ABSTRACT

WIENER, SARAH SUSANNE. Traditional Natural Resource Use and Modern Lifestyles in the Post-Apartheid Era; Age and Attitudinal Changes in Bushbuckridge, South Africa. (Under the direction of Dr. Erin Sills).

As the end of Apartheid brought much needed reforms to South Africa, many previously oppressed black South Africans embraced their newfound freedom, democracy, and equal rights across all facets of life, including household use of natural resources. These changes both reflect and contribute to socio-political progress, but they also affect the communal woodlands that are central to the livelihoods of many rural South Africans. Communal woodlands provide fuelwood and other non-timber forest products (NTFPs), such as fruit, traditional medicine, and building materials. Research suggests that since the end of Apartheid, these woodlands have been increasingly over-exploited, resulting in shortages of NTFPs including fuelwood. Weakened institutional governance of natural resources have facilitated this exploitation, despite increased availability of substitute modern goods and a massive rural electrification program. The youth are commonly perceived as the generation most dramatically affected by democratization and most responsible for over-exploitation of the woodlands. The aim of this study is to determine if attitudes towards woodlands and use of fuelwood are significantly different among youth compared to middle-aged and elderly people, and the implications of any differences.

Data were collected in three villages of Bushbuckridge, South Africa. In addition to a household survey, all individuals in those same households were interviewed. Semi-structured open-ended interviews were also conducted with members of the same communities who had not been interviewed and were not members of any of the interviewed households. Survey and interview data are analyzed to obtain insights on two main themes:
(1) attitudes towards woodlands, woodland use, and woodland regulation, and (2) preferences and choices of fuelwood vs. electricity. For both themes, differences across generations are examined. All else equal, younger respondents place less importance on the woodlands than their older counterparts, and they are more likely to prefer electricity as a cooking fuel. Youth are perceived as the most likely to break woodland regulations, with middle-aged and elderly respondents saying that the youth break regulations much more often than the youth themselves admit. Additionally, all generations prefer to have regulations at the same rate. Although youth are still involved with fuelwood collection, most of them do not want to be. This reluctance, along with their lower perceived importance of woodlands, could be a contributing factor to their perceived or actual disregard for woodland regulations. The proportion of respondents who prefer to have regulations does not vary across generations.

As youth age into heads of households and begin making decisions regarding household fuel and whether to harvest or purchase provisions, their attitudes and preferences will become increasingly important determinants of the fate of communal woodlands. These changes will also ultimately impact the welfare of the new generation of households; for example, if traditional knowledge about woodlands is not passed on to the younger generation, that will limit their ability to harvest NTFPs as an economic “safety net”. If the woodlands are seen as unimportant, less care will be taken to preserve valuable species and harvest sustainably, reducing the potential value of future harvests. Thus, generational differences in attitudes will shape the challenges and changes in future natural resource consumption.
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Traditional Natural Resource Use and Modern Lifestyles in the Post-Apartheid Era; Age and Attitudinal Changes in Bushbuckridge, South Africa.

by
Sarah Susanne Wiener

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APPROVED BY:

Erin O. Sills
Committee Chair

Wayne Twine

Heimo Karrpinen

Pam Jagger

Duarte Morais
BIOGRAPHY

Sarah Wiener graduated from the Honors Program at Iona College in 2010 with a Bachelor of Arts in International Studies. Wanting to combine her love for the environment and developmental studies, she began her Master of Science in Forestry at North Carolina State University’s Department of Forestry and Environmental Resources in 2011. She traveled to South Africa to collect the data for this thesis in the summer of 2012, and was a participant in the Atlantis Program, spending a semester each at the Swedish University of Agricultural Sciences and the University of Helsinki in 2013.
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# TABLE OF CONTENTS

LIST OF TABLES .................................................................................................................................................. vii

LIST OF FIGURES .................................................................................................................................................. viii

CHAPTER 1: INTRODUCTION ................................................................................................................................. 1

CHAPTER 2: RESEARCH SETTING AND METHODS ................................................................................................. 5
  2.1 Research Setting ............................................................................................................................................... 5
  2.1.2 Village Governance and Natural Resources ............................................................................................ 7
  2.2 Data Collection Methods ............................................................................................................................. 8

CHAPTER 3: INTERGENERATIONAL PERCEPTIONS OF WOODLAND USE AND REGULATION ................................................................................................................................. 12
  3.1 Review of Literature ....................................................................................................................................... 14
  3.1.1 Communal Woodland Resources ............................................................................................................. 14
  3.1.2 Woodland Use and Regulation after Apartheid ...................................................................................... 16
  3.1.3 The National Electrification Program ..................................................................................................... 17
  3.1.4 Youth and Woodland Resources ............................................................................................................ 17
  3.2 Data Analysis Methods ............................................................................................................................... 19
  3.3 Results ......................................................................................................................................................... 21
  3.3.1 Woodland Regulations ........................................................................................................................... 21
  3.3.2 Household Characteristics ..................................................................................................................... 22
  3.3.3 Individual Analysis .................................................................................................................................. 25
  3.4 Discussion .................................................................................................................................................... 34
  3.4.1 Youth and Woodlands ............................................................................................................................ 34
  3.4.2 Woodland Regulation ............................................................................................................................. 37
CHAPTER 4: HOW DOES AGE INFLUENCE PREFERENCES AND CHOICES REGARDING FUELWOOD AND ELECTRICITY CONSUMPTION? .................................................. 43

4.1 Review of Literature ............................................................................. 48

4.1.1 Social and Environmental Impacts of Fuelwood Consumption .......... 48

4.1.2 Fuel Switching and Technology Adoption ........................................ 50

4.1.3 Technology Adoption and Age ......................................................... 51

4.1.4 Fuelwood and Electricity in Bushbuckridge .................................... 52

4.2 Data Analysis Methods ....................................................................... 56

4.3 Results ................................................................................................ 57

4.3.1: Household Electricity Infrastructure ............................................. 57

4.3.2: Household Characteristics .............................................................. 61

4.3.3 Individual Analysis ........................................................................ 66

4.4 Discussion .......................................................................................... 73

4.4.1 Household Fuel Use ...................................................................... 73

4.4.2 Age, Fuel Choice, and Fuel Preferences ....................................... 75

4.4.3 Implications for the Future – Fuel and the Woodlands .................. 78

4.4.4 Sample Size .................................................................................. 80

4.4.5 External Validity ............................................................................ 80

4.5 Conclusions ...................................................................................... 81

CHAPTER 5: CONCLUSIONS ...................................................................... 84
REFERENCES ................................................................................................................................. 87

APPENDIX ..................................................................................................................................... 97

APPENDIX I: Household Survey Instrument......................................................................................... 98

APPENDIX II: Individual Survey Instrument.......................................................................................... 103

APPENDIX III: Open-Ended Survey Instrument................................................................................... 109

APPENDIX IV: Open-Ended Survey Responses; Woodland Attitudes and Habits................................. 112

APPENDIX V: Open-Ended Survey Responses; Themes in Electricity and Fuelwood......................... 113
LIST OF TABLES

Table 2.1 Demographics of Bushbuckridge Local Municipality (BLM) for 2011 .................6
Table 3.1 Household descriptive statistics .................................................................................23
Table 3.2 Activities included in variable “household dependence on woodlands” ............24
Table 3.3 Influences of household dependence on local natural resources ....................24
Table 3.4 Descriptive statistics for individual surveys ...............................................................31
Table 3.5 Drivers of opinions and preferences regarding woodlands and their regulation ....32
Table 4.1 Role of age in cooking technology adoption .........................................................53
Table 4.2 Distances to nearest shopping village, cost of electricity, and cost of electrical
appliances ...................................................................................................................................59
Table 4.3 Household descriptive statistics .................................................................................64
Table 4.4 Use of electricity and fuelwood in households .............................................................64
Table 4.5 Drivers of household choice of electricity for cooking .............................................66
Table 4.6 Descriptive statistics for individual surveys ...............................................................68
Table 4.7 Drivers of the preference to cook with electricity .......................................................69
Table 4.8 Reasons for cooking fuel preference, by generation ...............................................70
LIST OF FIGURES

Figure 2.1 Map of study sites in Bushbuckridge, South Africa........................................7

Figure 3.1 Perceived and self-reported preferences of woodland regulation by generation ...29

Figure 3.2 How often does each generation follow the woodland rules (responses broken
down by generation of respondents)? ..............................................................................29

Figure 3.3 Knowledge of woodland rules........................................................................30

Figure 4.1 Conceptual framework outlining costs, constraints, and individual preferences as
influences on the choice of fuelwood or electricity for domestic cooking energy, and the
impacts of that choice ........................................................................................................46

Figure 4.2 Card-reading electricity meter ........................................................................58

Figure 4.3 Punch code electricity meter ..........................................................................59

Figure 4.4 Machine for dispensing prepaid electricity codes ..............................................61

Figure 4.5 Why household use fuelwood over electricity .....................................................63

Figure 4.6 Fuel preferences of generations; Personal responses and perceptions ...............72

Figure 4.7 Household cooking technology choices and generation of head ......................73
CHAPTER 1: INTRODUCTION

South Africa underwent a dramatic overhaul of its oppressive political and social structures with the end of Apartheid in 1994. Generally, democratization, universal suffrage, integration, and improved social programs for the rural black populations all resulted from the fall of this regime. More specific to this study, were: (1) improved public services, including rural electrification and an improved education system, (2) access to modern goods and services, and (3) weakening of the local natural resource governance structures.

As the country nears its twentieth year of democracy, there are now young black and coloured adults who have lived their entire lives being told that they have equal rights to and the same opportunities as their fellow white citizens. These opportunities include a modern lifestyle.

Millions of black South Africans still live in the former homelands. These homelands are areas where people were forcibly relocated during the Apartheid regime, so that the best land could be allocated to white South Africans. This land is therefore typically marginal. Since the mid-1990s, provisions such as piped water, toilets, improved education, and electrification have been brought to these villages as steps to repair the wrongdoings of the past. In particular, South Africa invested heavily in rural electrification, and 60% of households now have electricity connections – much higher than in the rest of sub-Saharan Africa.

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1 Since the mid-1990’s, supermarkets have been expanding rapidly throughout Africa. South Africa’s expansion has been the largest in Africa, and includes rural areas (D’Heaese & Huylenbroeck, 2005; Weatherspoon and Reardon, 2003). Although this trend may not be directly related to the end of Apartheid, its timing coincides with the birth of South African democracy.
Africa (Government Communications, 2012). Certain areas are also becoming more urbanized, with shopping centers and access to modern goods and services.

Most households in these rural regions now use a combination of modern and traditional goods and services, depending on their income and personal preferences. For example, although many households are now connected to the electricity grid, most still use fuelwood as their main source of cooking fuel, but combine it with the use of electric stoves. Households also use a combination of household provisions that are collected form their local natural surroundings and products purchased from stores or vendors.

It would be a vast oversimplification to assume that the changing social climates in the country and these villages have affected everyone in the same way. Youth, in particular, have grown up in the age of democracy and modern provisions, and are likely more susceptible to attitudinal shifts than older generations, whose habits and preferences are already ingrained. These shifts include attitudes and habits concerning local natural resource consumption, as they can now be replaced with modern goods.

Local natural resources are a vital element of livelihood strategies for rural South Africans, providing food, fuel, and income. Overharvesting of such resources can lead to negative consequences, including the loss of the safety net they typically provide. It is therefore imperative to understand if and how the changing attitudes, brought on by democratization, will affect local natural resource consumption. With an accurate understanding of current and future habits, local leaders can adapt management strategies to strive for fair and sustainable use of local natural resources.
Of particular concern is how youth have adapted and will adapt to modern ways of life. With most or all of their lives spent in the new age of democracy and globalization, youth have been conditioned differently than their parents. As the currently young generations age and make household decisions, their different upbringing will likely become evident. While modernity can bring improved healthcare, education, and economic opportunities, there are also potential risks such as loss of traditional knowledge and abandonment of traditional sustainable harvesting practices. Identifying these risks is the first step to mitigating them.

This thesis focuses on the role of age in explaining the varied habits, attitudes, and perceptions in two domains central to rural South African livelihoods: (1) use, regulation, and perceived importance of woodlands; and (2) preferences and choices regarding fuelwood and electricity for household fuel consumption.

For focus 1, the following research questions are considered: (1) How do the uses, values, and preferences about regulation of woodland resources vary between age groups? (2) What are villagers’ perceptions of these variations, and are perceptions consistent with self-reports? (3) What are the underlying drivers of the self-reported and perceived variation in uses, values, preferences, and perceptions, including age?

For focus 2, the following research questions are considered: (1) Which factors influence choice and preferences for cooking technology, and do these factors vary across age groups? and (2) What are the contributions of individual level factors and household level factors to these choices and preferences?
Community members in three villages of Bushbuckridge, South Africa were interviewed to obtain information at the household and individual levels. Chapter 2 describes the methods including the study site. Chapters 3 and 4 are in-depth analyses of aforementioned foci 1 and 2, respectively. Chapter 5 concludes and proposes next steps for research and programs in Bushbuckridge.

This research can inform future policies and programs to improve livelihoods and conserve woodlands in Bushbuckridge by helping to project the future trajectory of local natural resource and electricity consumption and providing insight on local understanding and perceptions of the regulatory structures for woodland management.
CHAPTER 2: RESEARCH SETTING AND METHODS

2.1 Research Setting

Surveys were administered in three rural villages of the Mpumalanga Province of northeastern South Africa, from June-July 2012. All three villages, Buffelshoek, Edinburgh, and Ludlow, are part of the Bushbuckridge Local Municipality (BLM), located approximately 500 km northeast of Johannesburg (Figure 2.1). The study villages represent a range of size and surrounding woodland density. Buffelshoek is the largest of the three villages, with the lowest tree density surrounding the village. Tree coverage is denser off the southwest corner of the village, and the Andover Nature Reserve abuts the northeast corner of the village. Edinburgh is southeast of Buffelshoek, and Ludlow is adjacent to and east of Edinburgh. Woodlands exist in between the two villages, but tree coverage is sparse. To the east of Ludlow and the west of Edinburgh, tree coverage is denser, but Ludlow has a higher population that must depend on these woodlands.

The climate is semi-arid, with annual rainfall between 550-700 mm. The natural vegetation is savannah woodland. BLM is part of the Kruger to Canyons Biosphere, which also includes several game reserves, the Blyde River Canyon, and Kruger National Park. The villages are part of the former homelands, meaning that during Apartheid, black residents were forcibly relocated to these settlements despite limited opportunities for

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2 Bushbuckridge is part of the South African lowveld, where the natural vegetation is classified as savannah woodland, not forest.
employment. Since the end of Apartheid, the national government has attempted to improve the conditions in these settlements, including a massive electrification initiative and public works programs. Almost all homes within the main parts of the three study villages have an electricity connection. Newer households built on the outskirts of the villages are less likely to have electricity. As shown in Table 2.1, unemployment is high, and services such as piped water, refuse removal, and flush toilets are scant. The history and current status of BLM are discussed in greater detail in Sections 3.2 and 4.2.

| Table 2.1: Demographics of Bushbuckridge Local Municipality (BLM) for 2011 |
|--------------------------------|-----|--------------------------------|-----|
| Category                        | BLM | Category                        | BLM |
| Total population                | 541,248 | Percent of population aged 20+ with no schooling | 18.6% |
| Young (0-14)*                   | 37%  | Higher education aged 20+       | 7.4% |
| Working age (15-64)*            | 57.7%| Graduated high school aged 20+  | 25.7%|
| Elderly (65+)*                  | 5.3% | Average household size          | 4    |
| Female headed households        | 53.3%| Electricity as one source of lighting | 93.9%|
| Annual population growth rate   | 0.79%| Flush toilet connected to sewerage | 6.8% |
| Population density              | 53 persons / km2 | Weekly refuse removal | 7.5% |
| Unemployment rate               | 18.6%| Piped water inside dwelling     | 11.9%|

*Age categories used by Statistics South Africa are different than age categories used in data collection for this report
Source: Statistics South Africa, 2011
2.1.2 Village Governance and Natural Resources

In post-Apartheid rural South Africa, two parallel governance systems exist. The first includes traditional authorities, consisting of chiefs and their headmen or Induna. The second includes democratically elected officials, such as the municipality, wards, and Community Development Forum (CDF). Traditional authorities are responsible for land and natural resource governance on communal land, in addition to traditional affairs, while municipal bodies’ main function is service delivery. The chiefs became part of the Apartheid homeland bureaucracy, and are still paid salaries by the national government, but they do not answer to the municipality. BLM is composed of about nine chieftaincies today, but these
chieftaincies do not follow administrative boundaries. Instead, municipalities are administratively divided into wards, which are about the same size as chieftaincies, but with different boundaries determined by population density. Wards encompass around 10-15 villages, and each has a ward councilor, who answers to the municipality. The CDF is the lowest level of democratically elected governance, and consists of elected members of all stakeholder groups in one village. The induna is a de facto member of the CDF, representing traditional authorities. This body answers to the ward councilor (W. Twine, personal communications, March 17, 2014).

2.2 Data Collection Methods

Three different survey instruments were used: household, individual, and open-ended. Household surveys lasted 15-45 minutes, and were preferentially conducted with the person in charge of collecting fuelwood and other natural resources. In that person’s absence, interviews were conducted with another household member, or combination of members. The individual survey was then administered to all available, consenting, 18 years or older, household members in separate interviews that each lasted 20-60 minutes. Both of these structured survey instruments included questions in multiple formats: multiple choice, Likert scale, numeric, and a household roster. Finally, open-ended interviews were conducted with randomly selected community members who are not members of any of the previously interviewed households, lasting 20-30 minutes. This survey was semi-structured and covered ten topics. All interviews were conducted by the principal investigator, with the assistance of
one local translator, who does not live in any of the three study villages. Questions were asked in English, translated into Tsonga or Sotho, and answers were translated back into English and transcribed on-site. Some interviews were conducted in English at the respondents’ requests.

Households were chosen using a multi-stage cluster sample. Each village was divided into four quadrants. Streets were numbered on a map within each quadrant, and a number was drawn at random for each quadrant. The street matching the drawn number was the street in that quadrant to be sampled. On the selected streets, every third household was approached, switching sides of the street each time. If the household did not wish to participate or nobody was home, the adjacent household was approached on the same side of the street. For each of the three villages, 21 household interviews were conducted (63 total). In Buffelshoek, Ludlow, and Edinburg, 46, 45, and 50 individuals responded to the structured individual survey, while 4, 5, and 5 individuals responded to the open-ended survey, respectively.

For most questions, answer choices were not recited to the respondent. Instead, the respondent gave an answer and it was either selected from the pre-written answer choices, or written under “other.” Answer choices were always given for Likert scale questions. Three generations were specified for several questions: youth (<30), middle aged (30-59), and elderly (60+). When asking about rules, all respondents were specifically asked if they are allowed to cut live trees and if outsiders are allowed to collect fuelwood in their village. No other rules were prompted, but were recorded if stated by the respondent.
One member of the CDF in each village was also interviewed. CDF members were asked about the woodland, fuelwood, and electricity related issues faced by their community, and the role of local leaders in regulating these issues. They outlined, to the best of their ability, the history of electricity in the village, and shared the grievances of the villagers related to electricity and collecting necessary items from the bush.

Electricity and stove vendors were also visited. Electricity vendors were asked about prices, accessibility, quantity of business, and the history of electricity purchase in the village. Information on stove prices, stove availability, and typical stove preference of consumers was requested from stove vendors.

2.3 Measure of Socioeconomic Status

In the developing world, especially in rural regions, it is problematic to measure socioeconomic status (SES) purely with monetary income for several reasons, including that work can be transitory or seasonal, and temporary shocks can skew the measure of longer-term household wealth (McKenzie, 2003; Vyas & Kumaranayake, 2006). An alternative to measuring monetary income is measuring consumption expenditure (Howe et al., 2008; Vyas & Kumaranayake, 2006), but special care must be taken to assign the appropriate weight to material assets (Vyas & Kumaranayake, 2006) and to capture quality of assets (Falkingham & Namazie, 2002).

Four measures of SES were utilized in this study: cash income, agricultural production assets, consumer durable moveable assets (i.e. TV, car), and consumer durable
non-moveable assets (i.e. buildings on the property). Income sources and assets are weighted according to their value and then each household was given a score based on their sum of assets for each category. Analysis methods are described in each respective chapter.
CHAPTER 3: INTERGENERATIONAL PERCEPTIONS OF WOODLAND USE AND REGULATION

Changes in national political regimes and institutions can trickle down to affect local natural resource use, creating both beneficial and harmful impacts on the rural poor and the environment. One example of the former is reducing reliance on harmful, polluting solid fuels, by replacing them with modern cooking technologies, while the latter can be seen in loss of traditional knowledge, or more intensive harvesting. In this chapter, we examine these changes in rural South Africa, focusing on two important drivers: (1) the end of Apartheid in 1994, which resulted in greater empowerment of the poor, black population and altered regulation of communal woodlands, and (2) the National Electrification Program (NEP), which connected millions of people to the electrical power grid, giving them the opportunity to cook with electricity instead of fuelwood.

There is a body of literature recognizing that these shifts have affected local perceptions and consumption habits of rural South Africans, which have been studied because of the implications for the future of communal woodland resources as a crucial safety net and provider of ecosystem services. However, these perceptions and behaviors are constantly evolving, presenting a challenge for design of interventions to conserve woodlands. One way to predict future evolution of these characteristics is to analyze generational differences. Insight into how local people will perceive and use natural resources in the future can be sought by distinguishing habits and perceptions of older versus younger generations. If there is significant variation between generations, it is crucial to
understand the effects on the natural resource base, especially as today’s youth age into tomorrows’ heads of households. Communal woodlands provide a wealth of resources to rural South Africans (Paumgarten et al., 2005; Dovie et al., 2007; Hunter et al., 2007), and with vegetation change potentially threatening this resource base (Shackleton et al., 2004; Twine, 2005), it is imperative that the drivers of harvesting, and weaknesses in regulation, are understood at every level.

As a first step to address these complex issues, we examined three main research questions: (1) How do the uses, values, and preferences about regulation of woodland resources vary between age groups? (2) What are villagers’ perceptions of these variations, and are perceptions consistent with self-reports? (3) What are the underlying drivers of the self-reported and perceived variation in uses, values, preferences, and perceptions, including age? We hypothesize that youth will value modern resources and technologies more than their older counterparts, who prefer traditional lifestyles. Youth will also be vilified for these preferences, which will be exaggerated by perceptions of other villagers, and are largely a function of post-Apartheid changes such as electrification, education, and democratization.

While questions one and two were addressed with quantitative methods, the third research question involved an in-depth, qualitative approach, drawing from open-ended interviews with villagers. The answers to these questions can help tailor interventions to different age classes of generations in woodland management and conservation schemes.

South Africa is still deep in the throes of socio-political and economic transition, and understanding the values of its up and coming generations can support healthy socio-ecological systems in the most marginalized regions.
3.1 Review of Literature

3.1.1 Communal Woodland Resources

In regions across the developing world, rural populations are heavily dependent on collection of local natural resources to sustain their day-to-day lives (Shackleton et al., 2000; Twine et al., 2000; Belcher, 2005). Fruit, nuts, fuelwood, tree-derived construction materials, and resources for traditional medicine, are staples of traditional livelihoods, partially because they can be collected with no cash inputs (Shackleton et al., 2000; Twine et al., 2000). In poor regions with minimal cash flow, these resources serve as a dietary mainstay, and also as a safety net during difficult times (Pattanayak & Sills 2001; Shackleton & Shackleton, 2004 a; b; Hunter et al., 2007; 2011). However, increasing populations and unregulated collection of resources for sale, can drive unsustainable harvesting practices and threaten the supply of these non-timber forest products (NTFPs) (Twine et al., 2003b; Twine, 2011).

Although NTFPs play a crucial role in rural livelihoods, heavy reliance on these products has social implications. Regular collection of NTFPs takes time away from other productive tasks, such as education, employment, and daily household chores (Rehfuess et al., 2006; Ndirtu & Nyangena, 2010). Collection trips can also be dangerous, if individuals encounter criminals or wild animals. In the case of fuelwood, one of the most widely used NTFPs, these burdens fall disproportionately on women and girls, since they are traditionally the ones in charge of collection; trips become longer for these females if resources are depleted (Heltberg, 2004; Dinkleman, 2008).
Still, NTFPs provide immense nutritional value, and are vital for many families that cannot afford to purchase food (Shackleton et al., 2000; Twine et al., 2003). In times of financial hardship, rural South African households often resort to collection of NTFPs (Paumgarten, 2005). This is crucial in areas affected by the HIV/AIDS epidemic, where families that suffer the tragedy of losing a family member may also lose their only income source (Hunter et al., 2007; 2011). Households can soften this blow by collection of NTFPs for sale or subsistence. However, this practice is not limited to those suffering from recent tragedies.

Heavy reliance on NTFPs has its drawbacks. For example, fuelwood provides cheap or free cooking fuel for 90% of rural South Africans (Shackleton et al., 2004), but it can also cause respiratory problems due to smoke inhalation, and create a heavy collection burden for women and girls (Rollin et al., 2004; Naehler et al., 2007; Norman et al., 2007; Wilkinson et al., 2009). It is also argued that this safety net can turn into a poverty trap, which prevents individuals from advancing in society, beyond the trade of natural resources (Delacote, 2009).

Interventions to reduce collection pressure and conserve woodland resources can both help sustain ecosystem services and maintain a safety net for the rural poor. For this reason, steps must be taken to ensure perpetuity of resources, while still allowing locals to collect the products that support their livelihoods. Carefully constructed regulations should be in place that take into account the needs and opinions of locals, while promoting reasonable, sustainable harvesting practices.
3.1.2 Woodland Use and Regulation after Apartheid

It is widely acknowledged that the end of Apartheid in 1994 brought about a much-needed reconstruction of South Africa’s socio-political climate. The long oppressed non-white South Africans were empowered with a new sense of freedom and democracy. However, not all problems that were created by Apartheid disappeared when the regime ended. One such problem is the co-optation and consequent weakening of traditional institutions. Although the chiefdoms were part of traditional life, they were often seen as puppets of the Apartheid government, which fostered a mistrust of these figures in the post-Apartheid era (Ooman, 2011). Additionally, budget cuts in the democratic age reduced the size of the Chief’s police, who, among other things, were in charge of patrolling the woodlands for criminals and illegal harvesting (Twine et al., 2003b). These factors, combined with a new sense of democratic freedom to extract resources in uninhibited amounts, have led to dramatic increases in harvesting of woodland resources (Twine et al., 2003b; Twine, 2005).

Fuelwood, in particular, is increasingly being: harvested by the truckload, rather than headload; sold for commercial and industrial, rather than domestic use; and collected from live trees, despite laws that permit only the collection of dead wood (Twine et al., 2003b; Kirkland et al., 2007). Still, villagers recognize the need for regulation, and prefer that traditional authorities enforce those regulations, indicating desperation for improvements in the woodland management system (Twine & Moshe, 2003; Twine, 2005). It is becoming recognized that the structure and function of woodlands are negatively altered by these socio-economic shifts, creating a feedback loop that stresses both households and woodlands.
17

(Twine, 2005). By understanding local perceptions of woodlands and the regulatory instruments that attempt to control them, it is possible to understand why villagers break these rules, and what management alternatives might be more successful.

3.1.3 The National Electrification Program

When the post-Apartheid government assessed the socio-economic disparities between whites and non-whites, access to electricity became a major initiative. The National Electrification Programme (NEP) began in the mid 1990s, and now 81% of households, including 60% of rural households, have electricity access (Department of Energy, 2011). Providing access to electricity gives households the option to cook with electricity instead of fuelwood, which opens up time for education and employment (Heltberg, 2004; Dinkleman, 2008). Additionally, households are able to have televisions, radios, computers, cell phones, and easy lighting at night, which allows individuals to study or do household tasks after the sunset (Dinkleman, 2008; Winkler et al., 2011). Although the benefits of electrification are vast, households have not embraced the use of electricity in the volume expected. Despite government subsidies, unaffordable rates and personal attachments to the traditional methods of cooking with fuelwood, have prevented many households from switching to electricity as their main cooking fuel (Davis, 1998; Madubansi & Shackleton 2006; 2007). These households still, however, receive the other benefits of electrification.

3.1.4 Youth and Woodland Resources

When evaluating the impacts of socio-political change on natural resource use, it is
important to explore the demographic variables that could factor into opinions and habits. For example, if the majority of women over 50 understand environmental regulations, and are committed to sustainable harvesting, it could be wise to target women over 50 with credit for more efficient cookstoves, rather than with educational or informational interventions.

Throughout the literature examining South Africa’s transitional period and early independence, the youth are commonly cited as preferring modernity to traditional ways of life, and challenging traditional authority, putting their faith instead in the national government. The former is demonstrated by the stream of youth leaving villages and moving into cities, often abandoning traditions along the way (Malzbender et al., 2005; Paumgarten et al., 2005). The latter was initially demonstrated by the youth rebellions and revolts against chieftaincies in the 1980s, and their vehement opposition to the revival of chiefs in the post-Apartheid era (Ooman, 2011). In more recent times, youth have been reported to see issues of natural resource scarcity as problems that the national government will solve, while disputing the control that traditional authorities have over communal resources.

For example, Twine et al. (2003b) found that a lack of respect for traditional authorities’ jurisdiction to control woodland harvesting had contributed to unsustainable extraction of fuelwood in the post-Apartheid era. These feelings were especially pronounced among the youth. Another example is the case of water scarcity in Hamakuya, where youth expected that the national government would provide more infrastructures, and consequently more water, in the future. Meanwhile, the elderly blamed shifts from traditional ways of life for their village’s droughts (Celestino et al., 2012). Evaluating these differences can shed light on the future of local natural resource extraction and inform management policies.
3.2 Data Analysis Methods

Data were first analyzed with descriptive statistics and relevant variables were checked for multicollinearity. Chi-squared tests were used to determine where significant differences existed across means. Multivariate analyses included linear probability models and ordinary least squares.

Responses were analyzed across generations for a series of questions, including how often members of each generation follow the rules (with answer choices of always, sometimes, or never), if members of each generation wants woodland regulation to exist, and if the individual wants woodland regulations to exist.

To inform our understanding of the role of individuals in household decisions, regression analysis was run to determine how age composition, gender composition, and SES influence a household’s dependence on local natural resources. To understand the relationship of each generation with their communal woodlands, a regression was run to analyze values and preferences regarding the woodlands. The independent variables used were sex, age, whether or not the respondent collects fuelwood, and the four SES indicators, which are extrapolated from the household surveys to the individual surveys. Education was not included because it highly correlated with age (correlation coefficient -0.76, p-value < 0.001), so including both would not fulfill the assumption of no multicollinearity in the model. This relationship is due to dramatic increases in education after the end of Apartheid.

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3 Field methods are described in Chapter 2
4 Signs and significance are similar in Logit models estimated with maximum likelihood.
and smaller increases preceding that milestone. Age was included in the model instead of education because this study addresses how age, as a result of post-Apartheid changes, affects opinions and perceptions. Education is one of those post-Apartheid changes, and is a contribution to the impact of age on opinions and preferences. Thus, its significance is noted but it is not included as a variable. In bivariate tests, education had a significant relationship with the same dependent variables as age, and in the opposite direction as age, due to the negative relationship between age and education.

Not all SES indicators were used for each linear probability model in the individual analysis; rather the indicators were chosen based on insight gained during data collection. Non-moveable consumer production assets were only included for protection from wind, because household structures such as huts and houses are the second line of protection from wind, after the woodlands. For all other questions, this variable was not included because households often invested their money in items such as televisions, DVD players, and stoves before home expansion or upgrade. Access to modern appliances and media seemed to have a greater impact on preferences and opinions than factors such as cash income. Cash income was included because it allows households to access more modern goods, and can replace goods that were previously harvested by household members. Greater harvesting of local natural resources is expected to have a positive impact on perception of woodland value, because those families directly rely on the woodlands and most likely understand them better.

The dependent variables all came from questions about perceptions and opinions. Respondents were asked how important the woodlands are for a series of services. The answer choices were “not important,” “important,” or “very important.” Upon evaluating
descriptive statistics, the only variation was found to be between the latter two responses, so the few “not important” responses (between 0-5%, or 0-6 responses) were dropped from the analysis, resulting in dichotomous dependent variables. The other two dependent variables for the linear probability model were whether or not the respondent thinks there should be regulations on woodland use, and who the respondent thinks should enforce those regulations. Although there were several answer choices for the latter question, the answers were split into “Chief’s Police,” which is the entity that is currently in charge of enforcing regulations, and “other” for this analysis.

3.3 Results

As shown in Table 3.1, many households grow crops or fruit trees in their yards and in village common areas, but these activities are typically not enough to provide subsistence. Collection of local natural resources contributes substantially to household “income,” either as domestic provisioning or for sale. With high unemployment, households also rely heavily on retirement pensions from the states or remittances from migrant workers, which also means that many middle-aged males do not reside in the village.

3.3.1 Woodland Regulations

After speaking with members of the CDF, induna, and induna’s counselors, it was still unclear what the rules of woodland harvesting actually are. There was variation in all

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5 The information in the following two sections comes from conversations with induna, members of the Community Development Forum in each of the three study villages, and vendors of electricity and electric cooking appliances.
accounts. Some rules, however, were consistently reported. These included: no cutting wood from live trees (though some said it is allowed or encouraged to cut thorn trees), it is an even worse offense to cut live wood from fruit-bearing trees, particularly marula trees, certain trees are reserved for furniture companies and cannot be cut, and no lighting fires. Most agreed that cutting live thorn trees is allowed, but one induna said that a permit is required for this kind of harvesting. Some said that collecting dead wood is always allowed, but others said that a permit is required for this activity. This confusion about the rules extends into the community and is further discussed in Sections 3.3 and 3.4.

3.3.2 Household Characteristics

On average, households consisted of a disproportionately high percentage of youth, and low percentage of middle aged and elderly individuals (Table 3.1). There were also 10% more females on average in the study sample households. Most households grow crops and fruit trees in their yard, while significantly fewer households grow them in the fields outside of the homestead village. Chickens are the most common livestock, but cattle and goats are common as well. Refrigerators, TVs, stoves, and video or DVD players are the most frequently owned appliances. Few households own cars or bicycles, or have DSTV service. Only about one fourth of households use electricity as their main energy source for cooking, and the remaining households rely on fuelwood.

6 Induna were asked for permission to conduct research in their villages, at which time all three volunteered information. Since it was not originally in the research plan to interview Induna, these were conversational discussions and not structured in any way.
From the four SES measures described in the methods, agricultural production assets is the variable used to quantify a household’s dependence on local natural resources, and is the dependent variable for this household analysis. This variable is also included in the individual analysis as an independent SES variable. An explanation of the variable, which is a sum scale of livelihood strategies related to cultivation of local natural resources, is presented in Table 3.2.

The number of youth in a household had a negative relationship with household’s dependence on local natural resources, but the number of females had a positive relationship with the same variable (Table 3.3). The number of middle-aged and elderly individuals in a household did not have a significant effect in this model, and neither did cash income. Moveable consumer production goods, however, were almost significant.

**Table 3.1: Household descriptive statistics**

<table>
<thead>
<tr>
<th>Number of households</th>
<th>63</th>
<th>Fuelwood as main cooking fuel</th>
<th>76%</th>
<th>Chickens</th>
<th>65%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean size</td>
<td>5.76</td>
<td>Retirement pensions</td>
<td>54%</td>
<td>Car</td>
<td>17%</td>
</tr>
<tr>
<td>Mean percent female</td>
<td>55%</td>
<td>Child welfare</td>
<td>63%</td>
<td>Bicycle</td>
<td>17%</td>
</tr>
<tr>
<td>Mean percent male</td>
<td>45%</td>
<td>Growing crops in the woodlands</td>
<td>38%</td>
<td>Refrigerator</td>
<td>89%</td>
</tr>
<tr>
<td>Mean percent youth (0-30)</td>
<td>60%</td>
<td>Growing crops in the yard</td>
<td>90%</td>
<td>Stove</td>
<td>68%</td>
</tr>
<tr>
<td>Mean percent middle aged (30-59)</td>
<td>24%</td>
<td>Growing fruit trees in the yard</td>
<td>90%</td>
<td>TV</td>
<td>89%</td>
</tr>
<tr>
<td>Mean percent elderly (60+)</td>
<td>17%</td>
<td>Cattle</td>
<td>24%</td>
<td>DSTV</td>
<td>13%</td>
</tr>
<tr>
<td>Electricity as main cooking fuel</td>
<td>24%</td>
<td>Goats</td>
<td>21%</td>
<td>Video/DVD player</td>
<td>67%</td>
</tr>
</tbody>
</table>
Table 3.2: Activities included in variable “household dependence on local natural resources”

<table>
<thead>
<tr>
<th>Activity</th>
<th>Scale</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultivate crops in the woodlands</td>
<td>0=no, 1=yes</td>
<td>0-1</td>
</tr>
<tr>
<td>Cultivate crops in the yard</td>
<td>0=no, 1=yes</td>
<td>0-1</td>
</tr>
<tr>
<td>Number of woodland products collected</td>
<td>0-1*</td>
<td>0-5</td>
</tr>
<tr>
<td>Fruit trees grown in yard</td>
<td>0-1*</td>
<td>0-29</td>
</tr>
<tr>
<td>Collect fuelwood</td>
<td>0=no, 1=yes</td>
<td>0-1</td>
</tr>
<tr>
<td>Own cattle</td>
<td>0-1*</td>
<td>0-15</td>
</tr>
<tr>
<td>Own goats</td>
<td>0=no, 1=yes</td>
<td>0-1</td>
</tr>
</tbody>
</table>

*0-1 variables were rescaled, with 0 representing no participation in or income from the described activity, and 1 representing the maximum participation in or income from the described activity from the sample. All others represent a percentage of that maximum (i.e. for the variable “days per week cook with fuelwood, a household that does not cook with fuelwood gets a score of 0, a household that cooks with fuelwood 2 days a week gets a score of 0.29, and a household that cooks with fuelwood 7 days a week gets a score of 1. Variables were added to create a sum scale.

**Based on 2013 exchange rate of 1 USD to 10 South African Rand (ZAR)

Table 3.3: Influences of household dependence on local natural resources

<table>
<thead>
<tr>
<th>Activity</th>
<th>Estimate</th>
<th>Standard Error</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of youth in household</td>
<td>-0.235</td>
<td>0.105</td>
<td>0.030**</td>
</tr>
<tr>
<td>Number of middle-aged people in household</td>
<td>-0.132</td>
<td>0.2</td>
<td>0.511</td>
</tr>
<tr>
<td>Number of elderly people in household</td>
<td>-0.002</td>
<td>0.273</td>
<td>0.995</td>
</tr>
<tr>
<td>Females</td>
<td>0.361</td>
<td>0.164</td>
<td>0.032**</td>
</tr>
<tr>
<td>Cash income</td>
<td>0.035</td>
<td>0.137</td>
<td>0.800</td>
</tr>
<tr>
<td>Consumer production goods (moveable)</td>
<td>0.040</td>
<td>0.020</td>
<td>0.057*</td>
</tr>
</tbody>
</table>

*p<0.1; **p<0.05; ***p<0.01
3.3.3 Individual Analysis

The sample for the individual surveys (Table 3.4) was heavily female, with few middle-aged and elderly males, due to high migrant worker populations. All but one youth respondent have completed at least a ninth-grade education, and most elderly respondents have no education. Middle-aged respondents have a range of education.

Although females are typically in charge of cooking and collecting fuelwood, males contribute to these tasks as well. More than half of males in each age category collect fuelwood at least once a month. For both males and females, the highest percentage of fuelwood collectors is middle-aged, the second highest is youth, and the lowest is elderly. More females cook with fuelwood than males. For both females and males, youth most commonly cook with fuelwood, followed by middle-aged, and elderly individuals. Women perform these tasks more days per week than men, particularly middle-aged and elderly women. This sample represents a lower percentage of employed individuals than Statistics South Africa reports for all of Bushbuckridge (Table 2.1), which has an unemployment rate 18.6%. There are several factors that likely contribute to this difference: employed individuals would be at work during the time that the surveys were conducted; the study villages are more remote than some of the other parts of Bushbuckridge, with fewer opportunities for employment; and unemployment statistics do not include pensioners and those who are not actively seeking work.

When comparing whether or not individuals from each generation want the woodlands to be regulated there was no significant difference between self-reported preferences across generations (Figure 3.1). However, youth were perceived as wanting
regulations the least out of all generations, and this perception was exaggerated in the responses of the middle-aged and elderly. In a Chi-squared test, the difference in perception of youth’s preferences is significant at $p<0.05$, but there is no significant difference in perceptions of middle-aged and elderly generations.

When asked whether or not the general population and members of each generation follow the rules, on average, youth were seen as following the rules never, middle-aged people as sometimes, and elderly people as always. Chi-squared tests show that perceptions of the general population, middle-aged people, and elderly people do not vary by the generation of the respondent. Perceptions of youth however, vary significantly, with youth seeing themselves as following the rules more frequently than the middle-aged and elderly (Figure 3.2).

Perceptions of what the rules actually are vary as well. Respondents were asked if there is a rule prohibiting outsiders\(^7\), if rules exist to regulate woodlands, and if there is a rule prohibiting the cutting of live trees. Respondents were also asked to recall any other rules. The results are displayed in Figure 3.3. Youth were the least aware of all rules except for no cutting wood from marula trees, which is essentially an extension of no cutting wood from fruit trees. A Chi-squared analysis was run for each of the rules about which respondents were specifically asked. Youth were significantly less aware of the rule about outsiders, but not about whether rules exist, or cutting of live trees.

\(^7\) Outsiders are people who come to harvest fuelwood or other natural resources from woodlands that belong to a village other than their own. This issue is discussed in greater detail in Twine et al. (2003b).
When asked if there is now more, less, or the same amount of dry wood available compared to before, 84% of respondents think there is less dry wood now, and 67% of respondents think you have to walk farther now to collect wood than before. In a Chi-squared test, youth are significantly less likely to believe that you have to walk farther now to collect wood, but there is no significant difference in perceptions of the amount of dry wood.

For the results concerning drivers of opinions and preference of woodlands and their regulations (Table 3.5), an odds ratio of greater than 1 would mean that older individuals, females, collection of fuelwood, and higher SES are associated with greater perceived importance of the woodlands. An odds ratio less than 1 would mean that younger individuals, males, not collecting fuelwood, and lower SES are associated with lower perceived importance of the woodlands.

Age was significant for all of the “importance” variables, other than “providing products that we use”. Older people were more likely to perceive each of these services as “very important.” Age was also significant for who the respondent thinks should enforce woodland regulations, with younger people more likely to choose someone other than the Chief’s Police. Age was not significant for preferring that regulations exist.

Females were more likely to think the woodlands are very important for all five categories, but only “providing products that we use” was significant. Males were more likely to prefer that the Chief’s Police enforces woodlands regulations, as opposed to another regulatory unit. Someone who collects fuelwood is more likely to prefer that regulations exist, and less likely to think woodlands are very important for provision of products.
(although OR is close to 1), but collection of fuelwood was insignificant for all other
categories.

The four SES variables were infrequently significant, and all significant SES
variables had a negative relationship with perceived importance of woodlands. Moveable
consumer durable assets were negatively associated with importance for nature, as were non-
moveable consumer durable goods with wind protection. A higher amount of moveable
consumer durable goods was associated with the wish for someone other than the Chief’s
Police to enforce woodlands regulations.
**Figure 3.1:** Perceived and self-reported preferences regarding whether or not woodlands should be regulated

**Figure 3.2:** How often does each generation follow the woodland rules (responses broken down by generation of respondents)?
Figure 3.3: Knowledge of Woodland Rules
Table 3.4: Descriptive statistics for individual surveys; broken down by generation and gender (F=female; M=male)

<table>
<thead>
<tr>
<th></th>
<th>Youth (n=56)</th>
<th>Middle-Aged (n=45)</th>
<th>Elderly (n=40)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>M</td>
<td>F</td>
<td>M</td>
</tr>
<tr>
<td>Respondents</td>
<td>32</td>
<td>24</td>
<td>34</td>
<td>11</td>
</tr>
<tr>
<td>Education:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>9 (26%)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(27%)</td>
<td>(66%)</td>
</tr>
<tr>
<td>Grade 1-4</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>2 (6%)</td>
<td>1 (9%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(6%)</td>
<td>(9%)</td>
</tr>
<tr>
<td>Grade 5-8</td>
<td>0 (0%)</td>
<td>1 (4%)</td>
<td>6 (18%)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(18%)</td>
<td>(9%)</td>
</tr>
<tr>
<td>Grade 9-12</td>
<td>27 (84%)</td>
<td>21 (88%)</td>
<td>14 (41%)</td>
<td>4 (36%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(41%)</td>
<td>(36%)</td>
</tr>
<tr>
<td>Post- secondary</td>
<td>5 (16%)</td>
<td>2 (8%)</td>
<td>3 (9%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(9%)</td>
<td>(0%)</td>
</tr>
<tr>
<td>Collect fuelwood</td>
<td>14 (44%)</td>
<td>17 (71%)</td>
<td>25 (74%)</td>
<td>9 (82%)</td>
</tr>
<tr>
<td></td>
<td>(44%)</td>
<td>(71%)</td>
<td>(74%)</td>
<td>(82%)</td>
</tr>
<tr>
<td>Average days/week*</td>
<td>2.5</td>
<td>1.7</td>
<td>2.9</td>
<td>2.9</td>
</tr>
<tr>
<td>Cook with Fuelwood</td>
<td>31 (97%)</td>
<td>11 (46%)</td>
<td>30 (88%)</td>
<td>4 (36%)</td>
</tr>
<tr>
<td></td>
<td>(97%)</td>
<td>(46%)</td>
<td>(88%)</td>
<td>(36%)</td>
</tr>
<tr>
<td>Average days/week*</td>
<td>4.1</td>
<td>2.6</td>
<td>4.8</td>
<td>0.9</td>
</tr>
<tr>
<td>Employed</td>
<td>1 (3%)</td>
<td>0 (0%)</td>
<td>4 (12%)</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(12%)</td>
<td></td>
</tr>
</tbody>
</table>

*Average of only those who collect fuelwood and cook with fuelwood
Table 3.5: Drivers of opinions and preferences regarding woodlands and their regulation

The woodlands are very important for...

<table>
<thead>
<tr>
<th>Linear Probability Model</th>
<th>Providing products that we use</th>
<th>Protecting my village from wind</th>
<th>Our culture</th>
<th>Nature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Coefficient</td>
<td>0.003</td>
<td>0.005</td>
<td>0.008</td>
</tr>
<tr>
<td></td>
<td>Std Error</td>
<td>0.002</td>
<td>0.002</td>
<td>0.002</td>
</tr>
<tr>
<td></td>
<td>OR</td>
<td>1.007</td>
<td>1.005</td>
<td>1.012</td>
</tr>
<tr>
<td></td>
<td>p-value</td>
<td>0.110</td>
<td>0.003***</td>
<td>&lt;0.001***</td>
</tr>
<tr>
<td>Sex (male=0, female=1)</td>
<td>Coefficient</td>
<td>0.164</td>
<td>0.045</td>
<td>0.064</td>
</tr>
<tr>
<td></td>
<td>Std Error</td>
<td>0.090</td>
<td>0.072</td>
<td>0.088</td>
</tr>
<tr>
<td></td>
<td>OR</td>
<td>1.408</td>
<td>1.057</td>
<td>1.268</td>
</tr>
<tr>
<td></td>
<td>p-value</td>
<td>0.070*</td>
<td>0.537</td>
<td>0.466</td>
</tr>
<tr>
<td>Collects fuelwood</td>
<td>Coefficient</td>
<td>0.164</td>
<td>0.021</td>
<td>0.064</td>
</tr>
<tr>
<td></td>
<td>Std Error</td>
<td>0.090</td>
<td>0.074</td>
<td>0.088</td>
</tr>
<tr>
<td></td>
<td>OR</td>
<td>0.988</td>
<td>1.029</td>
<td>1.086</td>
</tr>
<tr>
<td></td>
<td>p-value</td>
<td>0.037**</td>
<td>0.775</td>
<td>0.292</td>
</tr>
<tr>
<td>Cash income</td>
<td>Coefficient</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Std Error</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>OR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>p-value</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agricultural production</td>
<td>Coefficient</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Std Error</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>OR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>p-value</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumer durable goods</td>
<td>Coefficient</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Std Error</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>OR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>p-value</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumer durable goods</td>
<td>Coefficient</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Std Error</td>
<td></td>
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<td></td>
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<tr>
<td></td>
<td>OR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>p-value</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumer durable goods</td>
<td>Coefficient</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Std Error</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>OR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>p-value</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumer durable goods</td>
<td>Coefficient</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Std Error</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>OR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>p-value</td>
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\[ p < 0.1 * \]
\[ p < 0.05 ** \]
\[ p < 0.01 *** \]
### Table 3.5 (continued)

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<thead>
<tr>
<th>Linear Probability Model</th>
<th>The woodlands are very important for my children</th>
<th>Prefer that Chief's Police regulates woodlands</th>
<th>Prefer that woodland regulations exist</th>
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<td>1.066</td>
<td>1.000</td>
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<tr>
<td></td>
<td>&lt;0.001***</td>
<td>&lt;0.001***</td>
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<td>(male=0, female=1)</td>
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<td>0.010**</td>
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<tr>
<td>Collects</td>
<td>Coefficient</td>
<td>Std Error</td>
<td>OR</td>
</tr>
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<td>OR</td>
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<td>Std Error</td>
<td>OR</td>
</tr>
<tr>
<td>p-value</td>
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<td>0.005</td>
<td>0.004</td>
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<td>0.005</td>
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<td>0.081*</td>
<td>0.440</td>
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<td>Consumer durable goods (non-moveable)</td>
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</tr>
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<td>p-value</td>
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<td>0.005</td>
<td>0.004</td>
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<td>0.992</td>
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<tr>
<td></td>
<td>0.307</td>
<td>0.081*</td>
<td>0.440</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.126</td>
<td>0.151</td>
<td>0.079</td>
</tr>
</tbody>
</table>

* p < 0.1*
** p < 0.05**
*** p < 0.01***
3.4 Discussion

3.4.1 Youth and Woodlands

Overall, youth in this study place less value on the woodlands than their older counterparts. The general consensus from the open-ended surveys is that youth do not want to go to the bush anymore, and prefer modern goods to collected ones. For example, a middle-aged female said in the open-ended surveys, “young people do not want to go with their parents to the bush. They don’t even ask about the things they see in the bush.” These results are in accordance with the findings from Malzbender et al. (2005) and Paumgarten et al. (2005) of youth preferring to leave rural areas for cities and the modern lifestyles available in urban settings. This apathy towards the woodlands and their resources could be the reason that a household’s agricultural production assets do not influence household members’ opinions or preferences. Even if a household relies on these resources, youth may not be participating in the harvesting, and may still prefer store-bought goods.

Given that SES was only occasionally significant in this study, education and connectivity to urban centers and media may be more important factors in perceptions and preferences. A middle-aged man lamented this point by saying “The young people think that they are educated and no longer listen to the older people. They don’t care about the culture and tradition. Youth of today don’t even want to go to collect water. People used to carry water on their heads, but now they don’t want to because they have nice hairstyles.” Youth do collect fuelwood at similar rates to middle-aged and elderly respondents, males included, but it is possible that they only collect fuelwood out of necessity, and do not grow crops in
the woodlands or collect other important products such as fruit and traditional medicine. These differences could explain the fact that, despite the lack of relationship between agricultural production assets and opinions, there is a negative relationship between amount of youth in a household and that household’s dependence on local natural resources. More youth in a household may not mean more labor for harvesting of local natural resources, especially if those youth are in school, as the increased education rates indicate. If youth are reluctant to participate in these activities, households may compensate with other livelihood strategies. The lack of significance of the other two age groups suggests that it is not their number, but their power that influences household decisions. Household heads are still in charge of decisions, regardless of if they are greatly outnumbered by youth.

Although there are significant differences in values across age groups, youth may be unfairly blamed for some of the villages’ problems, similar to how Celestino et al. (2012) found elderly villagers blaming the village’s droughts on younger people’s abandonment of traditional lifestyles. For example, youth are seen as wanting woodland regulations less frequently and breaking woodland regulations more frequently than middle-aged and elderly people. These differences are particularly pronounced in the responses from middle-aged and elderly individuals when answering questions about youth. However, self-reports indicate that youth want regulations at the same rate as middle-aged and elderly individuals. These results suggest that youth could be unfairly blamed for illegal or unsustainable harvesting. Additionally, the more frequent preference of youth for a non-traditional authority to regulate woodlands suggest that youth are want a voice in village matters, by
having rules enforced by democratically elected officials. These results support those by Twine et al. (2003b) and Ooman (2011).

Because youth want to live a modern lifestyle, they are blamed for problems related to traditional livelihoods. For example, a middle-aged female from the open-ended surveys believed that, “Young people do not care about conservation because they live the modern life and don’t want to go with their parents to the bush. They don’t even ask about the things they see in the bush.” Certain risks are associated with all youth abandoning traditional livelihoods. Loss of traditional knowledge could lead to inadvertent harvesting and subsequent loss of important tree and plant species, as well as lost economic opportunities associated with sale and trade of those species. All generations have noticed that collection trips now take longer and the amount of available wood has decreased, indicating that these shifts could threaten livelihood strategies.

Additionally, a mass exodus of youth to the cities would leave the aging village communities with nobody to take care of them in their old age, especially if, as an elderly female said, “Girls want to get married in urban areas because they don’t want to go to the bush. They avoid getting married here.” However, this scenario would only be possible if employment opportunities in cities increased dramatically.

Despite these risks, it is unfair to blame youth for wanting modern lifestyles, especially if those lifestyles include more opportunities for higher education and formal employment. Youth should be supported in their efforts to escape the “poverty trap” associated with heavy reliance on local natural resources, especially with the dangers of criminals and wild animals in the bush. As one middle-aged male said, “Young people are
scared of going to the bush because there are criminals in the bush. They act as if they are accompanying cows and then attack people. They rape women and sometimes kill people, especially if the person is alone.” Youth should not be slighted for wanting to avoid these dangers and improve their lives.

3.4.2 Woodland Regulation

Although knowledge of the rules did not vary significantly across age groups, except for rules prohibiting outsiders, this knowledge did vary across the sample. Some respondents were unaware of specific rules, while other respondents were unaware that rules exist at all. Additionally, the CDF members and induna who were interviewed also had varying perceptions of the actual woodland rules. Without clearly defined regulations, confusion can cause fear of arrest and unintentional rule breaking. Many respondents in the open-ended surveys believed that community members fear arrest while in the woodlands. An elderly male said, “I do not mind going to the bush, but I’m scared of getting arrested. They arrest you and they fine you. But people still go to the bush, because of poverty.” If the rules are more clearly defined, fear about collecting fuelwood can be diminished. However, if the rules prohibit collecting any wood, or prohibit cutting live wood when no dead wood is available, households that cannot afford electricity will need to break the rules in order to provide for their families.

3.4.3 Socioeconomic Status

Despite the role that poverty plays in woodland collection habits, cash income was
insignificant for all analyses. Two factors potentially contribute to cash income’s lack of significance for the household analysis. First, assets are a better measure of SES in this setting, because they accumulate over time and provide a longer-term picture of wealth. This variable was significant. Second, although households may be able to afford modern goods, the preferences of household members, particularly heads of households, have a greater impact on the decision to use local natural resources. A combination of SES and preferences of household decision-makers most likely influence the decision to rely on purchased or collected goods.

For individuals, the insignificance of household cash income suggests that preferences are shaped by factors other than economic standing, because it is not the amount of income that matters, but how it is spent. For example, although one household can afford all the modern provisions, and another cannot, the youth in both households may both regard these modern provisions highly, while the elderly in both households may both think they are unnecessary. Another household with high income may choose to still harvest local natural resources, even though they could now purchase substitute goods. The negative relationship between moveable consumer durable assets and perceived importance of the woodlands emphasizes this point, suggesting that access to media and modern appliances separates one from their local natural surroundings and diminishes the perceived value of those surroundings.

3.4.4 Gender

The low effects of gender in many of the tests could be in part due to both males and
females collecting fuelwood and cooking with fuelwood, although females still participate in these activities more frequently. The positive relationship between the number of females in a household and that household’s agricultural production assets suggests that females are still charged with these duties more frequently.

3.4.5 External Validity

The findings of this study are the most relevant for the over 19 million South Africans living in rural settings as of 2013 (World Bank, 2014). Additionally, however, the relationship between age and attitudes towards and use of local natural resources is relevant across sub-Saharan Africa. Apartheid makes South Africa unique, as does the dramatic increase in education rates, to a lesser extent. However, these relationships are worth examining in other settings, due to the potential impact on traditional knowledge, local natural resource harvesting, and ecosystem health.

3.5 Conclusions

It is clear that attitudes and perceptions have shifted from older to younger generations. Although a longitudinal study would be required to separate out the effects of age and the effects of generation, it is likely that the vast socio-political changes of the 1990s have bred a generation that thinks differently than the ones preceding it. It is uncertain if the values of today’s youth will change over time, but Jin & Rounds (2012) found in a meta-analysis of changes in work values over life spans found that these attributes remain
relatively steady. It is now important to understand what the implications of this generation’s variant perspectives are for the ecosystem and people of Bushbuckridge. With many youth placing less value on the woodlands, and wanting to avoid them altogether, it is possible that fuelwood harvesting will decline as today’s youth become household decision-makers, giving the woodlands an opportunity to regenerate. There could also be a mass exodus to the cities, meaning fewer community members would be harvesting from the woodlands. However, the ability to cook with electricity and move to cities depends on economic opportunities. If hard economic times come, people could resort to harvesting fuelwood, for household provision and sale, and be unaware of traditional knowledge and sustainable harvesting practices. Particularly if the situation is perceived as short-term, and no need for longer-term sustainability is seen, people could harvest uninhibitedly. With community members already noticing negative changes to the woodland ecosystem, reclaiming sustainable harvesting practices is a vital next step, especially as longer collection trips reduce time available for other productive tasks.

Research could be conducted to understand if traditional knowledge has decreased from older to younger generations, including knowledge of how to sustainably harvest woodland resources. Education about sustainable harvesting practices could be included in school curriculums, particularly regarding which trees produce fruit and traditional medicine, and the importance of allowing those trees to proliferate. This effort could contribute to preservation of woodland ecosystems and the traditional knowledge that some fear is being lost, so that future generations can have the woodlands as a safety net. However, if people do not value the woodlands in ways that encourage sustainable harvesting, then economic
incentives will likely be prioritized, regardless of knowledge and tradition.

The lack of clarity regarding rules also needs to be addressed. This uncertainty can lead to fear and inadvertent breaking of the rules. At the very least, community members should have an accurate perception of whether or not they are participating in an activity that could get them arrested or fined. They can then weigh the costs and benefits of breaking or following the rules in their situation. Without a true understanding of the rules, it is difficult for individuals to accurately weigh the risks of collecting wood to feed their families. For example, a fuelwood collector could be deterred from the woodlands because she thinks that collecting even dead wood is illegal, which is a substantial loss for a family that cannot afford electricity. Contrarily, another fuelwood collector could be arrested and fined for cutting wood from a living tree that she does not realize is protected. More clarity regarding the rules could prevent both of these situations.

One method for improving the regulatory system would be to involve the community. Giving community members a say in these regulations could both make them more aware of the real regulations, and they could potentially be more inclined to follow them. A participatory assessment of the current regulations could both create awareness and improve the current regulations to involve the needs of community members and the ecosystem. Particularly with youth leaning towards democratically elected officials regulating, integrating preferences of community members into the regulations could be a compromise.

To address the criminals, snakes, and wild animals in the woodlands, harvesters could be encouraged to collect in groups, thereby reducing the likelihood of attack and providing a support system in case an attack does occur. Community members should feel safe when
collecting the resources they need to survive. Awareness on these issues could also be raised simultaneously with the aforementioned participatory assessment. The communities could also take steps to deter criminals, such as increased policing of the woodlands. Costs could be prohibitive to increasing this force, however.

Attitudes in Bushbuckridge have shifted along with the socio-political changes following the end of Apartheid. These shifts could bring challenges, such as lack of traditional knowledge, apathy towards sustainable woodland harvesting, and a youth exodus to cities, but can also bring opportunities, such as improved regulatory structures, climbing economic ladders, and more choices in daily lifestyles. It is imperative to understand both the shifts and their consequences, in order to turn these challenges into opportunities for improved socio-economic and environmental welfare.
CHAPTER 4: HOW DOES AGE INFLUENCE PREFERENCES AND CHOICES REGARDING FUELWOOD AND ELECTRICITY CONSUMPTION?

The vast majority of people in the developing world rely on wood fuels for cooking and heating.\(^8\) There is debate over the impact of fuelwood harvesting on forests, with some arguing that it is unsustainable and will reduce the future availability of fuelwood (Schlag & Zuzarte, 2008) while others consider such concerns to be overstated (Arnold et al., 2006). However, there is general agreement that fuelwood use has negative implications for respiratory health, climate, the status of women, and time trade-offs with education. Multi-lateral organizations and NGOs have addressed these concerns with a variety of approaches, including rural electrification, promoting improved cookstoves (ICS), and establishing fuelwood plantations, but much of the donor community is currently focused on promoting new cooking technology (GACC, 2011). While new technologies have been broadly adopted in some regions, such as butane in Senegal, biogas in Nepal, and ICS in China (Schlag & Zuzarte, 2008; Smith et al., 1993), many interventions have achieved only low adoption rates, despite substantial investments of time and money (Arnold et al., 2003).

Interventions to promote new cooking technologies are typically planned and evaluated on the basis of household surveys, but such surveys do not capture intra-household dynamics and individual preferences, which can be important determinants of technology adoption and outcomes. Generational differences in preferences, knowledge, and experience

\(^8\) Wood fuels includes both firewood and charcoal, but the discussion of fuelwood in the context of the study site refers only to firewood, as charcoal production and consumption is negligible.
are also important because of their potential influence on the perceived benefits and adoption of new technologies in the future. By evaluating variation within households in preferences and habits regarding cooking technology and collection of fuelwood, we can assess how different types of individuals affect household decisions and gain insight into likely changes with generational turnover in the individuals making household decisions.

Although the typical alternatives to fuelwood in sub-Saharan Africa are charcoal, kerosene, and liquid petroleum gas (LPG), South Africa’s post-Apartheid development policies have resulted in relatively high rates of electricity access and use for residential cooking, including in rural areas. In an attempt to address the social inequalities that arose from the racial segregation of Apartheid, South Africa’s democratic government initiated the National Electrification Program (NEP) in the early 1990s, and by 2011, had provided electricity access for 81% of all households (South Africa, 2011), including almost 60% of rural households (Government Communications, 2012). However, over 90% of rural households still use fuelwood as their main domestic energy source, even though it is becoming increasingly scarce (Madubansi & Shackleton, 2006; Giannecchini et al., 2007; Kirkland et al., 2007; Matiska et al., 2013). Personal preferences – whether a commitment to traditional ways or a desire to modernize - have been cited as important factors influencing whether or not households adopt modern technologies (Slaski & Thurber, 2009). Others point out that the recent socio-political changes in South Africa have brought dramatic generational changes, with youth preferring modernity to the traditional norms (Malzbender et al., 2005; Paumgarten, 2005). These two findings suggest that it is worthwhile researching
both generational differences in perceptions and preferences, and the influence of different
generations on household decision-making regarding cooking technology.

Additionally, this research has implications for other regions that are initiating
improved cooking technology interventions. If youth are the most plausible adopters, efforts
can be targeted towards the appropriate generation, and can even include school programs
regarding the new technology. More generally, intervention strategies could be tailored to
different age groups in order to increase the adoption of cooking technologies that substitute
for fuelwood, thereby mitigating its negative externalities. By understanding how age is
related to adoption of electricity as a cooking technology, the future of South Africa’s energy
profile can be more accurately predicted and manipulated.

Figure 4.1 presents a conceptual framework whereby household fuel choice is
explained in terms of the benefits and costs of fuelwood and electricity use. The second
column describes factors that encourage fuelwood and electricity use; the third and fourth
column describe the constraints or costs of fuelwood and electricity use; and the last column
describes the impacts of each choices on those who collect, those who cook, and on the
woodlands themselves. The average opportunity cost of time for fuelwood collection varies
by age group, and preferences are also likely to vary systematically across age groups.
However, personal preferences of those in charge of making fuel decisions may be more
important than preferences of other household members. The cost of a particular fuel type
can outweigh preference for that fuel type, although resources can be shifted if the preference
is exceptionally strong. By examining these household and individual level dynamics, as
### Influences on Household Choice to Cook with Electricity

<table>
<thead>
<tr>
<th>Factors Encouraging Consumption</th>
<th>Costs</th>
<th>Other Constraints</th>
<th>Impacts of Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Familiarity with electric cooking</td>
<td>• May have to find additional formal/informal employment to pay for electricity</td>
<td>• Insufficient funds</td>
<td>• Less cash available for other expenditures</td>
</tr>
<tr>
<td>• Preference for modern methods</td>
<td>• May have to sacrifice money spent in other places such as school fees, food, and clothes</td>
<td>• No or inadequate electricity connection</td>
<td>• Decreased risks from fuelwood combustion and collection</td>
</tr>
<tr>
<td>• Aversion to smoke</td>
<td></td>
<td>• Lack of knowledge for operating stove</td>
<td>• More time available for other productive tasks</td>
</tr>
<tr>
<td>• Dislike for fuelwood collection</td>
<td></td>
<td></td>
<td>• Less potentially negative impacts on woodlands</td>
</tr>
<tr>
<td>• Perceived convenience</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**Figure 4.1: Conceptual framework outlining costs, constraints, and individual preferences as influences on the choice of fuelwood or electricity for domestic cooking energy, and the impacts of that choice**

*Although fuelwood is available for purchase in the study site, the primary means of obtaining fuelwood is collection. This conceptual framework focuses on fuelwood as a collected commodity, and assumes that household consumption = household production, therefore lumping together factors that influence both.*
well as their interactions, we can better understand fuel choice and cooking technology adoption.

The purpose of this study is to determine if age, at both the household and individual levels, influences the adoption of electricity as a cooking technology. At the household level, we examine the age composition of the household, rather than the age of the head or primary cook, to determine if other individuals in the household contribute to fuel decisions. We address two main questions: (1) Which factors influence household choice and individual preference of cooking technology? and (2) What are the contributions of individual level factors and household level factors to these choices? We hypothesize that younger individuals value the ease of cooking with electricity, while older individuals value the tradition of cooking with fuelwood, and household fuel choice will be determined by a combination of these preferences as well as costs. The alternative hypotheses are that the probability of adoption will be dominated by (a) the average preference of the adult household members, (b) the preference of the head of household, (c) the preference of the oldest member of the household, or (d) the preference of the household member responsible for cooking. Insights on these questions could help inform interventions to promote new cooking technologies, and plans for the future of South Africa’s rural electrification program.

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9 Although choice of fuel and choice of cooking technology are two different decisions, due to the setting, they are considered together in this study. All households interviewed cook with either fuelwood in a traditional stone fireplace or with an electric stove.
4.1 Review of Literature

4.1.1 Social and Environmental Impacts of Fuelwood Consumption

The widespread use of fuelwood for household thermal energy has negative externalities, especially for the environment, but also has direct negative impacts on the household. Nonetheless, partially due to the low (or zero) monetary cost of fuelwood, the majority of rural households in South Africa continue to cook with it (Williams & Shackleton, 2002). Cooking with fuelwood, especially in poorly ventilated rooms or with poorly ventilated stoves, contributes to respiratory and cardiac problems (Naeher et al., 2007; Norman et al., 2007; Röllin et al., 2004; Wilkinson et al., 2009; Barnes et al., 1994), and household air pollution from solid fuels is the third highest global risk factor for disease (Lim et al., 2010). Other research has also identified cooking smoke as a significant cause of infant mortality (Eberhard & Van Hooren, 1995; Wichmann & Voyi, 2006).

Additionally, individuals must often walk long distances to collect fuelwood, taking time away from other productive tasks, such as education, employment, and other household chores (Dovie et al., 2004). The burden of these time tradeoffs intensifies as fuelwood becomes scarce and individuals must walk farther to collect, while criminals and wild animals can make collection trips unsafe (Madubansi & Shackleton, 2007; Wentzel & Pouris, 2007). Women and girls, who traditionally do the household cooking and fuelwood collection in South Africa (Madubansi, 2003; Dinkleman, 2008), are most often the ones suffering from the negative effects of smoke inhalation, time trade-offs, and unsafe
conditions (Dinkleman, 2008; Wentzel & Pouris, 2007), contributing to the gender gap that the Millennium Development Goals are seeking to close (Rehfuess et al., 2006).

Collection and combustion of fuelwood also impacts both local and global environments. Combustion emits short-lived climate forcers and greenhouse gasses, contributing to climate change (Smith et al., 1993; Rosa & Ribiero, 2001; Johnson, 2008), and unsustainable collection has been linked to forest and woodland degradation and even deforestation where there is very high demand (Arnold et al., 2003; Schlag & Zuzarte, 2008). Impacts on forests or woodlands depend on population pressure and abundance of wood (Matsika et al., 2012). Although South Africa has enough wood to supply fuel for its entire population, spatial variability in supply and demand means that woodlands in some areas have insufficient stocks to meet local needs, which leads to unsustainable harvesting and woodland degradation in those areas (Matsika et al., 2012). Additionally, as fuelwood shortages in sub-Saharan Africa become more severe with time, threats to human welfare grow (Matsika et al., 2013), including increasing income insecurity (Dovie et al., 2004).

Ensuring the future supply of fuelwood and other thermal energy sources for household cooking is a pressing issue for the developing world. One way the development community has addressed this issue is with initiatives to improve cooking technologies, in an attempt to reduce pressures on fuelwood supplies, as well as address the aforementioned social and environmental concerns.
4.1.2 Fuel Switching and Technology Adoption

Numerous government programs and non-government organizations are promoting improved cooking technologies. These initiatives typically take one of two paths: development and distribution of improved efficiency cookstoves that reduce fuel requirements, or improved access to “clean” fuels, such as electricity and liquid petroleum gas (LPG). In both cases, the aim is to reduce the use of solid fuels, and consequently the time spent collecting, and human and environmental health impacts. However, despite the vast resources funneled into these efforts, traditional cooking methods persist. For example, in South Africa, even with the ongoing $3.5 billion electrification program (South Africa, 2011), over 90% of rural South Africa still relies primarily on fuelwood to meet domestic energy needs (Matsika et al., 2013), including in many areas where there have been intensive efforts to promote alternatives. Additionally, when households are given access to cleaner fuels, they typically do not switch entirely, but use a combination of the new fuel and the traditional one, if they adopt the new fuel at all (Heltberg, 2004; OECD & IEA, 2006; Schlag & Zuzarte, 2008). Although cost is often cited as the key barrier to adoption (Davis, 1998; Williams & Shackleton, 2002; Madubansi & Shackleton, 2007), consumption of fuelwood does not necessarily decrease with increasing income, as richer households can afford more food to cook, and/or may spend more on other needs (e.g. education or modernizing the home), and continue to save cash by cooking with fuelwood (Dovie et al., 2004). This indicates that there are more barriers to technology adoption than just the cost.
4.1.3 Technology Adoption and Age

Previous research on adoption of cooking technologies and fuel switching has considered the role of age of household head. However, there is a lack of research into how age composition of households impact fuel preferences and fuel use, and if individual preferences of non-heads impact household decisions. Additionally, the studies including “age of household head” most likely use this variable as a control, rather than a variable of policy interest. Table 4.1 synthesizes results from the seven empirical studies of choice of cooking technology in sub-Saharan Africa that I was able to identify in the literature published within 10 years of the initiation of this study. Studies were identified via Google Scholar, including only studies that used age in a multivariate regression model of fuel choice. Most studies report several different regression on different fuel types. These studies, report that age of household head does have an impact on household fuel choice, while others have found age to be statistically insignificant. All of these studies focus exclusively on age of household head, rather than age composition of the household.

Table 4.1 shows that three studies estimated statistically significant coefficients on age as a determinant of solid fuel choice. In all three cases, age had a positive relationship with use of solid fuels (without an ICS). In seven out of nine (78%) statistically significant cases examining non-solid fuels, or use of an ICS for solid fuels, age had a negative relationship with use of the fuel or ICS. There are also seven cases of statistically insignificant coefficients. These patterns in the literature imply that younger household heads prefer using more advanced cooking technology, while older household heads prefer fuels lower on the energy ladder.
The role of age merits further study, in particular the influence of the age composition of the entire household, since household members other than the head may influence these decisions. This is supported by the seven cases of statistically insignificant coefficients. In these cases, other members of the household could be influencing these decisions, but their role is masked when only examining heads of household. These effects could also be confounded by the gender of head, such as in cases where the head is male, but the female who cooks actually makes decisions regarding fuel. Intuitively, it is problematic to use age of head when conducting studies about household cooking choices in sub-Saharan Africa, because it is generally not the head who cooks or collects fuel. Only including age of head ignores the potentially greater influence of other household members.

4.1.4 Fuelwood and Electricity in Bushbuckridge

The Bushbuckridge Local Municipality is comprised of former “homelands,” where black residents were forcibly relocated into densely populated settlements by the Apartheid government of South Africa. Members of these communities historically earned their livelihoods from agriculture and a combination of other formal and informal sources of income, including harvest of natural resources, particularly fuelwood and other non-timber forest products, from village woodlands (Shackleton & Shackleton, 2004 a; b; Hunter et al., 2007; Shackleton et al., 2000). Fuelwood was collected in the largest volumes, since the “homelands” were generally not connected to the electricity grid.
<table>
<thead>
<tr>
<th>Study</th>
<th>Location</th>
<th>Technology</th>
<th>Age variable</th>
<th>Relationship with age variable</th>
<th>Statistically significant (p&lt;0.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ethiopia</td>
<td>Main fuel choice-wood</td>
<td>HH head</td>
<td>+</td>
<td>No</td>
</tr>
<tr>
<td>2</td>
<td>Ethiopia</td>
<td>Main fuel choice-wood</td>
<td>HH head</td>
<td>+</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>Ethiopia</td>
<td>Main fuel choice-solid</td>
<td>HH head</td>
<td>+</td>
<td>Yes</td>
</tr>
<tr>
<td>7</td>
<td>Ghana</td>
<td>Main fuel choice-biomass</td>
<td>HH head</td>
<td>+</td>
<td>No</td>
</tr>
<tr>
<td>1</td>
<td>Ethiopia</td>
<td>Main fuel choice-charcoal</td>
<td>HH head</td>
<td>+</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>Ethiopia</td>
<td>Main fuel choice-charcoal</td>
<td>HH head</td>
<td>-</td>
<td>No</td>
</tr>
<tr>
<td>1</td>
<td>Ethiopia</td>
<td>Main fuel choice-kerosene</td>
<td>HH head</td>
<td>-</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>Ethiopia</td>
<td>Main fuel choice-kerosene</td>
<td>HH head</td>
<td>-</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>Ethiopia</td>
<td>Main fuel choice-electricity</td>
<td>HH head</td>
<td>+</td>
<td>No</td>
</tr>
<tr>
<td>3</td>
<td>Uganda</td>
<td>Biogas adoption</td>
<td>HH head</td>
<td>-</td>
<td>Yes</td>
</tr>
<tr>
<td>1</td>
<td>Ethiopia</td>
<td>Electric mitad adoption</td>
<td>HH head</td>
<td>+</td>
<td>Yes</td>
</tr>
<tr>
<td>1</td>
<td>Ethiopia</td>
<td>Main fuel choice-Electricity</td>
<td>HH head</td>
<td>+</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>Ethiopia</td>
<td>Main fuel choice-mix</td>
<td>HH head</td>
<td>+</td>
<td>No</td>
</tr>
<tr>
<td>4</td>
<td>Sudan</td>
<td>Biomass ICS adoption</td>
<td>Wife age</td>
<td>-</td>
<td>Yes</td>
</tr>
<tr>
<td>4</td>
<td>Sudan</td>
<td>Biomass ICS adoption</td>
<td>Husband age</td>
<td>-</td>
<td>No</td>
</tr>
<tr>
<td>5</td>
<td>Ethiopia</td>
<td>Mirt injera biomass cook stoves adoption</td>
<td>HH head</td>
<td>+</td>
<td>No</td>
</tr>
<tr>
<td>5</td>
<td>Ethiopia</td>
<td>Lakech charcoal stove adoption</td>
<td>HH head</td>
<td>-</td>
<td>Yes</td>
</tr>
<tr>
<td>5</td>
<td>Ethiopia</td>
<td>Lakech charcoal stove adoption</td>
<td>HH head</td>
<td>-</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*Studies are arranged from the lowest rung on the “fuel ladder” to the highest.*

Studies: (1) Gebreegziabher et al., 2009; (2) Mekonnen & Köhlin, 2009; (3) Walekhwa et al., 2009; (4) Muneer & Mohamed, 2002; (5) Damte & Koch, 2011; (6) Mensah & Adu, 2013; (7) Kuunibe et al., 2013
In an attempt to address social inequalities in the new age of democracy, the government has been carrying out a National Electrification Program (NEP), with the goal of providing electricity access for 100% of South African households by 2022/23 (South African electrification program). In addition to substituting electric for fuelwood stoves, the touted benefits of the electrification program include electric lighting, television, radio, and cell phone chargers. Despite the NEP reaching Bushbuckridge in the 1990s and the majority of households in the region now having electricity connections, most households – regardless of whether connected to the electricity grid - still rely heavily on fuelwood for household thermal energy (Madubansi & Shackleton 2006; 2007; Matsika et al., 2012; 2013). Prohibitively high tariffs, despite subsidies, mean that access to electricity does not necessarily facilitate a switch to electricity for cooking purposes (Madubansi & Shackleton, 2006). Although households use electricity, it has not replaced fuelwood for cooking. In a longitudinal study, Madubansi and Shackleton (2007) found that fuelwood scarcity had increased and demand for fuelwood had not changed since the introduction of electricity into the area. However, a greater proportion of demand was satisfied through fuelwood markets rather than household collection. Coupled with observed woodland degradation, this indicates scarcity (Madubansi & Shackleton, 2007; Matsika et al., 2012) and demonstrates the inelasticity of fuelwood demand in the face of said scarcity (Matsika et al., 2013). These results are supported by a multitude of studies that have found declining wood stocks, increases in collection time, and increases in actual and perceived scarcity since the 1990s (Madubansi & Shackleton, 2006; Giannecchini et al, 2007; Kirkland et al, 2007; Matsika et al., 2012; Matiska et al., 2013; Twine et al., 2003a).
In Bushbuckridge, overharvesting of fuelwood has been found to lead to vegetation change and woodland degradation (Matsika et al., 2012; Twine, 2011). This has been related to recent increases in harvesting of live wood, as opposed to collection of dead or fallen branches, which typically occurs once the supply of dead wood has been exhausted (Dovie et al., 2004; Shackleton, 1993). Collection of live wood is illegal, and though the woodlands were well patrolled during the Apartheid era, shifting institutions and budget cuts in the democratic age have left the woodlands mostly unmonitored (Twine et al., 2003b). Outward expansion of the extent of communal woodlands is one way to reduce pressure on the current commons (Matsika et al., 2012). However, with Bushbuckridge encompassed in the Kruger to Canyons Biosphere, which includes a network of state and privately owned reserves, the opportunities for outward expansion are minimal (Matsika et al., 2013). This limitation could be one reason why there are increasing incidences of fuelwood harvesting from the commons of other villages, a prohibited practice that indicates village-level scarcity (Twine et al., 2003b).

The youth of rural South Africa are commonly described as preferring modernity to traditional ways of life (Paumgarten et al., 2005; Malzbender et al., 2005), which could make them ideal candidates for electricity adoption. However, as most youth are not yet heads of households, and therefore not in charge of decisions regarding cooking fuel, it is possible that their preferences cannot yet materialize into actual changes in household fuel choice. However, if youth are more inclined to cook with electricity, we could expect dramatic increases in the proportion of household using electricity to cook as the youth become heads
of households. This would be of critical importance for those in charge of planning expansion for South Africa’s already stressed electricity grid.

4.2 Data Analysis Methods

Data were first analyzed with descriptive statistics and relevant variables were checked for multicollinearity. Chi-squared tests were used to determine where significant differences existed across means. Multivariate analyses included linear probability models and ordinary least squares.

Households were asked about their habits concerning fuelwood and electricity, as well as the reasons for choosing one fuel over another. A linear probability model was estimated to identify factors associated with the probability that a household uses electricity as its main cooking fuel. The independent variables included the number of household members in each age category, the percent of females in the household, and the four socio-economic status (SES) variables.

Respondents were asked which cooking technology they preferred, if money was not a factor, and why they prefer that technology. These results were compared across generations. A linear probability model was estimated to determine which factors influence preferred cooking technology. The specification included sex, years of age, whether or not the respondent collects fuelwood, household cash income, household agricultural production assets, and household moveable consumer durable goods. Education was not included

10 Field methods are described in Chapter 2
11 Signs and significance are similar in Logit models estimated with maximum likelihood.
because it is highly correlated with age (correlation coefficient $-0.76$, $p$-value <0.001) and thus their effects could not be independently identified. This relationship between age and education is due to dramatic increases in education after the end of Apartheid, and smaller increases preceding that milestone. This study focuses on how age, as a result of post-Apartheid changes, affects opinions and perceptions. Education is one of those post-Apartheid changes. In bivariate tests, education had a significant relationship with the same dependent variables as age, and in the opposite direction as age, as expected due to the negative relationship between age and education.

4.3 Results

4.3.1: Household Electricity Infrastructure

Households must prepay for their electricity\(^{12}\) using a meter that they can load with either a prepaid card that is inserted into the meter (Figure 4.2) or a prepaid code that is punched into the keypad on the meter (Figure 4.3). Once the prepaid amount of electricity has been used, the electricity in that household shuts off until more electricity credits are loaded. Prepaid electricity cards can be purchased in shopping centers, and are usually sold in gas stations or grocery stores. No shopping centers exist within any of the study villages, so households with card-reading meters must travel to the closest commercial center to purchase

\(^{12}\) No households in the study site were observed to have off-grid electricity connections, nor was this reported in any of the literature on Bushbuckridge. However, other rural regions were observed to have entire villages with solar panels on roofs.
electricity. This travel requires time and money, adding to the cost of electricity, and forcing the household to live without electricity from the time the electricity shuts off until the time someone is able to travel to purchase electricity again. Travel distances vary, and the distances from each of the three study villages to the nearest place to purchase electricity are shown in Table 4.2. Prices also vary (6-9 cents/KwH) between vendors, with the larger centers charging less. Electrical appliances can also be purchased in these centers, for costs that are also shown in Table 4.2.

Figure 4.2: Electricity meter requiring a prepaid card to activate
Table 4.2: Distances to nearest shopping village, cost of electricity, and cost of electrical cooking appliances (in July, 2012)

<table>
<thead>
<tr>
<th>Village</th>
<th>Buffelshoek</th>
<th>Edinburgh</th>
<th>Ludlow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nearest shopping center</td>
<td>Acornhoek</td>
<td>Thulamahashe</td>
<td>Hluvukani</td>
</tr>
<tr>
<td>Distance to shopping center</td>
<td>7.5 km</td>
<td>8 km</td>
<td>11 km</td>
</tr>
<tr>
<td>Cost of electricity</td>
<td>2 USD*/35 units**</td>
<td>2 USD/26 units</td>
<td>2 USD/23 units</td>
</tr>
<tr>
<td>Cost of 1 plate hot plate</td>
<td>6.5 USD</td>
<td>7 USD</td>
<td>6.5 USD</td>
</tr>
<tr>
<td>Cost of 2 plate hot plate</td>
<td>15 USD</td>
<td>12 USD</td>
<td>12 USD</td>
</tr>
<tr>
<td>Cost of water heater</td>
<td>8 USD</td>
<td>8 USD</td>
<td>8.5 USD</td>
</tr>
</tbody>
</table>

*Prices based on 2013 exchange rate of 10 ZAR to 1 USD
**1 unit = 1 kWh
The electricity codes for boxes equipped with a keypad can be purchased within the village, because they can be sold on the same machine used to sell mobile phone credit. This machine is a landline phone with a receipt printer, connected to a provider (Figure 4.4). There were at least two vendors selling electricity codes within each of the three study villages. Community members are able to reach these vendors on foot, and the time and cost of travel is significantly less than to reach a shopping center. This system also provides another (small) source of income for the vendors (90ZAR profit on 500ZAR of electricity...
sold, after initial purchase of machine). Ironically, one of the central locations selling electricity this way was powering the machine with solar panels, because the room did not have an electricity connection. Although one CDF member estimated that card boxes outnumber code boxes 9:1, electricity vendors in shopping centers said that more people purchase the codes. These shopping centers serve several villages, however, so it is possible that some villages have more code boxes while other villages have more card boxes. According to the same CDF member, Eskom, South Africa’s main electricity provider, installed code boxes until there were no more, and then installed card boxes.

4.3.2: Household Characteristics

As the descriptive statistics in Table 4.3 show, households on average consisted of a high percentage of youth and low percentage of middle aged and elderly individuals. There were also 10% more females on average in the study sample households. Most households grow crops and fruit trees in their yard, while significantly fewer grow them in the woodlands. Chickens are the most common livestock, but cattle and goats also have a presence. Refrigerators, TVs, stoves, and video or DVD players are the most common appliances. Few households own cars or bicycles, or have dish-satellite television (DSTV) service. Only about one fourth of households use electricity as their main cooking fuel, and the remaining households rely on fuelwood.
*Household use of electricity and fuelwood*

When households were asked about their habits concerning fuelwood and electricity, all interviewed households use electricity for lighting, and 90% or more use electricity for television, refrigeration, and charging a cell phone (Table 4.4). Half or more of households use electricity for radio, heating, and cooking\(^{13}\). Almost all households use fuelwood for cooking, slightly fewer use it for heating water, and just over half use it for warmth. No households reported using fuelwood for light. When asked why they use fuelwood for cooking (Figure 4.5), the majority (68%) of households\(^ {14}\) responded that it is cheaper than electricity. A few households said that they cannot afford a stove or they use wood to save electricity, which are also cost-related barriers. The next most common reason (13%) was that food tastes better with fuelwood. The “Other” category contains responses of 2% or less, and includes: “cannot afford a stove,” “scared of using electricity,” “fuelwood is more natural,” and “fuelwood is for traditional occasions.” These reports of household decision-making suggest that cost is a major barrier – but not the only barrier - to complete adoption of electricity for cooking.

---

\(^{13}\) The percentage of households using electricity for cooking is different than the percentage of households whose main cooking fuel is electricity. The same applies to fuelwood.  
\(^{14}\) All households who cook with fuelwood, including those who use it occasionally, are included in this sample.
Figure 4.5: Why households use fuelwood over electricity (n=48)
Table 4.3: Household descriptive statistics (n=63)

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean size</td>
<td>5.76</td>
</tr>
<tr>
<td>Mean age of head</td>
<td>58</td>
</tr>
<tr>
<td>Percent of male-headed households</td>
<td>52%</td>
</tr>
<tr>
<td>Mean percent female</td>
<td>55%</td>
</tr>
<tr>
<td>Mean percent male</td>
<td>45%</td>
</tr>
<tr>
<td>Mean percent youth (0-30)</td>
<td>60%</td>
</tr>
<tr>
<td>Mean percent middle aged (30-59)</td>
<td>24%</td>
</tr>
<tr>
<td>Mean percent elderly (60+)</td>
<td>17%</td>
</tr>
<tr>
<td>Electricity as main cooking fuel</td>
<td>24%</td>
</tr>
<tr>
<td>Retirement pensions</td>
<td>54%</td>
</tr>
<tr>
<td>Child welfare</td>
<td>63%</td>
</tr>
<tr>
<td>Growing crops in the woodlands</td>
<td>38%</td>
</tr>
<tr>
<td>Growing crops in the yard</td>
<td>90%</td>
</tr>
<tr>
<td>Growing fruit trees in the yard</td>
<td>90%</td>
</tr>
<tr>
<td>Cattle</td>
<td>24%</td>
</tr>
<tr>
<td>Goats</td>
<td>21%</td>
</tr>
<tr>
<td>Chickens</td>
<td>65%</td>
</tr>
<tr>
<td>Car</td>
<td>17%</td>
</tr>
<tr>
<td>Bicycle</td>
<td>17%</td>
</tr>
<tr>
<td>Refrigerator</td>
<td>89%</td>
</tr>
</tbody>
</table>

Table 4.4: Use of electricity and fuelwood in households (n=63)

<table>
<thead>
<tr>
<th>Fuel and use</th>
<th>Percent of households</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooking (electricity)</td>
<td>62%</td>
</tr>
<tr>
<td>Cooking (fuelwood)</td>
<td>95%</td>
</tr>
<tr>
<td>Lighting (electricity)</td>
<td>100%</td>
</tr>
<tr>
<td>Light (fuelwood)</td>
<td>0%</td>
</tr>
<tr>
<td>Heating (electricity)</td>
<td>59%</td>
</tr>
<tr>
<td>Heating (fuelwood)</td>
<td>57%</td>
</tr>
<tr>
<td>Heating water (fuelwood)</td>
<td>89%</td>
</tr>
<tr>
<td>Television</td>
<td>90%</td>
</tr>
<tr>
<td>Cell phone</td>
<td>94%</td>
</tr>
<tr>
<td>Refrigerator</td>
<td>90%</td>
</tr>
<tr>
<td>Radio</td>
<td>51%</td>
</tr>
</tbody>
</table>
Drivers of fuel choice

For the results of the regression analysis of drivers of household choice of electricity for cooking (Table 4.5), all categories, an odds ratio greater than 1 signifies that households with a greater quantity or proportion of the independent variable are more likely to choose electricity as the household’s main cooking fuel. An odds ratio less than 1 means that households with a greater quantity of the independent variable are less likely to use electricity as their main cooking fuel. For example, households with more middle aged and elderly members (OR < 1) are less likely to choose electricity as their main cooking fuel, and more likely to choose fuelwood. Number of youth, however, was statistically insignificant. Of the SES variables, non-moveable consumer durable goods were the only significant variable in this model. Households with a higher sum of assets in this category are more likely to cook with electricity. Households with higher agricultural production assets were more likely to choose fuelwood as their main cooking fuel, but the results were not quite significant at the 10% level ($p=0.1253$). Higher cash income was correlated with the choice of electricity, but these results were also not statistically different from zero. Moveable consumer durable goods and percent of household that is female were also insignificant. This lack of significance could be due to the small sample size.
Table 4.5: Drivers of household choice of electricity for cooking (N=63)

<table>
<thead>
<tr>
<th>Linear Probability Model</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>OR</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of youth household members</td>
<td>0.001</td>
<td>0.019</td>
<td>1.001</td>
<td>0.953</td>
</tr>
<tr>
<td>Number of middle aged household members</td>
<td>-0.160</td>
<td>0.061</td>
<td>0.852</td>
<td>0.012*</td>
</tr>
<tr>
<td>Number of elderly household members</td>
<td>-0.203</td>
<td>0.087</td>
<td>0.816</td>
<td>0.024*</td>
</tr>
<tr>
<td>Percent of household that is female</td>
<td>-0.160</td>
<td>0.250</td>
<td>0.852</td>
<td>0.525</td>
</tr>
<tr>
<td>Cash Income</td>
<td>0.039</td>
<td>0.048</td>
<td>1.040</td>
<td>0.420</td>
</tr>
<tr>
<td>Agricultural production assets</td>
<td>-0.097</td>
<td>0.063</td>
<td>0.907</td>
<td>0.126</td>
</tr>
<tr>
<td>Moveable consumer durable goods</td>
<td>0.007</td>
<td>0.007</td>
<td>1.007</td>
<td>0.376</td>
</tr>
<tr>
<td>Non-moveable consumer durable goods</td>
<td>0.122</td>
<td>0.058</td>
<td>1.130</td>
<td>0.041*</td>
</tr>
<tr>
<td>Multiple R-squared: 0.220</td>
<td></td>
<td></td>
<td>0.220</td>
<td></td>
</tr>
</tbody>
</table>

4.3.3 Individual Analysis

The sample for the individual surveys (Table 4.6) was heavily female, with few middle-aged and elderly males, since many of them are migrant workers and thus not available to be interviewed. All but one youth respondent have completed at least a ninth-grade education, and most elderly respondents have no education. Middle-aged respondents have a range of education. Although females are typically in charge of cooking and collecting fuelwood, males contribute to these tasks as well. More than half of males in each age category collect fuelwood at least once a month. Among both males and females, the
highest percentage involvement in fuelwood collection occurs among the middle-aged, the second highest is youth, and the lowest is elderly. More females cook with fuelwood than males. For both females and males, youth most commonly cook with fuelwood, followed by middle-aged, and elderly individuals. Women - particularly middle-aged and elderly women - perform these tasks more days per week than men.

This sample represents a lower percentage of employed individuals than Statistics South Africa reports for all of Bushbuckridge (Table 2.1), which has an unemployment rate 18.6%. There are several factors that likely contribute to this difference: employed individuals would be at work during the time that the interviews were conducted; the study villages are more remote than some of the other parts of Bushbuckridge, with fewer opportunities for employment; unemployment statistics do not include pensioners and those who are not actively seeking work.

Overall, 56% of respondents preferred\textsuperscript{15} fuelwood, 44% of respondents preferred electricity, and 1%\textsuperscript{16} preferred both (Figure 4.6). Electricity preference was highest in youth (71%), moderate in middle-aged respondents (31%), and lowest in elderly respondents (20%). When respondents were asked which cooking technology they believe each generation prefers, the responses followed the same trend, but were more extreme. 97% of respondents said youth prefer electricity, 25% said that middle-aged people prefer electricity, and 3% said that the elderly prefer electricity.

\textsuperscript{15} Participants were asked to give their preference if cost was not a concern
\textsuperscript{16} Total over 100% due to rounding. The one individual preferring both fuels is excluded from the linear probability model.
For the linear probability model estimated to determine drivers of the preference to cook with electricity (Table 4.7), odds ratios for the SES variables can be interpreted in the same way as for the household analysis. For the remaining three variables, older individuals, females, and those who collect fuelwood would have an odds ratio greater than 1 is
Table 4.7: Drivers of the preference to cook with electricity

<table>
<thead>
<tr>
<th>Linear probability model</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Odds Ratio</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>-0.0184</td>
<td>0.003664</td>
<td>0.981</td>
<td>&lt;0.001***</td>
</tr>
<tr>
<td>Sex</td>
<td>0.355802</td>
<td>0.161026</td>
<td>1.427</td>
<td>0.031**</td>
</tr>
<tr>
<td>Collect fuelwood</td>
<td>0.484441</td>
<td>0.159489</td>
<td>0.616</td>
<td>0.003***</td>
</tr>
<tr>
<td>Cash income</td>
<td>-0.044462</td>
<td>0.058245</td>
<td>0.956</td>
<td>0.449</td>
</tr>
<tr>
<td>Agricultural production assets</td>
<td>-0.025602</td>
<td>0.075632</td>
<td>0.974</td>
<td>0.724</td>
</tr>
<tr>
<td>Consumer durable goods (moveable)</td>
<td>-0.001408</td>
<td>0.009958</td>
<td>0.999</td>
<td>0.886</td>
</tr>
<tr>
<td>R-squared</td>
<td></td>
<td></td>
<td>0.244</td>
<td></td>
</tr>
</tbody>
</table>

p < 0.1
p < 0.05 **
p < 0.01 ***

associated with the preference to cook with electricity, while an odds ratio less than 1 would associate younger individuals, males, and those who do not collect fuelwood with the preference to cook with electricity.

Females and those who do not collect fuelwood were more likely to prefer electricity. Age is included in continuous form (years of age), so the coefficient and odds ration effects are per year of age. Lower SES was associated with preference of electricity, but these results were insignificant.

The most common reason given by all three generations for preferring fuelwood (Table 4.8) was that food tastes better when cooked with fuelwood. The next most common
<table>
<thead>
<tr>
<th>Reason for preferring fuelwood or electricity</th>
<th>Generation</th>
<th>Youth (n=56)</th>
<th>Middle Aged (n=44)</th>
<th>Elderly (n=40)</th>
<th>Total (n=140)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prefer fuelwood</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food tastes better</td>
<td></td>
<td>14%</td>
<td>25%</td>
<td>33%</td>
<td>23%</td>
</tr>
<tr>
<td>Grew up using it/used to it</td>
<td></td>
<td>4%</td>
<td>20%</td>
<td>30%</td>
<td>16%</td>
</tr>
<tr>
<td>Faster or easier</td>
<td></td>
<td>7%</td>
<td>16%</td>
<td>8%</td>
<td>10%</td>
</tr>
<tr>
<td>Part of nature/tradition</td>
<td></td>
<td>2%</td>
<td>2%</td>
<td>5%</td>
<td>3%</td>
</tr>
<tr>
<td>Scared of electricity</td>
<td></td>
<td>2%</td>
<td>5%</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td>0%</td>
<td>0%</td>
<td>3%</td>
<td>1%</td>
</tr>
<tr>
<td>Total preferring fuelwood</td>
<td></td>
<td>29%</td>
<td>67%</td>
<td>80%*</td>
<td>56%</td>
</tr>
<tr>
<td>Prefer electricity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Faster or easier</td>
<td></td>
<td>38%</td>
<td>16%</td>
<td>8%</td>
<td>22%</td>
</tr>
<tr>
<td>Don't want to collect wood</td>
<td></td>
<td>11%</td>
<td>9%</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>Dislike smoke</td>
<td></td>
<td>16%</td>
<td>2%</td>
<td>0%</td>
<td>7%</td>
</tr>
<tr>
<td>Scared of fuelwood</td>
<td></td>
<td>7%</td>
<td>5%</td>
<td>3%</td>
<td>5%</td>
</tr>
<tr>
<td>Food tastes better</td>
<td></td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Total preferring electricity</td>
<td></td>
<td>71%</td>
<td>31%</td>
<td>20%</td>
<td>44%</td>
</tr>
<tr>
<td>Prefer both</td>
<td></td>
<td>0%</td>
<td>2%</td>
<td>0%</td>
<td>1%</td>
</tr>
</tbody>
</table>
answer for middle-aged and elderly respondents was that they grew up using fuelwood or were used to it, but few youth gave this answer.

The most common reason for youth (38%) and middle-aged respondents to prefer electricity was that it is faster or easier, which was the second most common response from the elderly. However, the proportion of youth that gave this answer is over twice that of middle-aged respondents, and over four times that of elderly respondents. Among elderly respondents, the most common reason for preferring electricity was that they do not want to collect wood, which was the second most common response for middle-aged people, and third most common for youth. Youth were the only age group with more than one person (or >2%) indicating that they prefer electricity because they dislike the smoke from cooking with fuelwood.

In cases where the household head was interviewed (n=46), the preference of the head was compared to household fuel choice, and broken down by generation (Table 4.9). In households that cook primarily with fuelwood, twenty-eight out of thirty-six (78%) household heads prefer fuelwood. In households that cook primarily with electricity, four out of ten (40%) of heads prefer electricity. Of the households who cook with fuelwood, but that have a head preferring electricity, six out of seven (86%) said they use fuelwood for cost-saving reasons. Households using electricity as their main fuel were not asked for a reason.

All three youth headed households use electricity as their main cooking technology, and all three heads prefer electricity. Of middle-aged households, thirteen out of seventeen (76%) heads prefer fuelwood, and eleven of those thirteen (84%) heads’ households cook
with fuelwood. Of elderly headed households, nineteen out of twenty-seven (70%) heads prefer fuelwood, and seventeen of those nineteen (89%) heads’ households use fuelwood as their main cooking technology.

![Figure 4.6: Fuel preferences of generations; Personal responses and perceptions](image)
4.4 Discussion

4.4.1 Household Fuel Use

Most households are using a mix of fuelwood and electricity, which is supported by previous studies (Heltberg, 2004; OECD & IEA, 2006; Schlag & Zuzarte, 2008), so that even...
those households cooking primarily with fuelwood still benefit from electricity connections. In open-ended surveys, electricity and fuelwood were commonly cited as back-ups for one another. For example, a middle-aged male stated “electricity has improved our lives because even if there is rain, we can cook,” while a young female said “Fuelwood is important because I am trying to save electricity. We don’t have money and my mom is unemployed. We try to save electricity so we can buy food.” Households that cannot afford to habitually use electricity for cooking can still benefit by being able to cook under conditions that would make fuelwood cooking difficult or impossible, but availability of fuelwood is still vital when households need to reduce the financial burden of cooking.

Electricity has provided other benefits to community members. The provision of electric lighting has made it possible to see into the night. This improves safety and prolongs productive hours. Studying, household chores, and other activities can replace what could have previously been hours of boredom. Electric lighting is also safer than candles and paraffin, which have caused burns and house fires. As one middle-aged female said, “Now, even if you leave your children at home, they won’t get burned by candles and paraffin lamps.” The benefits extend well beyond light, however. Refrigeration keeps food from spoiling. Being able to charge a cell phone opens up several possibilities, including mobile banking and internet access. Radio and television can provide entertainment, news, and education. Even if households cannot afford to consistently cook with electricity, they can still benefit from other opportunities provided by grid connections. Additionally, if economic conditions improve, households will already be equipped with the connection that they can then afford to use.
The benefits of electricity can perhaps be best seen through the eyes of one of the few individuals without electricity. Although every household interviewed for the household and individual analyses had electricity, one of the open-ended survey respondents did not. The middle-aged male said of his lifestyle, “We are trying to get electricity because we would be living better. It is a miserable life. Each day we have to use candles for light. We live here for eleven years without electricity.” Although not everyone wants to use electricity for cooking, the benefits of being connected to the grid are enormous.

Whether the household head prefers electricity or fuelwood, their preference is not the only influencing factor, and is less important for household using electricity. Households cooking with fuelwood when the head prefers electricity primarily do so because of the cost, which supports previous findings by Davis (1998), Williams & Shackleton (2002), and Madubansi & Shackleton (2007). Because no data was collected on why households choose electricity, reasons can only be inferred. It is likely that preferences of individuals other than the head of household are expressed in fuel choice, and that the family member(s) who cook are the ones influencing this decision. Even if youth are not in charge of cooking, they could persuade their parents to use electricity and explain how to use the stoves.

4.4.2 Age, Fuel Choice, and Fuel Preferences

Age clearly influences both household fuel choice and individual fuel preference, with youth preferring and choosing electricity much more frequently than their older counterparts. In this study, youth headed households were most likely to choose and have a head preferring electricity, while fuelwood use and preference was most common for middle-
aged and elderly headed households. These findings support the body of literature previously referenced (Table 4.1), in which ten out of twelve studies that found youth headed households were more likely to cook with modern fuels or technologies, as well as the findings by Paumgarten et al. (2005) and Malzbender et al. (2005) that youth more frequently prefer modernity to traditional ways of life.

It is logical that females, older individuals, and fuelwood collectors are more likely to prefer cooking with fuelwood because they are the ones who most often do cook with fuelwood (although males cook with and collect fuelwood more commonly in this study than is suggested by Madubansi (2003) and Dinkleman (2008)). As older individuals are more likely to be the decision-making heads of households, their numbers and general preference for fuelwood influences households to choose fuelwood as their main cooking fuel. Although expense is most frequently listed as the reason households choose fuelwood over electricity, cash income and wealth (represented by moveable consumer durable goods) were insignificant in household fuel choice. These results suggest that preference plays a role as well. While many households cite cost as the reason for not using electricity, it is more likely a mix of cost and preferences. For example, households may be able to shift cash expenditures to include or exclude purchasing electricity for cooking, and those decisions are made based on how important electric cooking is to those household members. If that same household had more cash, then perhaps they would use it to purchase electricity.

One possibility for the shift in fuel preference from older to younger generations is that youth have grown up seeing electric cooking for all or most of their lives, so it is not such a foreign and intimidating technology. However, youth are also typically not in charge
of household finances, so may not fully understand the burden of purchasing enough
electricity for cooking. Youth also value convenience more than middle-aged and elderly
respondents. When examining the importance of convenience as a whole, rather than
convenience of fuelwood separate from that of electricity, it accounts for a substantial
proportion of the responses. For example, 32% of respondents prefer fuelwood or electricity
because it is faster or easier than the alternative. These responses were most common among
youth (45%), moderate in middle-aged respondents (31%), and lowest in elderly respondents
(15%). For a middle-aged person who is used to fuelwood, it may seem more convenient
than electricity, especially if they have a continuously burning fire and electric cooking is a
new technology. Switching to electric cooking can also lead to difficulties in controlling the
temperature of the stove. These results suggest that both youth and middle-aged people are
more concerned with convenience, but they have different ideas of convenience based on the
time period in which they were raised.

Among the middle-aged and elderly, the second most popular reason for preferring a
cooking fuel is that they grew up using fuelwood, but this answer choice was seldom selected
by youth. Given that the youngest respondents to this survey were born in 1994, which is
around the time rural electrification began in South Africa, presumably even most youth
respondents experienced fuelwood as the dominants fuel choice for part of their childhood.
However, many of them would have used or at least observed electric cooking in their home
or their neighbors’ homes as they became teenagers.

There are also noticeable differences in the level of concern with smoke as a reason to
prefer electricity. Youth were most likely to express concern with smoke, while almost none
of the middle-aged and elderly respondents mentioned this factor. Older respondents may be resigned to the smoke because they grew up with no alternative, whereas youth grew up seeing this as a major difference between the two cooking technologies. Alternatively, older generations may be equally bothered by the smoke from cooking with fuelwood, but less likely than youth to consider that a burden, e.g. less likely to link respiratory disease to smoke.

It is not surprising that SES is not a significant indicator of fuel preference, because individuals were asked which fuel they would prefer if cost were not a consideration. This finding demonstrates that, although higher SES households are more likely to have the option to cook with electricity, individuals with lower SES can share the same fuel preferences as individuals with higher SES.

The perceptions of generational cooking preferences, when compared to the cooking preferences reported in this study, demonstrate a general understanding of the changing attitudes in Bushbuckridge. Even though the perceived responses were more extreme than the self-reported preferences, these responses suggest that perceptions are in line with the typical cooking preferences of the generations in these villages. Respondents were asked to give the most commonly preferred cooking fuel of each generation, rather than the share of individuals in each generation that prefer each technology.

4.4.3 Implications for the Future – Fuel and the Woodlands

Although it is difficult to separate the effects of age versus the effects of generation without conducting a longitudinal study, there are clear differences in the upbringing of
South Africa’s current youth vs. the currently middle-aged to elderly generations. As one young male said, “Most young people like electricity because they grew up with it, and are not used to using fuelwood. Older people are used to fuelwood and they are scared of being burned or electrified with electricity.” In a study of age and technology adoption in the workplace, Morris & Venkatesh (2002) postulate that younger individuals are more perceptive to new technologies because they were exposed to similar technologies and personal computer usage as early as elementary school, whereas older generations experienced these technologies much later in life. Today’s youth have spent most of their life seeing electricity as an option for cooking, even if their own household is not able to afford it.

As youth of today become heads of households and de-facto heads of households and start making the cooking decisions, it is likely that they will seek to shift towards more electricity use for cooking. The degree to which this shift can occur will largely depend on income. Even if the majority of those in charge of cooking decisions prefer to use electricity, they will only be able to switch if they can afford the electricity.

Preferences for electricity but inability to afford it could have unfortunate consequences for the woodlands. It was commonly stated that today’s youth do not understand or care about sustainable harvesting. Consider, for example, if today’s youth disregard traditional rules such as restricting fuelwood collection to deadwood, expecting that they will be able to use electricity in the future. Maybe they can support the purchase of electricity for a few years. However, if hard economic times fall on the village, it could lead to an increase in fuelwood collection, mostly by individuals who are not used to travelling to
the woodlands and do not value sustainable harvesting. Overharvesting could occur, leading to ecosystem changes and decreasing supply of fuelwood. In this study, the perceptions of having to walk farther to collect wood, and less wood being available suggest that overharvesting could already be a reality, which is supported by several studies conducted in this region (Madubansi & Shackleton, 2006; Giannecchini et al, 2007; Kirkland et al, 2007; Matsika et al., 2012; Matiska et al., 2013; Twine et al., 2003a). On the other hand, if the economy and incomes grow, that will present a challenge for the electricity grid to supply all of the new users.

4.4.4 Sample Size

The small sample size of this study limits both statistical power to detect significant determinants of fuel choice and preferences and generalizability of the results. In addition to a larger sample size, future studies should elicit more specific information on the uses of each fuel, as in proportion of cooking with each fuel, and use of electricity for heating water. More specific SES data would also be beneficial. Additionally, having more household surveys with accompanying individual surveys from two or more generations would allow for a more in-depth analysis of household dynamics.

4.4.5 External Validity

The findings of this study are the most relevant for the over 19 million South Africans living in rural settings as of 2013 (World Bank, 2014). Additionally, however, the role of age in relation to technology adoption is pertinent across sub-Saharan Africa, even if there is
no push to promote electricity as a cooking technology. For example, if improved cookstoves are advertised to youth as modern technologies that make life easier, higher adoption rates could result compared to if the same strategy was used on middle-aged and elderly adults. Other technological interventions may also benefit from targeting youth, who could be more likely to adopt, and also introduce the technology to their households.

4.5 Conclusions

Although electricity has not been adopted *en masse* for cooking, grid connections have improved the lives of people in Bushbuckridge. The opportunity to use electrical devices such as light, cell phones, television, and refrigerators has provided new opportunities to these rural regions. Additionally, the fact that most households cook with electricity at least occasionally suggests that electric stoves have served some purpose in those homes, whether it be the ability to cook when it rains, or a backup fuel when someone is unable to collect wood because something else occupied their time.

Youth, however, are more enthusiastic about this new option than middle aged and elderly people. There is a potential for dramatic increases in electricity consumption as these youth age and become heads of households. Both the local systems and the national electricity grid should be prepared for this shift to prevent another situation like the brown outs of 2008. Local systems are already reported to fail when it rains. It is unclear whether or not they would be able to handle dramatic increases in usage. This situation creates an important opportunity for South Africa to invest in renewable energy. It is difficult to
support increased electricity usage, even if it improves the livelihoods of the marginalized rural poor, when the electricity is produced with low-grade coal. As South Africa prepares for increased electricity consumption, the new infrastructure should prioritize clean energy.

In increasing electricity production, creation of local micro-grids should also be considered. However, research is needed to determine how the people of Bushbuckridge feel about creation of local grids, as well as how they feel about potential sources for these local grids. Utilizing participatory methods, a micro-grid that meets the needs of locals and provides jobs during its construction could be created. Building a micro-grid without considering the needs of locals could lead to resentment towards electricity infrastructure.

Still, a major limiting factor to increased adoption of electric cooking is the cost. The cost is already kept artificially low with government subsidies, and many argue that this practice is unsustainable. Electricity prices are expected to increase. Even if today’s youth all prefer to cook with electricity when they become heads of households, they will only be able to use electricity if they can afford it. The best way to ensure that people can afford to cook with electricity is to provide jobs in these rural areas. Although the government has already made substantial efforts to improve rural employment through public works programs, unemployment remains high. Without jobs, households will be forced to cook with fuelwood even if they do not prefer it, or to divert cash from other uses towards electricity.

Fuelwood will most likely still play an important role for the foreseeable future, both as a cheaper alternative to electricity, and for cooking when the electricity system falters and brownouts occur. It is therefore vital that rules are understood across villages, and an
effective enforcement system is in place to regulate woodland harvesting. For example, if branches of the marula trees were all cut during a brown out or black out because the harvesters were unaware of its economic importance for producing fruit and nuts, dramatic economic consequences would result for those who harvest marula products. It would also be beneficial for collectors to know which kinds of wood smoke least or cook the best food. Steps should be taken to retain this traditional knowledge, potentially in schools.

A longitudinal study could paint a clearer picture of the trajectory of household electricity consumption. Although preferences differ from older to younger generations, it is unclear if and at what rate these shifts will affect actual electricity consumption. This information is vital to the planning of South Africa’s national electricity production.

Domestic energy consumption patterns in rural South Africa have changed dramatically over the past twenty years, and will likely continue to shift. Households will be best able to cope with these changes if they have both (a) reliable electricity and (b) access to productive woodlands for collection of fuelwood. For the broader South African society, it is also important that electricity generation shift to increasingly clean sources, and fuelwood collection be grounded in traditional knowledge and sustainable. Both are necessary to ensure energy security and ecosystem health.
CHAPTER 5: CONCLUSIONS

Local natural resources are an integral part of the lives of the people of Bushbuckridge. For decades, these resources were the main livelihood support system, with few other options. With the end of Apartheid, and the accompanying reforms, community members now have the option to use modern goods and services if they can afford to purchase them. Despite these options, resource pressure remains high, as is indicated by the perception that fuelwood is in shorter supply and farther away. One possibility is that traditional knowledge, sustainable harvesting practices, and an understanding of the importance of the woodlands have been lost on the younger generations.

In this study, age influences preferences, opinions, and perceptions of traditional and modern lifestyles. Age affects both choices made at the household level, as well as individual preferences and values. Youth are perceived as disregarding traditional norms, breaking woodland rules, and preferring convenient, modern lifestyles. While self-reports indicate that youth do prefer electricity over fuelwood, and that youth do not want to go to the woodlands, it is unclear if youth actually break woodland rules more than their older counterparts, or if they have less traditional knowledge than their parents. Although most youth still collect fuelwood, many would prefer to use electricity and abandon fuelwood collection altogether. Given the variation in attitudes, youth may be less likely to walk farther to find dead wood, or to avoid cutting live wood from important trees. Household age dynamics affect both household fuel choice and household dependence on local natural
resources, with older generations encouraging traditional livelihoods, and younger generations encouraging modern lifestyles.

Democratization, increased education, modernization, and access to electricity, media, and urban centers are all potentially contributing factors to these changes. Although the trends are apparent, it is unclear what they mean for the future of Bushbuckridge. It seems that currently, household decisions regarding local natural resource consumption, including fuelwood, are a function of both preference and affordability. Preferences of household decision makers will likely change over the coming years, as today’s youth age, but the often-prohibitive cost of modern goods and services will remain a barrier.

It is likely that when today’s youth become household heads, they will want to utilize modern goods. However, without sufficient income sources, these households will still need to rely on traditional goods. It is therefore vital that the woodlands are sustainably managed to provide a safety net to these communities. Management strategies should include the need for locals to harvest, while limiting harmful practices such as cutting live wood from important trees. A clear understanding of the rules, as well as local participation in their formation, could help both villagers and the woodlands. Traditional knowledge must also be preserved, so that today’s youth can understand how to responsibly use the woodlands when they must rely on them to provide for their households.

Future research should include a longitudinal study to gauge the magnitude of these shifts over time, and to distinguish the influence of age from the influence of generation. An understanding of the variation in traditional knowledge across generations would also be beneficial, to determine if this vital information is being lost to modernization. Research into
the actual harvesting practices of each generation would help to clarify if any specific group is more responsible for the perceived decrease in fuelwood availability. Finally, communities’ opinions about local micro-grids would provide a path forward to prepare for a potential increase in electricity consumption, as today’s youth begin to make household fuel decisions. These steps can help to better understand the dynamics of Bushbuckridge’s socio-ecological system to improve the livelihoods for all generations and their surrounding environment.
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APPENDIX I: Household Survey Instrument

Woodland & Fuel Survey – Household

Start time__________ Village code: ____________ HH#:_______ Date:______________

First, I am going to ask you some questions about your household

1) Please provide the following information for all the household members, including those who are away at the moment.
   a. Age
   b. Gender
   c. Level of education
   d. Currently enrolled in school?
   e. What is the individual’s relation to the household head?
   f. Is the individual employed outside of the household, and if so, what does the individual do?
   g. Is the individual home or away for employment?
   h. Indicate with an asterisk (*) the individual(s) who are responding to this survey.

<table>
<thead>
<tr>
<th>Age</th>
<th>Gender</th>
<th>Education</th>
<th>Currently in school?</th>
<th>Relation to household head</th>
<th>Employment (temp/perm)</th>
<th>Migrant</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

2) Has this household always lived in this same house?
   a. Yes
   b. No → where else? ____________________________

3) Does this household receive any pensions and/or child grants? How many?

4) How many buildings are on the property?

5) Does this household grow any crops? Can you please show me where?
6) Does this household have any trees that you use for growing fruit or wood, or collecting insects?

7) Please tell me if your household has any of the following
   a. Car ____
   b. Bicycle ___
   c. Refrigerator ___
   d. Stove ➔ type of stove(s) ______________________
   e. TV ___
   f. DSTV ___
   g. Video/DVD player ___
   h. Cattle ____
   i. Goats ____
   j. Chickens _____

Electricity and Fuelwood
8) What is your household’s main source of fuel for cooking and heating water?

9) Does this household have electricity
   a. Yes
   b. No

10) In what year was this household given an electricity connection?

11) On average, what is your household’s monthly electricity bill over the last 12 months?

12) What does your household use electricity for? (circle all that apply) (P*)
   a. Cooking
   b. Heating
   c. Lighting
   d. Radio
   e. Television
   f. Cell phone
   g. Fridge
   h. Other (specify uses e.g. appliances)________________________
13) Does this household use fuelwood? (P*)
   a. Yes
   b. No

14) Why does your household not use fuelwood? (circle all that apply) (P*)
   a. Not enough wood around this village
   b. It takes too much time to collect wood
   c. Nobody in the household is able to collect wood
   d. Don’t have transport for wood
   e. Electricity or paraffin are easier
   f. Other ____________________

15) What does your household use fuelwood for? (circle all that apply)
   a. Cooking
   b. Heat
   c. Heating water
   d. Lighting
   e. Other ________________

16) How many days a week does your household cook with fuelwood?

17) Is the cooking done inside or outside?
   a. Inside
   b. Outside
   c. Both

18) When your household cooks with fuelwood, what is the main reason for using wood instead of electricity? (E*)
   a. Wood is free or cheaper than electricity
   b. Can’t afford a stove
   c. Electricity is weaker
   d. Food tastes better when cooked on a fire
   e. Don’t know how to use a stove
   f. Scared of using electricity
   g. Cooking with fuelwood makes me stronger
   h. Other____________________
19) Is the wood collected from the bush or purchased?
   a. Collected
   b. Purchased
   c. Both

20) When collected from the bush, how is the wood brought home? (P*)
   a. Wheelbarrow
   b. Carry on head or back
   c. Vehicle
   d. Other (specify how) ______________

21) Who, in relation to the household head, collects the fuelwood?

22) Why does your household purchase fuelwood instead of collecting? (circle all that apply) (P*)
   a. Not enough wood around this village
   b. Not enough time to gather wood ourselves
   c. Nobody in the household is able to collect wood
   d. No way to transport wood home
   e. Other ______________

23) In the last 12 months, has anybody in this household collected the following resources from the bush so that the following products could be used within the household or sold? (if yes, continue with questions a-d, if no, go to the next item on the list) (E*28)
   a. What is the age and gender of the person who typically collects the product? (can list multiple people, but list gender and age in same order)
   b. Is this product consumed in the household? (if yes, go to c, if no, go to e)
   c. Is the product ever collected to be sold by someone in your household? (if yes, go to f, if no, go to next product)
   d. In the last 12 months, how much income was generated from selling this product?
<table>
<thead>
<tr>
<th>Resource/Product</th>
<th>Collected</th>
<th>Age/G</th>
<th>HH</th>
<th>Sold</th>
<th>Income/yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muroho (e.g. guxe, thepe)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marula fruit for nuts, or making beer or jam</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other wild fruit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thatching grass</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wood for building walls, roofs, or fences</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resources for traditional medicine</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

End time ________________________________

Others individuals present __________________________________________
APPENDIX II: Individual Survey Instrument

Woodland & Fuel Survey - Individual
Start time ________ Village code: ___________ HH#:_______ Date:____________

Demographics

1) Gender (observed)
   a. Male
   b. Female

2) How old are you?

3) What is your relation to the household head?
   a. Household head
   b. Wife of household head
   c. Son of household head
   d. Daughter of household head
   e. Brother of household head
   f. Sister of household head
   g. Father of household head
   h. Mother of household head
   i. Other

4) Do you live away from the homestead for part of the year to work or study? If yes, how many months out of the past 12 months, and where did you live?

5) Are you employed? Temporary or permanent?

6) What is your education level?

Energy Use and Fuelwood Collection

7) Do you collect fuelwood from the bush?

8) How many days a week do you:
   a. Collect fuelwood
   b. Cook with fuelwood
9) [If the respondent collects fuelwood] Do you collect fuelwood for your household to use, to sell, or both?
   a. Use   b. Sell   c. Both

10) In your lifetime, has the distance you have to travel to collect fuelwood changed? If yes, do you now walk longer or shorter distances?
   a. Longer distances now   b. Shorter distances now   c. Unchanged distances   d. Not sure

11) In your lifetime, has the amount of dry wood available for collecting in the bush changed? If so, is there more now or less now.

12) For cooking, do you like electricity or fuelwood better?
   a. Fuelwood   b. Electricity   c. Both

13) Why did you choose that answer?

Trees/Woodland Conservation

14) Do you think that trees are important for daily life in your household?
   a. Yes   b. No

15) I am going to list some ways that woodlands are used. Please tell me if that use is very important, somewhat important, or not important.
   a. They are a source of income
   b. They provide products that we use
   c. They protect my village from wind
   d. They are part of our culture or history
   e. They are part of nature
   f. It is important for my children and grandchildren to know the trees that I know
   g. Other
16) Do you think that your village’s woodlands are in danger of disappearing?
   a. Yes → Why?
   b. No

17) Is this problem very serious, somewhat serious, or not serious?
   a. Very serious
   b. Somewhat serious
   c. Not serious

18) Do people from other villages harvest fuelwood from your village?
   a. Yes
   b. No
   c. Unsure

19) Is this a problem for your village?
   a. Yes
   b. No
   c. Unsure

20) Do people from your village go to other villages to harvest fuelwood?
   a. Yes
   b. No
   c. Unsure

21) How do most people carry fuelwood out of your village?
   a. On heads or backs
   b. Wheelbarrows
   c. Vehicles
   d. Other ____________________
   e. Don’t know
   f. Don’t know

   Woodland Laws

22) Are their rules about what people can collect from your village’s woodlands? If so, what are they?

23) Have these rules changed in your lifetime?
   a. Yes (explain what has changed and when/what year they changed)
   b. No

24) Do you think that people follow these rules always, sometimes, or never?
   a. Always
   b. Sometimes
   c. Never
   d. Not sure
25) Do youth follow these rules always, sometimes, or never:
   a. Always c. Never
   b. Sometimes d. Not sure

26) What about middle aged people?
   a. Always c. Never
   b. Sometimes d. Not sure

27) Elderly people?
   a. Always c. Never
   b. Sometimes d. Not sure

28) Who made these rules?
   a. Chief d. Municipality
   b. Induna e. National government
   c. Nature Conservation f. Other __________________
       authorities g. Don’t know

29) Who makes sure these rules are followed?
   a. Chief e. Municipality
   b. Chief’s police f. National government
   c. Induna g. Other __________________
   d. Nature Conservation h. Don’t know
       authorities

30) Has this always been the person who makes sure the rules are followed?
   a. Yes, the same person has always made the rules
   b. No…..Who was it before? __________________________

       When did these changes take place?_______________

       Which authority enforces rules more strictly?_______________

31) Who do you think should be in charge of making sure woodland rules are followed?
   a. Chief e. Municipality
   b. Chief’s police f. National government
   c. Induna g. Other __________________
   d. Nature Conservation h. Don’t know
       authorities

32) Do you think that access to woodlands should be regulated?
   a. Yes b. No
33) Do you think that the village’s woodland authorities:
   a. Protect the woodlands the right amount
   b. Protect the woodlands too much
   c. Do not protect the woodlands enough
   d. I don’t care about the woodland laws
   e. Don’t know

34) Do you think the youth in your village think access to woodlands should be regulated?
   a. Middle aged people?
   b. Elderly people?

Now I am going to ask some questions about your opinion of trees and woodlands, and how you think youth, middle aged, and elderly people value trees and woodlands

35) What do you think is the preferred cooking fuel of:
   a. Today’s youth
   b. Middle aged people
   c. Elderly people

36) Which generation do you think cares most about having healthy woodlands and trees?
   a. Youth
   b. Middle aged
   c. Elderly
   d. Not sure

37) Which generation do you think uses woodland products most?
   a. Youth
   b. Middle aged
   c. Elderly
   d. Not sure

38) In your opinion, the community woodlands should be
   a. Converted to money making uses such as pasture, crops or plantation
   b. Kept for community use with no regulation
   c. Kept for community use with regulation
   d. Protected from all use

39) Do most people in your village think that use of your village’s woodlands should be regulated?
   a. Yes
   b. No
   c. Not sure
40) Do you have any questions for me?

End time________________ Others present__________________________
APPENDIX III: Open-Ended Survey Instrument

Woodland & Fuel Survey – Open Ended

Demographics

1) How old are you?

2) What is your gender
   a. Male
   b. Female

3) What is your education level?

4) What is your relation to the household head?
   a. Household head
   b. Wife of household head
   c. Son of household head
   d. Daughter of household head
   e. Brother of household head
   f. Sister of household head
   g. Father of household head
   h. Mother of household head
   i. Other _______________

5) Are you away part of the year to work?
   a. Yes
   b. No

Only ask question 6 and 7 if respondent is not from a household where the household questionnaire was administered

6) How many males and females in your house are under the age of 18?
   Males __________
   Females __________

7) How many males and females in your house are over the age of 18?
   Males __________
   Females __________
Fuel

8) Does this household have an electricity connection?
   a. Yes (go to question 9)
   b. No (go to question 11)

9) What does your household use electricity for?

10) On average, what is your household’s monthly electricity bill?

How do you pay your electricity bill? (that is, do you go to an office to make a payment; give the money to someone to deposit in a bank; does someone come to your house to collect?)

Do you know how much electricity your household uses every month? Do you keep track of this on a daily basis?

11) Does this household use fuelwood?
   a. Yes ➔ why? (go to question 12)
   b. No ➔ why not (go to the topics for discussion, topic 2)

12) How many days a week does your household use fuelwood?

13) What does your household use fuelwood for?

14) Do you ever collect fuelwood?

   For your household or to sell?

   How many hours a week do you spend collecting?

   Is it difficult to estimate the number of hours? Do you think that most women can estimate the number of hours? How about most men?

15) How many hours a week do you spend:

   Cooking with fuelwood

   In the house when someone else is cooking with fuelwood
Is it difficult to estimate the number of hours? Do you think that most women can estimate the number of hours? How about most men?

Do you think that it is bad for your health to be a house where someone is cooking with fuelwood?

**Topics for discussion:**

1) Role of fuelwood in personal and household daily life

2) Perception of fuelwood as a cooking technology – personal perception and generational differences

3) Perception of electricity – personal perception and generational differences

4) Perception of cooking technology – personal perceptions and generational differences

5) Role of other woodland products in personal and household daily life

6) Perception of woodland products – personal value and generational differences

7) Value of conservation – personal value and generational differences

8) Importance of woodland regulation – personal value and generational differences

9) Changes in woodland regulation over time

10) Perception of woodland authority figures – personal perceptions and generational differences
**APPENDIX IV: Open-Ended Survey Responses; Woodland Attitudes and Habits**

Table 3.6: Open ended surveys, themes in woodland attitudes and habits (n=14)

<table>
<thead>
<tr>
<th>Theme</th>
<th>n</th>
<th>Example Quotation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Youth do not go or do not want to collect from the woodlands</td>
<td>11</td>
<td>Young people don’t go to the bush anymore. They are proud. If they go to the bush, people look down on them because you become dirty and scratched.</td>
</tr>
<tr>
<td>Disconnects in attitudes of youth and older generations</td>
<td>9</td>
<td>The young people think that they are educated and no longer listen to the older people. They don’t care about the culture and tradition. Youth of today don’t even want to go to collect water. People used to carry water using their heads, but now they don’t want to because they have nice hairstyles.</td>
</tr>
<tr>
<td>People get arrested if they break the rules</td>
<td>9</td>
<td>When people follow the rules, it’s because they are scared of getting arrested. When they don’t follow [the rules], it’s when there is nobody watching.</td>
</tr>
<tr>
<td>Provision of fruit is important</td>
<td>8</td>
<td>Wild fruit makes us strong. That’s why old people are strong compared to young people.</td>
</tr>
<tr>
<td>Criminals in the woodlands</td>
<td>5</td>
<td>Young people are scared of going to the bush because there are criminals in the bush. They act as if they are accompanying cows and then attack people. They rape women and sometimes kill people, especially if the person is alone. Older people are not afraid because they go as a group. Young people are really scared, even in a group.</td>
</tr>
<tr>
<td>Wild animals and snakes in the woodlands</td>
<td>4</td>
<td>It is dangerous to go to the bush; there are snakes and animals that can hurt you.</td>
</tr>
<tr>
<td>Going to the bush makes you tired</td>
<td>4</td>
<td>It is really difficult to collect the wood because you get tired. Electricity is better.</td>
</tr>
<tr>
<td>Provision of traditional medicine is important</td>
<td>4</td>
<td>[Woodland products] are important to my life because they protect me from getting disease by providing food and traditional medicine. The meat from the fridge can make people sick.</td>
</tr>
</tbody>
</table>
**APPENDIX V: Open-Ended Survey Responses; Themes in Electricity and Fuelwood**

<table>
<thead>
<tr>
<th>Theme</th>
<th>N</th>
<th>Example Quotation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Youth do not go or do not want to collect from the woodlands</td>
<td>11</td>
<td>Young people don’t go to the bush anymore. They are proud. If they go to the bush, people look down on them because you become dirty and scratched.</td>
</tr>
<tr>
<td>Electricity provides light, and is safer than candles or paraffin</td>
<td>10</td>
<td>Electricity has made my life better because you can have light if it’s dark or late. Houses get burned with candles.</td>
</tr>
<tr>
<td>Electricity expensive</td>
<td>9</td>
<td>If electricity could cost less, we would switch, but now it’s too expensive and none of us are working.</td>
</tr>
<tr>
<td>Disconnects in attitudes of youth and older generations</td>
<td>9</td>
<td>The young people think that they are educated and no longer listen to the older people. They don’t care about the culture and tradition. Youth of today don’t even want to go to collect water. People used to carry water using their heads, but now they don’t want to because they have nice hairstyles.</td>
</tr>
<tr>
<td>Older people are used to fuelwood</td>
<td>7</td>
<td>Older people are used to fuelwood and they are scared of being burned or electrified with electricity.</td>
</tr>
<tr>
<td>Fuelwood is an important back-up to electricity, when it shuts off or is rainy</td>
<td>6</td>
<td>It is important that the bush to last for future generations because electricity is slow and sometimes goes off, so we need fuelwood. During the rainy season, all the households lose electricity and it takes a day or two to come back on.</td>
</tr>
<tr>
<td>Youth are not used to fuelwood or were born with electricity</td>
<td>5</td>
<td>Youth don’t use fuelwood like their elders because they grow up in a modern way, with electricity, compared to elders who grew up without electricity.</td>
</tr>
<tr>
<td>Fuelwood causes physical problems</td>
<td>4</td>
<td>[I prefer] electricity because you don’t get any sickness in the lungs from electricity.</td>
</tr>
<tr>
<td>Fuelwood provides warmth</td>
<td>4</td>
<td>Fuelwood is really important because we are able to cook and if I am sick I can get warm from it.</td>
</tr>
<tr>
<td>Electricity is needed for cooking in rain &amp; dark</td>
<td>4</td>
<td>I like [electricity] though because I can cook inside the house. Even when it’s raining I can cook.</td>
</tr>
<tr>
<td>Running out of electricity is a problem</td>
<td>3</td>
<td>You can start cooking and find the electricity shuts off. That doesn’t happen with fuelwood.</td>
</tr>
</tbody>
</table>