

THE POLITICAL ECOLOGY OF HIV/AIDS:
A SPATIAL CASE STUDY OF WOMEN AND GIRLS' FIREWOOD COLLECTION ON
SOUTH AFRICA'S WILD COAST

By

BRITT ALICE COLES

A DISSERTATION PRESENTED TO THE GRADUATE SCHOOL
OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

UNIVERSITY OF FLORIDA

2011

© 2011 Britt Alice Coles

To my mother, father, and aunt – a triptych of love and support

ACKNOWLEDGMENTS

Needless to say, these pages are the most joyous ones to write. Finally, I have an opportunity to formally recognize all those who have helped directly or in-directly. At University of Florida (UF), I am grateful for my chair, Dr. Rick Stepp, deconstructing the often convoluted and confusing world of academia into a more easy-to-navigate map. I also wish to thank Dr. Marianne Schmink, my co-chair, the most time-generous and word-effective person at UF: my Mondays with Marianne did magic to my process. In addition, I am grateful for committee member Stanley Latimer's sincere enthusiasm and helpfulness. His office served as the hearth where I came to rebuild my bruised academic spirit. Finally, I am thankful for committee member Dr. Grenville Barnes' excitement about the Wild Coast and his piercing questions to push me further. At UF, I also wish to thank James Colee and Ariel Gunn. James helped disentangle my panic-stricken-numbers-brain on a number of occasions. Ariel offered an inspiring tap on the shoulder as well as soulful, hilarious, and encouraging friendly editorial sessions.

I am most grateful for the funding support of the National Science Foundation, the Rotary Foundation, the US Department of Education/UF African Studies Center, and other UF sources, including the Office of Graduate Minority Programs, SNRE, and TCD.

In South Africa, I am thrilled to have a great number of people to say *enkosi kakuhle* to. In Bulungula, I want to thank all the village participants. Due to their presence, dignity, and spirit, I will never look at life the same way again. I also wish to thank the interpreter/research assistants Queenie Pink, Des Witbooi, Albert Nogloina, and Lindile Mthiyo. Also, Liesl was a true help on a daily basis. Finally, I am indebted to Dave Martin and Rejane Woodruff for their openness and generosity as well as being such great visionaries of rural development. In Grahamstown, at Rhodes University, Dr.

Sarah Kaschula gave me highly valuable guidance on the fieldwork process. At Rhodes, I am also grateful for Drs. Charlie and Sheona Schackleton great knowledge and kind support as well as graduate students Dylan McGarry and Julia Cloete who kept stressing the need to look at children. I also want to thank Rose Kingswill for her kindness and hospitality. I am also inspired by the Rama family's compassion for all sentient beings. Finally, in Pretoria, I want to give a special thank you to the Symonds family, you are all so very special to me that I don't even know where to begin.

In my past second home and first and final home, I want to thank my dear friends Jane Dowling, Andrea Bichsel, Malin Thelin, Nanna Hoff and Anna-Lena Holm. You all encouraged me in such an earnest way.

Finally, back at UF, life in Gainesville would have been hard to survive without the lifesaving components of more friends, yoga, and community volunteering. For standing by my side, I am most grateful to Betty Yaretzki, Linda, Vanessa Harper, Chris Borek, Rose Smouse, Margo Stoddard, and Shoana Humphries. For physical re-charging, I am indebted to Sanctuary Yoga's Melissa Montilla and colleagues. Lastly, I would not have been able to survive emotionally and spiritually if it hadn't been for my Tuesdays at the amazing free pet care clinic at St. Francis. I am in awe of founder Dr. Dale Kaplain-Stein and her dedicated fellow volunteer veterinarians, Dr. Nathalie Isaza, Dr. Sarah Kirk, Dr. Cassidy Rist, and Dr. Frances Lane. This clinic also rests upon the mighty shoulders of the passionate support staff of Chris Machen (co-founder and head support spirit extraordinaire), Jill Kirk (fab veterinarian to be), Melissa Glikes (super-energizer), and Kat Brown. These women and their furry patients helped keep me sane, serene, and sincere during the last stages of writing.

TABLE OF CONTENTS

	<u>page</u>
ACKNOWLEDGMENTS.....	4
LIST OF TABLES.....	9
LIST OF FIGURES.....	11
LIST OF ABBREVIATIONS.....	12
ABSTRACT.....	14
CHAPTER	
1 INTRODUCTION.....	16
Practical Problem: the Impact of Female Double Duties on Firewood Travel.....	16
Research Objectives and Questions.....	20
Organization of Chapters.....	22
Important Notice Regarding Images.....	23
Re-Production of the Female Laboring Body.....	24
A Changing View of Women in Development.....	24
Contested Natural Resources, Vulnerable Female Collectors.....	27
Crashing the Household Black Box to Bring Attention to Female Labor.....	29
The Role of Children as Producers and Assets to the Household.....	31
HIV/AIDS – Re-Centering the Female Body in the Rural African Debate.....	33
Sub-Section Summary.....	34
Space, Mobility, and Land Use.....	36
Dependence on the “Hidden Harvest” in the Former Homelands.....	36
Optimal Foraging Theory vs. the Intricate Social Human Experience.....	38
The Expanding and Contracting Qualities of Female Spatial Mobility.....	41
From GIS to Feminist GIS – in Search of the Missing Female Subject.....	44
Sub-Section Summary.....	47
A Political Ecology of Disease.....	49
Shifting Voices on the Human-Nature Relationship.....	49
Controlling the Female Laboring Body.....	53
Disease as a Multi-Scale Driver.....	54
The South African Structural Constraints of HIV/AIDS.....	55
HIV/AIDS, Poverty, and Wild Natural Resources – a Triptych of Marginality....	56
Sub-Section Summary.....	58
2 SETTING.....	61
Selection of Study Site.....	61
Landscape and Land Use.....	62
The Spatial Qualities of Daily Life.....	63

Food Networks and Foraging.....	65
Socio-Economic Profiles	67
Connectivity, Health, and Service Provisions.....	70
3 FIELD METHODS.....	80
Sampling.....	80
Instrumentation	81
Procedure	84
Limitations and Assumptions	89
4 INTER-HOUSEHOLD VARIABILITY: SOCIO-ECONOMICS AND HEALTH	93
Data Analysis Overview	93
Spatial Distance Distribution	95
Lack of Seasonal Variability.....	96
Variable Selection and Model Validation.....	96
Regression Relationship of Adult Inter-Household Spatial Variability	98
Influence of Health/Disease	100
HIV/AIDS-Proxies as the Most Influential Variable	100
Spatial Distance vs. Quantity of Firewood.....	101
Influence of Socio-Economics.....	105
Less Socio-Economic Capital, Longer Distances	105
The Expensive Energy Alternative of Paraffin	106
A Female Face of Poverty	107
The Spatio-Temporal Investment of Applying for Grants.....	110
Socio-Economic Profiles and HIV/AIDS	112
Firewood and Food	114
Influence of Generational Company	117
The Second Most Influential Variable.....	117
Adults Who Prefer to Go with Other Adults: Three Recurrent Themes	118
Theme one: fear of the forest.....	118
Theme two: dissatisfaction with girls	121
Theme three: the social advantages of going with adults	122
Adults Who Don't Prefer Other Adults: Three Recurrent Themes	128
Theme one: the sole adult voice, the sole authority	129
Theme two: the spatio-temporal advantages of girls' company	129
Theme three: preferring to go out alone.....	130
The Firewood Burden of Adults	131
Chapter Conclusion	132
A Political Ecology of HIV/AIDS.....	134
Space and time, quantity and quality	134
A new landscape shaped by the presence or absence of disease.....	136
The South African context.....	137
A reproduction of poor health and poverty	140
Women's Spatial Individual Agency	141
A Feminist Geography of the Hidden Harvesters	143

5	INTRA-HOUSEHOLD VARIABILITY: AGE	151
	Data Analysis Overview	151
	Spatial Distance Distribution	152
	Lack of Seasonal Variability	155
	Variable Selection	155
	Regression Relationship of Girls' Inter-Household Variability	156
	Influence of Generational Company	157
	A Quantitative Variable Reveals Qualitative Characteristics	157
	Spatial Distance Variance Among Girls' Firewood Collection Groups	158
	Girls Who Prefer to Go with Other Girls: Three Recurrent Themes.....	160
	Theme one: fear of the forest.....	160
	Theme two: disadvantages of fast and busy adult collectors	161
	Theme three: the social advantages of girls.....	161
	Girls Who Prefer Not to Go with Other Girls	163
	The Firewood Burden of Girls	163
	Chapter Conclusion	166
6	CONCLUSIONS	174
	Summary of Findings	176
	Recommendations	179
	Recommendation One: Creating a Green Care Center.....	180
	Recommendation Two: Environmental "Enagendering" and Cash Incentives	184
	Recommendation Three: Grant Extension and Extending Social Networks ...	187
	Future Research Directions	188
	Spatializing the Female Social Network	188
	The Spatial Impact of the Fear of Sexual Violence in the Forest.....	189
	The Spatial Variance in Child-Headed vs. Adult-Headed Households	190
	Challenges Ahead	191
APPENDIX		
A	GENERAL HOUSEHOLD SURVEY	193
B	SEASONAL FOCAL QUESTIONNAIRE	195
	LIST OF REFERENCES	197
	BIOGRAPHICAL SKETCH.....	216

LIST OF TABLES

<u>Table</u>	<u>page</u>
4-1 Descriptive distribution statistics for female adult one-way spatial trajectories .	146
4-2 Student's t comparison of distance covered over three different seasons	146
4-3 REML model estimating the probabilities of impact on spatial trajectories	146
4-4 GLIMMIX Pearson Panel model predicting the effects on spatial trajectories ..	146
4-5 Student's t comparison of distance and reasons for choosing site	146
4-6 Contingency analysis comparing paraffin use between destitute and non- destitute households.....	146
4-7 Descriptive statistics for aggregated agricultural assets in the village	147
4-8 Contingency analysis table comparing female vs. male head of household with agricultural asset profile	147
4-9 Wilcoxon rank sum test to compare mean assets of female vs. male head of household (hh).....	147
4-10 Contingency analysis table comparing head of household with households not receiving any child-care grants	147
4-11 Regression adjusted estimates for covariance means	147
4-12 Regression without adjusting for covariate means	148
4-13 Descriptive statistics of how often households borrow/lend out food and size of food network	148
4-14 Kruskal-Wallis rank sum test to compare food borrowing with garden size	148
4-15 Kruskal-Wallis rank sum test to compare collection with size of garden.....	148
4-16 Wilcoxon rank sum test to compare food borrowing with perceiving firewood scarcity	148
4-17 Distribution of generational company of adult firewood collectors	148
4-18 Contingency analysis table comparing work exchanges with plot size	149
4-19 Contingency analysis table comparing firewood collection company with work exchanges	149

4-20	Descriptive statistics for amount of firewood collected by women	149
5-1	Descriptive distribution statistics for girls and adult spatial trajectories.....	169
5-2	GLIMMIX Pearson Panel model predicting the effect on girls' trajectories	169
5-3	Kruskal-Wallis rank sum to test generational group and the number of people collecting	171
5-4	Wilcoxon rank sum test to compare age of girls with number collecting.....	171
5-5	Descriptive statistics for amount of firewood collected by girls vs. adults	171
5-6	REML mixed model fixed effects test of girls' age leverage on kg carried	171
5-7	REML mixed model fixed effects test of the company leverage on kg carried..	172

LIST OF FIGURES

<u>Figure</u>	<u>page</u>
1-1 Model of theoretical framework. Adapted from Turner (2003) and Ellis.....	60
2-1 A map of Africa.	75
2-2 A map of South Africa. Study site is marked with a star.	75
2-3 A view of the Bulungula river ending at the ocean.....	76
2-4 Examples of the typical local circular rondavel huts	76
2-5 The wet sand cools down an Nguni cow during a hot summer day.....	77
2-6 Schematic of traditional Amabomvana gender and age seating inside hut	77
2-7 Traditional samp and beans, <i>umngqusho</i>	78
2-8 Girls trying to escape the waves while collecting mussels.....	78
2-9 One of many open spring water sources in use by local villagers	79
3-1 Illustration of GPS tracks. Geographical reference points and forest background have been altered to ensure anonymity.	92
4-1 Spatio-temporal schematic. Suggested (visually exaggerated) varying relationship of constraints for HIV/AIDS-proxy households	150
5-1 Remnants from a village firewood collection workshop held for young girls	169
5-2 Linear relationship between the number of girls who collect together and length they travel	170
5-3 Bi-variate relationship of the number of people who collect firewood and the nature of collection company.....	170
5-4 Graph showing relationship of amount of firewood collected and girls' collection company	172
5-5 A group of girls head back home with their collected firewood	173

LIST OF ABBREVIATIONS

AIDS	Acquired Immunodeficiency Syndrome
ANC	African National Congress
ARV	Antiretroviral
CLRA	Communal Land Rights Act
ECSECC	Eastern Cape Socio-Economic Consultative Council
FAO	Food and Agricultural Organization
FANR	Food, Agriculture and Natural Resources
GAP	Gender and Development
GEAR	Growth, Employment, and Redistribution
GIS	Geographic Information System
GPS	Global Positioning System
HBE	Human Behavioral Ecology
HDI	Human Development Index
HIV	Human Immunodeficiency Virus
IRB	Institutional Review Board
NGO	Non-Governmental Organization
OFT	Optimal Foraging Theory
RDP	Reconstruction and Development Program
SADC	Southern African Development Community
SAP	Structural Adjustment Programs
TB	Tuberculosis
UN	United Nations
UNAIDS	United Nations Programme on HIV/AIDS
WAD	Women and Development

WGS	World Geodetic System
WHO	World Health Organization
WID	Women in Development
ZAR	South African Rand

Abstract of Dissertation Presented to the Graduate School
of the University of Florida in Partial Fulfillment of the
Requirements for the Degree of Doctor of Philosophy

THE POLITICAL ECOLOGY OF HIV/AIDS:
A SPATIAL CASE STUDY OF WOMEN AND GIRLS' FIREWOOD COLLECTION ON
SOUTH AFRICA'S WILD COAST

By

Britt Alice Coles

May 2011

Chair: Rick Stepp
Co-chair: Marianne Schmink
Major: Interdisciplinary Ecology

Dependence on wild natural resources, integral to South African rural livelihoods, has increased among HIV/AIDS households. While the resulting heightened quantity has been investigated, the possibly changing spatial patterns of such harvesting have not yet been explored. This spatial case study focuses on female firewood collection. It assumes that a household's HIV/AIDS status (assessed with the help of proxies) increases female caregiver duties and thus hypothesizes that female time to travel for firewood is constrained, leading to shorter spatial distances traveled outside the home. The study interlaces spatio-temporal behavioral geography theory with a political ecology of disease.

Baseline socio-economic and health surveys of 103 households were incorporated with semi-structured interviews and self-mapped GPS trajectories of 21 focal households for a one-year time period in a remote Wild Coast village in South Africa. Mixed model regression procedures were used to analyze the seasonal spatial GPS readings and contextual quantitative and qualitative data.

The main finding of this research suggests that a HIV/AIDS-proxy household status does not affect the distance walked by girls. This status does, however, negatively impact distances walked by women. The household spatial entrapment thesis and the subsequent female relational spatio-temporal constraints therefore seems to relate differently to women than girls for firewood harvesting, especially in a HIV/AIDS context. A female adult spatial confinement – and suggested intensification of firewood collection in nearby forest fragments due to spatio-temporal constraints – could support a possible theoretical downward spiral of poor health and rural poverty in a finite fragmented forest environment, according to a political ecology of disease.

In addition, this study indicates that although women are constrained by structural constraints such as HIV/AIDS and, to a lesser degree, socio-economic status, they have some individual agency in the company they choose. For adults, firewood collection can be both social and an external household investment relating to fieldwork exchanges. For both women and girls, collecting with females only from their own generation result in longer firewood distances away from home.

This study contributes to wild harvesting literature generally, addressing how disease, age, and poverty may influence firewood collection, specifically.

CHAPTER 1 INTRODUCTION

Practical Problem: the Impact of Female Double Duties on Firewood Travel

A woman balancing a load of firewood on her head with a much younger female replica carrying a much smaller bundle right behind her is a common sight in African rural landscapes. This study travels in the footsteps of some of these women and girls to learn more about their journeys to and from home. The question this study focuses on is not only “how far” do they walk for firewood, but also, potentially, “why?” As a result, this study offers a glimpse into their struggle, strength, and social networks.

Previous studies of women’s firewood collection have illuminated the complexity of this activity, including the planning and allocation of multiple chores (Mehretu, 1992; Bryceson, 1993). The added contribution of the spatial findings of this study are consistent with earlier research that suggests that firewood collection is intricately linked to a bigger picture that includes poverty, food, labor constraints (Mahiri, 2001) and HIV/AIDS (Barany, 2005). Therefore, not all households are created equal when it comes to calculating the opportunity costs of travel away from home, making some households more vulnerable than others to the demands of firewood collection (Dovie, 2004).

The importance of this collection becomes even more apparent when considering previous South African research on firewood that calculates the net-direct use value of secondary woodland resources to be three times what a South African non-skilled wage earner would make at a commercial agricultural farm (Dovie et al., 2005). Firewood is thus part of a critical rural safety net of non-monetary subsistence goods in a micro-scale informal economy (Letsela, 2002; Andrew et al., 2003).

This study adds to past knowledge on firewood collection by looking more closely at the varying linear spatial aspect of female firewood collection as a result of women's double duties. The spatial variance of how far women and girls walk to collect firewood is addressed through a lens of behavioral geography, where travel constraints are assumed to be a consequence of the overall space-time relationship in relation to the allocation of chores. Women and girls have a number of household chores to perform. One of the main chores is home care giving, which has dramatically increased with the HIV/AIDS epidemic. The time spent on care giving impacts the time allocated for other female household responsibilities, such as firewood collection. That is, in accordance with the tenets of time-geographer Hägerstrand (1975), any spatial distance traveled for one activity – in this case, firewood – is dependent upon the time available once the space-time allocation of other female responsibilities has been taken into consideration. Like a rubber band, female travel tends to expand and contract around the center of household responsibilities, the home. This is related to women's relational spatio-temporal constraints (Davies, 2001), where a great amount of the day is dedicated towards attending to other family members' needs, in addition to their own.

First, the study concentrates on HIV/AIDS as the main household travel constraint in relation to the female responsibility of care giving. In many developing countries, women also are forced to take on more reproductive chores in the wake of government social expenditures cuts as a result of global structural adjustment policies (Deere, 1997; Beneria, 2003). The 2007 UNAIDS report estimated that 70% of South Africa's caregivers are female, almost a quarter of them over 60 years old. This time-demanding responsibility does not seem to be lessening. The estimated prevalence of HIV in South

Africa was less than 1% in 1990, but as high as 24% in 2000 (Walker, 2004). The 2007 UNAIDS report released numbers that put this country at the top of the list of countries with the highest rate of HIV/AIDS in the world. Moreover, a South African HIV/AIDS researcher notes “We are only at the beginning of the principal demographic impacts of HIV/AIDS in southern Africa” (de Waal, 2004:66).

Second, this spatial case study focuses on female travel and HIV/AIDS in the particular micro-geography of a South African remote rural former homeland. All homeland locations were initially chosen for their remoteness and lack of fertile soils, to force a rural dependence on male migration to peri-urban mines (Southall, 1983). Today, women, children, and pensioners still mostly populate the former homelands. The three major structural barriers to HIV prevention mirror those of South Africa’s past and continued post-apartheid political economy in the former homelands: economic under-development, mobile migrant workers, and gender inequality (Bond, 1999; Parker et al., 2000; Turschen, 2004).

Third, in the shadow of the epidemic, household dependence on free wild natural resources to meet local energy demands brings us back to the familiar image that opened this section: female travel to acquire much needed natural resources. In their classic political ecology text, *Land Degradation and Society*, Blaikie and Brookfield (1987) used the South African homelands as an example of how a political economy of inequality and poverty may impact an already fragile environment, and vice versa. This dependence on free wild natural resources, integral to poor southern African rural livelihoods, seems to have increased among struggling HIV/AIDS households (Barany, 2005; Shackleton et al., 2006; McGarry, 2008).

These three factors – illness, political economy, and finite natural resources – make up a recent sub-strand of political ecology: a political ecology of disease (Turshen, 1984; Mayer, 1996). This study is designed to contribute to this theoretical body of knowledge by examining the interrelationship of these three factors for women and girls from a spatial perspective. The hypothesized environmental spatial confinement – and suggested intensification of firewood collection in nearby forest fragments due to space-time constraints – could support a theoretical downward spiral of a political ecology of disease. That is, where rural poverty and poor health “each serve to (re)produce the other” especially for the so-called labor poor in a finite resource environment (Leatherman, 2005:50).

To conclude, in the spirit of feminist geography, environmental anthropology, and medical anthropology, this study points to the importance of paying proper attention to rural women and girls’ environmental spatial mobility in the shadow of HIV/AIDS as part of an integrated view of rural development, public health, and sustainable conservation. This study illustrates how women and girls pay for firewood harvested for free with time (spent) across space (traveled) as opposed to using money at the market. Albeit the activity itself is non-monetary in this informal economy, there is still a household labor cost to take into consideration.

Why is this a practical problem? Because failing health within the household could make it especially vulnerable to future environmental changes that push the distances needed for travel to collect firewood. It follows that, in a world where “a woman’s work is never done,” – as the old saying goes – space matters, especially in a time of disease and finite natural resources.

Research Objectives and Questions

This study's research objectives and related questions fit into three major categories.

- **The first objective:** to compare HIV/AIDS-afflicted and non-afflicted households' walking distances away from the home for firewood collection. Does the presence of household level HIV/AIDS-proxies lead to an expansion or a contraction of spatial linear distance for adult women? That is, does an assumed temporal constraint (due to caretaking) lead to more spatially restricted travel?
- **The second objective:** to determine whether (socio)-economic differences influence spatial trajectories of the different households. Does an accumulation of wealth lead to an expansion or a contraction of spatial linear distance for adult women? Does a wealth of assets influence spatial linear trajectories as much as, or less than, a possible influence of long-term disease?
- **The third objective:** to evaluate if there are generational differences within and across afflicted and non-afflicted households' firewood trajectories. What is the relative importance of age for spatial firewood trajectories in the context of a household level presence of HIV/AIDS-proxies? What is the relative importance of age for spatial firewood trajectories in the context of the household's accumulated wealth? Does intergenerational firewood collection differ spatially from intragenerational firewood collection?

An illustration of the overall framework for these objectives and research questions is found in Figure 1-1. This illustration introduces disease (Barany, 2005), aggregated wealth (Mahiri, 2001; Dovie et al., 2004), age (Biran, 2004), and firewood collection company (Biran, 2004) as potential drivers of varying spatial distance covered for firewood, all within a suggested perpetual political ecology of disease. In the center circle, to the far right in Figure 1-1, straight arrows are enclosed to represent a variation in travel to forest patches of varying distance away from the home.

Research questions belonging to objective one and two (health and aggregated wealth status across households) seek to explore if and how the structural context of disease, unemployment, and politico-economic policies – presented more in depth later in this chapter – can be embodied spatially (Kwan, 2000; Pavlovskaya, 2002) in the

focal households under investigation. That is, the two independent variables in the top box in the far left column of Figure 1-1, health and wealth, are tested to see if they influence firewood collecting spatial patterns in the far right representation of varying forest patches. Do women from sick households find less time to allocate to longer forest trips as their days fill up with caretaking instead? Do rich women travel less because they have the monies to pay for alternative energy sources that require less spatio-temporal investment?

Research questions belonging to objective number three add a generational perspective to the former objectives. First, age is added as an independent variable in the bottom box to the left in Figure 1-1, as part of possible structural constraints. Second, age is added to the center column as part of an investigation of intragenerational and intergenerational firewood collection networks. This center column in the middle of the illustration explores a female local spatial agency (Liebenberg, 1994) within and across generations. As suggested by Liebenberg's findings in the neighboring district of Willowvale, do women and girls sometimes use chores as an excuse to temporarily escape from the demands of the home?

These research questions are presented in a larger conceptual framework of a political ecology of disease as illustrated by the circular arrows moving counterclockwise between the column on the left and the circles of the right in Figure 1-1. As noted earlier in the introduction, a political ecology of disease framework suggests a theoretical downward spiral of poverty and health within a natural resource context (Turshen, 1984; Mayer, 1996; Leatherman, 2005; Finnis, 2007). The illustration in Figure 1-1 attempts to show how possible future anthropogenic environmental changes that lessen the

quantity/quality in the near by forest patches can put further pressure on households that are already vulnerable due to poor health and poverty. For example, having to walk further could take time away from a chore such as cleaning to sanitize sick people and the home environment, thus putting sick and frail house members at further risk, as they are more easily susceptible to disease. More time spent on firewood collecting could also take away from opportunities for temporary work in the neighboring field. In short, poverty, poor health and finite resources could be intricately linked in an unfortunate descent of possible further vulnerability in a spatio-temporal perspective.

Organization of Chapters

This dissertation is divided into six chapters, which attempt to evaluate the inter-relationship of HIV/AIDS, poverty, and age on female firewood collection in Nqileni, a remote coastal village in one of South Africa's former homelands.

This first chapter also includes a literature review driving the objectives and questions just mentioned. This review is divided into three sub-section overviews of: the study's primary agent, the female laboring body; the key dependent variable, spatial mobility; and the theoretical framework of this female spatial exploration, a political ecology of disease. Each sub-section concludes with a summary of the main points.

The next chapter introduces the particular study setting of the Nqileni village on the Wild Coast, with a presentation of the landscape, family life, socio-economic status, connectivity, and the lack of basic services.

The third chapter describes the methodology, including a presentation of the data collection sampling, instrumentation, and subsequent field procedure. This chapter serves as a set-up to the next two analytical chapters.

The first analytical chapter lays out the results and discussion as they relate to objectives one and two: exploring adult inter-household differences in illness and socio-economic status. This chapter first introduces the whole picture in the form of a regression model, then breaks it down to look at the individual parts, only to put all the pieces back together again for a chapter conclusion.

The fifth chapter, and concluding analytical chapter, goes inside the households to concentrate on objective three, age, by examining and comparing the spatial distances of girls to those of adults, as well as to compare girls across households, to mirror the inter-household comparisons of adult women in the previous chapter.

The final chapter concludes with a summary of the main findings and possible implications for theory and practice. Directions for possible future research are also discussed.

Important Notice Regarding Images

In the data collection process, HIV/AIDS-proxies were used on a household level to ensure the integrity and anonymity of all participants. Therefore, I do not claim to know the actual HIV/AIDS status of any individual or household in the village. However, as this study uses proxies in relation to a very sensitive subject matter, HIV/AIDS, I have carefully selected pictures I could digitally alter to assure the visual anonymity of all village members, regardless of possible health status. All possible recognizable features such as people's faces, clothing, rondavel huts, and livestock markings have been digitally edited through erasing, changing of colors and shapes, and digital filters. By doing these visual alterations, I have hopefully been able to strike a balance between showing the beauty of the Nqileni people and its landscape while keeping the individual visual anonymity of all village members.

Re-Production of the Female Laboring Body

A Changing View of Women in Development

In 1970, Danish development practitioner Ester Boserup published her now classic *Woman's Role in Development*. This book was integral to the inception of Women in Development (WID), a burgeoning field initiated by feminist scholars, advocates and practitioners of the women's movement (Tinker, 1990). Boserup's book was an important milestone that highlighted women in developing countries as vital producers and efficient contributors who, nevertheless, were left behind in a heightened industrialization process and misguided post-colonial development efforts (1970). Albeit influential, the book would later be critiqued for its sweeping generalizations of simplified uniform farming systems (Deere, 1979; Whitehead, 1990); monolithic categorization of women (Leach, 1994); omission of women's reproductive role and work (Beneria, 1986; Jaquette, 1990); focus on tools as the problem rather than on hierarchal gender social relations (Kabeer, 1994); as well as its uncritical embrace of neo-liberal market economics (Beneria, 1986). Since the late 1970s, policy approaches to women in development have subsequently moved along – and sometimes back again – a continuum of treating women as passive domestic welfare recipients to validating women as active public producers.

Starting in the 1980s, the entrepreneurial efficiency side of women's micro-level projects became part of the liberal market agenda of Structural Adjustment Policies (SAP) (Moser, 1989). Disillusioned by such globalizing policies, Marxist dependency feminists soon launched an alternative perspective to WID: Women and Development (WAD). This strand looked at the issue of development from a class and capital perspective with a focus on women as independent producers working side by side with

men (Visvanathan, 1997). Such a position has later been critiqued for its own dismissal of intra-class gender conflict and exploitation within such a proletariat household (Folbre, 1988; Blumberg, 1991; Kabeer, 1994). According to its critiques, WAD also failed to validate women's reproductive work, by ignoring its economic costs (Huber, 1991; Chafetz, 1991).

In the late '80s, Gender and Development (GAD) was introduced in an attempt to reconcile the best of the previous two within a more holistic framework (Visvanathan, 1997). GAD examines the complex political and socio-economic relations between men and women, the political-economic empowerment of both, and validates both the reproduction as well as production sphere (Young, 1997). In practice, this meant highlighting that not only did poor women have to intensify their unpaid domestic work as state social expenditures were cut but there was also a perpetual reproduction of women's exploitation as they suffered from low wages or total unemployment in the wake of SAP (Deere, 1997; Beneria, 2003). In the GAD approach, the state therefore has a clear role to play as employer as well as provider of a range of social services (Young, 1997). Thus, while classic individual neo-liberal economic principles tend to focus solely on the issue of employment, GAD views efficiency approaches and social welfare as complementary (Kabeer, 1994).

This chapter's opening brief overview of previous general studies on women's production and re-production gives a broad global historical context to the specific national scale to be discussed next; the South African political economy of the laboring female body in rural developing areas. In South Africa, there was a major re-structuring in 1996 when the ANC (African National Congress) government decided to abandon the

novel expanding social transformation trajectory of the Reconstruction and Development Programme (RDP) in favor of the more individual neo-liberal agenda of Growth, Employment and Redistribution (GEAR) policy to aid the post-apartheid reconstruction (Rangan et al., 2002). This employment policy focus does not seem to have worked equally for both sexes: a study from 2003 (Gelb) estimated a greater unemployment amongst women than men in South Africa, resulting in a poverty rate amongst rural female-headed households of over 60%, double that of male-headed households. In addition, the development status of both men and women in South Africa was lower in 2001 than in 1996, with women being even worse off, according to new gender-specific Human Development Indices (Radebe, 2007). Even though most rural women live in highly under-developed areas, they are still part of the national economy as recipients of cash transfers in the shape of pensions, child grants, and migrant remittances to buy staple goods, with agriculture being of little importance even within households (Dewar, 1994; Andrews, 2003). Having employed urban migrants in the extended household does not always, however, guarantee stable and regular remittances (McCuster and Weiner, 2003).

Concurrently with the worsening socio-economic conditions for South African women, in the late 1990s, ominous HIV/AIDS statistics were starting to grow dramatically (Walker, 2004). Now, the many poor unemployed women of South Africa spend considerable time caring for those suffering from HIV/AIDS (UNAIDS, 2007), especially in the rural areas of South Africa where there is a lack of adequate health service delivery. This study investigates whether women's subsequent labor constraints influence their use of natural resources, the focus of the following section.

Contested Natural Resources, Vulnerable Female Collectors

In the 1980s, the issue of natural resources was added to the general discussion about gender, development, and production (Leach, 1994). The 1986 UN Nairobi Forum's women case studies and the 1988 Brundtland Report set the stage for a gendered approach that incorporated managerial aspects as well as the economics of division of labor as it related to natural resource use (Braidotti, 1997). Prominent female scholars from the Northern (Leach, 1994) and the Southern (Agarwal, 1997) hemisphere stressed the need for GAD policies that took issues of class, caste, and/or race into account when looking at these relationships. Later research from various African projects have noted a continued difference between women and men in access to, rights, and control over natural resources (Nabane, 1997; Okot-Uma, 1999; Sullivan, 2000; Cassidy, 2001; FAO, 2002).

Women's insecure rights and tenure have been seen as a major constraint and lack of incentive to more successful natural resource management (Leach, 1994). Researchers have examined a subsequent gender-specific poverty as it relates to efficiency of land use by showing how the lack of land title make women less prone to make investments for long-term improvements of the land they work: even if they wanted to make such an investments, their lack of collateral prohibits them from acquiring the fertilizer or technology needed (Schroeder, 1992; Gladwin, 1997; Masika, 1997; Claassens, 2005).

In several African countries, traditional customary landholding rights in the lineage system, allowing women some rights, has been or is being replaced with male exclusive land ownership akin to Western capitalist private property holdings (Schroeder, 1992; Carney, 1993; Masika, 1997). This is especially problematic in an era of HIV/AIDS,

when widows can suddenly find themselves without use rights to land or other property assets (Slater and Wiggings, 2005; Izumi, 2006).

In post-apartheid South Africa there has been a heated discussion among researchers, legislators, and activists about the declining rights of rural women's land use under the 2004 Communal Land Rights Act (CLRA). Under this contested Act, rights that traditional authorities claim to be "customary" are actually a legacy of white colonial apartheid policies (Claassens, 2005). According to Anninka Claassens, these rights would give communal land power back to the old centralized un-elected apartheid tribal authorities – contrary to the new democratic post-apartheid South African Constitution (2005). Such a throw-back to colonial centralized practices strips South African rural women of the communal land rights subscribed to them under the pre-colonial decentralized family rights indigenous system that gave use and occupation rights to not only wives but also single women (Claassens, 2005). Claassens points out that the CLRA distortion of customary law is highly problematic since the 2003 General Household Survey indicates that more than 4 out of ten rural women over 18 are not married to the household head (2005).

Different kind of rights pertaining to women's access and control are not limited to the actual land itself. Because this case study focuses on the female use of firewood, Diane Rocheleau seminal research on tree use rights in Africa is of particular interest (1997). As a result of her work, she suggests a more "flexible, negotiable tenure rights" system that recognizes not only the gendered layered niches of such multiple-use of trees, but also the changing nature of such use as well as the changing power relations among the users (1997:1351). Such a recommendation echo Fortmann's long-time

observations in Zimbabwe of how wives and daughters' temporary use rights to trees and their products made them and their acquired knowledge vulnerable to any kind of change within and/or outside of the household (1992). The shrinking of the area's commons was blamed on men cutting poles for building. Women expressed a desire to have these areas restored, as they tried to juggle household duties with an ever-expanding distance to firewood materials (Fortmann, 1992). In another case, Myungwe described how Zimbabwe women from different households had to pool resources to borrow a donkey cart to carry the firewood from new collection sites much further away, after a sudden local village-level change in tree-use rights (2008). Finally, in Kenya, when men turned to commercial exotic on-farm production, women had to turn to the market for wood-fuel, as the commons supply was too scarce to make up for previous on-farm supplies (Bradley, 1991).

Crashing the Household Black Box to Bring Attention to Female Labor

The natural resource examples above highlight the possible conflict of interests between male and female economies within the same household. In the past, however, major development agencies viewed the black box of one household as convenient one-stop policy tools (Dwyer, 1988). This unitary household perception was influenced by Gary Becker's book *A Treatise on the Family* (1981) that helped shape the so-called New Household Economics. Becker's book ignores any kind of internal gender relations to serve the idea of optimal unitary maximizing household producing behaviors. According to Becker, these behaviors supposedly created a subsequent pooling of resources managed by the representative male head, "the benevolent dictator" (Becker, 1981:192). Not surprisingly, feminist scholars have found this unitary view highly problematic.

A gender analysis points attention to two dynamics that would question such a Beckerian unity: 1) the investment by family members outside the household to avert risk as well as change individual bargaining power within the household (Fapohunda, 1988; Beneria, 2003) and, 2) the possibility of economic exploitation, and conflict over distribution, inside the household (Hartmann, 1981; Folbre, 1988).

For the first dynamic, women's collected resource bundles, such as free woodland resources, can become an important tool for negotiation and bargaining within, as well as outside, the household (Leach et al., 1999). For the latter dynamic listed above, Kabeer also points to Becker's three "fallacies of aggregation" of intra-household welfare, income, and labor (1994: 101-107), where female members often receive less than male members but tend to spend more of their separate income and labor on the family (Mencher, 1988; Blumberg, 1991). Blumberg therefore argues that we should not ignore "the possibility that the family has a 'internal economy' differentiated primarily along the axes of gender and age" (1991:98).

This critique of Becker brings attention to the particular two-fold focus of this research project: the existence of a number of different productive agents within the household, as well as the issue of an overall inequitable domestic household reproduction labor distribution. What is problematic about the majority of the research above is that it seems to more or less assume the active presence of a male household head. Yet statistics show that an increasing number of women live alone or in households led by women (UN, 2002), with more and more men migrating to urban areas (Masika et al., 1997). This is very much the case with the great number of out-

migrant households in South Africa's former homelands, where rural unemployment continues to be rampant after the 1994 democratic elections.

The Role of Children as Producers and Assets to the Household

In the late 1970s, Nag and fellow researchers started a discussion on the value of children's work to poor rural people, by arguing that "households with a greater number of child producer units are economically more successful" (Nag, 1978). An ethnographic linear model (ELP) based on small-scale farming households in Peru concluded the opposite, however: "Families with fewer members were economically better off after 10, 20, and even 40 years. With more young or very old members, the expenses and consumption requirements exceeded the benefits from the additional labor, and debt was greater and of longer duration" (Cabrera et al., 2005: 207). However, this example must be viewed in a local Peruvian agricultural-based context of an ample supply of production labor at a low-cost for hire. The lack of gender-aggregated data does not illuminate if and how the additional labor addressed the separate spheres of the male and female sphere of labor allocation demands.

Another ELP conducted in Malawi examined the gender division of labor and the impact of HIV/AIDS – where the shortage of labor is indeed an issue (Thangata et al., 2005). This study presented a more complex, varied picture with the help of gender disaggregated data for all intra-household labor allocation: when the adult women fell ill, the community made arrangements for additional help to aid the husband, whereas this additional help was not offered to women when their husbands fell ill (Thangata et al., 2005). When Gill (2010) did his study on HIV/AIDS and agricultural interventions in Kenya, he could not find any support for the provision of such additional help, however. There were no extra adult people around to offer such help, Gill was told (2010).

The examples above point to the potentially valuable contribution of children, as a pair of extra adult hands may become harder and harder to find in the wake of the HIV/AIDS epidemic. Looking specifically at children's contribution to household firewood collection in Malawi (but without the HIV/AIDS context), Biran, Abbot and Mace (2004) build on Nag's conclusions by proposing that not only are children indeed an asset in such joint activities, but their findings also suggest that children's activities add a much needed spatial mobility to complement women's household entrapment. This observation is supported by Hawkes' earlier work with Hadza women and children (1995) and Bird's study of children's collection patterns in Mer de Torres Straits (2002); children's' mobility and collection returns were much greater than first assumed.

Biran and her colleagues observed that women walk further away from home and collect more wood with assistance of their daughters. In their conclusions, they argued that the additional help from young girls in firewood collection was vital, since their findings in Malawi "suggest that households with additional female labor do not use more firewood than households without daughters of wood collecting age" (Biran et al., 2004:14).

Another dimension of children's labor contributions relates to the argument that children's food consumption may negate their labor input benefit to the overall household (Cabrera et al., 2005). To address this point, Cavendish found that children performed plenty of opportunistic wild foraging in Zimbabwe on their way to school, as many of them were not fed breakfast (2000). His findings were corroborated by other Southern Africa researchers, but in a specific HIV/AIDS context: children from HIV/AIDS afflicted homes were found to spend a considerable time away from home, at

considerable distances, to forage wild foods, as a result of increased food insecurity at home (Barany, 2005; Shackleton et al., 2006, McGarry, 2008). Finally, McGarry notes that on South Africa's Wild Coast, children are now being served first, as opposed to last, since the HIV/AIDS epidemic – an important change in local IsiXhosa culture that could possibly be related to the elevated value of children as natural resource collectors (2008).

HIV/AIDS – Re-Centering the Female Body in the Rural African Debate

According to the UNAIDS December 2007 report, *AIDS epidemic update*, almost one-third of all new HIV infections and AIDS deaths last year took place in Southern Africa alone. The HIV/AIDS epidemic presents a major shock to the South African household. The South African Department of Health (2009) estimated that HIV prevalence among antenatal clinic attendees was 29.3% in 2008 (and 26% in 2007 in Eastern Cape where the study site resides). In addition, according to the same department, AIDS accounted for 23% of maternal deaths in South Africa 2005-2007.

Nevertheless, up until ANC's 2008 political re-shuffling of government officials, South Africa was criticized both outside and inside its borders for the failure to adequately address the epidemic, with the former late South African minister of health, Manto Tshabalala-Msimang, infamously advocating garlic and beetroots to fight the epidemic. Some South African provinces therefore took it upon themselves to pay for and distribute their own medicines, in defiance of centralized national health department policies refusing the needed double treatment to curtail HIV mother-child transmission (Ostergard, 2004). According to a New York Times article (March 9, 2008) the national government finally agreed to pay for and distribute both drugs in January of 2008, two years after the World Health Organization (WHO) issued such a recommendation. A

2008 Harvard study estimated, however, that the country's past refusal to disseminate adequate numbers of antiretroviral (ARV) drugs between 2000 and 2005 led to 330, 000 premature deaths from HIV/AIDS (Chigwedere et al., 2008).

From a perspective of gender, this epidemic is negatively affecting African women and girls disproportionately in relation to men and boys. Women and girls are not only the primary caregivers of an exploding epidemic, they are also more: susceptible to transmission; likely to be pulled out of school to make up for labor losses; and socio-economically vulnerable, as they risk losing access to property if a male household head dies (Walker, 2004; Poku, 2005; Slater and Wiggins, 2005; Barnett, 2006; Patterson, 2006). In addition, if the sexual encounter is performed under violent circumstances, the subsequent tear of women's internal tissue raises the risk of transmission further: in South Africa an estimated 80% of the country's women suffer from domestic violence (Walker, 2004). The 2008 South African National Health Survey estimated that 15.7% of the country's men had HIV while the HIV prevalence for women was estimated at 32.7%, double that of men (Human Science Research Council, 2008).

Sub-Section Summary

This section focused on highlighting the specific problem of rural women's double duties of reproduction and production in the developing world. Women's added burden of unpaid reproductive duties have become particularly taxing in light of many countries cutting down on social expenditures in response to global SAP (Deere, 1997; Beneria, 2003). In addition, the effectiveness of women's natural resource production can be negatively impacted by women's lack of use rights, access and control over these resources, making them and their activities highly vulnerable to household internal or external changes (Bradley, 1991; Fortmann, 1992; Leach, 1994; Masika, 1997;

Myungwe, 2008). The following two sub-sections on land use and political ecology will look more closely at the political economy issues surrounding the natural resource environment,

The production concerns of women and girls have often been overlooked in the past due to a unitary monolithic view of the household as represented by a sole male household head (Becker, 1981). Such a narrow view fails to include the issue of possible intra-household conflicts of interest and inequitable distribution of pooled resources, leading other researchers to stress the importance of gender and age-aggregated data to highlight possible multiple internal household economies (Hartmann, 1981; Fapohunda, 1988; Kabeer, 1991; Beneria, 2003), including the contribution of children (Nag et al., 1978; Biran et al., 1994, Hawkes, 1995; Bird, 2002; Biran et al., 2004; McGarry, 2008).

Female vulnerability due to inequitable division of labor and resources within and across households is further exacerbated by the HIV/AIDS epidemic (Walker, 2004; Poku, 2005; Slater and Wiggings, 2005; Barnett, 2006; Izumi, 2006; Patterson, 2006), the main independent variable of this study. This is also true in South Africa with a post-apartheid climate marked by persistent underlying structures of gender inequality where South Africa's many unemployed poor women and girls (Gelb, 2003) engage in domestic caretaking of sick household members. The political economy of HIV/AIDS in South Africa will be discussed more in depth in the last sub-section.

The question this study asks is: do the female labor constraints discussed in this section influence the subsequent land use and spatial mobility discussed in the next section?

Space, Mobility, and Land Use

Dependence on the “Hidden Harvest” in the Former Homelands

In the early 20th century, South Africa’s land segregation policies set in motion the removal of African people from fertile lands all over the country to over-populated homelands. Indigenous South Africans had been banished from their own land by Dutch and British colonizers as early as 1652, but with the advent of apartheid legislation such land segregation policies became both systematic and far-reaching. The South African Natives Land Acts of 1913 and 1936 demarcated 13% of the total land area for so-called native reserves (later named homelands) to segregate land ownership. In 1994, 85,000 white farmers controlled over 80% of the agricultural land, while 15 million Africans were packed into homelands (Wegerif et al., 2005).¹

In the former Transkei, as in many other former homelands, the historical apartheid “development of underdevelopment” (Southall, 1983:73) and subsequent male urban migration was orchestrated through a combination of factors: the loss of large tracts of land (but enough for a one-man-one-plot policy to subsidize a minimum of rural reproduction); heavy taxation; and lack of access to capital, subsidies, markets, and infrastructure for potential commercial agricultural production (Southall, 1983).

Almost a third of black South Africans still live in these homelands (Hargreaves and Meer, 2000). These residents depend upon the communal natural resources for food, health, fuel, and other purposes to supplement a cash economy of social welfare grants and remittances (Shackleton et al., 2001; Andrew et al., 2003). However,

¹ To combat past racial inequities, the new government created land reforms with the new constitution in 1994, consisting of three programs: restitution, redistribution, and tenure reform. The process of restitution has been extremely slow, however, greatly lagging behind greatly the initial goals.

according to Andrew and his South African colleagues (2003), natural resource policies and projects are put into place only to safeguard high profile species and regions related to protected areas – such as the South Africa National Environmental Management Protected Areas, 2003; National Biodiversity Act, 2004 – or commercial agricultural projects. The free woodland species used by people in the communal lands fall between the cracks of such natural resource management policies (Dovie et al., 2004). The harvesting of such woodland forest resources for household consumption use therefore has been fittingly referred to as the “hidden harvest” (IIED, 1995).

Up until the 1990s, the view of such homelands was one of degrading natural resources of no real use to anyone, locally or nationally. In his seminal article, “*Are the communal rangelands in need of saving?*” (1993), Shackleton broke ground by questioning this view of South Africa’s communal land as wastelands due to grazing practices. Looking at the landscape through the lens of resilient non-equilibrium systems theory, he disputed the old large-scale degradation narrative (1993). As will be noted, in the next chapter on political ecology, Leach (1999) and Robbins (2005) generally concur with such a critical view of the landscape, describing a dynamic variability that leads to transitional, rather than necessarily degrading, productions of landscape. In a later paper on the South African common lands, the two Shackletons and their colleagues further argued that the general view of natural resource use in the former homelands as inherently self-destructive is counter-productive to the improved conditions of the most destitute and poor rural populations (2001).

The Southern African communal lands’ natural resources offer an indispensable rural safety net and a number of critical non-monetary subsistence goods and services

as part of a micro-scale informal economy (Dovie et al., 2005; Letsela, 2002; Andrew et al., 2003). Dovie and his fellow researchers (2005) calculate the net direct use value of secondary woodland resources in Bushveld, South Africa to be three times that of what a non-skilled wage earner would make at a commercial agricultural farm. For firewood, which is the primary focus of this study, Letsela and his fellow researchers (2002) estimated the annual use value per household in the neighboring country of Lesotho to be US \$1,492, higher than both crops (US \$1363) and wild vegetables (US \$774). In the communal lands in Limpopo in northern South Africa, an estimated 96% percent of households use firewood (Dovie et al., 2004). Similarly, Timmerman found that an estimated 99% percent of the households collected firewood on the Wild Coast in the Eastern Cape in southern South Africa (2004).

In the late 80s, firewood was generally conceived of as an energy supply issue but was transformed into a gender and land use concern by the early 1990s (Mahiri, 2001). Situating firewood in a wider context of power and access Mahiri argued “that the rural energy problem cannot be treated in isolation as a single ‘crisis’ separate from the equally pressing issues of poverty, labor, food, culture and values” (2001:205). In this inter-connected view, women’s collection of firewood is not opportunistic but requires planning and subsequent reallocation in relation to other demanding chores: the time-intensive duties of firewood collection may therefore augment an already existing vulnerability of certain struggling households (Dovie, 2004).

Optimal Foraging Theory vs. the Intricate Social Human Experience

One would be remiss to speak of spatial patterns of foraging without mentioning the work – and subsequent critique of – human behavioral ecology’s optimal foraging theory (OFT). Human behavioral ecology took its first theoretical steps in the 1970s,

fusing Julian Steward's cultural ecological work on hunter-gatherers with behavioral explanations inspired by neo-Darwinism's natural selection approaches from evolutionary ecology (Winterhalder, 2000).² OFT makes use of four cornerstones to look at resource utilization as determined by: goal (optimization of gathering); currency (measure for costs and benefits: usually calories), constraints (context); and decision (behavioral traits to be examined) (Stephens, 1990; Winterhalder, 2000). OFT originated with economic models of decision-making were being incorporated by biologists to look at animal behavior, only to be brought back into the human domain by a particular brand of anthropologists (Winterhalder, 1981). Studies utilize OFT to help predict efficiency-driven foraging behavior, with the help of quantitative ethnographic observations, surveys and interviews that are distilled into reductionist mathematical or graphical models (Winterhalder, 2000). For example, by observing Mapuche Indians in Argentina, researchers concluded that such an OFT cost and benefits analysis helped explain foragers' decisions to walk further for very nutritious plants while choosing to collect less nutritious plants closer to the homestead (though researchers were hesitant to conclude this resulted in actual fitness maximization) (Ladio, 2000).

The pre-determined functional approach of OFT has been met with considerable critique. This critique can be categorized into four major categories: the fickleness of the human mind; the issue of risk vs. maximizing; the social-driver component; and the issue of structure vs. agency.

First, there is the issue of the actual capacity of the human mind to conduct such elaborate mathematical planning using spatial equations. As early as 1975, Alland

² In addition to foraging behavior, human behavioral ecology has also been used to look at the possibility of adaptive behavior in areas such as mating and parenting.

revolted against such a static view of specific characteristics of adaptive behavior. Instead he argued for an adaptation theory that focused on a more dynamic view of evolutionary systems that would also allow for explanations of irrational maladaptive behavior by the cognitive mind (Alland, 1975). Alland argued the now classic line to punctuate his critique: “Human are the only species in which too much thinking may lead to false solutions” (1975:68). There has also been other questioning, along the same line, from another researcher of whether the mental computing OFT models assumed was mentally feasible, considering the consistent lack of information in everyday life (Mithen, 1989).

Second, there is the issue of whether what is being optimized is always of the same quality, quantity or substance, or whether one should consider “optimum” to be a constantly changing condition. In 1990, Stephens added to Alland’s classical critique by tackling the neglected aspect of randomness in such traditional OFT models, examining the many facets of risk: is foraging always about maximizing or is rather about avoiding a worst-case scenario in the face of uncertainty? In 2006, Winterhalder responded to this particular criticism by re-defining maximization goals as a “constrained optimization” that included compromises to make room for adaptive subsistence options (2006: 11).

In another critique of OFT, the social collective facet of humans has been brought up as a direct opposite to the neoclassical individual economics upon which OFT builds its one and only goal. Drawing on observations of Amazon Indians, Baksh took a different spin on risk-taking by raising the issue of social risk-averse behavior that includes food transfers to reciprocate, as well as avoidance of certain people (1990), echoing earlier decision-making research work done on pastoralists in Africa (Gulliver,

1975; Boer, 1989). In addition, in the social world of organization, the social fabric of the collective can lead to multiple conflicting goals (Mithen, 1989; Bettinger, 1991) rather than a single optimizing one of reproductive success. Such social mechanisms are not addressed by HBE/OFT with its focus on how to most efficiently maximize calories. These critiques bring up the important point of looking at multiple variables in an effort to try to understand complex and changing human foraging behavior.

Finally, there have been concerns about issues of structure vs. agency in a highly confined HBE framework. In her lengthy and quite comprehensive critique, Joseph critiques how HBE both excludes contextual hierarchal structural constraints and negates individual agency, by reducing behaviors to predictive “adaptionist scripts” (2002: 31). Instead she calls for theories in ecological anthropology that recognize structural hierarchies, information as well as energy flows, knowledge systems, and historical negotiations of differences, as well as culture, to “explain rather than predict” (Joseph, 2002: 31) observations of human behavior. In a call to understand what makes such complex human systems differ from purely biological ecosystems, a number of researchers have looked at how to incorporate the agency of decision-making that follows human culture, institutions and knowledge systems (Pickett, 1997; Grimm, 2000; Gibson, 2000). Stepp and his colleagues have made a valuable addition to such a challenge by articulating an adaptive complex ecosystem that incorporates what they coin “unique human properties” (2003:1), focusing on the information flow and processing of functional as well as maladaptive traits in the human experience.

The Expanding and Contracting Qualities of Female Spatial Mobility

For this study, I chose to look at female foraging for firewood through a lens that mixes behavioral and feminist geography. According to behavioral geography, the

spatial structure of human activities in a specific environment is influenced by socio-economic characteristics shaping subsistence needs, constraints and capabilities in an adaptive process (Chapin, 1974; Cullen, 1978; Golledge and Stimson, 1990). As noted earlier, the particular spatial travel of female activities is similar to that of a rubber band, expanding out and away from the home only to snap back again towards the center. In terms of the expansive qualities of this rubber band, Jennifer Mandel highlights the importance of women's spatial human activities by arguing that "Access in the form of spatial mobility is at least as important to the creation of profitable livelihoods as availability of assets" (2004:361).

As an example of this expansive female mobility, Howard (2003:6) quotes Richard Lee's 58 surveys of foraging societies from 1968 that illustrated that – save from the Arctic – only a 35% average of food supply came from hunting, and that women and men walked equally far, but that women carried a much heavier load than men did. Looking specifically at an African context, Bryceson's study of household domestic activities found that men traveled 35% of the distances that women did and carried 25% of what women carried (1993). This walking and carrying led to opportunity costs for women (Bryceson, 1993) that were related to both food production and human health (Mehretu, 1992).

Female spaces can also be expanded by a defiant use of distant locations as one of the few tools of (spatio-temporal) rebellion available (Liebenberg, 1994). In a South African Wild Coast district, neighboring this study site's district, anthropologist Liebenberg noted that adult daughters-in-law would perform their chores as far away as they could go, in order to get away from the demands of their mothers-in-law. She aptly

called this managing of space and daily activities in and around the homestead due to politics of gender, age, and kinship as “body of avoidances” (1994:ii).

Just as it is important to recognize that women venture further away than what the domestic stereotype might lead one to believe, it is also important to recognize women’s spatial restrictions. The spatial entrapment thesis (Nelson, 1986) claims that due to the many family household responsibilities that fall upon women, female daily travel is spatially more constrained than male travel. As a consequence of women’s domestic caretaking duties, Karen Davies notes that men’s use of space and time tends to be more centered on their own needs: in contrast, women’s use of space and time tends to be more oriented towards other people’s needs in addition to their own (2001). Focusing on the amount of care women in Sweden spend on family caretaking, she writes “where women find themselves and when they find themselves where they are, is determined by others” (2001:37). As an example of both the spatial entrapment and female relational spatio-temporal constraints, Sheona Shackleton notes the need of craft-making South African grandmothers to work close to home in order to be able to take care of HIV/AIDS family members and orphans (2005).

Another set of research looks at the female use of space and the fear of (sexual) violence (Katz, 1993; Mandell, 2004). As an example, a Zimbabwe case study found that the building of a local school led to higher attendance for girls: the previous 30 km walk to the nearest school had made many parents hesitant to send their girls to school (Nabane, 1997), a concern that is mirrored in Cindi Katz’s research on girls in Sudan (1993).

From GIS to Feminist GIS – in Search of the Missing Female Subject

Scientists have had a long fascination with scale, humans and spatial land use. In the early 20th century, spatial thought in anthropology was centered around the notion of fairly large-scale so-called culture areas/circles in which certain cultural traits were mapped out manually as being present or absent in a hypothesized diffusional pattern emanating from a particular geographical local. In the 1930s and 40s scholars turned their attention to small scale lived experiences, with a focus on a sense of internal place rather than external extending space. Starting in the 1950s, with the advent and influence of cultural geography and ecological anthropology, there was a renewed interest in spatial coordinates, larger regional patterns, and varying scales. This shift made use of aerial photography in the 1950s, satellite imagery in the 1970s and Geographical Information Systems (GIS) since the 1980s (Aldenderfer, 1996).

The digital cartographic system of GIS– software, hardware, user, and method – can produce complex, systematic spatial analyses to examine several layers of geographically referenced data from its database of spatial coordinates and related attributes. GIS makes use of remote sensing satellite data that capture images of the earth to fuse ground-based studies with recorded land cover to model past and present social and ecological processes (Geoghan, 1998). For many of these models, GIS makes use of another geospatial technology, the satellite-based timing and ranging global positioning system (GPS), to acquire the coordinates (as well as time, altitude, speed, and direction) of the spatial data to be analyzed. The GPS receiver needs a minimum of four GPS satellite readings to determine an accurate 3-D position: latitude, longitude and elevation (the fourth signal is used for correctional purposes) (Thurston,

2003).³ There are three main uses for GPS: mapping for location purposes; ground truthing (for referencing); and spatial analysis (for linking spatial coordinates to non-spatial attributes) (Spencer, 2003).

What are some of the caveats of incorporating these new modern technologies, and how do they shape the subsequent production of knowledge? Certain social drivers can be hard to distinguish from a remote large-scale perspective, with HIV/AIDS as an example (Walker, 2007). Similarly, Turner has raised concerns of how a broad global view from outer space is used by prominent political players to make broad global-level scientific arguments about the environment, with local level data becoming secondary to that of a higher level (2003). Therefore, Turner calls for more fieldwork on micro-geographies since “the GIS/RS landscape needs to be socialized” (2003: 272).

Echoing similar concerns a decade earlier, a strand of practitioners in the 1990s created the study of critical GIS. This field was preceded by a great debate among researchers about whether GIS was inherently a western positivist quantitative driven tool (Taylor, 1990; Rundstrom, 1995) or a tool that could be used to integrate issues of social concerns as well (Openshaw, 1991). The two camps came together in two conferences in 1993 and 1995. These conferences produced a GIS and society research agenda including “critical GIS” (Sheppard, 2005). As a community approach within this strand, Public Participatory GIS (PPGIS) has been used as a participatory tool for alternative non-corporate maps, for various communities and grassroots movements (Craig et al., 2002). The most noted rural example in a developing context

³ GPS was developed and launched in space in the 1970s for the defense industry but did not become fully integrated with GIS until the mid-1990s when the U.S. NAVSTAR GPS system was fully functioning. In 2000, when selective availability was turned off, civilian uses for GPS – and the subsequent incorporation with GIS took off further (Thurston, 2003).

is the work of Daniel Weiner and his colleagues in South Africa who look at alternate views of land use from a perspective of previously disadvantaged communities (Weiner et al., 1995).

In the last ten years, another strand of critical GIS has emerged: feminist GIS. The mapping of women's everyday lives combines feminist theories with GIS to move the experience of women "from a missing object to a mapping subject" (Pavlovskaya, 2007: 583). Such work contributes to a new kind of GIS, by connecting women's invisible private sphere to the visible public sphere, through integrated mixed methods that offer alternative representations of women's everyday realities (Kwan, 2002a; Rocheleau, 1995; McLafferty, 2002).

A number of feminist GIS studies subsequently have looked at women, space, and every-day activities. In her research on women's multiple economies in Moscow before and after the privatization in the early 1990s, Pavlovskaya (2002) visualized how the consequent urban changes lessened the amount and proximity of services (such as child care, cleaners) and goods (food markets, clothing stores) women needed, leading to a rise in informal and non-monetized economies closer to home. According to Pavlovskaya, this is contrary to what the neo-liberal market policy-makers had claimed (2002). In the US, urban geographer Mei-Po Kwan has taken a critical look at access to job opportunities through the impact of restricted racialized "closeted spatiality" (2002b: 654) of African-American women. In addition, Kwan looked at the differences in opportunities between Caucasian-American men and women with the help of travel diaries illustrating space-time constraints (1999). All these examples point to the importance of not only creating gender-aggregated data, as pushed by the GAD

agenda, but also unveiling and investigating missing aspects of women's lives. These are all aspects that cannot be easily seen from outer space. All of the case studies mentioned here look at women in an urban Northern hemisphere. Currently, there is only one rural African GIS incorporating women, space, and health; with Tanser (2000) suggesting a correlation between women's HIV risk and their homesteads' proximity to major roads.

Sub-Section Summary

This section opened with presentation of the general dependence on and importance of common pool natural resources as a rural safety net in the geography of the former homelands (Shackleton et al., 2001; Letsela, 2002; Andrew et al., 2003; Dovie et al., 2005). The harvesting of these free woodland resources of no national interest, in this and similar locales, has been described as the "hidden harvest" (IIED, 1995).

The woodland resource of focus for this study, firewood, is part of a complex web that is inter-connected with health as well as labor constraints, poverty, and food security (Mahiri, 2001). Consequently, firewood collection is not a haphazard activity but requires planning and allocation in relation to a number of female chores, making some households more vulnerable than others to the demands of this activity (Dovie et al., 2004). This varying vulnerability of the household, also discussed in the previous section, is one of the key points of this study. This sub-section adds a wider natural resource management context, in the shape of firewood, to this varying female experience.

In terms of a general look at foraging and spatial mobility, OFT has been popular in the past but has received more and more criticism due to its singular focus on caloric

benefits, unitary goals, and maximizing, ignoring important aspects of the human experience, including the intricate and sometimes inexplicable ways of the human mind (Alland, 1975; Mithen, 1989), the multiple goals of social networks (Mithen, 1989; Baksh, 1990; Bettinger, 1991), as well as issues of structure vs. agency (Joseph, 2002). It is interesting to note that there are certain similarities between the critiques of Becker's household unitary household maximizing economics, in the previous subsection, and that of OFT maximum optimization of foraging. Both critiques look to expand a unitary, fairly monolithic one-dimensional view, to include multiple goals and variables interacting and negotiating with an outside social fabric that extends beyond the original confined unit of focus.

This study chooses to look at spatial firewood collection from a different lens, behavioral and feminist geography, with the latter's specific focus on the female traveling body. Connected to the issue of spatial investment for firewood is the general importance of female spatial mobility (Mandel, 2004). Women's spatial mobility can extend far away from the home (Bryceson, 1993; Liebenberg, 1994; Howard, 2003) only to snap back to the center due to the household spatial entrapment thesis (Nelson, 1986) and the socio-relational qualities of women's travel (Davies, 2001; Shackleton, 2006). Travel away from home involves a variety of opportunity costs for women that are related to both production and health (Bryceson, 1993; Mehretu, 1992), adding to the varying vulnerability of different women. Nevertheless, distant travel connected to chores can be one of few tools of rebellion available for females otherwise trapped with chores at home (Liebenberg, 1994). Observed examples of this "body of avoidances" (Liebenberg, 1994:ii) will be discussed in the next chapter, the case study setting.

Feminist GIS has added a further dimension to feminist geography with its explicit interest in measuring more closely the spatial distances covered by women in different contexts, involving females of different political climates (Pavlovskaya, 2002) as well as ethnicities (Kwan, 2002b). There is a research gap, however, in studies bringing the lived experience of rural women in the Southern hemisphere out of the hidden corners and into the center of the cartographic discourse. Before moving on to the particular rural Southern hemisphere field setting of this study's spatial exploration, the following section on political ecology will provide a wider multi-scale theoretical framework to further contextualize this case study and its main themes: women/girls, health, poverty, labor constraints, and natural resources.

A Political Ecology of Disease

Shifting Voices on the Human-Nature Relationship

Up until the early 20th century, the dominant viewpoint on human-environmental interaction was one of environmental determinism: humans were considered to be subservient to and defined by the power of their natural surroundings (Moran, 2000; Sutton and Anderson, 2004; Robbins, 2005). This discourse was also used as an argument to proclaim political dominance by certain geographies over others (Moran, 2000). In short, Northern hemisphere hegemony was heralded as a so-called natural process (Robbins, 2005). For example, as late as 1915, Ellsworth Huntington professed a so-called "preferential climatic condition" for human progress (Moran, 2000). Concurrent with environmental determinism, focusing on the forces of nature, there have been two alternate schools (Moran, 2000). The environmental possibilisms of Malthus and Frans Boas focus on dynamic human populations and culture being defined by a static "nature" (Moran, 2000; Sutton, 2004). The other school, human

adaptation, is a more dual interactional approach, as explained by fluctuations of change and stability of Darwin's natural selection theories, and the science of genetics (Moran, 2000).

In the 1950s, there was another major shift with Julian Steward's cultural ecology. In his *Theory of Culture Change*, Steward took the seeds of environmental possibilism and turned them into an exploration of multiple cultural adaptive evolutionary strands as the result of subsistence driven human-environment processes (Sutton, 2004; Robbins, 2005). Steward wished to determine whether resource-utilizing cultures in similar small-scale environments experienced similar short-lived adaptations (Steward, 1955; Moran, 2000; Sutton, 2004).

A decade later, however, Rappaport and his student Vayda rebelled against Steward's theories of cultural types, separation of humans and nature, and failure to adequately explain causality or include physiological changes (Moran, 2000; Sutton, 2004; Robbins, 2005). Instead, they proposed an anthropological use of Tansley's ecosystem model as a universal measure to incorporate biological as well as human adaptations (Moran, 2000; Sutton, 2004). In Rappaport's classic work, *Pigs for the Ancestors*, he argued that humans were but one of many integrated components, using rituals to self-regulate stability and change, in the greater adaptive unified wheel of homeostasis (Rappaport, 1968; Moran, 2000). Other anthropologists questioned this closed reductionist adaptation approach for its failure to deal with human processes over time (Sutton, 2004); local level inequalities and global level structural processes (Moran, 2000); maladaptive behavior (Alland, 1975); and a human need "to change the system, not adjust to it" (Leatherman, 2005:53). Both cultural ecology and this strand of

ecological anthropology were criticized for obsessing about the function of change at the cost of a needed discussion on the cause of change.

At the same time, geography had infused anthropological cultural ecology with a human-oriented look at hazards as well as Marxist influenced development studies (Bryant, 1998; Paulson, 2005; Robbins, 2005).⁴ The stage was set for yet another theoretical shift to look at the nature vs. culture debate: political ecology.

In 1972, Eric Wolf, a student of Julian Steward, presented a study of a European Alpine environment that he titled political ecology. Wolf portrayed this environment as a conflicted landscape between two different forces; an authoritarian vertical structure of ownership for governmental control in one corner, and the opposing local level horizontal tenurial organizations addressing the communities' heterogeneous needs. Vayda would expand on such a view by calling for a multi-scalar approach in a so-called "holistic progressive contextualization" (1983:265) that investigates the interdependent scales back and forth.

A few years later, Schmink and Wood developed political ecology further in Latin America (1987). Using political ecology, they explored the cozy relationship of the state with national and international dominant market forces as an ideological driver of unsustainable local accumulative environmental practices and subsequent class struggles in the Brazilian Amazon. Similarly, in West Africa, Bassett (1988) noted the influence of the state as a subjective judge in the local competition for land use. In this local level conflict peasants resented paying the surplus costs of pastoralists' livestock

⁴ These Marxist studies included green materialism, peasant studies, world systems theory, dependency theory, and feminism, to take a modern look at the political economy of unequal control and access to production resources in a postcolonial world (Bryant, 1998; Paulson, 2005; Robbins, 2005).

crop raiding to benefit the national interests of growing domestic meat production.

Around the same time in Asia, Peluso (1992) explored similar contestation over land use in Indonesia's forests, recommending flexible and diverse village level organization of extractive use to combat competing national and international timber interest.

From the late 1980s through the early 1990s, the field of political ecology became firmly established with case studies from all over the world. These case studies coincided with Blaikie and Brookfield's *Land Degradation and Society* (1987). The importance of this work is greatly attributed to tying the issue of plurality and marginality of local land managers and their capital to enduring multi-scalar politico-economic processes that together help define the landscape (and the potential land degradation). The authors even mentioned as the particular local geography of interest to this project, the South African homelands, and wrote the now classic definition of political ecology:

The phrase "political ecology" combines the concerns of ecology and a broadly defined political economy. Together this encompasses the constantly shifting dialectic between society and land-based resources, and also within classes and groups within society itself (p. 17).

In sum, the contestation of political ecology contains three basic concepts: the perpetual marginality of various kinds of capital; a diversity of voices speaking from different positions of power for access and control; and the subsequent multi-scalar relations of competing production processes that may put a strain on the environment, the object of human expression (Blaikie and Brookfield, 1987; Peet and Watts, 1996; Bryant, 1997; Paulson et al., 2003; Gezon et al., 2005; Robbins, 2005).

With the dawn of political ecology, the production of the landscape was no longer explained by simple one-note causes such as so-called natural disasters or Malthusian population theory (Blaikie and Brookfield, 1987; Bryant and Bailey, 1992; Batterbury,

1999; Zimmerer and Bassett, 2003). Now, political ecologists called for the production of landscape to be read as a multi-layered map of political and economic contestation.

Controlling the Female Laboring Body

Political ecology looking at women's issues has expanded to cover issues around gendered rights and responsibilities of land use as well as labor control. Addressing women as local reproducers, regional producers, and national community players of global concerns, Rocheleau, Thomas-Slayter and Wangari (1996) highlight the gendered dimensions of political ecology as they relate to knowledge, rights, responsibilities, and environmental movements in *Feminist Ecology: Global Issues and Local Experiences*.

While some researchers have focused on gendered rights and responsibilities in land use analysis, others have examined gendered rights to the benefits of one's own labor (Carney, 1993). Such work is just as pertinent to a gendered feminist ecology, as it shifts the focus onto women's increasing lack of control over their own labor in space and time, with the advent of agricultural diversification and technological change (Carney and Watts, 1991; Schroeder, 1993).

As an example of such a political ecology of labor, Carney (1993: 344) points to the creation of a Gambian "female labor reserve," in which women's customary rights to their own land were curtailed by the male head of household in order to have them work only on the family plot. Now, the income from the land use was going to the head of the household, whereas previously the women had been able to collect their own income for their own work on their own plot (Carney, 1993). Also, in his ethnographic work in the same country, Schroeder (1993: 361) explores similar politics through the planting of trees in what he refers to as a politics of "environmental stabilization" instigated by

global development institutions among local Gambian rural laborers. In the wake of agricultural modernization, additional sites where environmental gender labor allocation has been contested include Sierra Leone (Leach, 1994), Senegal (Fisher, 2000), and Bolivia (Paulson, 2005). In these examples, as intensification and profitability increases, women's access to space and control over their own labor decreases.

Disease as a Multi-Scale Driver

The authors above have provided a much needed complementary perspective on women working “double shifts” in segregated spaces within an agro-ecological system, which is helpful in understanding women working “double shifts” as wild harvester producers and HIV/AIDS caretakers. This relationship can be viewed through a theoretical lens of a political ecology of disease.

Within the traditional epidemiological triangle of disease (agent, host, and environment), political ecology of disease is focused mainly on the last two components (Whiteford and Hill, 2005). Looking at the host and environment of trypanosomiasis in Tanzania, Turschen first coined a “political ecology of disease” (1984). This new field received real attention (Bryant, 1998) with geographer Mayer (1996, 2000) pushing for an explicit link of disease to the politico-environmental land use. Subsequently, this field has been used to look at a variety of cases, including diseases and the refugee crisis south of Sahara as influenced by environmental factors (Kalipeni, 1998); a comparison of dengue outbreaks and globalization involvement in Cuba and the Dominican Republic (Whitehead and Hall, 2005); the impact of global economic transformations and revolutionary movements on illness and household production in the Peruvian Andes (Leatherman, 2005); and how commercial land use decisions have caused dietary changes, potentially leading to poor health (Finnis, 2007).

Of these texts, the work by anthropologist Leatherman is the most influential to this research due to his focus on labor constraints. This work further articulates the downward spiral of “how conditions of poverty and poor health are mutually causative and constituted: how each serves to (re)produce the other” (2005:50), adding a health component to the nested levels of marginality typical of those most vulnerable to illness. For example, when people turned sick in the Andes, they opted out of much needed agricultural labor exchanges to avoid possible social penalties in the case they could not reciprocate the labor they received. This opting out, in turn, led to a spiraling decline of field production among the sick households (Leatherman, 2005).

The South African Structural Constraints of HIV/AIDS

Today in South Africa, rural women’s reproduction activity includes unpaid time providing care for HIV/AIDS-afflicted family members. Rural women have yet to be the beneficiaries of post-apartheid reforms such as health care access, gender equality, and employment reforms (McCusker and Weiner, 2003). Many rural women and girls have to fend for themselves in fighting HIV/AIDS, as the sub-Saharan Africa World Bank Clinical package program, that concentrates on childbirth and TB care only, lacks a rural geographical distribution (Turschen, 1994; Poku, 2004). Hunter (2004) argues that such policies are based on the World Bank battling the epidemic on economic criteria, driven by efficiency parameters rather than compassionate policies that could be supporting the production of cheap generic anti-AIDS drugs. In addition, Natrass (2004) argues that tax expenditures for health care has become a moral issue rather than an economic issue by referring to two economic macro-models showing the impact of HIV/AIDS on population growth rather than economic growth. Finally, Poku (2004: 33) summarizes this structural dilemma accordingly: “Herein lies Africa’s predicament: on the one hand,

how to respond effectively to the multiple demands of HIV/AIDS, whilst on the other, struggling with a debt overhanging which is undermining investments in social welfare.”

South Africa is made even more vulnerable by a labor and production system that is directly tied to a conditioning macro-structure still marked by the apartheid legacy. In a review of the structural barriers to HIV prevention, researchers concluded that economic under-development, mobility (seasonal or out-migration), and gender inequality were symptomatic of the epidemic (Parker et al., 2000). These three barriers are the same cornerstones of the past and continued post-apartheid political economy with the reproduction of black labor being relegated to remote under-developed homelands serviced by unpaid female labor (Bond, 1999; Turschen, 2004). Bond (1999:15) even argues “post-apartheid policy-makers drew all the wrong lessons from ‘international experience’ and hence prepared to amplify rather than correct apartheid capitalism’s main economic distortions.”

In South Africa, continued post-apartheid rural underdevelopment is greatly accelerated by the HIV/AIDS epidemic. De Waal argues that a lower rate of HIV in rural areas does not necessarily mean that people are less affected by HIV/AIDS here than in the urban areas with high prevalence, as there are considerable structural constraints in the former (2004). He therefore concludes that: “With HIV/AIDS, the traditional ‘lack of labor’ structural poverty has returned with a vengeance” on a rural local level (2004: 56).

HIV/AIDS, Poverty, and Wild Natural Resources – a Triptych of Marginality

The rural structural poverty of labor caused by HIV/AIDS affects both cultivated and wild natural resource use. For the former category, previous research has looked at the loss of agricultural labor exchange, labor specialization, and laborsaving strategies (Haddad, 2001; Loevinsohn, 2003; Slater, 2005). As families struggle with lack of cash

for food and medicine with the loss of wages, HIV/AIDS-afflicted households have become even more dependent on their safety net of free forest resource surroundings (Hunter et al., 2005; Barany et al., 2005; Shackleton et al., 2006). The return of retrenched and/or HIV/AIDS afflicted miners has potentially increased the pressure on local harvested resources (Andrew et al., 2003). This dependence would be consistent with earlier findings that the poorer a household is, the more they are dependent on forest and woodland resources (Cavendish, 2000).

In response to this deepening reliance, there has been a variety of research looking at the impact of HIV/AIDS on non-cultivated natural resources such as water (Ngwenya and Kgathi, 2006), wild foods (Kaschula, 2008; McGarry, 2008), and firewood materials (Barany, 2005). First, a study on the impact of HIV/AIDS on water-use in Botswana found that HIV/AIDS households tend to collect larger quantities of water than non-afflicted households (Ngwenya and Kgathi, 2006). This need for an increased amount of water is not only for drinking and taking medications but also for helping wash ravaged bodies and soiled linens.

Secondly, looking at the use of wild foods to complement food security among HIV/AIDS-proxy households in the neighboring Kwa-Zulu Natal province, labor constraint and the stigma of collecting wild foods seemed to hinder adults from collecting a resource that could have been greatly beneficial to poorest of these households (Kaschula, 2008). These findings are contrary, however, to a South African study on children's wild foods collection (McGarry and Shackleton, 2009). This study found that children from food insecure HIV/AIDS proxy-households were more likely to hunt wild animal protein than other children. These two studies point to the importance

of breaking down “the household black box” referenced earlier, in order to explore different behaviors and economies along the axes of not only gender, but also age.

Finally, there seems to be a close relationship between HIV/AIDS, food, and the quality and quantity of firewood. Barany’s (2005) study in Malawi shows that: lack of firewood led to 6% of households missing meals; there was a negative correlation between the quality of woodland resources and HIV prevalence, leading people to have to walk longer distances; and HIV/AIDS afflicted households were five times more likely than unaffected households to have increased collection of firewood. In addition, in terms of labor constraints, earlier South African research suggests that if a female resource-collecting member dies, family members are forced to spend less time in the field to make up for the firewood collection labor loss (Hunter et al., 2005).

Sub-Section Summary

To recap the points of this final section, political ecologists call for the production of landscape to be read as a multi-layered multi-scale map of political and economic contestation, including a range of voices of varying power (Blaikie and Brookfield, 1987; Peet and Watts, 1996; Bryant, 1997; Paulson et al., 2003; Gezon et al., 2005; Robbins, 2005). In relation to the first sub-section on women, this range of voices speaks to a diverse female lived experience, as stressed by Leach (1994).

Political ecology also incorporates concerns related to women’s labor constraints (Carney, 1993; Schroder, 1993; Leach, 1994; Fisher, 2000; Paulson, 2005). These constraints are particularly evident in the sub-strand of a political ecology of disease (Turschen, 1984; Mayer, 1996; Whiteford and Hill, 2005; Finnis, 2007). Such a downward connected spiral of labor constraints, poor health, poverty, and possible declining

production of natural resources (Leatherman, 2005) could be applied to the former homeland study setting described in the next chapter.

The specific rural labor and under-development structural constraints of the South African former homelands, a legacy of the old apartheid, make for a high impact of HIV/AIDS even where the prevalence might be low (de Waal, 2004). Concurrently, struggling rural HIV/AIDS-afflicted households have become even more reliant on free wild natural resources (Hunter et al., 2005; Barany et al., 2005; Shackleton et al., 2006). The compounded effects of this epidemic on the remaining few rural assets can result in responses that lead to outcomes that may create further marginalization (Loevinsohn and Gillespie, 2003). Given the continued rise in South African rural poverty (Radebe, 2007) and the added shock of this epidemic (de Waal, 2004), our current limited understanding of a possible political ecology of disease is troubling.

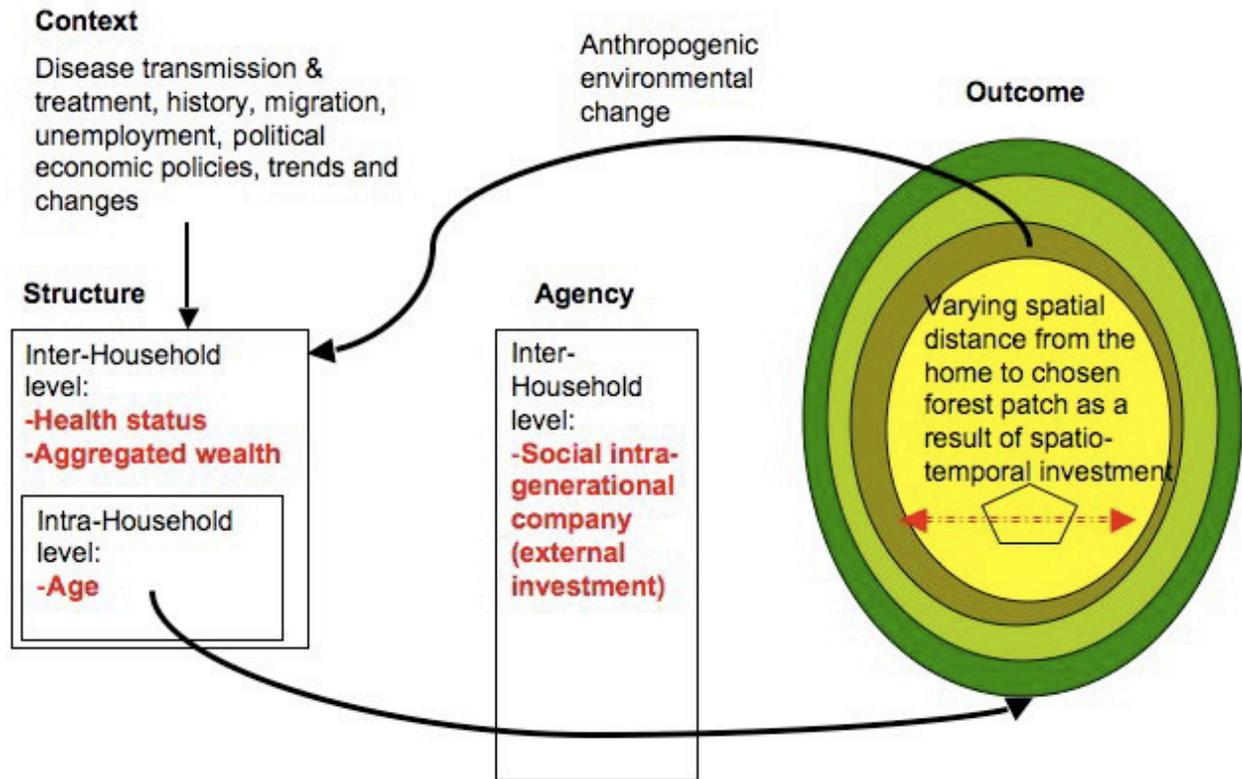


Figure 1-1. Model of theoretical framework. Adapted from Turner (2003) and Ellis (2000:30), the latter having been adapted from Scoones (1998:4) and Carney (1998:5).

CHAPTER 2 SETTING

Selection of Study Site

Responding to a call for more micro-scale investigations, a one-case study design was chosen to explore how socio-economics, health, and age influence local spatial mobility among female members in a particular population of interest in the country of South Africa, see Figure 2-1. The specific study site of the Nqileni village was selected due to the salient characteristics below.

First of all, I chose South Africa due to its high levels of HIV/AIDS (UNAIDS, 2007). Due to my introductory training in the Bantu language IsiXhosa, one of South Africa's 11 official languages, the focus turned to finding a remote, rural site in the Eastern Cape, see Figure 2-2. The specific small-scale community of Nqileni, in the former Transkei, was chosen due to a number of generalizable as well as representative geographic characteristics: a skewed gender structure due to urban male-out migration to urban areas, extensive poverty, lack of basic service deliveries, dependence on wild natural resources for local energy needs, as well as considerable distance from a major health facility. The highly remote location suggested an amplification of the overall marginalization.

From the outside, this research site looked highly suitable for exploring the main themes discussed in the previous chapter. Again, these themes include a female variance in: labor constraints, impact of HIV/AIDS, poverty, and a high use of free woodland resources. This chapter on the actual study setting will present some of the more general descriptive statistics from my village survey as well as notes from my observations of village life, to test whether the assumed political ecology climate, based

on the remote geographical locale and third party regional statistics, holds at a closer examination. An analysis and discussion of variance in actual spatial trajectories will be covered in the analytical chapters of inferential statistics.

Landscape and Land Use

The village of Nqileni (S 32.13998° E 029.01036°) covers a total area of 10 km. Within these historical boundaries, around 760 people (including children and extended out-migrant family members) reside. There are 103 different households, with a mean of 7 individuals per household (sd=3, minimum of 1 member and a maximum of 16 members). These residents belong to the IsiXhosa speaking AmaBomvana, one of 12 Southern Nguni tribal clusters (Southall, 1983).

This AmaBomvana village is situated in the Mbhashe local municipality of the Amatole district municipality of the Eastern Cape province. The village is within a climatic transition zone straddling the temperate south coast and the subtropical north coast. The wet season runs from November to March, with a mean annual rainfall around 1,000 mm and a mean temperature of 24 C. The dry season has slightly cooler temperatures, with a mean of 20 C.

Nqileni is about 100 km south of the former Transkei capital of Umtata. Today, Umtata is still the great town hub of this expansive rural area with local government offices, a large hospital, department stores, a university campus, long-distance bus stop, and an airport. The paved road going down south to the Wild Coast ends about 42 km north of the village, however, at the small outpost of Zithulele. From there, it is a long, bumpy and dusty road trip. The long and arduous trip is well worth it. Because once the dusty serpentine dirt road takes its final turn around a small forest patch on a top of a hill, the breath-taking view of the Nqileni landscape greets its visitors. Stretched

out between the left arm of the Bulungula river and the right arm of the Xora river, the undulating hills of grasslands and patches of fragmented woodland Coastal forest and Valley Bushveld extend all the way down to the ocean, see Figure 2-3.

Traveling the long hill into the village is either done by foot or on a slow-moving 4x4 vehicle, surrounded by grazing muted-color Nguni cows that contrast with the traditional huts painted in vibrant colors of turquoise, orange, or green, see Figure 2-4. The circular mud-and-straw built huts stand next to the meticulously built enclosures for house gardens and livestock (*kraals*). Agriculture and pastoralism are the dominant forms of land use. The village-elected sub-headmen allocate the residential and dispersed larger arable plots according to the communal tenure agreement. Arable plots of varying sizes (harvesting mainly maize, pumpkins, and beans) are worked by 60% of the households, whereas 78% of the households work smaller house gardens close to the hut. The arable plots are only allocated to a male household heads. In the field, both men and women work the plot, whereas the handling of all medium and large livestock – including the precious Nguni cows, see Figure 2-5 – is a traditional male chore. Young boys are in charge of making sure the cattle, donkeys, sheep and goats return safely to the *kraals* at night after the animals have roamed the open access landscape during the day. Since women and girls are not even allowed to step into the *kraal*, they raise poultry.

The Spatial Qualities of Daily Life

The spatial separation mentioned in connection with the *kraal* is not the only gender segregated daily activity of Nqileni life. At large social festive gatherings, I watched how men, women and children sat in smaller groups arranged within three separate larger clusters, served in the order just mentioned. At a funeral I attended, the

spatial divide was a considerable distance: all of us women, including the buried man's mother, sat more than 100 meters away from the men and the grave. Normally, I was told, the women would be allowed to visit the grave site after the ceremony had ended but since the man being buried had died at the hands of another, the tradition was for the women to walk straight home after the closing of the ceremony.

Even on a regular day at home, there are certain spatial structures. Upon entering one of the huts, visitors sit down on the correct side of the door at a proper distance into the hut with the rest of the host and family, all according to age and gender, see Figure 2-6. Women sit on the right side of the door, and men on the left. The older you are, the closer you sit towards the door opening.

Having made some spatial notes of village life, I was intrigued to read anthropologist Liebenberg's observations of women from the neighboring district, Willowvale. Liebenberg watched how daily activities in and around the homestead often were managed spatially according to politics of gender, age, and kinship (1994). She made a special note of how young women walked as far away from the homestead as possible while doing chores, to escape the demands of their mothers-in-law, rebelling against the hierarchal order of wives in an extended household that can contain several young women living under the same roof while their husbands work at the mines (1994).

As daily spatial structures have been noted according to age (as well as gender), this raises the question of what happens spatially when women or girls of the same generation go out to collect firewood together, as opposed to an intergenerational company of women and girls. This question will be explored further in the two explicitly spatial analytical chapters later on.

Food Networks and Foraging

Most of the women I interviewed said that the network of neighbors they made plans to collect firewood with were the same neighbors who made up their reciprocal food exchanges network. The village food exchange has certain informal rules, I was told. If a household is in need of extra food, a woman may ask to borrow food towards one meal that day but not for the whole day. Also, beggars can't be choosers: it is up to the person lending out food to decide what she can spare that day. Very poor families are sometimes allowed to harvest wild edible weeds from neighboring plots.

When asking the village households what they had eaten during the last 24 hours, the responses were very monolithic. For breakfast, the majority had tea and bread, with a local drinking porridge as the next choice. For lunch, 87% had *umngqusho*, traditional samp⁵ and beans, see Figure 2-7; the rest had only bread or porridge. For dinner, 56% had samp and beans again, another 19% had porridge again and every fifth household went without anything to eat. About a quarter of the households had some veggies with their samp and beans for lunch and dinner. For most households, meat is rarely eaten on a regular basis, as it is expensive. Those who can afford to buy meat usually buy it the day of grant disbursement, which is a celebratory day for most households in the village

Being that Nqileni is a coastal village, the village residents get some of their protein from the sea. Men and boys sometimes fish individually while large groups of women and girls are routinely seen collecting and eating mussels from the sea when the tide is low (men do not eat mussels). In the household survey, 83% of the

⁵ Samp is a South African crushed maize mush.

households had female members who went down to the shoreline to collect mussels. Those who did not collect mussels complained of the taste, the ferociousness of the water, and a lack of skills. Due to the fact that most of the mussels left can only be found all the way out by the end of the rocks where the waves break, only young girls dare to thread these slippery rocks as they still have the energy and stamina to quickly run back before the waves hit, see Figure 2-8.

The collection of wild foods from the forest was not as popular as mussels. In the general Nqileni village survey, 51.5% of the households responded that the women did not collect wild foods. When probed further, 43% of these households said that wild foods “were for kids” and another 37% simply said that they “did not like the taste.” The rest responded that they couldn’t see the wild foods (13%), did not have the time (5%), or didn’t know (2%). The lack of general interest in wild foods is interesting in light of the lack of variety of foods on a daily basis, and the poverty of many households. A similar lack of interest in wild foods, despite the much needed additional nutrition these plants would provide, was noted by Kaschula (2008) amongst adults in poor rural HIV/AIDS-afflicted households in the neighboring district of Kwa-Zulu Natal. Kaschula attributes this lack of interest to the stigma of collecting wild foods, as well as the labor input required, the latter being very much the focus of this study.

At one point during the research period, I had an opportunity to talk with one of the many doctors that came to the village from the regional hospital for short visits. He pointed out the stunted growth of many children in the village. This conversation confirmed what had earlier seemed to be a startling phenomenon when talking with the children of the village: they were all much older than they looked, especially taking their

height into consideration. A national South African 2003 study found that 27% of children under the age of five suffer from moderate to severe stunted growth (South Africa Department of Health: Demographic and Health Survey).

The lack of food and food variety in certain vulnerable households can be explained in part by earlier work from other rural common areas of the Eastern Cape (Andrews, 2003); which shows that agriculture in these areas is not a subsistence activity; the great majority of food is bought at the store. In the village, there are small food shops (*spaza*) with the most basic staples at the homes of a few rich individuals. The more variety of foods women in the village want, the further they have to walk and the more money they have to spend on travel (or time to walk by foot). Because the great majority of the food is bought at the store – I did not record one meal where all basic ingredients of the meal were cultivated – the quality and quantity of food in such remote rural areas is very much related to money, rather than agricultural labor saving strategies (Kaschula, 2008). This brings us to the next topic, the differing levels of wealth in the village.

Socio-Economic Profiles

Because out-migration is a large component of family life in the former homelands, urban-rural remittances are one of two big contributors to the local economy. This is also the case of Nqileni. Almost half of the village households, 47%, have one or more members working in the mines outside of Johannesburg. In the village, there are also additional households where there are widows of former miners (due to fatal mining accidents, long-term disease, or other causes). Due to recent mine retentions, however, 18% of the households have men who migrate to lesser-paid work on the fruit farms in the Western Cape.

The second great contributor to the local economy is government grants. In the village, 81% of the households are receiving some or all of the child grants for which they are eligible, each at a monthly fixed amount of ZAR240 (US \$36 according to 2009 exchange rates). Another important monthly grant is a pension fixed at ZAR 1000 (US \$150 according to 2009 exchange rates); 27% of the households receive this grant. Older people collecting pensions are therefore a big boost to the household economy.

This area is not known, however, for its wealth. According to the Eastern Cape Socio-Economic Consultative Council (ECSECC) report, in the local municipality of the study site, Mbhashe, 70.1% of the households lived in poverty in 2008, defined as a monthly income less than ZAR893 (an estimated US \$135 according to 2009 exchange rates). As a comparison, in the Eastern Cape Province, 58.13% lived in poverty and in all of South Africa 40.6% lived in poverty during the same time period. These statistics suggest that the study area has some of the poorest of the poor.

To compare the differing wealth of the various village households, the total agricultural assets were computed for each household. Albeit used as a continuous variable in the final comparative regression analysis in the analytical chapter, a first round of statistical descriptive explorations delineated three levels of local-specific categories of wealth clusters: destitute/survivors, adapters, and accumulators.

The distribution of the aggregated wealth in the village shows a clear demarcation of the poorest, 34%, here labeled “destitute.” They single themselves out by owning a few chickens at the most, and possibly a hoe and/or spade, the cheapest agricultural tools worth as much as a chicken or two apiece. The total assets range of this household is from ZAR0 – 650 (up to US \$100 according to 2009 exchange rates). They

are the most vulnerable to risk and uncertainty, as any kind of shock to their households – poor crop, theft, or bad health – has serious repercussions since they do not have any extra assets to help absorb the added stress.

The middle category of households, 35%, here categorized as “adapters,” have accumulated enough to start diversifying their assets with a large number of medium sized livestock and/or starting a small herd of large livestock (four cows at the most). The total assets range for this group range from ZAR1,500 – 24,000 (US \$225 – 3,600 according to 2009 exchange rates). This category of households has enough to cushion a potential blow to the households but is still reliant on other households. The lower bottom of this category is exemplified by the major investment of one donkey for ZAR1,500 (US \$225 according to 2009 exchange rates) – used for carrying food from the store or riding. The upper limit is defined by a total of four cattle, ZAR6,000 apiece (US \$900 according to the 2009 exchange rates). All households start with a cow in the hope to grow a herd. Cows are kept for reproduction only; they are never used for fieldwork. Those with one to three male cattle therefore need to pool their cattle with other households to total the four male cattle needed to work a plot.

The last category, 31%, the wealthiest one, is “the accumulators.” The total assets range from ZAR25,000 – 145,000 (US \$3,750 – 21,750 according to 2009 exchange rates). This class can be further broken up into smaller accumulators, a local upper middle-class, (16.5%) and bigger accumulators, a local upper class, (14.5%), with the latter locally considered to be the truly wealthy as they own 10 cattle or more, with assets starting at ZAR60,000 (US \$8,995 according to 2009 exchange rates). To varying degrees, these two accumulator categories both have enough assets to allow

them to work their plot without having to barter or rent equipment. These households are therefore in a position to buy horses (same price as cows above) for the men and boys to ride instead of the cheaper donkeys. The investment in horses only takes place if a household already has a considerable amount of cattle (which is the priority). With a comfortable herd of cattle, these households are in a position to slaughter one or several of their livestock for big events such as weddings, funerals, etc. They can also rent out or sell agricultural assets to accumulate and invest even more. This class is strongly invested in the future.

The different divisions above show a clear demarcation and variety of wealth in the small village, leading to differing levels of vulnerability. In the next section, such a vulnerability will be related to the issue of space as it relates to travel beyond and within the boundaries of the village.

Connectivity, Health, and Service Provisions

The lack of efficient and affordable means of transportation to and from the village has a number of implications for poor village inhabitants. First, there is the issue of grants. As noted above, they are an important addition to the household economy but acquiring them is a time-consuming venture. On the 15th of every month, women and men of all ages get up hours before sunrise to walk three to four hours in order to collect their cash social grants in person at one of the two collection points west and north of the village. Prior to receiving the grants, however, there are even longer initial trips needed to apply for the grants in Umtata. As there is no road structure within the village, the villagers first have to walk up to four kilometers (depending on where they live in the village) to the far northern point of the village where the dirt road starts the 100 km journey to Umtata, the site of all major government offices. This is an expensive and

long trip thanks to a privatized taxi system that only runs a few times a day.

Consequently, some women don't have time to apply for grants for which they are eligible. Of all the village households, 8% are not receiving any of the child grants for which they are eligible. The proportion of households in which some of the household's eligible children are receiving child grants but not all, is 34%.

Second, due to the lack of accessible, close health care, a major time commitment is needed in order to reach the health clinic or, for more major health concerns, the regional hospital Madwaleni. In the village, 25% of the households have at least one member who is suffering from a disease lasting more than three months, for which they are taking treatment. If a village resident is seriously sick or pregnant, s/he needs to first walk – or be pushed in a wheel barrow for those who can't walk due to pain – to the far western point of the village, where they pay for a small boat ride over the Xora river. Once they have arrived on the other side of the riverbank, they need to travel by foot for another 45 minutes to the village of Ntubeni. From there, the villagers walk another two hours to the health clinic for minor ailments, or pay for a private taxi to the regional hospital in Madwaleni 25 km away for more urgent matters. Again, these taxis only run a few times a day, making visiting the hospital a possible two-day venture if they miss the last afternoon taxi back from the hospital. This is usually the case, as there are often a great number of sick people in the waiting room of the remote rural under-staffed hospital, run by over-worked but dedicated health care providers. In the context of women's many time-consuming chores to be covered in many different spatial corners within the village, there are high opportunity costs involved in these long travels outside of the village.

The combination of remote health services and lack of basic services can have serious repercussions for some village residents. Piped water starts about 40 km away from the village. Apart from a few rainwater tanks in the village, most households collect their household drinking water from a number of open water springs that are shared by humans, livestock, and other animals, see Figure 2-9. All households are forced to use these springs in the late dry season when there is no longer any water left in the rainwater tanks. In the last two years, due to the poor water quality of these often-stagnant water points, 6% of the village households have had babies dying from dehydration, most probably caused by diarrhea-induced water contaminants. Other villagers also sometimes get stomach problems when failing to boil the collected water, yet their immune systems are more developed to handle such contaminants and thus the consequences are not as dire. As a comparison, in all of South Africa, an average of 9% of the households collected their water from a stream or spring in 2008 (ECSECC, 2009).

To address the bad water quality in Nqileni, the local NGO (the Bulungula Incubator), facilitated the installation of some more rainwater tanks and built fences or cement constructions around a number of springs to keep the animals away. Yet, the village was still in need of a better year-round solution. In June of 2010, the NGO finally found a drilling company willing to travel with their heavy equipment through the remote and rough terrain to start drilling a borehole for the village.⁶

⁶ Two former urban Cape Tonians, who now live in the village themselves, started the NGO. Additional 2009 projects created in partnership with the village include the building of a whole new school, a learning center for young and old, and multiple micro-entrepreneurship projects, involving tourism activities.

Finally, there are open access woodland resources for fuel (as well as construction, wild foods and medicinal purposes). Within the boundaries of the village, the women told me that they could roam freely for firewood without any restrictions. Women and girls collect this firewood by trampling, cutting and felling. They often start their firewood collection at 4 or 5 am in the morning when it is still pitch dark outside. According to the survey, almost all of the village households, 97%, use firewood for cooking and keeping warm in the cool mornings and evenings. This number is similar to the estimate of 96% percent of households using firewood in the communal lands of Limpopo in northern South Africa (Dovie et al., 2005) and 99% percent of households collecting firewood in other areas of the Wild Coast in the Eastern Cape province (Timmerman, 2004). A select number of households also use paraffin as an alternative when they can afford it, while those with less funds complement their energy needs with cow dung when they have time to collect it.

As with the water, there can be health concerns related to the use of firewood. When I visited the huts, I would sometimes see traces of a fire having been lit inside certain huts. This burning of firewood inside can cause indoor air pollution of smoke particles and carbon monoxide that can negatively affect the health of the residents inside (Scholes and Biggs, 2004).

In this case study the focus is not to study the impact of the use of certain natural resources on the health of the village residents but the possible impact of village households' health status on the spatial firewood collection behaviors. This chapter has helped set up a local village context of such a study by a presentation of: daily activities sometimes separated spatially by not only gender but also age; a local economy driven

by external grants and remittances, with a third of the village residents living under destitute conditions while others are doing very well; a high dependence on wild natural resources in the absence of basic services; and the impact of the remote geographical location on the village residents in terms of the spatio-temporal commitment needed to address their household economy as well as health issues. The latter is of particular importance considering that the village survey shows that every fourth household has at least one member suffering from a long-term disease for which they are taking treatments. In short, the stage is set for a study of a political ecology of disease using instrumentation and procedures that will be covered in the next chapter.



Figure 2-1. A map of Africa. Source: Britt Coles

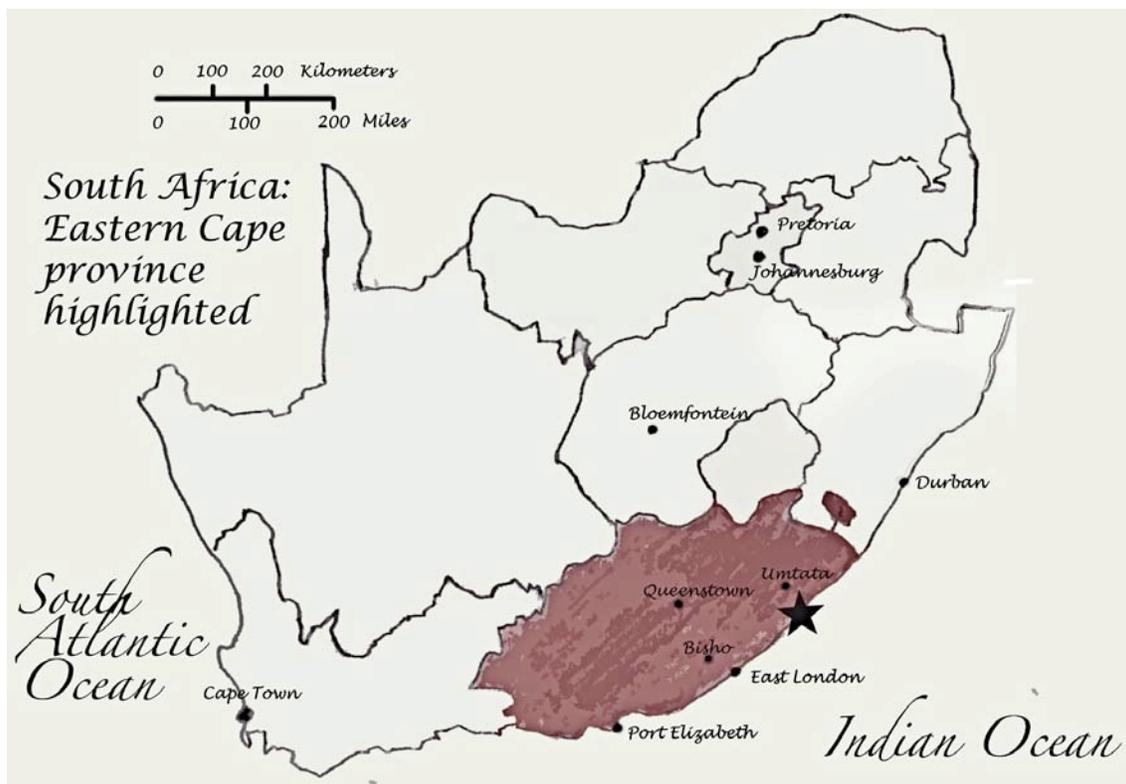


Figure 2-2. A map of South Africa. Study site is marked with a star. Source: Britt Coles



Figure 2-3. A view of the Bulungula river ending at the ocean



Figure 2-4. Examples of the typical local circular rondavel huts



Figure 2-5. The wet sand cools down an Nguni cow during a hot summer day

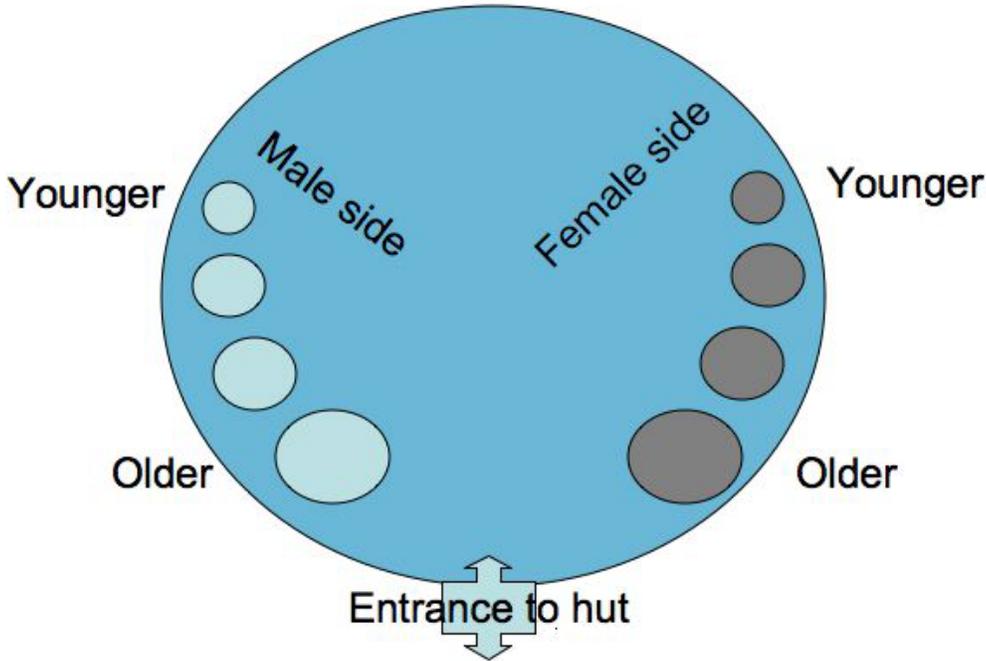


Figure 2-6. Schematic of traditional Amabomvana gender and age seating inside hut
Source: Britt Coles



Figure 2-7. Traditional sump and beans, *umngqusho*



Figure 2-8. Girls trying to escape the waves while collecting mussels



Figure 2-9. One of many open spring water sources in use by local villagers

CHAPTER 3 FIELD METHODS

Sampling

Because the project provides an inter- as well as intra-household examination, the sampling unit of analysis is individuals. The term household will be “used as the main shorthand for describing the resident social unit, extended where applicable to include migrants and others who make intermittent or regular contributions to household welfare” (Ellis, 2000: 21).

In this case, the entire population and the sampling frame is the same thing. The population is defined as all households residing within the historical Nqileni geographical village boundaries headed by two sub-headmen, a total of 103 households. The historical boundaries of the whole village cover a total area of ten square kilometers. Thus, the village is small enough to allow for a baseline survey coverage of all households yet large enough to offer distinct differences in socio-economic and health capital.

A two-tiered purposive sampling was used to choose the 21 households from the complete population. First, there was an unbiased map-sampling of spatial chunks with the help of drawing lines between randomly chosen numbers written on the sides of an aerial photograph of the area (Bernard, 2002). Within the randomly chosen chunks, there was a random selection without replacement of households within that chunk, taking spatial clusters of houses into consideration, with a total of 21 focal households chosen.

While designing the study, prior to going out into the field, the University of Florida Institutional Review Board (IRB) made it clear that they would not allow a stratified

sampling based upon a priori knowledge of a household's long-term illness status. This is the usual UF decision protocol when dealing with HIV/AIDS related projects to avoid the possibility of participants potentially being stigmatized for participating.

Consequently, the study was designed with a random sampling of all households, regardless of health status, all sampled as general firewood collectors. Because 25% of all households initially surveyed had proxies that indicated the possibility of household-level HIV/AIDS affliction, the project supposed a sufficient number of these households would be included in the random sample of focal households.

Instrumentation

Household surveys (Bernard, 2002) were conducted to collect baseline data for exploring future links of spatial variance to different household assets, constraints, and composition. To explore what independent variables might drive variance of kilometers walked, a number of continuous and categorical variables were collected from the general household demographic survey: household composition, school attendance, (out-migrant) employment, grants acquired, household HIV/AIDS affliction proxies (see further description below), household agricultural assets, energy sources, garden and/or plot presence, as well as natural resource habits and perceptions.

With the focal households, each GPS spatial reading, tracing the path of firewood collection, was followed by a follow-up interview (Bernard, 2002). In this interview, participants were asked with whom they went firewood collecting, how many went, with whom they prefer to go, and why they went where they went for that particular location. The collected firewood material was also weighed.

HIV/AIDS-proxy instrumentation. A possible HIV/AIDS affliction was inferred with the help of household-level proxies, to safeguard the integrity and privacy of

individual members. These household proxies do, however, recognize that HIV/AIDS affects the vulnerability of all people in the household, regardless of individual health status. The instrument used to assign a possible household-level HIV/AIDS affliction, measures the following five household level health status proxies as set forth by the Vulnerability Assessment Committee of the Southern African Development Community: Food, Agriculture and Natural Resources (SADC FANR) in 2003:

- Demographics: presence of orphans or foster children
- Morbidity A: Chronic illness (three months or longer) for people 0-56
- Morbidity B: Chronic illness for which treatment is taken
- Mortality A: Recent death within the last three years for people 0-56
- Mortality B: Recent death proceeding from chronic illness

According to this SADC FANR instrument, the presence of a minimum of two indicators is coded as a household marked by the affliction. Because of this particular case study's focus on present domestic labor constraints of home caretaking, households had to have a minimum of both parameters morbidity A and B present to be coded as afflicted (a binary variable of 1) for this particular case study. All proxies used measure the level of affliction on a household level to: (1) safeguard the integrity and privacy of all individual household members and (2) recognize that HIV/AIDS affects the vulnerability of all people in the household, regardless of individual health status.

Wealth instrumentation. The socioeconomic status of each household was determined with the help of aggregated agricultural capital reported in the general survey. This survey also noted the number of out-migrant workers and professions as a contextual variable of interest. Households were not asked, however, about their actual income due to the sensitivity of that particular financial information as well as the fickle nature of remittances, as noted earlier (McCusker and Weiner, 2003).

Instead, with the site-specific focus on agriculture and pastoralism, the households' varying socio-economic levels were determined with the use of an accumulated agricultural assets proxy. Eleven categories of agricultural assets – including large and medium livestock, poultry, and agricultural tools – were noted and tallied up based on local sale prices, to produce a continuous variable of total agricultural assets in the local currency (ZAR).

Spatial distance instrumentation. GPS units were used to measure the one-way firewood trajectories of the participants, see Figure 3-1. Prior to distributing the GPS units to the participants, all of the units were checked for accuracy in Nqileni according to manufacture instructions (an error margin of 2.5 meters). The GPS units were subsequently distributed to the participants to be attached to their clothing when leaving home to collect firewood on a date and time that was convenient for the participant, to ensure that the reading reflected their normal route.

After the GPS reading was completed, participants were asked to confirm that the spatial trajectory recorded was typical of their regular daily firewood collection routine. On one occasion, one woman had gone out into the pouring rain to collect firewood because she had been under the faulty notion that she had to return the GPS the next day. Because it was raining, she explained in the follow-up interview, her path was much shorter than usual. I re-iterated through the interpreter that she should only walk when she wanted to. That reading was consequently erased and the GPS was returned to her for a new reading at her convenience. There were no other such incidents.

The focal households were asked to do repeated readings across three seasons (not including the rainy-season) to explore the possibility of seasonal differences in

firewood spatial trajectories. The spatial readings were then input into an ArcView GIS with a Quickbird 2008 geo-referenced satellite imagery with a resolution of 54 pixels/cm, projected to Transverse Mercator WGS 84 Central Meridian 29. This base GIS served three purposes: 1) to delineate land use such as forest/bushveld, grassland, and cultivated plots, 2) to mark household homestead points, 3) and to map recorded GPS-tracked firewood collection movements.

Procedure

Introduction and Pre-dissertation work, October 2007. The village of Nqileni was first presented to me by people who had met the founders of the Nqileni local NGO, the Bulungula Incubator. The description of the site was highly interesting to me due to its geographical locale, as discussed in the previous chapter. The presence of the NGO was an important bonus as I had a desire to choose a research site where the aggregated results could be of local use and be disseminated in non-academic contexts as well. I traveled to Nqileni where I had a positive and encouraging meeting with both founders and the rest of the village community.

The overall importance of this NGO to the research project was twofold. First, it offered a tent-camping ground for rent that included solar generated electricity, clean rain water supplies, gas cooking facilities, and a satellite internet connection. Second, because the NGO was interested in using the aggregated research demographic data in the planning and preparation of future community projects, they offered an initial introduction to the sub-headmen and then subsequently the whole village. Without the full support of the NGO, the subsequent voluntary survey participation of all households and the focal households' willingness to operate the GPS receivers might not have materialized.

Permissions and introductions, June 2008. The objective of this phase was to re-confirm the approval of the local sub-headmen and the village community at large for a longer research period in their village. Once this approval was indeed confirmed, I attended a number of community member meetings with the various village participants to explain the independent nature of the research: it was not initiated or under-written by the government, the local NGO or other vested interests.

The field methods, including the working and function of the GPS tool, were also introduced, discussed, and approved. The GPS/GIS technology is a high-end tool that needs to be used with caution and sensitivity as it could easily reinforce uneven power relationships (Kwan, 2000) between an urban highly educated researcher and rural participants, many with little schooling. Therefore, the introductory and field collection process of GPS data was designed to continually gauge responses from the community to be sensitive to any concerns that might arise.

The working of a GPS unit was explained as similar to that of cell phone that was familiar to most households: a GPS must have a clear signal from the sky to work. The geographical monitoring function of spatial trajectories by the GPS was then carefully explained. The comments in response from the community were quite interesting from a gender perspective. One man wondered if the GPS tool would tell his wife who he had met up with at the local *shebeen*, the IsiXhosa word for a make-shift bar set up in some of the rural people's huts in the village. The answer was no, the tool does not record such actions. One of the women in the groups said that she would be happy to use the machine since she didn't have time to be bothered with a lot of questions from strangers

insisting on following her around. These and other comments confirmed that the basic concept and implications of the GPS tool had been understood.

The functioning of the GPS tool was explained and agreed upon a second time, on an individual basis, in the following months to allow for any follow-up questions or possible concerns or a change of mind (this was never an issue). It was explained that the GPS tool was only to be used for firewood collection trips – this was not a surveillance tool to map every step. Even though the community women and girls never raised such concerns, an open two-way discussion of the functioning and implication of the tools was important in light of the geographical feminist discussion of the dark side of spatial tracking of vulnerable women and girls (McLafferty, 2006). That is, any spatial work involving females (or any other person) must not mirror the unfortunate stalking of females in an effort to control and minimize women and girls' lives outside of the home.

Prior to my going out into the field, some researchers voiced concerns that the people in such a remote village might not have the visual geospatial literacy to understand a satellite image. This was not my experience. In the village, men and women, young and old, were instantly drawn to the big print-out of the satellite image of their village, tracing their own houses and that of their friends with fingers running up and down the image while chatting excitedly with each other.

In these informational meetings and subsequent individual follow-ups I also said that I would never share individual firewood paths with other households. Also, in the event a household no longer wanted to participate, all recorded paths would be deleted. This was never an issue, however. Finally, I explained that all subsequent individual

participation was voluntary and assured the village members of the confidentiality of all information received.

Field research collection phase one: July – October 2008. Prior to beginning each general household survey, I reiterated the educational nature of the research project and the voluntary participation, repeated my assurance of anonymity of all information acquired, and asked if the participants had any new questions or concerns they would like to ask before starting. Once household informed consent was given, participants were told that they could refuse to answer any question(s) or they could stop the survey at any time to reschedule or to terminate participation.⁷ The surveys (each lasting between 45-50 minutes) were conducted with me being present using the same interpreter with all 103 households. My presence at all interviews allowed for immediate follow-up to any irregularities or questions that might pop up during the survey session. All households in the village voluntarily agreed to participate.

At the conclusion of the general survey phase, 21 focal households were randomly selected. When approaching each selected household, I re-explained the voluntary participation, assured the household of the confidentiality of information collected, and invited them to voice any concerns or questions they might have. I also said they could terminate their participation at any time. Once this initial step was completed, I offered the household a test-run with a GPS unit where women and girls carried the GPS around to try it out before making a final decision about participating. Following this initial test-run, all households agreed to continue with the project. Subsequently, in each focal household, one adult woman and one girl (5-17 years of age) recorded their

⁷ Oral consent was approved by IRB due to the high rate of illiteracy in the village.

firewood collection trajectory with a GPS. Prior to handing out the GPS, anonymity of all individual spatial and non-spatial information acquired was assured, and oral informed consent was sought from the woman as well as the girl.

According to IRB protocol, the girl's consent was always confirmed with the mother present and included a minor's consent process: the girl could only participate if both she and her mom agreed that the girl could participate.⁸ Participants were told that they could refuse to answer any questions or stop participation at any time. All individuals of the focal households who were approached voluntarily agreed to participate, with all girls having "double consent" as outlined above.

After the first round of self-mapped GPS readings, the amount of firewood collected for that reading was weighed with a spring balance. There also were accompanying questions about whether the participant went alone or not and, if applicable, the generational category of companions. I also asked how many people went out to collect firewood at the time of the reading. Participants were also asked whether or not they preferred the company of adults and/or girls and why. In addition, adults of the focal household were also asked about whether the household health status had changed since last I spoke to them. Finally, I also asked the adults for a 24-hour food recall and how many times last week the adult had borrowed or lent out food.

Because carrying the GPS receiver entailed extra attention – making sure that it was securely fastened to the participant's clothing, that it was attached in a way that it received a signal, and that it was indeed on when in use and off when not in use to save batteries – the participants were paid a daily rate as participating research assistants.

⁸ This minor dual informed consent process worked both ways: in the event than an adult had wanted the girl to participate but the minor did not, the girl would not have been allowed to participate.

They were also reimbursed for the initial test-run. The rate for carrying the GPS for one firewood collection was equivalent to the local daily rate paid for one day's work in an arable plot, ZAR10 (an estimated US \$1.50 at 2009 exchange rates). Women and girls were paid the same rate, with an adult always being present at the time when the girl was paid. Extra care was taken to explain and make sure that the girls could only use the GPS on weekends or on school holidays in order not to encourage truancy.

Because the GPS records the date and time of all readings, the research project was able to verify that all of the girls' readings were done on weekends or during school vacations. Fortunately, all the girls enjoyed attending school and there was no truancy.

Field research collection phase two, November 2008 – January 2009. A second round of GPS readings, weighing of firewood, and follow-up questions was conducted with the same focal household participants. In addition, using a print-out of a satellite picture of the village, the researcher and interpreter sat down with groups of adults and young girls for a land use group discussion (Craig, 2002), asking the participants about where they go for firewood, with whom, and why.

Field research collection phase three, May – June 2009. The third and final season of GPS readings, weighing, and follow-up questions was conducted.

Limitations and Assumptions

Because this case study focuses on one site only, there is a consequent lack of comparison of findings across similar villages in different geographical landscapes. I argue that the generalizable and representative characteristics of the study site described in this case study setting – remoteness of the locale, feminization of the landscape, local unemployment and high poverty, and dependence on natural resources – will still provide enough substance to produce useful lessons that can be

applied or tested in future similar locales. I also recognize the small number of focal households, $n=21$, within the one study site. At the same time, the focal household sample is still quite high in relation to the entire village population, around 20%.

In terms of instrumentation, there is the issue of using HIV/AIDS-proxies. A proxies-aggregated HIV/AIDS affliction (and/or TB, since the two are intricately linked) is assumed due to the high prevalence of the epidemic in South Africa. These proxies were used due to the lack of accurate health diagnoses data for people in the village.⁹ Any instances of wrongfully labeling a household as HIV/AIDS-afflicted could still provide useful lessons on the general influence of long-term disease on firewood collection, as part of a general political ecology of disease. In addition, household proxies – rather than individual proxies – were used for ethical considerations, to ensure the integrity and anonymity of each individual in the household. However, I do recognize that such household-level proxies do not lend themselves to easy comparison to the individual-based estimates that are part of the general HIV/AIDS literature and policy papers, as noted by Kaschula (2008). As this study covered a small specific village, safeguarding the privacy and integrity of all village inhabitants took priority over the issue of using individual proxies for easily translated statistical comparisons.

Finally, in this study, spatial distance is used as a proxy for time, in accordance with the assumptions of spatial behavioral limitations dictated by time-geographer Hägerstrand (1975). That is, spatial behavior from one point to another is limited by the space-time relationship as it relates to limitations of the body, space, and time. A

⁹ Even where such data is present, however, this data too, carries with it a different set of problems by deducing a general individual HIV/AIDS rate based on neo-natal data of sexually active females of a particular age.

human's ability to travel from A to B is dependent upon the time available to cover this distance. My random sampling of every fourth reading and a subsequent pairwise correlation of 0.92, $p \leq .0001$ for minutes spent with kilometers walked justified such an assumption. The walking speeds were between 1-5 kph, consistently. An additional pairwise correlation of 0.93, $p \leq .0001$ for total stops in relation to total minutes spent further strengthened this assumption.

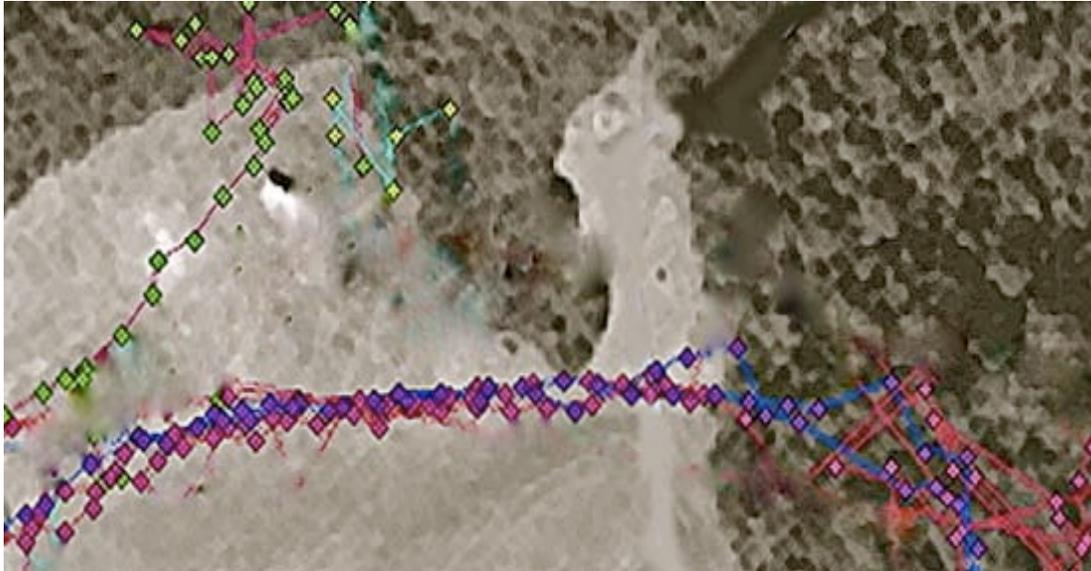


Figure 3-1. Illustration of GPS tracks. Geographical reference points and forest background have been altered to ensure anonymity. This image represents a typical pattern where girls keep to the forest edge, women venture inside.

CHAPTER 4 INTER-HOUSEHOLD VARIABILITY: SOCIO-ECONOMICS AND HEALTH

Data Analysis Overview

This chapter is the first of two analytical chapters, with each chapter presenting both the results and the subsequent discussions. Choosing to look at women first, this chapter explores the possible reasons behind differing spatial distances covered by adult female firewood collectors in the village of Nqileni on South Africa's Wild Coast. As mentioned earlier in this dissertation, the specific activity of firewood collection needs to be carefully planned as women have to allocate their time – and subsequent travel across the landscape – to accommodate a number of female productive and reproductive chores.

The majority of the statistical procedures were run in JMP® 7.0 for Macintosh (1989-2007), except for the GLIMMIX Pearson Panel procedure that was run in SAS® 9.2 (2008) on a Windows XP platform. Both of these statistical software are created by the SAS Institute, Inc., allowing for an easy transition between platforms.

First, women's variance in spatial distance is introduced with the unveiling of the result of a main mixed generalized linear regression model. This model is preceded, however, by a brief presentation of the adult distribution of the dependent variable, spatial distance, as well as the pre-regression procedure, including variable selection and model validation. The subsequent final chosen mixed model predicts the effects on firewood distances by looking at the three following variables: health, socio-economic status, and the generational make-up of the firewood collection company. Out of these three variables, the health status of the household seems to have the strongest influence on the spatial distance traveled by adult women. Albeit not as strong as

health, the generation of the person(s) accompanying the adult is also influential.

According to the model, the variable with the least influence on spatial distance, out of the three selected variables, is socio-economic status.

After the overall regression has been presented, each independent variable is presented and discussed individually in three different chapter sub-sections, starting with the most influential variable and ending with the second most important variable. Each sub-section includes a presentation and discussion of further statistical tests – including independent t-tests, χ^2 tests, and Fisher's exact tests – of both the complete household village survey as well as the sampled focal household data. These tests are performed to contextualize each variable and explore possible further connections. The discussion of the socio-economic variable differs slightly from the others: it also includes a statistical test of co-variate means to compare distances of HIV/AIDS-proxy and non-HIV/AIDS-proxy households across different socio-economic groups. The third and final sub-section discussion on generational company heralds the focus of the next analytical chapter – girls' spatial trajectory – by presenting snippets from interviews about why adults prefer fellow adults or their daughters to accompany them to collect firewood. Before moving on to this chapter conclusion, there is a brief investigation and discussion of how much firewood women carry.

Finally, all three major variables are brought together again in a concluding overall discussion. This discussion summarizes the main findings; expands on the subsequent vulnerability of certain households in a possible declining production as part of a political ecology of disease; highlights women's concurrent individual spatial agency; and, finally, situates the unraveling of the many hidden aspects of women's environmental

spatial mobility in a larger feminist time-space geography discourse on marginalized women.

Spatial Distance Distribution

The mixed regression model predicts the effect of three variables on the one-way spatial distance of adult women collecting firewood across three different seasons. A statistical distribution overview of this varying spatial distance – the dependent variable of interest – is shown in Table 4-1. All the spatial trajectories were undertaken by foot, with the women carrying the firewood back home on their head. The readings in Table 4-1 reflect the one-way trajectory away from home to the furthest point traveled within the chosen forest fragment. In all readings, the women chose one, and only one, particular forest fragment for each firewood collection event. The adults would alternate, however, between different forest fragments for different firewood collection events.

The number of complete seasonal readings (n=54) covered by the distribution in Table 4-1 show that not all 21 households were able to produce readings in all three seasons. These missing readings were due to a few individual women from different households having to make a temporary trip away from the village to visit family, being in the final stages of a pregnancy, or sudden extended illness in the second or third season. None of the missed seasonal readings were due to a requested withdrawal from the study.

The Table 4-1 presents a median of 0.64 km that is slightly less than the mean of 0.68 km, suggesting a spatial distribution that is slightly skewed to the right, with the longer tail in the higher range of the spatial readings. That is, the majority of women tended to walk distances that fell in the lower range of the distribution shown in Table 4-1. The distribution consequently has a skewness measure of .67. The fact that the adult

smallest value in the distribution is less than one standard deviation from the mean is another sign of this severe skewness. The adult distribution was not skewed enough, however, to fail a Shapiro-Wilk goodness of fit test.

These descriptive statistics measurements will be re-visited in the introductory comparison between adults and girls in the next chapter. For now, they present an introductory feel for the data to be explored further in this chapter.

Lack of Seasonal Variability

Because the readings are from three different seasons, a possible influence of variance on spatial trajectories due to seasonal differences needed to be tested. This testing for seasonal variability was the major reason for doing repeated measures of the same household across three different seasons rather than conducting new tests with a new set of households for every season. In addition, the repeated measures helped “stabilize” the differing spatial findings of every household.

To test if there was seasonal variability of the firewood spatial trajectories conducted in the three different non-rainy seasons between September 2008 and June 2009 a Student’s t comparison was conducted to test if any of the seasonal means differed from each other. The results in Table 4-2 suggest that the overall difference across seasons is not statistically significant. The subsequent analysis therefore rests on the deduction that further testing of variability can be traced to the adult characteristics of interest, not differing seasonal constraints.

Variable Selection and Model Validation

Prior to running the regression analysis, a variable selection process was performed with the help of a mixed (back and forth) stepwise regression (with an $\alpha = 0.05$) to validate the three independent variables of interest: presence of HIV/AIDS-

proxies, socio-economic status, and the generational company of the adult collector. These three main variables were suggested by the literature review covered earlier in this dissertation: Barany suggested that people walked further where there was high HIV/AIDS prevalence (2005); Mahiri brought up the issue of poverty in connection with firewood collection and activity allocation (2001); and Biran and her colleagues suggested a spatial variance depending upon whether the collecting adult was accompanied by her daughter or not (2004).

In addition, other contextual variables that could be of further interest were also entered into these initial exploratory stepwise regression models. These additional variables were extracted from the general household demographic survey and follow-up seasonal contextual interview data. All variables included were tested to affirm the assumption of no association between the independent variables themselves.

The stepwise regression procedure confirmed the inclusion of the theoretical three main independent variables of interest. In addition, there were a few additional variables that came to the forefront in this process, such as the number of women over 18 in the household. This and other exploratory variables were added to the main “reduced model” of only three variables, thus creating a number of new “complete models” with four or more variables. Each “complete” model was tested with the help of a goodness of fit likelihood ratio χ^2 test to see if the added variable(s) added any statistical significant exploratory power in comparison to the “reduced” model. This likelihood ratio χ^2 test is the logistic regression maximum likelihood equivalent of the standard least squares F-ratio test. The goodness of fit likelihood ratio tests showed that none of the additional parameters in the “complete” models added any significant additional

explanatory power to the reduced model at a 95% confidence interval. Therefore, the reduced model was chosen as the best predictive model to test the varying influences on spatial mobility.

This initial exploratory process and result tried to heed Box's classical statement (1976) on the importance of simplicity:

since all models are wrong, the scientist cannot obtain a "correct" one by excessive elaboration...Just as the ability to devise simple but evocative models is the signature of the great scientist, so overelaboration and overparameterization is often the mark of mediocrity (p. 792).

To conclude, as less is (most often) more, the final three variables leave plenty to explore about the intricacies of women's spatial mobility.

Regression Relationship of Adult Inter-Household Spatial Variability

First, the final reduced model was run in a Restricted Maximum Likelihood (REML) mixed model including a random intercept effect for each variable to correct for measuring the same individual multiple times. If the seasonal repeated readings had been processed as multiple independent readings in a standard least squares regression the results would have been biased, as the across-season dependencies had been ignored. Such a pooling of repeated readings would only have been appropriate had there been no statistical difference between the different household readings. This was not the case with this study, thus the random intercept effect was used.

The REML procedure in JMP® 7.0 gave a final model summary fit of $R^2=.77$ and an adjusted $R^2=.76$, $n=54$. All likelihood coefficient estimates were statistically significant at 95% as shown in Table 4-3. Having verified the effect size of the final model as well as the statistical significance of all coefficient estimates, this model was

then brought into the statistical programming SAS® 9.2 software for the sole and only purpose of producing more precise likelihood beta coefficients of the multiple variables. The SAS® software GLIMMIX Pearson panel procedure is able to produce more exact beta coefficient estimates due to a more accurate arithmetical recognition of the identical household repeated measures across the panels, in this case seasons. The Pearson panel procedure is a longitudinal analysis procedure that has the advantage that it does not require as many readings as that of a time series procedure. As an analysis tool of a few repeated readings, the Pearson panel procedure helps to stabilize and control for the heterogeneous nature of the project's multiple individual seasonal readings of the same household while simultaneously increasing variability and efficiency as well as reduce collinearity (Baltagi, 2001). The SAS® software GLIMMIX Pearson panel procedure produced the statistical results for n=54 as listed in Table 4-4. An examination of the resulting residuals output plots of the final model verified that all assumptions of normality, independence (no collinearity) and constant variance had been met.

The results in Table 4-4 reveal that the most influential variable on adult women's spatial trajectory away from home is the absence of HIV/AIDS-proxies in the household. The absence of HIV/AIDS-proxies seems to increase the distance traveled by 0.2646 km as the spatial distance increase by a factor of 1 km (26.46%). That is, households who were not coded as HIV/AIDS-proxy households walked much further than households coded as HIV/AIDS-proxy households. In addition, the GLIMMIX model shows that the absence of HIV/AIDS is significantly more influential on distance walked for firewood than is socio-economic level (as expressed in total agricultural assets). An

accumulation of ZAR1000 (US \$154 according to 2009 exchange rates).) seems to decrease the distance traveled by 0.0076 km as the spatial distance increase by a factor of 1 km (0.76%). In contrast, the company of girls seems to have a much larger negative influence on the distance walked by adult women than does socio-economic profile. The company of girls seems to decrease the distance traveled by 0.1911 km as the spatial distance increase by a factor of 1 km (19.11%), see Table 4-4.

To try to tease out the different relationships, the following sections will examine each category individually for a closer examination. The conclusion of this chapter will then synthesize the individual findings in an attempt to present a more integrated picture.

Influence of Health/Disease

HIV/AIDS-Proxies as the Most Influential Variable

As expected, according to the regression model presented earlier in this chapter, households without HIV/AIDS-proxies walked much further than HIV/AIDS-proxy households. The absence of household level HIV/AIDS-proxies seems to increase the distance traveled by 0.2646 km as the spatial distance increase by a factor of 1 km (26.46%), with this variable having a statistically significant effect at $p \leq .05$ on spatial distance, $t(1, 18.97) = 2.52$, $p = .0209$, see Table 4-4.

This particular finding of the regression model would therefore be consistent with both Davies' suggested female spatio-temporal relational constraint (2001) and Nelson's proposed female spatial domesticated confinement (1986). That is, Davies' theory that women spend more time taking care of other family members consequently has an impact on women's overall spatio-temporal allocation for all household chores. As a result, according to Nelson, because caretaking and other reproduction duties are

centered around the hearth of the home, women become spatially more constricted in their travel away from home. Paraphrasing Davies (2001), this study illustrates that how far adult women can venture away from their homes and into the forest in search of firewood is determined by how much time is left to allocate after the female caretaking responsibilities of household members have been taken into consideration.

Spatial Distance vs. Quantity of Firewood

What are some of the possible implications of such spatio-temporal constraints in the context of previous research? Even though Barany (2005) did not measure the actual spatial constraints of HIV/AIDS households in Malawi, his study is still relevant for this context as he studied a component of firewood that this study did not include; variance in the quality of firewood. Barany found that woodland resources were of worse quality where there was a high HIV prevalence (2005).

Even though the quality of firewood was not measured in my study, this component of the firewood selection process did surface in my discussions with the women (and girls) about where to go for firewood. In the setting of this South African study, women told me that a higher quantity of a better quality of woodland resources was the main reason some women chose to walk the longer distances to reach the larger forest fragments at the outskirts of the village, as opposed to visiting the small forest fragments interspersed within the village.

In our discussion over a satellite image of the village, in response to the question where the best firewood could be found, the women would consistently point to these larger forest fragments on the big satellite picture, at the very corners of the village, not to the smaller fragments inside of the village. Therefore, I decided to test whether the women who had told me that they had chosen the particular site that day due to the

known abundance of firewood had longer spatial readings recorded than those who cited proximity of the site. As shown Table 4-5, the women who chose a site due to abundance walked longer distances than those who chose a site due the cited reason of proximity. This one-way difference of 0.19 km was statistically significant at $p \leq .1$. Being able to walk longer distances thus seems to be associated with the women expecting to find more firewood – based on previous experience – than in forest fragments within shorter distances from the home.

This careful consideration of the many components of a particular firewood collection site speaks to the many facets of the firewood collection activity. Women and girls who collect firewood don't just pick up any piece of dead wood lying around before they quickly scurry back home again. Instead, they spend time not only choosing a particular collection location; once there, women and girls are also selective about what kind of tree species to choose. In interviews with the local women, they said that a few tree species are culturally taboo to bring into the house. Other tree species produce poisonous fumes. Finally, in the interviews, the women expressed a preference for wood species that burn quickly. Such firewood would contribute to their saving precious time, they said. The last comment harks back to the importance of timesaving strategies, always present in the day-to-day planning of these women's everyday lives.

Whereas this study did not include the measurement of the quality of firewood collected, it did, however, measure the amount of firewood collected during the recorded spatial trajectories. Because the regression suggests that HIV/AIDS-proxy households walked shorter distances, the question is, did this spatial constraint translate into a subsequent constraint in the amount of firewood collected (due to the

limited amount of supposedly good quality firewood found in the nearby forest fragments)?

To test whether the amount of firewood collected differed between HIV/AIDS-proxy households and non-HIV/AIDS-proxy households, a REML mixed model test, with a random intercept effect for repeated readings, was performed. This model had $R^2 = 0.44$ and an adjusted $R^2 = 0.43$. The test failed to show a statistically significant difference at $p \leq 0.05$ in relation to the means of the amount of collected when comparing the HIV/AIDS-proxy households with non-HIV/AIDS-proxy households, $F(1, 19.31) = 1.10$, $p = 0.3064$. This test was confirmed by a parallel statistical test to compare the amount of kg collected by those who said they had chosen a site due to reasons of “abundance” and those who said they had chosen the site due to “proximity.” Again, the statistical test failed to show any significant difference in the amount collected at $p \leq 0.1$. I would therefore argue that finding a site that has an abundance of firewood is therefore a question of women having more firewood to choose from in order to collect firewood of a higher quality, not of a greater quantity.

Because this bi-variate regression failed to prove a difference in the amount of firewood collected, such a finding could suggest a more intensified harvesting of firewood materials for HIV/AIDS-proxy households than non-HIV/AIDS-proxy households. That is, I am suggesting a more intensified harvesting activity as in HIV/AIDS-proxy households seeming to collect more firewood within a smaller spatial range than non-HIV/AIDS households. With fewer forest cover locations to choose from, yet having the need for the same amount of firewood material as those accessing a larger range of forest cover, quantity of firewood materials would therefore seem to

have precedence over quality of firewood materials. It would seem that for women from HIV/AIDS-proxy households, the potential to find a good quality of firewood is not enough of an incentive to spend more time on longer trips.

I would argue that HIV/AIDS-proxy households' lack of spatial mobility could have subsequent negative repercussions on the quality of firewood materials selected. In the short run, I am suggesting that the combined findings suggest that there could be a lower quality of firewood correlation for HIV/AIDS-proxy households. In the long run, a continuing lack of mobility could have serious future implications for these already vulnerable HIV/AIDS households; a possible scarcity scenario of any kind of firewood material, whether it be of high or low quality. The latter, long-term scenario would be supported by Barany's overall finding that the quality of firewood was worse where there was a high prevalence of HIV (2005). He further argues that this meant that people had to walk longer distances. The question this study raises, however, is what happens when women run out of time to travel these longer distances for firewood as the burden of caretaking at home worsens? What alternatives do they have? It would seem that the only choice they have is to choose the firewood discarded by others closer to home, with women from HIV/AIDS-afflicted households having to choose between lower and lowest quality of firewood as women from non-afflicted households have the time to walk further to choose between good and bad quality of firewood. Again, there is a pattern of a perpetually descending production for people who are already living at the margins.

In addition, according to Barany (2005), HIV/AIDS-afflicted households were five times more likely than unaffected households to have increased collection of firewood.

Such an intensification of firewood collection would put an even higher pressure on the natural resources found in a possibly smaller firewood home range due to women's temporal constraints as argued above.

Finally, in the context of many African women's lack of natural resource use and control rights, an additional constrained spatial mobility due to HIV/AIDS could make a sudden or slow change in tenurial rights even worse for women from HIV/AIDS-afflicted households. As an example of the latter, as noted earlier in the introduction chapter, research on firewood collection in neighboring Zimbabwe showed how vulnerable women were to a shrinking commons due to men's woodland priorities (Fortmann, 1992) or sudden changes in local tree-use rights where women had to pool donkey transportation to travel further for firewood (Myungwe, 2008). In short, this research suggests that HIV/AIDS is having a serious impact on women's already vulnerable natural resource management strategies, in this case firewood.

Because poverty also affects these natural resource management strategies, it will serve as the touchstone of the next subsection.

Influence of Socio-Economics

Less Socio-Economic Capital, Longer Distances

According to the regression model in Table 4-4, the socio-economic level – as expressed in total agricultural assets – had a statistically significant effect at $p \leq .01$ on spatial distance. However, this socio-economic effect produced a very small influence in comparison to the other effects of the model; an accumulation of ZAR1000 (US \$154 according to 2009 exchange rates) seems to decrease the distance traveled by 0.0076 km as the spatial distance increase by a factor of 1 km (0.76%). This socio-economic variable still adds an important piece to the overall puzzle.

The main regression model referenced above shows that the more assets a household has, the shorter distances the women travel. One possible explanation for these shorter distances could be that women from more affluent households can use their financial assets to buy energy alternatives to save them from extended spatial firewood collection trajectories in search of quality firewood. This explanation would be consistent with earlier findings that argue that the poorer a household, the more they depend on forest and woodland resources (Cavendish, 2000).

The Expensive Energy Alternative of Paraffin

In the village, the households mentioned paraffin as the preferable energy alternative to firewood for cooking over an open fire. Paraffin, which can be bought at the main store on the other side of the river, is expensive, however, as opposed to the free firewood found in the village. To test whether all or only some socio-economics group used paraffin as an alternative energy source, a subsequent χ^2 likelihood test was run using the complete village survey (N=103). This test produced the following likelihood ratio $\chi^2 = 4.12$, $df=1$, $p=.0425$, suggesting that paraffin is, indeed, more likely to be used as an alternative energy resource by “wealthier” households than “destitute” households, see Table 4-6. Again, “destitute” households refer to the lowest category described in the earlier case village setting section, with a total assets range of ZAR0 – 650 (up to US \$100 according to 2009 exchange rates). All other households, with total assets of more than ZAR1,500 (more than US \$225 according to 2009 exchange rates), would belong to the two better off categories, “adapters” and “accumulators”. (These individual categories that were first mentioned in the case study setting will be described more again shortly).

A Female Face of Poverty

Who are these “destitute” households? Previous research on women in post-apartheid South Africa suggests that this category would most likely be female-headed. In South Africa, after seven years of post-apartheid rule, women were worse off in 2001 than in 1996 according to new gender-specific Human Development Indices (Radebe, 2007). Consequently, the poverty rate among South African female-headed households is double that of male-headed households, with a higher rate of female than male unemployment (Gelb, 2003). I will refer to these compounding components of women’s lives as a female gender-specific poverty in the following pages. The vulnerability of female-headed households is an important point as UN statistics show that an increasing number of women live alone or in households led by women (2002).

Prior to testing whether this female gender-specific poverty scenario also fits the most “destitute” category of the South African study village, I first present the overall village distribution of the aggregated wealth as a base comparison. The majority of the households in the village are situated more towards the lower end than the higher end, as noted by comparing the mean of ZAR21,445 and median of ZAR11,050 in Table 4-7. There are a few outlier households at the high end of the distribution; they consist of retired male miners who have been able to build up substantial assets through large herds of cows, horses, donkeys, and medium livestock. At the other end of the distribution, the high concentration of a number of very poor households creates a distribution skewness measure of 2.2. This high concentration of very poor households – categorized as “destitute” in this study – is exemplified by a lower quartile as low as ZAR 400.

As mentioned earlier, in the research site description, the survey descriptive distributions delineated three levels of local-specific categories of wealth clusters: “destitute,” “adapters,” and “accumulators.” Households labeled “destitute,” 34%, had a total assets range of ZAR0 – 650 (up to US \$100 according to 2009 exchange rates). As mentioned earlier, they are the most vulnerable to any kind of internal or external shock to their livelihood – sudden illness or bad weather ruining their harvest – as they have no extra assets to cushion the blow.

The next category, “adapters,” 35%, had a total asset range of ZAR1,500 – 24,000 (US \$225 – 3,600 according to 2009 exchange rates). This category has an easier time to adapt to the unforeseen shocks mentioned above as they have some extra capital to give them some leeway. They are still dependent upon others for work exchanges and pooling cows.

Finally, the wealthiest category, “the accumulators,” 31%, had a total asset range of ZAR25,000 – 145,000 (US \$3,750 – 21,750 according to 2009 exchange rates). This category can further divided into smaller accumulators, a local upper middle-class, (16.5%) and bigger accumulators, a local upper class, (14.5%). In the village, the latter group is locally considered to be the “truly” wealthy as they have accumulated 10 cows or more, that is having assets starting at ZAR60,000 (US \$8,995 according to 2009 exchange rates). All categories of “accumulators” have the capital, however, to accumulate even more by renting out or selling some of their assets if they see an opportunity for further growth.

To test whether destitute households are more likely to be female-headed than male-headed, a subsequent χ^2 likelihood test was run using the complete village

household survey. The contingency Table 4-8 produced a Pearson $\chi^2 = 3.87$, $df=1$, and $p=.0492$, showing that households in the two non-“destitute” categories are more likely to be male households than *de jure* female-headed households.

Almost a third of the village households, 33%, consist of *de jure* female household heads caring for children or grandchildren: they are widowed, divorced, or single women. In addition to these households, there are a great number of out-migrant *de facto* female households in the village, married women who have taken over the daily responsibility of running the households in lieu of their out-migrant husbands. The *de jure* female-headed households are more vulnerable than *de facto* female-headed households, however, as they do not have the potential access to out-migrant remittances, nor do they have access to their own agricultural land the same way that *de facto* female-headed households do who can work their own plot.

Because the distribution of agricultural assets was non-normal, a non-parametric Wilcoxon test (the two-group equivalent of the Kruskal Wallis test) using median as the basic measure was performed to look more closely at the actual differing total assets between the assets of female *de jure* households and male households (including out-migrant heads), see Table 4-9 (the descriptive mean statistic is also included in this table as an additional comparison). A subsequent 2-sample test normal approximation gave the Z-score= -2.89, $p=0.0039$ of the values in Table 4-9. These tests show that there is a significant difference in the amount of aggregated assets between male and female *de jure* households with differing means of ZAR26,505 and ZAR11,716. Female *de jure* households are very much at the lower scale in terms of aggregated wealth.

The Spatio-Temporal Investment of Applying for Grants

The relationship of women and poverty is important in relation to the spatial distances needed for good quality firewood collection. As noted earlier in regard to paraffin, a lack of wealth can demand a higher investment from women in terms of space and time required for firewood collection. As the majority of the households who can afford to use paraffin as an alternative energy source are male-headed adapting or wealthy category households, female-headed destitute households have less flexibility in their energy sources, most of them solely dependent on the collection of free firewood.

In terms of spatio-temporal investments, women in the village do not only have to plan around local village-level spatial distances, there is also the possibility of needing to allocate time for longer spatial distances needed to travel outside of the village. Women living in South African rural areas, where unemployment is very high, are very much dependent upon cash transfers in the shape of pensions, child grants, and/or migrant remittances to buy staple goods for food security (Andrew et al., 2003). *De jure* female-headed households who do not have a male head of household sending remittances are thus solely dependent on these government grants. However, as noted in the setting study description, to acquire these grants involves a major spatio-temporal and monetary investment, as women have to travel an extensive distance to a major administrative town to file the necessary paperwork. The women usually have to make a number of trips over a possibly extended period of time to complete the whole application due to the high volume of applicants and the paper-intensive process requiring several forms and certificates.

To test whether female-headed households are less likely to complete the application for child grants than male-headed households, a subsequent χ^2 likelihood test was run using the complete village survey, N=103, see Table 4-10. The contingency numbers in Table 4-10 produced a homogeneity test with a Pearson $\chi^2=3.41$, $p=.0648$. Thus, there seems to be a greater probability that female households are missing all child grants for which they are eligible than male households. To recap, *de jure* female-headed account for a third of the population, yet they make up a little less than half of all destitute households and more than half of all households missing child grants out of the total village population.

As for the last finding listed above, the question is, why would these predominantly poor households not invest more of their time and money to take advantage of this extra cash transfer, especially considering their destitute situation? I argue that it is a matter of these women prioritizing their immediate time and money needs in their daily struggle to meet every-day pressing practical needs within the smaller spatial parameters of the local village. That is, because *de jure* female-headed households are so pressed for time and money due to their daily labor constraints, many of them cannot spatio-temporally afford further investments for travel outside of the village, even if it carries the promise of possible further financial long-term relief, as monthly child grants, if the application is accepted. With the help of my interpreter, I asked the women why they were not receiving any or all of the grants for which they were eligible. The answer was almost always the same “I just don’t have the time to apply.”

Socio-Economic Profiles and HIV/AIDS

Because the first sub-section commented on the influence of HIV/AIDS on distance traveled, I also explored the intersection of the issues discussed in this section – poverty and wealth – with that of an absence and presence of disease on a household level. The GLIMMIX Pearson panel procedure performed for the multiple regression analysis shown in Table 4-4 also produced covariance estimates of the three different socio-economic means for the varying household health proxies as shown in Table 4-11. These linear combinations of the group effects at different wealth mean categories show that poor households travel further than wealthier households even when adjusting for differences in the mean of the covariate total ZAR (total agricultural assets), see Table 4-11. The additional Table 4-12 gives a contextualizing overview without the co-estimates projections as a baseline comparison.

According to Table 4-11, households with HIV/AIDS-proxies present walk shorter distances than households without HIV/AIDS-proxies within the same wealth category. In contrast to the earlier stated finding – where “adapters” and “accumulators” have the luxury of buying paraffin as alternative to make up for shorter distances – there was no such likelihood ratio for the general HIV/AIDS-proxies households category, ($N=103$, $df=1$, $\chi^2=0.90$ and $p=.3416$). This could mean that HIV/AIDS proxy households who belong to the “destitute” category can’t afford to buy the “firewood time and spatial distance” with the help of paraffin, as would be the case for HIV/AIDS-proxy households belonging to wealthier categories.

In this spiraling political ecology of disease, those most vulnerable to long-term illness – “the labor poor, cash poor, and land poor” (Leatherman, 2005:66) – are thus

more vulnerable than the wealthier households with long-term illness. Poor households are more vulnerable as they are more dependent upon free firewood resources and thus more vulnerable to possible future environmental changes in the commons, including possible future scarcity.

In addition, in the context of HIV/AIDS and the threat of future poverty, women are particularly vulnerable in terms of lack of use and property rights, where widows from deceased men can suddenly find themselves without use rights to land or other property assets (Slater and Wiggings, 2005; Izumi, 2006). A death of an out-migrant member could also mean the loss of remittances, an important cash injection in this rural economy as agriculture is of minor importance to households in these former homelands (Dewar, 1994).

In the remote rural former homelands, the nested levels of marginality caused by the specific geographic and politico-economic locale put further stresses on the vulnerability of the poorest of the poor – women – due to the local lack of basic health services and a continued “under-development.” In such all-around-resource-poor environment, it is hard for destitute households to find ways to cushion the shock of HIV/AIDS as they battle rural unemployment as well as a lack of affordable energy alternatives, piped water, and cheap efficient travel. Many of the basic services that urban and peri-urban South African women take for granted require a major alternative spatio-temporal investment for their rural counterparts – finding firewood, fetching water from springs, and daylong travels for medicines and grants. These are all rural spatio-temporal investments which take away precious time from other daily female household

chores, further impacting the greater vulnerability of rural HIV/AIDS household who belong to the poorest category.

Firewood and Food

The question is why would families put such a focus on prioritizing firewood collection in light of the labor constraints discussed above? In response, Barany's Malawi study found that a lack of firewood led to 6% of households missing meals in HIV/AIDS households (2005). Similarly, I chose to briefly include the firewood and food connection after learning about the nature of identical female adult food exchange networks and firewood collection groups.

In this village, the women said that when they made plans to collect firewood with other women, this group was usually identical to the same group of female neighbors that constituted their household's food exchange networks. (In the event women did not have time to plan with their neighbors, they would often follow and catch up with other women they would see from afar when leaving their homes). Before exploring this connection between firewood and food further, Table 4-13 presents an overview of the descriptive statistics of the times the village households borrowed and lent out food as well as the number of participants in their network.

As suggested by Table 4-13, the maximum number of neighbors in a food network corresponds to the maximum number that people asked to borrow food, suggesting that the exchange is possibly built upon a certain equitable distribution of favors. Not surprisingly, according to the rules of reciprocity, the village survey (N=103), showed an overall village correlation of the number of times food was borrowed from a neighbor and times that food was lent out to a neighbor, Spearman's $\rho = .3954$, $p < 0.0001$.

In the same spirit of being able to reciprocate, another test found that, save for the biggest size gardens, households who had no or just a very small garden borrowed food less often than people with medium size gardens, as suggested by Table 4-14. A subsequent 1-way χ^2 approximation test of the values in Table 4-14 produced $\chi^2 = 8.21$, $df=3$, $p=.0418$. According to these test results, it seems that if a household cannot reciprocate with a substantial amount of garden produce, they will refrain from borrowing. Table 4-14 can also be interpreted as households who have a big enough garden are more or less self-sufficient, possibly buying the extra produce they might need.

For an overall exploration of a connection between food produce and firewood, the next test, presented in Table 4-15, looks at the relationship between the size of a garden – and possible produce output – and the amount of times the household went out for firewood the previous week of the survey. A subsequent 1-way χ^2 approximation test produced $\chi^2 = 6.39$, $df=3$, $p=.0941$. According to the Table 4-15 results, the household survey seems to suggest that people who have medium or bigger gardens also have a higher frequency of collecting firewood. If we compare this and the previous table, it seems that people with no or small gardens tend to borrow less food and collect less firewood where as people with medium sized gardens borrow more food and collect more firewood. Households with big gardens do not seem to be as much in need of borrowing food as that of a medium sized garden; they still need to collect more firewood than the latter, however, implying a correlation of a growing size of potential garden produce output and firewood.

Before concluding this smaller section on food and firewood, I wanted to note one last relationship of perceived firewood scarcity and a frequency of borrowing food. According to Table 4-16, people who had a higher frequency of borrowing food also perceived that they spent more time collecting firewood due to the scarcity of such material. This issue of firewood scarcity came up in response to the open-ended survey question: “does it take you longer to collect firewood now than 5-10 years ago? If so, why?” A subsequent 2-sample test normal approximation test of the values in Table 4-16 produced the Z-score= 2.04, $p=0.0408$. To explore this issue further, I also ran a correlation test of the whole village survey (N=103) to explore a more general relationship between the amount of times a household borrowed food and the amount of times the household had gone out for firewood the previous week. This test came up with a Spearman’s $\rho=.3239$, $p= 0.0008$. Both these tests results seem to be consistent with Barany’s finding that a scarcity of food in the household is related to firewood scarcity as well.

It should be noted, however, that Barany’s findings on the relationship of food and firewood were specifically looking at variance between HIV/AIDS households and non-HIV/AIDS households as well as variance before and after illness in the household. To include at least one aspect of this epidemic for this particular section I therefore ran tests to see if HIV/AIDS-proxy households were more prone to borrowing food than non-HIV/AIDS-proxy households. Keeping with the additional theme of socio-economic status, I also tested for variance in destitute or wealthier households: were poor households more prone to borrowing than wealthier households? Both tests failed to show a statistically significant correlation.

Nevertheless, in the spirit of reciprocity, the finding that some households are less prone to borrow food should not be interpreted as a sign of overall food security; rather it could be a sign of vulnerable households having to withdraw from an overall system of reciprocity. Just as Leatherman (2005) found that sick households pulled out of needed labor exchanges in the Andes, knowing they could not reciprocate and fearing social penalties, destitute households in this South African village could be opting out of much needed food exchanges for the same reason. This withdrawal could, in turn, possibly lead to a continued spiraling decline of food security and further vulnerability.

Influence of Generational Company

The Second Most Influential Variable

The social component of food and firewood is an appropriate transition to the focus of this last section, the influence of generational company on spatial distances covered in the search for firewood. This is the last of the three independent variables of the main multiple regression analysis introduced at the beginning of this chapter, see Table 4-4. The Pearson Panel model presented a statistically significant effect at $p < .05$ of generational company, $F(1,44.04) = 7.02$, $p = .0111$, much more influential than socio-economic profile but not quite as influential as the health status of the household. According to this estimate for generational company, a lack of other adults in the collection party seems to decrease the distance traveled by 0.1911 km as the spatial distance increase by a factor of 1 km (19.11%). In short, adults walked further if accompanied by other adults only than when they went with their daughters, alone, or in a mixed group of several adults and girls.

To look at the distribution of generational company of female adult firewood collectors, I ran an additional descriptive statistical overview from the village survey, see

Table 4-17. The largest category in Table 4-17 consists of women choosing to collect firewood with other adults only (38%). In contrast, almost half of that number consists of women who prefer to go with their daughters only (17%). This latter category is still almost double that of the smallest category for adult females, women who prefer to go alone (8%). Follow-up interviews unveiled a variety of concerns behind these varying generational company responses.

Adults Who Prefer to Go with Other Adults: Three Recurrent Themes

For adults who preferred to go with other adults, there were only three recurrent themes that came to the surface in the open-ended interviews: fear of the forest, dissatisfaction with young female collectors, and the social advantages of going with other adults.

Theme one: fear of the forest

Women expressed fear about a variety of elements while going to collect firewood material in the forest. These elements included fear of accidents, wild animals, and a more non-descript area of the unknown. It is notable that the women of this village never brought up the fear of sexual violence in the forest. When asked specifically whether the women had ever had such concerns when entering the forest they responded no. In general, there is very little to no violence in the public spaces within the village (I cannot speak of what happens domestically) compared to the average staggering crime statistics of the rest of the country. Speaking to the village locals, it was generally agreed that the lack of roads within the village was counterproductive to outsiders coming into the village to steal and attack, as the bumpy terrain made a quick getaway almost impossible. Further down the Wild Coast, however, in a neighboring less remote area with better road infrastructure, a female key informant said that the

women there did speak of being fearful of going into the forest to collect firewood due to the escalating violence in the area, including sexual attacks. A similar fear of sexual violence related to female travel has also been noted by other geographers (Katz, 1993; Mandell, 2004).

Back in the village of Nqileni, one woman spoke of a fear of accidents since “sometimes we need to climb the branches to get to the firewood we want and then we might slip and fall” (Interview #76 November 23, 2008). She also said, “if I am not in the company of other adults, I will stay in the outskirts of the forest so that if I fall and have an accident I know other people can see me and come to help” (Interview #76 November 23, 2008).

Much more often, however, adults spoke of being fearful of “wild animals” in the forest. One woman said that adult company is much better because “if you see an animal one person can run home and tell: girls are too scared to act” (Interview #57 November 11, 2008). When asked what kind of animals they feared, the women responded that they feared snakes and larger animals. (The former made perfect sense but the latter was a curious comment. Even the largest forest fragment did not seem to be big enough to carry any viable population sizes of anything bigger than the one small-sized monkey I sighted on one rare occasion).

Finally, the fear could also be described as more non descript, with one woman saying “sometimes the rustling of branches for no reasons at all is enough to give me a fright” (Interview #98 December 12, 2008). Some women even said that fear was one of the reasons they decided to stop collecting firewood and return home earlier than planned.

The different examples above describe how different kinds of fear did not only result in the common drive to choose adult company; fear could also be strong enough to change the environmental spatial behaviors. Fear is therefore an example of how a seemingly irrational but humanly understandable driver produced by the cognitive mind can impact people's foraging-decision-making in ways that cannot be simply categorized as purely caloric "efficient-driven" behaviors according to OFT. That is, using "OFT speak," the currency (Winterhalder, 1990) in this case – as in calculating costs and benefits – is not purely based on something as tactile as the numeric values of calories. If a woman is suddenly feeling fearful, what she considers optimal or most efficient foraging can change from one moment to another as the female forager starts to mentally calculate the cost of falling or being bitten by a snake if she would venture further into the forest for the potential benefit of finding a better quality of firewood.

To address this narrow view of what could be viewed as "rational" human behaviors, Stepp and his colleagues have made a valuable addition to the OFT discourse with the incorporation of "unique human properties" (2003:1), including a human information flow and processing of functional as well as maladaptive traits. The intricate levels and imaginations of the different kinds of human fear could very well be part of such a unique human system for a better understanding of environmental behaviors.

Consequently, this spatial study is not only uncovering a "hidden harvest" (IIED, 1995) in which female hidden harvesters roam; it is also uncovering their "hidden emotions." These emotions are termed "hidden" in the sense that they would not be visible in a caloric-driven OFT computing model. Nevertheless, these emotions, the

result of a mental internal visualization of possible scenarios, can be as real to some of these women and girls as the external vision of the firewood itself, or at least real enough to change foraging behavior.

Theme two: dissatisfaction with girls

The next theme adults mentioned, as a reason for choosing to go with other adults only, is that they perceived girls as an impediment to effective firewood collection. This perceived impediment took a variety of forms, including both spatial and temporal concerns.

In terms of spatial distances, some adults lamented that they could not go as far as they would like since the girls moved too slowly. In contrast to the 2004 Malawi study (Biran et al.), the adults in this study said they walked further without girls accompanying, not the other way around. The Pearson Panel multiple analysis regression presented earlier in this study supports this statement, see Table 4-4. One woman even expressed some loving frustration in the interview when she described how she had discovered that her daughter had followed her into the woods without her knowing. “She really wasn’t supposed to have gone with me; I was trying to sneak out so she would not see me” (Interview #23 October 1, 2008). This issue of women possibly walking shorter distances when accompanied by their daughters will be discussed again a bit later in this chapter in the context of women who, in contrast, see shorter distances as an advantage rather than a disadvantage.

In addition to the spatial distance impediment, the women also spoke of the time impediment involved with girls. Some women complained that girls spent additional time playing when accompanying adults, thus wasting adult precious time. Even when the girls were busy collecting, a number of women perceived them as being too slow in their

efforts to be considered efficient company. Finally, other women did not complain of the actual work performed by girls but rather their constricted weekday schedule due to the girls' schooling. Neither wanting to pull their daughters out of school nor wait for them to return home in the afternoon, it was easier to meet up with other adults, the women explained.

Theme three: the social advantages of going with adults

The final and most popular reason that adults chose to go with other adults only were the different social advantages associated with adult company. These social advantages included: the opportunity to socialize with other adults outside of the household, the pooled collective knowledge of the best firewood collection sites, and the building of external household social capital for various kind of work exchanges.

A distant social getaway. A great number of women said they preferred the social company of other adult women to have the opportunity to catch up and socialize while searching for firewood. This social quality time was cherished for its adults only private time.

As the regression model suggests that women walk further in the company of other adults, this socializing also seems to carry a distance-inducing component, in a world far, far away from the many demands put upon them by other household members. As mentioned earlier, in the neighboring district Willowvale, Liebenberg (1994) found that adult daughters-in-law would sometimes choose to go as far away from the household as they thought they could get away with, all under the guise of performing external household chores. Even though Liebenberg's note related specifically to adult daughters-in-law wanting to get away from the demands put upon them by their mothers-in-law, what woman would not want some distant relief from the

pressure put upon them as 24-7 caretakers of the household? The kind of extended firewood social spatial excursion described in this section is possibly one of the only few tools available for rural women tired of the female spatial confinement of the home.

Whether such extended excursions are part of a spatial rebellion or part of other avoidance mechanisms (Liebenberg 1994), they are all part of the social fabric of foraging. These kind of social aversion strategies to avoid certain people are, however, very much missing in the explanatory fabric of the efficient-driven OFT models, as illustrated by Baksh (1990). Instead, these extended excursions point to a certain amount of individual agency that drives foraging, not predictive rules of strict adaptation (Joseph, 2002).

A pooling of firewood knowledge. In addition to enjoying each other's social company, the women also spoke of the advantage of getting together to share knowledge of firewood sites that might offer more quality material than other places. This kind of a social collective advantage – in this case, the choice to go with other adult women rather than go alone – is the direct opposite to the neoclassical individual economics upon which OFT builds its one and only goal for foraging. Because this kind of subsequent collective decision-making, where women meet to discuss which of the many firewood sites suggested to choose from, points to a collective social fabric that can lead to multiple possibly conflicting goals within that group. The existence of these multiple conflicting goals run counter to the OFT single optimizing goal of one person's view of the most efficient maximizing of return (Mithen, 1989; Bettinger, 1991).

Therefore, it would seem that a conventional OFT model would risk obscuring rather than illuminating the complex social aspects of female firewood collection. That

is, even though some women know they might be the ones who are going to have to compromise on their preferred firewood site, they still chose to join such a firewood collection collective because of the social advantages offered, including the kind described next.

Firewood collection as an external social household investment. Finally, the choice to engage in a group of firewood collectors is an example of a social external household investment. Household members have been found to invest in external social networks to help avert present and future risk to the household (Fapohunda, 1988; Beneria, 2003). The findings discussed in this section support earlier research by Leach and her colleagues that found that women's collected free woodland resource bundles can become an important tool for negotiation and bargaining within and outside the household (1999). The importance of these free resource bundles is apparent when considering that the net-direct use value of secondary woodland resources to be three times that of what a non-skilled wage earner would make at a South African commercial agricultural farm (Dovie et al., 2005), with firewood having an even higher use value than crops in certain Southern African rural areas (Letsela et al., 2002).

Just as important, this kind of social external investment can also serve a household's practical short-term day-to-day needs as well as possible future needs. Whether the investment is for short-term or long terms needs, the participation in social foraging networks is therefore not centered solely on individual maximizing. Instead, these social foraging networks include a social investment and exchange that form a part of a much bigger picture that includes not only one but possibly multiple risk-averse

behaviors. Such risk-averse behaviors serve different goals than those of the OFT strictly maximizing modeling, as illustrated by Stephens (1990).

Adults' firewood company and work exchanges. This sub-section will focus on testing the possible relationship of present practical day-to-day work exchanges and the possible external household social investment of adult firewood collection company. First, a contingency analysis was conducted of all households of the village to test if households with an average or large plot engaged in work exchange parties to help the management of their plot, see Table 4-18. A categorical test response of homogeneity of the values in Table 4-18 produced a Pearson $\chi^2=38.38$, $p<.0001$. Not surprisingly, people with substantial plots are more dependent upon social work-exchanges than those with small or no plot.

Once this first relationship was verified, another test was run to explore if adult women who walked with other adult women only were more prone to engage in fieldwork-exchange than adults who walked with their daughters or alone. Here it is assumed that adults who choose to walk alone or with their daughters do so because they do not have the same need to invest in social external work-exchange due to a smaller sized plot or no plot. Because the contingency analysis shown in Table 4-19 contained all categorical variables, a repeated measure could not be used. Instead, the seasonal repeated measures were recoded into two different overall generational make-up readings: one category for households who always walked alone or with their daughters and another category for adults who always walked with other adults or adults and daughters. Because one of the categories contained a zero, a Fisher's exact right tail test was performed on the contingency analysis in Table 4-19. This test

produced a probability=.0295 that adult women who joined groups of adults only or mixed adults and girls groups were more likely to engage in work exchanges than those walking alone or with girls only. The significance of the relation above suggests that what seems like another chatty stroll searching for firewood with other adults could also be driven by a woman's external household social investment need, all in the interest of having the work of a substantial plot run more smoothly.

In the interest of the spatial focus of this study, the social investment connected to firewood social networks requires a substantial temporal investment out of women's daily household allocation as adults accompanied by other adults seem to walk longer distances, as suggested by the Pearson Panel model covered earlier in this chapter, see Table 4-4. This extra firewood spatio-temporal investment in the name of social reciprocity thus raises the issue of personal opportunity costs for every firewood trip in relation in the present as well as the future. It would seem almost impossible for a woman who comes from households with a substantial plot to repeatedly turn down such social firewood collection quality time with other adult women, even if she did prefer to go with her daughters (more about such reasons later in this chapter).

To be more specific in terms of foraging, this research is in line with earlier work by Baksh (1990) who pointed to social risk-averse foraging behavior among Amazon Indians that included external food transfers in the hope of future reciprocation, supporting earlier decision-making foraging studies on African pastoralists (Gulliver, 1975; Boer, 1989). Again, by breaking apart the old black box of household economics, it is apparent that the old male-benevolent-dictator-household-head-view as the only ruling economy within the household would not help to explain the complex decision-

making and social fabric of external household investment related to women's firewood collection.

This research adds to the earlier findings described above, however, by highlighting the female spatio-temporal household dimension in this social fabric of external household investment. A household exchange and investment should therefore not only be seen as a transaction that only prioritizes the end products, be it calories, monies, or other tactile resource bundles. This research points to the importance of putting a value on the ephemeral components that help produce these tactile products: the investment of women's time somewhere in space. Again, the further women walk, the more inclined they are to do so in the company of women, which in turn seems to be associated with social fieldwork exchanges to help save women time and labor when managing substantial agricultural plots. These time and space components are a valuable resource in themselves that women need to manage and allocate carefully every day of their lives, while also planning for the future.

HIV/AIDS, firewood and social investments. Before concluding this sub-section on women's social external household investment in connection with firewood, the issue of HIV/AIDS should be introduced into this equation. As noted earlier, the Pearson Panel model showed that HIV/AIDS-proxies resulted in adult women walking shorter distances for every socio-economic category, see Table 4-4. This could generally suggest that females from households with HIV/AIDS would more often than not be forced to opt out of longer social firewood collection trajectories. Such an opting out could, in turn, result in women from HIV/AIDS households not being able to invest in the social fieldwork exchanges that seem to be associated with longer firewood trajectory

trips. Subsequently, the lack of help in the field could lead to further decline in local food production, making HIV/AIDS households even more vulnerable. Such a possible chain of events is suggested by medical anthropologist Leatherman (2005): in the Andes, he found that when people there fell ill, they opted out of much needed labor exchanges to avoid future social penalties, leading to a spiraling decline of production. If one takes all these issues into account, the social as well as spatial component of firewood collection becomes all the more complex. In short, there is nothing casual about a group of women collecting firewood together.

Before moving on to the next section, I do want to mention, however, that a statistical test conducted to see whether adult women from HIV/AIDS household were more inclined to go with girls or alone than other households, due to their specific time-constraints, showed no such statistical significance. That is, in the village, women from HIV/AIDS household do sometimes use their individual agency to accompany other adults only groups despite the possibly implied longer distance.

Adults Who Don't Prefer Other Adults: Three Recurrent Themes

As mentioned earlier in this chapter some adults did not prefer the company of other adults. The daughters usually accompanied these women; on rare occasions women would accompany the daughters of their neighbors as well. The adult women who preferred the company of girls spoke of two main advantages: being the sole adult authority, as well as spatio-temporal advantages. Once these two themes have been discussed, this section will also include a separate but related third theme, women who preferred neither the company of adults nor girls, but that of going alone.

Theme one: the sole adult voice, the sole authority

Some women talked about the benefit of being the major non-disputed authority of the firewood collection party. Or, as one woman put it “the girls respect me as an adult,” (Interview #78 November 25, 2008) seeming to suggest that this was perhaps not so much the case with other adults. As the sole adult, the woman was in charge, making all the major decisions, including where to go.

Once the company arrived at the site chosen by the adult, yet another advantage of being the undisputed leader of the pack materialized: the lack of competition. One woman echoed the comments of many others when she said, “when I go with girls I do not have to worry about competing with other women for the best firewood material” (Interview #32 Oct. 5, 2008). A number of women complained of the disadvantage of a group of adult women descending on the same site at the same time. Even though a group of adult women would fan out from a temporary point at the forest edge where all the material was collected, some women still felt cramped for space and restricted in their choice of material. With girls, this was never a problem, the women explained; the girls would do whatever an adult woman told them.

Theme two: the spatio-temporal advantages of girls’ company

The most positive responses about going with girls seemed to be tied to various aspects of spatial savings. That is, while others complained of girls being too slow and not wanting to walk too far into the forest, these women viewed such qualities as the upside of going with girls. One woman said that “adults walk too far and nowadays my body is tired, so I prefer the company of my daughters” (Interview #42 Oct.10, 2008). In contrast to Biran’s (2004) Malawi findings that the daughters’ company was an asset because the women walked longer distances for firewood with them, this spatial study

found that women of this village considered the company of daughters an asset because their company resulted in shorter distances, not longer.

In addition, for women who were fearful of the forest, girls offered a welcome compromise. One woman felt that “adults go too far into the forest,” (which could be related to adding to the spatial trajectory as well as feeling more fearful). In contrast, girls, who generally also did not like to go as far into the forest, were still able to provide some relief while collecting firewood as the woman “felt less fear when I am with the girls than when I’m alone in the forest” (Interview #54 November 7, 2008).

Before concluding with women who liked to go alone, there are a few more reasons of temporal note that women mentioned in relation to going with their daughters. A number of other women simply echoed the sentiment of one woman, who said, “I don’t have the time to make plans to go with adults” (Interview #42 Oct.10, 2008). Even the activity of planning some of these chores with other women can be (too) time-consuming, as the women of this study pointed out. That is, it takes time to hold a meeting with other women about making the time to meet up for yet another social gathering, in this case gathering to go out and collect firewood. Along these lines, another woman commented that “other adults are too busy,” (Interview #72 November 20, 2008) so she just didn’t bother asking them. With girls, the woman explained, an adult can be more spontaneous as she does not have to plan so much.

Theme three: preferring to go out alone

Finally, a few women actually preferred to go alone. One woman put it succinctly “adults waste time chatting and girls need to be home working” (Interview #88 December 1, 2008). In this case, the household seemed to be more of a contained smaller unit of self-efficiency than the complex social network described earlier.

All these cases pertaining to generational company have shown a variety of responses for a variety of women. As opposed to the structural constraints of having to battle illness and poverty mentioned earlier, women also seem to be left with some room for personal agency in terms of the generational company they choose.

The Firewood Burden of Adults

Before concluding this chapter on adults, I want to briefly look at not only variance in distance but also at possible variance of how much women collected. I will first present an overall distribution of how much women carried. Secondly, having found a different result to that of Biran's findings in terms of spatial distances, I also test whether there was a variance in how much women collected individually when accompanied by different generational groups.

First, I wanted to contextualize the subsequent findings by presenting the overall distribution of kg carried by women for the spatial recordings noted, see Table 4-20. As noted by the relationship of the median (30.50 kg) vs. the mean (29.25 kg), this normal distribution is only slightly skewed towards the higher range.

A comparison of the amount of firewood collected by women depending upon the company they kept during the firewood collection did not show any statistically significant differences, with $F(3, 47.37)=0.32$, $p=.8082$, with a model $R^2=.46$ and an adjusted $R^2=.43$ for the following least squares mean for adults: 29.64 kg (SE=1.70) when accompanied by daughters, 30.19 kg (SE=1.95) when accompanied by adults and 28.06 kg (SE=1.71) when going solo. To test Biran's specific claim about the advantages of going with daughters, a student's paired t-test was performed to test possible correlations between individual pairs. Again, this test did not show any statistical differences. That is, a woman does not, by herself, collect more firewood

when accompanied by girls than when she is alone, with adults, or with a mixed group of people.

Nevertheless, as the girl accompanying the mother is most probably her daughter, the household total collected is thus most probably larger than if a woman went with a neighbor instead. In this wider total household perspective, the extra pair of hands and weight carried by girls is beneficial to the overall households (Biran et al., 2004).

Because girls are important to adult women who juggle multiple chores with various spatio-temporal constraints, the next analytical chapter will look at variance not only among girls but also among girls and adults. Before moving on to the next chapter, however, I will present an overall concluding discussion of the material discussed in this analytical chapter. This discussion includes a look at women's structural constraints as well as women's opportunities for individual agency. This chapter ends with a contextual discussion of feminist geography.

Chapter Conclusion

Heeding Carney's call to further conceptualize female labor in the context of political ecology, this study provides a spatial perspective on women working double shifts as HIV/AIDS caretakers and wild harvest producers. Consequently, this study addresses three overall concerns. First it recognizes women's reproductive role and that of being active producers (Beneria, 1986; Jaquette, 1990; Young, 1997). Secondly, the study illustrates the importance of women's spatial mobility (Mandel, 2004) in an environmental context. Finally, this study illustrates the variance among females (Leach, 1994), since being a rural woman is not a monolithic experience.

By suggesting a link between HIV/AIDS-caretaking and a subsequent confinement of environmental spatial patterns, this study adds a spatial perspective to previous

research emphasizing the varying costs of women's reproductive work (Huber, 1991; Chafetz, 1991). This burden has become even heavier in response to government social expenditure cuts in the wake of Structural Adjustment Programs (SAP) (Deere, 1997; Beneria, 2003). In a South African structural context, poor women have had to intensify their duties as unpaid caretakers of the ill as a result of a post-apartheid's government choice to favor the more individual neo-liberal agenda of Growth, Employment and Redistribution (GEAR), deserting the previously supported social transformation trajectory of the Reconstruction and Development Programme (RDP) (Rangan et al., 2002). Concurrent with a rise in HIV/AIDS statistics, South African women have suffered from a perpetual reproduction of exploitation, as they suffer from higher levels of poverty and unemployment than men (Gelb, 2003).

In addition, women's spatial mobility is currently a neglected non-material facet of research on rural coping strategies: the focus tends to be on larger, more tactile assets, such as socio-economic, physical, and natural capital. However, taking this study's findings into consideration, I very much concur with Jennifer Mandel's argument that spatial mobility should be considered to be as important as any other asset in women's everyday lives (2004). From the remote corner of a former homeland, this study suggests that the pressure of structural labor constraints and the spatial household confinement of female domestic reproductive chores in conjunction with the pressing need for free woodland resources outside of the home, further compound the precarious situation of rural women's spatio-temporal constraints.

Finally, the findings of this study also illustrate another important point: the female experience with natural resources contains a range of differing variables. Even though

there has been a needed focus on the continued difference between women and men in access to, rights, and control over natural resources in Africa (Leach, 1994; Nabane, 1997; Okot-Uma, 1999; Sullivan, 2000; Cassidy, 2001; FAO, 2002), there is also a concurrent need to highlight differences within the subset of women. As was shown in this chapter, adult women not only differ in the amount or quality of capital they have – human, social, economic etc – but they also differ in terms of personal preferences. The next analytical chapter will add to this variance by looking at the differing female experience according to age.

A Political Ecology of HIV/AIDS

Space and time, quantity and quality

In this first analytical chapter, the data showed how disease seems to have the biggest impact on the varying effect on women's spatial allocation of critical woodland resources. In response to the question "Who get firewood where and why?" this study suggests that adult women from HIV/AIDS-proxy households are spatially more constrained in their firewood collection.

Even though the mixed regression analysis showed that women from HIV/AIDS-proxy households walk shorter distances than women from households without HIV/AIDS-proxies, there was no statistical significant variance in the amount collected between the two groups. Consequently, I argue that the shorter distances walked by women from HIV/AIDS households may impact the quality of the firewood they collect, consistent with the finding of previous research (Barany, 2005). In interviews, the women expressed a preference for firewood that burned quickly to make further timesavings. The best firewood could be found in the larger forest fragments at the very corners of the village, the women continued, not in the smaller fragments inside of it.

In the short-term, a narrowing of a so-called firewood home range could result in a scarcity of the preferred good quality firewood material, as suggested by Barany (2005). In the long run, however, with a continued intensified use of the close smaller forest fragments, these spatio-temporally challenged households could face a scarcity of all kinds of firewood material closer to home. Such a scarcity scenario would seem even more possible, as Barany found that HIV/AIDS-afflicted households were five times more likely than unaffected households to have increased their collection of firewood (2005).

Finally, with the suggested spatio-temporal constraints of women from HIV/AIDS households – due to the unpaid duties of home-caretaking of the sick – such a dramatic change in free woodland resources could further compound these households' vulnerability, as there is little extra time left to address such changes outside of the home, see Figure 4-1. Nevertheless, such vulnerability could be even worse for poor HIV/AIDS households, as the data from this study also show that the more expensive energy alternative of paraffin is mainly used by households who are more financially secure. This finding is supported by the earlier research that shows that dependence on forest and woodland resources increase with poverty (Cavendish, 2000).

HIV/AIDS compounds the overall vulnerability of rural poor households who find themselves struggling to meet the additional costs of medicine with the possible concurrent loss of wages. Consequently, these households are even more dependent upon free forest resources, according to Southern African research (Hunter et al., 2005; Barany et al., 2005; Shackleton et al., 2006).

A new landscape shaped by the presence or absence of disease

The research findings discussed in this chapter are consistent with earlier research that suggests that the activity of firewood collection is intricately linked to a larger web of the human experience that includes poverty, food insecurity, labor constraints (Mahiri, 2001), and HIV/AIDS (Barany, 2005). Depending on the differing level and compounded nature of constraints, the total effects can result in outcomes that may create further marginalization of the most vulnerable households (Loevinsohn and Gillespie, 2003), many of them *de jure* female-headed (Gelb, 2003; Radebe, 2007). This study puts a spatial perspective on such a possible spiraling decline of political ecology.

Again, the basic tenets of political ecology are the marginality of various kinds of capital in an often perpetually descending circle; a diversity of voices speaking from different positions of power for access and control; and the consequent multi-scalar relations of competing production processes that may put a strain on the environment (Blaikie and Brookfield, 1987; Peet and Watts, 1996; Bryant, 1997; Paulson et al., 2003; Gezon et al., 2005; Robbins, 2005). Disease became an explicit link to the politico-environmental land use in the late 1990s, as suggested by geographer Mayer (1996, 2000).

In the last chapter of his foundational text *Political Ecology: an Introduction* (2005), Paul Robbins asked what new ecologies might take shape in the wake of the demographic changes caused by the HIV/AIDS epidemic. In this study, the regression relationship finding between spatial distance and health suggests that there could, indeed, be a new landscape forming in the shadow of the HIV/AIDS epidemic. That is, just as one could argue that the remote rural landscapes of the former homelands are marked by a “feminization” of the landscape – shaped by the wives, widows, single

adults, and adolescent women left behind – there is now a possible additional layer of change determined by the absence or presence of disease.

The South African context

This changing rural landscape is very much driven by women's location-specific structural vulnerability due to a larger multi-scale continuing apartheid legacy, including local labor constraints and high local unemployment as a consequence of the urban-centric migrant employment structure. As noted earlier in the introduction, a comparison of the structural barriers to HIV prevention (Parker et al., 2000) and the structural characteristics of past and continued post-apartheid political economy in the remote former homelands (Bond, 1999; Turschen, 2004) are highly similar: economic under-development, urban-rural out-migration, and gender inequality (Parker et al., 2000).

Women in rural areas have two things working against them: having to perform time-demanding female-specific caretaking duties in addition to their regular production chores as well as having to perform these double duties in a rural context of structural labor constraints in a continued so-called under-development of a former homeland. In these remote rural areas, women have yet to be the beneficiaries of post-apartheid reforms that urban women have, such as health care access, gender equality, and employment reforms (McCusker, 2004).

South Africa is battling the same dilemma as other African countries, where they are trying to find ways to battle HIV/AIDS while having to cut social expenditures to pay their national debts (Poku, 2004). As noted by Beneria (2003), it is mainly women who have to pay the price of regional and national SAP social expenditure cuts by providing free labor in lieu of missing social services. In addition, external past funders, such as World Bank Clinical package programs, have focused on childbirth and TB care-only in

health initiatives lacking a sufficient rural geographical distribution, according to Turschen (1994) and Poku (2004). Hunter even argues that this glaring omission of HIV/AIDS in such public health policies, is symptomatic of a World Bank epidemic response that is focused on solely economic efficiency parameters, with little interest in labor losses among the unemployed or unskilled (2004).

The current policies described above leave little room or incentive for helping unemployed rural remote women take care of themselves or sick family members: the cost, or value, of their rural unpaid caretaking reproductive chores simply does not fit into a certain kind of formal monetary economic equation. In this context, tax expenditures on health become an issue of morality (Natrass, 2004) or compassion (Poku, 2004). As evidenced by past health expenditures in Africa, these particular issues have not been the top priorities of high-ranking economic policy decision-makers.

In this study, the resulting unpaid double-duties of rural women are exemplified by women having to struggle with the spatio-temporal allocation of firewood production chores in addition to the reproductive chore of HIV/AIDS caretaking in a rural context with already consisting labor constraints due to male out-migration. These overall rural structural labor constraints make for a high impact of HIV/AIDS in these areas, even if the prevalence is low (de Waal, 2004).

As another example of such overall labor constraints, previous South African research has shown there is less time spent in the field to find more time for firewood collection in households where the person who died from HIV/AIDS was the resource collector (Hunter et al., 2005). Due to the engineering of past apartheid policies,

subsistence agriculture is not the focal point of livelihoods for households in the former homelands – remittances are (Andrews, 2003).

This was also evident in the study, in the 24-hour food recall: it was extremely rare for any of the two or three daily meals to come from the garden only. Therefore, I would like to echo the caveat put forth by Kashula based on her work on food-security and HIV/AIDS in the neighboring province of Kwa-Zulu Natal: policy-makers should focus more on long-term structural goals of supplying broadly based health services and steady employment, not short-term quick fixes for labor-saving agricultural strategies (2008). In a gender context, Kaschula's recommendation is mirrored by Kabeer's critique of Boserup's focus on tools as the problem rather than hierarchal gender social relations (1994). In the context of this study, there are no quick-fix-tools to solve women's struggle to juggle HIV/AIDS caretaking with the time-demanding chore of firewood collection.

This rural micro-geography study suggests spatial environmental behaviors shaped by a concurrent multi-scale political ecology influenced by the continued so-called underdevelopment of the former homelands. In short, it pushes the study findings and contextualizing literature review into a political ecology of disease theoretical framework, or more specifically, a political ecology of HIV/AIDS. However, due to the unfortunate and, more importantly, unfair current stigmatization of people suffering from this epidemic, such a particular strand of a political ecology of disease needs to heed Robbins' advice to look at the possible changing landscape as "a political ecology of transitions, rather than unhealthy/healthy or broken/fixed ecosystems" (2005:104).

A reproduction of poor health and poverty

This political ecology of disease also incorporates issues of poverty. Poor households who cannot afford paraffin as an alternative energy source are therefore more dependent on free woodland resources than are rich households. Even though wealth did not produce a high leverage estimate in the overall regression, this variable was still statistically significant at $p \leq .01$.

As mentioned earlier, the findings of this study suggest that poor households with HIV/AIDS-proxies are more vulnerable than wealthier households with HIV/AIDS-proxies as they do not have the monies for alternative energy resources. This added vulnerability of poor HIV/AIDS-proxy households would support medical anthropologist Leatherman's articulation of a downward spiral of a political ecology of disease, where a lack of assets and health "each serves to (re)produce the other" (2005:50).

This spiral of decline is further compounded by the relationship of food and firewood. Tests of the village data suggesting a general correlation between a perception of firewood scarcity and food scarcity could support Barany's (2005) finding that a lack of firewood led to 6% of households skipping meals in HIV/AIDS households. For this study, there was no statistical evidence, however, to suggest that HIV/AIDS-proxy households were more prone to borrowing food than non-HIV/AIDS-proxy households. This, in turn, should not be interpreted as a sign that the former households have all the food they need, especially those belonging to the poorest category. Instead, it could be a sign that the most vulnerable of HIV/AIDS households have been forced to pull out of the system of reciprocity upon which the food exchange network rests, as illustrated by Leatherman (2005). Such a withdrawal could augment the speed of the overall spiraling decline.

In the spirit of political ecology, this particular production of a possible landscape shaped by HIV/AIDS is ultimately neither driven by the human local producers – the women and girls left behind – nor by the actual epidemic itself. Instead, there is a need to look at the degree of effectiveness of a sustainable management of natural resources; the restoration of an encompassing public health services; and the alleviation of poverty as the major drivers of global emerging diseases (McMichael, 2004), and as the ultimate drivers of the subsequent changing production of these remote rural landscapes.

Women's Spatial Individual Agency

As we explore women's spatial mobility, or lack thereof, due to such a political ecology of HIV/AIDS, their travel must not be reduced to structural constraints only. The lack of statistical correlation between the third variable in the regression equation – generational company – to that of the other two major variables – health and socio-economic status – seems to offer women some amount of flexible agency.

The findings of this study suggest that whereas health constricts women's firewood spatial trajectories, adult-only social collective gatherings tend to expand these trajectories. A woman's choice for social company can thus be seen as an example of individual agency. In her anthropological study from the neighboring district of Willowvale, Liebenberg (1994) noted that adult women sometimes choose to go further in their external household chores than they need to, in order to rebel against the demands of the homestead. Even though this note related to adult daughters-in-law wanting to get away from the demands put upon them by their mothers-in-law, other women also need relief from the pressure put upon them as constant caretakers of the whole household.

Such an individual agency rebels against the contextual predictable structural constraints based purely on spatio-temporal foraging efficiency, as argued by Joseph (2002) in her OFT critique. As an example, this study found that despite being pressed for time, some women from HIV/AIDS-proxy households do sometimes accompany other adult women even though this might result in a larger time-investment, as the spatial trajectory is more likely to be longer than when they go with their daughters or alone. When testing the company of adult women from HIV/AIDS-proxy households, there was no consistent pattern of them repeatedly turning down adult only firewood collection company. In response, one could argue that time-constrained adults choose to go only with those other adults who are in the same time-constrained position. However, interviews held in the village support the notion that women choose their firewood collection company based primarily on a very close spatial proximity to the homestead in a village where households of varying wealth and health status are interspersed with another. There are no spatial clusters, as in sub-neighborhoods, of the exceedingly poor or exceedingly sick within the village.

Consequently, women from HIV/AIDS-proxy households might choose to go with other adults for the simple reason that they – perhaps even more so than other women – feel the need to socialize with other adult women and to get some space and time away from the burdens of the homestead. All such socializing would, however, be performed under the guise of performing household chores. In any case, this could be an area of future research: a study of the particular household characteristics, in a spatial mapping of adult women's firewood collection networks.

Generational company can also be seen as an external household social investment in needed resources for present and future work-exchanges in the field. This social resource demands a spatio-temporal firewood collection investment, however, as a group of adult women tend to walk longer distances, according to the regression analysis. The regression finding of this study suggests that such repeated social spatio-temporal investments could be problematic for HIV/AIDS households with agricultural plots as they are more confined in their spatial behaviors due to the possible added care-burden of the ill. Consequently, their labor constraints can be compounded further as they possibly have to withdraw from the reciprocal nature of field work-exchanges.

As part of this spatial agency, women also seem to define time-saving in a way that makes most sense to them based upon what seems to be personal preference – some women find excursions for firewood collection with girls time-consuming, others argue just the opposite. This difference of perspective could be tied to the issue of personal opportunity costs. That is, what would a woman lose by spending time with adults as opposed to choosing the company of daughters? Quantifying these possible opportunity costs could be an area of future research. To conclude, the findings show that not everything can be explained by broad overriding characteristics such as health or poverty; there is also a component of personal choice and perception.

A Feminist Geography of the Hidden Harvesters

The vital asset of women's spatial mobility is confined by the main structural constraint of HIV/AIDS and expanded by a certain amount of individual agency in the form of generational company chosen. Nevertheless, these alternately confining and expanding spatial patterns are not easily detected or differentiated from each other on the larger-scale land use satellite pictures popular amongst many policy makers for

making broad-level decisions, where local-level data becomes a lesser priority (Turner, 2003).

Just because this study is done on a small micro-scale does not mean that the issues these women face should be considered “small problems” in relation to the favored large-scale projects just mentioned. The possible micro-changing patterns and possible further constraints could have serious repercussions for the women themselves in the event of future environmental changes that would push distances needed for travel.

The findings of this study suggest that the aptly named “hidden harvest” (IIED, 1995) could be further shaped by an epidemic of which most people wish not to speak, while creating possible small-scale changes not visible to the large-scale land use projects. Heeding Turner’s advice for more work on socialized micro-geographies (2003), feminist geographers have made a point of bring out local level data about women, specifically, and their immediate finite-scale environment (Kwan, 2002c; McLafferty, 2002; Pavlovskaya, 2007). Almost all of the feminist studies take place in an urban or peri-urban Northern hemisphere context, however. This study adds a much-needed rural Southern hemisphere example of women’s socialized micro-geographies.

Following in these feminist geographers’ footsteps, but adding a rural Southern hemisphere experience to this knowledge, this study traces the spatial trajectories of the female collectors of the “hidden harvest.” By doing so, this project has unraveled the possible consequences of women’s “hidden” use of time and space as they juggle productive and reproductive chores. In addition, this project has also uncovered the

“hidden” emotions, such as fear, that can also drive spatial behaviors, contrary to the OFT caloric-centered efficient-driven models.

Also, just as urban geographer Kwan expressed a restricted racialized “closeted spatiality” (2002b: 654) for African-American women in comparison to job access opportunities of Caucasian women in the U.S., this project suggests a similar “closeted spatiality” for rural women in households afflicted with HIV/AIDS. That is, this project revealed a more restricted spatial confinement and subsequent possible intensified extraction of firewood materials that warrants further attention.

By pointing to the possible silent driver (HIV/AIDS) of a hidden harvest extraction (firewood) by a neglected group of natural resource users (women), this study seeks to shine a light on new rural spatial categories of women’s everyday experiences while recognizing the human complexity and variety of that same experience.

Table 4-1. Descriptive distribution statistics for female adult one-way spatial trajectories

Readings (n)	Range (km)	Median (km)	Mean (km)	Standard deviation
54	0.15–1.57	0.64	0.68	0.30

Table 4-2. Student's t comparison of distance covered over three different seasons

Season comparison	Difference (km)	p-value
First and third season	0.05	.6490
Second and third season	0.04	.6755
Third and first season	0.00	.9868

t=2.008 at $\alpha=.05$ and n=54

Table 4-3. REML model estimating the probabilities of impact on spatial trajectories

Independent variable	DF	t-value	Probability
Intercept	19.27	11.41	<0.0001
No HIV/AIDS-proxies	18.12	2.30	0.0336
Total ZAR	17.94	-2.66	0.0161
Adults not accompanied by other adults	45.95	-2.35	0.0234

R²=.77, adjusted R²=.76, and n=54

Table 4-4. GLIMMIX Pearson Panel model predicting the effects on spatial trajectories

Independent variable	Beta coefficient estimate	Standard error	DF	t-value	Probability
Intercept	0.7570	0.10	25.09	7.34	<0.0001
No HIV/AIDS-proxies	0.2646	0.10	18.97	2.52	0.0209
Total ZAR	-7.76E-6	2.68E-6	18.55	-2.89	0.0095
Adults not accompanied by other adults	-0.1911	0.07	44.04	-2.65	0.0111

Table 4-5. Student's t comparison of distance and reasons for choosing site

Comparison "abundance of firewood" and "proximity of site"	Mean difference of one-way distance covered (km)	p-value
Abundance vs. proximity	0.19	.0530

t=2.01 at $\alpha=0.05$ and n=54

Table 4-6. Contingency analysis comparing paraffin use between destitute and non-destitute households

Household profile		Households using paraffin	
		No (N=92)	Yes (N=11)
Household profile	Destitute households (N=35)	37%	9%
	Non-destitute households (N=68)	63%	91%

$\chi^2 = 4.12$, df=1, $p=.0425$, and N=103

Table 4-7. Descriptive statistics for aggregated agricultural assets in the village

Readings (N)	Range (ZAR)	Median (ZAR)	Mean (ZAR)	Standard deviation
103	0-146,300	11,050	21,445	29,672

Table 4-8. Contingency analysis table comparing female vs. male head of household with agricultural asset profile

		Household profile	
		Destitute (N=35)	Non-destitute (N=68)
Head of household	Male (N=69)	54%	74%
	Female (N=34)	46%	26%

$\chi^2 = 3.87$, $df=1$, $p=.0492$, and $N=103$

Table 4-9. Wilcoxon rank sum test to compare mean assets of female vs. male head of household

Head	Count	Mean (ZAR)	Score mean
Male head of household	69	26,505	57.97
Female head of household	34	11,176	39.88

Z-score= -2.89, $p=0.0039$, and $N=103$

Table 4-10. Contingency analysis table comparing head of household with households not receiving any child-care grants

		Household eligible for child grants	
		Receiving all or some for which they are eligible (N=95)	Not receiving any child grants for which they are eligible (N=8)
Head of household	Male (N=69)	70%	38%
	Female (N=34)	30%	62%

$\chi^2 = 3.41$, $p=.0648$, and $N=103$

Table 4-11. Regression adjusted estimates for covariance means

Group Variable	Total ZAR group mean	Adjusted estimate	SE	DF	t-value	Pr > t
Destitute: no HIV/AIDS-proxies	325	0.9235	0.07	20.45	12.42	< 0.0001
Destitute HIV/AIDS-proxies	325	0.6589	0.09	19.34	7.04	< 0.0001
Coping: no HIV/AIDS-proxies	12,750	0.8271	0.06	21.95	13.84	< 0.0001
Coping: HIV/AIDS-proxies	12,750	0.5625	0.09	18.96	6.41	< 0.0001
Accumulators: no HIV/AIDS-proxies	50,000	0.5381	0.10	19.88	5.13	< 0.0001
Accumulators: HIV/AIDS-proxies	50,000	0.2735	0.13	18.12	2.05	0.0555

Table 4-12. Regression without adjusting for covariate means

Variable	Estimate	SE	DF	t-value	Pr > t
All groups: no HIV/AIDS-proxies	0.8029	0.06	22.20	13.27	< 0.0001
All groups: HIV/AIDS-proxies	0.5383	0.09	18.83	5.21	< 0.0001

Table 4-13. Descriptive statistics of how often households borrow/lend out food and size of food network

Category	Range	Median	Mean	Standard deviation
Borrow food	0-5	0	0.87	1.26
Lent out food	0-4	1	1.30	1.27
Food network	0-5	2	2.25	1.04

Table 4-14. Kruskal-Wallis rank sum test to compare food borrowing with garden size

Garden size	Count	Mean borrowed food	Score mean
None	24	0.67	48.12
Small	28	0.54	45.08
Medium	38	1.32	61.62
Large	13	0.69	45.92

$\chi^2 = 8.21$, $df=3$, $p=.0418$, and $N=103$

Table 4-15. Kruskal-Wallis rank sum test to compare collection with size of garden

Garden size	Count	Mean times firewood collected	Score mean
None	24	1.50	44.96
Small	28	1.64	45.59
Medium	38	2.16	56.62
Large	13	2.77	65.31

$\chi^2 = 6.39$, $df=3$, $p=.0941$, and $N=103$

Table 4-16. Wilcoxon rank sum test to compare food borrowing with perceiving firewood scarcity

Perceiving scarcity of firewood materials	Count	Mean times borrowing food	Score mean
No	60	0.65	47.50
Yes	43	1.19	58.28

Z-score= 2.04, $p=0.0408$, and $N=103$

Table 4-17. Distribution of generational company of adult firewood collectors

Who goes to collect firewood and with whom	Percentage (N=103)
Only daughters go to collect firewood	5%
Adult goes solo	8%
Adult goes with daughters only	17%
Adult goes with other adults	38%
Adult goes with other adults and daughters	32%

Table 4-18. Contingency analysis table comparing work exchanges with plot size

		Work exchanges to work field plot	
		No (N=54)	Yes (N=49)
Household	No or small plot (N=56)	83%	22%
	Average or large plot (N=47)	17%	78%

$\chi^2=38.38$, $p<.0001$, and $N=103$

Table 4-19. Contingency analysis table comparing firewood collection company with work exchanges

		Overall firewood collection company over three seasons	
		Alone or with girls only (n=7)	With adults only or with adults and girls (n=14)
Involved in plot work exchange	No (n=14)	100%	50%
	Yes (n=7)	0%	50%

Fisher's exact right tail test: probability=.0295, n=21

Table 4-20. Descriptive statistics for amount of firewood collected by women

Readings (n)	Range (kg)	Median (kg)	Mean (kg)	Standard deviation
54	9 –43	30.50	29.25	6.78

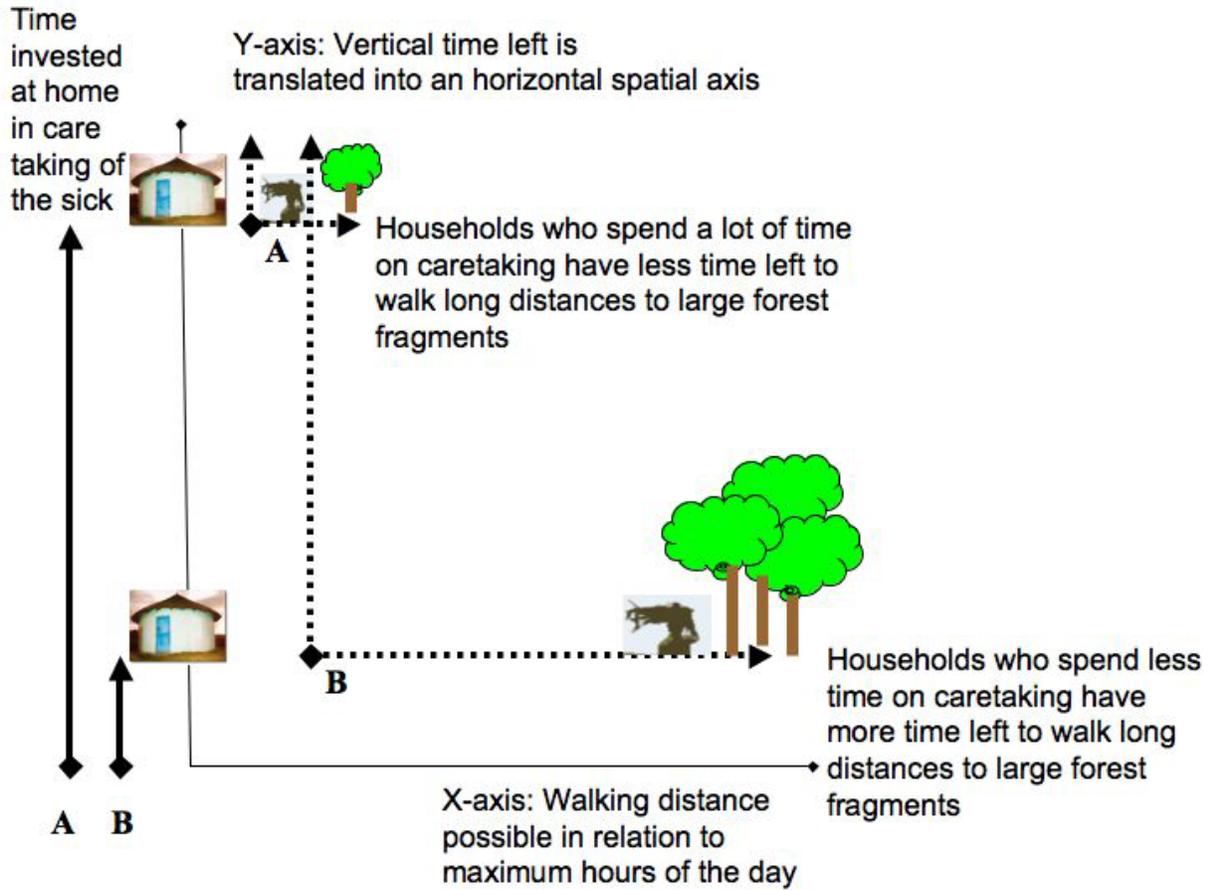


Figure 4-1. Spatio-temporal schematic. Suggested (visually exaggerated) varying relationship of constraints for HIV/AIDS-proxy households (A) and non-HIV/AIDS-proxy households (B). Source: Britt Coles

CHAPTER 5 INTRA-HOUSEHOLD VARIABILITY: AGE

Data Analysis Overview

This chapter is the second and final analytical chapter including both results and subsequent discussions. Having looked at variance of spatial distances in relation to firewood collection amongst adults in the previous chapter, this chapter shifts the focus onto girls' possible spatial variances in the village of Nqileni on South Africa's Wild Coast. Girls are taught at a young age how to collect firewood in workshops conducted by adult women, see Figure 5-1. The youngest girl who participated in the study was 10 years old and the oldest was 17 years old. In this chapter, the spatial distances covered by girls for firewood collection are also compared to those of adult women in the village.

As in the previous analytical chapter, the majority of the statistical procedures were performed in JMP® 7.0 for Macintosh (1989-2007). The one exception to these procedures is the one case when the GLIMMIX Pearson Panel procedure was run in SAS® 9.2 (2008) on a Windows XP platform for more exact beta coefficients.

First, girls' variance is introduced with the unveiling of the result of a main generalized linear regression model. Following the organization of the previous chapter, this model is preceded, however, by a brief presentation of the girls' distribution of the dependent variable, spatial distance, as well as the pre-regression variable selection procedure. The final chosen model predicts the effects on girls' spatial distance by looking at only one variable: the number of people who go together to collect firewood.

A closer examination of this one variable unveils that the number of people is closely related to the nature of the generational company. Consequently, there is a distinct difference between girls and adults, with the latter seeming to be influenced by

health and socio-economic constraints as well. In contrast, girls seem to have much less spatial structural constraints and, consequently, more individual agency.

The sole variable is presented and discussed in the context of further statistical tests – including independent t-tests, χ^2 tests, and Fisher's exact tests – of both the complete household village survey as well as the sampled focal household data to explore possible further connections.

As with the adult analytical chapter, before moving onto the overall concluding discussion, this chapter also presents and discusses girls' preferences in generational company as well as the variance in how much girls carry.

Because the influence of generational company was the only significant variable of this main regression model, this chapter concludes with an overall discussion of not only girls' spatial distance variance but also the difference between girls and adult women's contextual constraints. More specifically, this concluding section summarizes the main findings; situates the results in a larger context, and expands the discussion on the differences and similarities of women and girls' spatial distances covered for firewood collection.

Spatial Distance Distribution

The final regression model predicts the effect of one variable on the one-way spatial distance of girls collecting firewood across three different seasons. All the spatial trajectories were undertaken by foot, with the girls carrying the firewood back home on their heads, just like their mothers do. The readings reflect the one-way trajectory away from home to the furthest point of firewood collection traveled within the chosen forest fragment. In all readings, just as was the case with adults, the girls chose one, and only

one, particular forest fragment for each firewood collection event. The girls would also alternate between different forest fragments for different firewood collection events.

A statistical distribution overview of all the spatial trajectories across three different seasons – the dependent variable of interest – is shown in Table 5-1 for both girls and adults. The number of complete seasonal readings covered by the distribution in Table 5-1 show that not all girls from 21 households were able to produce readings for all three seasons. The two missing seasonal readings were due to one girl going away for a temporary stay with relatives during the summer school vacation and another girl suffering from a sudden extended illness in the same season. None of the missed seasonal readings were due to a requested withdrawal from the study.

First, in a quick comparison of girl and adult spatial distances, the maximum distance (2.65 km) and mean (1.02 km) measures of girls' one-way trajectory are substantially longer than those of adults' maximum (1.57 km) and mean (0.68 km) measures, see Table 5-1. Consequently, there is a much bigger range of distances among the readings produced by girls than that of adults, with girls' readings being more dispersed around the mean. At the same time, this bigger range among girls is explained by fewer variables than that of adults' smaller range. This one variable of influence for girls – the number of people in the firewood collection party – will be covered more in depth shortly. As an introductory remark, however, it seems that this one sole variable still offers a great variety of spatial behaviors.

In addition, as was the case with adults, the girls' distribution presented in Table 5-1 produced a median (0.75 km) that is less than the mean (1.02) of the spatial trajectories, suggesting a distribution that is skewed to the right, with the longer tail in

the higher range of the spatial readings. As the smallest value in the distribution is the same in the distribution of both adults and girls, we can see that girls standard deviations is even higher than that of adults, both distributions being quite skewed as the smallest reading is even smaller than one standard deviation. The girls' distribution has a consequent skewness measure of 0.84, quite higher than that of adults' distribution skewness of .67. Therefore, even though the girls have more observations in a higher spatial range than adults, the majority of readings still tended to be in the lower range. Unlike the adult distribution of spatial readings, the girls' spatial readings did not pass a Shapiro-Wilk normal distribution goodness of fit test.

This propensity of the girls' distribution towards the shorter distances could help explain another model that showed that even though girls' overall range and mean was substantially longer than that of adults, there was no statistically significant difference between the spatial least squares means recorded by women collecting with other women only, 0.88 km (SE: 0.16), and those of girls collecting with other girls only 1.09 km (SE 0.11), with a REML generational fixed effects test of $F(49.71)=1.66$ and $p=.2033$. This separate REML mixed model – including a random intercept effect for each variable to correct for measuring the same individual multiple times – had a $R^2=.48$ and adjusted $R^2=.47$.

When I asked the adult women in the village who they thought walked the furthest, them or the girls, the women would laugh and point to themselves. This lack of faith in girls' spatial mobility could perhaps be explained by the fact that, contrary to what adult women in the village might think, girls seemed to walk further when they went with other

girls than when they collected with adults, as will be shown in the main regression model later on in this chapter.

Lack of Seasonal Variability

Before moving on to the variable selection procedure, a possible influence of variance due to seasonal differences needed to be tested, just like the adult variance was tested in the previous chapter. Again, this testing for seasonal variability was the major reason for doing repeated measures across three different seasons rather than conducting new seasonal tests with a new set of households. Also, the repeated measures helped “stabilize” the many spatial readings of the same household.

Therefore, a REML model test was run to see if there was seasonal variability of one-way firewood trajectories conducted in the three different non-rainy seasons between September 2008 and June 2009. This model gave a fixed seasonal effects test of $F(2)=0.56$, $p=.5732$. As was the case with adults, the seasonal difference of spatial distance is not statistically significant across seasons. The subsequent analysis therefore rests on the deduction that further testing of variability can be traced to the girl firewood collector characteristics of interest, not differing seasonal constraints.

Variable Selection

Prior to running a regression analysis, a variable selection process was performed with the help of a mixed (back and forth) stepwise regression ($\alpha = 0.05$). Only one variable came out as significant in this stepwise regression process: the number of people who accompanied the girl to collect firewood. Consequently, as opposed to the adult model, the final model for girls did not include HIV/AIDS-proxies or socio-economic status of the household.

It seems then that girls are overall less constrained than are adults. That is, even though girls were constantly seen helping their mothers to perform chores in the village daily life, girls' different stage in the female life cycle still seems to offer them some reprieve from the larger constraints of female adulthood, at least as they relate to spatial firewood collection.

The situation for children in child-headed households would probably be different from children in adult-headed households as the former are forced to shoulder the responsibilities of grown-ups in the absence of adults. According to the village survey, there were no such child-headed households in the village, however. A comparison of the possible variance between such two groups of children in other geographic locales could be an area of future research.

Regression Relationship of Girls' Inter-Household Variability

The final bi-variate model was first run in a basic regression REML mixed model including a random intercept effect for each variable to correct for measuring the same individual multiple times across seasons. This REML procedure gave a final model summary fit of $R^2=.72$ and an adjusted $R^2=.71$, $n=61$. The only likelihood coefficient – the number of people in the firewood collection group – had $t(51.56)=3.43$ and $p=.0012$ for $n=61$.

As with adults, having verified the power of the final model as well as the statistical significance of the coefficient estimate in a basic statistical software, the final bi-variate model above was brought into the statistical programming SAS® software to produce a more precise likelihood coefficient with the help of the GLIMMIX Pearson panel procedure. This model revealed that the only influential variable, the number of people

collecting, lead to an increase of 0.1282 km as the spatial distance increased by a factor of 1 km (12.82%), see Table 5-2.

An examination of the resulting residuals output plots of the final model verified that all assumptions of normality, independence (no collinearity) and constant variance had been met.

Influence of Generational Company

A Quantitative Variable Reveals Qualitative Characteristics

The linear effect of the one-way distance covered as a result of the number of number of people who went out together to collect firewood is shown in Figure 5-2. The graph in Figure 5-2 shows that the more people who join in the firewood collection company, the further they travel. A further analysis of the larger firewood collection groups companies suggests “the more the merrier,” as in a younger, potentially more playful crowd, because when analyzing this one variable further, a greater number of people translated into a girls-only crowd, no adults included.

In this context, I wish to bring back the earlier mentioning of a female spatial range possibly being expanded by social interaction as was evidenced by adult female collectors in this same study. To recap, when adult women collected firewood with other adult women only, they tended to travel further according to the findings of this study. In the context of this finding, I also mentioned the anthropological note found in the neighboring village where females had used spatially distant locations as acts of defiance, as illustrated by Liebenberg (1994).

Subsequently, as girls in the village were seen helping their mothers all day long, it seems that young females also favor longer trips to be able to work and play with their peers away from the demands of the home. Such social avoidance foraging behaviors

by children are similar to those found not only among adults of this study but also by adults in the Baksh study (1990).

As shown in Figure 5-3, when girls are accompanied by adults only (category #6), this turns out to be quite a small group of people collecting together, mostly consisting of the daughter and her mother and in some rare cases a daughter and her mother as well as an auntie or an adult neighbor. If there are other girls accompanying the adults and the girl (category #8) the group can get a bit larger (this group only produced three events though so I would hesitate to make too big of a case of this one here and in Table 5-3). However, when the girls come together to go for firewood by themselves (category #7), some of these groups expanded to become the biggest groups in terms of numbers, with these groups traveling the furthest away from home.

To see if there was a statistical difference when comparing the different generational groups shown in Figure 5-3, a non-parametric Kruskal-Wallis test was run, see Table 5-3. As a comparison, the overall mean number is also included in the results of this Kruskal-Wallis test. A subsequent 1-way χ^2 approximation test produced $\chi^2=21.26$, $df=3$, $p<.0001$. Therefore, there does seem to be a statistically significant difference in the nature of generational firewood collection groups in relation to the number of people who go out together.

Spatial Distance Variance Among Girls' Firewood Collection Groups

After looking at differences across generations, I now turn to look at differences within the group of young girls themselves. When examining the age distribution frequency of girls who went with the different sized groups, younger girls – except for the very youngest – seemed to be more inclined to form larger groups and thus walk

further. Subsequently, a statistical test was run to compare girls 11-15 years old with those who were older or younger to see if there was any difference in the size of firewood collection companies they joined, see Table 5-4 (as a comparison, mean values are also included in the Wilcoxon rank sum). A subsequent 2-sample test, normal approximation gave the Z-score= -2.24, $p=.0254$. There does seem to be a statistically significant difference at $p<.05$ for the two groups. That is, these tests suggest that girls between 11-15 years old have larger firewood collection groups than girls younger than 11 and older than 15. It would seem that girls younger than 11 might not quite have the stamina to walk as far as the girls in large groups do, as they need to carry all that firewood back home. Also, it could be that girls older than 15 are preparing for their roles as women by joining smaller groups. Because, as a comparison, groups of female adults were never as big as those of girls when the adults went out together to collect firewood in an adults only group. The adult groups consisted of two to three women at the most, including the woman herself. At only two occasions did such an adults only group consist of as many as five women in total.

A possible reason for this generational difference in the number of people in the groups could be the varying quality in the so-called spatiality of these social networks themselves, as will be discussed more in the following section when talking to girls about their preferences. As with adults, follow-up interviews revealed that there were a variety of answers in response to the question with whom the girls preferred to go. Some preferred the company of other girls whereas others preferred that of adults or to go alone.

Girls Who Prefer to Go with Other Girls: Three Recurrent Themes

For girls who preferred to go with other adults, there were only three recurrent themes that came to the surface in the open-ended interviews: fear of the forest, unhappiness with accompanying adult collectors, and the social advantages of going with other girls. These three themes are identical to those of adults, but this time with a girl-centered variation.

Theme one: fear of the forest

As with adults, the girls feared wild animals and a more non-descript area of the unknown. This is why they preferred to go with other girls, they said. As with the adults in the village, the girls said that they did not fear sexual violence in the forest.

Even though it would seem that fear could easily be transferred from one generation to the next, I failed to find such an obvious pattern in my interviews with the women and girls. For example, in one of the interviews when one of the girls said she felt frightened when going to the forest, the mother stopped sweeping the floor of the hut and asked the girl directly “afraid of what?” In response, the girl solemnly described being fearful of what could culturally be translated as zombie-like creatures that were said to roam the forest. Upon hearing this, the mother laughed and shook her head. “There is no such thing,” she said to the girl and then turned to us. “Me,” the mother said, “I am not afraid of going to the forest alone...” (Interview #100, December 14, 2008). Perhaps some girls found more solace in going with other girls who are as afraid of the forest as they are, rather than be ignored by adults who might have similar reactions as the mother above.

Theme two: disadvantages of fast and busy adult collectors

Other girls also spoke of the disadvantages of going with adults. Some girls complained that adults walked too fast for them: the girls had a hard time keeping up. A few girls also said that it was better to ask other girls or sisters so they did not have to bother adults who were often very busy and did not have the time.

In between busy adults and playful girls, was also the option of going with older girls, on the brink of adulthood, but still considered girls as they were not old enough to marry. Consequently, younger girls were often matched up to go with older girls to learn from the latter. However, the older girls complained to me that once the group of girls reached the firewood collection site, the younger girls would often go off to their own site a bit further away from where the older girls were collecting. The young girls did this, the older girls explained, so they could have an opportunity to play while collecting, away from the watchful eyes of the older girls.

Theme three: the social advantages of girls

As with adults, the final and most popular reason girls liked to go with other girls was the social aspect, to have the opportunity to chat and play while collecting firewood. In contrast to the adults, however, this intragenerational company seemed not to be about building social capital for work exchanges but – more age appropriately – for nurturing friendships formed at school.

It seems that due to the intense schedule of chores for young girls when they are at home with their mothers, firewood collection away from the home is subsequently turned into girls' playtime as well. According to the previous finding discussed, as the group of girls became larger, the young girls seemed to become even bolder in their extended spatial rebellion away from home. One young girl smiled sheepishly but

whispered softly “if we walk far away mother cannot call us back to do chores” (Interview #74 November 25, 2008).

As part of this play-work world, the local girls also told me that they often make plans for firewood collection for the following day while they are at recess in school. Subsequently, in the follow-up interviews, when I asked the girls where the other girls lived with whom they had collected firewood, some of those girls lived a few hundred meters away (yet still within the boundaries of the village). These spatially distant networks are supported, however, by the girls’ daily interaction at the same village school in the far northern part of the village.

Consequently, these social networks also seemed dependent upon the “play-worthiness” of the accompanying girl, or, as one young female said, “if a girl seems silly we don’t invite her to go with us for firewood” (Interview #80 November 29, 2008). The make-up of the firewood collection group also seemed to differ depending upon the girls’ changing priorities of who was their closest friend that week. Again, the act of firewood collection seems very much to be part of the changing social fabric that is an extenuation of what happens during school.

In contrast, adult women told me that if they make plans to go with other women, they do so with women in their food network who live very close by. The adult social spatial network therefore seems to be more constricted – as in having a smaller radius – than the social spatial network of young girls. The smaller radius of the adult women’s networks could also help explain why these groups are much smaller in size than the big networks formed by girls at school. It would seem that out of practical reasons, women do not have time to make too big and too vast a spatial social network for the

firewood groups that also function as food exchanges networks, as mentioned in the previous chapter. It would take considerable time to nurture big spatial social networks as there is no daily adult central collective point like that of the girls' school. Also, the adult women did not seem to be as discriminating as girls in their firewood collection company. When the women had not made plans with other women, they said they would often just run after any woman they would see heading towards the forest, so as not to have to go alone.

Girls Who Prefer Not to Go with Other Girls

Even though many girls enjoyed the social time spent with other girls, a number of girls felt just the opposite. There was a quiet but resolute determination amongst these girls who said they preferred to go with adults because they were “more efficient than girls who just chat and do silly play” (Interview #82 November 29, 2008). In addition, other girls complained that the silly play also made girls stay out too long. One girl said solemnly that she “likes to go alone to be back quickly; the girls just play, and I must work at home to help mother” (Interview #90 December 10, 2008).

Finally, adults were also valued for their accumulated experience of firewood collection sites: “Auntie knows where to go,” explained one girl (Interview #93 December 10, 2008).

The Firewood Burden of Girls

Before concluding this chapter on girls, I want to briefly look at not only variance in distance but also at a possible variance of how much girls collected, as I did with the adults. Therefore, I will first present an overall distribution of not only how much girls carried but also show the comparison of that distribution with that of adults. Secondly, having found no variance in the amount women collected with different generational

companies, I wanted to see if there was a statistical difference for girls. First, however, I want to contextualize the subsequent results and discussion by presenting the overall distribution and comparison of kg carried by girls and women for the spatial recordings recorded. As noted by the relationship of the median (21 kg) vs. the mean (21 kg) in Table 5-5, the normal distribution of girls collected amount is only slightly skewed: the distribution is fairly evenly distributed between heavy and light firewood bundles. The median and mean weight carried by girls is around two thirds of that of adults. This is quite an impressive production considering that the mean body weight of all these young girls seemed to be much less than two thirds of the average body weight of grown-ups. Their contribution is even more admirable if one takes the local occurrences of possible stilted growth into consideration. As expected, the variance of age amongst the girls influenced how much they were able to carry, however, as shown in Table 5-6. This REML mixed model had a $R^2=.51$ and an adjusted $R^2=.50$. The result of the fixed effects test of this REML model was statistically significant at $p<.01$.

As a parallel to the earlier discussions, further statistical tests revealed that the girls collected much less firewood when they went with adults than when they went by themselves or with other girls as shown in Figure 5-4. The REML mixed model with a random intercept effect for each variable shown in Figure 5-4 had $R^2=.54$ and adjusted $R^2=.51$, $n=61$. As part of this test, an additional fixed effects test was performed to look at the leverage of the amount collected, see Table 5-7. This fixed effects test shows a statistically significant difference at $p<.1$ of how much the girls collected depending upon the generational profile of the females who accompanied them. Being the sole girl in a company of only adults seems to have a negative impact on how much girls carry.

Because the girls' firewood experience with other girls differs from that when they accompany adults, this could be one of the reasons that some adults underestimate both the distance traveled and the amount that girls bring back. While the adults might not be aware of the girls' varying contribution, the young girls themselves seem to be quite aware of the specific contribution of their peers, however. This could be a reason that girls carry more, in addition to travel further, in the company of other girls: girls might feel more competitive with one another than when they are with adults who can carry so much more than they can. One of the days when my interpreter/research assistant and I accompanied the girls, one of them suddenly turned to us impulsively and pointed to another young girl in the firewood collection party. "Look at her," she said to us, "see what a small pile of firewood that girl carries back home; she always does that. She is really lazy..." (Interview #10 July 31, 2008).

As a comparison from the previous analytical chapter, contrary to Biran's finding (2004), this study did not show any statistically significant differences in the amount of firewood women collected depending upon the company they kept during the firewood collection: the adult's fixed effects company leverage on the amount they collected was $F(3, 47.37)=0.32, p=.8082$. This study shows that for girls, it is a different story.

In short, this study has found both similarities and differences between adults' and girls' firewood collection. The major findings of this chapter will be discussed and synthesized further in the next section, the overall concluding chapter conclusion, before moving on to the final study conclusion with recommendations and future research directions.

Chapter Conclusion

This analytical chapter adds to previous research on the value of children's work, starting with Nag and his fellow researchers arguing for the economic value of children in the early 1970s. Around 30 years later, Biran, Abbot and Mace (2004) drew similar conclusions in their specific research on women and girls' firewood collection in Malawi (without an HIV/AIDS context, however).

This study adds to Biran and her colleagues' work by not only adding an overall HIV/AIDS perspective to female firewood collection but also by incorporating the more exact measurement of using GPS tools for the spatial readings in order to compare the spatial mobility of women and girls more accurately in a remote part of a former South African homeland. This study's focus on age – as well as other differential qualities of the female experience – therefore heeds Blumberg's advice (1991) to crash Becker's old monolithic unitary household economics view (1981) in order to recognize and highlight intra-household differentiation and contribution according to age.

Consequently, contrary to what the women of the village thought, statistical tests showed no difference between the spatial distances girls and adult women walked when they walked with females of their own generation. (The adult women though, were sure they walked much further than the girls when I asked them). As mentioned earlier, this adult women's misconception could be due to the fact that according to further tests of the readings, girls walked further and collected more firewood in the company of other girls than when they were alone or collected with their mother.

Earlier work by Hawkes (1995) with Hadza women and children also concluded that children's mobility and collection returns were much greater than first assumed (1995). A later study by Bird (2002) in Mer de Torres Straits found that children

foraged in a way that could be seen as maximizing, even though their age-specific constraints could erroneously be seen as the girls being slow learners. Consequently, it seems that in the rural households of the so-called female adult hidden harvesters discussed in the previous chapter, the firewood contribution of girls seems even more hidden than that of adult females.

Because the girls tend to make plans and form their firewood collection networks at school, certain important aspects of these young girls' activities are moved away from the actual home (in addition to the firewood trajectory itself). These school-based social networks probably contribute to the large number of girls of the firewood collection collectives formed by these young females, as opposed to the smaller-sized collectives formed by the collecting adult females.

Perhaps the most important difference found in this study is that girls seem to be less constrained than adult women by the structural constraints of long-term disease as well as poverty. This finding would support Biran (2004) and her colleagues' argument that children's activities add a much needed spatial mobility to complement women's household entrapment. Why is this important? In the context of HIV/AIDS, and this study's finding of a possible consequent constrained spatial mobility of adult women, girls' extended mobility could potentially result in the girls' being able to collect a better quality of firewood than their mother's firewood collected closer to the home. The potential consequent heightened firewood quality as a result of the greater roaming spatial quantity of girls could be an important asset not only to the household but also to help lessen the intensified use of the immediate environment by several households in a

nearby cluster. This could be an area of further research, as will be noted in the next concluding chapter.

Finally, this chapter not only exposed differences but also pointed to one important similarity between women and girls: many of them valued firewood collection as a social activity where they were able to temporarily escape the demands of the home for a few precious hours with peers of their own generation, see Figure 5-5. The need for this social spatial outlet by both women and girls should not be underestimated or ignored. When I walked around in the village, I would almost always see women and girls working incessantly around the house. The only time I watched young girls play around the house was when I saw them skipping while waiting for some other girls to join them for that Saturday morning firewood collection trip. The jump rope, made up of several separate pieces, was quickly disassembled when the last girls arrived. I then realized the true and primary function of these strands – they were used to tie up the collected firewood, not for child's play.



Figure 5-1. Remnants from a village firewood collection workshop held for young girls

Table 5-1. Descriptive distribution statistics for girls and adult spatial trajectories

	n	Range (km)	Median (km)	Mean (km)	Standard deviation
Girls	61	0.15–2.65	0.75	1.02	0.66
Adults	54	0.15–1.57	0.64	0.68	0.30

Table 5-2. GLIMMIX Pearson Panel model predicting the effect on girls' trajectories

Variable	Beta coefficient estimate	Standard error	DF	t-value	Probability
Intercept	0.6068	0.16	49.66	3.70	<0.0005
Number of people collecting	0.1282	0.04	58.79	3.23	0.0021

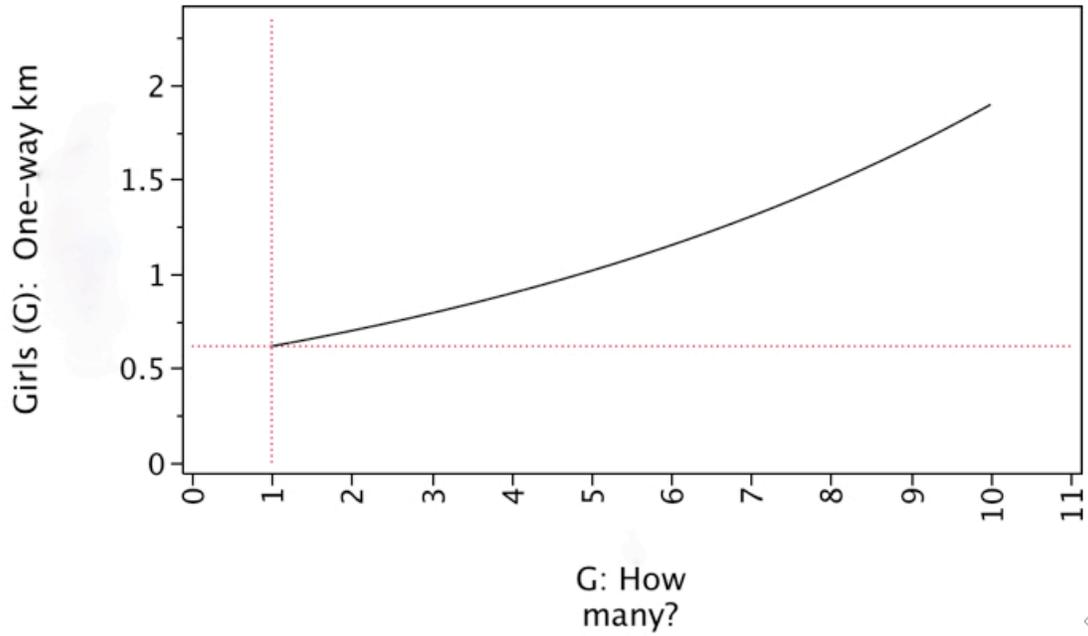


Figure 5-2. Linear relationship between the number of girls who collect together and length they travel

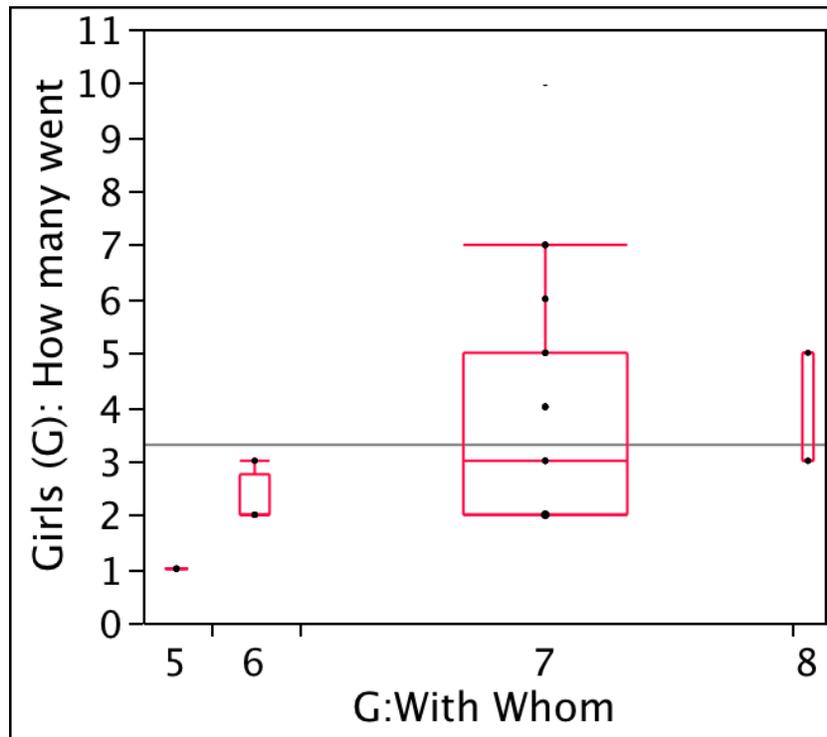


Figure 5-3. Bi-variate relationship of the number of people who collect firewood and the nature of collection company (5: solo, 6: with adults only, 7: with girls only, and 8: with adults and girls)

Table 5-3. Kruskal-Wallis rank sum to test generational group and the number of people collecting

Generational character	Count	Mean number of people	Score mean
Girl went solo	6	1	3.50
Girl went with adults only	8	2 (2.25)	23.12
Girl went with other girls only	44	4 (3.78)	35.56
Girl went with adults and girls	3	4 (3.67)	40.17

$\chi^2=21.26$, $df=3$, $p<.0001$, and $n=61$

Table 5-4. Wilcoxon rank sum test to compare age of girls with number collecting

Age of girls who formed firewood collection companies	Count	Mean size of firewood collection company	Score mean
Girls younger than 11 years old and older than 15 years	12	2 (2.17)	21.08
Girls between 11-15 years	49	4 (3.57)	33.43

Z-score= -2.24, $p=.0254$, and $n=61$

Table 5-5. Descriptive statistics for amount of firewood collected by girls vs. adults

Age group	n	Range (kg)	Median (kg)	Mean (kg)	Standard deviation
Girls	61	6-35	21	21 (21.18)	6.50
Adults	54	9-43	30	29 (29.24)	6.78

Table 5-6. REML mixed model fixed effects test of girls' age leverage on kg carried

Readings (n)	DF	F-ratio	Age probability
61	1, 40.49	11.62	0.0015

$R^2=.51$ and adjusted $R^2=.50$

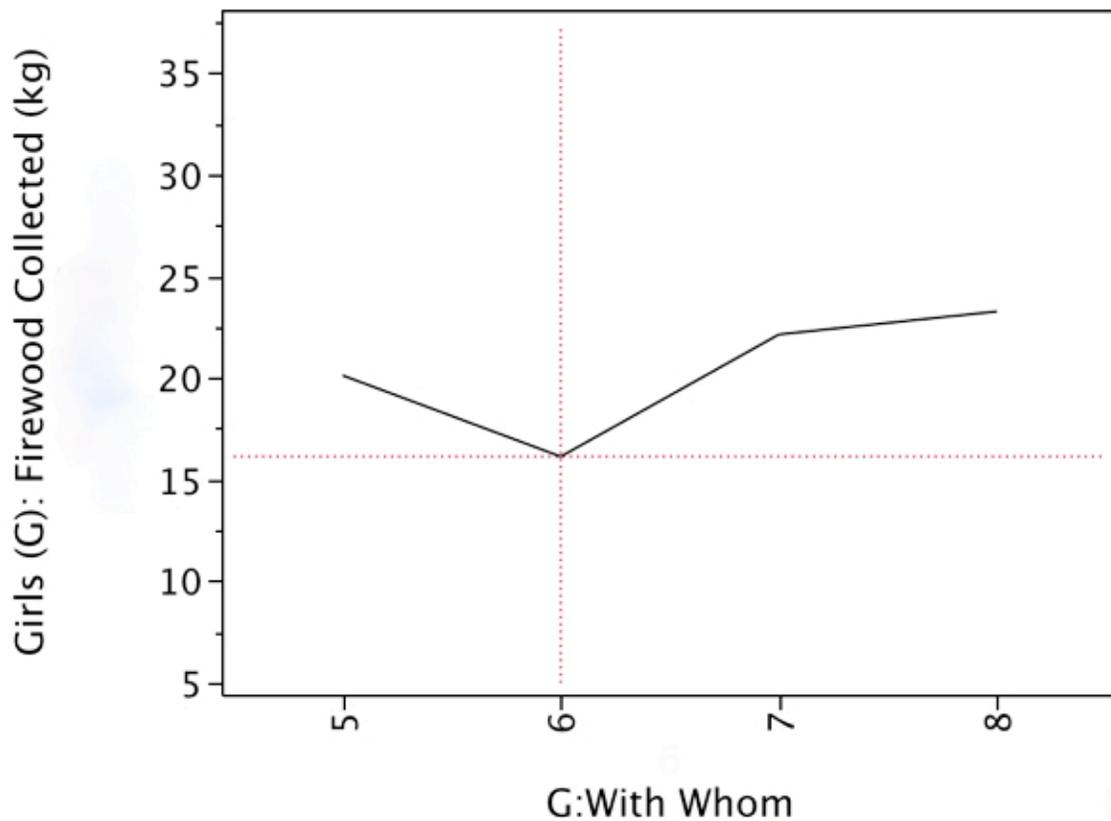


Figure 5-4. Graph showing relationship of amount of firewood collected and girls' collection company (5: alone, 6: other adults only, 7: other girls only, 8: with a mixed group of girls and adults)

Table 5-7. REML mixed model fixed effects test of the company leverage on kg carried

Readings (n)	DF	F-ratio	Age probability
61	3, 49.64	2.61	0.0617



Figure 5-5. A group of girls head back home with their collected firewood

CHAPTER 6 CONCLUSIONS

This study opened with my describing the picture of an African rural woman balancing a bundle of firewood on her head, with a much smaller female carrying an even smaller bundle right behind her. Even though this is a common sight in much of rural Africa, I have argued that there is still plenty to explore about this specifically female rural activity. This activity is truly a balancing act as the women need to allocate their precious time to cover a considerable amount of spatial distances to collect firewood while taking the rest of their chores into consideration as well. According to my findings, girls' firewood balancing act seems to be lesser than that of women's, due to fewer constraints. The findings add to previous research on children's foraging (Hawkes, 1995; Bird, 2002; Biran et al., 2004) by pointing to the existence of a number of different productive agents within the household in the context of a spatial internal economy.

This study set out to further knowledge on the interconnected nature of firewood (Mehretu, 1992; Mahiri, 2001; Dovie, 2004; Barany, 2005) by not only focusing specifically on disease, poverty and age as possible constraints in the context of firewood collection, but also by adding a needed spatial behavioral dimension (Hägerstrand, 1975). There are previous geographical studies that also have looked specifically at the double duties of women – production as well as reproduction – to theorize about women's consequent relational spatio-temporal constraints (Davies, 2001) and to visualize the spatial consequences of such constraints with feminist GIS (Kwan, 2002a; McLafferty, 2002; Pavlovskaya, 2007). These geographers have focused

mainly on women in the developing Northern hemisphere, however. There are some notable exceptions from Africa (Katz, 1993; Mandel, 2004).

First, the main dependent variable of interest in this study was the impact of HIV/AIDS on the female spatial trajectory covered for firewood collection. The UNAIDS 2007 report put South Africa at the top of the list of the countries with the highest estimated rate of HIV/AIDS in the world: 70% of the caregivers being female.

Second, this study took place in the specific South African geography of Nqileni, a remote coastal village in a former homeland, the former Transkei, in the Eastern Cape province. According to earlier research, the economic under-development, mobile migrant workers, and gender inequality symptomatic of the continued post-apartheid political economy of the former homelands mirror the structural barriers to more effective HIV prevention (Bond, 1999; Parker et al., 2000; Turschen, 2004).

Finally, in poor rural areas such as the former homelands, firewood and other free natural resources from the communal lands are a critical part of the rural safety net (Letsela, 2002; Andrew et al., 2003). Despite its importance to the rural poor, this “hidden harvest” (IIED, 1995) is not covered by South African national management policies (Dovie et al., 2004). This lack of attention is alarming since Southern African research has suggested an increased dependence on such natural resources among HIV/AIDS-afflicted families (Barany, 2005; Shackleton et al., 2006; McGarry, 2008).

These three general areas of disease, political economy, and finite natural resources are the cornerstones of a political ecology of disease (Turschen, 1984; Mayer, 1996; Kalipeni, 1998; Leatherman, 2005; Whiteford and Hill, 2005; Finnis, 2007). Therefore, this study uses this theoretical framework to look specifically at how

HIV/AIDS has the possibility to further re-produce the marginalization of the labor (and cash) poor, as these females struggle to balance the time-intensity of caretaking with the investment needed to cover long spatial distances for firewood.

Summary of Findings

The research questions asked whether and how the varying human health and wealth status of the different households influenced women and girls' spatial distances covered for firewood. As part of the age examination, this study also investigated the impact of the generational firewood collection company. The study addressed these research questions by integrating self-mapped GPS spatial readings with household surveys and individual interviews over a one-year time period.

The five main findings below illustrate the diversity of this female firewood collection experience. To contextualize the local importance of traveling longer distances, it is important to note that the women of the village generally agreed that the best spots for firewood collection were found in the forest fragments at the outskirts of the village, not within. Subsequent analysis of the spatial readings supported such statements by illustrating that women traveled further when they cited "an abundance of firewood" as the driver of the locale chosen as opposed to the other frequent answer "proximity of site." As the quantities of firewood between these two groups did not produce a statistically significant difference, this result seems to imply that finding abundance is about having a great quantity of firewood from which to select a good quality of firewood (wood species that burn quickly and are not culturally taboo).

Main finding A: HIV/AIDS. According to the Pearson Panel regression model, women from households without HIV/AIDS-proxies walked much further than HIV/AIDS-proxy households. The absence of household-level HIV/AIDS-proxies led to an increase

of 0.2646 km as the spatial distance increased by a factor of 1 km (26.46%). Such a finding would support Davie's suggested female spatio-temporal relational constraint (2001) and Nelson's proposed female spatial domesticated confinement (1986). In short, the time women spend taking care of other members with frail health at home impacts the amount of time they have left to allocate for travel away from the home for firewood collection. If one would bring the assumption of quality and spatial distances mentioned above into the equation, such a finding would support Barany's claim that there is a lower quality of firewood where there is a higher prevalence of HIV/AIDS (2005).

Main finding B: wealth. Even though wealth was not as influential as HIV/AIDS (or that of generational company discussed below), the Pearson Panel procedure did note a small but still statistically significant difference in the impact of wealth on spatial distances. An accumulation of ZAR1000 (US \$154 according to 2009 exchange rates) seems to decrease the distance traveled by 0.0076 km as the spatial distance increase by a factor of 1 km (0.76%). The more agricultural assets a household had, the shorter distances the women traveled.

An additional test showed that paraffin is more likely to be used as an alternative energy source by wealthier households than destitute households in the village. That is, wealthier households have the money to buy energy alternatives to make up for the shorter distances (and potentially worse quality) of firewood. Mirroring national South African statistics (Radebe, 2007), a further test of the village data showed that the village destitute households are more likely to be a *de jure* female head of household

than a male head of household, giving local village poverty a predominantly female face.

Main finding C: HIV/AIDS and wealth. Co-variate means of the two variables discussed above showed that households with HIV/AIDS-proxies present walk shorter distances than households without HIV/AIDS-proxies within the same wealth category. A parallel likelihood test did not show a higher use of paraffin, however, among the general population of HIV/AIDS-proxy households.

This means that wealthier households with HIV/AIDS-proxies are not as vulnerable, as destitute households with HIV/AIDS-proxies are, to the potentially worse firewood quality due to shorter walks: the former can afford paraffin as an alternative energy source if needed. Subsequently, the co-variance means also showed that poor HIV/AIDS households walked longer distances than wealthy HIV/AIDS-proxy households. These findings highlight the importance of not treating all HIV/AIDS afflicted households as one vulnerable monolithic group: there are great variances between these households, including wealth assets.

Main finding D: age of the collector. As referenced briefly in the beginning, in contrast to the adult regression model, the final model for girls did not include HIV/AIDS-proxies or socio-economic status of the household. These two variables did not come up as significant variables in the mixed (back and forth) stepwise selection procedure for girls. Therefore, girls seem to be overall less constrained than adults in relation to their firewood collection spatial behaviors.

Main finding E: generational quality of the company. There were not only differences but also similarities between women and girls. The intragenerational

company of other females positively influenced the spatial distances of both groups. A lack of other adults in the collection party of a female adult seems to decrease the distance traveled by 0.1911 km as the spatial distance increase by a factor of 1 km (19.11%). Subsequent interviews revealed that adults not only enjoyed the social time with other adults, but these trips seemed to be part of an external household investment in the shape of field work exchanges. An additional test showed that adult women who joined adults only (or mixed adults and girls) groups were more likely to engage in work exchanges than those adult women walking alone or with girls only. As for girls, they not only walked longer distances when accompanied by other girls, they also collected more firewood than when they went with adults.

Even though the company of their peers positively influenced both girls and women's distances, the actual firewood collection network groups had different spatial qualities. Girls' firewood collection groups not only tended to involve a higher number of females, but the girls who came together also seemed to lived much further away from each other. That is, the girl network covered a much larger social spatial range of households than the adult network did. The main reason for this reason seems to be that girls' firewood collection groups are formed – and re-formed as friendships are broken or mended – at the village school. Adults' social firewood groups were not only smaller, the women they made plans with usually lived in the neighboring households, making the social spatial range much narrower than that of girls.

Recommendations

The research findings above describe variation among female spatial firewood collection trajectories as they relate to long-term disease, poverty, age, and the generational quality of the collecting group in a remote corner of a former homeland in

South Africa. Even though this is only one case study, I argue that there are enough generalizable representative characteristics of this case to consider these findings when drafting policies in similar settings to integrate women and girls, rural development and public health in remote locales with a strong dependence on wild natural resources. Based on the findings above, I would like to suggest the following recommendations.

Recommendation One: Creating a Green Care Center

A Green Care Center is a multiple use center dedicated to addressing the interconnected system of women's time constraints within an environmental context. The suggested Green Care Center would offer three potential basic services: daycare, healthcare, and alternative energy options. The overall "green" environmental context would be further stressed by using local, sustainable building materials and other sustainable infrastructure components to build and run the daily operation of the actual center.

First, some policy makers might find the day-care center recommendation too mundane or the use of funds too discriminatory to men (as they are not the primary caretakers of children). There are several advantages to take into consideration, however. First, this recommendation doesn't target HIV/AIDS audiences specifically – it targets all mothers of the village. Motherhood is a source of pride, not shame. It would therefore not be any stigma involved in using the day care center. Because what the labor poor (as in those with ill family members) and cash poor women do share is this – children. In Africa, where womanhood is motherhood, most women have not only one but several children. As an example, in the village of Nqileni, the household had a mean of 7 individuals per household (sd=3, minimum of 1 member and a maximum of 16 members). The majority of these family members are usually children.

The day care facility would address a major labor time constraint: time spent on taking care of the children. Whether or not women have sick family members in their household, taking care of the many children in the household takes up a major portion of the day. Any help to address this time-consuming chore would be beneficial to all, especially the poor and those with sick family members.

Alleviating women's labor constraints to facilitate women's spatial mobility is an important step to improve women's lives. Women's spatial mobility is currently a neglected non-material facet of rural coping strategies: the focus tends to be on larger more tactile assets such as socio-economic, physical, and natural capital. However, taking this study's findings into consideration, I very much concur with Jennifer Mandel's argument that spatial mobility should be considered to be as important as any other asset in women's every-day lives (2004). Just as women's insecure rights and tenure have been seen as major constraints and lack of incentive to more successful natural resource management (Bradley, 1991; Fortmann, 1992; Leach, 1994; Meinzen-Dick, 1997), women's confined spatial mobility should also be incorporated as a possible major constraint to more sustainable and efficient natural resource management in both the short-term and long-term.

Second, the health center would be a space where women could come and discuss their questions and problems with professional health care workers. There is already a system in the larger region of the study area where the regional hospital sends out personnel to various rudimentary local health centers in the different villages at different time intervals. The interior space of the health care center would be carefully designed to ensure the privacy of the information shared between the visiting health

care provider and the patient (or home caretaker). It is important that the health center is built into the general Green Care Center to stress the importance of taking care of the whole village, be it to take care of the children or the adults, preventive health issues or long-term disease issues.

The final component of the Green Care Center would consist of an outside area dedicated to experimenting with alternative sustainable energy options. As the center would be located in the center of the village, one might consider experimenting with fast growing biomass fuel alternatives, such as non-spreading bamboo species. Such a small plantation would be a possible closer option than the remote spatial forest fragments, addressing the issue of spatial confinement for those with labor constraints. This outside space would be dedicated specifically to addressing the energy needs of women. Such a female public energy plot would be an asset to the many poor women – including the single, the unmarried, or widowed – who don't have rights or access to field plots through male relatives. Also, as the energy plantation is situated close to the day-care, the women could leave their children at this facility while they work the alternative energy area. In addition, there could also be the possibility of creating different kind of cash incentives for working in the alternative energy grounds.

This alternative energy project would be an option for women who don't want to or can't find the time to collect firewood at the outskirts of the village. This alternative would not be offered in order to discourage women from collecting firewood elsewhere, however. Because socializing with other women under the guise of distant firewood collection is highly valued by the women in the village, giving them some individual agency, and a respite from the constant demands around the house. Just as important,

policy recommendations that ignore this social need for space could also threaten to upset carefully woven social structures of important external household investments that connect firewood collection to various food exchanges as well as work exchanges between women from different households, as mentioned earlier in this study.

All three components of the Green Care Center – daycare, healthcare, and alternative energy – would share an additional space for larger village gatherings wanting to attend informational sessions or workshops on a given subject relating to caring for individual health issues, alternative energy options, or issues relating to the management of the forest patches. This educational space stresses the need to look at village health and environmental education as one unit. Possible seminars from visiting professional could range from doctors or veterinarians to conservationists or engineers. Such visitors could talk about issues ranging from specific health care of people as well as livestock to possible energy alternatives as showcasing home-based solar cooking units.

The integrated Green Care Center would be a one-stop facility that offers many different services to all village households who are interested in a holistic inclusive view of care, be it for themselves, their animals, or their immediate environment. The Green Care Center recognizes the interconnected system of labor constraints, health, and the environment, a system that impacts all village members.

The main concern the Green Care Center would address is female time constraint, independent of HIV/AIDS. A recent study from Kenya (Gill, 2010) illustrates the possible downside of creating HIV/AIDS-targeted solutions in a climate that stigmatizes people who have or are suspected of having HIV/AIDS. While doing research on the possibility

of having HIV/AIDS-affected families adopt grain amaranth to address labor constraints, Gill learned of the fate of another grain adoption project that had been suggested with the particular needs of HIV/AIDS-affected families in mind, yet still targeting general audiences. The project had failed miserably. Households with HIV/AIDS were afraid to use the grain for fear that growing this particular grain would confirm to the whole village that these households were in fact afflicted by HIV/AIDS. Non-afflicted households did not want to touch the grain for fear of being accused of having HIV/AIDS.

Recommendation Two: Environmental “Engendering” and Cash Incentives

Whereas women might be a silent group in every-day decision-making related to natural resource management (Leach, 1994; FAO, 2002), there is an even quieter group standing right behind them – their daughters. Yet the findings of this study have illustrated that many girls are important spatial agents who are able to roam even more freely than their mothers. This was exemplified in the generational differences found between women and girls in HIV/AIDS-proxy households of this study. These girls’ extended mobility could potentially result in them being able to collect a better quality of firewood than that collected by their mothers closer to home. As Bird (2002) pointed out, the age-appropriate maximization of children foragers should not be underestimated. This finding also supports Biran (2004) and her colleagues’ general argument that girls’ activities add a much needed spatial mobility to complement women’s household entrapment. Finally, in the context of HIV/AIDS, later Southern African studies have also shown the vital contribution of children as collectors of wild food in times of food insecurity (Barany, 2005; Shackleton et al., 2006; McGarry, 2008).

This project focuses on the girls’ contribution. I am therefore advocating not only a general mainstream engendering of development, conservation, and health projects but

an additional “enagendering” that recognizes the girls within that mainstream process of acknowledging female production. The goal is to acknowledge children’s – in this case girls specifically – experience and knowledge with wild natural resources without crossing the treacherous line of seeming to encourage illegal child labor. Fear of the latter should not be an excuse to ignore the former.

As the findings of this study indicate that the school ground is a fertile soil for many girls’ wild resource decisions of where to go and with whom, the already existing school infrastructure could be an excellent site to initiate such “enagendering” projects within an environmental context. Such “enagendering” projects would build upon the already existing extensive knowledge girls have of the forest. For example, to address the unfortunate current stigma of wild foods mentioned earlier in this study – many adults claimed that wild foods was for kids only – there could be classes dedicated to talking about wild foods, nutrition, human metabolism, and plant ecology to encourage a continued interest in harvesting of wild foods, human health, and floral knowledge as the girls get older. This recognition of non-adult foraging members and their knowledge is also important to note as the HIV/AIDS epidemic is leaving a great number of child-headed households in its wake: we cannot afford to ignore children’s particular environmental knowledge, natural resource concerns, and vital contribution.

The connection girls, education, health, and natural resources management is an important one. Environmental “enagendering” school projects is not only about recognizing girls as present important natural resource contributors and managers but also about recognizing their potential general future contribution as educated females before they risk acquiring HIV. Because one should not lose sight of the

disproportionate female burden of the South African fight against HIV/AIDS as it relates to caretaking, girls leaving school to help their families, and the higher HIV prevalence rates among women (Walker, 2004; Poku, 2005; Slater and Wiggins, 2005; Barnett, 2006; Patterson, 2006; Human Sciences Research Council, 2008).

The question is, what options do young rural girls have to sex and subsequent motherhood? In the South African remote rural areas, women have yet to be the beneficiaries of post-apartheid reforms that urban women have, such as health care access, gender equality, and employment reforms (McCusker, 2004). Therefore, rural women are very much dependent on cash injections of rural remittances and/or government grants in the shape of pensions, foster, and child grants (Andrew et al., 2003). The issue of grants can be contentious, however. South African anthropologist Ainslie (1999) argues that:

there is a tension between the obvious need to keep people from utter destitution and the observation that net effect of increased pension disbursements has been to further economically marginalize these [rural] areas and the people resident in them (p. 386).

In the context of this research, the question is, what role do child grants play in terms of poverty, rural unemployment, and HIV/AIDS? Does it carry them out of poverty or bring them further down in a downward economic spiral? For these rural young women, motherhood is the only job available to them and child grants seem to be the only way to receive cash injections to the household, as higher education and job opportunities seem so out of reach geographically and financially. Is it therefore realistic to ask that these girls to defer their dream of motherhood – i.e. womanhood – by demanding condoms in consensual sex until a more financially secure future arises (and they are sure of their partner's HIV/AIDS negative status)?

To address this question of financial insecurity, education, and HIV/AIDS, the World Bank released a Malawi study (2010) that found that conditional cash transfers to girls seemed to lower the rate of HIV/AIDS affliction. The study involved 3,796 girls between the ages of 13 and 22. They divided the girls into two groups: one received monthly cash payments for attending school and the other did not. After 18 months, the girls from the former group had had sex later in life with fewer and younger partners than the other group (the latter group interacted sexually with more partners who were older, often older adult men). Most importantly, the group of girls that received cash incentives for going to school had much lower rates of sexually transmitted diseases and a lower rate of HIV than the group that did not receive cash. In short, rewarding girls with cash for going to school seems to produce females with better health.

I suggest building on this study by offering similar cash incentives connected not only school attendance, but also connected to taking part in “enagendering” environmental projects that make use of their knowledge of local natural resources and recognize their contributions as stewards of not only their environment but also of their own bodies.

Recommendation Three: Grant Extension and Extending Social Networks

Even though some of the aspects of government grants can be a contentious (as mentioned in the previous recommendation), there is no doubt that they still serve an important function to the many rural women living in areas of high unemployment (Andrew et al., 2003). Government grants are offered in the shape of pensions, foster, and child grants (as well as disability grants). As discussed in the case study setting chapter of this study, applying for these grants can be an exhaustive and complicated process, however.

I would therefore encourage support of existing or new initiatives of governmental and/or non-governmental organizational liaisons that aid women in applying for grants. Just as there agricultural extension workers, I would suggest a network of grant extension workers who travel to rural villages to help the women navigate through this maze of bureaucracy and be their advocates in further policy-making.

These networks could make use of the much smaller local informal networks of women existing within the different villages. For example, in Nqileni, this study suggests that there are small adult neighborhood networks related to food exchange and firewood collection. Such existing groups could be used for other actions, such as making sure that the right papers get processed within the village. For single women, it can sometimes be a very time-consuming matter just to get the signatures needed for birth certificates from their own local village headmen. Women's paperwork is often not prioritized the way men's paperwork is. With the support of outside grant extension workers and small neighborhood collectives, these women might have more leverage to make sure that their documents get processed more efficiently locally as well as regionally. This way, the women's small social collectives not only expand women's spatial trajectories away from home, they can also potentially extend women's power well outside the borders of the village.

Future Research Directions

Looking ahead, there are a number of potential research projects to build upon the findings of this study as well as the many questions that are left unanswered.

Spatializing the Female Social Network

In interviews with the women and girls, I noted that women's spatial networks – that replicated their food exchange networks – were more spatially confined than those

of girls. When talking to girls about with whom they went, they would point out households on the satellite image that were quite far away from their own. They would also talk about how they made plans of where to go during recess at school. The school, at the very Northern end of the village, provided the nurturing ground for an extensive network that changed weekly as the girls' friendships went through different phases.

A future research project could note not only the particular household qualities of each node in these girls' social firewood collection networks but also their seemingly ephemeral quality. The number of nodes, distances, and tenacity could then be contrasted with that of adult women's spatial social networks. The subsequent spatio-temporal qualities of the actual networks could then be compared to the effectiveness and spatio-temporal qualities of the wild foresting behaviors of each group.

The Spatial Impact of the Fear of Sexual Violence in the Forest

As mentioned earlier, the women and girls in this village said they did not fear sexual violent attacks when walking into the forest to collect firewood. Further down the coast, however, in a neighboring less remote area of the same district, with many more roads connecting the village, I spoke to a key female informant who did bring up the subject. In her area, she said, many women had grown more and more fearful of going into the forest to fetch firewood as the sexual attacks in the area were escalating. This fear of certain spaces mirrors the spatial confinement influenced by fear covered by other researchers in different parts of the world (Katz, 1993; Nabane, 1997; Mandell, 2004).

There is a research gap, however, as to how this fear influences rural spatial behaviors and the possible concentration of firewood collection intensity as women fear

to venture further into the forest. Such a study would be part of a movement to take back women's spaces not only in urban areas but also in rural areas. How do these two different landscapes of fear differ? By visualizing the fear and the violence in an environmental context, a variety of women and girls' concerns can be addressed. Such a study could unravel the missing spatial categories of rural sexual violence in the public areas of the forest. The mapping of rural women and girls' emotional forest experience would make for a worthwhile and needed feminist GIS study.

The Spatial Variance in Child-Headed vs. Adult-Headed Households

This study found that the young girls' different stage in the female life cycle seem to offer some reprieve from the larger constraints of female adulthood (such as the effects of HIV/AIDS and wealth), at least as they relate to spatial firewood collection. There are, however, a number of children today in the Southern hemisphere who live in households where there are no longer any adults present, due to HIV/AIDS.

The firewood collection experience for the children in these child-headed households would probably be very different from children living in adult-headed HIV/AIDS-afflicted households, as the former are forced to shoulder the responsibilities of grown-ups in the tragic absence of parents or other adults.

According to the village survey, there were no such child-headed households in the village. Nevertheless, a similar study performed in another rural setting with a large percentage of child-headed households could investigate the possible variance in firewood collection distances covered between the possible two groups of girls: those from adult-headed households and those from child-headed households, both affected by HIV/AIDS. The questions to explore would be: how much do the spatial firewood collection experiences of girls from child-headed households mirror or differ from those

of adults and girls of adult-headed households? Any lessons learned here could help further tailor policies to the specific needs of this growing group of young wild resource collectors.

Challenges Ahead

Even though you, the reader, and I, the writer, end our mutual journey here, the women and girls we have hopefully come to know a bit more, are still continuing theirs over the undulating hills of the village of Nqileni. Yet these women and girls are not alone. All over Africa – and in many other corners of our globe as well – females spend several hours of their day searching for, collecting, and carrying firewood, trying to balance not only the load on their head but also a demanding schedule of many chores.

According to a political ecology of disease, there is the possibility of a perpetually descending spiral for the most vulnerable of females. As they get more and more desperate to try to stretch the day not only to make ends meet but also to finish their chores, this time constraint could have a serious impact not only on the females and their families but also their surrounding environment. First, there is the potential loss of the overall quality of firewood, and then one day there might be a loss of the overall quantity of firewood close to the home. The extra time needed to travel further, might put a further strain, however, on not only a busy day but on the whole web of female production and re-production.

In light of the large-scale environmental discussions and policy-making around climate change, forest deforestation, and natural resource pollution, the possible fragmented small-scale local impact of rural women and girls' escalating double duties can easily be forgotten. The rural female need for additional labor, close health facilities, and jobs is often put on the back burner while solving other pressing national needs,

with a focus on easy-to-manage tools rather than complicated gender relations. In addition, these rural female voices are seldom heard on a local level in the daily decision-making of their male chiefs, husbands, brothers, and sons. Meanwhile, the HIV/AIDS epidemic is weighing more and more heavily on the many unpaid women and girls taking care of the ill and the orphaned.

I argue that our challenge for the future is to pay as much attention to: female reproductive work as to that of male production; small-scale problems as to those of large-scale solutions; and the continued encompassing health of human and natural resource health of the common lands as to that of charismatic national parks.

There is an international program called “One World, One Health.” This program addresses the interconnected nature of human health with the health of the world’s ecosystems. In light of this study’s focus on the impact of HIV/AIDS and how female caretakers use their environment, I would like to borrow their slogan to add to three more words of my own “One World, One Health, One Shared Responsibility.” I end this study by arguing that the ultimate challenge to maintaining the best health of all systems on this earth is to better balance the costs of the overall caretaking of HIV/AIDS-afflicted members between not only women and men but also between state social expenditures and the private caretaking of citizens. For the latter, some of them are already running low on time.

APPENDIX A
GENERAL HOUSEHOLD SURVEY

GPS Point:

Name of Household:

Date of survey:

1. How long have you lived in this house? yrs
2. Is anyone in the household a member of a committee/church/school-board? Yes/No

3. Name of family member	4. Age	5. Sex	6. Grant (what kind?)	7. Attends School/Works

8. Are there any orphans/foster children present in the household? Yes/No
9. Anyone in the household suffering from illness for more than 3 months? Yes/No
10. If so, are they getting treatment for that illness? Yes/No
11. Any deaths in the household within the last 2 years? Yes/No
12. If death within the last 2 years, was it after illness for more than 3 months? Yes/No
13. What do you cook with? (Circle several options if applicable)

Firewood Paraffin Dung

14. Do you own			
Horses/Donkeys		/	Radio
Cows			Cell phone
Sheep/goats		/	Table
Chickens/Geese		/	Chairs
Plow			Spade/hoe

15. Do you work	No	Yes, smaller than village average	Yes, average	Yes, larger	16. Who works there?
Plot					
Garden					

17. Have you paid people to work in the field? Yes/No
18. Have you exchanged help to work in the field? Yes/No
19. What do you grow in plot? Maize Pumpkins Beans Other, list:

20. In garden? Maize Pumpkins Beans Other, list:

21. What did you eat yesterday?	Bought	Grown in plot/garden	Got from neighbor	Wild harvest
Breakfast				
Lunch				
Dinner				

22. How many times last week did you borrow food from neighbors?
 23. How many times last week did neighbors borrow food from you?
 24. How many neighbor households are in your network of regular food exchange?
25. Same people in food network that you collect firewood with? Yes/No
 26. When you collect firewood whom do you usually go with? (Circle several if applicable)
 I don't Only the kids go I go alone I go with my kids I go with other adults
27. How many times last week did you collect firewood?
 28. What determines when you stop collecting firewood?
 29. How do you collect? Cut fresh Collect dry from ground
 30. Do you look for specific kind of wood species? Yes/No 31. If yes, why?
 31. Do you go to many different places or the same one all the time?
 32. Do you go different place(s) now than 5-10 yrs ago? Yes/No
 33. If yes, why?
 34. Does it take longer for you to collect firewood than 5-10 years ago? Yes/No
 35. If yes, why?
 36. What determines where you go now to collect firewood (abundance/species/social)?
37. Do you collect wild foods from forest? Yes/No
 38. If yes: What do you collect?
 39. If no: Why not?
 40. When you collect wild foods do you go with? (Circle several if applicable)
 I don't Only the kids go I go alone I go with my kids I go with other adults
41. Do you collect wild foods while collecting firewood? Yes/No
42. When you collect mussels whom do you go with? (Circle several if applicable)
 I don't Only the kids go I go alone I go with my kids I go with other adults
43. If you don't collect mussels, why?
 44. What determines when you stop collecting mussels?
 45. What do you do with mussels that are left when you are finished eating?
46. What takes the most time (rate 1 to 5, 1 is the longest time)?
 Collecting firewood Fieldwork Collecting mussels Cooking Getting water
47. What do you do to help (time-wise) in your daily chores?

APPENDIX B
SEASONAL FOCAL QUESTIONNAIRE

Household GPS Point:

Date Completed:

GPS #	Date GPS OUT	Date GPS IN	Date GPS used	Adult or Girl	Paid	Age	One-Way Distance	Kg

Notes on loaded reading (if applicable)

1. Do you usually go where you went today? (To verify that reading represent regular routine) If no, what was different and why?

2. When you went out to collect with the GPS machine, did you go:

Adult: Alone With girls With other adults With adults & girls

Girl: Alone With other girls With adults With adults & girls

3. How many people went to collect firewood including you?

4. When you go to collect firewood, do you prefer to go

Alone With girls With other adults With adults & girls

5. Why do you prefer to go with (see above)...?

6. Why did you pick the site you did?

7. Is there anything else you want to talk about in regard to the firewood collection trip you took when you carried the GPS machine?

Note: These follow-up questions below should only be asked of adult of household for each seasonal reading.

A. Have there been any changes in the health status of any of your household members since we last talked? Yes/No

If change, did someone in the household get sick or get well?

B. What did you eat yesterday?	Bought	Grown in plot/garden	Got from neighbor	Wild harvest
Breakfast				
Lunch				
Dinner				

C. How many times last week did you borrow food from neighbors?

D. How many times last week did neighbors borrow food from you?

LIST OF REFERENCES

- Abbot, J. O., and Mace, R. (1999). Managing protected woodlands: Fuelwood collection and law enforcement in Lake Malawi National Park. *Conservation Biology* 13: 418.
- Agarwal, B. (1997). The Gender and Development Debate: Lessons from India In Visvanathan, N., Duggan, L., Nisonoff, L., and Wiegiersma, N. (eds.), *The Women, Gender, and Development Reader*. Zed Books, London.
- Ainslie, A. (1998). *Managing natural resources in a rural settlement in Peddie district (South Africa)*. Unpublished Masters, Department of Anthropology, Rhodes University, Grahamstown.
- Ainslie, A. (1999). When 'community' is not enough: managing common property natural resources in rural South Africa. *Development Southern Africa* 16 (3): 375-401.
- Aldenderfer, M. (1996). Introduction (Ch. 1). In Aldenderfer, M., and Machner, H. (eds.), *Anthropology, Space and Geographic Information Systems*. Oxford University Press, New York.
- Alland, A. (1975) Adaptation. *Annual Review of Anthropology* 4:59-73.
- Andrew, M., Ainslie, A., and Shackleton, C. (2003). Land Use and Livelihoods. *Evaluating land and agrarian reform in South Africa: an occasional paper series*. Programme for Land and Agrarian Studies, School of Government, University of the Western Cape, Cape Town.
- Baksh, M., and Johnson, A. (1990). Insurance Policies among the Machiguenga: An Ethnographic Analysis of Risk Management in a Non-Western Society. In Cashdan, E. (ed.), *Risk and Uncertainty in Tribal and Peasant Economies*. Westview Press, Boulder.
- Baltagi, B.H. (2001) *Econometric Analysis of Panel Data*. John Wiley & Sons, New York.
- Barany, M., Holding-Anyonge, C., Kayambazinthu, D., and Siteo, A. (2005). *Firewood, food and medicine: Interactions between forests, vulnerability and rural responses to HIV/AIDS*. IFPRI Conference, HIV/AIDS and Food and Nutritional Security, April 14-16, 2005, Durban, South Africa.
- Barnett, T., and Blaikie, P. (1992). *AIDS in Africa*. Belhaven Press, London.
- Barnett, T., and Whiteside, A. (2006). *AIDS in the Twenty-First Century: Disease and Globalization*. Palgrave Macmillan, New York.
- Bassett, T. J. (1988). The Political Ecology of Peasant-Herder Conflicts in the Northern Ivory Coast. *Annals of the Association of American Geographer* 78 (3): 453-472.

- Batterbury, S. P. J., and Bebbington, A.J. (1999). Environmental Histories, Access to Resources and Landscape Change: An introduction. *Land Degradation and Development* 10: 279-289.
- Baylies, C. (2002). The Impact of AIDS on Rural Households in Africa: A Shock Like Any Other? *Development and Change* 33 (4): 611-632.
- Becker, G. (1981). *A Treatise on the Family*. Harvard University Press, Cambridge, MA.
- Beneria, S., and Sen, G. (1986). Accumulation, Reproduction, and Women's Role in Economic Development: Boserup Revisited. In Leacock, E., and Safa, H. (eds.), *Women's Work: Development and the Division of Labor by Gender*. Begin & Garvey Publishers, Inc., South Hadley.
- Beneria, S. (2003). *Gender, Development, and Globalization: Economics as if All People Mattered*. Routledge, New York.
- Bernard, R. (2002). *Research Methods in Anthropology: Qualitative and Quantitative Approaches*. AltaMira Press, Walnut Creek, CA.
- Bettinger, R. L. (1991). *Hunter-gatherers: Archeological and evolutionary theory*. Plenum Press, New York.
- Biran, A., Abbot, J., and Mace, R. (2004). Families and Firewood: A Comparative Analysis of the Costs and Benefits of Children in Firewood Collection and Use in Two Rural Communities in Sub-Saharan Africa. *Human Ecology* 32 (1): 1-25.
- Blaikie, P., and Brookfield, H. (1987). *Land Degradation and Society*. Methuen, London.
- Blumberg, R. L. (1991). Income Under Female Vs. Male Control: Hypotheses from a Theory of Gender Stratification and Data from the Third World. In Blumberg, R.L. (ed.), *Gender, Family, and Economy: The Triple Overlap*. SAGE Publications Limited, Newbury Park.
- Bond, P. (2000). *Elite Transition: From Apartheid to Neoliberalisation in South Africa*. Pluto Press, London.
- Boserup, E. (1970). *Woman's Role in Economic Development*. Gower Publishing Company, Brookfield.
- Box, G.E.P. (1976). Science and Statistics. *Journal of the American Statistical Association* 71:791-799
- Bradley, P. N. (1991). *Woodfuel, Women and Woodlots*. McMillan, London.

- Braidotti, R., Charkiewicz, E., Hausler, S., and Wieringa, S. (1997). Women, the Environment and Sustainable Development. In Visvanathan, N. Duggan, L., Nisonoff, L., and Wiegiersma, N. (eds.), *The Women, Gender, and Development Reader*. Zed Books, London,
- Bryant, R., L. (1992). Political Ecology: An emerging research agenda in Third-World studies. *Political Geography* 11 1: 12-36.
- Bryant, R., and Bailey, S. (1997). *Third World Political Ecology*. Routledge, London.
- Bryant, R. (2002). Non-governmental Organizations and Governmentality: 'Consuming' Biodiversity and Indigenous People in the Philippines. *Political Studies* 50: 268-292.
- Bryceson, D. (1993). Rural Household Transport in Africa: Reducing the Burden for Women? *World Development* 21 11: 1715-1728.
- Bryceson, D. (2000). Rural Africa at the crossroads: livelihood practices and policies. *Natural Resource Perspectives* No. 52 Overseas Development Institute (ODI), London.
- Cabrera, V. E., Hildebrand, P.E., and Jones, J.W. (2005). Modeling the effect of household composition on the welfare of limited resource farming in Canele, Peru. *Ag Systems* 86: 207-222.
- Carney, J., and Watts, M. (1991). Disciplining women? Rice mechanization and the evolution of Mandinka gender relations in Senegambia. *Signs* 16: 651-81.
- Carney, J. (1993). Converting the Wetlands, Engendering the Environment: The Intersection of Gender with Agrarian Change in the Gambia. *Economic Geography* 69 (4): 329-348.
- Cassidy, L. (2001). *Improving women's participation in community-based natural resources management(CBNRM) in Botswana*. The World Conservation Union (IUCN), Bay Publishing, Gaborone,
- Cavendish, W. (2000). Empirical Regularities in the Poverty-Environment Relationship of Rural Households: Evidence from Zimbabwe. *World Development* 28 (11): 1979-2003.
- Chafetz, J. S. (1991). The Gender Division of Labor and the Reproduction of Female Disadvantage: Towards an Integrated Theory. In Blumberg, R. L. (eds), *Gender, Family, and Economy: The Triple Overlap*. SAGE Publications Limited, Newbury Park.

- Chapin, F.S. Jr. (1974). *Human activity patterns in the city: Things people do in time and space*. Wiley and Sons, New York.
- Chigwedere, P., Seage G.R., Gruskin, S., Lee T-H, and Essex, M. (2008) Estimating the Lost Benefits of Antiretroviral Drug Use in South Africa. *Journal of Acquired Immune Deficiency Syndrome* 49:410-415
- Claassens, A. (2005). The Communal Land Rights Act and women: Does the Act remedy or entrench discrimination and the distortion of the customary? *Land reform and agrarian change in Southern Africa : An occasional paper series*. Programme for Land and Agrarian Studies, School of Government, University of the Western Cape, Cape Town.
- Coffee, M., Lurie, M., and Garrett, G. (2007). Modeling the impact of migration on the HIV pandemic in South Africa. *AIDS* 21 (3): 343-350.
- Cousins, B. (1999). Invisible capital: the contribution of communal rangelands to rural livelihoods in South Africa. *Development of Southern Africa* 16: 299-318.
- Craig, W. J., Harris, T.M., and Weiner, D. (2002). *Community participation and geographic information systems*. Taylor and Francis, London.
- Cullen, I.G. (1978). Human time allocation of spatial behaviors. In Carlstein, T., Parkes, D., and Thrift, N. (eds.), *Human Activities and Time Geography*. John Wiley, New York.
- Davies, K. (2001). Responsibility and daily life: reflections of timespace. In May, I. and Thrift, N. (eds.), *TimeSpace: Geographies of Temporality*. Routledge, New York.
- De Boer, W. F., and Prins, H.H.T. (1989). Decisions of Cattle Herdsmen in Burkino Faso and Optimal Foraging Models. *Human Ecology* 17 (4): 445-464.
- de Waal, A., and Whiteside, A. (2003). New Variant Famine: AIDS and Food Crisis in Southern Africa. *Lancet* 362: 1234-7.
- de Waal, A. (2004). AIDS-Related Famine in Africa: Questioning Assumptions and Developing Frameworks. In Poku, N., and Whiteside, A. (eds.), *The Political Economy of AIDS in Africa*. Ashgate Publishing Company, Burlington.
- Deere, C., and de Janvry, A. (1979). A Conceptual Framework for the Empirical Analysis of Peasants. *American Journal of Agricultural Economics* 61 (4): 601-11.

- Deere, C., Safa, H., and Antrobus, P. (1997). Impact of the Economic Crisis on Poor Women and their Households. In Visvanathan, N., Duggan, L., Nisonoff, L., and Wiegersma, N. (eds.), *The Women, Gender, and Development Reader*. Zed Books, London.
- Deere, C., and Leon, M. (2003). The Gender Asset Gap: Land in Latin America. *World Development* 31 (6): 925-947.
- Dewar, D. (1994). *Planning for the rural-urban interface: A case-study of Transkei*. Development Bank of Southern Africa, Cape Town.
- Dovie, D. B. K., Witkowski, E. T. F., and Shackleton, C. M. (2004). The fuelwood crisis in southern Africa - relating fuelwood use to livelihoods in a rural village. *GeoJournal* 60: 123-133.
- Dovie, D. B. K., Witkowski, E. T. F., and Shackleton, C. M. (2005). Monetary valuation of livelihoods for understanding the consumption and complexity of rural households. *Agriculture and Human Values* 22: 87-103.
- Dwyer, D., and Bruce, J. (1988). Introduction. In Dwyer, D., and Bruce, J. (eds.), *A Home Divided: Women and Income in the Third World*. Stanford University Press, Stanford.
- ECSECC (2009) *Eastern Cape Socio-Economic Consultative Council Socio-Economic Database*. http://www.ecsecc.org/socio_economic_database.asp Sourced September 30, 2009.
- Ellis, F. (2006). *Rural Livelihoods and Diversity in Developing Countries* Oxford University Press, Oxford.
- Elwood, S. (2002). GIS in Community Planning: A Multidimensional Analysis of Empowerment. *Environment and Planning A* 9: 271-79.
- FAO (2002). Gender and Access to Land. *FAO Land Tenure Series*. FAO, Rome.
- FAO (2002). *The Impact of HIV/AIDS on Rural Households/Communities and the Need for Multisectoral Prevention and Mitigation Strategies to Combat the Epidemic in Rural Areas*. FAO, Rome.
- Fapohunda, E. (1988). The Non-Pooling Household: A Challenge to Theory. In Dwyer, D., and Bruce, J. (eds.), *A Home Divided: Women and Income in the Third World*. Stanford University Press, Stanford.
- Finnis, E. (2007). The political ecology of dietary transitions: Changing production and consumption patterns in the Kolli Hills, India. *Agriculture and Human Values* 24: 343-353.

- Fisher, M. G., Warner, R. L., and Masters, W. A. (2000). Gender and Agricultural Change: Crop Livestock Integration in Senegal. *Society and Natural Resources* 13 (3): 203-222.
- Folbre, N. (1988). The Black Four of Hearts: Toward a New Paradigm of Household Economics. In Dwyer, D., and Bruce, J. (eds.), *A Home Divided: Women and Income in the Third World*. Stanford University Press, Stanford.
- Fortmann, L., and Nabane, N. (1992). The fruits of their labours: gender, property, and trees in the Mhondoro District. *CASS Occasional Paper series – NRM*. Centre for Applied Social Science, University of Zimbabwe, Harare.
- Gelb, S. (2000). Inequality in South Africa: Nature, cases and responses. Section 2. An overview of inequality, poverty and growth in South Africa. *DFID policy initiative in addressing inequality in middle-income countries*. The Edge Institute, Johannesburg.
- Geoghan, J., Pritchard, L., Ogneva-Himmelberger, Y., Chowdhury, R.R., Sanderson, S., and Turner, B.L. (1998). Socializing the Pixel and Pixelizing the Social in Land-Use and Land-Cover Change. In Liverman, D., Moran, F., Rindfuss, R.R., and Stern, P.C. (eds.), *People and Pixels: Linking Remote Sensing and Social Science*. National Academy Press, Washington D.C.
- Gezon, L. L. (2005). Finding the Global in the Local: Environmental Struggles in the Madagascar. Paulson, S., and Gezon, L.L (eds.), *Political Ecology across Spaces, Scales, and Social Groups*. Rutgers University Press, New Brunswick.
- Gibson, C. C., Ostrom, E, and Ahn, T.K. (2000). The concept of scale and the human dimensions of global change: a survey. *Ecological Economics* 32: 217-239.
- Gill, T. (2010) *Potential adoption of grain amaranth production HIV/AIDS-affected rural Kenyan communities* Unpublished Thesis (Ph.D), Interdisciplinary Ecology, University of Florida, Gainesville.
- Gladwin, C. G., Buhr, K.L., Goldman, A., Hiebsch, C., Hildebrand, P.E., Langham, M., Lee, D. Nkedi-Kizza, P., and Williams, D. (1997). Gender and Soil Fertility in Africa. In Buresh, R.J., Sanchez, P., and Calhoun, F. (eds.), *Replenishing soil fertility in Africa* Soil Science of America and America Society of Agronomy, Madison, WI.
- Golledge, R. G., and Stimson, R. J. (1990). *Analytical Behavioral Geography* Croom Helm, New York.
- Goodchild, M. F. (1996). GIS and spatial analysis in the social sciences. In Aldenderfer, M., and Machner, H. (eds.), *Anthropology, Space and Geographic Information Systems*. Oxford University Press, New York.

- Grimm, N. B., Grove, M., Pickett, S.T, and Redman, C.L. (2000). Integrated Approaches to Long-Term Studies of Urban Ecological Systems. *Bioscience* 50 (7): 571-584.
- Groenfeldt, D. (2003). The future of indigenous values: cultural relativism in the face of economic development. *Futures* 35: 917-929.
- Grove, J., and Burch, W. (1997). A social ecology approach and application of urban ecosystem and landscape analysis: a case study of Baltimore, Maryland. *Urban Ecosystems* 1: 259-275.
- Gulliver, P. H. (1975). Nomadic movements: Causes and implications. In Monod, T. (ed.), *Pastoralism in Tropical Africa* Oxford University Press, Oxford.
- Guyer, J. (1988). Dynamic Approaches to Domestic Budgeting: Cases and Methods from Africa. In Dwyer, D., and Bruce, J. (eds.), *A Home Divided: Women and Income in the Third World*. University Press, Stanford.
- Haddad, L., and Gillespie, S. (2001). Effective food and nutrition policy responses to HIV/AIDS: what we know and what we need to know. *Journal of International Development* 13: 487-511.
- Hartmann, H. (1981). The Family as a Locus of Gender, Class, and Political Struggle: The Example of Housework. *Signs* 6: 366-94.
- Hawkes, K., O'Connell, F., and Jones, B. (1995). Hadza Children's Foraging: Juvenile Dependency, Social Arrangements, and Mobility among Hunter-Gatherers. *Current Anthropology* 36 (4): 688-700.
- Howard, P. (2003). *Women and Plants: Gender Relations in Biodiversity Management and Conservation*. Zed Books, London.
- Huber, J. (1991). A Theory of Family, Economy and Gender. In Blumberg, R. L. (ed.), *Gender, Family, and Economy: The Triple Overlap*. SAGE Publications Limited, Newbury Park.
- Human Sciences Research Council (2008) *South African National HIV Prevalence, HIV Incidence, Behaviour and Communication Survey, 2008*. Human Sciences Research Council, Pretoria.
- Hunter, L. M., Twine, W. and Patterson, L. (2005). *Locusts Are Now Our Beef: Adult mortality and Household Dietary Use of Local Environmental Resources in Rural South Africa*. Working Paper, Environment and Behaviour Research Program, Institute of Behavioural Sciences, University of Boulder, Boulder.

- Hägerstrand, T. (1975). Space, time and human conditions. In Karlqvist, A., Lundqvist, L., and Snickars, F. (eds.), *Dynamic allocations of urban space*. Saxon House Lexington Books, Lexington, MA.
- IIED (1995). *The hidden harvest: the value of wild resources in agricultural systems*. International Institute for Environment and Development, London.
- Izumi, K. (2006). *Reclaiming our lives: HIV and AIDS, women's land and property rights and livelihoods in southern and East Africa – narratives and responses*. HSRC Press, Cape Town.
- Jaquette, J. S. (1990). Gender and Justice in Economic Development. In Tinker, I. (ed.), *Persistent Inequalities: Women and World Development*. Oxford University Press, New York.
- JMP® Version 7 (1989-2007). SAS Institute Inc., Cary, NC.
- Joseph, S. (2002). Reply to Winterhalder's Behavioral and other human ecologies: Critique response and progress through criticism. *Journal of Ecological Anthropology* 6 (1): 24-37.
- Kabeer, N. (1994). *Reversed Realities: Gender Hierarchies in Development Thought*. Verso, New York.
- Kalipeni, E., and Oppong, J. (1998). The Refugee Crisis in Africa and Implications for Health and Disease: A Political Ecology Approach. *Social Science Medicine* 46 (12): 1637-1653.
- Kaplan, H., Hill, K., and Hurtado, A.M. (1990). Risk, Foraging, and Food Sharing Among the Ache. In Cashdan, E. (ed.), *Risk and Uncertainty in Tribal and Peasant Economies*. Westview Press, Boulder.
- Kaschula, S. A. (2008). Wild foods and household food security responses to AIDS: evidence from South Africa. *Population Environment* 29: 162-185.
- Katz, C. (1993). Growing Girls/Closing Circles: Limits on the spaces of knowing in rural Sudan and US cities. In Katz, C., and Monk, J.J. (eds.), *Full Circles: Geographies of women over the life course*. Routledge, New York.
- Kwan, M.-P. (1999). Gender and Individual Access to Urban opportunities: A Study Using Space-Time Measures. *Professional Geographer* 51 (2): 210-27.
- Kwan, M.-P. (2000). Gender differences in space-time constraints. *Area* 32 (2): 145-156.

- Kwan, M.-P. (2002a). Time, Information Technologies and the Geographies of Everyday Life. *Urban Geography* 23: 471-82.
- Kwan, M.-P. (2002b). Feminist Visualization: Re-envisioning GIS as a Method in Feminist Geographic Research. *Annals of the Association of American Geographer* 92: 645-61.
- Kwan, M.-P. (2002c). Is GIS for Women? Reflections on the Critical Discourse in the 1990s. *Gender, Place and Culture* 9: 271-79.
- Ladio, A., and Lozada, M. (2000). Edible Wild Plant Use in a Mapuche Community of Northwestern Patagonia. *Human Ecology* 28 (1): 53-71.
- Leach, M. (1994). *Rainforest Relations: Gender and Resource Use Among the Mende of Gola, Sierra Leone*. Smithsonian, Washington D.C.
- Leach, M., Mearns, R., and Scoones, I. (1999). Environmental Entitlements: Dynamics and Institutions in Community-Based Natural Resource Management. *World Development* 22 (2): 225-247.
- Leatherman, T. L. (1996). A Biocultural Perspective on Health and Household Economy in Southern Peru. *Medical Anthropology Quarterly* 10 (4): 476-495.
- Leatherman, T. L. (2005). A Space of Vulnerability in Poverty and Health: Political-Ecology and Biocultural Analysis. *Ethos* 33 (1): 46-70.
- Letsela, T., Witkowski, E.T.F., and Balkwill, K. (2002). Direct use values of communal resources: in Bokong and Tsehlanyane in Lesotho: wither the commons? *International Journal Sustain. Dev. World Ecol.* 9: 351-368.
- Letsela, T., Witkowski, E.T.F., and Balkwill, K. (2003). Plant resource used for subsistence in Tsehlanyane and Bokong in Lesotho. *Economic Botany* 57 (4): 619-639.
- Liebenberg, (1994) *Authority, avoidances, and marriages: an analysis of position of Gcaleka women in Qwaninga, Willowvale district, Transkei* Unpublished Masters, Department of Anthropology, Rhodes University, Grahamstown.
- Little, P. E. (1999). Environmentats and Environmentalisms in Anthropological Research: Facing a New Millennium. *Annual Rev Anthropol* 28 (1): 253-284.
- Loevinsohn, M., and Gillespie, S. (2003). HIV/AIDS, food security and rural livelihoods: understanding and responding. *IFPRI FCND Discussion Paper* No 157, IFPRI, Washington DC.

- Longley, P. A., Goodchild, M., Maguire, D., and Rhind, D. (2005). *Geographic Information Systems and Science*. John Wiley and Sons, Inc., Hoboken.
- Mandell, J. L. (2004). Mobility Matters: women's livelihood strategies in Porto Novo, Benin. *Gender, Place and Culture* 11 (2): 257-87.
- Mandell, J. L. (2006). Creating profitable livelihoods: Mobility as 'practical' and 'strategic' gender need in Porto Novo, Benin. *Tijdschrift voor Economische en Sociale Geografie* 97 (4): 343-63.
- Masika, R., and Joekes, S. (1997). *Environmentally Sustainable Development and Poverty: A Gender Analysis*. Institute for Development Studies, Brighton.
- Mayer, J. D. (1996). The political ecology of disease as one new focus for medical geography. *Progress in Human Geography* 20: 441.
- Mayer, J. D. (2000). Geography, ecology and emerging infectious diseases. *Social Science and Medicine* 50: 937-952.
- McCusker, B., and Weiner, D. (2003). GIS Representations of Nature, Political Ecology, and the Study of Land Use and Land Cover Change in South Africa. In Zimmerer, K.S. and Bassett, T.J. (eds.), *Political Ecology: an integrative approach to geography and environment-development studies*. Guilford Press, New York.
- McGarry, D. K., and Shackleton, C. M. (2009). Is HIV/AIDS jeopardizing biodiversity? *Environmental Conservation* 36 1: 5-7.
- McGarry, D. K. (2008) *The impact of HIV/AIDS on rural children's reliance on natural resources within the Eastern Cape, South Africa*. Unpublished Masters, Department of Environmental Sciences, Rhodes University, Grahamstown.
- McLafferty, S. (2002). Mapping Women's Worlds: Knowledge, Power and the Bounds of GIS. *Gender, Place and Culture* 9: 263-69.
- McLafferty, S. (2006). Women and GIS: Geospatial Technologies and Feminist Geographies. *Cartographica* 40 (4): 37-45.
- McMichael, A. J. (2004). Environmental and Social Influences on Emerging Infectious Diseases: Past, Present and Future. *Philosophical Transactions: Biological Sciences* 359 (1447): 1049-1058.
- Mehretu, A., and Mutambirwa, C. (1992). Gender differences in time and energy costs of distance for regular domestic chores in rural Zimbabwe: A case study in the Chiduku Communal Area. *World Development* 20 (11): 1675-1683.

- Meinzen-Dick, R., Brown, L.R., Sims Feldstein, H., and Quisumbing, A.R. (1997). Gender, Property Rights, and Natural Resources. *FCND Discussion Paper No. 29* Food Consumption and Nutrition Division, IFPRI.
- Meinzen-Dick, R., Pandolfelli, L., Dohrn S., and Athens, J. (2002). *Gender and Collective Action: A Conceptual Framework for Analysis* International Research Workshop on 'Gender and Collective Action', Chiang Mai, Thailand, 17-21 October 2005.
- Mencher, J. P. (1988). Women's Work and Poverty: Women's Contribution to Household Maintenance. in South India. In Dwyer, D. and Bruce, J. (eds.), *A Home Divided: Women and Income in the Third World*. Stanford University Press, Stanford.
- Merrill, H. (2004). Space Agents: anti-racist feminism and the politics of scale in Turin, Italy. *Gender, Place and Culture* 11 (2): 189-204.
- Mithen, S. J. (1989). Modeling Hunter-Gatherer Decision Making: Complementing Optimal Foraging Theory. *Human Ecology* 17 (1): 59-83.
- Moser, C. (1989). Gender planning in the Third World: meeting practical and strategic needs. *World Development* 17 (11): 1799-1825.
- Myungwe, S. (2005). *Access to and control of forest resources in former commercial farming areas by communal people: the case of Mhindurwa and Mangwende villages in Seke*. Unpublished Masters, Department of Social Ecology, University of Zimbabwe, Harare.
- Nabane, N., and Matzke, G (1997). A Gender-sensitive analysis of a community-based wildlife utilization initiative in Zimbabwe's Zambezi Valley. *Society and Natural Resources* 10 (6): 519-534.
- Nag, M., White, B. White, N., and Peet, R.C. (1978). An Anthropological Approach to the Study of the Economic Value of Children in Java and Nepal. *Current Anthropology* 19 (2): 293-301.
- Nattrass, N. (2004). Unemployment and HIV/AIDS: the socio-democratic challenge for South Africa. *Development in Southern Africa* 21 (4): 87-108.
- Nelson, K. (1983) Labor Demand, Labor Supply, and the Suburbanization of Low Wage Office Work, In Scott, A.J. and Storper, M. (eds), *Production Work and Territory*. Allen and Unwin, Boston.
- Neumann, D. (2004). Moral and discursive geographies in the war for biodiversity in Africa. *Political Geography* 23: 813-837.

- Ngwenya, B.N., and Kgathi, D.L. (2006). HIV/AIDS and access to water: A case study of home-based care in Ngamiland, Botswana. *Physics and Chemistry of the Earth* 31: 669-680.
- Okot-Uma, R., and Odiachi, R. (1999). *Biodiversity and Gender for Sustainable Development*. SFI Publishing, London.
- Openshaw, S. (1991). A view of the GIS crisis in geography: Or, using GIS to put Humpty-Dumpty back together again. *Environment and Planning A* 23: 621-628.
- Ostergard, R. L., and Tubin, M.R. (2004). Between State Security and State Collapse: HIV/AIDS and South Africa's National Security. In Poku, N. and Whiteside, A. (eds.), *The Political Economy of AIDS in Africa*. Ashgate Publishing Company, Burlington.
- Packard, R. (1989). *White Plague, Black Labor: Tuberculosis and the Political Economy of Health and Disease in South Africa*. University of California Press, Berkeley.
- Papanek, H. (1990). To Each Less than She Needs, From Each More Than She Can Do: Allocations, Entitlements and Value. In Tinker, I. (ed.), *Persistent Inequalities: Women and World Development*. Oxford University Press, New York.
- Parker, R., Easton, D., and Klein, C. (2000). Structural barriers and facilitation in HIV prevention: a review of international research. *AIDS* 14 (Supplement 1): 22-32.
- Patterson, A. (2006). *The Politics of AIDS in Africa*. Lynne Rienner Publishers, Boulder.
- Paulson, S., Gezon, L. L., and Watts, M. (2003). Locating the Political in Political Ecology: An Introduction. *Human Organization* 62 (3): 205-217.
- Paulson, S., Gezon, L.L., and Watts, M. (2005). Politics, Ecologies, Genealogies. In Paulson, S. and Gezon, L.L. (eds.), *Political Ecology across Spaces, Scales, and Social Groups*. Rutgers University Press, New Brunswick.
- Paulson, S. (2005). Gendered Practices and Landscapes in the Andes: The Shape of Asymmetrical Exchanges. In Paulson, S. and Gezon, L.L. (eds.), *Political Ecology across Spaces, Scales, and Social Groups*. Rutgers University Press, New Brunswick.
- Pavlovskaya, M. (2002). Mapping Urban Change and Changing GIS. *Gender, Place and Culture* 9: 281-89.
- Pavlovskaya, M., and Martin, K. (2007). Feminism and Geographic Information Systems: From a Missing Object to a Mapping Subject. *Geography Compass* 1 (3): 583-606.

- Peet, R., and Watt, M. (1996). Liberation Ecology: Development, sustainability, and environment in an age of market triumphalism. In Peet, R. and Watt, M. (eds.), *Liberation ecologies: environment, development, social movements*. Routledge, London.
- Peluso, N. (1992). The political ecology of extraction and extractive reserves in East Kalimantan, Indonesia. *Development and Change* 23 (4): 49-74.
- Peluso, N. (1993). Coercing Conservation: The Politics of State Resource Control. *Global Environmental Change* June (4): 199-217.
- Pickett, S. A., Burch, W., Dalton, S.E., Foresman, T.W., Grove, J.M., and Rowntree, R. (1997). A conceptual framework for the study of human ecosystems in urban areas. *Urban Ecosystems* 1: 185-199.
- Pickett, S. A., Burch, W., Foresman, T.W., and Grove, J.M (1999). Interdisciplinary Research: Maintaining the Constructive Impulse in a Culture of Criticism. *Ecosystems* 2: 302-307.
- Poku, N. (2004). Confronting AIDS with Debt: Africa's Silent Crisis. In Poku, N. and Whiteside, A. (eds.), *The Political Economy of AIDS in Africa*. Ashgate Publishing Company, Burlington.
- Poku, N. (2005). *AIDS in Africa*. Polity Press, Cambridge.
- Pretty, J., and Ward, H. (2001). Social Capital and the Environment. *World Development* 29 (2): 209-227.
- Radebe, M. (2007). Setback for South Africa's women. *Mail and Guardian*. Johannesburg. 23 (45): 2.
- Rangan, H., and Gilmartin, M. (2002). Gender, Traditional Authority, and the Politics of Rural Reform in South Africa. *Development and Change* 33 (4): 633-658.
- Rappaport, R. (1968). *Pigs for the Ancestors: Ritual in the Ecology of a New Guinea People*. Yale University Press, New Haven.
- Rindfuss, R. R., and Stern, P.C. (1998). Linking Remote Sensing and Social Science: the Need and the Challenges. In Liverman, D., Moran, F., Rindfuss, R.R., and Stern, P.C.(eds.), *People and Pixels: Linking Remote Sensing and Social Science*. National Academy Press, Washington D.C.
- Robbins, P. (2004). *Political Ecology: A Critical Introduction*. Blackwell Publishing, Oxford.

- Rocheleau, D. (1995). Maps, Numbers, Text, and Context: Mixing Methods in Feminist Political Ecology. *Professional Geographer* 47 (4): 458-466.
- Rocheleau, D., Thomas-Slayter, B., and Wangari, E. (1996). *Feminist Political Ecology: Global Issues and Local Experiences*. Routledge, London.
- Rocheleau, D. (1997). Women, men, and trees: Gender, power, and property in forest and agrarian landscapes. *World Development* 25 (8): 1351-1371.
- Rundstrom, R. A. (1995). GIS, Indigenous Peoples and Epistemological Diversity. *Cartography and Geographic Information Systems, Special Content: GIS & Society* 22 (1): 45-57.
- SADC-FANR Vulnerability Assessment Committee (2003). *Towards indentifying impacts of HIV/AIDS on food security in Southern Africa and implications for responses: Finding from Malawi, Zambia and Zimbabwe*. Southern African Development Community (SADC): Food, Agriculture and Natural Resources (FANR), Harare.
- SAS/STAT® Version 9.2 (2008). SAS Institute Inc., Cary, NC.
- Schmink, M., and Wood, S. (1987). Political Ecology of Amazonia. In Little, P., and Horowitz, M. (eds.), *Lands at Risk in the Third World: Local-level perspectives*. Westview, Boulder.
- Scholes, R.J., and Biggs, R. (2004) *Ecosystem Services in Southern Africa: A Regional Assessment*. Council for Scientific and Industrial Research, Pretoria.
- Schroeder, R. (1992). Shady practice: Gender and the Political Ecology of Resource Stabilization in Gambian Garden/Orchards. *Economic Geography* 69 (4): 349-365.
- Seeley, A., Malamba, S., Nunn, A., Mulder, D., and Kengeyakaundu, J. (1995). Socio-economic status, gender, and risk of HIV 1 infection in rural Uganda. *Medical Anthropology Quarterly* 8 (1): 78-89.
- Sen, A. (1990). Gender and Cooperative Conflicts. In Tinker, I. (ed.), *Persistent Inequalities: Women and World Development*. Oxford University Press, New York.
- Senauer, B. (1990). The Impact of Value of Women's Time on Food and Nutrition. In Tinker, I. (ed.), *Persistent Inequalities: Women and World Development*. Oxford University Press, New York.
- Shackleton, C. M. (1993). Are the communal rangelands in need of saving? *Development Southern Africa* 10 (1): 65-78.

- Shackleton, C. M., Shackleton, S.E., and Cousins, B. (2001). The role of land-based strategies in rural livelihoods: the contribution of arable production, animal husbandry and natural resource harvesting in communal areas in South Africa. *Development Southern Africa* 18 (5): 581-604.
- Shackleton, S. E., Shackleton, C.M., and Cousins, B. (2000). Re-valuing the communal lands of southern Africa: New understandings of rural livelihoods. *Natural Resource Perspectives* No. 62 Overseas Development Institute (ODI), London.
- Shackleton, S. E. (2005). *The Significance of Local Trade in Natural Resource Products for Livelihoods and Poverty Alleviation in South Africa*. Unpublished Ph.D Dissertation, Department of Environmental Sciences, Rhodes University, Grahamstown.
- Shackleton, S. E., Kaschula, S., Twine, W., Hunter, L., Holding-Anyonge, C., and Petheram, L. (2006). *Forests as safety nets for mitigating the impacts of HIV/AIDS in southern Africa*. *CIFOR Livelihood Brief* No. 4 Centre for International Forestry Research (CIFOR), Bogor.
- Sheppard, E. S. (2005). Knowledge production through critical GIS: geneology and prospects. *Cartographica* 40 (4): 5-21.
- Sillitoe, P. (2003). Globalizing indigenous knowledge. In Sillitoe, P., Bicker, A. and Pottier, J. (eds.), *Participating in Development: Approaches to indigenous knowledge*. Routledge, London.
- Singh, J., and Houtum, H. (2002). Post-colonial nature conservation in Southern Africa: same emperors, new clothes? *GeoJournal* 58: 253-263.
- Slater, R., and Wiggins, S. (2005). Responding to HIV/AIDS in agriculture and related activities. *Natural Resource Perspectives* No. 98 Overseas Development Institute (ODI), London.
- Slocum, R., Wichhart, L., Rocheleau, D., and Thomas-Slayter, B. (1995). *Power, Process and Participation - Tools for Change*. Intermediate Technology Publications, London.
- Smith, E., and Boyd, R. (1990). Risk and Incomplete Information in Behavioral Ecology. In Cashdan, E. (ed.), *Risk and Uncertainty in Tribal and Peasant Economies*. Westview Press, Boulder.
- South Africa Department of Health (2008) *South Africa Demographic and Health Survey 2003*. South Africa Department of Health, Pretoria.
- South Africa Department of Health (2008). *National HIV and Syphilis Prevalence Survey in South Africa 2002-2007*, South Africa Department of Health, Pretoria.

- South Africa Department of Health (2009). *National HIV and Syphilis Prevalence Survey in South Africa 2008*, South Africa Department of Health, Pretoria.
- South Africa Department of Health (2009). *Fourth Report on Confidential Enquiries into Maternal Deaths in South Africa 2005-2007*, South Africa Department of Health, Pretoria.
- Southall, R. J. (1983). *South Africa's Transkei: The Political Economy of an 'Independent' Bantustan*. Monthly Review Press, New York.
- Spence, M. D. (1999). *Dispossessing the Wilderness: Indian Removal and the Making of the National Parks*. Oxford University Press, New York.
- Spencer, J., Frizzelle, B.G., Page, P.H., and Vogler, J.B. (2003). *Global Positioning System: A Field Guide for the Social Sciences*. Blackwell Publishing, Malden.
- StatsSA (2009) *Mid-year population estimates 2009*. Stats SA, Pretoria.
- Steinberg, S. J., and Steinberg, S. L. (2006). *Geographic information systems for the social sciences: investigating space and place*. Sage Publications, Inc., Thousand Oaks.
- Stephens, D. W. (1990). Risk and Incomplete Information in Behavioral Ecology. In Cashdan, E. (ed.), *Risk and Uncertainty in Tribal and Peasant Economies*. Westview Press, Boulder.
- Stepp, J. R., Jones, E. C., Paavo-Zuckerman, M., Casagrande, D., and Zarger, R.K. (2003). "Remarkable Properties of Human Ecosystems" *Conservation Ecology* 7(3): 11.
- Steward, J. (2006). The Concept and Method of Cultural Ecology. In H. Haenn, and Wilk, R. (eds.), *The Environment in Anthropology: A Reader in Ecology, Culture, and Sustainable Living*. New York University Press, New York.
- Sullivan, S. (2000). Gender, Ethnographic Myths and Community-Based Conservation in a Former Namibian 'homeland.' In Hodgson, D. (ed.), *Rethinking Pastoralism in Africa: Gender, Culture and the Myth of the Patriarchal Pastoralist*. James Currey, Oxford.
- Sunderin, W. D., Angelsen, A., Belcher, B., Burgers, P., Nasi, R., Santoso, L., and Wunder, S. (2005). Livelihoods, Forests, and Conservation in Developing Countries: An Overview. *World Development* 33 (9): 1383-1402.
- Tanser, F. (2000). HIV heterogeneity and proximity of homesteads to roads in rural South Africa: an exploration using geographical information system. *Tropical Medicine and International Health* (5): 40-46.

- Thangata, P., Hildebrand, P., and Kwesiga, F. (2007). Predicted Impact of HIV/AIDS on Improved Fallow Adoption and Rural Household Food Security in Malawi. *Sustainable Development* 15: 205-215.
- Thorp, R., Stewart, F., and Heyer, A. (2005). When and How Far is Group Formation a Route Out of Chronic Poverty? *World Development* 33 (6): 907-920.
- Thurston, J., Poiker, T., and Moore, J. (2003). *Integrated Geospatial Technologies: A Guide to GPS, GIS, and Data Logging*. John Wiley and Sons, Inc., Hoboken.
- Timmermans, H. G. (2004). *Rural livelihoods at Dwesa/Cwebe: poverty, development and natural resource use on the Wild Coast, South Africa*. Unpublished Masters thesis, Department of Environmental Science, Rhodes University, Grahamstown.
- Tinker, I. (1990). The Making of a Field: Advocates, Practitioners, and Scholars. In Tinker, I. (ed.), *Persistent Inequalities: Women and World Development*. Oxford University Press, New York.
- Turner, M. D. (2003). Methodological reflections on the use of remote sensing and GIS Science in human ecological research. *Human Ecology* 31 (2): 255-279.
- Turshen, M. (1984). *The political ecology of disease in Tanzania*. Routledge University Press, New Brunswick.
- Turshen, M. (1994). The impact of economic reforms on women's health and health-care in Sub-Saharan Africa. In Aslanbeigui, N., Pressman, S., and Summerfield, G. (eds.), *Women in the Age of Economic Transformation: Gender impact of reforms in post-socialist and developing countries*. Routledge, New York.
- UN (2002). *The Worlds Women 2002: trends and statistics*. United Nations, New York.
- UNAIDS (1999). *A review of household and community responses to the HIV/AIDS epidemic in rural areas of Sub-Saharan Africa*. UNAIDS, Geneva.
- UNAIDS (2007). *AIDS epidemic update*. UNAIDS, Geneva.
- Vayda, A. (1983). Progressive Contextualization: Methods for Research in Human Ecology. *Human Ecology* 11 (3): 265-281.
- Vayda, A., and Walters, B. (1999). Against political ecology. *Human Ecology* 27 (1): 176-179.
- Visvanathan, N. (1997). Introduction to Part 1. In Visvanathan, N., Duggan, L., Nisonoff, L., and Wieggersma, N. (eds.), *The Women, Gender, and Development Reader*. Zed Books, London.

- Walker, L., Reid, G., and Cornell, M. (2004). *Waiting to Happen: HIV/AIDS in South Africa: the bigger picture*. Lynne Rienner Publishers, Inc., Boulder.
- Walker, P. (2005). Political ecology: where is the ecology? *Progress in Human Geography* 29 (1): 73-82.
- Walker, P., and Peters, P.E. (2007). Making Sense in Time: Remote Sensing and the Challenges of Temporal Heterogeneity in Social Analysis of Environmental Change - cases from Malawi. *Human Ecology* 35: 69-80.
- Watts, M., and Peet, R. (1996). Conclusion: Towards a theory of liberation ecology. In Peet, R. and Watt, M. (eds.) *Liberation ecologies: environment, development, social movements*. Routledge, London.
- Wegerif, M., Russel, B., and Grundling, I. (2005). *Still Searching for Security: The reality of farm dweller evictions in South Africa*. Nkuzi Development Association and Social Surveys, Johannesburg.
- Weiner, D., Warner, T.A., Harris, T.M., and Levin, R.M. (1995). Apartheid Representations in a Digital Landscape: GIS, Remote Sensing and Local Knowledge in Kiepersol, South Africa. *Cartography and Geographic Information Systems* 22 (1): 30-44.
- Whiteford, L., and Hill, B. (2005). The Political Ecology of Dengue in Cuba and the Dominican Republic. In Guest, G. (ed.), *Globalization, Health, and the Environment: An Integrated Perspective*. AltaMira Press, Oxford.
- Whitehead, A. (1990). Rural Women and Food Production in Sub-Saharan Africa. In Dreze, J. and Sen, A. (eds.), *The Political Economy of Hunger*. Clarendon Press, Oxford.
- Wilshusen, P. R., Brechin, S.R., Fortwangler, C.L., and West, P.C. (2002). Reinventing a Square Wheel: Critique of a 'Protection Paradigm' in International Biodiversity Conservation. *Society and Natural Resources* 15: 17-40.
- Winterhalder, B., and Smith, E. (1981). *Hunter-gatherer foraging strategies: ethnographic and archeological analyses*. Chicago University Press, Chicago.
- Winterhalder, B. (2002). Behavioral and other human ecologies: Critique response and progress through criticism. *Journal of Ecological Anthropology* 6 (1): 4-23.
- Winterhalder, B., and Kennet, D.J (2006). Behavioral Ecology and the Transition from Hunting and Gathering to Agriculture. In Kennet, D. J. and Winterhalder, B. (eds.), *Behavioral Ecology and the Transition to Agriculture*. University of California Press, Berkeley.

- Wolf, E. (1972). Ownership and Political Ecology. *Anthropological Quarterly* 45 (3): 201-205.
- World Bank (2010) *Schooling, Income and HIV Risk (SIHR) Malawi*.
[http://siteresources.worldbank.org/DEC/Resources/HIVExeSummary\(Malawi\).pdf](http://siteresources.worldbank.org/DEC/Resources/HIVExeSummary(Malawi).pdf) .
Sourced on July 21, 2010.
- Wunder, S. (2001). Poverty Alleviation and Tropical Forests - What Scope for Synergies? *World Development* 29 (11): 1817-1833.
- Young, K. (1997). Gender and Development. In Visvanathan, N., Duggan, L., Nisonoff, L., and Wiegersma, N. (eds.), *The Women, Gender, and Development Reader*. Zed Books, London.
- Yuliana, L. (2005). *Strengthening Women's Participation through Collective Action for Inclusive Decisions making Processes: Lessons Learned from Two Villages in Jambi Province, Sumatra, Indonesia*. International Research Workshop on 'Gender and Collective Action' 17-21 October, 2005, Chiang Mai, Thailand.
- Zimmerer, K. S. (2000). The Reworking of Conservation Geographies: Nonequilibrium Landscapes and Nature-Society Hybrids. *Annals of the Association of American Geographers* 90 (2): 356-369.
- Zimmerer, K. S., and Bassett, T.J. (2003). *Political Ecology: An Integrative Approach to Geography and Environment-Development Studies*. Guilford, New York.
- Zlotnik, H. (2000). Female Migration in Relation to Female Labour Force Participation: Implications for the Alleviation of Poverty. In Garcia, B. (ed.), *Women, Poverty, and Demographic Change*. Oxford University Press, Oxford.

BIOGRAPHICAL SKETCH

Britt Alice Coles was born in Bangkok, Thailand. Raised in Sweden, she later moved to the U.S. as an adult to pursue university studies. She has a bachelor's degree in history from SUNY-Binghamton and a master's degree in interactive telecommunications from New York University - Tisch School of the Performing Arts. In the winter of 2001, after volunteering with a small but inspiring conservation and development program in Northern Thailand, Britt decided to change careers. Subsequently, she applied to the Interdisciplinary Ecology program at the School of Natural Resources and the Environment, University of Florida.