previous study by S. Shackleton (2004) who reported that local people in Swaziland, Namibia, and Zimbabwe make an income through selling of marula beer. The cash injection earned from selling marula products comes at a particularly crucial time of the year, when money is required for school fees, uniforms, and books (S. Shackleton & Shackleton, 2005). In contrast, local communities in Benin (West Africa) have not yet transformed marula fruits into alcoholic beverage (wine and beer). As a result, marula fruits are not a source of income for local communities. The fruits of *S. birrea* are harvested mainly for children consumption (Gouwakinnou, Kindomihou, & Sinsin, 2009; Gouwakinnou, Lykke, et al., 2011). Thus, the utilization of *S. birrea* fruits remains opportunistic despite its high economic potential.

The study recorded a variety of methods used by local communities to conserve marula trees in communal land. The majority of respondents do not cut marula trees for fuelwood despite fuelwood being their principal source of energy because of the high cost of electricity. Those who cut marula trees for fuelwood or for making sculptures indicated that they target the dry and male marula trees that do not bear fruits. In addition, a high proportion of respondents do not cut the branches of trees when harvesting from marula trees, rather, they wait for the marula fruits to fall. This is consistent with Nwonwu (2006) and R. P. Wynberg and Laird (2007) who reported that communities collected only fruit that had fallen to the ground and ripened for various purposes. Furthermore, more than 60% of the older generation were of the view that tradition continues to play a role in the conservation of marula trees in the 21st century. A previous study in Namibia (R. P. Wynberg & Laird, 2007) also indicated that tradition and customary law still play a significant role toward marula tree conservation. Over the years, fruit trees like marula were traditionally not allowed to be cut or damaged as they were considered the source of food. In other words, felling particularly of female fruit trees was strictly taboo amongst most rural societies (Nwonwu, 2006; R. Wynberg et al., 2002; R. P. Wynberg & Laird, 2007). Although this customary regulation has lost its power and is rarely strictly enforced at a local level by traditional authorities, they still exist among elderly individuals. This is the reason why young and tall female trees of marula often remain standing on village land whilst other nonfruiting male species are chopped down or harvested for fuelwood or fencing.

Unlike in protected areas where there are security guards and rangers that guard against poaching or illegal harvesting of resources, this study found that there are no officials from government or traditional authorities employed to guard against the destruction of marula trees in the village. Rather, local communities make it their own duty to protect marula trees in the village. Interestingly, this has ensured the population of marula trees remains high in the village land relative to protected areas where the marula trees are destroyed by elephants (Cook et al., 2017; Jacobs & Biggs, 2002; C. V. Helm & Witkowski, 2013) and fire (C. Helm et al., 2011). This protection in communal areas happens despite the fact that marula trees are generally a common property or open access resource to everyone (R. Wynberg et al., 2002). In addition, the importance of indigenous resources, in particular, marula trees for rural households, has led to a domestication initiative by local people. This study found that the seedlings of marula in individual properties are nurtured and both the young and old trees are retained. Importantly, the study found that local communities in households have purposefully cultivated marulas from seed or truncheons. Several previous studies have shown that during the last two decades, numerous marula domestication processes took place particularly in southern Africa (High & Shackleton, 2000; R. Leakey, 2005) and Israel (Gutman, Nerd, Mizrahi, Bar-Zvi, & Raveh, 1999; Nerd & Mizrahi, 1993) in order to establish orchards that would supply both fresh fruit and fruit for the canning and beverage industry. This is in line with the International Centre for Research in Agroforestry that have identified *S. birrea* as an important species for domestication and commercialization (R. Leakey, 2005; R. R. B. Leakey & Simons, 1998).

Planting or cultivating marula trees in the study area has made some local communities to have household tenurial rights over specific marula trees within their properties, and Ramutsindela and Sinthumule (2017) have noted that this contribute to its conservation. In contrast, Gouwakinnou et al. 2009; Gouwakinnou, Lykke, et al., 2011) reported that no efforts have been made by local communities in West Africa to cultivate or plant marula trees in their properties. Rather, those who

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have marula tree in their farms have inherited it with the farm. Following the definition of tree domestication by Simons and Leakey (2004), *S. birrea* was still regarded as wild species in West Africa, and efforts were still needed to ensure its domestication (Gouwakinnou, Assogbadjo, Lykke, & Sinsin, 2011). This study also found that majority of respondents within the village under study would be willing to vote for a counselor who promised to protect marula trees in the village. The majority of respondents were furthermore willing to go the extra mile of donating money that could be used for the conservation of marula trees in the area. The high percentage of the people who are supportive of the conservation of marula trees demonstrate that local communities are the custodian of this species.

Implications for Conservation

As documented by many scholars, rural communities in sub-Saharan Africa depend on their environment for their everyday livelihood needs, including agriculture, grazing, fuelwood collection, wild fruits and herbs, wood for construction and tools, craft materials, medicines, and construction poles (Mokganya et al., 2018; Munyati & Sinthumule, 2014; S. Shackleton, 2004). Such reliance on the environment has often resulted in the depletion of forest and woodland tree cover (Chipika & Kowero, 2000; Geist & Lambin, 2002; Toillier, Serpantié, Hervé, & Lardon, 2011). However, contrary to the findings by other scholars that the dependency of local people on their environment leads to depletion of forest and woodland cover, this study found that the dependency on marula trees by local communities for cultural and socioeconomic purposes is contributing to the protection of this species in Matiyane Village. A high proportion of respondents avoid dependence on marula trees for fuel wood and do not cut the branches when harvesting fruits. The study also found that just like other important trees such as mangos, avocadoes, oranges, and apples that have been domesticated, some local people have also cultivated marula trees in their properties which contribute to its conservation. In addition, traditional beliefs of protecting fruit trees were playing a significant role in marula trees conservation in the study area. Conservation outside the borders of protected areas as in the study area supports the notion of bioregional planning or regional landscape approach that encourages the protection of species wherever it is found (Sayer et al., 2013). As Sinthumule (2016) has noted, regional landscape approach has emerged as the 21st approach of managing biodiversity. The idea is to ensure long-term sustainability of biodiversity conservation or natural resource management (DeFries & Rosenzweig, 2010).

Overall, rural communities in Matiyane village in South Africa have shown that they are guardian of marula trees. In other words, local people have demonstrated positive attitudes toward marula trees. It is these positive attitudes that have meaningfully contributed to the success of conservation of marula trees in the study area. This study suggests that there is need to (a) recognize and promote such positive attitudes and (b) reinforce the indigenous knowledge system for sustainable natural resource management. Where possible, such indigenous knowledge system should be integrated with scientific knowledge. In addition, it is important that senior citizens (old-age people) should be encouraged to educate the young community members on the indigenous knowledge systems that promote conservation of natural resources. Despite the wealth of research on marula trees that has been conducted in sub-Saharan Africa, further research aimed at monitoring the distribution and abundance of marula trees in communal land using remote sensing technology still requires adequate attention.

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