Use of Mopane Woodland Resources and Associated Woodland Management Challenges in Rural Areas of South Africa

Rudzani A. Makhado, Martin J. Potgieter, Dirk C.J. Wessels, Amani T. Saidi, and Kgabo K. Masehela

Research

Abstract

Mopane woodland resources in South Africa are essential to the wellbeing of rural communities living near them. They provide the primary source of poles used for construction of traditional structures as well as fuel wood. In mopane woodland areas, 80% of rural people use fuel wood as the primary source of energy for cooking and heating. Villagers prefer to use mopane (*Colophospermum mopane* (J. Kirk ex Benth.) J. Léonard) tree for fuel wood and construction of traditional structures; because it has high energy content, emits less smoke when it is dry, and it is durable. A family of about 7 people uses a mean of 7.8 kilograms for cooking per day per meal, resulting in about 2.8 metric tons consumed per year per household. A mean volume of 1.4 m^3 is used when constructing a traditional hut, which means that a family with three or four houses would use 4.1 m^3 - 5.4 m^3 in constructing them. Mopane worms harvested from mopane woodland are consumed for their nutritional value and also traded to generate income. Despite the value of mopane woodland resources to rural livelihoods, unsustainable resource use and irresponsible management resulted in dwindling woodland resources.

Introduction

Mopane woodland covers an estimated 555,000 km^2 of land in southern Africa, and is the dominant vegetation type in southern Angola, northern Namibia, northern Botswana into Zimbabwe, and central and northern Mozambique, in southern Zambia, Malawi and northern South Africa (Figure 1). In South Africa, it covers about one third of the total land area (DWAF 2005) with an estimated 23,000 km^2 of mopane woodland occurring in the Limpopo and Mpumalanga Provinces (Mapaure 1994). The dominant tree species in mopane woodland is *Colophospermum mopane* (J. Kirk ex Benth.) J. Léonard (Léonard 1949), which is the only species in the genus *Colophospermum* (tribe Detarieae, sub-family Caesalpinioideae, Fabaceae) (Lock 1989). *Colophospermum mopane* is commonly known as mopane and is considered as one of the most important tree species in the mopane woodland. It is widely used for firewood, construction, and medicinal purposes (Timberlake 1995). *Colophospermum mopane* also hosts mopane worms (*Gonimbrasia belina* Westwood, 1849 moth larvae) which are consumed in large numbers by rural people (Palgrave 1983).

Mopane woodland is important to the livelihoods of an unknown but probably substantial number of people in southern Africa. Rural inhabitants obtain fuel wood, poles used for construction of traditional structures, edibles and medicine from the surrounding mopane woodland (Liengme 1983, Madzibane & Potgieter 1999, Malan & Owen-Smith 1974, Mashabane *et al*. 2001, Shackleton *et al*. 2000). Non-wood products such as mopane worms, termites (*Macrotermes* species), stink-bugs (*Encosternum delegorguei* Spin., 1852) and thatching grass (*Hyparrhenia*

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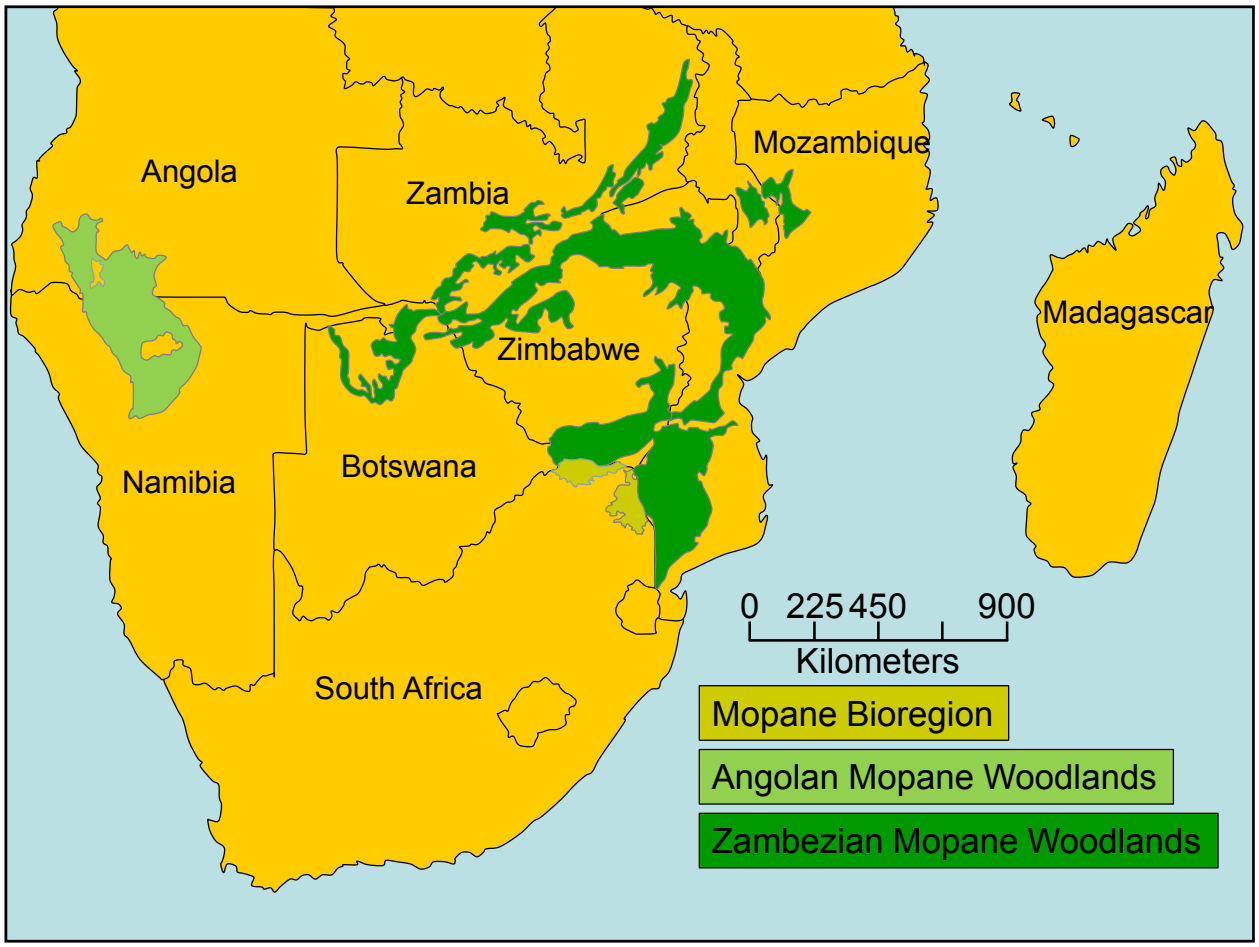

Figure 1. The distribution of mopane woodlands in southern Africa. This map is an extract from Mucina and Rutherford (2006) data on the vegetation of South Africa, Lesotho and Swaziland (VegMap) and White (1983) data on vegetation of Africa.

species) are used for household subsistence and income generation. The resource which is extensively utilized in mopane woodland is mopane worms. Mopane worms are extensively consumed by the rural and increasing urban populations across southern African countries for their nutritional value, and also sold to generate incomes. Mopane woodland also provides nutritious fodder for browsers, particularly in the dry season (Timberlake 1995). Its leaves form an important source of crude protein, ranging from 8.4% in September to 16.6% in November (Bonsma 1942). The leaves are preferred by browsers during winter when the tannins have leached-out. The grasses under *C. mopane* tree are quite nutritious and are highly preferred by grazing animals.

A number of factors have, of late, brought the sustainability of the mopane woodland resource use into question. Those factors relate to rapid transition and challenges encountered in the management of these woodland. This was also exacerbated by the slow process of tenure reform, and unclear roles and responsibilities in the management of woodland. This has resulted in the depletion of woodland resources in most rural areas. Various regulations such as the National Forest Act No. 84 (1998) were enacted in order to promote sustainable management of woodland resources. In spite of these regulations, woodlands continue to be harvested unsustainably (Shackleton *et al*. 2001) which indicates some deep-rooted woodland management challenges, particularly in rural areas. High population growth, unsustainable harvesting of natural resources and frequent fires are anthropogenic pressure on natural resources, which is resulting in the conversion of woodlands to settlements, cultivation areas, and even degraded lands.

This paper specifically assesses the use of mopane woodland resources and management challenges in the rural areas of the northeast of the Limpopo Province, South Africa. It also provides synthesis of recent articles, reports and legislation on woodland resource use and management for rural wellbeing. The questions answered in this paper are:

- What benefits do people get from mopane woodland resources, either as cash or through use?
- Have patterns of resource use and trade been affected by the transition in woodland resource management?

Study Area

The study was conducted in six villages in the Greater Giyani Municipality, northeast of the Limpopo Province, South Africa. The six villages are Homu 14A (23.30385°S, 30.80417°E), Homu 14C (23.31561°S, 30.740526°E), Mapayeni (23.35412°S, 30.82297°E), Makhuva (23.58236°S, 30.97446°E), Zaba (23.57581° S, 30.70878°E) and Mbaula (23.60878°S, 31.03742°E) (Figure 2). The total population in those six villages was estimated as follows: Homu 14A (5000), Homu 14C (6000), Mapayeni (8500), Makhuva (8000), Zaba (5000) and Mbaula (3000). Each household has 4 people on average. About 85% of the dwellings are traditional and the number of huts ranges between three and four per household. Eighty two percent of respondents are unemployed (Makhado *et al*. 2009), and rely on old age pensions, subsistence agriculture and woodland products to sustain their livelihood.

The climate is characterized by low rainfall, which is about 400 mm on average per annum. The average temperature ranges from a minimum of 15 °C in winter to a maxi-

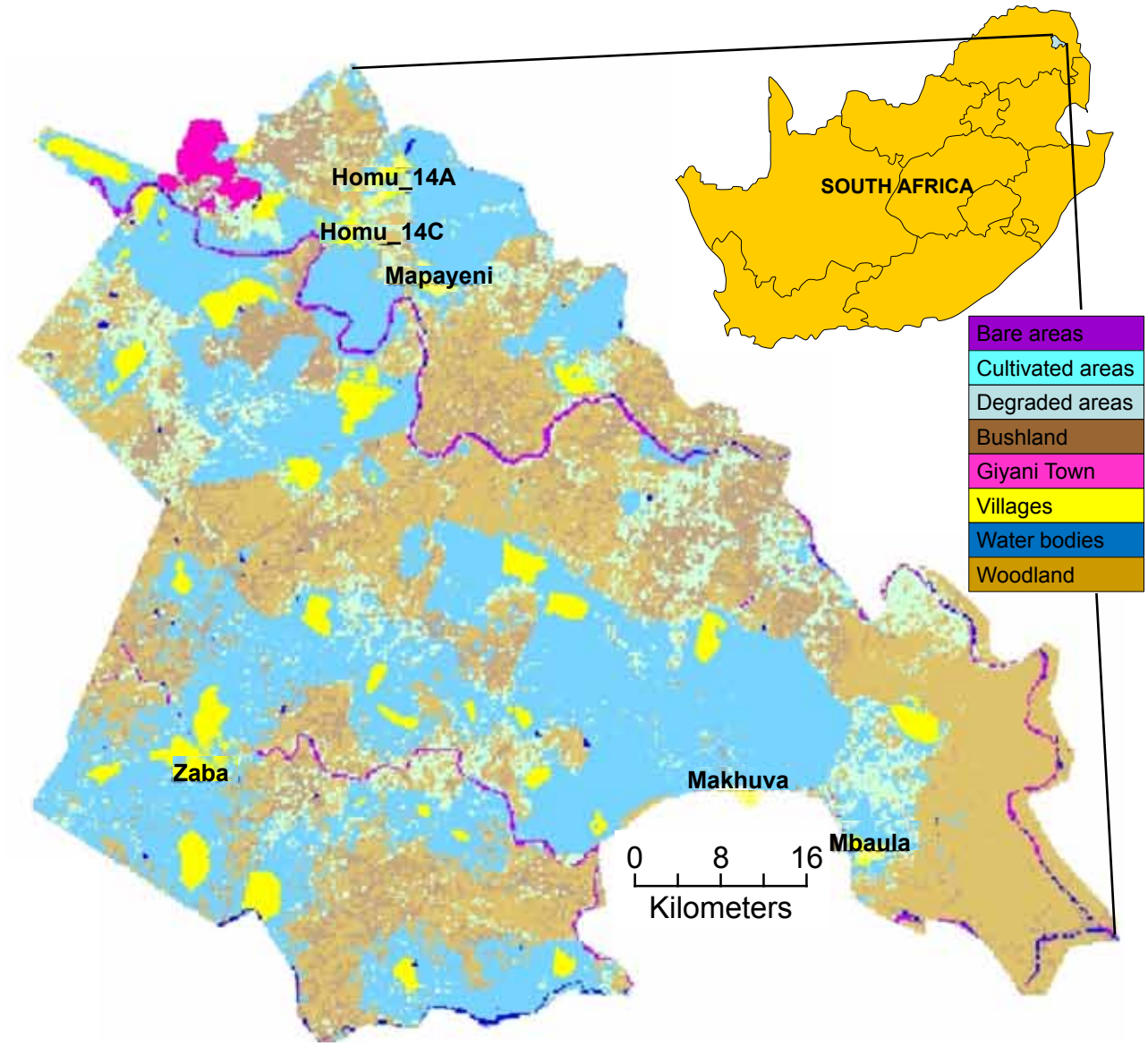

Figure 2. Six selected rural villages in the Greater Giyani Municipality. These villages are located in the northeastern part of the Lowveld, Limpopo Province, South Africa. Source: Makhado *et al*. (2009).

mum of 30 ºC in summer (South Africa Weather Service data 1980-2003). The vegetation is classified under the lowveld mopaneveld savannas (Rutherford *et al*. 2006), characterized by a mixture of trees, shrubs and grasses. *Colophospermum mopane* occurs in abundance together with other trees species such as *Combretum apiculatum* Sond., *Sclerocarya birrea* (A. Rich.) Hochst., *Dichrostachys cinerea* (L.) Wight & Arn., and *Acacia* species.

Methodology

A synthesis of published articles, reports and legislation that deals with mopane woodland resources use in rural areas forms the background of this research. This was done in order to understand the sustainability of using woodland resources, primarily in South Africa, but also across southern African countries.

The study was carried-out between August 2004 and May 2005 in six randomly selected villages. Household surveys and participatory group interviews were conducted with a total of 180 villagers (by randomly selecting 30 people per village from different households). Ten officers from the conservation departments in the Greater Giyani Municipality and thirteen traditional leaders from the Homu Traditional Authority, Dzumeri Traditional Authority and Makhuva Traditional Authority were also interviewed. Semi-structured interviews (open and closed-ended questions) were used to collect data on woodland resource use and management from the respondents. A questionnaire form was used to capture the data. The questionnaire covered aspects on resource use pattern, amount of resources consumed, trends and challenges on woodland management. The amount of wood used by villagers for fuel wood and construction was also quantified using a measuring scale. Quantitative and qualitative methods were used to analyze the collected data. South African Rands were converted to US Dollars (convention factor was 8.14 ZAR is equivalent to 1 US$ (converted in August 2012)).

Vegetation data from White (1993) and Mucina and Rutherford (2006) were used to produce the mopane woodland distribution map (Figure 1). A SigmaScan Image Analysis ver. 5 (Build number 3981, 1987-1999 SPSS Inc.) was used to estimated the percentage landuse cover as identified in Figure 2.

Results and Discussion

Ethnobotanical uses

This paper primarily focuses on: the direct use values of mopane woodland resources where *C. mopane* is the dominant tree species in southern Africa. The direct use values include fuel wood, poles, medicine, mopane worms, stink bugs, termites, edible locust, thatching and sweeping grasses. Those products are harvested, mostly by women, in order to meet household needs such as food and energy, and are also traded to generate incomes (see Figure 3).

Energy source

Makhado *et al*. (2009) reported that 80% of rural people in the northeast of Limpopo Province, South Africa use fuel wood as the primary source of energy for cooking and heating. They prefer to use tree species such as *C. mopane* for fuel wood (Makhado *et al*. 2009) because it burns easily (the energy content has been shown to be 21.57 kJ/kg; Tietema *et al*. 1991) and emits less smoke when it is dry (Liengme 1983). A family of about 7 people uses a mean of 7.8 kilograms for cooking per day per meal, resulting in about 2.8 metric tons consumed per year per household. The trading price of *C. mopane* fuel wood was R10 (US$1.23) for 10 kilograms (Makhado *et al*. 2009), which is about R1.00 (US$0.12) per kilogram. This means that the annual value of fuel wood per house-

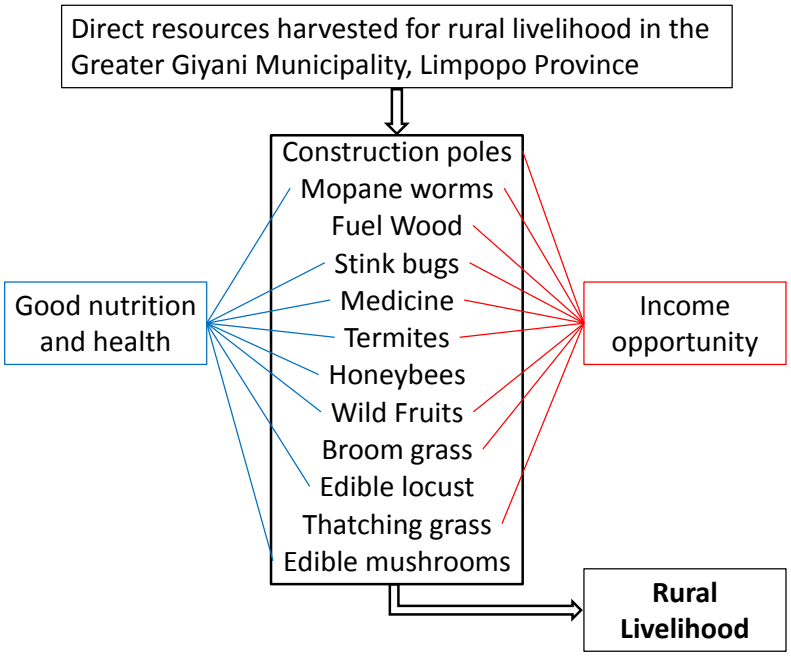

Figure 3. Mopane woodland resources harvested for rural livelihood in the northeast of the Limpopo Province, South Africa. The blue lines indicate products harvested for household nutritional supplement and health, while the red lines indicated products harvested to generate household income. Based on Makhado *et al*. (2009).

hold is worth R2,800 (US$343.98). However, a study conducted by Twine *et al*. (2003) in the same locality estimated it to be worth R587 (US$72.11). The total annual consumption of fuel wood in South African rural areas ranges from 9 to 11 million tons, of which 6.6 million tons are estimated to be harvested from natural woodlands (Shackleton *et al*. 2001, White Paper on Sustainable Forest Development 1996). High reliance on fuel wood in rural areas is due to the fact that it is the cheapest and most accessible source of energy to the majority of rural poor people. Elders also believed that porridge cooked using wood has a better taste than that cooked using electricity. Aesthetic factors such as this have contributed to high demand of fuel wood as a first choice energy source for cooking. Other tree species used for fuel wood include: *Acacia nigrescens* Oliv., *C. apiculatum*, *Dalbergia melanoxylon* Guill. & Perr., *D. cinerea*, *Diospyros mespiliformis* Hochst. ex A. DC., *Euclea divinorum* Hiern, *Euphorbia confinalis* R.A. Dyer, *Maytenus senegalensis* (Lam.) Exell, *Peltophorum africanum* Sond., *Philenoptera violacea* (Klotzsch) Schrire, *Terminalia argentea* Mart., *Trichilia emetica* Vahl., *Ximenia caffra* Sond., and *Ziziphus mucronata* Willd.

Women and girls travel more than a kilometer to harvest fuel wood. Harvests take between one and five hours, which compares favorably with four hours spent by women in Mametja, Limpopo Province (Twine *et al*. 2003). As the distance and time taken to harvest firewood increases, it negatively affects fuel wood collectors, especially female fuel wood collectors. Madzibane and Potgieter (1999) showed that time spent by woman collecting firewood limits their involved in other socio-economic development activities.

Construction of traditional structures

Rural inhabitants use poles for construction of traditional huts, maize granaries, fences, animal **kraals** and utensils such as mortars, pestles and wooden spoons. The use of wood to construct traditional structures is a common practice in most rural areas of southern Africa (Liengme 1983, Van Wyk & Gericke 2000). A mean volume of 1.4 m^3 is used when constructing a traditional hut, and a family with three or four houses would use 4.1 m^3 - 5.4 m^3 in constructing them. A medium-sized granary alongside the hut can consume 0.4 m^3 of poles, while fencing of homestead consume 7.2 m^3 and 27.7 m^3 for large cattle **kraal** (Makhado *et al*. 2009). The lifespan of the structures is between 10 and 25 years if *C. mopane* poles were used. Other trees such as *A. nigrescens* are less durable, lasting for less than 10 years. *Colophospermum mopane* poles are highly valued for construction of traditional structures because they are durable, termite resistant (Prior & Cutler 1992), and are relatively straight. The durability of *C. mopane* poles is a result of the secondary metabolites collectively known as extractives, which contribute to the final density of wood (J. Wesley-Smith, personal communication 2005).

Medicinal use

Traditional medicines from plant, animal or mineral sources are widely used in most rural areas of southern Africa to treat common illnesses (Cunningham 1996, Mabogo 1990, Van Wyk & Gericke 2000, Vorster 1999). Shackleton (2001) estimated that 70% of people in South African rural areas use traditional medicine gathered from the surrounding woodland. The use of traditional medicine is currently growing in urban areas of South Africa.

Focusing on the medicinal value of *C. mopane*, the leaves and bark are used to relieve stomach pain, and for the treatment of diarrhoea, whooping cough, cancer (Mashabane *et al*. 2001, Van Wyk & Gericke 2000), syphilis (Timberlake 1995) and even to stop excessive bleeding (Madzibane & Potgieter 1999). The roots are used to avoid gum bleeding, treatment of kidney stones, bilharzia, vomiting (Madzibane & Potgieter 1999, Mashabane *et al*. 2001), and healing of wounds (Palmer & Pitman 1972). Palgrave (1956) also alleged that it treats temporary madness.

Non-wood products

Non-wood products are mainly harvested by women for subsistence and commercial purposes. However, men are currently becoming involved, being attracted by income opportunities. Those products include bee honey, mopane worms, locust, termites and stink-bugs (Makhado *et al*. 2009). Insects such as mopane worms, locust, termites and stink-bugs form an important protein source to many rural people, and constitute a lucrative income for rural traders. Protein content reported varies for mopane worms, termites and stink bugs: about 64% (Dreyer & Wehmeyer 1982), 42% (Phelps *et al*. 1975), and 35% (Teffo *et al*. 2007) respectively. According to Teffo *et al*. (2007) between 680 and 3400 stink-bugs need to be consumed in order to meet a person's daily minimum phenylalanine and methionine requirements.

Trade in edible insects has the potential to generate millions of dollars, but this is not fulfilled due to irregularities in their population outbreak. Makhado *et al*. (2009) found that individual mopane worm traders in the Limpopo Province, South Africa can earn about R20,000 (US$2,457) per annum. Styles (1994) further estimated that the annual population of mopane worms in South Africa is worth US$57 million. It is recognized that sustainable use of mopane woodland resources could lead to better livelihoods in rural areas; however, unsustainable practices are common, depriving those communities of their opportunities. We now examine the prior and post 1994 woodland management systems in South Africa.

Transition in Woodland Management in South Africa

Woodland management systems - prior 1994

Before the democratic government was established in South Africa, woodland resources in the former homelands were considered as common goods. The control of resource use was assigned to the tribal authority (Chiefs and Headmen) by the then Bantu Laws and Administration Act (White Paper on Sustainable Forest Development 1996). Control of woodland resources by the tribal authority was widespread in the former Venda (Mabogo 1990) and Gazankulu (Mashabane & Potgieter 2001). The tribal authorities had the power to regulate and enforce the use of woodland resources within their area of jurisdiction (Mabogo 1990, von Maltitz & Shackleton 2004). They were also responsible for the transfer of conservation knowledge to the youth, which was done at tribal gatherings and during cultural ceremonies. Systems and norms were developed by the tribal authorities in order to protect the use of woodland resources. A certain portion of the woodland could be declared as a no-go area, by imposing stringent restrictions over the use of resources within that area, particularly by commoners (non-royals). Commoners were not allowed to go near burial sites of the royals, and harvesting of wood near them was strictly prohibited. Although the motive was for spiritual reasons, it did assist in protecting trees from being cut down.

Management of woodlands by the traditional authorities has also been reported from the rural areas of Zimbabwe (Campbell *et al*. 1993, Chambwera 1996, Grundy 1996, Gumbo 1993), Namibia (Cunningham 1993), and Tanzania (Kajembe & Monela 2000), among others. The traditional authorities prohibited the cutting of certain fruit trees such as *S. birrea* and those trees were even planted at homesteads to prevent other people from exploiting them. Methods and seasons for harvesting woodland resources were introduced in order to promote sustainable use of resources (e.g., Cunningham 1993). The chiefs could also declare certain areas of woodland as sacred places, and practices such as harvesting of fuel wood or poles could only be done with prior consultation with the traditional council (e.g., Grundy 1996). The season, and actual days as well as method of woodland resource harvesting were prescribed by the traditional authorities. As also found in the study area, failure to comply with the rules set by the tribal council could result in some sort of penalty or fine. Traditional systems of woodland management are understood to have been effective in restricting over-exploitation of woodland resources (Cunningham 1993, Grundy 1996).

Villagers requiring resources from their surrounding woodlands were obliged to purchase permits, which were granted by the tribal authority (e.g., Mabogo 1990). However, permits were not required for the collection of dry wood and wild fruits by villagers. The harvest of wood by outsiders (people from other villages) was restricted by making the required permits relatively more expensive. If an offence was to be committed the person responsible could be fined. Fines were usually paid in the form of a domestic animal (e.g., cow, sheep or goat). Failure to pay the fine could result in being threatened with expulsion from a village by the village chief.

Woodland management systems - post 1994

The end of the apartheid system of government in South Africa led to the reintegration of all previous homelands into the Republic of South Africa. Woodlands are currently included within the scope of forestry policy. This marked a drastic change in the way woodland resources were regulated, and paved a way forward towards sustainable management of woodlands. This resulted in the development of criteria, indicators and standards for monitoring sustainable forest and woodland practices. Regardless of this progress, it is unclear who among the traditional leaders, villagers and conservation officials at the local level has the responsibility for management of woodlands. However, the conservation section within the local municipality indicated that they are attempting to enforce conservation regulations in rural areas, but with little success in reducing over-exploitation. This is due to a lack of clear responsibility in the management of woodlands, diminished roles of tribal authorities in woodland management (Steenkamp & Urh 2000, von Maltitz & Shackleton 2004, White Paper on Traditional Leadership and Governance 2003), and lack of adequate resources to effectively enforce conservation regulations. This has resulted in the flouting of traditional conservation norms, continuous over-exploitation of woodland resources, irresponsibility in the management of natural resources (Evans *et al*. 2000, von Maltitz & Shackleton 2004), and increasingly open systems of woodland resource use in rural areas.

The response from the traditional authorities indicates that the steady weakening of their roles in the management of woodland resources appears to have promoted less respect for chiefs by villagers, lack of communication between chiefs and villagers, power conflicts between chiefs and elected leaders (civic officials and ward counsellors) and less trust in benefit-sharing mechanisms between the traditional leaders and the villagers. The shift in authority is causing considerable tension and confusion at the village level (Lawes *et al*. 2004), and simultaneously subordinates the status of traditional leaders in the eyes of villagers. This gives an impression that traditional leaders ruled previously by means of fear, and currently, villagers no longer fear their traditional leaders. However, traditional authorities and villagers indicate that historically, a villager who disobeyed the chief's order could be expelled from the village. By contrast, now people have rights to occupy and use land on which they reside (Extension of Security of Tenure Act 1997). This has resulted

in negligence of traditional norms by villagers, weakening of traditional power and increased reluctance to follow woodland harvesting methods and seasons of harvest as decreed by traditional authorities. Villagers are also reluctant to pay for permits to harvest woodland resources. The cause of villagers' reluctant to pay for permits are uncertain, but it might be influenced by poverty, unemployment and lack of ownership by local residents. This may also result from the fact that there is a low probability of being caught harvesting woodland resources illegally and fines are low if caught, while permit costs are high. In this situation, people probably take the risk of harvesting woodland resources without a permit.

As a result of unsustainable use of woodland resources, regulatory measures that aim to promote sustainable use of forest and woodland resources were developed. Section 7(1) of the National Forest Act (No. 84 of 1998) states that no person is allowed to cut, disturb, damage or destroy any indigenous living tree except those holding a permit. At the same time, the use of a permit system to regulate the use of woodlands also gives an opportunity for outsiders to access and overuse resources as long as they have permits. As stipulated in the National Forest Act, the permit can be suspended if any activity does not promote sustainable use of forests and woodlands. The Act further provides that if any person contravenes the prohibitions, they may be sentenced to a fine or imprisoned for a period of up to three years. However, lack of a permit monitoring system in rural areas has increased abuse of woodland resources, particularly by outsiders.

In rural areas, permits are obtained from the local tribal authority, but enforcement of regulations is done by the conservation section (rangers) within a local municipality. The conservation officials and traditional leaders indicated that the cost of a permit varies, but villagers pay about R30 (US$3.69) to harvest poles used for construction of traditional structures. No permit is required to collect dry wood by villagers, but people staying in another village pay about R20 (US$2.46) to collect fuel wood in a one ton pick-up vehicle. A permit is valid for a period of three months. People who fail to comply with the conservation rules are punished, mostly in the form of a fine. A fine for collection of non-dry wood is between R100 (US$12.29) for a headload and R500 (US$61.43) for a pick-up vehicle load. Failure to pay the fine can result in a two-month jail sentence imposed by a court of law, not the traditional council. Although fines are paid to tribal councils, it is unclear how the money is used. The money is supposed to be used for community development but, villagers speculate that it is used for other purposes by the council.

The Communal Land Rights Act, No. 11 (2004) provides for the rights of communities or persons (including women), to land and the benefits from communal lands. Section 21(2) of the Communal Land Rights Act states that if a community recognized a traditional council, the powers and duties of the land administration committee of such a community may be exercised and performed by such a council. The recognition of traditional councils as land administrators becomes complicated in section 22(2) of the Communal Land Rights Act, which states that members of a land administration committee must be persons not holding any traditional leadership position and must be elected by the community in the prescribed manner. The result is that little to no action has been taken to restore the roles, status, and institution of traditional leadership, and as such traditional authorities are sidelined as far resource use, allocation and management is concerned. This has eroded the authority of traditional leaders, increased uncertainties about who is responsible for woodland management, and created difficulties for management of woodlands (von Maltitz & Shackleton 2004). It is currently unclear whether communities have rights of ownership of their land, but it seems that the use of land is given as private property with provision from the municipality. This creates gaps in attempts to transfer community control over woodland resource use and management at the village level.

Challenges for Woodland Resource Management

Socio-economic issues

Woodlands in South Africa mostly occur in rural areas, where unemployment and poverty is prevalent. The human population growth rate in those areas is resulting in expansion of human settlements, cultivated fields, and an increase in woodland resource demand. The effect is depletion of the surrounding woodland resources and increased distance and time to harvest woodland resources. A high rate of unemployment has also increased reliance on fuel wood as a primary source of energy for cooking and heating in most rural areas of South Africa (White Paper on the Renewable Energy Policy of the Republic of South Africa 2003).

Analysis of percentage area cover of land use types (Figure 2) shows that cultivated areas constitute about 59% of total land area, woodlands about 27%, villages about 5%, degraded areas about 5%, bushlands about 3% and Giyani town about 1%. This suggests that woodlands were converted in order to create more cultivation areas for the majority of people who practice subsistence farming. The current challenge is that most villagers do not regard themselves as the owners of woodland resources, and therefore consider the woodlands as an open access resource. This has increased unsustainable practices with woodland resources and depletion of woodland resources as a consequence.

Institutional issues

Although villagers were reluctant to buy permits, they were obliged by the traditional leaders to buy them as a

regulatory measure to reduce over-exploitation. The permits used to be granted by the traditional authorities, but currently, the conservation departments within municipalities are also responsible for granting the permits. After 1994, a new woodland management system emerged, which changed the structure, function and responsibilities of traditional authorities. Currently, the conservation section within the local municipality is directly responsible for woodland management at the village level, but the legislative basis of this responsibility is unclear. Rangers are employed to monitor any infringement of conservation regulations, which further reduces the roles of traditional authorities. The permits granted are essentially "blank checks" in that they are silent on quantities of woodland resources that can be exploited during their periods of validity. This means people obtaining the permits are free to exploit as much as they can, indicating that the permit system cannot protect natural resources from over-exploitation.

Woodland resource depletion in the study area is mainly due to overharvesting of woodland resources, weakening roles of traditional leaders in the management of woodland, population increase, unemployment and a high level of poverty. In addition; high population growth, advances in harvesting technologies, and increased value of woodland products for income generation result in depletion of woodland resources.

Regulation enforcement

Regulations are developed at the national level to control use of woodland resources. But, putting these regulations into effect has proven to be a challenge particularly at the village level. At the municipality level, there are insufficient rangers to monitor and enforce woodland regulations. There is also a lack of transport for the rangers to monitor daily practices in various villages under their jurisdiction. The conservation officials indicated that five rangers are deployed in all villages in Giyani to monitor woodland practises. It was further reported that deployment of rangers does not effectively reduce illegal harvesting of woodland resources, because some people harvest and transport non-dry wood at night. The illegal harvesters are also aware of the ranger's patrol days and take advantage to exploit woodlands in the absence of rangers. Lack of transport for rangers and the apathy of some rangers for working after hours; have therefore made it difficult to catch illegal harvesters. This has also makes it difficult to effectively monitor illegal activities and enforcement of conservation laws. All of those challenges have contributed to ignorance and breach of conservation rules by the villagers and people residing outside the village.

Institutional framework for woodland management

The custodian of forests including woodlands in South Africa is the Department of Agriculture, Forestry and Fisheries. However, enforcement of conservation laws is done by the Department of Environmental Affairs through the appointment of rangers. In essence, woodlands are managed in a fragmented fashion, at all levels of government (e.g., Shackleton *et al*. 2001, von Maltitz & Shackleton 2004). The effect is overlapping of the responsibilities between the National Departments, Provincial Departments and Municipalities. This creates gaps and decreases coordination in the way resources are administered (von Maltitz & Shackleton 2004, Willis *et al*. 2001). Alternatively overlap potentially results in conflicting policies and practices. Furthermore, the electoral wards are not clearly demarcated and tend to overlap with the boundaries of traditional authorities' territories. It is still not clear how roles differentiate between municipal structures and tribal structures, but it is understood that the municipal structures are not responsible for the management of communal land resources (von Maltitz 2005). This has resulted in the integration of some villages that fall under different traditional authority in the same ward, and complicates the roles of traditional authority and municipal structures in woodland use and management at village level.

Conclusions

Mopane woodland resources are essential in supporting rural livelihoods. Villagers harvest various products which are used to supplement household nutritional requirements, meet energy demand, and also traded to generate incomes. However, unsustainable use of resources, lack of responsibility to effectively manage woodland resources, and conversion of woodland to other landuse types is depriving rural communities from full range of benefits that could be harvested from woodland. We therefore concluded that:

1. Community-based Natural Resource Management (CBNRM) projects should be initiated to empower the communities, eradicate poverty in rural areas, and promote sustainable use of woodland resources. However, current thinking shows that CBNRM projects will not, on their own lift communities out of poverty (e.g., Elliot & Sumba 2011). To empower communities economically, there should be commercial or industrial sides to CBNRM involving activities such as wood crafting, bee keeping, **marula** fruit processing, mopane worm processing and eco-tourism (e.g., Kgetsi ya Tsie n.d.) The projects need to contribute toward rural development through raising awareness on the role of woodland resources to rural livelihood, poverty eradication and creation of employment in rural areas. We also concur with Scoones and Matose (1993) that CBNRM projects need to be managed as common property to avoid an open access system.
2. Administration of permits to harvest woodland resources needs to be transferred to village-elected committees to encourage a sense of ownership of land by people residing on that land. The price tag on

permits issued to people from outside concerned areas should be relatively higher to discourage people flocking from towns, cities and even neighboring rural communities to exploit woodland resources. Money generated from the permits needs to be administered in a transparent and auditable way by a locally-elected and trusted committee, and used for developmental activities or compensation of villagers working as woodland monitors and regulation enforcers.

3. There is a need to capacitate conservation officials and to raise awareness with the public about conservation and environmental laws in order to promote compliance.
4. There is also a need for the Department of Agriculture, Forestry and Fisheries and its sector partners to increase investment and funds for research and development in order to promote sustainable use and management of woodland resources.
5. Traditional methods or indigenous knowledge systems for woodland resource harvesting and management need to be encouraged and promoted.
6. There is need for improved coordination in woodland management activities in order to avoid overlapping of responsibilities.
7. The custodian for woodland management, in this case the National Department of Agriculture, Forestry and Fisheries should engage with the municipalities and community structures in order to promote sustainable use of woodland resources at all levels of governance.

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