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Clearing the Confusion

The roles of local formal institutions in regulating firewood harvesting in Bushbuckridge, South Africa

A thesis submitted in partial fulfilment of the requirements for the degree of

MASTER OF SCIENCE

at

University of the Witwatersrand

by

Sarah Jane Findlay

February 2013



Declaration

I declare that this project is my own unaided work, that I have not plagiarized any work from any other authors, and to my knowledge, nothing of its kind has been submitted before.



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(Signature of candidate)

26 day of June 2013

Abstract

From pre-colonial leadership through to the Apartheid regime, local traditional authorities played an essential role in natural resource management throughout rural South Africa. The advent of democracy in 1994, however, generated much confusion over the modern function of traditional leaders in many rural communities, specifically regarding natural resource regulation. By understanding local perceptions of governance regimes, resource use initiatives can use and enhance institutions already in place to combat further over-harvesting.

The aim of this study was therefore to determine the perceived functions of traditional and democratically elected community leaders in the governance of firewood harvesting and compare perceptions between interviewed leaders and their community members. The study was conducted in six villages spanning two chieftaincies and four municipal wards in Bushbuckridge Local Municipality, Mpumalanga Province. In-depth interviews were conducted with the following local leaders: the chiefs from the two chieftaincies, the *nduna* (headman) from each village, the ward councillor from each ward and three members of the Community Development Forum from each village. Five community focus group sessions were also run in each village to determine local community perspectives on wood availability and governance regimes.

It was found that the majority of respondents, from both individual interviews and focus groups, believed that firewood availability had decreased in recent years. In addition, 21 of the 30 focus groups (across both chieftaincies) suggested that there was insufficient firewood to meet the needs of their village now. While all interviewed parties across both chieftaincies regarded the chief as the ultimate authority in firewood management, his actual system of regulation as well as the perceived roles and responsibilities of subsidiary leaders appears highly differentiated between the chieftaincies. Results also indicate that although there is some ambiguity around community-level firewood regulation, these instances of uncertainty are village-specific and could indicate diminished village-level enforcement of regulation. Overall, however, other lines of evidence evince a general weakening of traditional local control across all the villages. Some authors maintain that this deterioration of village firewood management stems from community confusion and/or contestation over the roles of local leaders. However, I argue that reduced government budgets as well as leader's empathy for poor firewood-dependent households have also contributed to the

increasingly relaxed implementation of strict firewood systems. With this in mind, future policy decisions need to consider ways in which to reduce rural over-harvesting, either by increasing the affordability of alternate energies or by implementing strategies that allow for continued firewood harvesting but in more sustainable ways. Recommendations that detail such approaches are presented for the study region.

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List of Acronyms

CDF	Community Development Forum
K2C	Kruger to Canyons Biosphere Reserve
IFAD	International Fund for Agricultural Development
SANParks	South African National Parks

1 INTRODUCTION

The livelihoods of most rural poor populations worldwide remain solidly rooted in the collection, trade and consumption of natural resources (Kaimowitz, 2003; Shackleton, 2004b; Shackleton and Shackleton, 2004; Kirkland *et al.,* 2007; Babulo *et al.,* 2008). Typically, such resource dependence stems from poor socio-economic and agricultural conditions that constrain households from pursuing other livelihood opportunities (Clarke and Grundy, 2004; Mutamba, 2011). The use of these natural resources buffer households against financial and physical vulnerability, and assists them in maintaining, and in some cases boosting, household livelihood security (McSweeney, 2004). In light of escalating village populations, however, this heavy reliance on resources has led to growing concerns regarding the sustainability of the natural asset base in many parts of the world (e.g. Kristensen and Lykke, 2003; Scholes and Biggs, 2004; Wilfred *et al.,* 2007). In South Africa, many rural communities mirror these global patterns in natural resource use, with a growing number of reports describing the increasingly unsustainable use of natural resources, including firewood (e.g. Andrew *et al.,* 2003; Makhado *et al.,* 2009). Given the centrality of firewood as an essential energy source to millions of households in the country, the management of such resource harvesting is fundamental to sustaining the livelihoods of these resource-dependent populations.

Much research conducted in Bushbuckridge (Mpumalanga) show how the growing population demands are likely to, or have already, exceeded the natural firewood supply (Griffin *et al.,* 1992; Banks *et al.,* 1996; Williams *et al.,* 1996). Here, the impacts of burgeoning village populations are also exacerbated by the fast-eroding systems of local resource governance and regulation instituted by traditional authorities (Clarke and Grundy, 2004; Giannecchini *et al.,* 2007; Kirkland *et al.,* 2007). This weakening traditional control is thought to stem largely from confusion and uncertainty over the role of local tribal leaders where new modern governance structures have emerged since South Africa's transition to democracy in 1994 (Twine *et al.,* 2003b; Kirkland *et al.,* 2007). Although it is accepted that local, and specifically traditional, institutional control has decreased in these firewood regulation systems, most commentary in published South African literature has been anecdotal about this change rather than explicit. For example, while many authors acknowledge this aforementioned ambiguity regarding the roles of traditional leaders and local government (e.g. Twine *et al.,* 2003b; Kirkland *et al.,* 2007), this confusion has yet to

be definitively addressed or documented in South African studies. Furthermore, research into what the local leaders themselves deem as their exact function in community resource regulation remains unexplored. By understanding local perceptions of governance regimes, future resource use initiatives and policy makers can use and enhance institutions already in place to combat further over-harvesting (Cousins *et al.*, 2007; Ostrom, 2007).

As such, the aim of this study was to explore and understand different stakeholders' perspectives on the roles and responsibilities of local institutions (e.g. traditional authorities, village community development forums, municipalities and community residents) in the management of natural resources, specifically firewood. These perspectives were examined to establish the degree of institutional competence in firewood resource management, as perceived by local residents, and why they believe such functioning exists. In order to gain comprehensive insight into the firewood management systems, perceptions on the condition and availability of local firewood resources were also examined. All of these perspectives were compared between members of different villages, chieftaincies and across a municipality to determine the variability in these perceptions at different scales. Stakeholders' suggestions of how natural firewood depletion can be combated were also investigated.

The objectives of this study were therefore:

1.1.1. To establish the dominant attitudes of various stakeholders towards the current state of local firewood resources

1.1.2. To determine the roles of various institutions in firewood governance as perceived by different stakeholders

1.1.3. To determine the perceptions of firewood governance efficiency of different players (i.e. traditional authorities, municipalities) in and between different villages as well as between chieftaincies at the municipality scale

1.1.4. To uncover the dominant challenges in local firewood governance

To achieve the objectives outlined above, this research report is structured as follows: Section 2 provides an overview of relevant literature, including sub-sections on global natural resource use, firewood harvesting in South Africa and governance-related changes that have, in many ways, contributed to local resource depletion. Section 3 describes the research study sites and the methods that were employed to accomplish the objectives. Section 4 analyses

and compares participants' perspectives on firewood use, availability and governance systems at various scales, while Section 5 offers interpretations of these results and relates them to findings from other studies, particularly those from other parts of Africa. Then, in light of these findings, Section 6 proposes some solutions and provides some recommendations for local and national policy as how best to achieve economic, social and environmental sustainability in these firewood-dependent communities.

2 LITERATURE REVIEW

2.1. Global natural resource dependence in rural communities

It is estimated that over 1.4 billion people live below the poverty line of less than US$1/day (IFAD, 2011). Of these, roughly 70% live in rural areas (IFAD, 2011). In Africa, rural poverty remains widespread and is said to persist because of the many environmental, economic and institutional factors that prevent households from pursuing more lucrative income-generating activities (McSweeney, 2005). In many cases, these populations are: (1) restricted to small tracts of agriculturally unproductive land, (2) have limited access to basic services and infrastructure and (3) are far removed from adequate credit, employment or education opportunities (Clarke and Grundy, 2004; Mutamba, 2011).

Under these conditions of poor agricultural and economic security, and as a means of mitigating external risk, many rural households employ a diverse range of strategies to secure their income streams and livelihoods (Paumgarten, 2005; Vedeld *et al.,* 2007). Such activities include livestock rearing, subsistence agriculture, wage and remittance-based labour, and natural resource extraction (Shackleton *et al.,* 2001). The combination of strategies used depends on the various assets or access to assets that a household has at any one time. As a result, rural livelihood portfolios are dynamic, multi-dimensional and complex, often shifting in response to other internal and external changes or disturbances (Dovie *et al.,* 2004; McSweeney, 2004; Babulo *et al.,* 2008).

One common livelihood activity adopted by many rural populations is that of natural resource use. Here, an assortment of biotic resources which range from firewood, medicine and craft materials to honey, fruit and animal fodder are used and these assist not only in meeting daily domestic needs, but also in generating cash-based income through their trade (Kaimowitz, 2003; Shackleton and Shackleton, 2004). Natural resource extraction, as discussed earlier, usually forms one component of an elaborate and diversified rural livelihood portfolio, but it has been shown to make marked contributions to the physical well-being and financial security of many rural households (Crookes, 2003; Shackleton and Shackleton, 2004; Vedeld *et al.,* 2007). For example, Dewees *et al.* (2010) suggest that for some of the rural households in central Southern Africa, up to one third of household domestic consumption is met with products gathered from the surrounding miombo

woodlands. From another perspective, Hegde and Bull (2011) found in their study of 290 households in rural Mozambique that local woodland produce accounted for 40% of total livelihood income by directly meeting households' domestic needs. Likewise, Cavendish and Campbell (2011) show in their evaluation of 213 rural Zimbabwean households that the monetary value of environmental goods used for household consumption totalled 30% of the whole household budget. These are just three of many studies that highlight the central role of natural resources in many rural livelihoods through the direct provisioning of domestic goods.

Beyond this domestic consumption, the local gathering, processing and selling of such environmental produce has also been found to make important and often essential contributions to rural household economies (Arnold, 1994; Shackleton, 2004b; Shackleton and Shackleton, 2004; Vedeld *et al.,* 2007; Shackleton *et al.,* 2008). In his case study of Botswana, Zitzmann (1999) found that roughly 19% of total rural household cash income was obtained through the sale of woodland products, such as firewood and mopane worms. Likewise, Mutamba (2011) reveals that the trade in both processed and unprocessed forest-based goods contributed between 43% and 49% to the total household cash income in rural Zambian villages. Monela *et al.* (2000) even suggest that in Tanzania the sale of some forest commodities, most notably honey and charcoal, has the possibility of comprising up to 70% of total household cash revenue. As such, the cash contributions of the natural resource trade are, in some cases, comparable to income generated from other livelihood activities, such as agriculture and waged employment, and these findings highlight that the trade in environmental produce can often be a crucial element in rural livelihood portfolios (Twine *et al.,* 2003a; Dovie *et al.,* 2004; Shackleton *et al.,* 2008; Mutamba, 2011).

In line with this, many authors describe how harvested natural resources contribute not only to the everyday needs of rural households, but also act as temporary 'emergency nets' to families in times of unexpected hardship or distress (McSweeney, 2004; Shackleton and Shackleton, 2004; McSweeney, 2005; Paumgarten, 2005; Völker and Waibel, 2010). Harvested environmental products buffer households against financial insecurity by providing cheap alternatives to bought goods as well as offering potential sources of income through the formal and informal resource trade (McSweeney, 2004; Shackleton and Shackleton, 2004; Paumgarten, 2005). As such, many rural households increase their

consumption and sale of natural resources as a coping strategy in response to unforeseen economic, ecological or familial adversity (Shackleton and Shackleton, 2004; Paumgarten, 2005). For example, Hunter *et al.* (2007) found in their rural South African survey that households that had experienced the recent death of a family member were often more reliant on collected wild foods than those that had not. It was found that harvested edible goods were often used to replace previously bought food products, and in this way, offered a cash-saving and helped cushion the impact of the mortality (Hunter *et al.,* 2007). Equally, McSweeney (2004), in her study of poor Honduran households, found that households that had suffered a disturbance, including weather-related calamities or the illness of breadwinners, were more likely to engage in the trade of natural commodities as a temporary solution to the hardship experienced. Vedeld *et al.* (2007) go on to suggest that even when forest-based income contributions appear relatively meager or transitory, those small cash injections could be of paramount importance to the subsistence and very survival of poor households. Therefore natural resource extraction offers a significant function in sustaining rural livelihood security, particularly in times of distress (McSweeney, 2004; Hunter *et al.,* 2007).

It is important to note that although the consumption of natural resources is viewed as an essential constituent of rural livelihood subsistence to many, the actual degree of use varies between households, regions and over time (Vedeld *et al.,* 2007). Many studies demonstrate these differences in resource dependency, intensities of use and seasonality of extraction (e.g. Twine *et al.,* 2003a; Dovie *et al.,* 2004; Babulo *et al.,* 2008; Cocks et *al.*, 2008; Matsika *et al.,* 2012), where differences are governed by a suite of economic, social, institutional, market and environmental factors (Babulo *et al.,* 2008). Understanding the intricate ways in which these factors interact and impact on household and village resource use is essential to developing appropriate resource use management strategies (Babulo *et al.,* 2008).

2.2. Resource use in South African communal lands

Rural South African populations are no exception to the global norm in which rural communities continue to heavily rely on local environmental resources for physical, financial and social security (Andrew *et al.,* 2003). This reliance on natural produce is widespread in South Africa and is evidenced in the variety of communal land products consumed as well as in the intensity of use by rural populations (Dovie *et al.,* 2002). For example, in their review of South African natural resource use, Shackleton and Shackleton (2004) show that of the

investigated rural households, over 85% use wooden utensils, firewood, twig hand-brushes and edible fruit on a regular basis. In addition, most households were also found to consume insects, weaving grass, housing poles and medicinal plants, among other products, harvested from the communal grazing areas (Dovie *et al.*, 2002). Similar results were revealed by studies conducted by Twine *et al.* (2003a) and Shackleton and Shackleton (2000). Although the degree of resource consumption may vary between households or villages, almost all rural households use at least some type of natural resource at one time or another (Shackleton and Shackleton, 2004; Shackleton and Shackleton, 2006; Cocks *et al.*, 2008).

Resource use has characterised South African indigenous populations for centuries (von Maltitz and Shackleton, 2004). This rural land use pressure, however, was substantially increased by the implementation of Apartheid policies that brought about the large-scale relocation of black populations onto small tracts of land known as Bantustans (Thornton, 2002; Shackleton, 2004a). The establishment of these 'homelands' resulted in high population densities, households with limited access to other forms of livelihood capital, and often occurred in regions where climatic conditions were not particularly conducive to subsistence agriculture (Shackleton, 2004a). As such, this forced influx of relocated households dramatically increased the number of households harvesting and consuming local environmental produce, and this substantially intensified the resource use pressures on those small parcels of land (Shackleton, 2004a).

2.3. Firewood harvesting in South Africa

One particularly notable natural commodity in much of rural South Africa is firewood, which remains extensively used as a primary domestic fuel, both for cooking and heating (Biggs *et al.*, 2004; Scholes and Biggs, 2004; Shackleton *et al.*, 2004; Madubansi and Shackleton, 2007). Research across the country has shown that an overwhelming majority of investigated rural households continue to use firewood as their dominant energy source (Crookes, 2003; Twine *et al.*, 2003a; Dovie *et al.*, 2004; Shackleton *et al.*, 2004; Giannecchini *et al.*, 2007; Madubansi and Shackleton, 2007), where household consumption has been found to average roughly 5.3 tonnes of firewood per year (Shackleton and Shackleton, 2004).

Although domestic fires have been implicated in the high number of acute respiratory infections observed in some rural communities (see Ezzati and Kammen, 2001; Riojas-Rodríguez *et al.,* 2001), firewood use in South Africa often occurs despite household electrification and government-funded Free Basic Electricity allowances (Griffin *et al.*, 1992; Davis, 1998; White *et al.,* 1997; Madubansi and Shackleton, 2007). Firewood is generally collected free-of-charge from the surrounding communal lands. It is therefore a cheap, and essentially free, energy alternative to electricity, which has markedly high costs and requires expensive appliances (Madubansi and Shackleton, 2007). Even buying firewood was found to be cheaper than purchasing electricity (Madubansi and Shackleton, 2006). Over and above affordability, White *et al.* (1997) also found that one of the main reasons behind households' persistent use of wood was that fires offer multi-functional household benefits. That is, wood fires, in addition to cooking and heating water, also provide an essential social gathering place that supplies ample warmth to those around it (White *et al.,* 1997). In contrast, electrical stoves can not replace the culturally-significant gathering spot, are deemed inefficient at room heating and because of the restricted number of hot plates, can not cook multiple items simultaneously (White *et al.,* 1997). As such, many households still opt to use firewood rather than alternative fuels. From this, Shackleton *et al.* (2007), among others, expect that rural firewood use will remain unchanged at least into the medium-term as household economics and preferences will, for the most part, continue to constrain the use of substitute fuels.

Bearing this persistent dependence in mind, and in light of the growing number of households turning to the firewood trade to supplement incomes (Giannecchini *et al.,* 2007), concerns over the long-term sustainability of firewood harvesting have been raised in the literature (Banks *et al.,* 1996; Andrew *et al.,* 2003; Kirkland *et al.,* 2007). Many studies, as to be discussed in the following section, highlight instances of possible over-exploitation (Williams *et al.,* 1996; Kirkland *et al.,* 2007; Matsika *et al.,* 2012). There is therefore an indisputable need to develop and implement strategies that prevent such over-harvesting in order to sustain and enhance the livelihoods of local resource-dependent communities.

2.4. Concerns about wood over-exploitation in communal lands in South Africa

In South Africa, woodlands remain the principal source of usable firewood, and constitute approximately 34% of all national terrestrial biomes (Andrew *et al.,* 2003). On a national

scale, annual firewood production estimated at 16 million tonnes exceeds human demand of 9-10 million tonnes (Williams and Shackleton, 2002). Williams and Shackleton (2002) argue, however, that this conjecture of national firewood sustainability does not adequately reflect the spatial variations in local firewood availability and demand. They suggest that most woodland regions occur either on government reserves or on private lands, and are therefore inaccessible to firewood-dependent populations (Williams and Shackleton, 2002). As such, ecological surveys conducted on a village-level often indicate the emergence of a local 'energy gap' in which rural firewood harvesting seems to exceed proximate natural firewood production, and much of the literature is focused on resource patterns in the Bushbuckridge region of Mpumalanga (Banks *et al.,* 1996; Matsika *et al.,* 2012). For example, in an investigation of five key Bushbuckridge tree species, Shackleton *et al.* (2005) found: (1) high, and an increasing, proportion of mature stems had been chopped, (2) an overall decrease in tree density over a 10-year period and (3) no evidence of a harvesting gradient with distance from villages indicating a homogeneous harvesting pressure (Shackleton *et al.,* 2005). These findings suggest that harvesters are increasingly felling live trees as deadwood is in short supply (Williams and Shackleton, 2002; Dovie *et al.,* 2004), and this in turn points to the intensifying community pressure on firewood stocks. Although the authors note the high resilience of these savanna species to heavy harvesting, particularly through coppicing, they warn that such continued high harvesting may potentially reduce the future reproductive potential of such species and thereby impact future ecological sustainability (Shackleton *et al.,* 2005). In the same way, Matsika *et al.* (2012) found that although the degree of woodland degradation around their two Bushbuckridge study villages differed, the total amount of wood available in both communal lands had significantly decreased over the 17-year study period.

These findings parallel many other studies across South Africa that indicate growing firewood scarcity in rural communal lands (Andrew *et al.,* 2003). In five rural Bushbuckridge villages, for example, Madubansi and Shackleton (2007) found that over 60% of respondents indicated that finding firewood to harvest had become increasingly difficult in recent years and that residents were therefore spending longer on harvesting trips than they had previously (Madubansi and Shackleton, 2007). These suggestions of local shortages were also mirrored by analyses which showed that the majority of the 26 preferred firewood tree species had become increasingly scarce over the 11-year study period (Madubansi and Shackleton, 2007). Similarly, Kaschula *et al.* (2005) revealed that the majority of their interviewees in

Welverdiend village (Bushbuckridge) expressed concern that the current firewood harvesting levels were unsustainable. Such regional shortages are also evidenced in the changes households make to acquire firewood (Andrew *et al.*, 2003). These changes include: more households buying firewood rather than self-collecting (Giannecchini *et al.*, 2007; Madubansi and Shackleton, 2007), the harvesting of resources from neighbouring village commons (Twine *et al.*, 2003b) and the harvesting of less preferred species and size classes (Madubansi and Shackleton, 2007; Matsika *et al.*, 2012). These studies form part of mounting evidence highlighting the intense resource exploitation of firewood in many rural South African communities.

In addition, the social consequences of these resource shortages also cannot be overlooked. Madubansi and Shackleton (2007) suggest that the increased harvesting times (as noted above) not only increase the opportunity costs associated with firewood collection, but also thereby impact the allocation of time and labour to other livelihood activities in the household. Furthermore, Brouwer *et al.* (1997) comment that such shifts in the allotted resources to livelihood pursuits may render households further impoverished as fewer labour resources and less time are spent on other potential income-generating activities. Another study reveals that greater conflict between harvesters within and between villages resulted from the growing local firewood scarcity (Kirkland *et al.*, 2007). Here, quarreling and even theft had become common as a result of the increasing competition for the dwindling wood resources (Kirkland *et al.*, 2007). Although it is recognised that there are village-specific differences in intensities of extraction, the general trend indicates increasingly unsustainable harvesting and in light of the negative consequences for social well-being, this necessitates urgent redress (Matsika *et al.*, 2012).

2.5. Socio-economic drivers of resource use

The degree to which resource consumption rates are sustainable is determined by a far more complex relationship than simply that of supply and demand (Kaschula, 2003). It is increasingly recognised that the degree of natural resource availability in a human-impacted landscape is determined by the intricate and dynamic interplay between the biophysical and climatic features of the region as well as the social and economic context of its inhabitants (Kepe and Scoones, 1999; Hoffman and Todd, 2000; Anderies *et al.*, 2004; Hamilton, 2004; Twine, 2005; Giannecchini *et al.*, 2007). As such, these coupled human-environment systems

are characterised by complex interacting feedbacks and processes that are not only multi-scalar in nature but also vary through time and space (Anderies *et al.*, 2004; Kaschula *et al.*, 2005; Liu *et al.*, 2007). For example, Campbell and Byron (1996) argue that miombo woodlands can be described as intricate 'ecological-social-economic system[s]' (Campbell and Byron, 1996, pp 221), where factors such as product commercialisation, resource shortages, local and regional institutional interactions, droughts and national economic conditions interact to shape the ways in which local households use, harvest and consume environmental goods (Campbell and Byron, 1996). These factors also equally affect the ways in which local environments respond and supply resources for future livelihood security and household use. As such, any changes or disruptions to variables in these multifaceted resource-use systems have a complex cascade of effects that feedback into and shape other features of these human-environment networks (Twine, 2005; Liu *et al.*, 2007).

This emerging understanding of natural resource use is a far cry from the historically separatist theories of environmental degradation, which saw people simply as exploiters of the land and its products (Kaschula, 2003; Jones and Murphree, 2004; von Maltitz and Shackleton, 2004). Here, resource-dependent communities form part of a larger web of interactive feedback loops, driven by local, regional and even global changes, where the degree of sustainable resource use is governed by more than just people's propensity to degrade. These new insights have led to the global trend in which environmental management has moved away from previously 'preservationist' approaches of conservation which focused solely on banning local people from ecological sites. Now, approaches aim to recognise and enhance the capacity of communities to use their surrounding environments more sustainably. From this, conservation is increasingly centred on understanding the needs, rights and responsibilities of local people in their use of surrounding natural environments (von Maltitz and Shackleton, 2004).

In line with this development in socio-ecological theory, researchers are also increasingly appreciating the importance and value of local community views in their studies (Kaschula *et al.*, 2005). It is now well-recognised that insight into the socio-economic drivers of local resource use can only be fully achieved by consulting local populations (Wong *et al.*, 2001; Dovie *et al.*, 2004; Pei *et al.*, 2009), where the use of local indigenous knowledge can provide context-specific practical information regarding resource utilization practices and livelihood impacts that scientific assessments may overlook (Huntington, 2000; Wong *et al.*, 2001; Kaschula *et al.*, 2005). Gaining an in-depth understanding of the local socio-economic,

institutional and environmental context in any resource-use system therefore requires consultation with local residents.

2.6. Importance of governance systems

Most research on local natural resource use either only considers environmental determinants, such as regional rainfall and geology patterns, as governing the supply of resources, or focuses solely on how household-level demand and harvesting activities drive regional resource abundance (Anderies *et al.*, 2004; Ostrom, 2007). These over-simplifications produce findings that fail to acknowledge the mechanisms by which resource users interact with their environments, and as suggested by Ostrom (2007), thereby ignore one of the most fundamental elements in resource-use systems: the institutional context.

Basedau (2005) points out that while resource use is driven by household needs, decisions and behaviours, individual and regional consumption patterns remain nested in and fundamentally governed by the institutional dynamics of the society. Many authors agree that context-specific institutions shape perceptions, activities, behaviours and techniques associated with resource harvesting (Folke *et al.*, 1996; Bob and Banoo, 2002), and this, as suggested by Goetz (1995), reinforces the role of institutions as the formal and informal principles that guide human-environment relations.

Formal institutions, more specifically, influence the use of environmental resources by managing community's access to natural resources (Belcher *et al.*, 2005). This occurs specifically by governance structures determining land user rights (Belcher *et al.*, 2005) and by enforcing specific resource-focused laws (Barrett *et al.*, 2005; Cocks *et al.*, 2008). Here, the local and regional institutional context shapes and influences individual harvesting decisions (Katz, 2000; Kirkland *et al.*, 2007) often through the prospect of punishment for disobedience. The effectiveness of resource use governance and consequent environmental sustainability thus rests primarily on the capacity of institutions to enforce their local laws and practices. From this, many authors note the strong associations between ineffectual institutions, open access resource systems and environmental degradation (Belcher *et al.*, 2005). They highlight that common property resources, if unregulated or weakly managed, may result in a 'Tragedy of the Commons' scenario (Hardin, 1968). Here, decreased institutional control translates into insecure resource tenure, reduced collective responsibility,

greater insubordination for harvesting laws and ultimately over-exploitation (Bromley and Cernea, 1989; Belcher *et al.,* 2005). Although deemed a simplistic model, examples of this system have been seen around the world: Ivory Coast (López, 1998), Burkina Faso (Kristensen and Lykke, 2003) and Mexico (Marshall and Newtown, 2003), among others.

Of particular interest to this study is that many resource-use systems in rural South Africa are thought to have transitioned from well-managed communal property to essentially 'open-access' firewood systems (von Maltitz and Shackleton, 2004; Cousins *et al.,* 2007; Kirkland *et al.,* 2007). Although these firewood regimes remain under the theoretical control of local traditional leaders, many authors attribute the observed over-harvesting (described in the previous section) to the weakening institutional power of these local leaders (Twine *et al.,* 2003b; von Maltitz and Shackleton, 2004; Cousins *et al.,* 2007; Kirkland *et al.,* 2007). Since institutions regulate and govern the ways in which resources are harvested, Seidman (1992) reasons that governance structures should therefore be central to the enquiry into natural resource use. As such, the following section unpacks the different features of reduced governance efficiency seen in many of South Africa's rural communities in an attempt to understand why such diminished functioning exists and what steps can be taken to overcome this reduced control.

2.7. Past and present institutional governance of communal lands in South Africa

In the pre-colonial era, natural resource harvesting on the communal lands of the South African lowveld was regulated by local traditional authorities, specifically the chiefs and *ndunas* (Thornton, 2002). Then, during both the colonial and Apartheid regimes, the then-governments used these same traditional institutions to implement their own set of rules regarding resource use. By elevating the power and authority of tribal leaders and by providing them with greater land-based responsibilities and higher salaries, the governments used these leaders as agents of indirect government rule (King, 2005). Moreover, those that engaged with the Apartheid system were often rewarded financially, while the leaders that challenged or opposed the Nationalist government were dismissed from duty. As such, only leaders closely aligned with the Apartheid government remained in power in the homelands (King, 2005) and it was these same leaders that governed natural resource use.

The implementation of local harvesting systems, based on the guilty paying financial penalties or completing community service, controlled, to some extent, the impact of resource harvesting on the surrounding environments (Twine, 2005). This local control, however, has gradually yet noticeably weakened, particularly since the birth of democracy in 1994 (Thornton, 2002; Cousins *et al.,* 2007). This has been attributed to three dominant factors. Firstly, the induction of the new democratic government triggered a change in the perceptions of village residents, particularly among the youth, regarding the authority and power of traditional leaders. The close corrupt ties between traditional leaders and the former government bred widespread mistrust and suspicion of tribal leadership both during and after Apartheid (King, 2005). The continuation of tribal institutional rule, despite the establishment of democracy, has therefore generated pervasive discontent in much of the rural populace (King, 2005). It is this view of chiefs as illegitimate and corrupt authorities that has led to autonomy and blatant disrespect for local traditional leaders and their attempts at resource management (Campbell *et al.,* 2001; Twine *et al.,* 2003b).

Secondly, the new government, upon appointment, reduced the financial resources previously granted to the traditional institutions, and as such, rendered the monitoring and policing capacity of these local leaders severely challenged. Their ability to enforce legislative discipline was significantly lessened, and as such, greater insubordination and non-compliance was observed in the people under their jurisdiction (Twine, 2005; Kirkland *et al.,* 2007).

Thirdly, the inauguration of the new government generated confusion regarding the modern function of the traditional authorities in a new democratic society (Twine *et al.,* 2003b; Cousins *et al.,* 2007). Other forms of governance, including provincial officials, local municipalities and village-level governance structures, have emerged under the democratic dispensation. Traditional leaders are now thought to share authority and responsibility with these newly established institutions, but the roles and responsibilities of these separate groups are thought to be undefined, ambiguous and often conflicting (King, 2005; Kirkland *et al.,* 2007). These uncertainties and capacity insufficiencies have therefore created an 'institutional vacuum' in the region, where the system of governance has become increasingly unclear and the access to and consumption of natural resources no longer as strongly moderated (Twine *et al.,* 2003b; Kirkland *et al.,* 2007).

These resource use systems, as suggested by von Maltitz and Shackleton (2004), are therefore in a state of flux. Transitions in national-level politics have not only impacted on the funding to maintain natural resource management, but they have also filtered down to destabilise the legitimacy and authority of the local institutions that previously presided over such systems. With greater attention being paid to local institutions as the primary vehicles of local natural resource management, research into the local-level processes and institutional functioning has become central to the development of suitable interventions. In line with this, the study here has explored perceptions around natural resource management systems in an attempt to understand the extent of this aforementioned eroding institutional functioning. This greater understanding can be used to shed light on how to move forward and to prevent further over-exploitation in these communities in the future.

3 METHODS

3. 1. Study Site

This study was conducted in six villages that fall under the Bushbuckridge local municipality in Mpumalanga Province (31° 0'-31° 35' E; 24° 30'-25°0' S), South Africa. In the Amashangane chieftaincy, the three villages were New Forest A, Merry Pebble Stream (MP Stream) and Arthur Stone and in the Mnisi chieftaincy, the study villages were Cottondale, Burlington and Islington (Khokhovela).

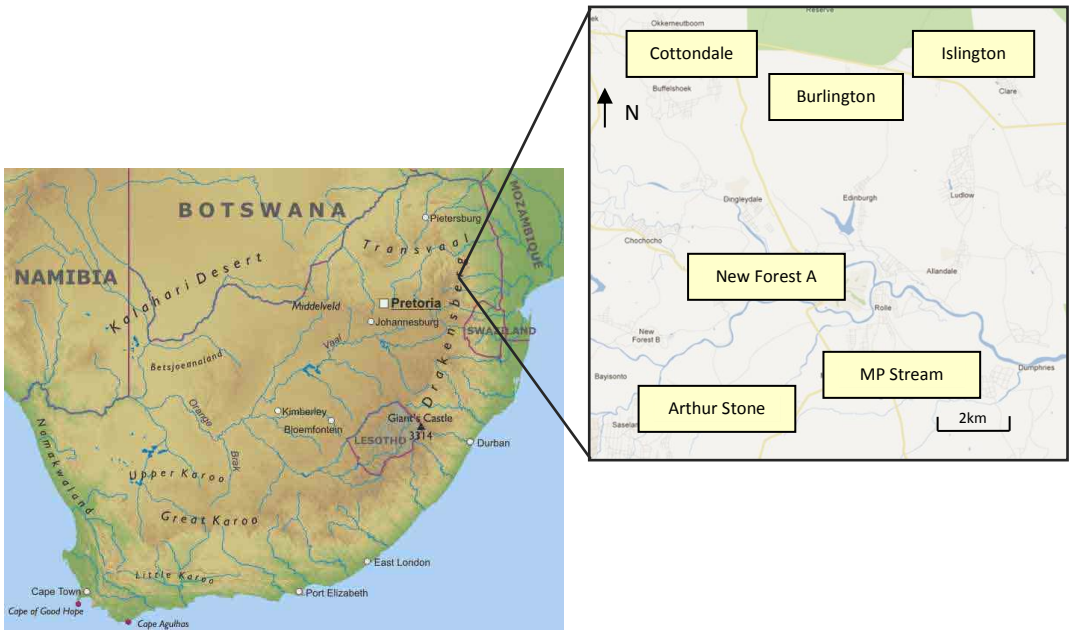


Figure 3.1. Map of the six study villages in the Bushbuckridge region, South Africa.

3. 1. 1. Biophysical conditions

The Bushbuckridge local municipality is bordered by the Drakensberg escarpment in the west and the Kruger National Park to the east (Thornton, 2002). This region has clear topographical, climatic and geologic gradients which produce distinct differences in herbaceous dominance and land use patterns across the landscape (Emanuel *et al.*, 2005). The western parts of the region are characterised by higher mean annual rainfall (approximately 1 200mm) (Shackleton, 2000) where Legogote Sour Bushveld dominates (Mucina and Rutherford, 2006), while the drier eastern areas are characterised by Granite Lowveld vegetation, as described by Mucina and Rutherford (2006), and receive roughly only 550mm

rainfall per annum (Shackleton, 2000). Regional variations in geology also exist as nutrient-rich gabbro intrusions intersperse with the dominant underlying nutrient-poor granite bedrock. *Combretaceae* and *Mimosaceae* tree species prevail throughout the woodland vegetation in the region (Emanuel *et al.*, 2005).

3. 1. 2. Socio-economic characteristics

Each of the six selected villages fall within the boundaries of the former homeland, Gazankulu, and are therefore characterised by poor economic development, low employment levels and inadequate infrastructure. As a result, most households rely heavily on migrant labour remittances and government social grants as primary sources of income (Hearn and Pollett, 1993; Shackleton and Shackleton, 2000; Thornton, 2002; Kirkland e*t al*., 2007). Many households also continue to engage in some form of subsistence agriculture, either by planting in homestead gardens or by farming larger arable fields, to supplement these cash-based incomes (Shackleton, 2000; Emanuel *et al*., 2005). In addition, a significant proportion of households depend on the harvesting and trade of local natural resources, both for domestic use and for income generation (Shackleton *et al.*, 2001; Shackleton, 2004a). These resources are generally collected from the communal lands that surround each village settlement and fall under communal tenure. Besides these similarities in livelihood attributes, the residents of each of the villages (as part of the same former homeland Gazankulu) are also predominantly from the same language and cultural group (Shangaan).

3. 1. 3. Institutional context

The Bushbuckridge local municipality is one of five local municipalities of the Ehlanzeni district of Mpumalanga. The municipality is divided into 37 wards and each ward consists of 5-10 villages. Within this region, all communities fall under the jurisdiction of dual leadership structures: civic government and traditional councils (Thornton, 2002) that occur at different spatial scales (see Table 3.1).

Community Development Forums (CDF) represent the lowest tier of municipal governance and are comprised of two representatives from each village civic group (Community Based Organisation or Civic Association) together with the village *nduna* or headman (a representative of the Chief's traditional council) (Cousins *et al.*, 2007). From here, delegates from CDFs across different villages in conjunction with a nominated ward

councillor constitute a ward council. These councils form the next level of local governance and present village-level matters to the local municipality. As such, the ward council is answerable both to higher-level municipal offices as well as to community-level CDFs (Cousins *et al.*, 2007).

In terms of traditional leadership, the chief's jurisdiction generally extends to between ten and 12 villages. In each of these villages, the headman or *nduna* acts on behalf of the chief. The *ndunas* meet regularly to form traditional councils that, under the directive of the chief, discuss issues around development and general village concerns. The councils also resolve individual or household disputes and try local cases brought before them (von Maltitz and Shackleton, 2004; Cousins *et al.,* 2007). The traditional authorities also theoretically regulate the use of natural resources in the village commons.

Although the traditional councils and their decisions remain highly respected in some communities (Cousins *et al.,* 2007), the authority of traditional leaders has greatly decreased in the study site since South Africa's transition into democracy in 1994. In many cases this has resulted in communal lands that have become, in effect, open access systems (Kirkland *et al.,* 2007).

Table 3.1. Institutions operating at various spatial scales across the Bushbuckridge study site.

Scale	**Municipal government**	**Traditional authority**
Village level	Community Development Forum (CDF)	*Nduna*
Meso level	Ward councillor, Ward Council	Chief, Traditional Council
Municipality level	Local municipal government	

3. 2. Study design and protocol

3. 2. 1. Community Selection

To establish the scale at which possible differences in resource availability and governance exist, six villages were selected that fall under the jurisdiction of two different chieftaincies (see Table 2 below). It is important to note that one village from each chieftaincy was also the site of that chief's residence and his Tribal Office. i.e. chief Ncumalo of the Amashangane Tribal Authority resides in New Forest, while chief Mnisi of the Mnisi Tribal Authority

resides in Islington. In addition, the six villages chosen share similar patterns of rainfall and geology and as such minimize the effect of different biophysical conditions.

Table 3.2. Population estimates of the six study villages.

Village	Chieftaincy	Approximate number of households[1]	Approximate total population[2]
New Forest	Amashangane	798	4 628
MP Stream	Amashangane	1 064	6 171
Arthur Stone	Amashangane	1 728	10 022
Islington	Mnisi	1 004	5823
Burlington	Mnisi	1 109	6 432
Cottondale	Mnisi	2600	15 080

[1] Number of households estimated from number of delineated homesteads seen on GoogleEarth.
[2] Total village population calculated from mean household size in Bushbuckridge estimated at 5.58 people (see Kahn *et al.*, 2012).

3. 2. 2. Data Collection

To obtain the most comprehensive overview of the roles of local governance structures, a combination of community focus group sessions and key informant interviews were used. These discussions were held in September and October 2011.

Focus group sessions

Five focus groups were carried out in each of the six villages giving a total of 30 focus groups. Community members (none of whom were related to any community leaders) were invited to participate in the focus groups, which were stratified by age (18-30, 30-50, >50) and gender to avoid possible biases produced by age and gender hierarchies present in the communities.

Due to the pervasiveness of migrant labour in the area (see Kahn *et al.*, 2012), economically active men (aged 30-50) were largely absent in these areas and were therefore not available to participate in discussions groups. This meant that in total three female (18-30, 30-50, >50) and only two male focus groups (18-30, >50) were carried out in each village.

Each group was conducted via a translator in the local language of Shangaan (XiTsonga). Group sizes varied between three and 12 people, where the mean group size was roughly six people.

The focus groups were used to gather information regarding perceptions of village residents about resource use and availability as well as firewood governance and the institutional roles thereof. These sessions were run as semi-structured group interviews (see Appendix A), where discussions although flexible aimed to address specific predetermined topics, such as: (1) extent of community firewood use, (2) changes in local firewood availability through time, (3) local firewood harvesting laws and the implementers of such laws, (4) the roles of various local institutions in firewood regulation, and (5) the dominant governance challenges and possible solutions to prevent future over-harvesting.

To supplement general question-and-answer-based information, and following suggestions by Marshall and Newtown (2003), some Participatory Rural Appraisal techniques were also used. For example, to establish the relative contribution of each institution in local firewood management, each group was asked to arrange a set of pre-written cards (with the names of the institutions on them) in order of importance in firewood regulation matters. The key institutions were allocated the highest rank (first position) and the minor institutions the lowest rank, and the order of these structures was then noted.

Key informant interviews

In each village, the *nduna* as well as the chairperson, secretary and another member of the CDF were interviewed individually. On the next level of governance, each of the ward councillors as well as chief Mnisi (from Mnisi Traditional Affairs) and the secretary of the Amashangane Traditional Affairs (in lieu of the chief who was away) were interviewed. Attempts at finding and interviewing municipal or provincial officials responsible for the environment or natural resource management proved unsuccessful despite extensive enquiry.

Each questionnaire (see Appendix B) was used to gather information on the respondent's perceptions of: (1) the state of the surrounding natural environment, specifically firewood availability; (2) the role of different institutions, including themselves, in resource governance; (3) the dominant challenges in resource management. The interviews were all

conducted in the local language (Shangaan or XiTsonga) by a translator and were 30-40 minutes long, depending on the length of responses.

Ethics

It was made clear to each respondent that the answering process was completely voluntary, anonymous and confidential. Ethics clearance was obtained from the Wits Non-Medical Human Subjects Ethics Committee (Protocol number: H110913), and permission from each village's *nduna*, heads of the CDFs and chiefs was also obtained prior to any data collection.

3. 3. Data analyses

As most of the information collected was qualitative data, responses were categorised and coded to provide numerical data. These totals were then compared:

(a) within each village (between leaders and community members)

(b) between the six villages

(c) between the two chieftaincies.

Because of the small sample size of leaders (n=5) and focus groups (n=5) in each village, non-parametric analyses were carried out to compare the responses between villages (Kruskal-Wallis test) and between the chieftaincies (Mann-Whitney test). Chi-squared tests were used to compare the frequency of responses between villages and chieftaincies.

For the analysis of the institutional ranking exercise, and following suggestions from Abeyasekera (2005), each institution was assigned a score from 9 to 1 according to where the institutions were ranked (i.e. first position, second position etc.). A score of 9 was given to the most important institution and a score of 1 to the least important institution. Any institutions not ranked in the exercise were assigned 0. Although the assigned score values (9-1) are the inverse of the ranks (1-9), the calculated mean scores provide values that are 'numerically meaningful' (Abeyasekera, 2005, pp 5) and that account for the instances in which certain institutions were not ranked at all. From here, the scores of each institution were then compared between villages and chieftaincies using Kruskal-Wallis and Mann-Whitney U analyses, respectively.

All leaders and community members were also asked to describe the responsibilities of each institution in firewood regulation. These responses were then indexed and totalled. Each of those activities or duties was then assigned a score (0, 0.5 or 1.0) according to the level of authority required to undertake it. For example, ‘issuing fines’ or ‘having security that actively patrol’ were allocated 1.0 as these responsibilities indicate a high degree of authority. Tasks such as ‘advise community members not to harvest’ or ‘host meetings’ were assigned 0.5 as they suggest an active yet minor role in firewood governance. Suggestions of ‘no responsibility’ or ‘can’t fine’ were given scores of 0. These scores were then totalled and divided by the total number of responsibilities cited for that institution. As such, the closer the mean scores were to 1.0, the greater the number of high-order responsibilities thought to be undertaken by that institution. Significant differences were then calculated using Mann-Whitney U tests between the institutions of the two chieftaincies and between leaders and communities of the same chieftaincies.

4 RESULTS

4. 1. Overview

Focus group sessions revealed interesting differences between the villages and chieftaincies in terms of firewood availability and local management systems. Although further analyses may uncover certain gender- and age-related differences in responses, such breakdowns go beyond the scope of this report and therefore all village estimates represent means generated across all focus groups. The results are organised into five main sections. The first two sections analyse the differences in firewood use, availability and the perceived drivers thereof. The next section compares the perceived firewood governance systems and institutional roles thereof between villages and chieftaincies, while the two remaining sections deal with the perceived governance issues and possible solutions for future firewood management, respectively.

4. 2. Firewood use and reasons for continued dependence

The extent of firewood use and electrification in each village was estimated in each of the focus groups. The mean percentage of village residents thought to still use firewood (at least on occasion) is significantly lower in Amashangane (70%) than in Mnisi (90%) ($p<0.05$) (Table 4.1). In addition, even though focus group discussions revealed that on average over 85% of these villages in both chieftaincies have access to electricity, numerous Amashangane (60%) and Mnisi (64.5%) community members are thought to still depend on firewood as their primary energy source (Table 4.1).

When asked why households continue to rely on firewood when electricity is available, the most common responses across both chieftaincies were linked either to a personal partiality towards firewood or to electricity-related costs (Figure 4.1). For example, answers such as ‘it’s tradition to use firewood’, ‘pap tastes better with firewood’ and ‘pap is cooked faster with firewood’ were collectively mentioned nine and eight times in Amashangane and Mnisi focus groups, respectively (Figure 4.1). Such responses suggest households’ consciously choosing and favouring firewood over electricity. The next most common answers of ‘Can’t afford [electricity]’ and ‘Electricity is too expensive’ reference the financial constraints associated with electricity, either as a result of unemployment and poverty or from high electricity prices. These difficulties render households unable to afford a completely electricity-based lifestyle even if they wanted to. Interestingly, although the expensiveness of electricity was a common theme in both chieftaincies, double the number of

focus groups offered this response in Mnisi (8) compared with Amashangane (4). Conversely, Amashangane respondents more frequently suggested that firewood use helps in 'saving electricity' so that electricity can be used for non-cooking purposes (6) as well as provides a more reliable energy source than electricity (4) than Mnisi residents (Figure 4.1).

Table 4.1. Mean percentage (± SD) of households that use firewood, use firewood as their main fuel and have electricity, as estimated by community focus groups and averaged within the chieftaincy. Means within a row which do not share a common superscript letter are significantly different ($p<0.5$).

Percentage of households in each village (%)	Amashangane Chieftaincy (n=15)	Mnisi Chieftaincy (n=15)
Use firewood	79.0 ± 18.05[a]	90.13 ± 9.32[b]
Use firewood as main fuel	60.0±19.7[a]	64.5±28.3[a]
Have electricity access	87.8±25.3[a]	93.1±18.9[a]

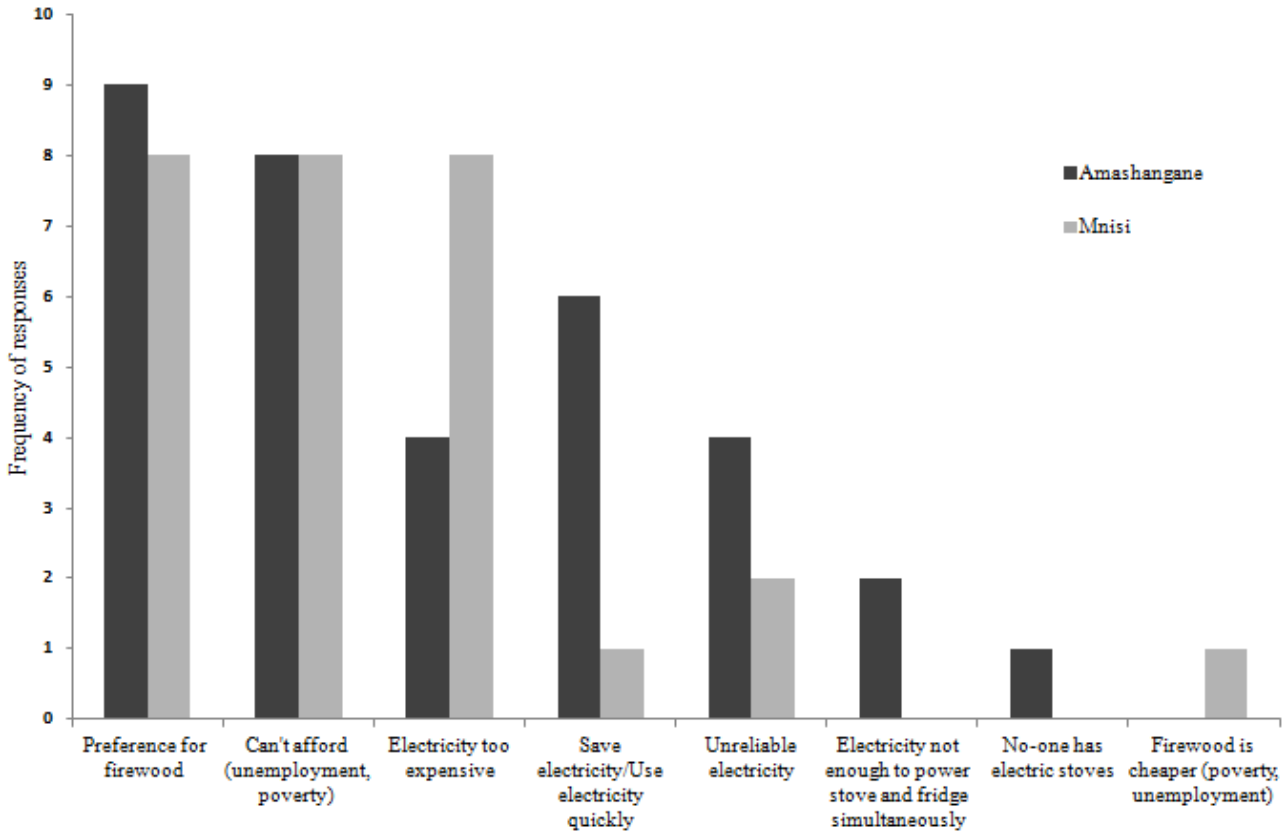


Figure 4.1. Reasons for continued firewood use despite household electrification from 30 focus groups (multiple responses possible).

4. 3. Changes in availability of firewood and reasons behind the changes

4. 2. 1. Perceived firewood availability by leaders and focus groups

Of the 15 Amashangane focus groups, 14 agreed that local firewood availability had decreased over the past 20 years. Despite this, eight of these discussion groups thought that there was still enough firewood available to meet the needs of their respective villages (Figure 4.2). Of these groups, however, only three believed that there would be enough of these wood resources in 20 years time (Figure 4.3). Leaders in this chieftaincy provided more varied answers to questions around current and future firewood availability, where nine leaders indicated decreased availability, two leaders suggested unchanged firewood resources and another four leaders asserted that there were increased amounts of firewood now available. Even with this range of perceptions, only a handful of Amashangane leaders felt that firewood was sufficient in their villages both at present (2) (Figure 4.2) and in the future (3) (Figure 4.3).

In contrast, there was little variation in responses from Mnisi respondents where all focus groups (15) and 14 of the 15 interviewed leaders reported that firewood resources had diminished over the past two decades and that the current levels of proximate firewood were insufficient to meet community-level demands (Figure 4.2). Interestingly, though, while 13 focus groups suggested that firewood would become increasingly scarce over the next 20 years, one third of Mnisi leaders (5) suggested that firewood resources would prove adequate in the future (Figure 4.3).

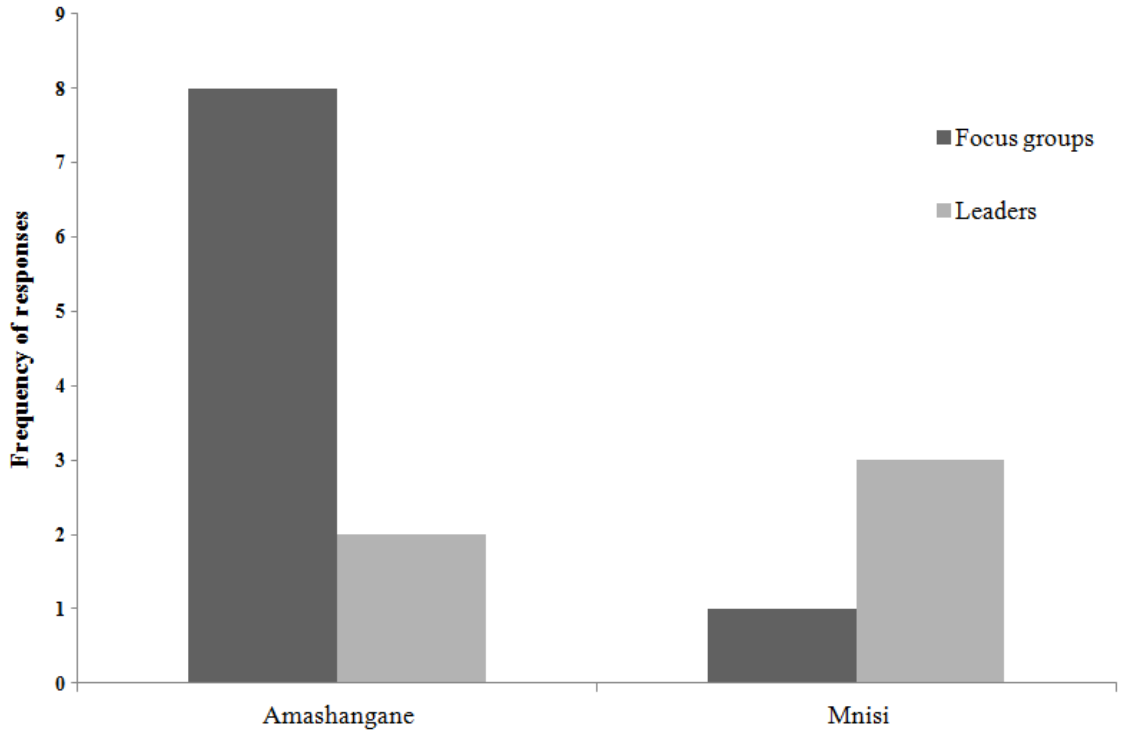


Figure 4.2. Focus groups (n=15) and leaders (n=15) per chieftaincy that believe there is enough firewood available at present.

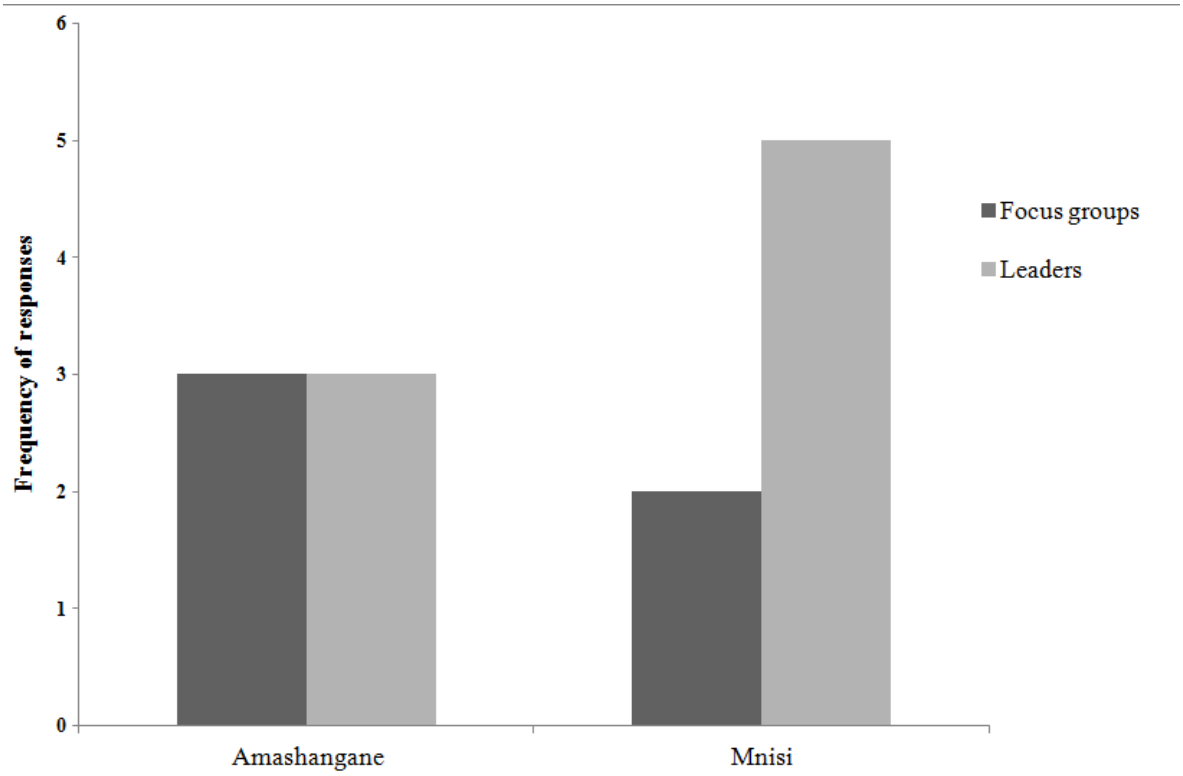


Figure 4.3. Focus groups (n=15) and leaders (n=15) in each chieftaincy that believe there will be enough firewood available in 20 years time.

4. 2. 2. Causes of local firewood scarcity as perceived by focus groups

Findings from Giannecchini *et al.* (2007) indicate that villages, despite sharing similar biophysical and socio-economic conditions, may exert different harvesting pressures on the local environment. The authors therefore advocate the importance of finer-scale research when attempting to uncover the relationships between people and their environment within any socio-ecological study system (Giannecchini *et al.*, 2007). As such, discussions into the perceived reasons behind firewood availability changes are explored on a village level rather than a chieftaincy level.

The negative impact of escalating village populations on firewood supplies was a recurring theme throughout many of the focus group discussions, where 'increased population size' was the most commonly cited reason for the dwindling firewood resources in Arthur Stone (3), Islington (4) and Burlington (4), and the second most frequently mentioned response in Cottondale (5) and New Forest (3) (Figure 4.4). In MP Stream, however, emphasis was placed on the role of intensified local commercial harvesting in reducing firewood availability (5), while in Cottondale and New Forest 'infrastructure expansion' (referring to the proliferation of houses, gardens, roads and game reserves that reduce the space in the communal lands for firewood production) dominated talks, being cited six and five times in each village, respectively (Figure 4.4). 'Reckless harvesting', which refers to irresponsible harvesting practices and intensities that place pressure on current and future firewood supplies, was prominent in Burlington groups (4) and was collectively mentioned ten times across both chieftaincies (Figure 4.4). Other reasons suggested in group discussions include natural phenomena that prevent tree growth and reduce consequent firewood production (2), poverty-driven firewood dependence (2), increased firewood consumption per capita (2), wood being used for non-cooking purposes (2) and the Department of Land Affairs cutting trees down for their own purposes (1) (Figure 4.4).

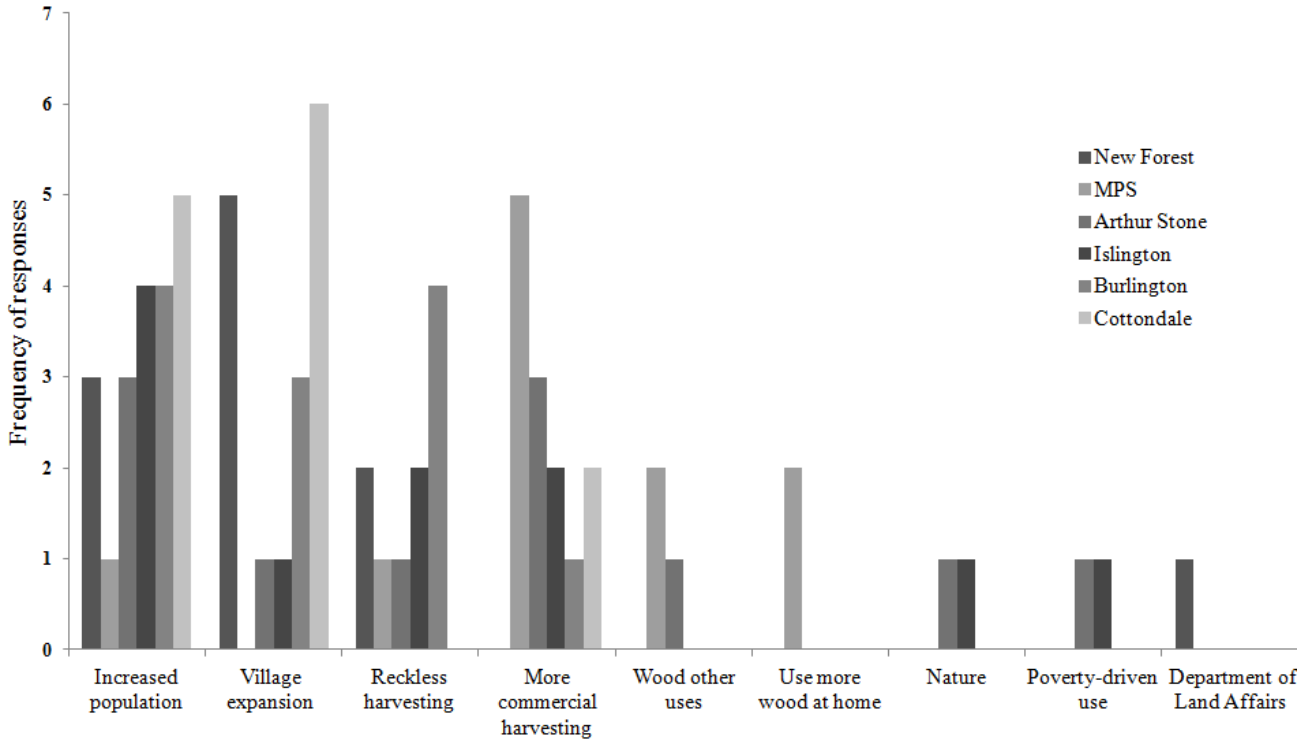


Figure 4.4. Perceived causes of decreased firewood resources as cited in focus groups (n=5) from six villages.

4. 2. 3. Perceived causes of firewood availability changes by leaders

Of the four leaders (all Amashangane) that suggested that proximate firewood resources had increased over the past twenty years, each one attributed their observations to the increased electricity available in the villages which had decreased households' dependence on firewood as an energy source. The remaining 24 leaders who agreed that firewood availability had decreased, cited increased population size (12), poverty-driven use (6) and reckless harvesting (6) as the three most important causes of these diminished firewood resources (Figure 4.5). Leaders from MP Stream also highlighted commercial harvesting as a main culprit (2) while in Arthur Stone the use of wood for non-cooking purposes was emphasised (3) (Figure 4.5).

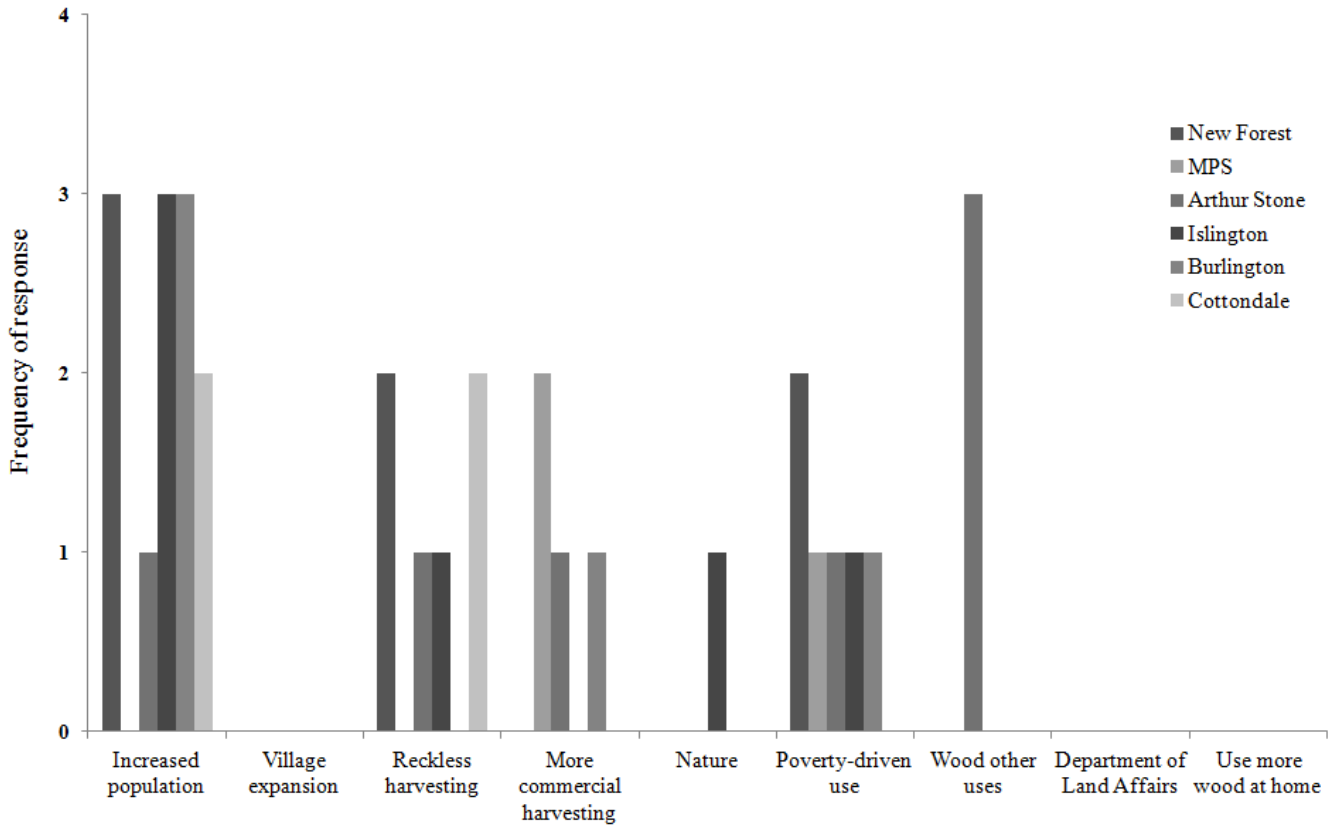


Figure 4.5. Perceived causes of decreased firewood as cited by leaders (n=5) in six villages.

4. 2. 4. Differences and similarities between responses of community members and leaders as to the dominant causes of local firewood availability

In some instances, similarities between the responses of the village leaders and their communities emerged and such consensus could indicate village-specific firewood issues. For example, intensified commercial harvesting was a matter raised far more frequently by both MP Stream leaders and community members than in any other village (Figure 4.4, Figure 4.5). The recurrence of this response throughout discussions leads one to reason that commercial harvesting in and around MP Stream is of critical concern to the local community.

In other cases, differences between the responses of community members and their respective leaders were noted. For instance, poverty-driven use, describing households' dependence on firewood because of their financial difficulties, was a reason for firewood scarcity commonly mentioned by village leaders but was only noted in two of the 30 focus groups (Figure 4.4, Figure 4.5). Likewise, although increased population size was a common answer both in focus groups and leader interviews, infrastructure expansion, an issue related

to increased population density, was only cited in focus group talks (Figure 4.4, Figure 4.5). These differences in perceptions between community members and their leaders are important differences to note as one explores these socio-ecological systems.

4.3. Governance regime

4. 3. 1. Perceptions regarding the implementer of local firewood laws

It was unanimous that local laws about harvesting firewood existed. However, the specifics of these varied greatly both within and between villages. Despite these differences, the majority of focus groups (22) across both chieftaincies cited the chief as the primary implementer of local firewood laws (Figure 4.6). Other traditional institutions, such as the *nduna* and the chief's police, and non-tribal authorities, including Nature Conservation rangers and various government departments, were also mentioned. However, these were only cited in isolated instances (Figure 4.6).

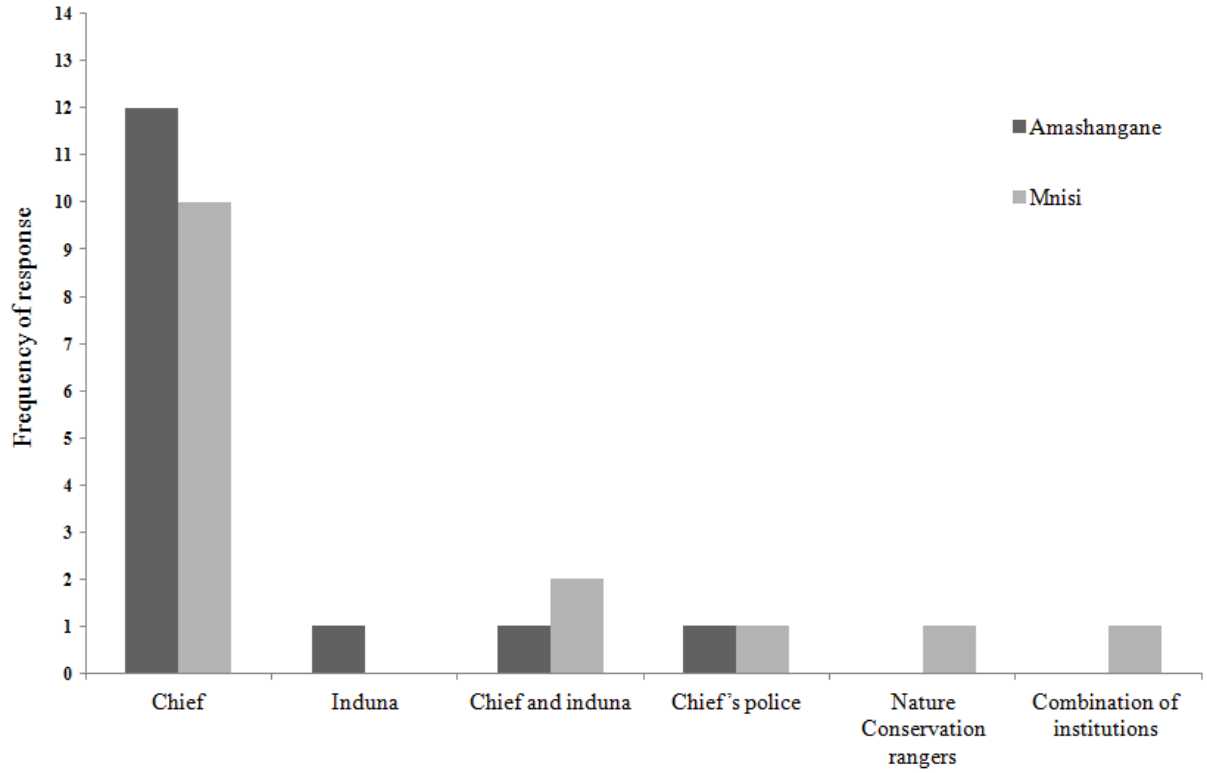


Figure 4.6. Frequency of focus groups (n=15) from two chieftaincies citing the authority which implements the local firewood laws.

In the informant interviews, the chief was also the most common response, being mentioned by 18 of the 30 leaders across the chieftaincies (Figure 4.7). Unlike group discussions, various combinations of leadership structures acting jointly were mentioned. These ranged from the 'chief and the chief's police' to the '*nduna* and the ward councillor' but these were also generally only suggested once between the leaders (Figure 4.7).

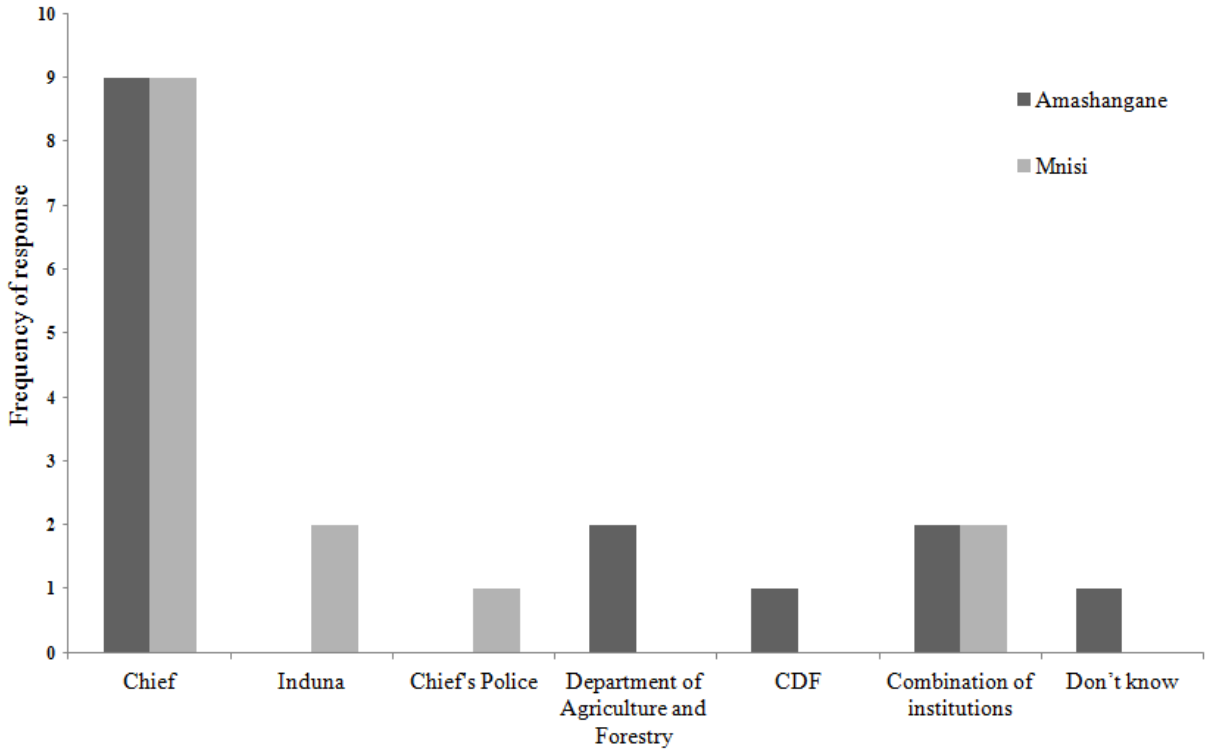


Figure 4.7. Number of leaders (n=15) from two chieftaincies citing the main implementer of firewood laws.

4. 3. 2. Permission

Every interviewed party, apart from one Mnisi focus group, agreed that permission was required to harvest firewood. However, the specifics around who grants permission, which types of harvesters require permission as well as the price of the permit varied between respondents.

Firstly, although the majority of leaders and community members across both chieftaincies saw the chief as the only issuer of firewood permits, a handful of Mnisi (3) and Amashangane (2) focus groups also indicated that it was the responsibility of the *nduna* to grant permission (Figure 4.8). This perception of the *nduna* was also shared by two leaders from Mnisi, but with none of the Amashangane leaders (Figure 4.9).

Secondly, while the majority (9) of the Mnisi focus groups stated that everyone needed permission to harvest, most of Amashangane (6) groups suggested that only commercial harvesters require permission (Figure 4.10). Although two leaders from Amashangane agreed that only commercial harvesters are expected to get permits, every other leader (from both chieftaincies) stated that all harvesters, commercial or domestic, need permission (Figure 4.11).

Finally, variations in the price of the harvesting permits were seen between all respondents. Each focus group and leader offered a different value both for the permit and the harvestable amount it allowed. These ranged from ‘no payment required’, to R5 per single piece of wood to R100 for 2 or 3 days of continuous harvesting. Many focus groups (8) also conceded that they did not actually know the cost of a permit.

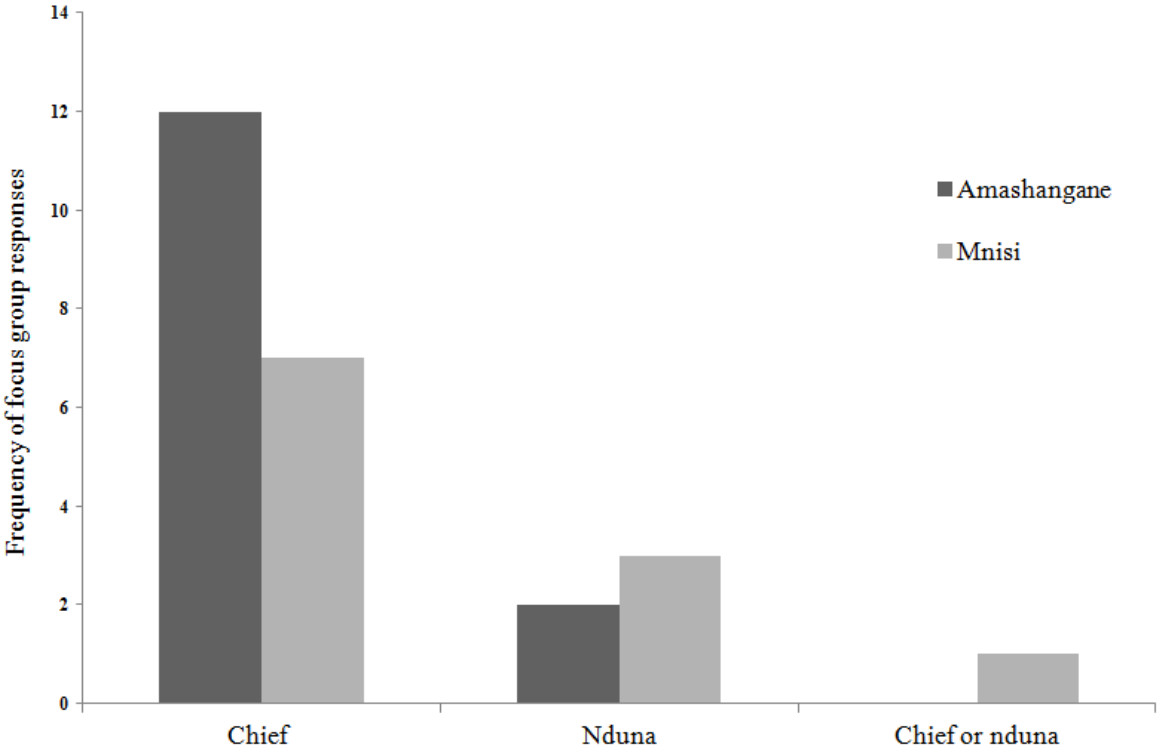


Figure 4.8. Frequency of focus group responses indicating the authority who grants permission to harvest firewood.

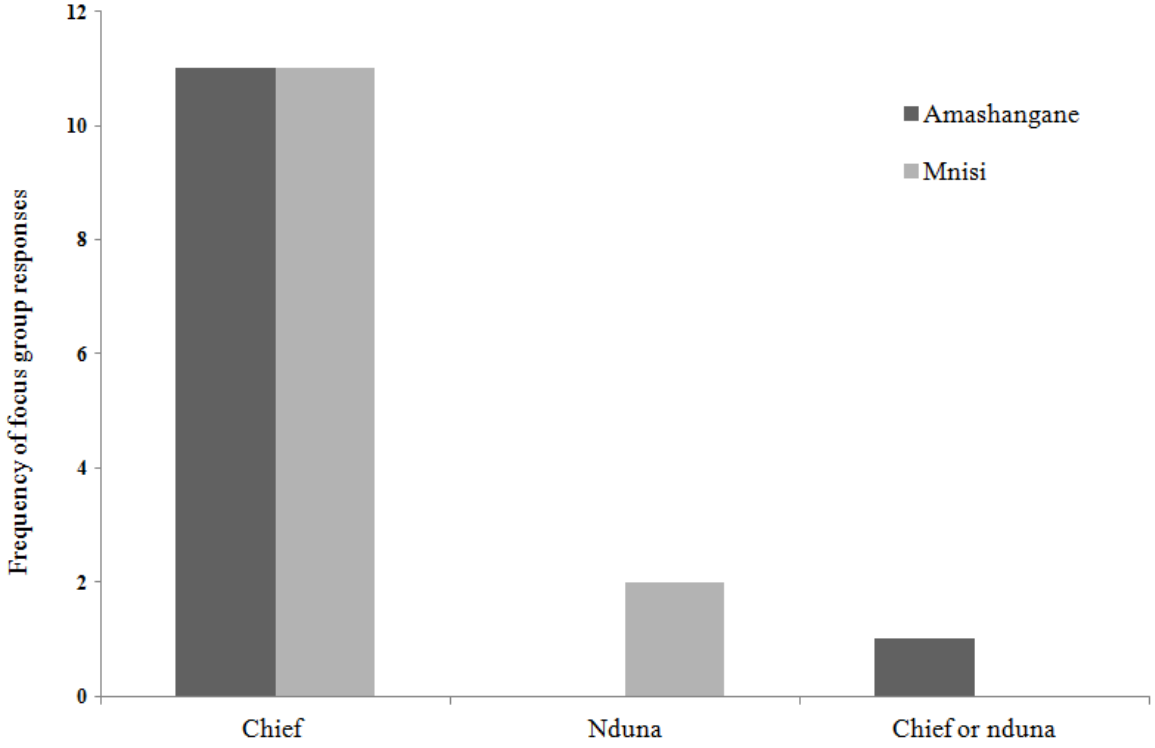


Figure 4.9. Frequency of leaders responses indicating the authority who grants permission to harvest firewood.

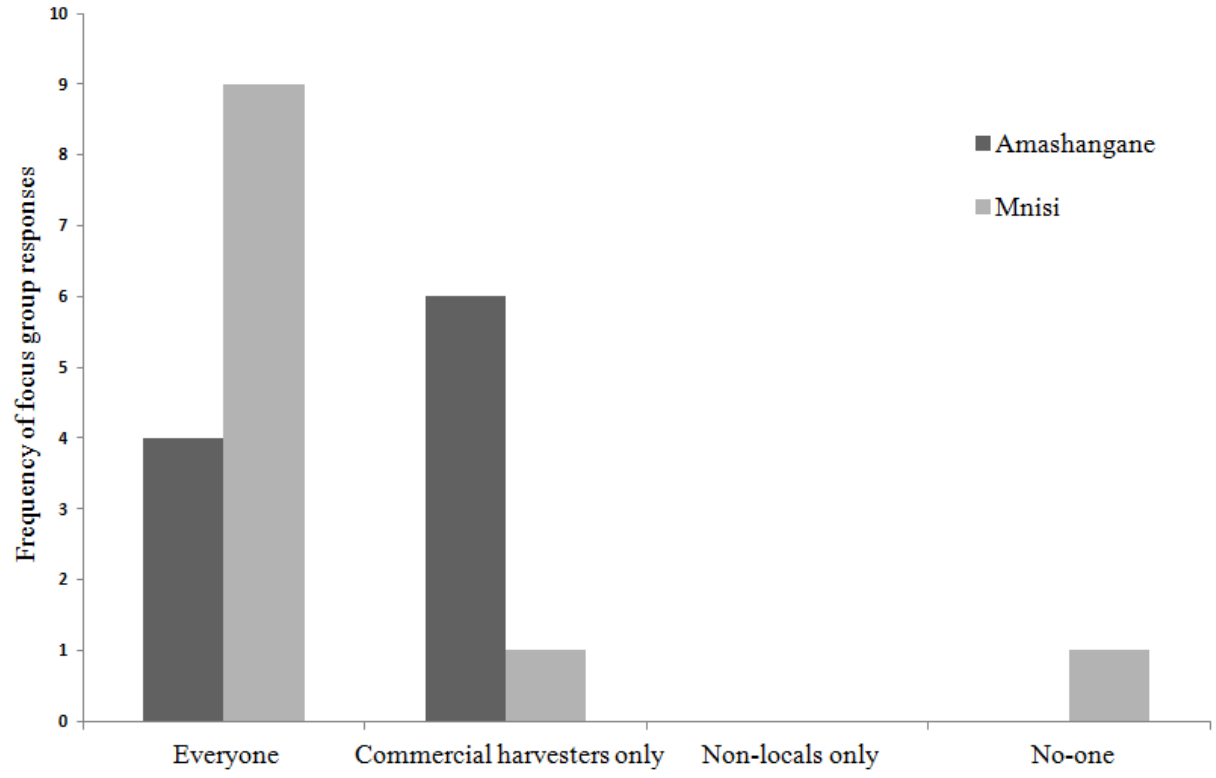


Figure 4.10. Frequency of focus group responses indicating the people groups that require permission to harvest firewood.

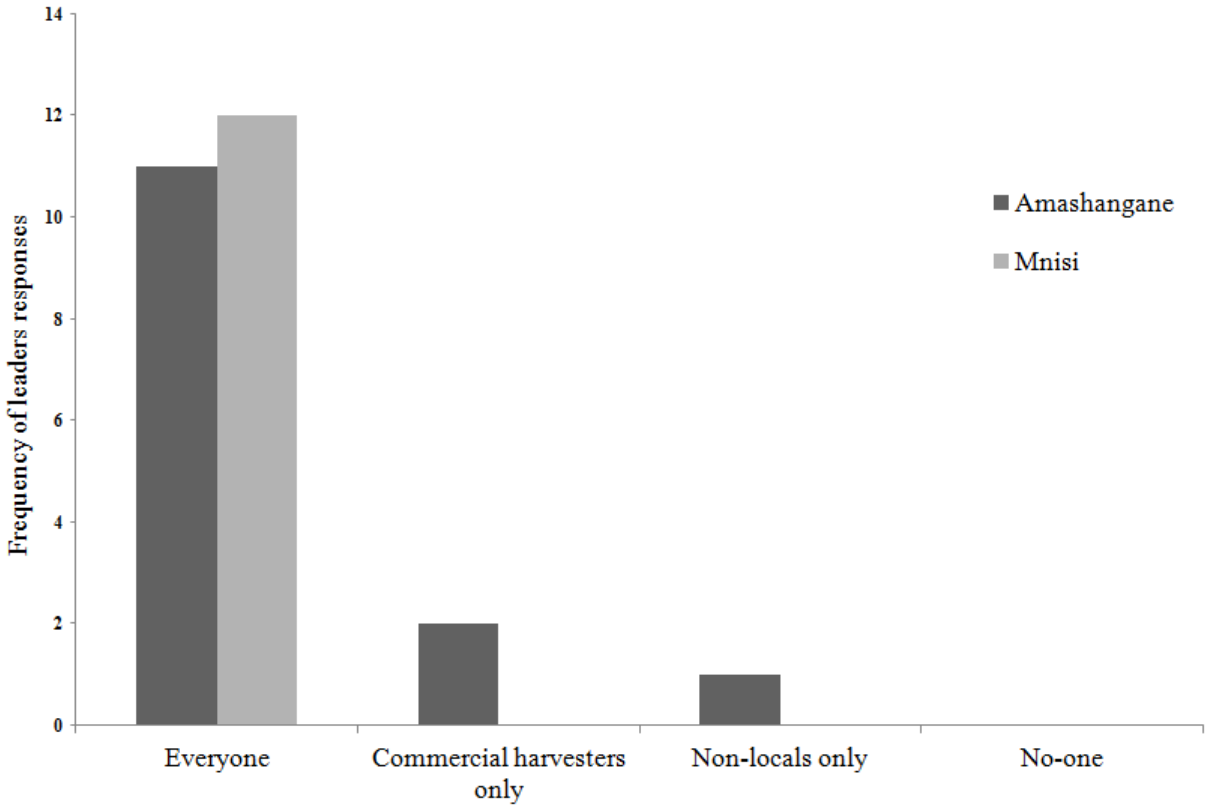


Figure 4.11. Frequency of leaders responses indicating the people groups that require permission to harvest firewood.

4. 3. 3. 'Responsibility' scores

The 'responsibility' values are scores generated from the list of activities each institution is thought to undertake in firewood regulation, as suggested by the leaders and focus groups in each village. The closer to 1.0 an institution's score, the more frequently they were thought to take on responsibilities of higher importance.

Every community focus group and every leader indicated that all of the chief's duties associated with firewood management were of the highest import and these perceptions did not differ between villages, chieftaincies or interview group (Table 4.2, Table 4.3). The two most commonly cited of these responsibilities was fining transgressors, as mentioned by 15 leaders and in 18 focus groups, and having security that actively patrol the communal lands, as cited by 11 leaders and in 11 focus groups (Table 4.4, Table 4.5). The supremacy of the chief's duties were reiterated by the 24 instances by focus groups and 11 instances by leaders in which he was deemed the 'ultimate authority' and 'decision-maker' in firewood governance, and where he was described as the 'overseer of everything' with 'firewood [as] his responsibility' (Table 4.4, Table 4.5). Other less commonly mentioned duties, such as issuing permits, sending transgressors to jail and giving laws to the *ndunas*, all similarly indicate the chief's high order role in firewood management. All of these responsibilities immediately ascribe an upper level of authority to the chief, where not only does he have the power to finalise punishment for lawbreakers, including the possibility of jail time, but he also has 'lower level' personnel who work under his instruction.

The leaders' discussions around the responsibilities of other institutions also yielded remarkably similar scored values between the two chieftaincies. It must be noted, however, that although the values in the table reflect the mean 'level' of authority of each institution, they do not necessarily point to similarities in the suggested roles themselves. For example, the *ndunas* in both chieftaincies received mean scores of 0.66 by leaders (Table 4.3) and these values indicate like levels of intermediate to high responsibility in firewood governance. However, the actual duties thought to be undertaken by the *ndunas* as suggested by the leaders, differ in some ways between the chieftaincies. Although the *nduna* was thought to 'host traditional courts', 'report illegal harvesters to higher powers' and 'have security that actively patrol' equally across the chieftaincies, his capacity to issue fines was mentioned far more frequently by Mnisi leaders (8) than by Amashangane leaders (2). In the

same way, more Amashangane leaders (6) openly stated that the *nduna* could not fine compared to Mnisi leader respondents (4) (Table 4.5).

This divergence in the perceived role of the *nduna* was also highlighted in the analysis of community responses where the *ndunas* of Mnisi generated a higher (although not significantly) level of authority in responsibilities (0.70) than the Amashangane *ndunas* (0.44) (Table 4.2). Therefore, while Amashangane focus groups reiterated the *nduna's* moderate role in firewood governance with the five most common responsibilities being 'able to report illegal harvesters to a higher power' (4), 'advising community members not to harvest' (4), 'calling meetings' (4), 'having no active security' (4) and 'being unable to fine' (7), the *nduna*s of Mnisi were most frequently suggested as being 'able to fine' (14), 'sending transgressors onto the Chief only if the matter is unresolved by him' (11), 'having active security' (10) and 'hosting traditional courts' (8) (Table 4.4). These findings indicate some chieftaincy-level differences in the roles of the *ndunas*, where despite their sharing similar levels of apparent responsibility, the functional roles they are thought to undertake appear quite different.

Municipal government was the only institution noted as having a significantly different level of authority in firewood activities, as perceived by the leaders, between the Mnisi (0.68) and Amashangane chieftaincies (0.26) ($p<0.05$) (Table 4.3). This discrepancy stems from the seven Amashangane leaders who explicitly stated that the local municipality had 'no responsibility' in firewood management, while five Mnisi leaders suggested that municipal officers were of intermediate importance. These Mnisi leaders mentioned that municipal officials had the right to report illegal harvesters to a higher authority, had the power to arrest firewood transgressors (Table 4.5) and were therefore highly ranked in firewood regulation. These suggestions of active municipal security were also raised, but to a lesser extent, in some of the Mnisi focus groups. Suggestions of the municipality having 'actively patrolling security' were mentioned twice, while 'can arrest transgressors', 'confirms validity of permit' and 'advises not to harvest' were all roles mentioned at least once in different Mnisi focus groups (Table 4.4). Although these suggestions do reinforce some of the perceptions held by Mnisi leaders, the majority of both Mnisi (11) and Amashangane focus groups (12) maintained that the local municipality had 'no responsibility' (Table 4.4) and this thereby contests the high-order authority assigned by the Mnisi leaders.

Similar discrepancies between the perceptions of the leaders and the community members were also noted for the provincial government. On multiple occasions leaders in both chieftaincies indicated that provincial authorities had active patrolmen who 'advised community members not to harvest', could 'send transgressors to a higher authority' and 'could arrest' (Table 4.4). These responsibilities, along with other higher order duties such as 'run workshops about the environment', 'provide electricity' and 'make the laws', generated the moderate levels of responsibility for provincial government of 0.46 and 0.65 as perceived by Amashangane and Mnisi leaders, respectively (Table 4.3). In contrast, 24 of the 30 focus groups stated that the provincial government had 'no responsibility' in firewood regulation, which resulted in the 'responsibility' scores of 0.14 and 0.2 by Amashangane and Mnisi focus groups (Table 4.4). As such, significant differences between the responses of the leaders and community members in both chieftaincies about the role of provincial government were generated ($p<0.05$).

Analysis of the CDF's responsibilities in firewood governance also revealed significant differences between the leaders and communities of both chieftaincies. Leaders in each of the chieftaincies ascribed an intermediate level of authority to the CDF with mean responsibility scores of 0.32 and 0.43 in Amashangane and Mnisi, respectively (Table 4.3), while focus group scores are significantly lower at 0.07 (Amashangane) and 0.23 (Mnisi) ($p<0.05$) (Table 4.2). The leaders' higher scored values stem from their most common suggestions being that the CDF 'report illegal harvesters to a higher authority' (12), 'advise community members not to harvest' (12) and 'assist the Nduna' (7), while on occasion, are also thought to 'call meetings' (4) and 'confirm the validity of permits' (3) (Table 4.5). Although these suggestions of CDF members playing a somewhat active role in firewood regulation were reiterated in a handful of focus groups, particularly in Mnisi, the majority of community respondents (20 of 30 focus groups) in both chieftaincies asserted that the CDF plays no role in firewood governance (Table 4.4).

The higher perceived responsibility score of the CDF in both Mnisi leader and focus group responses may indicate chieftaincy-level differences in the role of this institution in firewood management. In the three Mnisi villages, it seems that the CDF are seen as active contributors to firewood regulation through their patrolling of the communal lands and their advising against the harvesting of live trees.

Table 4.2. Mean scores of each institution's perceived responsibility in firewood regulation, averaged across five **focus groups** in each village. Values range from 1.0 (highest responsibility) to 0.0 (no responsibility). Values in parentheses denote the range of focus groups' scores. Means within a row which do not share a common superscript letter are significantly different ($p<0.5$).

Institution	Village						**Chieftaincy**		**TOTAL**
	New Forest	MP Stream	Arthur Stone	Islington	Burlington	Cottondale	**Amashangane**	**Mnisi**	
Chief	1.0	1.0	1.0	1.0	1.0	1.0	**1.0[a]**	**1.0[a]**	**1.0**
Nduna	0.23 (0-0.5)	0.46 (0.2-1.0)	0.62 (0.25-1.0)	0.61 (0.1-1.0)	0.53 (0-1.0)	0.96 (0.83-1.0)	**0.44[a] (0-1.0)**	**0.70[a] (0-1.0)**	**0.57 (0-1.0)**
CDF	0.2 (0-0.5)	0	0	0.4 (0-0.5)	0.2 (0-0.5)	0.1 (0-0.5)	**0.07[a] (0-0.5)**	**0.23[a] (0-0.5)**	**0.16 (0-0.5)**
Civic Association	0.1 (0-0.5)	0.125 (0-0.5)	0.23 (0-0.67)	0.2 (0-0.5)	0.48 (0-0.75)	0	**0.15[a] (0-0.67)**	**0.23[a] (0-0.75)**	**0.20 (0-0.75)**
Community Members	0.2 (0-0.5)	0.2 (0-0.5)	0.1 (0-0.5)	0.3 (0-1.0)	0.25 (0-0.5)	0.1 (0-0.5)	**0.17[a] (0-0.5)**	**0.22[a] (0-1.0)**	**0.19 (0-1.0)**
Municipal Government	0.1 (0-0.5)	0	0	0.35 (0-1.0)	0.07 (0-0.33)	0.2 (0-1.0)	**0.04[a] (0-0.5)**	**0.21[a] (0-1.0)**	**0.12 (0-1.0)**
Provincial Government	0.2 (0-1.0)	0.25 (0-1.0)	0	0.4 (0-1.0)	0.2 (0-1.0)	0	**0.14[a] (0-1.0)**	**0.2[a] (0-1.0)**	**0.17 (0-1.0)**

Table.4.3. Mean scores of each institution's perceived responsibility in firewood regulation, averaged across **five leaders** in each village. Values range from 1.0 (highest responsibility) to 0.0 (no responsibility). Values in parentheses denote the range of leaders' scores. Means within a row which do not share a common superscript letter are significantly different ($p<0.5$).

Institution	Village						**Chieftaincy**		**TOTAL**
	New Forest	MP Stream	Arthur Stone	Islington	Burlington	Cottondale	**Amashangane**	**Mnisi**	
Chief	1.0	1.0	1.0	1.0	1.0	1.0	**1.0** [a]	**1.0** [a]	**1.0**
Nduna	0.47 (0.29-0.75)	0.75 (0.5-1.0)	0.76 (0.63-1.0)	0.74 (0.43-1.0)	0.53 (0.25-1.0)	0.71 (0.625-0.75)	**0.66** [a] **(0.29-1.0)**	**0.66** [a] **(0.25-1.0)**	**0.66 (0.25-1.0)**
CDF	0.33 (0-0.5)	0.33 (0.-0.5)	0.3 (0-0.5)	0.5	0.5	0.28 (0-0.5)	**0.32** [a] **(0-0.5)**	**0.43** [a] **(0-0.5)**	**0.37 (0-0.5)**
Civic Association	0.19 (0-0.33)	0	0.3 (0-0.5)	0.33 (0-0.5)	0.375 (0-0.625)	0.2 (0-0.6)	**0.23** [a] **(0-0.5)**	**0.30** [a] **(0-0.625)**	**0.27 (0-0.625)**
Community Members	0.17 (0-0.5)	0.375 (0-0.625)	0.22 (0-0.5)	0.11 (0-0.33)	0.06 (0-0.17)	0.44 (0-1.0)	**0.25** [a] **(0-0.625)**	**0.20** [a] **(0-1.0)**	**0.23 (0-1.0)**
Municipal Government	0.25 (0-0.75)	0.25 (0-0.75)	0.28 (0-0.83)	0.67 (0.5-1.0)	0.75 (0.5-1.0)	0.61 (0-1.0)	**0.26** [a] **(0-0.83)**	**0.68** [b] **(0-1.0)**	**0.47 (0-1.0)**
Provincial Government	0.5 (0-1.0)	0.3 (0-0.05)	0.56 (0-1.0)	0.94 (0.83-1.0)	0.83 (0.5-1.0)	0.17 (0-0.5)	**0.46** [a] **(0-1.0)**	**0.65** [a] **(0-1.0)**	**0.56 (0-1.0)**

Table 4.4. The frequency of selected duties thought to be undertaken by different institutions as cited by community **focus groups** (n=30) pooled across all villages.

	No responsibility		**Intermediate responsibility**			**High responsibility**		
	No responsibility	Can't fine	Report illegal harvesters to a higher power	Advise not to harvest	Call community meetings	Can fine	Ultimate authority	Has security that actively patrol
Chief	0	0	0	0	0	36	24	17
Nduna	4	11	6	5	6	18	0	12
Community Development Forum	20	0	5	1	1	0	0	0
Civic Association	19	0	4	2	3	0	0	0
Community Members	19	0	8	2	0	0	0	0
Municipal Government	23	0	2	1	0	0	0	2
Provincial Government	24	0	0	0	0	0	0	0

Table 4.5. The frequency of selected duties thought to be undertaken by different institutions as cited by **leaders** (n=30) pooled across villages.

	No responsibility		**Intermediate responsibility**				**High responsibility**	
	No responsibility	Can't fine	Report illegal harvesters to a higher power	Advise not to harvest	Call community meetings	Can fine	Ultimate authority	Has security that actively patrol
Chief	0	0	0	0	0	15	11	8
Nduna	0	10	11	4	4	10	0	10
Community Development Forum	7	0	12	12	4	0	0	0
Civic Association	10	0	8	6	1	0	0	0
Community Members	17	0	4	2	0	0	0	0
Municipal Government	9	0	5	0	1	0	1	0
Provincial Government	7	0	2	3	2	0	2	1

4. 3. 4. Relative importance of institutions in firewood regulation

Each focus group was asked to rank the institutions, both traditional and democratic, according to their responsibility in firewood regulation. Each of these institutions was then given a score from nine (9) to one (1) and these scores were averaged across focus groups within each village (Table 4.6).

There were no significant differences between the rank scores of each institution between the chieftaincies or between the villages (Table 4.6). This indicates that the focus groups tended to rank the institutions in similar positions of importance regardless of the village or chieftain in which they lived. Both the chief and the *nduna* were consistently classed as the two most important authorities in terms of firewood governance across all six villages (Table 4.6). The chief was repeatedly assigned a first or second position of importance over all other parties and such high rankings are reflected in the mean scores across villages that range from 8.2 and 9.0 (Table 4.6), where 9 represents the upper limit on the score scale. Similarly, the *nduna's* average scores (4.6-8.0),although more diverse than those of the chief, still designate him as the second most important institution in each village and reinforce the notion, as suggested in some focus group sessions, that he is second-in-command to the chief. The markedly low score for the *nduna* in New Forest stems from two focus groups that failed to mention the *nduna* at all in their discussions.

The chief and the *nduna* were the only authorities whose rankings appear relatively consistent across the focus groups. All of the other institutions vary between villages, although not generating significant differences (Table 4.6). For example, while the Civic association in Burlington received a mean rank score of 5.4 and was therefore the third most important institution locally, the Civic Association in the adjacent village of Cottondale received no mention at all and a consequent rank score of 0 (Table 4.6). Likewise, in MP Stream, community members were highly regarded and in three of the five focus groups were deemed the third most important party (thereby receiving a score of 5.0), while in New Forest and Cottondale, community members were only mentioned once and each time were only ranked sixth overall. These differences in institutional scores may reveal the systems that operate at a village level to regulate firewood harvesting. These discrepancies could also equally reflect the small sample sizes of the study where each village is only represented by one value.

Ambiguity around the importance of provincial and municipal government in firewood governance was evident in the ranges of scores generated in the focus group discussions. Three focus groups maintained that the provincial government was the highest authority as 'all departments fall under the provincial government' and it 'gives the law to the Chief' and was therefore ranked first. In contrast, other focus groups fail to mention the provincial government at all. Similar inconsistencies are noted for the municipal government. These discrepancies in community perceptions may result from difficulties between differentiating 'level' of authority and their importance in actually regulating firewood harvesting. As such, some community groups may recognise the importance of government bodies in developing legislation and in their 'upper level' governance operations and are therefore highly regarded, while others overlook the import of such institutions as their on-the-ground presence or degree of active regulation is scarce or limited.

Table 4.6. Mean rank scores of local institutions with regard to their importance in firewood regulation across six villages, as perceived by community focus groups (n=5) (9.0 is highest rank).

	Villages						**Chieftaincy**		
	New Forest	MP Stream	Arthur Stone	Islington	Burlington	Cottondale	**Amashangane**	**Mnisi**	**TOTAL**
Chief	8.8	8.8	8.2	8.4	8.0	9.0	**8.6[a]**	**8.5[a]**	**8.53**
Nduna	4.6	7.8	7.8	7.4	6.4	8.0	**6.7[a]**	**7.3[a]**	**7**
CDF	2.6	1	0	2.6	2.6	1.4	**1.2[a]**	**2.2[a]**	**1.7**
Civic Association	1.4	1.2	1.6	1.6	5.4	0	**1.4[a]**	**2.3[a]**	**1.87**
Community members	1.2	5.0	1.4	3.0	3.2	1.2	**2.5[a]**	**2.5[a]**	**2.5**
Municipal Government	1.2	0	0	4.0	0.4	0	**0.4[a]**	**1.5[a]**	**0.87**
Provincial Government	1.8	1.8	0	2.6	1.2	0	**1.2[a]**	**1.3[a]**	**1.23**

4. 4. Village-level governance regimes

Although there were commonalities in the perceived importance of some of the institutions between villages, namely the chief and the *nduna*, the variability noted for other institutions could indicate nuances in village-level governance dynamics. As such, the following section explores the perceived roles and responsibilities of each institution at a village level and attempts to make sense of and understand the local firewood governance regime.

4. 4. 1. New Forest

In New Forest, the governance hierarchy in firewood regulation was uncontested between leaders and community members. The chief was repeatedly stated as being the 'ultimate authority' as well as being the most important institution in firewood governance (generating a mean score rank of 8.8 seen in Table 4.6). His role in firewood matters was highlighted in discussions around arresting and punishing transgressors, where the chief's police were noted by every party as being the primary apprehenders of illegal harvesters while the chief and his tribal court were the only institutions with the authority to charge lawbreakers. Although fines and the confiscation of belongings and/or firewood were commonly mentioned as firewood penalties issued by the chief, the capacity of the chief to send offenders to jail remains questionable as uncertainty around this responsibility arose in discussion groups and interviews.

In this village, the *nduna* is seen simply as an intermediary between the community and the chief, with limited authority in firewood-related matters. Leaders and community members all agreed that the *nduna's* primary responsibility was only to 'send transgressors on to the chief' as he had no capacity to fine, arrest or issue permits. These ideas were supported by the *nduna* himself who stated that his role was not "looking after the forest" and that "if he finds some one [harvesting illegally] then he calls the tribal police to come deal with the person". These perceptions generated the low 'responsibility scores' of 0.47 and 0.23 provided by the leaders and community members, respectively (Table 4.2, Table 4.3) as well as the mean rank score of only 4.6 (Table 4.6), the lowest score of all village *ndunas*. Each of these results reiterates the *nduna's* low level of authority in firewood regulation relative to the chief.

In the same way, the CDF appears detached from issues around firewood harvesting, where, as suggested by one CDF member, "firewood is under Tribal [authority] and is

therefore not really their responsibility". The CDF is focused more on "development and service delivery". These remarks are supported by both the *nduna* and three focus groups who maintained that this local democratic organisation has 'no responsibility' in firewood management. Interestingly, however, the two other CDF members, the ward councillor as well as the remaining focus groups indicated that members of the CDF have the authority to stop lawbreakers, check the validity of harvesters' permits as well as tell them not to harvest.

Community members, with mean responsibility scores of 0.17 and 0.2 by leaders and focus groups, respectively (Figure 4.2), were most commonly described as having 'no responsibility' in firewood governance. Although their lack of formal firewood duties is not surprising, the critical and negative attitude towards local villagers that emerged in discussions with leaders was quite startling. Comments such as "all they [the community] want to do is harvest", they "know the rules but don't follow them" and "they are the ones doing something wrong" all intimate the leader's perceptions that community members are reckless and disobedient in their harvesting activities. There was a definite sense of blame directed at the community from the leaders.

4. 4. 2. MP Stream

In MP Stream, the hierarchy of authority in firewood regulation was well-known by most respondents. Here, the chief was once again perceived to be the 'main source of authority' by both leaders and community members where he was thought to "monitor everything in the land" and was described as being "in charge of the land". His high level of importance in firewood regulation was indicated by his high mean score rank of 8.8 (Table 4.6), his being deemed the implementer of firewood laws by all MP Stream focus groups and his undertaking duties that are only of the highest consequence (Table 4.2, Table 4.3). Sending out rangers to monitor, patrol and arrest lawbreakers was his most commonly mentioned responsibility. The supremacy of the chief was also made evident in that most respondents, both leaders and community members, suggested that lawbreakers are either sent straight to the chief or are ultimately sent to the chief via the *nduna* for firewood-related punishments.

The second tier of the hierarchy in this village was the *nduna* who was described by focus groups as the "chief's right-hand man", as being "second-in-command to the chief" and as receiving all his "instructions from the chief". He appears to be a well-established authority, with a mean rank score of 7.8 (Table 4.6), but his powers in firewood regulation also appear to be limited. It was generally agreed by leaders and community members that the

nduna could not fine for firewood offences and that his primary responsibility was to host tribal council meetings (to which the lawbreakers were brought) in which he would reiterate the rules and regulations around firewood harvesting and highlight the importance of environmental sustainability. In this way, the *nduna* of MP Stream seems to be more of an exponent of firewood laws, rather than a direct enforcer of them.

Interestingly, there was quite a marked discrepancy in the perceptions of the *nduna*'s responsibilities between the community members and the leaders. While community members tended to focus on the *nduna* being unable to issue punishments and only advising the community not to harvest, thus generating a 'responsibility score' of 0.46 (Table 4.2), the leaders highlighted his role in hosting important council meetings about harvesting that resulted in a high 'responsibility score' of 0.75 (Table 4.3).

Perceptions around the role of the CDF were also divided between focus groups and leaders. While all the interviewed leaders, except the *nduna,* suggested that the CDF are active as firewood regulators in that they are "deployed by the CDF Chairman to monitor and check if people have permission [to harvest]" as well as "call together general meetings to tell people not to cut", all of the focus groups said that the CDF had 'no responsibility' in firewood harvesting. Likewise, while the majority of respondents emphasised the role of the chief's police in apprehending firewood transgressors, the CDF representatives were the only interviewed individuals to mention the CDF as important in patrolling the communal lands.

It was accepted by almost all of the leaders and focus groups that the Civic Association, municipal government and provincial government had little to no responsibility in firewood governance.

4. 4. 3. Arthur Stone

Unlike other villages, Arthur Stone respondents provided highly varied answers about the institutional system associated with firewood regulation, where opinions about the responsibilities and capacities of authorities, specifically of the *nduna,* were split throughout discussions with focus groups and leaders.

One indication of these varied perceptions was seen in responses to the question "Who is the implementer of firewood laws?". While all the focus groups in the two other Amashangane villages only cited the chief as the primary implementer of these rules, Arthur Stone respondents provided four different answers, namely 'chief', '*nduna',* 'chief and

nduna' and 'chief's police'. These diverse responses already allude to differences in opinions around institutional roles.

Although both the chief and the *nduna* were seen as important in firewood governance and were therefore highly ranked among focus group respondents (generating the high mean rank scores seen in Table 4.6), the many different descriptions of their firewood-related activities produce an unclear picture of their actual roles and interactions in the regulation regime. For example, while most focus groups acknowledged that the *nduna* is actively involved in firewood regulation, specifically by warning villagers not to harvest and by hosting community meetings, his role in arresting and charging firewood transgressors remains uncertain. Some groups suggested that the lawbreakers are sent directly to the *nduna* who has the power to fine and is therefore a supreme local authority. Other groups intimated that the *nduna's* only role is to send transgressors on to the chief because he has no power to issue punishments himself. One focus group even went on to suggest that the *nduna* has "no real responsibility because the chief's police are there" and they send any lawbreakers straight to the chief, bypassing the *nduna* completely. This mixture of responses, however, was not replicated in talks with leaders. In these interviews, it was generally agreed that the *nduna* had some authority with firewood-related matters and could therefore issue fines, but should the lawbreaker disregard his discipline he or she would then be sent onto the chief.

In terms of who apprehends firewood offenders, opinions were divided across community members and leaders, where cited patrolmen ranged from the chief's police and *nduna*'s rangers to the CDF and government conservation officials. Such inconsistency in perceptions was also noted for descriptions of specific 'policing' institutions. For example, while one group said that the *nduna's* 'police' were able to "arrest and charge illegal harvesters", another group said that the *nduna's* police were not involved in firewood patrolling at all. Similarly, while two CDF members suggested that the CDF had a role to play in canvassing the communal lands, each of the other interviewed parties stated that this local organisation had 'no responsibility' in firewood regulation.

As such, discussions in Arthur Stone were characterised by large differences in opinion as to the importance and the roles of each of the local institutions. This assortment of perceptions indicates uncertainty as to the firewood management regime in place.

4. 4. 4. Islington

Discussions held with both community members and leaders in Islington revealed very similar ideas about the roles of each of the institutions involved in firewood governance. The chief remained the most important perceived authority in firewood regulation, generating a mean rank score of 8.4 (Table 4.6), and described in focus groups as the "most responsible [institution] because he governs the land" as well as being "the over-riding authority" whose responsibility it is to "ensure nature is respected and protected". Interestingly, although the chief's most commonly cited duty among respondents was his capacity to fine transgressors [7], each of the leaders and two of the focus groups stated that lawbreakers were only sent to the chief once a small court meeting had been held with the village *nduna* first. The local tribal council, headed up by the *nduna*, decides if the misdemeanour warrants further punishment or not, and only from here are those caught violating firewood rules sent on to the chief. This idea was confirmed by the *nduna* who suggested that his "responsibility is to decide whether the transgressors should be sent to the chief or not". What remains unclear, however, is the extent to which the *nduna* can issue punishments himself. While some respondents indicated that the *nduna* could fine lawbreakers at the tribal councils, others stated outright that he had no authority to penalize or charge wrongdoers. Despite this difference in opinion, the *nduna* remains a notable institution in local firewood regulation described as an "extension of the Tribal Office" with high 'responsibility scores' of 0.74 and 0.61 generated by leaders and community members, respectively (Table 4.2, Table 4.3).

Unlike other villages, responses about the role of the CDF and the Civic Association in Islington suggest that both these institutions are active in firewood management. Their most commonly mentioned and uncontested responsibility was to remind community members not to harvest live wood, and this was either through community meetings or during encounters with harvesters in the communal lands. It was also mentioned by all five leaders that although members of the CDF do not actively police the 'forests', they do have the authority to report any lawbreakers to the *nduna* should they come across them. These suggestions were corroborated by the *nduna* and the three CDF members who all highlighted that the Civic and the CDF act in tandem with the Chief's Police to apprehend firewood offenders. In contrast, none of the focus groups mentioned the Civic or the CDF as 'firewood police', and these respondents instead highlighted the role of external rangers, including Environmental Affairs officers, Nature Conservation Rangers, Bushbuckridge municipality rangers and the South African Police, in partnering with the chief's rangers to patrol the

lands. This discrepancy may highlight how although the community members maintain that both the CDF and the Civic have a definite role to play in firewood governance, their duties are perceived to be advisory rather than regulatory in nature.

In terms of higher-level democratic governance, although the Bushbuckridge local municipality was most commonly described as having 'no responsibility' in firewood management by focus groups, some discussions did indicate that there were municipal officers who sometimes patrolled the lands and could arrest lawbreakers. Leaders' responses highlighted that these officials could send transgressors onto the chief and they therefore, as stated by one leader, "assist in the implementation of the chief's laws". These perceptions seem to suggest that in terms of firewood the municipality is thought to fall under the authority of the chief.

The responsibilities associated with provincial government, however, were highly uncertain, particularly in relation to the chief. While some suggest that provincial officials can only send lawbreakers to the chief, others describe this level of government as the supreme authority as "all power stems from provincial government" and "all departments fall under provincial government". One focus group suggested that provincial government do have responsibilities "but they are so far from communities" that they are rarely seen implementing them on-the-ground.

4. 4. 5. Burlington

The chief was once again recognised as the highest level of authority in firewood management in Burlington where he was described throughout discussions as the "most important structure" as well as the firewood "decision-maker". The chief's most prominent role appeared to be charging lawbreakers with issuing financial punishments and sending disobedient or aggressive transgressors on to the South African police as his most commonly mentioned duties. In line with this, every interviewed party cited the chief as at least one of the institutions involved in indicting firewood offenders and his 'police' as the primary apprehenders of illegal harvesters. As such, perceptions of the chief were focused more on his disciplinarian role of reprimanding and punishing guilty parties than on tasks mentioned in other villages, such as developing new firewood laws.

The consistency noted for responses around the role of the chief were not seen in discussions around the role of the *nduna.* Although the village headman generated a firewood

'responsibility score' of 0.53 by both leaders (Table 4.3) and community members (Table 4.2) as well as a mean rank score of 6.4 (Table 4.6), opinions of what the *nduna* actually carries out in terms of firewood regulation were divided across the board. For example, while two focus groups stated that the *nduna* could not arrest lawbreakers, two other focus groups said that apprehending firewood transgressors was one of the *nduna*'s main responsibilities. Similarly, while it was mentioned three times that the *nduna* could fine guilty parties for firewood-related crimes, in another three instances it was stated outright that he could not. As such, the exact authority of the *nduna* in firewood regulation remains unclear where his capacity to issue punishments and his power in governance was blurred by the variety of perceptions noted in this village.

On the other hand, almost total consensus about the role of the Civic Association was seen in talks with both leaders and focus groups. Although one focus group as well as the village's ward councillor thought that the Civic had 'no responsibility' in regulating firewood, each of the other groups and leaders highlighted the Civic's active role in patrolling the lands, sending illegal harvesters onto the *nduna* or chief and in hosting community meetings. Interestingly, Burlington was the only village to attribute any formal responsibility in firewood governance to the Civic. Here, they produced 'responsibility scores' of 0.375 and 0.48 by leaders and community members, respectively (Table 4.2, Table 4.3). In addition, this institution also generated a mean rank score of 5.4 (Table 4.6), which not only exceeded scores for the Civics of every other village, but it also surpassed Burlington's mean rank scores for its other democratic institutions, including the CDF and community members (Table 4.6). Although the CDF was also recognised as being able to report illegal firewood activities to higher authorities and advising community members against cutting live wood, the bulk of responsibility seemed to lay on the Civic Association, rather than the CDF, in this village.

Interestingly, but unsurprisingly, a definite split between leaders and focus groups was seen in discussions around the importance of municipal and provincial government. Therefore while leaders' perceptions generated 'responsibility scores' of 0.75 and 0.83 for municipal and provincial government, respectively (Table 4.3) which indicates a high level of authority, community members only generated scores of 0.07 and 0.2 for each of those same institutions (Table 4.2). These discrepancies stem from focus groups most commonly suggesting that these tiers of regional governance have no responsibility in firewood

regulation, while the leaders emphasised their role in arresting transgressors and in making the firewood laws.

4. 4. 6. Cottondale

In Cottondale, there was complete consensus as to the order of importance of institutions involved in firewood regulation where all community focus groups ranked the chief and the *nduna* as the first and second most important institutions. Such agreement generated mean rank scores for the chief and the *nduna* that were the highest across all villages at 9.0 and 8.0, respectively (Table 4.6). In this village, it appears that other institutions such as the CDF and the Civic Association are not involved in firewood management whatsoever as they were either only ranked in single instances or not at all.

Regarding the roles of the different regulatory institutions, the chief is seen as the highest level in the governance hierarchy, where his role in creating laws and instructing lower authorities was emphasised far more in discussions than his directly executing those laws through fining or punishing. For example, while six focus groups mentioned that the role of the chief was to give laws to the *ndunas* or to create the laws, only three groups stated that his role was to issue fines to firewood transgressors. The chief was therefore seen more as an upper-level leader who conveys instructions and delegates responsibility to his lower level 'management' i.e. the *ndunas*, than the practical enforcer of the law. This perception of the chief's high-order duties was similarly expressed by the *nduna* who stated that he "answers to the chief who dictates what he should do". Following this, the village-level authority appeared far more active in the practical aspects of firewood regulation than the chief, being most commonly noted as fining lawbreakers (4), hosting tribal courts (3) and commanding actively patrolling firewood security (3).

The authority of the *nduna* and his patrolmen was also highlighted in talks around villagers who break the firewood laws. While every focus group mentioned the *nduna's* rangers in arresting transgressors, three focus groups also mentioned the chief's police, CDF and the Bushbuckridge Municipality in apprehending firewood criminals. In terms of issuing punishment, however, only the *nduna* was mentioned by all five focus groups. The *nduna's* active role in firewood regulation, under the instruction of the chief, was also reiterated by him being deemed the regulator of firewood laws by four focus groups and by him generating the highest 'responsibility' score of 0.91 compared to all other village *ndunas* (Table 4.2).

Therefore while the chief creates and conveys the laws to his lower level management, the *nduna* undertakes the practical aspects associated with keeping and maintaining those laws.

Although the roles of the chief and the *nduna* were uncontested by both leaders and community members, the roles of the other institutions were disputed and in some ways contradicted between these two groups. While the focus groups disregarded the roles of all the other institutions in firewood management by most commonly suggesting that they have 'no responsibility', the leaders challenged many of these opinions. For example, while the municipal government was most frequently described as having 'no responsibility' in firewood management by community members and hence generating a 'responsibility' score of 0.2 (Table 4.2), leaders suggested that municipal government officials run environmental education workshops and can also send lawbreakers to jail thereby assigning a 'responsibility' score of 0.61 (Table 4.3). Likewise, while community members described themselves most commonly as having 'no responsibility' (0.1 in Table 4.2), some leaders indicate that villagers patrol, actively educate future generations and follow the rules and are therefore in some ways actively responsible in firewood governance (0.44 in Table 4.3).

4. 5. Firewood regulation issues

The most important challenge to effective firewood governance, as noted by focus groups in both chieftaincies, was community members' non-compliance with and neglect of well-established firewood laws (Figure 4.12). Such disregard for the local rules was encapsulated in statements such as "they [the community] do know the laws but they keep breaking them' and 'lots of people break the law". Although some focus groups viewed such disobedience as insubordination where it is just "human nature to break the rules", a far more common perception was that villagers could not afford to buy permits and were therefore forced "to harvest [illegally] to survive". These constraints of poverty and unemployment were also emphasised in suggestions of households continuing to rely on firewood as a coping strategy because they are unable to pay for electricity or alternative energy sources. This issue, as stated in one younger male focus group, of "Everyone harvests. Electricity is expensive" was also shared as one of the most frequent responses by leaders in both chieftaincies (Figure 4.13).

Although many of the governance issues were cited fairly equally throughout discussions, the problem of ‘threats to security’ produced a statistically significant difference between the two chieftaincies ($p=0.007$). This problem of patrolling rangers being beaten, shot, threatened with bewitchment or having to face unwarranted aggressiveness appears to be a central concern in Amashangane villages, being raised nine times in group discussions, compared to Mnisi, where such violence to security was not mentioned at all (Figure 4.12). Interestingly, however, although Mnisi community members appear unaware of the intimidation and hostility towards patrolmen, it was the third most common issue raised by Mnisi leaders (4) (Figure 4.13). Another intriguing discrepancy between Mnisi community members and their leaders related to suggestions of discord between village leaders and their communities, where issues of bribery, corruption, nepotism and lack of trust were collectively mentioned six times in village talks, but were completely omitted in leadership answers (Figure 4.12, Figure 4.13).

Other governance issues including ‘limited security’ and ‘unpaid fines’, although not significantly different, were all notably higher in Mnisi focus group answers than in Amashangane (Figure 4.12) indicating possible difficulties around governance resources and consequent law enforcement.

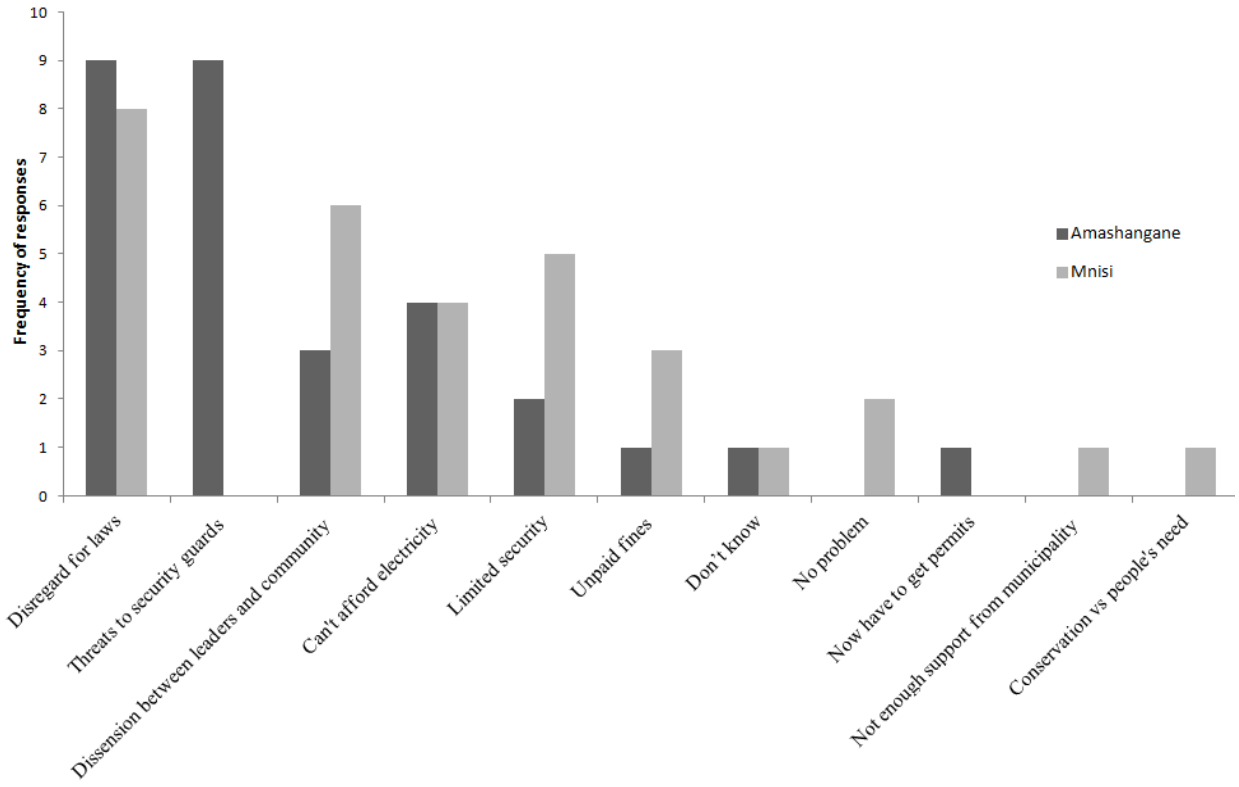


Figure 4.12. Frequency of firewood governance issues raised in focus groups (n=15) between two chieftaincies.

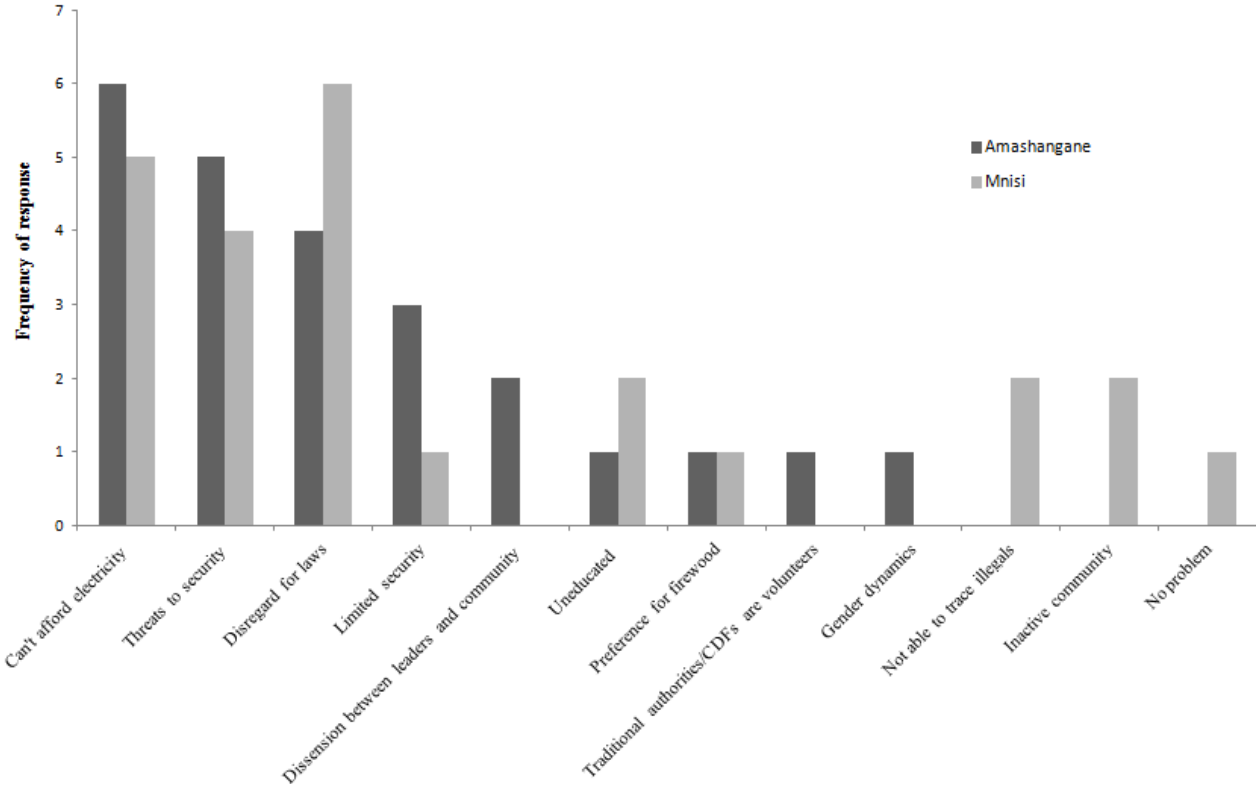


Figure 4.13. Frequency of firewood governance issues raised by leaders (n=15) between two chieftaincies.

4. 6. Solutions to prevent over-harvesting

When asked to suggest how local over-harvesting could be prevented in the future, 28 of the 30 focus groups mentioned making electricity a more affordable and/or a more accessible energy source. In line with the recurring theme of poverty-induced firewood use, suggestions of job creation, higher salaries and income-generating projects dominated discussions both in Mnisi and in Amashangane (Figure 4.14). Statements such as "if people have jobs then they'll stop going out into the field" and "increased salaries [..] help pay for electricity", as shared in two focus groups, reiterate community's perceptions that increased household incomes will reduce firewood dependence and associated harvesting. Similarly, the provision of free or cheaper electricity was the second most commonly cited solution in both chieftaincies; however, it was particularly emphasised in Amashangane groups where it was collectively mentioned ten times (Figure 4.14). 'More security', which refers to suggestions of increased numbers of *nduna* or chief's police as well as extended working hours for patrolling, was also a possible solution equally mentioned in both chieftaincies (Table 4.14).

The analysis of the other less frequently cited responses reveals subtle yet important differences between the chieftaincy focus groups in terms of their perceptions around curbing over-harvesting. For example, in Amashangane the emphasis placed on increasing the supply of electricity complements other responses in this chieftaincy that aim to improve the access to alternative energy sources. Responses, such as 'greater provision and use of paraffin' and 'greater provision and use of charcoal', mentioned four and two times, respectively (Figure 4.14), seem to indicate a desire to move away from firewood use altogether in these Amashangane communities. In contrast, Mnisi respondents appear to favour firewood harvesting over electricity, but highlight the need for more regulated systems, be it through "increased law enforcement", "erected fences" or "greater education for the community" in terms of harvesting techniques (Figure 4.14).

Interestingly, these differences are reinforced by the responses provided by the leaders of the different chieftaincies. Therefore, while Amashangane leaders repeatedly mentioned greater employment and income as well as greater electricity resources as aiding firewood sustainability, Mnisi leaders emphasised the role of increased law enforcement and greater security as the primary measures to safeguard against over-exploitation (Figure 4.15).

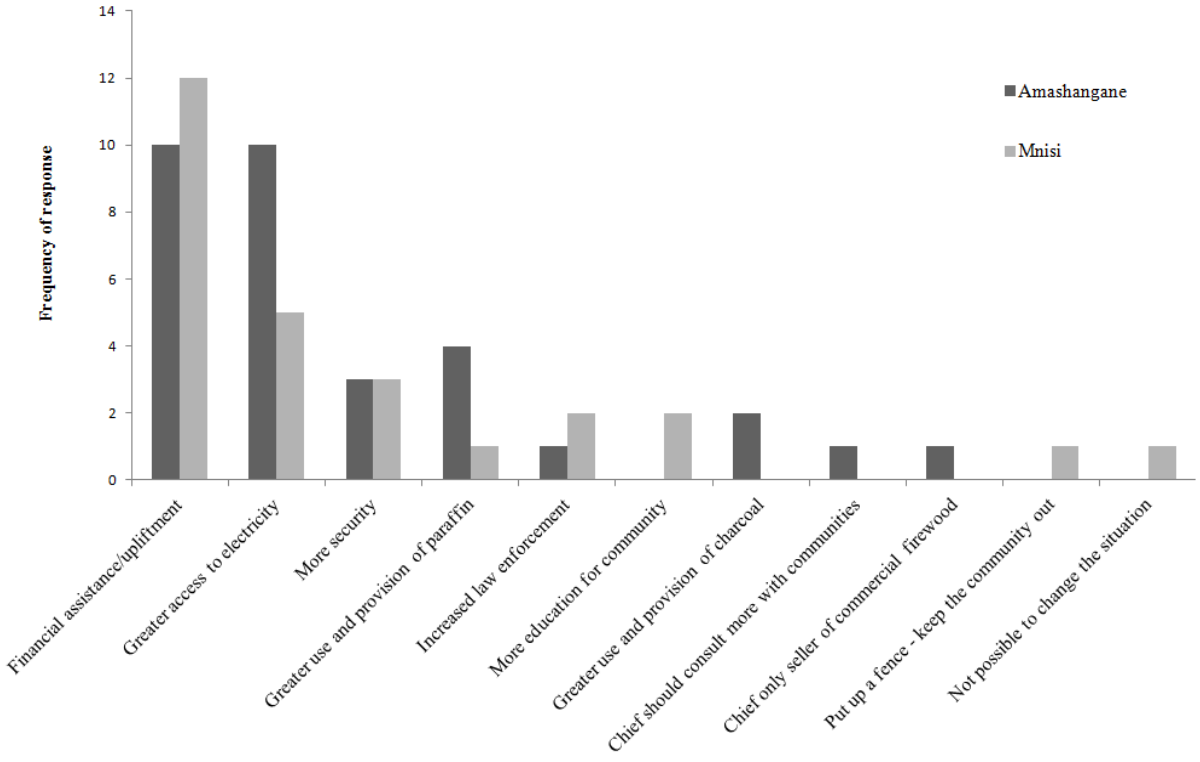


Figure 4.14. Ways to prevent firewood over-harvesting by focus groups (n=15) in two chieftaincies.

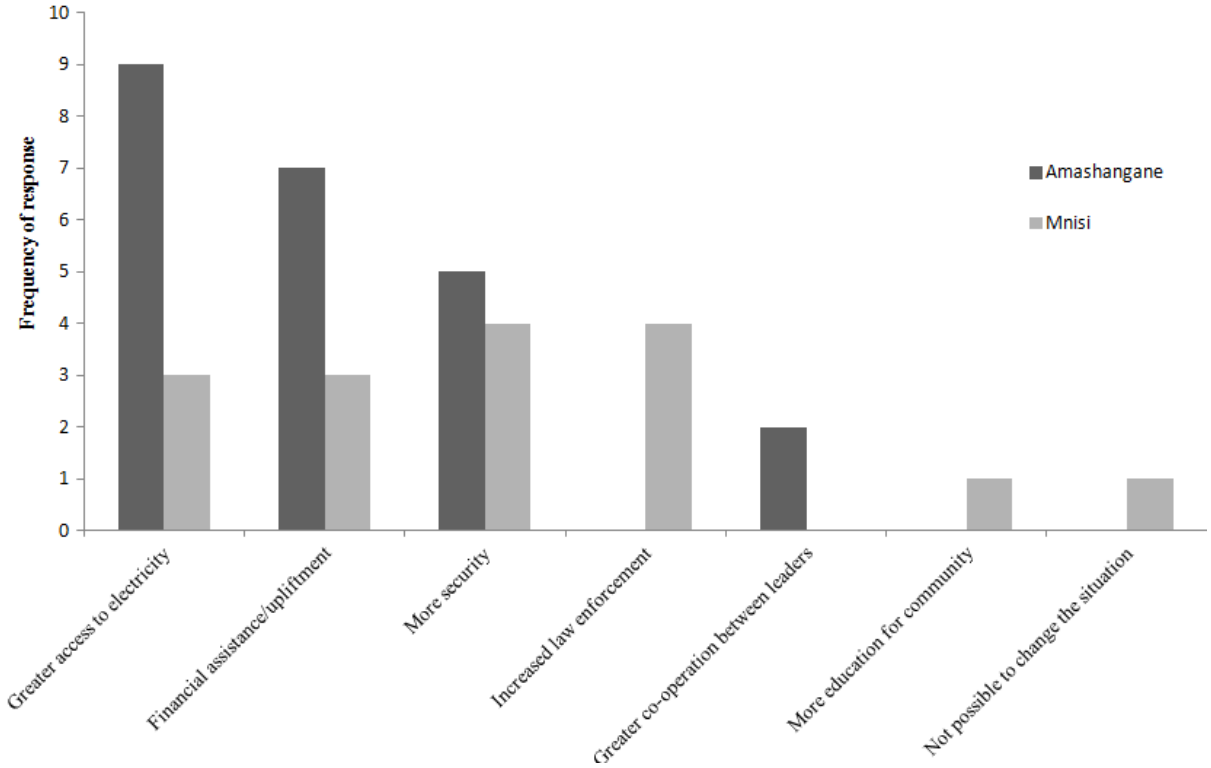


Figure 4.15. Ways to prevent firewood over-harvesting as suggested by leaders in two chieftaincies.

5 DISCUSSION

5. 1. Overview

In this study, I set out to investigate the perceived state and availability of local firewood stocks and the roles of various institutions involved in the regulation of such firewood harvesting and use. I compared perceptions of leaders and community members in three villages in each of two neighbouring chieftaincies. I start the discussion below by considering the patterns and prevalence of firewood use in the study area, and the drivers of these. I then discuss the perceptions of community members and leaders around firewood availability and how this has changed over the past 20 years. This section also considers the possible drivers of the perceived resource shortages and thereby provides some context to the circumstances around firewood harvesting in the region. This then leads into the next section which focuses on resource management and governance. Here, I discuss the different systems of firewood regulation, their varying degrees of active implementation and the possible reasons why these differences in system functioning exist. A common theme throughout the discussion is the heterogeneity in patterns of use, availability and governance, despite the close proximity of villages, as well as differences in perceptions, sometimes conflicting, concerning these. I end with a summary of key policy implications and recommendations.

5. 2. Firewood use

Firewood remains an extensively used energy commodity in rural Bushbuckridge, where estimates of village use exceed ~80%, as seen both in this study and elsewhere (Dovie *et al.*, 2004; Giannecchini *et al.*, 2007; Kirkland *et al.*, 2007; Madubansi and Shackleton, 2007; Makhado *et al.*, 2009). These values also reflect the high degrees of firewood use typical of other developing countries, including Tanzania (Luoga *et al.*, 2000), Mozambique (Brouwer and Falcão, 2004) and Malawi (Brouwer *et al.*, 1997). The high level of firewood consumption continues despite the rapid electrification programme implemented by the national government that saw 75% of households have access to electricity in 2009 (Department of Energy, 2009). Suggestions from respondents indicate that firewood dependence persists primarily because of electricity-related expenses, where a household's access to electricity does not necessarily translate into their being able to afford it. As such, although the majority of rural households use electricity for some domestic purposes, such lighting, the bulk of their energy-intensive needs are mostly met with a combination of other

less expensive fuels, including paraffin and firewood (Davis, 1998; Madubansi and Shackleton, 2006). These findings corroborate those of other studies where although most households were electrified, their degree of electricity use was constrained by the high monthly electricity fees and the expensiveness of electrical appliances (Davis, 1998; White *et al.,* 1997; Madubansi and Shackleton, 2006).

The expenses associated with electricity, however, are not the only determinants of firewood use. For example, respondents from this study also indicated that 'it's tradition to use firewood', 'pap tastes better with firewood' and 'pap is cooked faster with firewood'. These views, also noted by Shackleton *et al.* (2007), highlight that for some households, their continued reliance stems from their partiality towards and preference for firewood rather than from an inability to afford other energy sources. Equally, some respondents mentioned that electricity sometimes 'cuts out' indefinitely and was hence seen as an unreliable fuel. These residents therefore consciously chose to use firewood instead of electricity as it was seen as a more dependable and consistent energy source.

These responses highlight that decisions around electricity consumption are complex, and are likely to vary across households, depending on their socio-economic status, size, and age and gender composition. These findings contribute to a growing body of knowledge that suggests that households consider a range of factors in their energy decisions and as such, the availability of additional energy sources, such as electricity, may not immediately or dramatically alter the ways in which families meet their energy needs (Davis, 1998; Dovie *et al.,* 2004; Heltberg, 2005; Madubansi and Shackleton, 2006; Shackleton *et al.*, 2007; Matsika *et al.,* 2013). It is therefore vital that strategies aimed at reducing local harvesting pressures consider factors other than electricity access alone (Shackleton *et al.,* 2007) as matters related to personal preferences or even the disadvantages of electricity are equally important in households' energy use decisions (Heltberg, 2005).

5. 3. Perceived availability of firewood

Firewood scarcity was a major concern among the respondents of this study. Most participants agreed not only that proximate firewood had decreased over the past twenty years, but also that firewood stocks would probably be inadequate to meet villagers' energy demands in the future. Although the idea of a regional 'firewood crisis' as suggested by Bembridge and Tarlton (1990) has been disputed (e.g. Banks *et al.,* 1996; Matsika *et al.,* 2012), concerns over the declining firewood levels have been voiced elsewhere in

Bushbuckridge (Dovie *et al.,* 2004; Kaschula *et al.,* 2005; Kirkland *et al.,* 2007; Madubansi and Shackleton, 2007). In a study conducted by Kirkland *et al.* (2007), 90% of the households interviewed in southern Bushbuckridge stated that local firewood was becoming notably scarce. Similarly, 63% of respondents in a study by Dovie *et al.* (2004) described the firewood supply around their Bushbuckridge village of Thorndale as insufficient. In other studies, the escalating scarcity in the region is evidenced by the greater travelling distances, longer collection times and greater proportion of households buying firewood (Andrew *et al.,* 2003; Giannecchini *et al.,* 2007; Kirkland *et al.,* 2007; Madubansi and Shackleton, 2007). In other parts of rural Africa, similar examples of deteriorating local firewood stocks have been noted (Cooke *et al.,* 2008). For instance, Mlambo and Huizing (2004) found that 76% and 93% of interviewed households in their two rural Zimbabwean study villages stated that they found it increasingly difficult to find and harvest firewood from within their village lands. Other studies, through photograph analysis or satellite imagery, show progressively degrading woodland condition near rural settlements, as has been seen in Tanzania (Luoga *et al.,* 2005), Malawi (Abbot and Homeward, 1999) and Burkina Faso (Ouedraogo *et al.,* 2010).

It is increasingly recognised that the degree of resource use and consequent exploitation is strongly context- and village-specific (e.g. Mlambo and Huizing, 2004; Cocks *et al.,* 2008; Matsika *et al.,* 2012). Nevertheless, this handful of examples highlights firstly that issues around sustainability of rural firewood extraction are not limited to South African communities, and secondly that the concerns around over-exploitation in this study site are widespread. In light of the heavy dependence described in the previous section, intervention measures are essential to prevent the possibility of further over-harvesting apparent here.

5. 4. Drivers of local firewood availability

5.4.1. Population size

The majority of respondents in this study deemed increased local populations as the primary cause of the diminished firewood stocks. It was believed that the notable upsurge in village populations had intensified the resource demand, accelerated deforestation and thereby reduced proximate firewood abundance. Although it is increasingly recognised that the relationship between population growth and wood extraction is multi-factorial and complex (Dovie *et al.,* 2004), population size remains a primary driver of absolute resource use (Leach and Mearns, 1988). In a region where municipal level statistics indicate that the population rose by 2.4% between 2001 and 2007 (Stats SA, 2008), and where firewood consumption

continues despite electrification (see previous section 5.2), it is unsurprising that population growth was viewed as the dominant cause of the perceived resource scarcity.

The impact of increased population size, however, is not restricted simply to increasing household firewood demands. Growing village populations also affect the supply of available firewood through the process of settlement and infrastructure expansion (Luoga *et al.,* 2002; Luoga *et al.,* 2005; Giannecchini *et al.,* 2007). This was noted as one of the leading causes of the firewood decline by community members in this study. Here, the clearing of land for agricultural and residential development not only reduces the availability of firewood-producing lands, but also intensifies the harvesting pressure on those ever-decreasing tracts of woodland (Matsika *et al.,* 2012). In a study conducted by Madubansi and Shackleton (2007), participants also suggested that the increase in gardens, homesteads and fields had made collecting firewood more difficult for them. Evidence of this population-driven expansion and associated decrease in firewood resources has been seen across the landscape, most notably in the last 50 years (Giannecchini *et al.,* 2007; Coetzer *et al.,* 2010; Matsika *et al.,* 2012). For example, Coetzer *et al.* (2010) reveal in their land-use analysis of the Kruger to Canyons Biosphere Reserve (K2C) that the settlements in their study region, and more specifically those of rural Bushbuckridge, had increased significantly between 1993 and 2006. Their results also show that the 'footprint' of human environmental impact had likewise increased and expanded outward from each of the villages over the research period (Coetzer *et al.,* 2010). Similarly, Giannecchini *et al.* (2007) show in their analysis of aerial photographs of three Bushbuckridge villages that the residential settlements had also grown exponentially over the 30-year study period while the communal woodland cover had correspondingly decreased. In both cases, the deteriorating woodland condition was attributed to the increased local population densities that had not only extended the residential village boundaries but had also amplified the local resource harvesting pressures (Giannecchini *et al.,* 2007; Coetzer *et al.,* 2010). These findings mirror results from other studies across the globe in which population-driven residential sprawl had negatively impacted on the state of surrounding forest and woodland ecosystems (e.g. Luoga *et al.,* 2005; Paré, 2008; Ouedraogo *et al.,* 2010).

Another aspect of village expansion thought to decrease firewood stocks and mentioned by respondents was that of general urban development, such as the installation of tarred roads. Although studies tracking the progress of such features in this area are lacking,

research conducted elsewhere in Africa show support for these suggestions (Monela *et al.*, 1993; Luoga *et al.*, 2002; Aabeyir *et al.*, 2011). For example, Luoga *et al.* (2002) found in their study of Eastern Tanzania that the establishment of the national highway had severely degraded the woodstocks adjacent to the road. The authors suggest that this new road provided a key location for the firewood trade, and as such, commercial harvesters collected and cut wood from the areas closest to this road-based market (Luoga *et al.*, 2002). Likewise, Mwavu and Witkowski (2008) suggest that the development of roads increases the accessibility of woodland products to any harvesters, and this, they argue, had stimulated the increase in the illegal harvesting of resource products in their Ugandan study site. It is therefore important to note that although the features of local infrastructure development are critical to stimulating both the local and national economy, they also have important implications for the sustainability and use of local natural resources (Luoga *et al.*, 2005).

Interestingly, although village expansion was one of the most commonly cited drivers of firewood scarcity by community members in this study, it was not mentioned by a single leader in either chieftaincy. This discrepancy in perceptions may stem from one of two factors. Firstly, the interviewed leaders, as currently employed individuals, are unlikely to fall into the lowest local economic bracket. As such, some studies suggest that they are more likely to buy electricity and/or to purchase firewood (Davis, 1998). Therefore these leaders may simply be unaware of the impact of residential sprawl and development on local firewood availability as they no longer harvest their own firewood. Secondly, the majority of the interviewed leaders were male. Much work across the developing world has shown strong gender differentiation in natural resource gathering, where the harvesting of firewood typically falls under the women's domestic portfolio (Brouwer *et al.*, 1997; Karekezi and Kithyoma, 2002; Dovie *et al.*, 2004). As such, these leaders may be unaware of the impact of village development as once again they rarely harvest firewood themselves.

5.4.2. Increased livewood harvesting

In Bushbuckridge, as with all socio-ecological systems, the observed firewood scarcity is brought about by more than just increased population size alone (Giannecchini *et al.*, 2007). Here, the population-driven shortages are amplified by the regional socio-economic and institutional context that has resulted in households being unable to transition to the use of alternative domestic fuels (Madubansi and Shackleton, 2006). As a result of their inability to switch exclusively to other energy sources and in response to the ever-dwindling firewood

stocks, an increasing number of households are engaging in different methods of firewood collection, which include the felling of live trees (Dovie *et al.*, 2004; Kirkland *et al.*, 2007; Madubansi and Shackleton, 2007) and the purchasing of firewood (Giannecchini *et al.*, 2007; Madubansi and Shackleton, 2007; Matsika *et al.*, 2013). Both of these activities have markedly increased in recent years despite local prohibitions (Kirkland *et al.*, 2007), and were noted in discussions as contributing to the perceived decrease in available firewood.

In surveys conducted elsewhere in Bushbuckridge, respondents showed similar concerns over the increased levels of live woodcutting and their associations with firewood scarcity. For example, 80% of participants in a study conducted by Kirkland *et al.* (2007) indicated that the main cause of the decline in firewood was the increase in live tree chopping by local residents. As apparent evidence of this, almost 50% of respondents in a survey conducted by Madubansi and Shackleton (2007) admitted to felling live trees for firewood. In other studies across rural Africa, similar increases in the propensity of rural households to harvest live trees have been noted, even where restrictions exist, and these are also largely in response to resource scarcity (Hartter and Ryan, 2010; MacKenzie *et al.*, 2012).

In much the same way, and as was repeatedly noted in this study's discussions, the commercial firewood trade is also considered a major contributor to local deteriorating firewood stocks. Here, as with domestic harvesting, the dearth of available deadwood presses most, if not all, commercial harvesters to cut live stems. However, while domestic harvesters continue to harvest only headloads or wheelbarrow-loads of wood, commercial harvesters are increasingly using vehicles to transport their harvested stock (Twine, 2005). As such, the volume of woodland resources being removed by any one commercial harvester is often far greater than that of a domestic counterpart. In addition, the extraction pressure is further augmented by the increasing number of harvesters engaging in the firewood trade. Many surveys both in South Africa and other African countries note how the trade of natural resources, such as firewood, has intensified in recent times, often in response to unemployment and persistent poverty (see Kayambazinthu *et al.*, 2003; Twine *et al.*, 2003b; Luoga *et al.*, 2005; Giannecchini *et al.*, 2007; Shackleton *et al.*, 2008; Aabeyir *et al.*, 2011).

Even though most instances of live tree harvesting are ascribed to the lack of available deadwood (see Williams and Shackleton, 2002; Dovie *et al.*, 2004; Kirkland *et al.*, 2007; Madubansi and Shackleton, 2007), the practice of live stem felling has been shown to worsen the condition of the woodlands. For example, the cutting of live stems has been shown to

decrease total wood availability (Matsika *et al.*, 2012), augment tree mortality rates (Luoga *et al.*, 2004), change woody population structure (Luoga *et al.*, 2004) and alter woodland species compositions (Shackleton, 1993; Matsika *et al.*, 2012). As such, these attempts at accessing firewood, although driven by deadwood shortages, are thought to contribute to the further degradation of the local firewood supply.

These cases above exemplify a cycle of firewood degradation where livewood harvesting, for both domestic and commercial purposes, is both a cause and a symptom of local deadwood scarcity (Wunder, 2000). Although it is recognised that often harvesters have no choice but to harvest live trees, the continuation of live tree chopping has the possible and indeed high likelihood of further decreasing the natural resource supply and rendering resource-dependent households further impoverished (Twine *et al.*, 2003b; Kirkland *et al.*, 2007). This cycle evinces the inter-dependence and inter-connectedness of social systems and the environments on which they rely, where changes to one feature ultimately feedback, directly or indirectly, to modify another (Twine, 2005; Liu *et al.*, 2007). This case, through its complexity, therefore adds support to suggestions by Colding and Folke (2001) who highlight that only by investigating, identifying and understanding all the social and ecological drivers in these multifaceted resource-use systems can one adequately develop appropriate and targeted conservation strategies that sustain both the environment and its dependents.

5.4.3. Weakened institutional control

Of particular interest to this study is that live wood harvesting, be it for domestic or commercial purposes, is in fact prohibited in the area (Kirkland *et al.*, 2007). Some studies conducted in Bushbuckridge have found that the institutional regulation and control of firewood use has deteriorated in recent years, and that this has, to some extent, allowed these practices of live tree chopping to continue and indeed escalate (Giannecchini *et al.*, 2007; Kirkland *et al.*, 2007). In this study, although the idea of 'eroded institutional control' was not explicitly cited as a cause of the dwindling firewood stocks, discussions around governance problems indicate that decreased traditional regulation and enforcement are important factors believed to be impeding effective harvesting management. For example, suggestions offered by respondents to prevent over-harvesting such as 'increased law enforcement' and 'more patrolling security' point to issues of reduced firewood governance. These diluted systems of local firewood regulation are widespread and are increasingly understood to be the product of a far more complex set of political, social and institutional

transformations that have taken place in recent times (Twine, 2005; Kirkland *et al.*, 2007). These issues and changes are central to this research and will therefore be discussed in more detail in the following section.

As can be seen here, socio-economic variables other than population size, including aspects of financial, social, cultural and institutional dynamics, act concurrently to mediate, alter or amplify the harvesting pressure on the natural resource base (Twine, 2005; Giannecchini *et al.*, 2007). Overall, these results echo those of other studies done in the region, as reviewed in the section above, where poverty and unemployment specifically, and weakened institutional control to some extent, have augmented the resource harvesting pressure on communal resources and in many cases worsened the state of available firewood.

5. 5. Local firewood management systems

5.5.1. Importance of traditional leaders over democratic structures

Across our rural research villages, there was little contestation that the chief, and traditional authorities in general, are the over-riding powers in firewood governance. This perception is evidenced in the consistency of responses across all six villages where the chief was repeatedly cited as the ultimate authority in firewood regulation, the primary implementer of firewood laws and, in most cases, the most important institution in firewood harvesting management. While the chief was seen as the highest institutional power, the local *ndunas* were also seen as important, but as village-level authorities, second-in-command to the chief. In contrast, the other governance structures, such as the CDF and the Civic Association, were consistently considered to either have no responsibility in firewood governance or to fall under the directive of one of the traditional leaders. From this, the bulk of responsibility in firewood governance is therefore understood to lie with traditional authorities rather than local democratic institutions, and these findings match numerous other examples seen throughout the developing world where traditional leaders, rather than modern governance structures, are the primary governors of natural resources (Kajembe *et al.*, 2003; Kayambazinthu *et al.*, 2003; Mukamuri *et al.*, 2003; Brown and Lassoie, 2010).

5.5.2. Systems of firewood governance at chieftaincy level

Within this broad appreciation for traditional authorities, different systems of firewood governance appear to be operating, specifically at a chieftaincy level. For example, in the Mnisi chieftaincy, the *ndunas* were regarded as highly important regulatory institutions with

the capacity to issue punishment and attempt to resolve firewood-related issues, and the CDF committees as active patrollers of the communal lands. In Amashangane, on the other hand, the *ndunas* were seen as intermediaries in firewood regulation with limited practical authority and the CDF being said to have 'no responsibility'. These subtle differences in the activities of different local institutions could reflect the different practical systems of firewood regulation instituted at a local level by the two different chiefs. This once again reiterates the role of traditional leaders, specifically the chief, in determining and establishing modes of natural resource regulation in the region.

5.5.3. Implementation of firewood governance systems at a village level

While these chieftaincy-level differences tend to indicate how firewood governance regimes are set at a regional scale, the extents to which these systems are implemented and enforced are seen at a village level. I argue that the degree of uniformity (or inconsistency) in community responses about the roles of different institutions reflects the degree of active firewood regulation. That is, if there are large discrepancies between leaders and community members in the perceived roles of different leadership groups, how effectively or actively are those roles and responsibilities being carried out?

For example, in three of the study communities, namely New Forest, MP Stream and Cottondale, the perceived roles of the different institutions were unambiguous and clear across all parties. Here, the homogeneous intra-village perceptions about the responsibilities of the leadership groups, specifically the *nduna*, suggest a well-recognised and equally well-established system of firewood governance. On the other hand, the irresolute responses from participants in Arthur Stone, Islington and Burlington as to whether the *nduna* can punish firewood transgressors or not and whether he can issue the required firewood permits or not suggests a lack of awareness by the community as to the practical and enforceable aspects of firewood regulation.

While some authors suggest that this uncertainty stems from general regional confusion over the role of traditional authorities where modern governance structures now exist (e.g. Twine *et al.*, 2003b), I posit that this ambiguity occurs at a village level and therefore reflects the nature of individual leadership and control exercised by the local *nduna* himself. Three lines of evidence support this hypothesis. Firstly, the level of confusion was highly localised where even villages within the same chieftaincy exhibited different levels of

ambiguity. Secondly, there was little contestation around the responsibilities of the local democratic institutions, namely the CDF and the Civic Association. Most of the uncertainty about institutional roles stemmed from discussions about the local *nduna's* role. Thirdly, there was no apparent tension or rivalry between the two sets of institutions (traditional and democratic) to indicate competition for control over firewood. Other studies highlight how conflict and competition between traditional institutions and their democratic counterparts often leads to ambiguity over their functional roles (Mukamuri *et al.*, 2003; Brown and Lassoie, 2010). In this case, all parties seem well-aware of the separate portfolios of the different leadership groups. As such, I posit that the inconsistencies noted in some discussions around the different institutional roles indicate a general weakening of authority and lack of enforcement by village-level headmen rather than from general community confusion.

5.5.4. General weakening of institutional control

Although these variations in responses point to village-specific levels of control, and thereby reinforce the notion of highly localised institutional functioning (King, 2005), other lines of evidence indicate a generalised disintegration of traditional control across all the study villages. For example, numerous respondents from both chieftaincies agreed that one of the most pressing governance issues in firewood management was villagers' increasing non-compliance with firewood laws. Where previously, harvesters were said to unequivocally observe the traditional rules and laws, most harvesters were now said to simply overlook these well-established firewood regulations to harvest as they pleased. These concerns are also reiterated in the numerous instances, as seen in section 5.4.3, in which the practice of live tree felling, although prohibited, was thought to have intensified in recent times. In the same way, while almost all respondents indicated that permission was required to harvest firewood and while most acknowledged the chief as the primary issuer of permits, there was no consensus as to the amount required to pay for the permit or what the permit authorises the holder to harvest. It is possible that these vague and incongruous responses, evident in both chieftaincies, indicate that very few, if any households, ever actually obtain permits or that leaders ever issue them.

These findings suggest a widespread attenuation of obedience to traditional firewood laws in these study villages. This persistent flouting of traditional regulations evidences the increasing powerlessness of traditional leaders against illegal firewood collection and

demonstrates the local weakening of institutional control, as noted in other literature (Twine *et al.*, 2003b; Giannecchini *et al.*, 2007; Kirkland *et al.*, 2007). It must be said, however, that these breaches of customary rules are not limited to South Africa (Campbell *et al.*, 2001). Across rural Africa, numerous studies demonstrate similar levels of insubordination by communities and reflect on the increasingly diluted systems of governance by historically well-respected tribal leaders. Mukamuri *et al.* (2003), for instance, describe how in some regions of rural Zimbabwe community members are increasingly contravening local harvesting laws, cutting previously sacred trees and thereby undermining the traditional systems of miombo woodland regulation. Such non-compliance to customary resource use rules has also been noted in Tanzania (Luoga *et al.*, 2005) and Mozambique (Bowen *et al.*, 2003).

Although it is critical to recognise situations of diminished local control, particularly in natural resource management, it is often even more crucial to recognise and understand what factors have lead to those changes in governance in order to develop suitable interventions (Kepe and Scoones, 1999). As such, the following section delves into the possible drivers of the weakened traditional control described above.

5.5.5. Drivers of weakening traditional resource control in Bushbuckridge

5.5.5.1. Poverty-driven use

A common theme throughout this study was that of poverty-driven firewood use. Here, lack of livelihood options, low employment prospects and high electricity prices have meant that for many, firewood remains a central feature of household subsistence and security (Madubansi and Shackleton, 2007). Leaders, more so than community members, cited this as one of the primary drivers of decreased firewood availability, where households, out of poverty, were left with no choice but to continue harvesting both live- and deadwood. In the same way, one of the most commonly cited governance issues by leaders (more so than community members) was that of residents' being unable to afford electricity and therefore having to carry on collecting firewood for energy. These observations indicate that these interviewed authorities see firewood dependence as a last resort for community members and that livewood harvesting, although proscribed, is believed to stem from desperation, necessity and poverty, rather than from malevolence. From this, some leaders gave the impression that they found themselves in a "catch-22" situation, where although acknowledging the laws and

proscriptions of livewood harvesting, also saw such unlawful behaviour as the result of residents having no other option but to harvest livewood in a firewood-scarce and poverty-stricken environment. These views are shared by Kirkland *et al.* (2007) who emphasise the role of poverty, unemployment and lack of alternatives in driving illegal firewood harvesting in their Bushbuckridge study villages. In the same way, 56% of the respondents in a study by Madubansi and Shackleton (2007) who admitted to cutting live trees attributed their actions to decreased local deadwood availability.

Given these perceptions, I argue that some leaders may be consciously choosing to overlook the illegal harvesting that has intensified across the landscape. Here, they may feel empathetic towards community members who, being unable to buy electricity, find themselves having to disobey customary rules in order to access a much-needed fuel source.

The decision of local leaders to turn a 'blind eye' is also seen in other parts of the world. For example, local leaders in certain regions of rural Zimbabwe, despite having the capacity and authority to detain firewood transgressors, are consciously choosing not to because they believe illegal harvesters are doing so out of livelihood destitution (Mukamuri *et al.,* 2003). Mukamuri *et al.* (2003) go on to suggest that 'it would appear that traditional leaders put the immediate needs of their people first, rather than the conservation of natural resources' (Mukamuri *et al.,* 2003, pp 40). In some of these study villages, this sympathy and consequent leniency may therefore be an important feature of the observed deterioration of local governance control.

5.5.5.2. Political self-interest

Although poverty-driven use may be an important factor influencing leaders' degree of law enforcement, another reason could be more closely related to that of leaders maintaining their social standing in the community. For instance, von Maltitz and Shackleton (2004) describe how in other areas of rural South Africa, traditional leaders are no longer enforcing local regulations as strictly or chastising lawbreakers as regularly out of fear of losing local votes to democratically-elected councillors. Here, competition for local support with newly emerging institutions has prompted tribal leaders to be more lenient on community transgressors, leading to an increasingly relaxed governance system (von Maltitz and Shackleton, 2004). In these villages, although this was never specifically highlighted by

respondents, it may also be an important factor producing the increasingly relaxed systems of firewood control.

5.5.5.3. Decreased financial capacity

Much of the South African literature highlights how the notable weakening of traditional resource control is closely related to the reduced financial support offered by the current government (Twine, 2005; Kirkland *et al.,* 2007). Previously, the Apartheid administration allocated funds to traditional leaders to hire patrolmen, secure tribal courts and thereby enforce resource harvesting laws. The institution of the new government in 1994, however, saw this funding significantly reduced, and this rendered traditional leaders largely incapable of maintaining the previous firewood governance systems (Twine, 2005; Kirkland *et al.,* 2007). In their study, Twine *et al.* (2003b) note that traditional authorities themselves asserted that one of the main factors making it progressively more difficult for them to implement resource laws was reduced government funding. These views of leaders with limited physical and financial capacities were also shared by respondents in this study in their suggestions of leaders' not having enough security to patrol the communal lands.

5.5.5.4. Decreased institutional respect

Another important governance issue raised in discussions was that of discord and dissension between community members and their leaders. That is, the bribery, corruption and nepotism exhibited by some of the village and regional leaders had created a sense of distrust between them and the communities they intend to govern. Interestingly, but unsurprisingly, these divisions were noted far more frequently with community members than with leaders in either of the chieftaincies. Although these differences in responses may stem from leaders not actually participating in corrupt activities and therefore not citing them, the pervasiveness of community responses tends to indicate that these dishonest dealings were well-known and widespread. Other instances of corruption in natural resource management have been seen in South Africa (Klitgaard, 1993; Twine *et al.,* 2003b; Kirkland *et al.,* 2007) and elsewhere in Africa (Mukamuri *et al.,* 2003; Oyono *et al.* 2006).

While perceived poverty-driven use or decreased fiscal resources may influence the degree to which leaders enforce the laws, this aforementioned deterioration in institutional respect and trust may influence the degree to which villagers obey leaders' commands and regulations. In this study, concerns over intensified commercial harvesting as well as the

increased aggressiveness of residents towards patrolling security may evince this. Specifically, the chief's local patrolmen were said to be faced with increasing threats of violence and hostility from firewood harvesters. While this could indicate some level of desperation for firewood access on the part of the harvester, it could also point to the reduced respect that harvesters have for their leaders and their representatives. These responses of aggression could signify the underlying social tensions that exist between community members and their leaders. Support for this hypothesis is seen in Malawi and Zimbabwe where Kayambazinthu *et al.* (2003) suggest that powerful commercial harvesters increasingly flout the traditional rules around natural resource use because of the reduced legitimacy that harvesters associate with their local leaders.

In South Africa, this mistrust may also be compounded by the tribal leaders' historical associations with the apartheid government (Kepe and Scoones, 1999). King (2005) highlights that the Nationalist government, in their establishment of the South African homeland system, chose and employed various chiefs, legitimate or otherwise, as overseers of local-level issues. These chiefs were richly rewarded for their role in the implementation of homeland regulation and were therefore seen as pawns and institutional accessories to apartheid rule (Kepe and Scoones, 1999; Cousins *et al.,* 2007). As such, the abolishment of Apartheid in 1994 saw large segments of the rural population, particularly the youth, deny the authority of these leaders as many thought that democracy would bring an end to this tribal and corrupt sovereignty (King, 2005). The regime of traditional leaders has, however, for the most part continued in many parts of the country. Despite this, or perhaps because of this, traditional authorities have been seen as increasingly illegitimate institutions by some communities (Kepe and Scoones, 1999; von Maltitz and Shackleton, 2004; King, 2005). Studies from around South Africa demonstrate this decline in the perceived legitimacy and authority of traditional leaders (Kepe and Scoones, 1999; Twine *et al.*, 2003b; Kirkland *et al.*, 2007). It is therefore very possible that the friction between community members and their leaders in these study villages is also augmented by the leaders' historical associations with the Apartheid government. This mistrust, although oblique, therefore cannot be overlooked as a possible contributing factor to the increased rebellion and flouting of firewood harvesting laws in the region. It must be said, however, that these misgivings between community members and tribal leaders are highly context-specific, where in some villages, residents continue to hold their traditional chiefs in high esteem (von Maltitz and Shackleton, 2004).

Future work into the exact nature of the relationship between local leaders and their communities would be required to unpack the extent to which such insubordination and distrust occurs within each village.

5.5.5.5. Summary of the drivers seen in this study

The findings described above have significant implications for firewood management. Where previously, it was accepted that traditional authorities could not enforce the resource harvesting laws because of certain exogenous factors, such as their reduced financial capacity and weakened social legitimacy, these results suggest that weakened resource control may in some cases stem from the leaders' own deliberate reduced implementation. Here, leaders may be voluntarily withholding harsh enforcement, to some degree, for both reasons of compassion and for reasons of political self-interest. Either way, Abbot and Mace (1999) suggest that this decline in law enforcement perpetuates a cycle of unsustainable woodland use where leaders' failing to implement governance systems or to patrol the lands influences the community's pattern of resource collection, specifically resulting in increased illegal firewood collection. As such, this decline in authority, regardless of the cause, may stimulate the open flouting of laws which further undermines leadership authority. It is this cycle of disobedience and institutional collapse that some authors consider the basis for the 'open access' nature of communal land systems observed in much of rural Southern Africa (Jones, 1999; Luoga *et al.,* 2005). In order to prevent the continuation of this cycle, resource use plans need to focus not only on providing strengthened institutional and financial support, but also in exploring different avenues of intervention in which leaders may be more willing to regulate firewood harvesting more effectively.

5.5.6. Other drivers of weakened institutional control

Other studies examining traditional institutions attribute community non-compliance and reduced local resource control to one of the following: (1) emergence of modern democratic governance structures, (2) immigration and (3) modernisation. Although none of these factors were explicitly stated or seen in the results of this study, they have also possibly affected, to some extent, the resource management in these study villages. As such, they will be briefly examined in the following section.

5.5.6.1. Emergence of modern institutions

The establishment of local modern governance institutions, frequently at the behest of national government, has often been found to blur the legitimacy of traditional leaders in the eyes of local communities (Wills, 1998). Here, the authority and functional roles of tribal institutions become unclear as these 'new' organisations attempt to take over and often compete with traditional leaders for the power to regulate natural resource use. Although in some cases, these parallel institutions govern the communal resources jointly (Kajembe and Kessy, 2000), more commonly the lack of defined responsibility and authority results in conflict, institutional uncertainty and ultimately ineffective governance between these two different sets of leaders. Examples of this friction and confusion have been seen across the developing world, including in Cameroon (Brown and Lassoie, 2010), Mozambique (Clover and Eriksen, 2009), Zimbabwe (Mukamuri *et al.,* 2003), Malawi (Kayambaxinthu *et al.,* 2003) and South Africa (Twine *et al.,* 2003b; Kirkland *et al.,* 2007).

In this study, and contrary to expectation, the functional roles of the traditional leaders and local democratic structures appear to be generally quite well-defined. That is, while the portfolios of the CDF, and to a lesser degree the Civic Association, were thought to be closely associated with issues of service delivery and community development, the roles of the traditional leaders were always directly linked to natural resource matters, and more specifically firewood governance. Interestingly, although the cited responsibilities of the democratic institutions were consistently minor in importance to those of traditional authorities, the leaders mentioned far more frequently (than community members) the role of the CDF in patrolling the communal lands. This incongruity may stem from the fact that three of the interviewed leaders were CDF members and they may have been simply trying to 'paint a better picture' of the activities of their organisation for the interviewer. Despite this small discrepancy, leaders, both CDF and non-CDF, recognised that this organisation's jurisdiction did extend beyond the possibility of simple patrolling. As such, the emergence of modern institutional structures appears to have had little impact on the perceived functional roles of traditional authorities in these villages.

Having said this, however, the possibility of such conflict between leader groups occurring in the future is not unprecedented. Kepe and Scoones (1999) emphasise that the ways in which institutions interact are dynamic rather than static, and that these relationships change in response to other external social, economic and political drivers. As such, friction

and tensions have the potential to arise in the future, and therefore policy-makers should aim to verify and legitimatise these different institutional roles in natural resource management.

5.5.6.2. Immigration

In-migration has also been shown to impact the legitimacy of traditional institutions, where respect for local cultural customs and practices is diluted by the influx of foreigners with alternative belief systems and traditions (Kayambazinthu *et al.,* 2003; Leach *et al.,* 2003). Here, the authority of traditional leaders is weakened by the heterogeneity of cultural values, where new residents may choose to align themselves with different institutional powers and not necessarily with traditional authorities and their regulations (Kayambazinthu *et al.,* 2003; Kaschula *et al.,* 2005). Evidence of such decline in authority (in response to immigration) has also been noted in Zimbabwe (Mukamuri *et al.,* 2003) and Burkina Faso (Gray, 2002).

In the context of Bushbuckridge, the influx of Mozambicans in the 1980s may have played a role in tempering locals' adherence to customary laws and practices. However, the impact of this massive in-migration was probably felt more acutely in the exceptionally high population densities that emerged as a result of between 250 000-300 000 Mozambicans (Schatz, 2009) arriving in the region. Here, the resultant intensified population pressure is more likely to have been the driver of increased illegal poverty-based harvesting and reduced institutional control than the possible dilution of local cultural customs.

5.5.6.3. Modernisation

In a similar way, modernisation has also been shown to undermine the legitimacy and authority associated with local traditional leaders (Campbell *et al.,* 2001; Kayambazinthu *et al.,* 2003; Mukamuri *et al.,* 2003*).* For example, both Mukamuri *et al.* (2003) and Campbell *et al.* (2001) describe how modernisation and the associated upsurge in individualistic ideals in some areas of Zimbabwe have driven households to pursue resource collection strategies that violate customary natural resource laws. Mukamuri *et al.* (2003) go on to suggest that this widespread defiance of well-established community norms and values, specifically those associated with the commercialisation and trade of natural products, signifies a progressively reduced respect for and control by traditional institutions in those same Zimbabwean districts. Similarly, Wilfred *et al.* (2007) in their study of rural Tanzania found that modernisation had diluted the importance of certain traditional beliefs and rites in the local younger generations. The authors suggest that this deterioration of cultural practices had contributed to the decline

of regional forests, particularly those associated with traditional rituals (Wilfred *et al.*, 2007). In these cases, the traditional community-centred conventions of resource harvesting are increasingly lost as households pursue, often poverty-driven, more individualistic strategies that mimic those of the Western world (Mukamuri *et al.*, 2003). As globalisation and infrastructure development in these rural areas continue, the impacts of modernisation on cultural customs and resource use are likely to follow suit.

The discussion above reinforces the notion that these firewood harvesting systems, and socio-ecological systems in general, are (1) complex and intricate, (2) are governed by multiple interacting feedbacks that vary through space and time, (3) are context-specific and (4) are shaped equally by socio-economic features and environmental processes (Liu *et al.*, 2007). Therefore in order to develop suitable intervention measures and prevent further over-harvesting, all these aforementioned aspects of the system need to be considered. Following this, the policy recommendations outlined below attempt to mirror the multi-faceted nature of these systems and hence multiple solutions at all scales and in all forms are proposed.

6 POLICY RECOMMENDATIONS AND CONCLUSION

6. 1. Overview

This study confirms firstly that rural firewood dependence continues primarily because of poverty and lack of access to affordable energy alternatives. As such, to reduce the demand for firewood and thereby curb its seemingly inevitable over-harvesting, policy and national strategies need to target issues around the affordability of alternative fuel sources, such as electricity and solar power. Policy-makers also need to consider the provisioning of technologies or mechanisms, such as fuel-efficient stoves, that also could reduce the absolute demand for firewood.

Secondly, regardless of the strategies proposed above, and in light of Eskom's approved annual price hikes, firewood dependence is likely to continue into at least the medium-term. As such, policy-makers need to develop, implement and promote sustainable harvesting strategies that allow for the continued use of firewood while still ensuring the long-term supply of the wood resource. These options may include managed coppice plans or rotational harvesting programmes. In some villages, the possibility of tree planting, specifically for firewood, may also be considered. Another strategy could involve the distribution of timber offcuts or surpluses from plantations to resource-dependent communities.

Finally, the results of this study show that weakened law enforcement, be it deliberate or involuntary, and reduced social legitimacy of local leaders have contributed to the eroded resource control in the study villages. Pagdee *et al.* (2006) describe how the success of any natural resource management programme rests on the effectiveness of local institutions to implement those strategies. As such, suggestions of how such local institutional control can be re-established and strengthened are provided below.

6. 2. Reduce demand for firewood

6. 2. 1. Increase access and affordability of electricity

The rapid roll-out electrification programme, although successful in connecting vast portions of the population to the national electricity grid, has not had the significant impact on firewood demand that had been anticipated (Madubansi and Shackleton, 2007). It was

expected that increased access to alternative energies, such as electricity, would reduce dependence on firewood. However, the expensiveness of this 'modern' energy fuel in conjunction with limited household financial resources has meant that for much of the rural population, electricity is used only for lighting and entertainment while firewood remains used for the energy-intensive activities such as cooking (Howells *et al.,* 2005). Therefore, despite widespread access to electricity, the uptake of this alternative fuel has been constrained largely by its affordability in much of the rural population (Williams and Shackleton, 2002).

Following this, it is unsurprising that most study respondents suggested that the only way to prevent further exploitation of firewood is through financial aid or decreased electricity prices. The assumption here is that higher household incomes and/or reduced electricity tariffs would allow households to rely more heavily on electricity for all their energy needs, including cooking, which would in turn alleviate their dependence on firewood. These solutions have also been offered by participants in studies conducted elsewhere in the region (Kirkland *et al.,* 2007; Madubansi and Shackleton, 2007). Although the idea of reduced electricity prices provides an 'easy' solution to the complex problem of firewood use, in light of Eskom's accepted price hikes of 16% from 2012 (Eskom, 2013), such an approach seems highly unlikely in South Africa. While efforts to stimulate rural economic growth should not be overlooked (von Maltitz and Shackleton, 2004; Kirkland *et al.,* 2007), policy-makers should also focus on other ways in which the rural and urban poor could be assisted to cope with the high expenses associated with electricity.

6. 2. 2. Increase Free Basic Electricity

One such option could be to increase the Free Basic Electricity (FBE) allowances. Currently, the government subsidises 50 kWh per household per month (RSA, 2003; Madubansi and Shackleton, 2006). The high energy requirements of electrical cooking appliances, such as stoves, however, means that the energy subsidy fails to meet all the thermal needs of the household. With poverty and unemployment widespread in these regions, many households can't pay for additional electricity (over and above the allowance) and they therefore turn to firewood as a fuel source, particularly towards the end of each month (Shackleton *et al.,* 2007*).* The government should therefore earnestly consider increasing the allotted Free Basic Electricity allowance, such that the subsidy covers all household thermal and cooking requirements. This option, although calling for thorough research into how much more

household electricity is needed and how much could be realistically funded, might prove invaluable in reducing much of the firewood demand made by poor electrified households.

6. 2. 3. Increase energy grants

In the case above, the assumption is that all households are connected to the electricity grid. It is estimated, however, that in 2010 up to 25% of households in South Africa remained without electricity (Eskom, 2013). As an alternative to Free Basic Electricity, the government should also consider another means-based energy grant in which households can choose and buy the fuels most affordable and convenient to them (Howells *et al.*, 2006; Shackleton *et al.*, 2007). With this option, grant-receiving households are not limited to using only electricity and this therefore allows them the opportunity to use fuels with which they feel more familiar and comfortable, such as paraffin or gas. This comes in light of suggestions by Dovie *et al.* (2004) who emphasise that for some rural households, the pressure of having to use electricity is a burden rather than an improvement to their living circumstances. Once again, research based on extensive local consultation and participation would be required to assess the feasibility of this option and to see which fuels would continue to be consumed. For instance, if firewood was found to be the fuel of preference for households, even with a basic energy grant, then policy-makers would need to recognise and re-evaluate this in terms of the strategy's objectives of attempting to reduce firewood use.

6. 2. 4. Access to other energies

Another mechanism that has been widely suggested to reduce local firewood demands is the installation of alternative sustainable energies, such as solar panels or geysers (Gustavsson and Ellegård, 2004). These fuel sources may prove valuable in that they operate separately from the national electricity grid, they harness a resource abundant in Mpumalanga and they could play a role in skills development, training and job creation. However, the limited capacity of current solar-based systems means that the electricity generated is still only used for household lighting and entertainment. For example, in rural Ghana, Bawakyillenuo (2007) found that all interviewed households continued to use biomass fuels for cooking, regardless of whether they had a photovoltaic system or not. As such, the dissemination of solar energy systems to rural households now will do little to curb current firewood consumption. However, technological innovations and advances in the design and manufacture of solar

panels, batteries and stoves could make this a viable energy alternative for cooking in the future.

Another use of solar energy could be in the form of parabolic solar cookers (Kirkland *et al.,* 2007). Although this project holds promise in that it dramatically decreases the demand for firewood, and in some studies the use of solar cookers was widely accepted by respondents (Biermann *et al.,* 1999), it has yet to make major inroads into rural communities in Africa. Wentzel and Pouris (2007) suggest that this stems from the technology of the solar cookers and the dramatic changes that its implementation requires in the actual process of cooking. Nevertheless, the use of sustainable energy in this way needs to be explored further, where innovative marketing may make this option more culturally and socially attractive and thus feasible in the long-term.

6. 2. 5. Energy-efficient stoves

A final suggestion to reduce local firewood demands would be to implement measures and technologies that use firewood more economically. Williams and Shackleton (2002), among others, suggest that the provision and use of more energy-efficient low-cost wood stoves could prove useful in decreasing the absolute amounts of firewood consumed. Karekezi and Kithyoma (2002) also suggest that the use of more efficient stoves could improve overall household health and decrease respiratory ailments associated with firewood smoke.

Despite these benefits, the uptake of this technology has for the most part been unsuccessful in South Africa (Williams and Shackleton, 2002; Shackleton *et al.,* 2007). Here, the stoves, although firewood-based, failed to act as adequate substitutes for customary fires. It was found that fires not only contribute to daily cooking activities, but they also offer a culturally-significant familial meeting spot around which households gather to socialise. These social and cultural aspects of household life were lost with the introduction of these new stoves (Williams and Shackleton, 2002). In addition, these stoves used smaller pieces of wood which required extra chopping, and as an added time constraint, this acted as a deterrent to their use (Williams and Shackleton, 2002). Despite these failings, the employment of energy-efficient technologies needs to be explored further and developments in this arena could prove critical to the longevity of wood resources (Karekezi and Kithyoma, 2002).

6. 3. Increased firewood supply

6. 3. 1. Sustainable harvesting strategies

Although accelerated inter-fuel substitution or more efficient firewood use may prove vital in reducing firewood demands in the future, it is realistic to assume that firewood will remain a crucial energy source for much of the rural South African population in the medium- to long-term (Gandar, 1994; Karekezi and Kithyoma, 2002; Williams and Shackleton, 2002; Shackleton *et al.*, 2007*).* As such, it is essential that the adequacy of its supply is maintained at the local level into the foreseeable future. This necessitates the development and implementation of local harvesting strategies that allow for continued resource use but that ensure the supply of firewood into the future.

Previously, community firewood regulation systems in Bushbuckridge prohibited all livewood harvesting. However, the intense localised harvesting pressures and the lack of available deadwood both necessitate the employment of strategies that consider livewood harvesting as a means of households obtaining firewood. Research shows that if specific harvesting techniques are employed, the harvesting of live trees need not be unsustainable or environmentally harmful (Shackleton, 2001; Williams and Shackleton, 2002; Luoga *et al.*, 2004). For example, Shackleton (2001) demonstrates that if trees are chopped at certain heights or if only coppicing shoots are clipped, plant growth is stimulated and such regrowth can be harvested in the future. Similar results were found by Luoga *et al.* (2004) in their assessment of coppice regrowth in Tanzanian miombo woodlands. These authors therefore suggest that firewood management plans should incorporate and account for these beneficial characteristics of savanna tree growth. For example, a managed coppice plan could be implemented, where, under specific regulatory conditions, periods of coppice harvesting are interspersed with periods of coppice regrowth (Kaschula, 2003; Luoga *et al.*, 2004). In the same way, rotational harvesting systems could also take advantage of the natural process of vegetative regeneration, where tracts of communal land are set aside and are seasonally rotated between periods of harvesting and non-harvesting. Although more research into the specifics of coppice regrowth and harvesting regeneration is required, these strategies, if suitably and strictly enforced, could offer a means of sustainable firewood harvesting (Kaschula, 2003).

6. 3. 2. Community tree-planting strategies

Another approach suggested in the literature is that of widespread tree-planting. It has become clear in recent times that community woodlot initiatives, in which trees are grown in communal lands to act as sources of future firewood, are unsuccessful for a number of reasons. Competing land uses, weak institutional control and low collective responsibility are among the most important contributing factors to these project failures (Cernea, 1992). Nevertheless, tree planting strategies may prove critical to improving the local firewood supply. To overcome the challenges listed above, programmes should target individual households rather than continuing to use village commons (Williams and Shackleton, 2002). At this smaller scale, land tenure of homesteads and fields is more well-defined with well-established resource rights and clearly delineated boundaries. The degree of ownership also allows households to plant freely, with no conflict over which family derives the benefits. The implementation of this approach, however, requires substantial government input, where education, technical support and other tree-planting resources, such as water and seeds, would be ssential to the success of this type of intervention.

6. 3. 3. Improved supply of firewood from external sources

A final option to maintain community firewood stocks is through increased supplies from external sources (Shackleton *et al.,* 2007). Government incentives and increased co-ordination between communities, government and the private sector could stimulate the increased transferral of residual wood stocks from other activities, such as plantations or bush clearing, to communities for use as firewood. Although the type of tree species would need to be considered given community species preferences (Williams and Shackleton, 2002), the transfer of wood from a site where it's a nuisance to a site where it's a necessity may prove to be a win-win situation for both parties. Once again major government support would be required to improve the co-ordination between different groups and to develop and assess the actual system processes by which this wood would be transported and fairly distributed.

6. 4. More effective governance

The findings of this study confirm other observations of deteriorating resource control in the Bushbuckridge region, where both poverty and democracy have, in various ways, begun to undermine the legitimacy and functioning of traditional natural resource leaders (Lawes *et al.,* 2004). Swallow and Bromley (1995) emphasise that an element absolutely crucial to the

functioning of any common-property resource system are the authorities that implement laws and define the ways in which resources are used. Linked to this, policy-makers therefore need to strengthen and re-establish these weakening local institutions.

The results of this study indicate firstly that leaders may not be active in their role as firewood regulators because they see environmental sustainability as a trade-off to impoverished firewood-dependent households meeting their current energy needs. To combat this, the strategies described above (e.g. managed coppice and rotational harvesting) provide leaders with systems of regulation that in no way impede or deprive firewood users. Here, harvesters maintain access to their essential fuel source, while still ensuring its long-term supply. This change in harvesting programme may prompt more willingness from leaders to govern more effectively than what they had in recent years.

From this, government funding and technical support would also be essential in enabling leaders to regulate resource use. Through improved financial support, local leaders may be better equipped to co-ordinate and direct suitable firewood management programmes (such as those discussed above). The funds could be used to instate sufficient numbers of patrolmen to police the communal lands and arrest any lawbreakers. The money provided could also be used to research and develop village-specific harvesting rules and laws as well as to institute formal conflict resolution systems (Yeatman *et al.,* 2003). Each of these features, in and of themselves, enhances the legitimacy of such firewood governance systems and also helps define use and ownership rights. With established regulatory mechanisms in place, the resultant security of communal tenure would also generate a sense of responsibility and accountability among local harvesters. This acts as a robust incentive for positive resource management (Dovie *et al.,* 2004; Willis, 2004; Luoga *et al.,* 2005; Clover and Eriksen, 2009). Here, if residents are well-aware of the laws, the systems by which they are enforced and the consequences of disobedience, they are more likely to follow such rules and facilitate its implementation with other harvesters.

Additionally, the task of securing communal tenure may also require the re-establishment of physical boundaries between villages, perhaps through fencing, in order to curtail the increased unlawful harvesting of communal land resources by 'outsiders' (e.g. Twine *et al.,* 2003b). Although this has a number of other implications which would require more research to be fully understood, including the possibility of violence and conflict

(Yeatman *et al.*, 2003), Kajembe *et al.* (2003) reiterate that the establishment of boundaries is a crucial component of secure resource tenure and ownership in common-property systems.

Underlying all these issues of eroded institutional control are challenges around the legitimacy of local institutions. Bearing in mind the context-specific nature of institutional interactions, the results of this study highlight how traditional leaders, and specifically the chief, are still regarded as the central overseers of local firewood management systems. Although these results might prompt policy-makers to channel funding into the strengthening of these local tribal institutions, no enquiries into how well-suited or lawful communities perceive these leaders to be have been undertaken. In light of concerns over leaders' involvement in bribery, corruption and nepotism together with Adams *et al.* (2001) who remark that the effectiveness of institutional regulation is often directly linked to their perceived legitimacy in society, insights into communities' perspectives are essential. For example, the seemingly high regard for traditional leaders in this study may stem from historical legacy or perhaps even fear of retribution. The strengthening of these tribal authorities may therefore simply reinforce communities' non-compliance with local regulation systems. For example, Brown and Lassoie (2010) found in their Cameroon study that the election of local leaders without the contributions of community members saw the appointed leadership and their recently-instituted regulations completely ignored by those they were set to govern. As such, more in-depth analysis, essentially at village-level, is required to uncover which leadership group community members believe to be the most appropriate to manage natural resources. Von Maltitz and Shackleton (2004) suggest that this process may even involve the establishment of new institutional structures created specifically for a specific village or task, where both democratic and traditional leaders are deemed unsuitable. Although these processes will require major government effort and funding, from the running and organising of discussions to the support of firewood programmes, the centrality of firewood to rural energy security and the probability of its degradation necessitate these seemingly large-scale interventions (von Maltitz and Shackleton, 2004).

6. 5. Socio-ecological framework

Before any of these projects and policy interventions are undertaken, three issues need to be heavily considered.

6.5.1. Local participation

Firstly, the incorporation of local perspectives is pivotal to the success of any community-based natural resource management project (Berkes, 2003). Shackleton (2005) describes how although national policy remains informed by generalised patterns of cause-and-effect, an effective on-the-ground intervention requires the indepth understanding of the specifics of that one system. And, as suggested by Yeatman *et al.* (2003), such a complete grasp on the complexities of such a system can only be achieved through local community insights. The results here are indicative of this, where perspectives from multiple stakeholders provided important insight into the diverse factors affecting how and why firewood is used and governed in these study villages. As such, research involving, incorporating and absorbing local knowledge is essential to the development and implementation of appropriate firewood management strategies. In this case, further research into the roles of other less frequently-mentioned local and regional leaders, such as provincial conservation agencies, SANParks representatives and higher-order government officials might help triangulate and further clarify the regional governance systems in place.

6.5.2. Establishing linkages between different parties

Secondly, the multi-dimensional nature of this issue requires input from all sectors of society, government and academia to ensure that a full understanding of the complexities, constraints and opportunities associated with any intervention are identified. This necessitates increased co-ordination and integration of ideas, funds and experience both between on-the-ground organisations as well as between upper-level governance structures. Improved horizontal linkages at village level, such as between communal natural resource leaders and provincial conservation officials will prove critical in developing ecologically-sound management strategies. Here, the sharing of resources, knowledge, skills and capacity would allow for this improved collaboration. In the same way, strengthening vertical ties between village-level institutions and higher government departments will aid effective communication, resource provisioning and institutional support. This strengthened inter-institutional framework

therefore acts to bolster all efforts around local firewood regulation, thereby increasing its chances of success.

6.5.3. Engage with complexity

Finally, the complexity of these socio-ecological systems as well as the complexity of household energy use decisions needs to be considered in policy development. These features of rural resource-use are determined by a complex array of social, cultural, political, environmental and economic elements that interact in various ways to produce the outcomes seen above. As such, no single strategy could address the multi-dimensional nature of resource-use systems. These networks therefore call for the development of policy and local strategy that engage with such complexity and thereby offer solutions with holistic, multi-pronged approaches. These strategies also need to be malleable, dynamic and designed to undergo a continual process of adjustment and improvement as internal and external variables change and thereby affect the internal dynamics of these systems. Continuous research would prove invaluable to this endeavour.

6. 6. Conclusion

The results of this study add to the growing body of literature about the pervasive and intense dependence of some rural South African communities on firewood. Interestingly, while these results support the well-accepted notions of weakening local governance and their impact on firewood availability, they also shed new light on the possible causes of such eroded control. This new insight was only achieved by coupling community and leader perspectives, and it is therefore essential that future resource use studies incorporate these different perspectives to understand more fully the complexities of local issues. Although the resilience of local communities to external environmental pressures is well-appreciated, the urgency of the localised firewood shortages in these villages necessitates urgent and radical intervention. Policy-makers need to develop and implement strategies that reduce local demands, enhance supplies and aim to promote the sustainable use of firewood. All of these approaches need to take place within a framework of strengthened institutional support, enhanced funding and greater community participation in order to surmount the critical issues currently facing these resource-use systems and their governance. Without external intervention, the issues of energy security, rural poverty and livelihood vulnerability are unlikely to be addressed, and this spotlights the centrality of government support to any of these intervention programmes.

7 REFERENCE LIST

Aabeyir, R., Quaye-Ballard, J.A., van Leeuwen, L.M. and Oduro, W. 2011. Analysis of factors affecting sustainable commercial fuelwood collection in Dawadawa and Kunsu in Kintampo North District of Ghana. *The IIOAB Journal* 2(2): 44-54.

Abeyasekera, S. 2005. Quantitative analysis approaches to qualitative data: Why, when and how. University of Reading. pp 12.

Abbott, J.I.O. and Homewood, K. 1999. A history of change: causes of miombo woodland decline in a protected area in Malawi. *The Journal of Applied Ecology* 36: 422–433.

Abbot, J.I.O. and Mace, R. 1999. Managing protected woodlands: Fuelwood collection and law enforcement in Lake Malawi National Park. *Conservation Biology* 13(2): 418-421.

Adams, W. M., Brockington, D., Dyson, J., and Vira, B. 2001. *Common Choices: policy options for common pool resources*. Unpublished project discussion paper.

Anderies, J.M., Janssen, M.A. and Ostrom, E. 2004. A framework to analyze the robustness of social-ecological systems from an institutional perspective. *Ecology and Society* 9(1): 18-35.

Andrew, M., Ainslie, A., and Shackleton, C. 2003. *Land use and livelihoods*. Research report no. 8, Cape Town: Programme for Land and Agrarian Studies, University of the Western Cape. pp 42.

Arnold, J.E.M. 1994. *Non-farm employment in small-scale forest-based enterprises: Policy and environmental issues. Working Paper #11.* EPAT/MUCIA Research and Training, University of Wisconsin-Madison. pp 49.

Babulo, B., Muys, B., Nega, F., Tollens, E., Nyssen, J., Deckers, J. and Mathijs, E. 2008. Household livelihood strategies and forest dependence in the highlands of Tigray, Northern Ethiopia. *Agricultural Systems* 98:147-155.

Banks, D.I., Griffin, N., Shackleton, C.M., Shackleton, S.E. and Mavrandonis, J. 1996. Wood supply and demand around two rural settlements in a semi-arid savanna, South Africa. *Biomass and Bioenergy* 11: 319–331.

Barrett, C.B., Lee, D.R. and McPeak, J.G. 2005. Institutional arrangements for rural poverty reduction and resource conservation. *World Development* 33(2): 193-197.

Basedau, M. 2005. Context matters: Rethinking the resource curse in Sub-Saharan Africa. Global and Area Studies Working Paper No. 1. pp 46.

Bawakyillenuo, S. 2007. *Rural electrification in Ghana: Issues of Photovoltaic energy technology utilization.* PhD Thesis. University of Hull. pp 402.

Belcher, B., Ruiz-Pérez, M. and Achdiawan, R.I. 2005. Global patterns and trends in the use and management of commercial NTFPs: Implications for livelihoods and conservation. *World Development* 33(9): 1435-1452.

Bembridge, T. J., and Tarlton, J. E. 1990. Woodfuel in Ciskei: A headload study. *South African Forestry Journal.* 154(1): 88-93.

Berkes, F. 2003. Rethinking community-based conservation. *Conservation Biology* 18(3):621-630.

Biermann, E., Grupp, M. and Palmer, R. 1999. Solar cooker acceptance in South Africa: Results from a comparative field test. *Solar Energy* 66(6): 401-407.

Biggs, R., Bohensky, E., Desanker, P.V., Fabricius, C., Lynam, T., Misselhorn, A.A., Musvoto, C.,Mutale, M., Reyers, B., Scholes, R.J., Shikongo, S. and van Jaarsveld, A.S. 2004. Nature supporting people: the Southern African Millenium Ecosystem

Assessment. Integrated report. Council of Scientific and Industrial Research. Pretoria: South Africa.

Bob, U. and Banoo, I. 2002. Local institutions and sustainable land use management in land reform redistribution projects in rural Kwazulu-Natal. Papers from the International Symposium on Contested Resources: Challenges to the Governance of Natural Resources in Southern Africa. Programme for Land and Agrarian Studies (PLAAS). University of Western Cape.

Bowen, M.L., Chilundo, A. and Tique, C.A. 2003. Social differentiation, farming practices and environmental change in Mozambique. In: Bassey, T.J. and Crummey, D. (eds.) *African savannas: Global narratives and local knowledge of environmental change.* Oxford: James Currey. pp 225–247.

Bromley, D.W. and Cernea, M.M. 1989. *The management of common property resources: some conceptual and operational fallacies, World Bank Discussion Paper 57*. World Bank, Washington DC, USA.

Brouwer, R. and Falcão, M.P. 2004 Wood fuel consumption in Maputo, Mozambique. *Biomass and Bioenergy* 27: 233 – 245.

Brouwer, I.D., Hoorweg, J.C. and van Liere, M.J. 1997. When households run out of fuel: Responses of rural households to decreasing fuelwood availability, Ntcheu District, Malawi. *World Development* 25(2): 255-266.

Brown, H.C.P. and Lassoie, J.P. 2010. Institutional choice and local legitimacy in community-based forest management: Lessons from Cameroon. *Environmental Conservation* 37: 261-269.

Campbell, B. and Byron, N. 1996. Miombo woodlands and rural livelihoods: Options and opportunities. In: Campbell, B. (ed.) *The Miombo in transition: Woodlands and welfare in Africa.* Center for International Forestry Research. Bogor: Indonesia. pp 221- 230.

Campbell, B.M., Jeffrey, S., Kozanayi, W., Luckert, M., Mutamba, M. and Zindi, C. 2002. Household livelihoods in semi-arid regions: options and constraints. Center for International Forestry Research. Jakarta: Indonesia. pp 153.

Campbell, B., Mandondo, A., Nemarundwe, N., Sithole, B., De Jong, W., Luckert, M., and Matose, F. 2001. Challenges to proponents of common property resource systems: Despairing voices from the social forests of Zimbabwe. *World development*, *29*(4): 589-600.

Cavendish, W. and Campbell, B.M. 2011. Poverty, environmental income and rural inequality: A case study from Zimbabwe. . In: *Managing the miombo woodlands of Southern Africa: Policies, incentives and options for the rural poor.* Technical Annexes. The World Bank. PROFOR. pp 39-54.

Cernea, M. M. 1992. A sociological framework: policy, environment, and the social actors for tree planting. In: Sharma, N.P. (ed.) *Managing the world's forests: Looking for balance between conservation and development.* Kendall/Hunt Publishing Company: Iowa. pp. 301-335.

Clarke, J. and Grundy, I. M. 2004. The socio-economics of forest and woodland resource use: a hidden economy. In: Lawes, M.J., Eeley, H.A.C., Shackleton, C.M. and Geach, B.G.S. (eds.) *Indigenous forests and woodlands in South Africa: Policy, people and practice*. Scottsville: University of KwaZulu-Natal Press. pp 167-193.

Clover, J. and Eriksen, S. 2009. The effects of land tenure change on sustainability: human security and environmental change in southern African savannas. *Environmental Science and Policy* 12:53-70.

Cocks, M.L., Bangay, L., Shackleton, C.M. and Wiersum, K.F. 2008. 'Rich man poor man': Inter-household and community factors influencing the use of wild plant resources amongst rural households in South Africa. *International Journal of Sustainable Development and World Ecology* 15: 198–210.

Coetzer, K.L., Erasmus, B.F.N., Witkowski, E.T.F. and Bachoo, A.K. 2010. Land-cover change in the Kruger to Canyons Biosphere Reserve (1993– 2006): A first step towards creating a conservation plan for the subregion. *South African Journal of Science* 106(7/8). pp 10.

Colding, J. and Folke, C. 2001. Social taboos: "Invisible" systems of local resource management and biological conservation. *Ecological Applications 11*(2): 584-600.

Cooke, P., Köhlin, G. and Hyde, W.F. 2008. Fuelwood forests and community management evidence from household studies. *Environment and Development Economics* 13: 103-135.

Cousins, T., Pollard, S. and du Toit, D. 2007. Legislation in relation to land, water and natural resource governance in communal land in South Africa. Working Report for the Craigieburn Wetlands Governance Project. Acornhoek: AWARD. pp 17.

Crookes, D. 2003. The contribution of livelihood activities in the Limpopo Province: case study evidence from Makua and Manganeng. *Development southern Africa* 20: 143-159.

Davis, M.1998. Rural household energy consumption: the effects of access to electricity evidence from South Africa. *Energy Policy* 26: 207–217.

Department of Energy. 2009. Electrification Statistics. Department of Energy. Pretoria: South Africa. pp 36.

Dewees, P.A., Campbell, B.M., Katerere, Y.M., Sitoe, A., Cunningham, A.B., Angelsen, A. and Wunder, S. 2010. Managing the miombo woodlands of Southern Africa: Policies, incentives and options for the rural poor. *Journal of Natural Resources Policy Research* 2(1): 57-73.

Dovie, D.B.K., Shackleton, C.M. and Witkowski, E.T.F. 2002. Direct-use values of woodland resources consumed and traded in a South African village. *International Journal of Sustainable Development and World Ecology* 9: 269–283.

Dovie, D.B.K., Witkowski, E.T.F. and Shackleton, C.M. 2004. The fuelwood crisis in southern Africa – relating fuelwood use to livelihoods in a rural village. *GeoJournal* 60: 123–133.

Emanuel, P.L., Shackleton, C.M. and Baxter, J.S. 2005. Modelling the sustainable harvest of *Sclerocarya birrea* subsp. *caffra* fruits in the South African Lowveld. *Forest Ecology and Management* 214: 91–103.

Eskom. 2013. 'Tariffs and charges'. Accessed online 14-02-2013. http://www.eskom.co.za/c/53/tariffs-and-charges/

Ezzati, M. and Kammen, D.M. 2001. Indoor air pollution from biomass combustion and acute respiratory infections in Kenya: an exposure-response study. *Lancet* 358: 619–624.

Folke, C., Holling, C.S. and Perrings, C. 1996. Biological diversity, ecosystems and the human scale. *Ecological Applications* 6(4): 1018-1024.

Gandar, M.V. 1994. Status report on biomass resources, fuelwood demand and supply strategies in South Africa. A report for Biomass Initiative. Department of Mineral and Energy Affairs: Pretoria.

Giannecchini, M., Twine, W. and Vogel, C. 2007. Land-cover change and human–environment interactions in a rural cultural landscape in South Africa. *The Geographical Journal* 173(1): 26-42.

Goetz, A.M. 1995. Institutionalizing women's interests and accountability to women in development. *IDS Bulletin* 26(3): 1-10.

Gray, L.C. 2002. Environmental policy, land rights, and conflict: rethinking community natural resource management programs in Burkina Faso. *Environment and Planning D: Society and* 20: 167-182.

Griffin, N.J., Banks, D.I., Mavrandonis, J., Shackleton, C.M. and Shackleton, S.E., 1992. Household energy and wood use in a peripheral rural area of the eastern Transvaal lowveld. Department of Minerals and Energy Affairs, Pretoria.

Gustavsson, M. and Ellegård, A. 2004. The impacts of solar home systems on rural livelihoods. Experiences from the Nyimba Energy Service Company in Zambia. *Renewable Energy* 29: 1059-1072.

Hamilton, A.C. 2004. Medicinal plants, conservation and livelihoods. *Biodiversity and Conservation* 13: 1477–1517.

Hardin, G. 1968. Tragedy of the commons. *Science* 162: 1243–1248.

Hartter, J. and Ryan, S.J. 2010. Top-down or bottom-up?: Decentralization, natural resource management, and usufruct rights in the forests and wetlands of western Uganda. *Land Use Policy* 27(3): 815-826.

Hearn, G. and Pollet, E.A. 1993. Sabi Sand Pfunanani Project: An Integrated Conservation and Development Project. *INR Working Paper* No. 86. Institute of Natural Resources. Pietermaritzburg: South Africa. pp 88.

Hegde, R. and Bull, G. 2011. Socio-economics of miombo woodland resource use: A household level study of Mozambique. In: *Managing the miombo woodlands of Southern Africa: Policies, incentives and options for the rural poor.* Technical Annexes. The World Bank. PROFOR. pp 19-35.

Heltberg, R. 2005. Factors determining household fuel choice in Guatemala. *Environment and development economics* 10(3): 337-361.

Hoffman, M.T. and Todd, S. 2000. A national review of land degradation in South Africa: The influence of the biophysical and socio-economic factors. *Journal of Southern African Studies* 26(4): 743-758.

Howells, M.I., Alfstad, T., Victor, D.G., Goldstein, G. and Remme, U. 2005. A model of household energy services in a low-income rural African village. *Energy Policy* 33: 1833–1851.

Howells, M.I., Victor, D.G., Gaunt, T., Elias, R. and Alfstad, T. 2006. Beyond free electricity: The costs of electric cooking in poor households and a market-friendly alternative. *Energy Policy* 34: 3351-3358.

Hunter, L.M., Twine, W. and Patterson, L. 2007. "Locusts are now our beef": Adult mortality and household dietary use of local environmental resources in rural South Africa. *Scandinavian Journal of Public Health* 35(Suppl 69): 165–174.

Huntington, H.P. 2000. Using traditional ecological knowledge in science: Methods and applications. *Ecological Applications* 10(5): 1270–1274

IFAD. 2010. *Rural poverty report 2011*. Rome: International Fund for Agricultural Development.

Jones, B.T.B. 1999. *Community Management of Natural Resources in Namibia*. Issue Paper No. 90. International Institute for Environment and Development (IIED). London.

Jones, B.T.B. and M.W. Murphree. 2004. Community-Based Natural Resource Management as a conservation mechanism: Lessons and directions. In: Child, B. (ed.) *Parks in Transition: Biodiversity, Rural Development, and the Bottom Line*. London: Earthscan. pp. 63–103.

Kahn, K., Collinson, M.A., Gómez-Olivé, F.X, Mokoena, O., Twine, R., Mee, P., Afolabi, S.A, Clark, B.D, Kabudula, C.W., Khosa, A., Khoza, S., Shabangu, M.G., Silaule, B., Tibane, J.B., Wagner, R.G., Garenne, M.L., Clark, S.J. and Tollman, S.M. 2012. Profile: Agincourt Health and Socio-demographic Surveillance System. *International Journal of Epidemiology* 41: 988–1001.

Kaimowitz, D. 2003. Not by bread alone . . . forests and rural livelihoods in sub-Saharan Africa. In: Oksanan, T., Pajari, B. and Tuomasjukka, T. (eds.) *Forests in Poverty reduction strategies: capturing the potential*. Finland: EFI. pp 45–63.

Kajembe, G.C. and Kessy, J.F. 2000. Joint forest management in the Urumwa Forest Reserve, Tabora, Tanzania: A process in the making. In: Virtanen, P. and Nummelin, M. (eds.) Forests, chiefs and peasants in Africa: Local management of natural resources in Tanzania, Zimbabwe and Mozambique. *Silva Carelica* 34: 141-158.

Kajembe, G. C., Luoga, E. J., Kijazi, M. S. and Mwaipopo, C.S. 2003. The role of traditional institutions in the conservation of forest resources in East Usambara, Tanzania. *International Journal of Sustainable Development and World Ecology* 10(2): 101-107.

Karekezi, S. and Kithyoma, W. 2002. Renewable energy strategies for rural Africa: is a PV-led renewable energy strategy the right approach for providing modern energy to the rural poor of sub-Saharan Africa? *Energy Policy* 30: 1071–1086.

Kaschula, S. 2003. *Integrating indigenous and ecological perspectives on harvesting and coppice response of three savanna fuelwood species in the Limpopo Province.* MSc Research Report. University of the Witwatersrand: Johannesburg. pp 105.

Kaschula, S., Twine, W.C. and Scholes, M.C. 2005. The effect of catena position and stump characteristics on the coppice response of three Savanna fuelwood species. *Environmental Conservation* 32: 76–84.

Katz, E.G. 2000. Social capital and natural capital: A comparative analysis of land tenure and natural resource management in Guatemala. *Land Economics* 76(1): 114-132.

Kayambazinthu, D., Matose, F., Kajembe, G., and Nemarundwe, N. 2003. Institutional arrangements governing natural resource management of the Miombo woodland. In: Kowero, G., Campbell, B.M. and Sumaila, U.R. (eds.) *Policies and governance structures in woodlands of Southern Africa*. Center for International Forestry Research. Bogor: Indonesia. pp 45-64.

Kepe, T. and Scoones, I. 1999. Creating grasslands: Social institutions and environmental change in Mkambati area, South Africa. *Human Ecology* 27(1): 29-53.

King, B.H. 2005. Spaces of change: tribal authorities in the former KaNgwane homeland, South Africa. *Area* 37(1): 64–72.

Kirkland, T., Hunter, L.M. and Twine, W. 2007. ‘‘The bush is no more’’: Insights on institutional change and natural resource availability in rural South Africa. *Society and Natural Resources* 20:337–350.

Klitgaard, R. 1993. *Cultural variations and their importance: An empirical exploration.* Unpublished paper. University of Natal: Durban.

Kristensen, M. and Lykke, A.M. 2003. Informant-based valuation of use and conservation preferences of savanna trees in Burkina Faso. *Economic Botany* 57: 203-217.

Lawes, M.J., Eeley, H.A.C., Shackleton, C.M. and Geach, B.G.S. 2004. South African forests and woodlands: Recurring themes in integrating policy, people and practice. In: Lawes, M.J., Eeley, H.A.C., Shackleton, C.M. and Geach, B.G.S. (eds.) *Indigenous forests and woodlands in South Africa: Policy, people and practice*. Scottsville: University of KwaZulu-Natal Press. pp 815-831.

Leach, M. and Mearns, R. 1988. Beyond the woodfuel crisis: people, land and trees in Africa. Earthscan Publications: London.

Leach, M., Mearns, R. and Scoones, I. 1999. Environmental Entitlements: Dynamics and institutions in Community-Based Natural Resource Management. *World Development* 27(2): 225–247.

Liu, J., Dietz, T., Carpenter, S. R., Alberti, M., Folke, C., Moran, E. Pell, A.N., Deadman, P., Kratz, T., Lubchenco, J., Ostrom, E., Ouyang, Z., Provencher, W., Redman, C.L., Schneider, S.H. and Taylor, W.W. 2007. Complexity of coupled human and natural systems. S*cience* 317(5844): 1513-1516.

Lopez, R. 1998. The tragedy of the commons in Cote d'Ivoire agriculture: empirical evidence and implications for evaluating trade policies. *The World Bank Economic Review* 12(1): 105-131.

Luoga, E. J., Witkowski, E. T. F., and Balkwill, K. 2000. Subsistence use of wood products and shifting cultivation within a miombo woodland of eastern Tanzania, with some notes on commercial uses. *South African Journal of Botany* 66(1): 72-85.

Luoga, E.J., Witkowski, E.T.F. and Balkwill, K.. 2002. Harvested and standing wood stocks in protected and communal miombo woodlands of eastern Tanzania. *Forest Ecology and Management* 164: 15–30.

Luoga, E.F., Witkowski, E.T.F. and Balkwill, K. 2004. Regeneration by coppicing (resprouting) of miombo (African Savanna) trees in relation to land use. *Forest Ecology and Management* 189: 23–35.

Luoga, E.F., Witkowski, E.T.F. and Balkwill, K. 2005. Land cover and use changes in relation to the institutional framework and tenure of land and resources in eastern Tanzania miombo woodlands. *Environment, Development and Sustainability* 7:71–93.

MacKenzie, C. A., Chapman, C. A. and Sengupta, R. 2012. Spatial patterns of illegal resource extraction in Kibale National Park, Uganda. *Environmental conservation 39*(1): 38-50.

Madubansi, M. and Shackleton, C.M. 2006. Changing Energy Profiles and consumption patterns following electrification in five rural villages, South Africa. *Energy Policy* 34: 4081–4092.

Madubansi, M. and Shackleton, C.M. 2007. Changes in fuelwood use and selection following electrification in the Bushbuckridge lowveld, South Africa. *Journal of Environmental Management* 83: 416–426.

Makhado, R.U., von Maltitz, G.P., Potgieter, M.J. and Wessels, D.C.J. 2009. Contribution of woodland products to rural livelihoods in the North East of Limpopo Province. South Africa. *South African Geographical Journal* 91(1): 46 – 53.

Marshall, E. and Newton, A.C. 2003. Non-timber forest products in the community of El Terrero, Sierra de Manantlan Biosphere Reserve, Mexico: Is their use sustainable? *Economic Botany* 57: 262-278.

Matsika, R., Erasmus, B.F.N. and Twine, W.C. 2012. A tale of two villages: assessing the dynamics of fuelwood supply in communal landscapes in South Africa. *Environmental Conservation* 1(1): 1-13.

Matsika, R., Erasmus, B.F.N. and Twine, W.C. 2013. Double jeopardy: The dichotomy of fuelwood use in rural South Africa. *Energy Policy* 52: 716–725.

McSweeney, K. 2004. Forest product sale as natural insurance: The effects of household characteristics and the nature of shock in Eastern Honduras. *Society and Natural Resources: An International Journal* 17(1): 39-56.

McSweeney, K. 2005. Natural insurance, forest access and compounded misfortune: Forest resources in smallholder coping strategies before and after Hurricane Mitch, Northeastern Honduras. *World Development* 33(9): 1453-1471.

Mlambo, D. and Huizing, H. 2004. Household responses to fuelwood scarcity: A case study of two villages in Zimbabwe. *Land Degradation and Development* 15: 271–281.

Monela, G. C., Kajembe, G. C., Kaoneka, A. R. S. and Kowero, G. 2000. Household livelihood strategies in the miombo woodlands of Tanzania. *Tanzania Journal of Forestry and Nature Conservation* 73: 17-33.

Monela, G.C., O'Kting'ati, A. and Kiwele, P.M. 1993. Socio-economic aspects of charcoal consumption and environmental consequences along the Dar-es-Salaam–Morogoro highway, Tanzania. *Forest Ecology and Management* 58: 249–258.

Mucina, L., and Rutherford, M. C. 2006. *The vegetation of South Africa, Lesotho and Swaziland*. South African National Biodiversity Institute.

Mukamuri, B.B., Campbell, B.M. and Kowero, G. 2003. In: Kowero, G., Campbell, B.M. and Sumaila, U.R. (eds.) *Policies and governance structures in woodlands of Southern Africa*. Center for International Forestry Research. Bogor: Indonesia. pp 28-43.

Mutamba, M. 2011. Supplementing or sustaining livelihoods? The role for forest products in household livelihoods in Mufulira and Kabompo districts of Zambia. In: *Managing the miombo woodlands of Southern Africa: Policies, incentives and options for the rural poor.* Technical Annexes. The World Bank. PROFOR. pp 1-17.

Mwavu, M.N. and Witkowski, E.T.F. 2008. Land-use and cover changes (1988–2002) around Budongo Forest Reserve, NW Uganda: Implications for forest and woodland sustainability. *Land Degradation and Development* 19:606-622.

Ostrom, E. 2007. A diagnostic approach for going beyond panaceas. *PNAS* 104(39): 15181–15187

Ouedraogo, I., Tigabu, M., Savadogo, P., Compaoré, H., Odén, P.C., and Ouadba, J.M. 2010. Land cover change and its relation with population dynamics in Burkina Faso, West Africa. *Land Degradation and Development* 21: 453-462.

Oyono, P.R., Ribot, J.C. and Larson, A.M. 2006. Green and black gold in rural Cameroon: natural resources for local governance, justice and sustainability. In: Ribot, J.C. (ed.) *Environmental Governance in Africa Working Papers*. World Resources Institute. Washington, DC: USA. pp 1–88.

Pagdee, A., Kim, Y. and Daugherty, P.J. 2006. What makes community forest management successful: A meta-study from community forests throughout the world. *Society and Natural Resources: An International Journal* 19(1): 33-52.

Paré, S. 2008. Land use dynamics, tree diversity and local perception of dry forest decline in Southern Burkina Faso, West Africa. PhD Thesis. Acta Universitatis Agriculturae Sueciae. pp 78.

Paumgarten, F. 2005. The role of non-timber forest products as safety-nets: A review of evidence with a focus on South Africa. *GeoJournal* 64: 189-197.

Pei, S., Zhang, G. and Huai, H. 2009. Application of traditional knowledge in forest management: Ethnobotanical indicators of sustainable forest use. *Forest Ecology and Management* 257(10): 2017-2021.

Riojas-Rodríguez, H., Romano-Riquer, P., Santos-Burgoa, C. and Smith, K. R. 2001. Household firewood use and the health of children and women of Indian communities in Chiapas, Mexico. *International Journal of Occupational and Environmental Health. 7*(1): 44-53.

RSA (Republic of South Africa). 2003. Electricity Basic Services Support Tariff (Free Basic Electricity) Policy. Department of Minerals and Energy. Pretoria, South Africa.

Schatz, E.J. 2009. Reframing vulnerability: Mozambican refugees' access to State-funded pensions in rural South Africa. *The Journal of Cross-Cultural Gerontology* 24:241-258.

Scholes, R. J. and Biggs, R. 2004. (eds.). *Ecosystem services in southern Africa: a regional assessment*. Millennium Ecosystem Assessment. Council for Scientific and Industrial Research: Pretoria, South Africa. pp 84.

Seidman, R.B. 1992. State, law and agricultural institutions: A theoretical framework. In: Seidman, A., Mwanza, K., Simelane, N. and Weiner, D. (eds.) *Transforming Southern African agriculture.* Africa World Press: New Jersey. pp 19–30.

Shackleton, C.M. 1993. Fuelwood harvesting and sustainable utilisation in a grazing land and protected area of the eastern Transvaal lowveld. *Biological Conservation* 63: 247-254.

Shackleton, C.M. 2000. Comparison of plant diversity in protected and communal lands in the Bushbuckridge lowveld savanna, South Africa. *Biological Conservation* 94(3): 273-285.

Shackleton C.M. 2001. Managing regrowth of an indigenous savanna tree species (*Terminalia sericea*) for fuelwood: the influence of stump dimensions and post-harvest coppice pruning. *Biomass and Bioenergy* 20: 261–270.

Shackleton, C.M. 2004a. Assessment of the livelihoods importance of forestry, forests and forest products in South Africa. Unpublished report prepared for the Department of Water Affairs and Forestry and DFID. Department of Environmental Science, Rhodes University, Grahamstown. pp 43.

Shackleton, C.M., Buiten, E., Annecke, W., Banks, D., Bester J., Everson, T., Fabricius, C., Ham, C., Kees, M., Modise, M., Phago, M., Prasad, G., Smit, W., Twine, W., Underwood, M., von Maltitz, G. and Wenzel, P. 2007. Exploring the options for fuelwood policies to support poverty alleviation policies: Evolving dimensions in South Africa. *Forests, Trees and Livelihoods* 17: 269–292.

Shackleton, C.M., Grundy, I.M. and Williams, A. 2004. Use of South Africa's woodlands for energy and construction. In: Lawes, M.J., Eeley, H.A.C., Shackleton, C.M. and Geach, B.G.S. (eds.) *Indigenous forests and woodlands in South Africa: Policy, people and practice*. Scottsville: University of KwaZulu-Natal Press. pp. 337-363.

Shackleton, C.M., Guthrie, G. and Main, R. 2005. Estimating the potential role of commercial over-harvesting in resource viability: A case study of five useful tree species in South Africa. *Land Degradation and Development* 16:273- 286.

Shackleton, C.M. and Shackleton, S.E. 2000. Direct use values of savanna resources harvested from communal savannas in the Bushbuckridge lowveld, South Africa. *Journal of Tropical Forest Products* 61: 28–47.

Shackleton, C. and Shackleton, S. 2004. The importance of non-timber forest products in rural livelihood security and as safety nets: a review of evidence from South Africa. *South African Journal of Science* 100:658-664.

Shackleton C.M. and Shackleton S.E. 2006. Household wealth status and natural resource use in the Kat River Valley, South Africa. *Ecological Economics* 57: 306–317.

Shackleton C.M., Shackleton S.E. and Cousins B. 2001. The role of land-based strategies in rural livelihoods: the contribution of arable production, animal husbandry and natural resource harvesting in communal areas in South Africa. *Development Southern Africa* 18: 581–603.

Shackleton, S.E. 2004b. Livelihood benefits from the local level commercialization of savanna resources: A case study of the new and expanding trade in marula (*Sclerocarya birrea*) beer in Bushbuckridge, South Africa. *South African Journal of Science* 100: 651-657.

Shackleton, S.E. 2005. *The significance of the local trade in natural resource products for livelihoods and poverty alleviation in South Africa.* PhD Thesis. Rhodes University. pp 301.

Shackleton, S, Campbell, B., Lotz-Sisitka, H. and Shackleton, C. 2008. Links between the local trade in natural products, livelihoods and poverty alleviation in a semi-arid region of South Africa. *World Development* 36(3): 505-526.

Stats SA (Statistics South Africa). 2008. Community Survey 2007: Statistical Release Basic Results Municipalities / Statistics South Africa. Pretoria: South Africa.

Swallow, B.M. and Bromley, D.W. 1995. Institutions, governance and incentives in Common Property Regimes in African Rangelands. *Environmental and Resource Economics* 6:99-118.

Thornton, R. 2002. Environment and land in Bushbuckridge, South Africa. In: Zarsky, L. (ed.) *Human rights and the environment: Conflicts and norms in a globalizing world*. Earthscan: London. pp 219–240.

Twine, W.C. 2005. Socio-economic transitions influence vegetation change in the communal rangelands of the South African Lowveld. *African Journal of Range and Forage Science* 22(2): 93–99.

Twine, W., Moshe, D., Netshiluvhi, T. and Siphugu, V. 2003a. Consumption and direct-use values of savanna bio-resources used by rural households in Mametja, a semi-arid area of Limpopo province, South Africa. *South African Journal of Science* 99: 467-473.

Twine, W., Moshe, D. and Siphugu, M. 2003b. Harvesting of communal resources by 'outsiders' in rural South Africa: A case of xenophobia or a real threat to sustainability? *International Journal of Sustainable Development and World Ecology* 10: 263–274.

Vedeld, P., Angelsen, A., Bojö, J., Sjaastad, E. and Berg, G.K. 2007. Forest environmental incomes and the rural poor. *Forest Policy and Economics* 9: 869–879.

Völker, M. and Waibel, H. 2010. Do rural households extract more forest products in times of crisis? Evidence from the mountainous uplands of Vietnam. *Forest Policy and Economics* 12: 407–414.

von Maltitz, G. and Shackleton, S.E. 2004. Use and management of forests and woodlands in South Africa: Stakeholders, institutions and processes from past to present. In: Lawes, M.J., Eeley, H.A.C., Shackleton, C.M. and Geach, B.G.S. (eds.) *Indigenous forests and woodlands in South Africa: Policy, people and practice*. Scottsville: University of KwaZulu-Natal Press. pp 109-138.

Wentzel, M. and Pouris, A. 2007. The development impact of solar cookers: A review of solar cooking impact research in South Africa. *Energy Policy* 35(3): 1909-1919.

White, C., Bank, L., Jones, S. and Mehlwana, M. 1997. Restricted electricity use among poor urban households. *Development Southern Africa* 14: 413–430.

Wilfred, P., Madoffe, S. S., and Luoga, E. J. 2007. Role of institutions in biodiversity conservation in Northern Uluguru Mountais, Morogoro, Tanzania: The villagers' perspective. *Discovery and Innovation* 19(1-2): 15-24.

Williams, A., Eberhard, A.A. and Dickson, B. 1996 Synthesis Report of the Biomass Initiative. Chief Directorate Energy, Department of Mineral and Energy Affairs: Pretoria.

Williams, A. and Shackleton, C.M. 2002. Fuelwood use in South Africa: Where to in the 21st century? *South African Forestry Journal* 196:1-6.

Willis, C.B. 2004. Policy frameworks pertaining to the conservation and sustainable use of forests and woodlands in South Africa. In: Lawes, M.J., Eeley, H.A.C., Shackleton, C.M. and Geach, B.G.S. (eds.) *Indigenous forests and woodlands in South Africa: Policy, people and practice*. Scottsville: University of KwaZulu-Natal Press. pp 77-108.

Wills, M.P. 1998. Institutions and incentives for biodiversity conservation. *Biodiversity and Conservation* 7: 815-835.

Wong, J.G., Thornber, K. and Baker, N. 2001. *Resource assessment of non-wood forest products: Experience and biometric principles*. Non-Wood Forest Products Technical Papers 13. Food and Agriculture Organization. Rome: Italy. pp 110.

Wunder, S. 2000. *The economics of deforestation: The example of Ecuador*. Macmillan Press Ltd: London.

Yeatman, L., Du Toit, M., and Andreasen, L. 2003. Developing approaches for improved natural woodland resource use and management: Lessons learnt in the communal areas of Bushbuckridge (Part 2). DANCED/DARUDEC/DWAF: Nelspruit. pp 48.

Zitzmann, G. 1999. Multiple use livelihood strategies in mopane woodlands: The case of Ditladi, N.E. District, Botswana. Thesis. Technische Universitat Dresden, Institut fur Internationale Forst-und-Holzwitschaft. Tharandt.

APPENDIX A

Focus Groups **Sarah Findlay** **Masters Data Collection 2011**

Date: …… Village: …….

Group (Gender, Age):..... Size of group:.....

Read through information sheet

Was informed consent obtained from the group? Yes/No

General household firewood use

1.1. How many of the households (present) use firewood? ……..

1.2. Does your household get most of their firewood from harvesting, buying or both?

Harvesting	Buying	Both

Village firewood use

1.3. In the village as a whole, what percentage of households still uses firewood? ……

1.4. In the village as a whole, what percentage of households do you think use firewood as their *main* source of fuel? …….

1.5. In the village as a whole, what percentage of households has electricity? ……..

1.6. With so many people with electricity, why do so many people use firewood?

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……

Firewood availability changes through time

1.7. Do you think that the amount of firewood available in and around this village has changed over the past 20 years (increased/stay the same/decreased)?

1.8. What do you think has caused the changes in firewood availability that you've seen?

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……
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……
……

1.9. Do you think that there is enough firewood for everyone in the village now? Yes/No

1.10. Do you think that there will be enough firewood for everyone in the village in 20 years time? Yes/No

Local laws

2.1. What are the laws about using/harvesting firewood in this village?

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……
……
……
……
……..

2.2. Who implements each of these laws?

……
……

2.3. What happens if any of these laws are broken?

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……
……
……

Institutional Roles

3.1. Ranking exercise: Each institution's level of responsibility in firewood regulation i.e. the institution most responsible for firewood regulation to the institution least responsible for firewood regulation.

……..Nduna ……..CDF ……..Ward Councilor …….. Civic

……..Chief ……..Municipal Government …… Provincial Government

……..Community Members ……..Other *(please specify)*

3.2. What are the responsibilities (if any) of the following leaders in regulating firewood harvesting:

a) Traditional leaders (Ndunas): .....

.....

.....

b) Community Development Forums: .....

.....

.....

.....

c) Civic Associations:.....

.....

.....

d) Bushbuckridge municipality: .....

.....

.....

e) Chiefs (or Tribal Offices): .....

.....

.....

.....

f) Community members: .....

.....

.....

g) Provincial government: .....

.....

.....

3.4. What do you think the main problems are that leaders face when it comes to regulating firewood harvesting?

……

……

3.5. What do you think is the solution to prevent over-harvesting of wood in your village? What needs to change? Who should implement these changes?

……

……

APPENDIX B

University of Witwatersrand

School of Animal, Plant and Environmental Science

Sarah Findlay Masters Project Data Collection

THE ROLES OF LOCAL FORMAL INSTITUTIONS IN REGULATING FIREWOOD HARVESTING IN BUSHBUCKRIDGE

Date: ……

Questionnaire number: .....

Has the informed consent form been signed by the participant? Yes/No

Leadership information

1) How many years have you been in your current leadership position?.....
2) How did you acquire your position i.e. through elections or did you inherit it?
   .....
3) Which villages fall within your authority?
   .....
   .....
   .....

State of the environment

4) In your village or chieftaincy, how many households do you think use firewood *(give a percentage)*? .....
5) Do you think that the amount of firewood available in and around the village or chieftaincy has changed over the past 20 years (increased/stay the same/decreased)?

6. a) Does your household collect firewood? Yes/No

   If yes, answer question 6b

   If no, answer question 7

6. b) Do you think you get more/the same/less firewood each time you collect firewood compared to 20 years ago?

6. c) Does it take you more/the same/less time to collect firewood each time compared to 20 years ago?
7. Do you think amount of deadwood available is more/the same/less as 20 years?
8. a) Do you buy firewood? Yes/No

   If yes, answer question 8b

   If no, answer question 9

8.b) Do you buy more often/the same as/less often than 20 years ago?

9. What do you think has caused these changes to firewood availability?

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Laws: Firewood harvesting

10. Who is in charge of regulating firewood use? .....

12. a) Are there any rules about firewood harvesting in your village/chieftaincy? Yes/No

    If yes, answer question 12b

    If no, answer question 13

12. b) What are some of these rules?.....

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.....

12. c) Who implements these laws?.....

12. d) What happens if someone breaks these laws? .....

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Institutional responsibilities

13. In terms of firewood, what (if any) are your responsibilities? .....

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14. How do you carry out these responsibilities?.....

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15. What are the responsibilities (if any) of the following leaders in regulating firewood harvesting:

    a) Traditional leaders (Ndunas): .....

    .....

    b) Community Development Forums: .....

    .....

    c) Civic Associations:.....

    .....

    d) Bushbuckridge municipality: .....

    .....

    e) Chiefs (or Tribal Offices): .....

    .....

    f) Community members: .....

    .....

    g) Provincial government: .....

    .....

Governance efficiency

16. What do you think the main problems leaders face when managing resources?

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17. What needs to or should be changed to promote sustainable resource use in your village/cheiftancy?

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18. What do you think is the best way of arranging local leaders is to prevent resource over-harvesting in your area?

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Thank you very much for your time. Sala kahle.