

# FINAL REPORT

## (SUMMARY)

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**AIDS mortality and Household Characteristics  
in Rural South Africa:  
Implications for Natural Resource Use  
and Development**

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Submitted by

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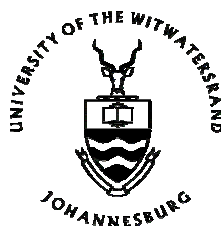
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PRIPODE



## **Introduction**

This project sought to explore relationships between household characteristics and experience of a prime-age adult mortality, and household use patterns of key natural resources in a rural sub-district of South Africa. The implications of such associations for development in rural African settings were assessed in a context of rising adult mortality due to HIV/AIDS, increasing levels of environmental degradation, and the centrality of natural resources in rural livelihoods. The study was conducted in the far north east of South Africa, in the Agincourt sub-district of Bushbuckridge district, Limpopo Province.

There is a significant lack of research as to how population and economic factors interact to influence household use of natural resources in rural South Africa. This information is key to understanding the complex interactions between humans and the environment, and the development implications of these interactions, within these less developed communities, particularly in the face of high HIV/AIDS prevalence, environmental degradation and high reliance on natural resources. This project specifically addresses these issues, within the context of the affect of AIDS mortality, by investigating patterns of use of key natural resources by rural households, as influenced by a recent mortality of a household member in the productive age group most vulnerable to AIDS mortality, as well by household size, composition and wealth status. The project took a novel approach to understanding the population — environment — development (PED) relationship by focusing on the development implications of resource use, with household-level natural resource use acting as a mediating factor between population factors and development potential. We also carefully integrated consideration of the impacts of HIV/AIDS upon household dynamics, resource use, and relevant development implications.

## **Methodology**

### *Research questions*

This project aims to address the following key questions within the context of a rural area in South Africa :

- 1) *What are the associations between natural resource selection, use, consumption and acquisition strategies and the household characteristics of size, composition and economic status in rural South Africa?*
- 2) *Beyond these household characteristics, how is prime-age adult mortality associated with the ways in which households select, use, consume, and acquire key natural resources?*

3) *What are the implications of these associations for development in the context of rising AIDS mortality among poor rural communities?*

#### *Data sources*

To answer the above research questions, we made use of 3 data sources, each reviewed in turn below. First, however, we provide a brief overview of the study context: the Agincourt sub-district of the Bushbuckridge region the Limpopo Province of South Africa.

*Study Context:* The Agincourt sub-district, named after one of the local villages, consists of 21 villages, comprising over 12 000 households and 70 000 people. This is the demographic surveillance site of the Agincourt Health and Population Unit (AHPU) of the University of the Witwatersrand. The area is typical of rural communities across South Africa, and is characterised by poverty, high human densities, and a high reliance on both natural resources and on remittances from a large migrant population. Due to poor employment opportunities in the region, a large proportion of adults are migrant labourers, working on commercial farms and in the towns and cities across the country. A significant proportion of households depend on the state pension of an elderly resident as the only reliable source of household income. Sero-prevalence of AIDS is around 18% in the region (Pronyk Pers Com..).

*Data Source #1, Ongoing Demographic Surveillance System:* Incidence of mortality in age groups most vulnerable to AIDS mortality, as well as other demographic characteristics of Agincourt households was provided through the Agincourt Health and Population Unit's (AHPU) longitudinal demographic surveillance system (DSS). Since 1992, the AHPU has collected census data at 12-18 month intervals from all 12,000 households in the Agincourt sub-district. The resulting data are incredibly rich in demographic detail, allowing identification of key household demographic characteristics (e.g., male/female headship, age composition). Of particular interest in the present project is household economic status, measured in the Agincourt DSS through an 'asset index' derived from an asset register including presence of a tap and toilet on the household stand, ownership of appliances (e.g. radio) and equipment (e.g. wheelbarrow), and income for a given census year. Having a solid demographic surveillance base was a strength of this project, demonstrating the value of a DSS as a foundation for cross-sectional and longitudinal studies.

*Data Source #2, Natural Resource and Development Survey:* Insight into the resource use patterns of Agincourt residents was provided through a survey of a random, stratified sample of 248 households. Half of these were randomly selected from a pool of households which had experienced a recent mortality in the productive age group most vulnerable to AIDS (15-49 years) in the previous two years. The parameter criteria for the selection of this start were that a) the household had to have been existent for the last five years, b) the household had experienced the death of a member aged 15-49 at death in the last two years, c) the household did not experience a death in that age group in the three years preceding the last two year period, and d) the household was still in existence at the time of the most recent census (July 2003). The other 124 *control* households were randomly sampled from households which have not had a mortality in the last two years. The parameter criteria for these households were that a) the household had to have been existent for the last five years, b) the household had not experienced the death of a member aged 15-49 at death in the last two years, c) the household did not experience a death in that age group in the three years preceding the last two year period, and d) the household was still in existence at the time of the most recent census.

*Data Source #3, Qualitative Interviews:* In addition to the quantitative data available through the DSS and field surveys, we undertook in-depth qualitative interviews with 30 households drawn randomly from the sample of 124 households which had experienced a death of a prime-age household member during the last two years. The interviews focussed upon the use of natural resources, including wild foods, as a coping strategy following a death in the household, while at the same time further exploring the constraints which a mortality places on the household's ability to acquire natural resources.

#### *Data collection*

Survey fieldwork started in early May 2004. The survey questionnaire was administered by a team of four experienced fieldworkers from the AHPU, supervised by a senior fieldworker and the PIs. The fieldworkers and field supervisor were from the study area and spoke the local language fluently. Households were thus interviewed in their mother tongue. Data collection took approximately six weeks.

The 30 qualitative interviews were conducted towards the end of the field campaign, after most households had been surveyed. The researchers were assisted by an interpreter who

translated questions and responses. Interviews were recorded using a dictaphone. This data collection took approximately two weeks.

### *Data analysis*

Analysis of the data was done by the PI's, lead by Hunter, and assisted by graduate students (Johnson, Kirkland, Patterson and Lefakane). The survey data were analysed using descriptive statistics and multivariate logistic and ordinary least squares regression models. The qualitative data were analysed primarily by Hunter and Kirkland. Thematic areas were identified, and representative statements were coded and compared. Pseudonyms were used.

### **Results**

Before examining the effects of household characteristics and experience of adult mortality on household resource use, we first consider general patterns of use of fuelwood and water in order to understand the context. Tables 1 and 2 show the descriptive statistics for fuelwood and water usage for all households included in the sample. Although the centrality of water in livelihoods is a given, the high reliance on fuelwood is an important finding. Over 90% of households used fuelwood, despite the fact that over 80% of all households had electricity (Table 1). This illustrates the context of poverty, in which electricity and appliances are expensive luxuries. Qualitative evidence from the interviews substantiates this fact. As an example, although the harvesting of live trees is prohibited by local rule, Asnath<sup>1</sup> explains that *“dry wood are scarce and some people use electricity stoves but some don't, then they are forced to cut down living trees ....”* She specifically argues that *“if jobs can be made available we can buy our own electricity stoves and we can stop getting to the bush to collect fuelwood.”* Melias verifies this by saying *“electricity is so expensive hence we chop down living trees despite restrictions.”*

Levels of use of both fuelwood and water are relatively frugal (Tables 1 & 2), indicating poor availability or access. Most households (78.4%) used 100 litres or less per day. The substantial proportion of households purchasing fuelwood also points to local scarcity of this resource around some villages, mainly due to overexploitation and land-use change. For both resources, the female head or wife and her daughters were primarily responsible for household provisioning.

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<sup>1</sup> Pseudonyms are used throughout.

**Table 1. Descriptive profiles of household fuelwood use.**

<i>Resource Use</i>	<i>Percentage or Mean</i>	<i>Min</i>	<i>Max</i>	<i>N</i>
<b>Use wood for fuel (%)</b>	92.8%			241
<b>Wood uses</b>				
Cooking	90.8%			227
Heating water for bathing	85.4%			225
Brewing traditional beer	3.3%			227
Heating house	1.3%			227
<b>Alternative Fuels</b>				
Electricity for cooking	31.3%			241
Electricity for lighting	82.5%			241
<b>Level of use</b>				
Wood per day in summer (in kg)	8.70	0	22	171
Wood per day in winter (in kg)	10.38	0	29	171
<b>Acquisition Strategies</b>				
Purchases wood	44.6%			241
Male head harvests	13.8%			241
Female head or wife harvests	36.2%			241
Son harvests	7.9%			241
Daughter harvests	34.6%			241
Other	14.1%			241

**Table 2. Descriptive profiles of household water use.**

<i>Resource Use</i>	<i>Percentage or Mean</i>	<i>Min</i>	<i>Max</i>	<i>N</i>
<b>Water Uses</b>				
Drinking	100.0%			248
Cooking	100.0%			248
Bathing	97.6%			248
Washing	98.4%			248
Water for plants	29.8%			248
Water for making bricks	18.2%			248
Water for animals	8.9%			248
Brewing traditional beer	6.1%			248
<b>Level of use</b>				
Water per day in summer (in litres)	82.73	10	225	236
Water per day in winter (in litres)	69.67	3	225	235
<b>Acquisition Details</b>				
Purchases water	0.4%			248
Minutes to collect	54.18	1	660	201
Male head collects	15.7%			248

Female head or wife collects	43.6%	248
Son collects	23.0%	248
Daughter collects	50.8%	248
Other	10.1%	248

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***1) What are the associations between natural resource selection, use, consumption and acquisition strategies and the household characteristics of size, composition and economic status in rural South Africa?***

Our first research question sets the stage for examination of mortality impacts by initially exploring other household factors as associated with resource use. Findings are summarised in Tables 3 and 4, under “Research Question # 1”.

Household characteristics influenced relatively few resource use variables for fuelwood and water. Electricity was used less often as an energy source for cooking by larger households, a plausible estimate given that larger households have more individuals for which to provide and more hands available for wood collection. Household size had no effect on levels of water consumption. Controlling for household size, age composition, and socio-economic status, households with relatively more men tended to use higher levels of wood in both summer and winter (Table 3). In addition, households with older age structure and higher SES tended to use slightly more wood in the summer. The interviews also provide evidence that households are clearly very conservative in their resource utilization as daily homestead fires are carefully tended, burning only the requisite amount of wood. Households with higher SES used less water in winter, which is difficult to account for.

Regarding acquisition strategies, the results of the regression models suggest that household composition and socio-economic status each have limited, but statistically significant effects on by whom fuelwood and water is acquired (Tables 3 & 4). In particular, larger households are more likely to have a male head who harvests wood or collects water. The male head is also more likely to harvest wood in households with more males. As would be expected, female heads are less likely to collect wood or water in households with relatively more male members. A daughter was less likely to collect water in households with higher SES. Households with a higher SES required less time to collect water, primarily due to better access, usually from taps in their yards.

The interviews shed qualitative light on decisions with regard to fuelwood collection strategies. Specifically, the in-person dialogues often reveal tradeoffs with regard to time and money. As an example, Virginia offers a description of such tradeoffs whereby her household uses wood *“from the field ... for cooking and for boiling water”* although they also purchase wood on occasion *“because [wood] is not available nearby hence we sometimes buy....”* This is not to say, however, that Virginia’s household has disposable income. Rather, when asked the source of the cash used to purchase fuelwood, she contends that *“we get this from relatives.”* However, due to the absence of regular income, some households have no option but to acquire scarce fuelwood through harvesting. Sbongile would like to buy natural resources, as opposed to collecting, as she explains: *“If we had money we were going to purchase fuelwood or hire someone to collect water because sometimes you feel tired but with no option.”*

Finally, village context influenced the daily consumption of water and whether households used electricity and. Local fuelwood shortages drove increased reliance on electricity, while local water shortages resulted in sparing consumption of water.

***2) Beyond these household characteristics, how is adult mortality experience associated with the ways in which households select, use, consume and acquire key natural resources?***

Our second question focuses more directly on the relationship between household experience of the death of a prime-age adult member and patterns in household resource use. Results of the multivariate models relating to this question are summarised in Tables 3 and 4 under “Research Question #2”.

Recent adult mortality experience had little effect on water use, but was associated with an increased likelihood of a household making use of wood, especially for cooking, although the negative coefficient for mortality\*SES suggests that this association is lesser for households of higher socio-economic status (Table 3). The implication is that poorer households impacted by an adult mortality are most likely to use fuelwood as their primary energy source. The mortality experience did not have a converse significant effect on the probability of using electricity for cooking or lighting. In addition, the negative estimates for years since mortality nearly reach statistical significance with  $p < 0.08$  for prediction of cooking with wood and  $p < 0.07$  for prediction of heating water with wood. Although not reaching the  $p < 0.05$



threshold, these estimates suggest that the association between these outcomes and adult mortality experience lessens with the passing of time. An interesting short-term impact was the widespread use of large amounts of fuelwood (mean = 750 kg) for catering purposes at funerals (84% of “mortality” households).

Loss of an adult had an impact on household collection strategies for fuelwood and water. Male heads were more likely to collect wood in mortality-impacted households (Table 3). In examining the gender of the deceased within households with a male head collecting wood, we find that gender is evenly split. It is possible, then, that male heads are called to collection duty in households in crisis. This is further suggested by the negative coefficient estimate for years since mortality, as the likelihood of male heads harvesting wood declines as time passes. A similar pattern emerges for the collection of water (Table 4).

Mortality experience had no discernable influence on household decision to buy wood instead of collecting it. However, despite these results, the qualitative interviews indicated that collecting, rather than buying, fuelwood was one of the cost-saving strategies engaged in by households which had lost a breadwinner (discussed in more detail below). The non-significant coefficients for purchasing wood in the “mortality” models may be as a result of confounding factors such as local availability, SES, and the absence of the role of the deceased in the household economy in the models. Purchasing water was not included as a water acquisition strategy in the multivariate models, as so few households indicated that they bought water (Table 2).

The interviews revealed substantive and important impacts of an adult mortality on household coping strategies, but these impacts were nuanced and represented by matters of degree. The dialogues suggest that mortality impacts are manifested by subtle, but important, alterations in task allocation and livelihood strategies, along with changes in related opportunity costs. Illustrative examples are presented in the following paragraphs.

In general, patterns of change in the selection, use, consumption and acquisition strategies of households experiencing an adult mortality are clearly related to the role of the deceased in the household economy. If the deceased was a resource collector, for example, but did not engage in income-generating work outside of the household, their resource collection duties were typically taken on by other household members. For example, George’s household lost their primary resource collector, George’s wife. As he explains, “*she used to collect fuelwood*

*in the bush .... She was responsible for household duties like cleaning and other things.”* George now stays with his sister’s daughter who *“performs those duties now.”*

Although the shifts in time allocation describe above are clearly important, the most significant changes in the household economy were felt when the deceased had contributed wages. But that said, impacts involving natural resource selection, use, consumption and collection strategies varied greatly. In some cases, the lost income had been used to purchase fuelwood and water, with household members subsequently being forced to collect wood and water on their own. As stated by Ntombi, the death of her self-employed household head *“brought a lot of changes. The first thing being changes on the diet and the second thing is that we are no longer able to buy fuelwood and water, so it requires us to do that by our own hands.”* Her household’s longer-term social capital has also been compromised since *“eventually his son had to drop out of school to look for a job.”* As noted, these increases in collection time entail opportunity costs, including reduced time for schooling and, in some cases, for household chores such as tending gardens.

Further illustrating shifts due to lost wages, Trezia discusses the impacts on her household following the death of her father. He worked as a gate keeper at a local game reserve and contributed important income to the household. Trezia describes *“there are lot of changes like I did not have to collect fuelwood, and he used to buy groceries, but now I need to do that on my own.”*

Another example of the potential impacts of lost wages is seen in the situation following the passing of Lucille’s husband. Lucille’s husband had been engaged in hard labour *“piece jobs like brick making and digging toilet holes.”* During his time of illness he was unable to work and was cared for by a traditional healer. Lucille thus had to take a job as a domestic worker. Since Lucille was then less available for household tasks, the children took primary responsibility for resource collection *“because they also needed to do the things I used to do.”* Unfortunately, after her husband’s death, Lucille became ill and she too was no longer able to work and must now rely completely on her children for maintenance of household tasks and modest contributions of income. Overall, Lucille’s story reveals a complex array of task reassignments to manage daily living in the context of illness and uncertainty.

Also revealing of the complex changes in household natural resource use patterns is the reconfiguration of household tasks following the death of Asnara's sister, who had been employed. The children in the household now have to collect fuelwood and, as she explains *"it is difficult to get fuelwood because there are no longer trees around."* Asnara is looking for a job and, if she finds one, *"I would reduce the boy's responsibilities since I will buy fuelwood. But with water, they would have to collect."* She would prefer that *"these boys would collect sand for ... bricks."*

#### *Food security and dietary reliance on the local environment*

The qualitative interviews revealed that the passing of an adult member also impacted on the household's food security and reliance on wild foods and foods from their gardens. Although not dealt with in the quantitative models, these results are important, as they further reflect human – environment interactions as shaped by experience of an adult mortality. As suggested by Tsakani's story, the strongest associations between mortality and shifts in household food security appear in cases where the lost income had been used specifically to purchase groceries. Tsakani's employed adult son recently passed away. He *"was a very good person who related well with siblings. He could do anything for them when asked."* He worked regularly and, as explained by Tsakani, *"would remember us every month end, buying groceries and a sac of maize meal [a local staple] ...."* Since his income has not been replaced, she explains that *"there is a serious gap now."*

Our interviews suggested that edibles collected from the local environment often replaced previously purchased goods. As clearly articulated by one respondent whose household had lost its primary wage earner, *"locusts are now our beef."* To further illustrate these associations, following are insights by Triza, Elliott and Meslina, each offering brief descriptions of their household's increased dependence on wild sustenance and their gardens following adult mortality experience.

Triza's deceased husband also worked long distance on a contract basis, regularly remitting *"some money which we used for groceries."* She has since found a job as a domestic worker, but explains that *"it used to be very hard because we had nothing to keep us surviving .... We relied [on wild vegetables] on a day-to-day basis because in the past we used to buy chicken, wors [sausage] and fish."*

Elliott explains that his wife passed away and he also recently lost his job. Elliott substantiates the fact that purchased food is often forgone once wages are lost “*yes, we stopped purchasing because you only do that when you have money ... sometimes we buy [food], but most of the time we rely on the garden.*”

Finally, Meslina lost her sister who was a waitress at a local game reserve. Her sister’s income was of great importance to their 7-person household and Meslina specifically noted the changes in diet in her description of household-level impacts. “*We used to buy groceries like beef and chicken but now we can only afford mixed portions no longer tinned stuff and other things. So you find that we rely on the field or borrow some money from neighbours.*” When asked which strategy they most often take, she explains that “*I may want to rely on asking money but when it comes to returning it, you find it is too difficult. I work on a budget that is why we rely on vegetable collection.*”

As seen from these examples, some households substituted bought foods with wild foods and crops from their gardens following the loss of a breadwinner. However, conversely, loss of household members who had done household chores forced other households to buy food which they had previously grown themselves, due to lack of household human resources. For example, Joseph used to tend his garden which provided important sustenance to the household, but since the deaths of both his parents, he no longer has the time. When asked if he now buys what he used to grow, Joseph agrees “*yes, I buy them now*” thereby resulting in decreased fiscal resources for other household needs. Similarly, both of Hope’s parents passed away, each of whom had previously assisted in their household’s resource collection. Hope explains that when her mother was alive, “*she used to do*” the cooking but now “*I do it myself.*” Hope also collects wood and water and, as she says, “*I have to do a lot of things by myself now.*” Because of necessity of taking on these new duties Hope no longer has time to tend the garden. “*I used to have a garden and I could go out to collect water to water my plants .... But I buy now [what I used to grow].*”

Clearly, mortality is not the only cause of loss of income which impacts on household food provision. For example, in addition to losing his sister who had been employed, Thomas was also laid off from his job several months ago, and due to the lost income, they stopped regularly purchasing food although “*sometimes we buy, but most of the time we rely on the garden.*”

**Table 3. Coefficients from the multivariate models for fuelwood use.**

	<u>Use Wood</u>	<u>Alternative Energy</u>		<u>Uses of Wood</u>		<u>Level of Use</u>		<u>Acquisition Strategies</u>				
	yes/no	Electricity for cooking	Electricity for lighting	Cooking	Heating water	Wood per day (kg, summer)	Wood per day (kg, winter)	Buy wood	Male head harvests	Female head/ wife harvests	Son harvests	Daughter harvests
<i>Research Question #1: What are the associations between household size, composition and economic status, and natural resource use?</i>												
<b>Household Size</b>	-0.01	<b>-0.10*</b>	0.03	0.03	0.09	0.04	0.10	-0.01	<b>0.18**</b>	-0.03	-0.08	0.03
<b>Household Composition</b>												
Sex Ratio	-0.41	0.20	0.07	-0.33	-0.49	<b>1.92**</b>	<b>1.93**</b>	0.10	0.35	<b>-0.42*</b>	0.07	0.07
Young Age Structure	-0.67	0.20	-0.70	-0.63	-0.34	0.48	-1.80	-0.22	-0.51	-0.26	-0.55	0.07
Older Age Structure	0.15	-1.27	-0.70	0.50	1.38	<b>2.64*</b>	3.67	0.06	0.89	0.25	-0.99	0.18
<b>SES</b>												
Possessions Index	0.50	0.11	0.19	0.33	<b>0.14**</b>	<b>0.99*</b>	0.61	-0.06	0.18	-0.10	-0.05	-0.12
<b>Village</b>	-0.04	<b>-0.06*</b>	<b>-0.25**</b>	-0.04	-0.09	-0.01	-0.02	-0.01	-0.01	-0.01	0.02	-0.07
<i>Research Question #2: Beyond these household characteristics, how is mortality experience associated with natural resources?</i>												
<b>Adult Mortality within past 2 years</b>	<b>3.39*</b>	-1.27	0.28	<b>3.48**</b>	<b>3.02</b>	3.47	-0.17	0.01	<b>2.84*</b>	-0.54	-1.89	1.20
<b>Mortality*SES</b>	<b>-0.83*</b>	0.09	-0.19	<b>-0.69*</b>	<b>-0.64**</b>	-1.21	0.61	0.05	-0.36	-0.05	0.64	-0.30
<b>Years since mortality</b>	-0.40	0.36	0.13	-0.56	-0.49	0.13	0.61	-0.14	<b>-0.89**</b>	0.23	-0.59	-0.05
<b>Constant</b>	<b>2.32*</b>	-0.09	3.68	<b>2.15*</b>	<b>2.19**</b>	4.12	9.05	0.19	<b>-3.79**</b>	0.64	-1.27	-0.17
<b>R<sup>2</sup></b>	0.08	0.06	0.20	0.08	0.10	0.11	0.09	0.01	0.11	0.04	0.08	0.04
<b>N</b>	239	239	239	239	239	169	169	239	239	239	239	239

\*p<0.05;\*\*p<0.01

1: Data Source: Agincourt Health and Population Unit, Population & Environment Survey, June 2004.

**Table 4. Coefficients from the multivariate models for water use.**

	<u>Uses of Water</u>				<u>Level of Use</u>			<u>Acquisition Strategies</u>			
	Brewing Trad. Beer	Water for plants	Water for animals	Water for making bricks	Daily consumption (litres summer)	Daily consumption (litres winter)	Minutes to Collect	Male head collects	Female head/ wife collects	Son collects	Daughter collects
<b>Research Question #1: What are the associations between household size, composition and economic status, and natural resource use?</b>											
<b>Household Size</b>	0.12	-0.04	0.05	-0.10	0.33	11.20	0.92	<b>0.13*</b>	-0.05	-0.09	0.01
<b>Household Composition</b>											
Sex Ratio	-0.35	0.01	0.14	0.00	2.19	2.12	7.26	<b>0.53**</b>	<b>-0.37*</b>	0.08	0.12
Young Age Structure	-0.51	-0.43	0.26	-0.25	5.91	7.51	10.56	0.21	-0.04	0.07	-0.16
Older Age Structure	0.57	-0.12	-0.50	0.84	5.29	8.91	-2.34	0.99	-0.16	-0.62	0.27
<b>SES</b>											
Possessions Index	-0.40	0.00	-0.01	0.09	-3.30	<b>-6.24**</b>	<b>-11.28*</b>	0.12	-0.13	0.12	<b>-0.26*</b>
<b>Village</b>	-0.03	<b>-0.01*</b>	-0.06	0.03	<b>-1.71**</b>	<b>-2.22**</b>	0.83	-0.01	-0.04	-0.02	-0.04
<b>Research Question #2: Beyond these household characteristics, how is mortality experience associated with natural resources?</b>											
<b>Adult Mortality within past 2 years</b>	2.393	0.27	0.92	0.33	-10.87	2.12	-36.46	0.21	-0.38	-0.06	0.78
<b>Mortality*SES</b>	-0.43	0.01	-0.05	-0.37	3.78	1.28	8.82	0.20	0.04	0.13	-0.18
<b>Years since mortality</b>	-0.10	-0.18	-0.66	0.22	3.58	1.84	12.36	<b>-0.70*</b>	0.08	-0.32	-0.01
<b>Constant</b>	-2.73	0.43	<b>-2.30*</b>	<b>-1.72*</b>	<b>98.46**</b>	<b>87.43**</b>	<b>67.41*</b>	<b>-3.27**</b>	<b>1.25*</b>	-0.65	0.78
<b>R<sup>2</sup></b>	0.09	0.04	0.05	0.07	0.05	0.10	0.08	0.11	0.04	0.03	0.03
<b>N</b>	240	240	240	240	228	227	195	240	240	240	240

\*p<0.05;\*\*p<0.01

1: Data Source: Anglicourt Health and Population Unit, Population & Environment Survey, June 2004.

***3) What are the implications of these associations for development in the context of rising AIDS mortality among poor rural communities?***

With regard to mortality, both quantitative and qualitative data reveal that adult mortality experience influences natural resource selection and collection strategies. Specifically, interview data suggest that wages lost due to the death of an adult member further reduce the likelihood that a household will be in a position to afford electricity for cooking, and hence climb the “energy ladder”. In this case, mortality exacerbates poverty, with poverty being the factor most shaping natural resource use strategies. Regarding natural resource collection, the analyses reveal shifts in time allocation of the remaining household members to cover the collection tasks previously undertaken by the deceased, especially with regard to the participation of the male household head in collection duties.

What emerges from our data is a picture of the role that natural resources play in buffering households against some of the economic shocks associated with the loss of a productive adult. First, by using natural resources such as fuelwood and wild foods, households are able to save much needed financial resources. Similarly, harvesting resources such as fuelwood instead of buying them, or paying for costlier alternatives, enables financial savings. Clearly, environmental degradation erodes this buffering effect of resource use. Importantly though, resource collection entails opportunity costs, and loss of household human capital to mortality may render harvesting of resources impractical, further stressing the household financially as it is forced to purchase resources. Second, the qualitative data suggest that increased dietary use of wild foods in response to the loss of a breadwinner, and thus the inability to buy food, may make a positive contribution to food security in such households.

The evidence from this study suggests that adult mortality and environmental scarcity are indeed colliding to shape and re-shape household strategies with regard to natural resource use and collection strategies. Importantly, the survey data reveal associations between SES and village resource context reflecting the interaction between poverty and location in determining household coping strategies. Combined with the interview data, the results reveal subtle and complex shifts at the household level. Based on this work, we argue that better understanding the role of natural resources in coping strategies is central to the design of effective policy aimed at supporting impoverished, adult mortality-impacted rural households.

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## APPENDIX

### Publications and presentations

The following publications and presentations are based primarily or exclusively on data from this study. CICRED is acknowledge in all of these. More are envisaged to follow.

#### Policy briefs

- 1) Twine, W. & Hunter, L. Adult mortality and household use of forest products in northeast South Africa. In S. Shackleton, *Forests as safety nets for mitigating the impacts of HIV/AIDS in southern Africa*. CIFOR InfoBrief. (In Press)

#### Journal articles (in prep., under review, forthcoming or in press)

- 1) Hunter, L.M., Twine, W., & Johnson, A. Population dynamics and the environment: Examining the natural resource context of the African HIV/AIDS pandemic. (In prep.)
- 2) Hunter, L.M., Twine, W. & Patterson, L. “Locusts are now our beef”: Adult mortality and household dietary use of local environmental resources in rural South Africa. *Scandinavian Journal of Public Health*. (Under review after corrections)
- 3) Kirkland, T., Hunter, L.M. & Twine, W. “The bush is no more”: Insights on institutional change and natural resource availability in rural South Africa. *Society and Natural Resources*. (Forthcoming)
- 4) Sherbanin, A. et al. Rural household micro-demographics, livelihoods and the environment. ( In prep., Hunter and Twine contributing a section on morbidity and mortality, rural livelihoods, and environmental resources)

#### Working papers

- 2) Hunter, L.M. & Twine, W. (2005) *Adult mortality, natural resources and food security: Evidence from the Agincourt field site in rural South Africa*. Working Paper EB2005-0001, Environment and Behavior Research Program, Institute of Behavioural Sciences, University of Colorado Boulder (USA).  
<http://www.colorado.edu/ibs/pubs/eb/eb2005-0001.pdf>
- 3) Hunter, L. M., Twine, W & Johnson, A. (2005) *The Role of Natural Resources in Coping with Household Mortality: An Examination in Rural South Africa*. IBS Working Paper: EB2005-0004: <http://www.colorado.edu/ibs/pubs/eb/eb2005-0004.pdf>

- 4) Kirkland, T., Hunter, L.M., and Twine, W. (2005) *The bush is no more: Insights on Natural Resource Availability from the Agincourt Field Site in Rural South Africa*. Working Paper EB2005-0002, Environment and Behavior Research Program, Institute of Behavioural Sciences, University of Colorado Boulder (USA).  
<http://www.colorado.edu/ibs/pubs/eb/eb2005-0002.pdf>

#### Presentations

- 1) Hunter, L.M. & Twine, W. Adult mortality, natural resources and food security: Evidence from the Agincourt field site in rural South Africa. *International Conference on HIV/AIDS and Food and Nutrition Security: From Evidence to Action*, Durban, South Africa, April 2005.
- 2) Hunter, L.M. & Twine, W. Adult mortality, food security and the natural environment: Evidence from the Agincourt field site in rural South Africa. *Invited presentation at the Agincourt Health and Population Unit Roundtable*, University of Witwatersrand Rural Facility, South Africa, June 2005.
- 3) Hunter, L.M., Twine, W. & Johnson, A. The natural resource context of HIV/AIDS mortality in rural South Africa. *25<sup>th</sup> Congress of International Union for the Scientific Study of Population*, Tours, France, July 2005.
- 4) Kirkland, T., Hunter, L.M. & Twine, W. “The Bush is No More”: Insights on natural resource availability and institutional change in rural South Africa.” *100<sup>th</sup> Annual Meeting of the American Sociological Association*, Philadelphia, USA, August 2005.
- 5) Twine, W. & Hunter, L.M. HIV/AIDS mortality and household reliance on natural resources in Bushbuckridge. *4<sup>th</sup> Kruger Park Networking Meeting*, Skukuza, South Africa, March 2006