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Ndengejeho, Henry Michael

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LINKING HOUSEHOLD WEALTH AND RESOURCE USE: A CASE STUDY IN THE AGINCOURT RURAL DISTRICT OF SOUTH AFRICA.

Henry Michael Ndengejeho

A research report submitted to the Faculty of Science, University of the Witwatersrand, Johannesburg, in partial fulfillment for the degree of Masters of Science in Environmental Science

Johannesburg, March 2007

DECLARATION

I declare that the dissertation is my own, unaided work except where acknowledged. It is being submitted for the degree of Master of Science in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

(Signature of candidate)

_____day of _____ 2007

ABSTRACT

The importance and value of natural resources to rural livelihoods have been well documented. However, most studies quantify mean consumption and direct use values across households, overlooking the significant differences that occur within and between households. This study investigated the influence of household wealth on the use of natural resources and the direct use values derived from them in the Agincourt sub-district of the Bushbuckridge local municipality in Mpumalanga Province, rural South Africa. Four natural resources were examined, namely edible herbs, wild fruits, edible insects, and fuelwood, although 13 additional resources were referred to. Households were grouped into three socio-economic classes (poor, medium and wealthy) based on assets possessed by the household, to explore wealth-related differences and similarities in the use and value of natural resources. The asset register included household possession of assets such as vehicles, appliances, cellphones, wheelbarrows, as well as the number and type of dwellings in the homestead yard. The households' use of natural resources was compared among the different socio-economic classes. The study found no difference in the number of natural resources used by households of different socio-economic status. The type of resources used was influenced by household's possession of material resources. Poor households relied more on natural resources than wealthier households for their daily food and energy needs. The household consumption and direct use values of edible herbs and fuelwood were higher in poor households. The per capita consumption and direct use values of edible herbs, edible insects and fuelwood were higher in poor households too, although only fuelwood differed significantly among socio-economic classes. This study highlighted that wealth in isolation may not have an obvious influence on natural resources use, and that culture and gender play significant roles too. The assessment of household wealth is not easy and should be based on multiple criteria (i.e. a proper livelihoods analysis) to fully capture all relevant aspects of wealth.

ACKNOWLEDGEMENT

I have not given anything to reach this point and time but the Loving God has given me life, health and strength to go through these years. He did not act alone though; He gave me a loving and caring family that stood behind me all the way filling me with hope and encouragement that helped me aim for the stars. I owe it all to you.

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1. INTRODUCTION

1.1. BACKGROUND OF THE STUDY

The significance and importance of natural resources to rural livelihoods have been well documented (Barham *et al.* 1999; Campbell *et al.* 2000; Cavendish 2000; Arnold and Pérez 2001; Barrett *et al.* 2001; Takasaki *et al.* 2001a; Twine *et al.* 2003; Dovie *et al.* 2005; Hunter *et al.* 2005; Shackleton and Shackleton 2004; de Haan 2006; Shackleton and Shackleton 2006). They are used for daily subsistence and/or traded commercially.

One way of valuing the resources used is by calculating the direct use value. Direct use value is an economic value derived from direct use or interaction with a biological resource or resource system (Shackleton and Shackleton 2000). Most studies demonstrating the value of natural resources have dealt with mean consumption and direct use values across households. Although rural households are generally poor (Barham *et al.* 1999) significant differences within and among communities do occur (Barham *et al.* 1999; Shackleton and Shackleton 2006). These differences are mostly overlooked because socio-economic stratification is less visible in rural areas. Nevertheless, strata do exist in these communities and are based on socio-economic factors such as level of employment and education, relationship to elites, age (Shackleton and Shackleton 2006) and gender (Smith *et al.* 2001).

There is evidence that all households regardless of their wealth status make use of natural resources. Studies have suggested that wealth (type and level) influences the way rural people use locally available natural resources (Barham *et al.* 1999; Carter and May 1999; Cavendish 2000; Barrett *et al.* 2001; Takasaki *et al.* 2001; Twine *et al.* 2003; Niefhof 2004; Shackleton and Shackleton 2006). This study explores the relationship between household wealth and the use of natural resources in rural South Africa.

1.2. OBJECTIVES AND KEY QUESTIONS OF THE STUDY

1.2.1. Objectives

The project investigated the influence of household wealth status on the use (harvesting, consuming, selling and buying) and the direct use value of natural resources utilized by rural households in rural South Africa.

1.2.2. Key questions

1. What is the relationship between household wealth status and household use (harvesting, buying, consumption, and trade) of natural resources?

2. What is the relationship between household wealth status and the direct use value of natural resources consumed by households?

1.2.3. Predictions

1. Wealthier households consume a greater quantity and diversity of natural resources than poorer households.

2. Wealthier households buy more natural resources than poorer households.

3. Poorer households sell more natural resources than wealthier households.

4. Because they use greater amounts of resources, the gross direct use value of natural resources is higher in wealthy households compared with poor households.

2. LITERATURE REVIEW

2.1. RURAL LIVELIHOOD STRATEGIES AND DIVERSIFICATION

There is a growing focus on rural livelihood strategies and diversification as an approach to rural poverty reduction and development in developing countries (Reardon and Vosti 1995; Scoones 1998; Ellis and Biggs 2001; Niefhof 2004). Livelihood is defined as a means of earning a living and achieving well being (de Haan and Zoomers 2005). The household is at the centre of livelihood strategies and diversification. de Haan and Zoomers (2005) define a household as a "co-resident group of persons who share most aspects of consumption, drawing on and allocating a common pool of resources to ensure their material reproduction" and well-being. This definition regards the household as a unit of consumption, production and resource management (Dovie *et al.* 2005; Niefhof 2004). The household relies on the contribution of every individual member to the well-being of the overall household (Dovie *et al.* 2005).

The household members use various resources and assets to build their livelihood (Barrett *et al.* 2001; de Haan 2006; Dovie *et al.* 2005; Smith *et al.* 2001). The resources and assets used can be grouped into five capitals (de Haan 2006; Scoones 1998), namely:

- Natural capital: ecosystem goods (e.g. food, medication, energy, etc) and services (hydrological cycle, carbon sequestration, recreational services, etc);
- Human capital: skills, experience, knowledge, creativity, good health and physical capacity of household members;
- Financial capital: savings, cash, capital base, loans and credits;
- Social capital: relationships and networking; and
- Physical capital: homestead, materials and equipment.

The household uses these capital assets to achieve the household goals and objectives (e.g. health, food and livelihood security and well being) in formulating a livelihood strategy (Figure 1).

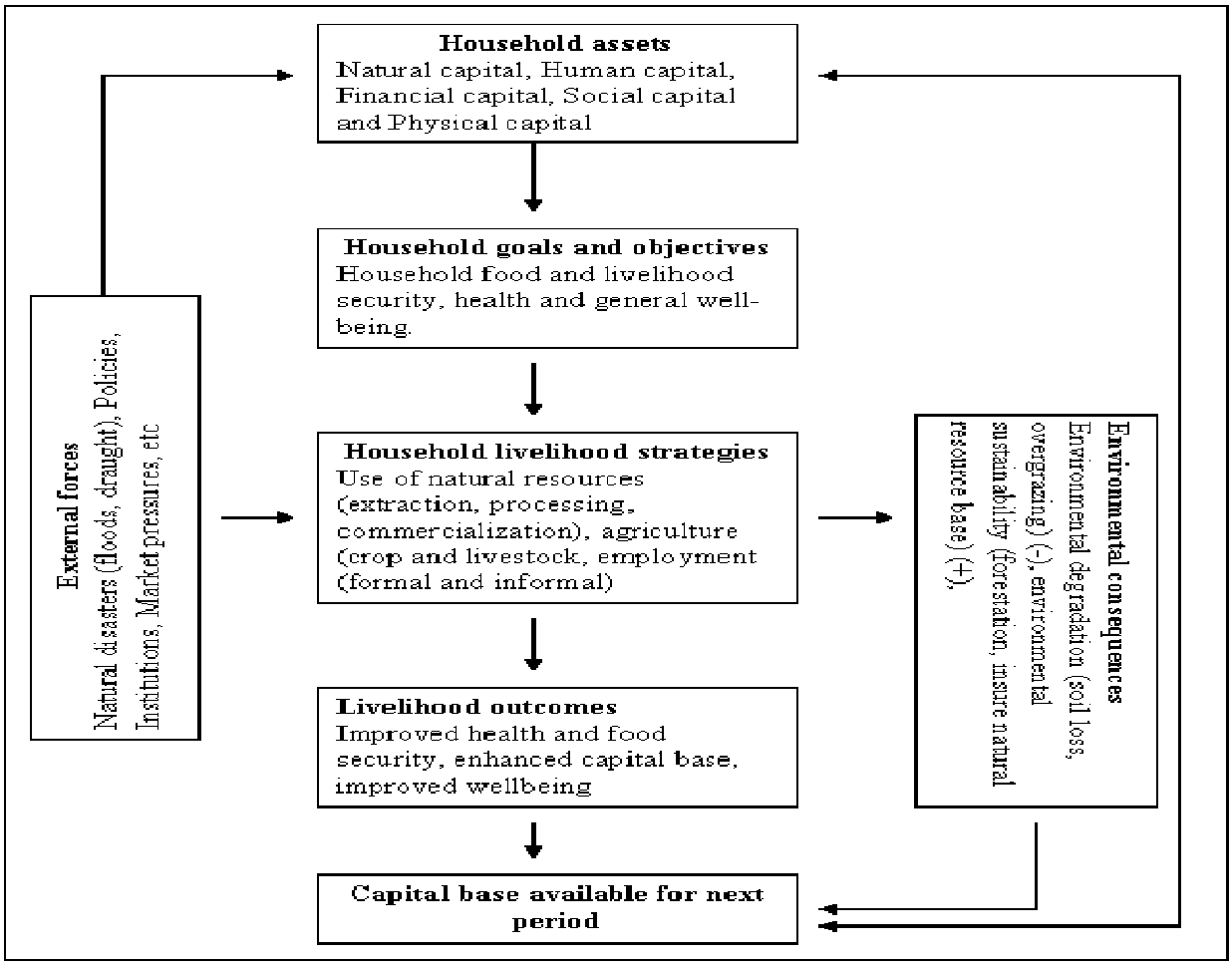


Figure 1. Rural livelihood strategy, a modified diagram from Haan 2006; Reardon and Vosti 1995; and Scoones 2001.

The chosen livelihood strategy can involve the extraction of natural resources, formal and informal trade, and agriculture, to mention a few. External factors (e.g. institutions, policies, and drought) influence the form of livelihood strategy the household would adopt (de Haan 2006). For example, policies might be put in place regulating the extraction (e.g. period of extraction and quantity extracted) of natural resources forcing household members to find alternative means of maintaining their livelihood. The livelihood outcome could be improved in terms of health and food security and overall capital base but there could also be a loss of capital through failed investments. The livelihood strategy chosen by a household could have either positive or negative

implications for the environment. Using resources sustainable ensures the continuous supply of resources; otherwise uncontrolled and intensified pressure on the resources could result in environmental degradation and/or resource loss.

A livelihood is considered sustainable when it is able to adequately meet household members` individual needs and withstand shocks and stresses without compromising the capital base, but rather enhancing it (Scoones 2001; de Haan 2006). Rural livelihoods are diverse (Barham *et al.* 1999; Carter and May 1999; Barrett *et al.* 2001; Smith *et al.* 2001; Takasaki *et al.* 2001, Niefhof 2004; Shackleton and Shackleton 2006) and do not rely simply on one livelihood option or collection of their wealth in one form (Barrett *et al.* 2001, Shackleton and Shackleton 2006). Livelihood strategies usually include farming (e.g. crops and livestock), and non-farming activities (e.g. employment, informal trades, etc) (Reardon and Vosti 1995; Smith *et al.* 2001) and extraction of natural resources.

2.2. NATURAL RESOURCES AND RURAL LIVELIHOODS

The importance and value of natural resources have been well documented (Arnold and Pérez 2001; Barham *et al.* 1999; Barrett *et al.* 2001; Campbell *et al.* 2000; Cavendish 2000; de Haan 2006; Dovie *et al.* 2005; Hunter *et al.* 2005; Shackleton and Shackleton 2004; Shackleton and Shackleton 2006; Takasaki *et al.* 2001a; Twine *et al.* 2003). Natural resources provide ecosystem goods such as food (e.g. wild fruits, bushmeat, insects, and wild edible herbs), energy (e.g. fuelwood), medication (e.g. medicinal plants), material and tools (e.g. poles for construction, thatch grass for roofs and wooden utensils for cooking), ecosystem services (e.g. hydrological cycle, carbon sequestration, air purification) and recreational services. They also have cultural and spiritual values (Shackleton *et al*. 2007).

Certain types of natural resources such as wild fruits, wild edible herbs and fuelwood, are used daily for domestic purposes. Studies have indicated that over 80% of rural South African households may use these resources (Twine *et al.* 2003; Dovie *et al.* 2005,

Shackleton and Shackleton 2006). Other natural resources such as bushmeat, insects, poles for houses, fences and kraals, reeds for weaving, thatch grass, wood for carving and medicinal plants are used by fewer households. Poles for houses, fences and kraals, reeds for weaving and thatch grass are used once-off during construction of a homestead, and replaced after a long period of time, while wood for carving and medicinal plants require special skills that are not possessed by all households.

A number of studies have calculated the household consumption and direct use value of a number of natural resources. The direct use value expresses the importance of a natural resource in monetary terms and illustrates the financial value of resource used domestically (Shackleton and Shackleton 2000; Twine *et al.* 2003). Shackleton and Shackleton (2004) reviewed a number of South African studies and found that the average household annual direct use value of all natural resources ranged from R900 to R12,462.

The ability to collect natural resources for free in the wild is seen as a means of saving the otherwise scarce cash resources and provides households with the opportunity to use the cash for other household needs and assets leading to a more secure livelihood (Twine *et al.* 2003; Shackleton and Shackleton 2006). However, there are costs other than monetary associated with the extraction and processing of natural resources (e.g. time allocated to extraction and processing of natural resources). Apart from domestic provision, natural resources are also a source of income generation (Shackleton and Shackleton 2006). The annual income derived from natural resources in Bushbuckridge, South Africa, ranges from approximately R500 (seasonal resources such as the sale of marula beer) (Shackleton 2004) to R17,000 (gained by hardwood carvers) (Shackleton and Shackleton 2004). Natural resources traded include wild fruits and herbs, mats, wooden carvings and utensils, grass and twig handbrooms, indigenous poles and fuelwood. Fuelwood is an important source of energy in rural South Africa (Madubansi and Shackleton 2007). More than 90% of households in rural South Africa make use of fuelwood as a source of energy (Shackleton and Shackleton 2000; Shackleton *et al*. 2001, Dovie *et al*. 2002; Twine *et al*. 2003; Dovie *et al*. 2004; Shackleton and Shackleton

2004). Fuelwood is mostly harvested by women and children in communal lands (Dovie *et al*. 2004).

Another fundamental role played by natural resources in the lives of rural people is that of a subsistence and economic buffer (Arnold and Pérez 2001; Hunter *et al.* 2005). Droughts, retrenchments, death, and illness have been shown to influence the way rural households use natural resources (Hunter *et al.* 2005; Niefhof 2004). Households turn to natural resources in hard times to supplement and/or replace the lost source of income and food. To achieve this, a household might (i) increase the amount of usually consumed resources; (ii) use natural resources previously not used and (iii) become temporarily involved in the trading of natural resources (Shackleton and Shackleton 2004). Shackleton (2004) indicated how the timing of the income generated from the sale of *marula* beer (*Sclerocarya birrea*) plays an important role in sustaining rural livelihoods through paying for school fees and purchasing of uniforms and books.

Least focused on, but nevertheless important, is the contribution of wild food to the diversity and nutrition of rural people (FAO 1991, Glew *et al.* 1997, Glew *et al.* 2005, Grivetti and Ogle 2000, Kalenga Saka and Msonthi 1994 and Ryman and Agoloyon 2006). Nutritional quality of wild fruits is comparable and in some cases superior to that of domesticated fruits (FAO 1991). Fruits are a good source of minerals and vitamins (Herzog and Amado 1994; Kalenga Saka and Msonthi 1994) and do contribute significant quantities of calories (FAO 1991) to rural people. The energy value supplied by wild fruits is comparable to that of domesticated fruits (Kalenga Shaka and Msonthi 1994). Seeds and nuts provide them with calories, oil and protein (FAO 1991). Wild vegetables are known to have higher micronutrients, minerals and vitamins than domesticated vegetables (Flyman and Afoloyom 2006). Some wild leaves provide fats and are a good source of proteins. Roots and tubers provide carbohydrates and some minerals (FAO 1991), while wild animal and fish resources are sources of animal protein (FAO 1991).

The services provided by the ecosystem to rural people have not been well documented (Shackleton and Shackleton 2006). In their study, Kundhlande *et al.* (2000) estimated the value of carbon sequestration services and water in the savanna woodlands of Zimbabwe. The value of carbon sequestration was calculated at Z$ 20[1] per hectare while that of water ranged from Z$ 0.12 per mm per ha (water used in wild foods) to about Z$ 40 per mm per ha (water used in crops). The cultural and spiritual importance of certain natural resources has been clearly demonstrated but few studies have been conducted (Shackleton *et al.* 2007). In providing the possible reason behind this, Shackleton *et al.* (2007) stated that **"**the notion of culture has different meanings and interpretations, and is frequently difficult to define or describe in tangible or monetary terms**".** Cocks and Møller (2000) found that 30% of medicinal plants collected are for cultural use. Cocks and Wiersum (2003) identified the use of wood piles and fuelwood species in specific ritual and ceremonies; while Campbell *et al.* (1997) indicated that 29% and 16% of the total goods acquired from the environment by the residents of Jinga and Matendeudze villages respectively, in Zimbabwe are for cultural use.

2.3. WEALTH AND NATURAL RESOURCES USE

Wealth can be defined as a sense of well-being (Wolff 1998), encompassing money, personal property (e.g. land, cars), access to essential services (e.g. health care, education, natural resources), possession of crops and livestock and social contacts. Because socio-economic stratification is less visible in rural areas, rapid rural appraisal and participatory appraisal techniques were developed to better evaluate household wealth (Adams *et al.* 1997, Takasaki *et al.* 2000). The method involves mapping and classifying households into different socio-economic classes or wealth classes by local people, who have the best knowledge of all the wealth measures the communities feel are important indicators of wealth. Some of the wealth measures outlined in the literature include ownership of livestock (cattle) and land, number of formal jobs, number of social grants, household health status, income, and household possessions or assets (Adams *et al.* 1997, Carter and

[1] At the time of Kundhlande *et al.* (2000) study, the exchange rate between Zimbabwean dollar (Z$) and the US dollar (US$) was US$ 1 = Z$ 10.

May 1997, Ellis and Mdoe 2003, Shackleton and Shackleton 2006, Takasaki *et al.* 2000, Takasaki *et al.* 2001, Twine *et al.* 2001).

Cavendish (2000) found that the demand for natural resources increases with wealth, making wealthy households the greatest users of natural resources (quantitatively) compared with poor households. Apart from using more resources, Twine *et al.* (2003) found that in the Mametja villages in the Limpopo Province of South Africa, wealthy households used a greater range of resources compared with poor households. This was attributed to the demand for more resources by bigger households, the availability of transportation (donkeys and trucks) and access to more manpower. However, poor households rely more heavily on natural resources for their basic needs than do wealthy households (Cavendish 2000; Shackleton and Shackleton 2006). Although poor households may consume less natural resources in absolute terms, these resources often make up a substantially greater contribution to the household economy, ie. value is greater, relative to total household income. Wealthy households derive a smaller but important proportion of their household income from natural resources compared with poor households. This proportion is reduced by a number of additional sources of income (e.g. formal employment, livestock and farming) available to them. Shackleton and Shackleton (2006) indicated that natural resources contribute on average 40% of the total income of poor households while the proportion contributed to wealthy households was 29%. Apart from this, poor households derive 20% of their income from the sale of natural resources compared with 5% by wealthier households.

In their study, Shackleton and Shackleton (2006) agreed that poor households rely more on natural resources than do wealthy households, but found that wealth did not change the quantity or the diversity of natural resources used by households, but rather the amount of bought resources relative to the amount self-harvested. Wealthy households bought more resources from neighbours and vendors than poor households while a large proportion of poor households (36%) were involved in the selling of at least one natural resource as their only source of income. Investigating the benefits of commercialization of natural resources, Arnold and Pérez (2001) concluded that wealthy households tend to

capture the most profit as they have the skills, technology and capital to start up and capture the markets regardless of the low barriers to entry.

3. STUDY AREA

The study was conducted in the Agincourt sub-district of the Bushbuckridge local municipality in Mpumalanga Province (formerly Limpopo Province), South Africa (Figure 2). Bushbuckridge local municipality forms part of the former homelands of Gazankulu and Lebowa.

The Agincourt sub-district is the field site of the Wits/MRC Agincourt Health and Population Unit (AHPU). The AHPU`s demographic surveillance system collects household data (e.g. size, migration, death, birth, asset possession, etc) from every household at the site in an annual census. The Agincourt field site consists of 21 villages of approximately 67,000 people occupying 12,000 households (Hunter *et al.* 2005) in an area of approximately 400km^2. The population per village ranges from 480 to 6,834 individuals.

As is the case in most rural South Africa, the area is characterized by a high unemployment rate, high level of migrant labour (especially males), high human population, and high reliance on remittance, social grants and natural resources (Hunter *et al.* 2005). Natural resources are collected from the village commons. Communal lands are generally under communal or customary land tenure (Hunter *et al.* 2005). The access to natural resources is mainly controlled by the traditional authority, although at times an overlap between the traditional authority, community development forum(s), and local government does occur causing confusion (Dovie *et al.* 2005). Apart from collecting natural resources, communal lands are used for grazing. Homestead yards are generally big and include dwellings, animal pens and gardens used for small-scale farming of subsistence products (Hunter *et al.* 2005). Agriculture is mainly small-scale arable plots, home gardens and road verges that contribute significantly to rural livelihoods (High and Shackleton 2000). Livestock is an important source of meat, milk, cash, and manure

(Shackleton *et al*. 2001, Dovie *et al.* 2006). Livestock are used for transport and regarded as a means of saving for the future (Dovie *et al.* 2005). Cash base strategies revolve around cash remittances from family members working in urban environments, local wages for labour (mainly from working on farm lands), informal trading (e.g. trade in natural resources and small shops) and social grants (e.g. pensions, child grants and disability grants).

The region is semi-arid with an annual rainfall of 550 to 700 mm (Hunter *et al.* 2005). The rainfall has an east-west gradient with the west being moister and east drier (general characteristic of the Bushbuckridge area) (Shackleton 2004). The western area against the Drakensberg escarpment being the wettest compared with the east. The vegetation is predominately broad-leaf savanna woodlands on granitic soils (Shackleton 2004).

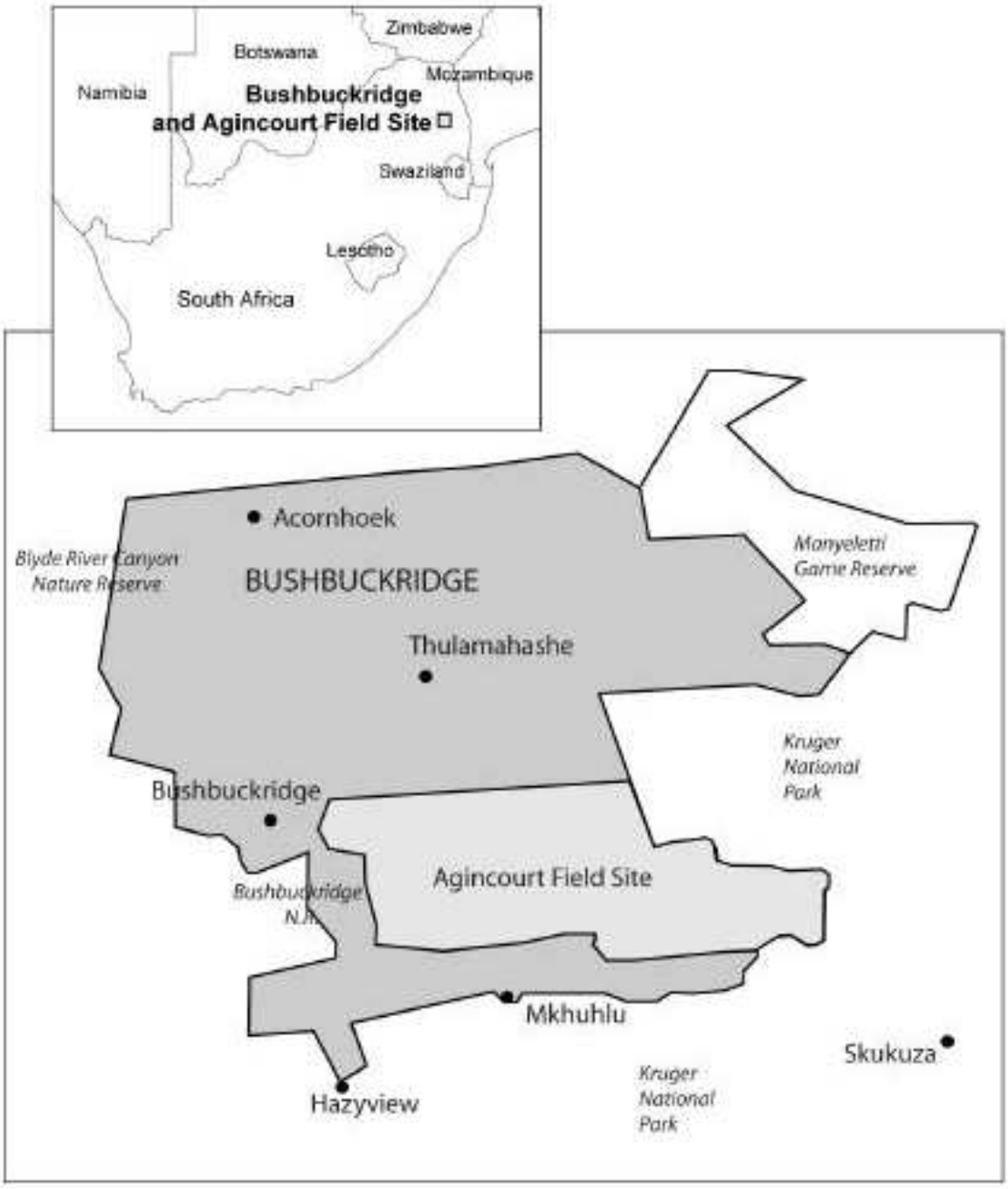


Figure 2. The study area, Agincourt part of the Bushbuckridge local municipality, South Africa. The Agincourt field site is approximately 400km^2. Source: Hunter *et al.* 2005.

4. METHODOLOGY

4.1. DATA COLLECTION

This study made use of two data sources. Firstly, data for household socio-economic and general resources use were obtained from a recent household survey conducted as part of a study funded by RENEWAL (Regional Network on HIV/AIDS, Livelihoods and Food Security, (RENEWAL project, unpublished data). The study investigated the relationship between adult mortality, household resources use and food security, and included a quantitative survey of 300 households. The households were stratified by their recent experience of an adult death (HIV/AIDS; non-HIV/AIDS; no death). The RENEWAL study collected detailed data on resource use, acquisition, consumption and trade, in the households but no information on the quantity of each resource consumed, sold or traded by households was collected. The RENEWAL study focused on 17 resources (namely, edible herbs, wild fruit, edible insects, wild birds, bushmeat, fish, honey, fuelwood, grass brooms, twig brooms, traditional medicine, fence poles, thatching, building poles, wood carvings, reed mats, traditional baskets) known to be widely used at the Agincourt field site.

The data collected were made available to this study by principle investigators Twine and Hunter and were used to investigate the relationship between household resource use (percentage of households consuming, harvesting, selling and buying) and the household wealth status. Households' demographic and wealth status was drawn from the Agincourt Health and Population Unit (AHPU) database for the studied households. Household wealth scores were derived by the AHPU scientists from an asset index derived from the asset register data collected by the unit for all households in the study site in 2006. The asset register included household possession of assets such as vehicles, appliances, cellphones, wheelbarrows, as well as the number and type of dwellings in the homestead yard. It also included access to electricity and water in the yard. Households were thus assigned an asset ownership score, and were categorized into five socio-economic status

(SES) classes based on the scores, with "1" being the poorest and "5" being the richest in terms of assets.

The second set of data was collected by the author for a subset of houses from the RENEWAL sample. Information on the quantity of fuelwood, edible insects, edible wild fruits and herbs consumed per household was collected through the use of structured interviews. The above resources were selected because they are reported to be widely used by most rural households (Twine *et al.* 2003; Dovie *et al.* 2005, Shackleton and Shackleton 2006) and play an important role in household food security. Questions were also asked about the perception of the respondent on the relationship between household wealth and use of these resources. Mothers were the focal group of the interviews as they are the ones mostly involved in the gathering of natural resources and preparation of household meals. In instances where mothers were not present or did not have time for the interview, a new date was scheduled, but where mothers worked far from villages, the eldest child looking after the household and preparing the meals was interviewed. Interviews were carried out on a household basis. A household is considered a unit of consumption, production and resource management. The interviews were conducted in the same manner to generate comparative data.

Households from the RENEWAL sample without a recent adult mortality (n = 107) were used for this study. This was to 1) avoid research burden on these heavily studied households, and 2) factor out the confounding impacts of loss of an adult on the household use of resources. All households within this stratum (excluding households with missing data from the RENEWAL database) were selected from SES quintile 1 (poor; n = 13), 3 (medium; n = 26) and 5 (wealthy; n = 19). These made up a sub-sample (n = 58 households) of the 107 households interviewed in the RENEWAL study. Quintile 2 and 4 were not used for the analysis of household consumption and direct use values to ensure statistical independence of the wealth classes used in this study. Interviews were carried out with the assistance of a local translator. Maps obtained from the AHPU office helped in the identification of the exact location of households interviewed, since each house in the database had a unique identifier which appeared on the maps. For each

resource, interviewees were asked to show the amount of each of the four resources consumed daily, weekly and seasonally by the household (e.g. bundle of wood, a bucket or a pot used) and to indicate whether they harvested, bought or sold the resources. Bundles of fuelwood were weighed using a spring balance. Where containers were used, their dimensions were measured using a tape measure (e.g. height and diameter of the pots), as well as height to which it would be filled with the resource. All the measurements were recorded and converted (where necessary) to standard units (kilogram or litre). Local prices of these resources were obtained from the interviews. Prices were expressed per unit mass or volume. Where volumes were given as wheelbarrow load or track load, they were converted into mass using conversion factors from Twine *et al*. (2003).

4.2. DATA ANALYSIS

4.2.1 Socio-economic/household characteristics data

Household characteristics of the 58 houses (number of permanent residents [members who eat meals in the household four days a week], sources of income [including social grants] and number of employed residents) were averaged across households in each SES quintile. The number of permanent jobs and income sources were divided by the number of permanent residents per household. This gave an indication of the number of permanent jobs and income sources per resident for each household in each of the three SES classes.

Multivariate analysis of variance (MANOVA) was used to test if the observed differences in the household characteristics between the three SES classes were statistically different. Where the differences were significant, a Scheffe's post hoc test was performed to reveal where the difference lay.

4.2.2 Relationships between household wealth and resource data

The percentage of households using (consuming, harvesting, buying and selling) a resource in each of the socio-economic status was computed. The annual consumption of each resource was calculated, taking into consideration the summer and winter periods (for edible herbs and fuelwood) and in-season (for fruits and edible insects). The official summer (39 weeks) and winter (13 weeks) periods obtained from the weather bureau were used. Where different patterns were observed, the summer and winter consumptions were calculated separately and added up later to provide a single figure for the annual consumption. Annual household consumption represented the amount of a resource that reached home and consumed by its residents. The annual consumption and the direct use value of the four resources were computed as follows:

4.2.2.1 Edible herbs

Summer and winter weekly consumptions were multiplied by the weeks in-season giving rise to summer and winter consumptions. The seasonal consumptions were added to compute the annual consumption of edible herbs. The annual consumption was then multiplied by the unit price given the direct use value. The direct use value was obtained by multiplying the annual consumption by the unit price.

4.2.2.2 Wild fruits

Weekly consumption of each type of fruit was calculated and multiplied by the fruiting season to get the seasonal consumption. This separation was important as all the fruits did not have the same fruiting season. The fruiting seasons used for the various fruits were obtained from literature. *Sclerocarya birrea* trees are known to flower from September to November and bear fruits from November to January (Shackleton *et al.*, 2002). 13 weeks was used as the fruiting period for the tree. The fruiting season for *Strychnos spinosa*, *Strychnos madagascariencis* and *Diospyros mespiliformus* is from March to October (Pooley 1993). A period of 26 weeks was used as the fruiting season. Fruit annual consumption was obtained by adding together seasonal consumption of all fruits. The proportion of each fruit towards the overall annual consumption was calculated. The

direct use value of each fruit was then calculated by multiplying seasonal consumption of each fruit type by the given unit price. Adding the direct use value of all the fruits gave the direct use value for the household fruit consumption.

4.2.2.3 Edible insects

Edible insects were estimated to be available for 6 months of the year as indicated in Twine *et al.* (2003)**.** Weekly consumption was multiplied by 26 weeks to obtain the annual consumption. This then was multiplied by the unit price resulting in the direct use value.

4.2.2.4 Fuelwood

Weekly summer and winter consumption of fuelwood were multiplied by 39 and 13 weeks respectively and the products added together to obtain the annual fuelwood consumption. The direct use value was obtained by multiplying the price of fuelwood by the annual consumption.

4.2.3 Statistical tests

ANOVA (analysis of variance), MANOVA, and Kruskal-Wallis tests were used to test for any significant differences between the annual household and per capita consumption and direct use value of the four selected resources between the three SES classes. Pair-wise t-tests were conducted to test if seasonal consumptions were statistically different.

Linear regression was carried out to establish the relationship between per capita consumption of edible herbs, wild fruit, edible insects and fuelwood, and a) number of resources per permanent resident used and b) number of sources of income per permanent resident. Income sources and number of resources used were expressed as a ratio to permanent household members in order to control for household size. After analyzing the residual plots, the per capita consumption data was transformed using square root transformation and outliers removed following outliers' diagnostics.

Apart from the four selected natural resources for which consumption and direct use values were computed, the percentage of households (n = 58) using 13 additional resources were calculated. The number of resources used was averaged for SES classes and ANOVA test used to test those significant differences. Using all the households from the RENEWAL sample, the percentage of households using the 17 resources were calculated and chi-square tests performed using the actual counts to test if there were any significant differences.

5. RESULTS

5.1. HOUSEHOLD CHARACTERISTICS

On average, number of permanent household members increased with household wealth status, although the p value (0.07) just missed the 95% significance criterion (Table 1). Wealthy households had significantly more people employed (1.1±0.18 individuals), compared with medium and poor households (0.5±0.15 and 0.41±0.15 individuals, respectively) ($F = 5.06$; $df = 28$; $p = 0.009$). This did not hold when considering the number of permanent residents. Wealthy households still had the highest mean ratio of permanent employment per resident (0.21±0.04 permanent employment per resident) but not significantly different ($p = 0.14$) from that of medium and poor households (0.11±0.03 and 0.11±0.05), respectively. Poor households had the least number of income sources (2.3±0.41) compared with the rest of the households, with the medium households having the most (3.2±0.39), but these differences were not statistically significant ($p = 0.42$). On average, a household used 10.0±0.03 resources while the mean ratio of resources used to number of individuals was 2.8±0.28. The average number of resources per household and per resident used between the different households in SES classes were not significantly different ($p = 0.91$ and $p = 0.21$, respectively).

5.2. RESOURCE USE

5.2.1 Edible herbs

All households, regardless of SES, consumed edible herbs (Table 2). All poor households (13) harvested edible herbs themselves, while 13.0% (26) and 5.6% (19) of medium and wealthy households, respectively, bought edible herbs. Of the households that harvested edible herbs themselves, 76% (58) harvested them from their home gardens and fields (Figure 3). The remaining 24% harvested edible herbs from communal lands and open fields. Of the 13 households harvesting edible herbs from communal lands and open fields, 7 households belonged to the medium socio-economic class, 5 households belonged to the poor socio-economic class and 1 household to the wealthy socio-economic class (Figure 3). No household stated selling edible herbs (Table 2), but the averaged price was R24.10/kg.

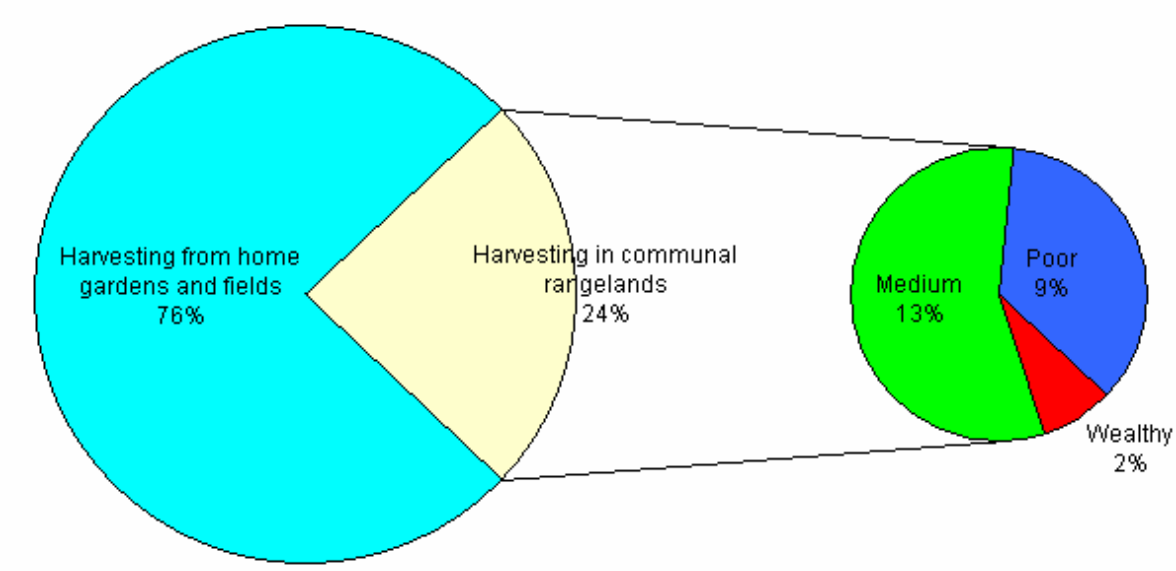


Figure 3. The proportion of households harvesting edible herbs from the two sources; home gardens and fields and communal rangelands. The additional pie-chat illustrates the percentage of each SES classes harvesting from communal and open fields.

Table 1. Household characteristics (n = 58) (means±s.e.) of the three socio-economic status (SES) classes (values averaged across SES)

Households variables	Socioeconomic status				
	Poor (n = 13)	Medium (n = 26)	Wealthy (n = 19)	Significance	Mean
Permanent residents	3.8±0.51	4.6±0.58	5.7±0.64	p = 0.07	4.8±0.36
Permanent jobs	0.41±0.15[a]	0.50±0.15[a]	1.1±0.18[a]	*F = 5.06; df = 28; p < 0.009*	0.69±0.10
Temporal jobs	0.25±0.13 [a]	0.59±0.14 [a]	0.17±0.09 [a]	*F = 3.92; df = 21; p < 0.037*	0.37±0.08
Social grants	1.3±0.31	1.6±0.25	1.3±0.41	p = 0.71	1.4±0.19
Informal employment	0.33±0.14	0.45±0.12	0.56±0.12	p = 0.99	0.46±0.08
Permanent jobs/permanent resident	0.11±0.05	0.11±0.03	0.21±0.04	p =0.14	0.15±0.02
Total income sources	2.3±0.41	3.2±0.39	3.1±0.46	p = 0.42	2.9±0.25
Total income sources/permanent resident	0.64±0.09	0.87±0.21	0.57±0.07	p = 0.28	0.72±0.09
Number of resources used	10.1±0.37	9.9±0.41	10.00±0.70	p = 0.91	10.0±0.30
Ratio of resources used to number of residents	3.3±0.44	2.9±0.39	2.3±0.36	p = 0.21	2.8±0.23

Note: Values in the same row with the same letter are statistically significantly different. Italic p-values are significant.

Table 2. Percentage of households (n = 58) in the three SES classes using, harvesting and buying the four selected resources

Resources	Using SES				Harvesting SES				Buying SES			
	Poor (n=13)	Medium (n= 26)	Wealthy (n= 19)	Mean	Poor (n= 13)	Medium (n= 26)	Wealthy (n= 19)	Mean	Poor (n= 13)	Medium (n= 26)	Wealthy (n= 19)	Mean
Edible herbs	100.0	100.0	100.0	100.0	100.0	95.7	100.0	98.6	0.0	13.0	5.6	6.2
Fruits	71.4	60.9	77.8	70.0	100.0	65.2	100.0	88.4	7.1	4.4	0.0	3.8
Insects	71.4	73.9	88.9	78.1	81.8	69.6	83.3	78.2	18.2	0.0	11.1	9.8
Fuelwood	100.0	91.3	88.9	93.4	57.1	82.6	72.2	70.7	50.0	21.7	22.3	31.3

5.2.2 Wild fruits

Almost all households (70.0%, 58) consumed wild fruits (Table 2). Both the poor and wealthy households harvested fruits themselves. Poor and medium households supplemented the harvested wild fruits by buying wild fruits while none of the wealthy households bought wild fruits. The main types of fruits used were *Sclerocarya birrea* (nkanyi), *Strychnos madagascariencis* (mkwakwa), *Diospyros mespiliformus* (ntoma) and *Strychnos spinosa* (nsala) (Figure 4). The unit price of these fruits differed. *S. birrea* was estimated to cost 37.5 cents/kg (R30 for a 80 kg bag), *S.s madagascariencis* and *D. mespiliformus* R2/kg and a fruit of *S. spinosa* would cost 50 cents each (or R 2/kg).



Strychnos madagascariencis



Strychnos spinosa



Diospyros mespiliformus



Sclerocarya birrea

Figure 4. The main types of fruits consumed by rural households in the Agincourt district. (Sources: http://www.ntbg.org/plants/plant_details.php, http://www.Plantzafrica.com /plantqrs/strychspin.htm, http://www.gateway-africa.com/food/index.html, http://news.bbc.co.uk/olmedia/1785000/images/_1789661_marula_300.jpg)

5.2.3 Edible insects

The main types of insects collected in the study area were grasshoppers and locusts. The majority of the households consumed edible insects (78.1%, 58). Of poor households, 81.8% (13) collected edible insects themselves, but still a large proportion (18.2%) bought edible insects as opposed to 11.1% (26) and 0% (19) of the wealthy and medium households respectively. The unit price of insects was R 8.3/liter.

5.2.4 Fuelwood

All poor households used fuelwood. The proportion of households using fuelwood decreased with increasing income (Table 2) although the proportions were still high bringing the overall average to 93.4% (58). The majority of households (70.1%) collected fuelwood themselves. Medium and wealthy households bought less fuelwood than poor households. Half of poor households did buy fuelwood as opposed to 21.7% (26) and 22.3% (19) of medium and wealthy households, respectively. The price of a truck load of wood was R200. Twine *et al.* (2003) cited a track load as 532 kg bringing the price of fuelwood to 37.6 cents/kg.

5.2.5 Other resources used

Of the other 13 resources, poor households did not use bushmeat and honey while medium households did not use honey (Table 3). The number of wealthy households using bushmeat was significantly higher than that of households in the poor and medium SES classes ($\chi^2 = 7.949$; df = 2; p = .019). All poor households used wooden carving and reed mats and had the highest percentage using poles for fences, grass broom, thatching grass and poles for building (92.3%, 76.9%, 38.5% and 38.5%, respectively), although these were not statistically different between SES classes.

Table 3. The number of households (n = 58) using natural resources (other then the selected four) in the three socio-economic status

Type of resource	Socio-economic status				
	Poor (n=13)	Medium (n= 26)	Wealthy (n= 19)	Significance	Mean
Wild birds	2	5	3	p = 0.94	3.3
Bushmeat	0	2	6	$\chi^2 = 7.95, df = 2; p < 0.019$	13.0
Fish	2	6	2	p = 0.53	3.3
Honey	0	0	2	p = 0.12	0.7
Grass brooms	10	15	14	p = 0.37	13.0
Twig brooms	12	24	18	p = 0.94	18.0
Traditional medicine	7	18	11	p = 0.58	12.0
Poles for fences	12	18	13	p = 0.24	14.3
Thatching grass	5	5	2	p = 0.15	4.0
Poles for building	5	5	6	p = 0.40	5.3
Wooden carvings	13	26	17	p = 0.12	18.7
Reed mats	13	25	18	p = 0.72	18.7
Traditional baskets	2	7	9	p = 0.13	6.0

Note: Significant p-values are in italics

Across 107 households (Table 4), edible herbs, wild fruits, wood carvings and reed mats were used by more that 90 % of the households. There were no significant differences in the number of households using the different resources between SES class, with the exception of bushmeat and traditional baskets. A greater proportion of the wealthiest households (SES class 5) used bushmeat than the other classes ($\chi^2 = 11.38$; df = 4; p = 0.023). There were significantly more households in the SES classes 4 and 5 ($\chi^2 = 9.88$; df = 4; p = 0.042) using tradition baskets that households in SES class 1, 2 and3.

Table 4. The proportion (%) of the 107 households using the commonly used natural resources in the Agincourt field site (frequency in brackets).

Resources used	*Socio-economic status*						
	1 (13)	2 (28)	3 (26)	4 (22)	5 (18)	Significance	Mean
Edible herbs	100.0 (13)	100.0 (28)	100.0 (26)	95.0 (21)	95.0 (17)	p = 0.48	98.1
Wild fruit	100.0 (13)	92.6 (26)	96.2 (25)	95.0 (21)	90.0 (16)	p = 0.71	94.4
Edible insects	85.7 (11)	62.9 (18)	84.6 (22)	70.0 (15)	85.0 (15)	p = 0.35	76.6
Wild birds	14.3 (2)	25.9 (7)	19.2 (5)	5.0 (1)	15.0 (3)	p = 0.59	16.8
Bushmeat	0.0 (0)	7.4 (2)	7.7 (2)	5.0 (1)	35.0 (6)	*$\chi^2 = 11.38$; df = 4; p = 0.023*	11.2
Fish	14.3 (2)	18.5 (5)	23.1 (6)	25.0 (6)	10.0 (2)	p = 0.85	18.7
Honey	0.0 (0)	3.7 (1)	0.0 (0)	10.0 (2)	10.0 (2)	p = 0.33	4.7
Fuelwood	100.0 (13)	81.5 (23)	76.9 (20)	100.0 (22)	90.0 (16)	p = 0.07	87.9
Grass brooms	78.6 (10)	59.3 (17)	57.7 (15)	80.0 (18)	75.0 (14)	p = 0.34	68.2
Twig brooms	98.9 (12)	96.3 (27)	92.3 (24)	100.0 (22)	95.0 (17)	p = 0.74	95.3
Traditional medicine	57.1 (7)	51.9 (15)	69.2 (18)	70.0 (15)	55.0 (10)	p = 0.67	60.8
Fence poles	92.9 (12)	74.1 (21)	69.2 (18)	65.0 (14)	70.0 (13)	p = 0.51	72.9
Thatching	37.7 (5)	14.8 (4)	19.2 (5)	35.0 (6)	10.0 (8)	p = 0.22	21.5
Building poles	42.9 (6)	40.7 (11)	19.2 (5)	50.0 (11)	30.0 (5)	p = 0.32	35.5
Wood carvings	100.0 (13)	100.0 (28)	100.0 (26)	95.0 (21)	90.0 (16)	p = 0.15	97.2
Reed mats	100.0 (13)	92.6 (26)	96.2 (25)	95.0 (21)	95.0 (17)	p = 0.90	95.3
Traditional baskets	21.4 (3)	26.6 (7)	26.9 (7)	65 (14)	45.0 (8)	*$\chi^2 = 9.88$; df = 4; p = 0.042*	37.4
Total number	10.3	9.5	9.6	10.6	9.9		9.9
Total number/resident	4.1	2.9	3.2	3.1	2.4		3.1

Note:. Significant p-values are in italics.

5.3. COMPARING CONSUMPTION OF FOUR SELECTED NATURAL RESOURCES BETWEEN THE DIFFERENT SOCIO-ECONOMIC STATUS CLASSES

5.3.1 Edible herbs

The mean household consumption of edible herbs decreased with increasing wealth class, but the observed differences were not statistically significant ($F = 0.93$; $df = 2$; $p = 0.40$). However, consumption by poor households was significantly higher than that in the other two SES classes when expressed as per capita ($F = 3.18$; $df = 2$; $p = 0.036$). On average, poor households ate wild herbs with 0.78±0.08 meals a day as opposed to 0.58±0.20 for medium households and 0.48±0.10 for wealthy households. The difference was not significant ($F = 1.17$; $df = 2$; $p = 0.15$). The average daily winter consumption of edible herbs across SES classes was 37.8% less than that of summer (Table 5). The difference between the amount of edible herbs consumed per day in summer and winter was found to be significant ($F = 4.01$; $df = 2$; $p = 0.000$). All households consumed significantly more edible herbs in summer [poor households ($T = 3.36$; $df = 13$; $p = 0.0051$); medium households ($T = 2.57$; $df = 20$; $p = 0.0184$) and wealthy households ($T = 3.22$; $df = 17$; $p = 0.005$)] than in winter. The difference in the amount of edible herbs consumed in summer and winter was statistically significantly different amongst SES classes ($T = 4.01$; $df = 52$; $p = 0.0002$).

Table 5. The consumption and direct use values (means±s.e.) of the four selected resources between the different socio-economic status classes

		Socio-economic status				
Resources	Variable	Poor	Medium	Wealthy	Significance	Mean across SES
Edible herbs	Household consumption (kg)	92.3±15.4	89.3±29.8	60.4±11.4	p = 0.40	80.3±13.0
	Per capita consumption (kg)	25.4±4.6 [a]	17.7±4.2 [b]	15.9±5.2 [b]	*F = 3.18; df = 2; p = 0.036*	18.9±2.8
	Meal per day	0.73±0.08	0.58±0.20	0.48±0.10	p = 0.15	0.59±0.14
	Summer consumption (g/day)[#]	272.6±45.6	256.6±68.9	177.2±33.4	p = 0.14	242.2±37.2
	Winter consumption (g/day) [#]	196.4±36.0	148.5±65.9	132.2±27.1	p = 0.69	155.6±29.0
	Household direct use value (R)	2222±363.9	2153±716.9	1456±274.7	p = 0.53	1935±313.1
	Per capita direct use value (R)	612±111.2 [a]	427±102.2 [b]	384±126.2 [b]	*F = 4.26; df = 2; p = 0.043*	455±66.5
Fruits	Household consumption (kg)	1956±548.4	1537±555.1	3223±1006	p = 0.16	2196±430.4
	Per capita consumption (kg)	504.9±165.2	263.2±83.2	557.5±148.3	p = 0.20	420.8±73.9
	Times collected per day	0.28±0.06	0.17±0.04	0.31±0.06	p = 0.14	0.24±0.06
	Household direct use value (R)	1757±754.0	1572±552.8	2486±733.7	p = 0.51	1918±381.3
	Per capita direct use value (R)	518±246.4	281±92.0	402±94.7	p = 0.48	378±75.5
Insects	Household consumption (l)	25.89±7.9	27.4±10.0	25.8±8.4	p = 0.81	26.5±5.3
	Per capita consumption (l)	6.62±3.2	6.4±2.6	4.4±1.6	p = 0.75	5.8±1.4
	Day per week	3.0±0.74	2.6±0.58	2.5±0.46	p = 0.10	2.7±0.3
	Household direct use value (R)	215±65.2	218±79.6	190±63.8	p = 0.77	208±42.0
	Per capita direct use value (R)	55±26.6	53±21.4	37±13.5	p =0.79	48±11.7
Fuelwood	Household consumption (kg)	6420±898.2 [a]	3477±590.3 [b]	5629±1055 [a]	*F = 2.39; df = 2; p = 0.010*	4987±515.9
	Per capita consumption (kg)	1663±317.6 [a]	781.4±194.1 [b]	1271±320.6 [a]	*F = 3.28; df = 2; p = 0.046*	1154.4±160.8
	Times used per day	0.89±0.08	0.71±0.15	0.82±0.07	p = 0.24	0.8±0.04
	Summer consumption (kg/day)*	14.9±1.7[a]	7.8±1.2[b]	12.9±2.2 [a]	*F = 3.49; df = 2; p = 0.02*	11.4±1.1
	Winter consumption (kg/day)*	25.9±5.3	14.8±3.1	22.9±5.8	p = 0.24	20.5±2.8
	Household direct use value (R)	2414±337.7 [a]	1307±222.0 [b]	2116±396.8 [a]	*F = 2.94; df = 2; p = 0.034*	1875±194.0
	Per capita direct use value (R)	625±119.4 [a]	294±73.0 [b]	478±102.5 [a]	*F = 2.53; df = 2; p < 0.046*	434±60.5

Note: Values in the same row with the different letter are statistically significantly different. Significant p-values are in italics.

5.3.2 Wild fruits

Wealthy households consumed more wild fruits than poor households and twice as much as medium households at household and per capitalevels (Table 5), but these differences were not statistically significant ($F = 1.94$, $df = 2$; $p = 0.16$ and $F = 1.64$; $df = 2$; $p = 0.20$ respoectively). The greatest proportion of consumed fruits was made of *Sclerocarya birrea* (69.2%), followed by *Strychnos madagascariencis* (24.1%), *Diospyros mespiliformus* (6.4%) and *Strychnos spinosa* (0.3%) (Figure 5).

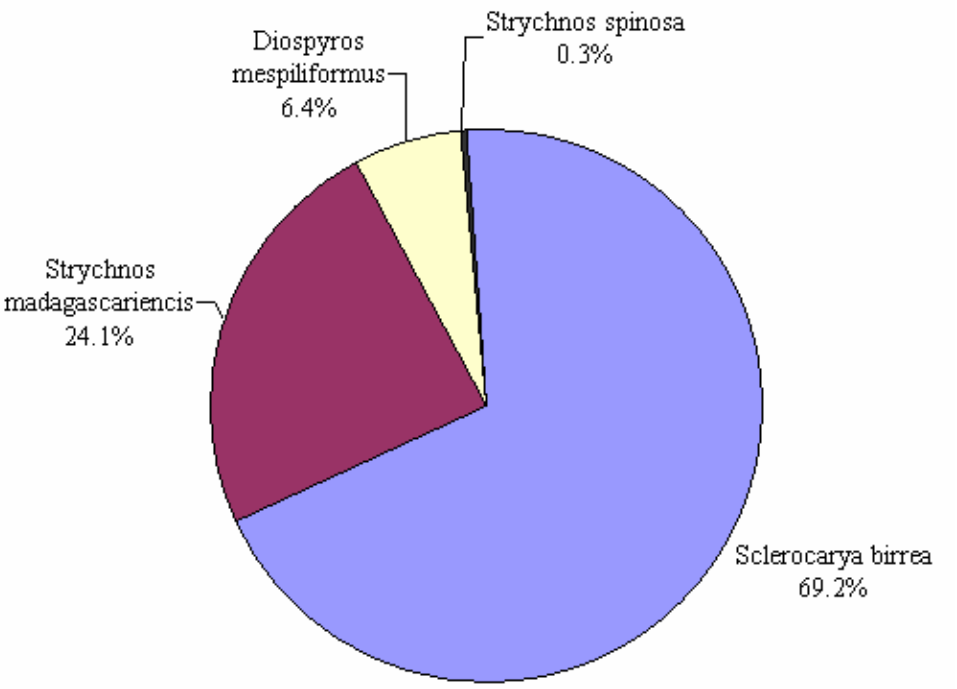


Figure 5. The proportion of different fruits that make up the averaged households consumption of fruits.

5.3.3 Edible insects

No significant difference was observed between the amount of edible insects consumed by households in the different SES classes ($F = 0.01$; $df = 2$; $p = 0.81$) (Table 5). Although the consumption among wealthy households dropped relative to the other two SES classes when expressed as per capita, the observed differences were not significant

(F = 0.32; df = 2; p = 0.75). The average number of days per week edible insects were consumed decreased slightly with increasing wealth class but differences were not significant (F = 2.39; df = 2; p = 0.10).

5.3.4 Fuelwood

Poor households used more fuelwood than did the households from the other two SES (Table 5). However, the consumption of poor and wealthy households showed no significant difference, although the household and per capita consumption of poor households and wealthier households were significantly higher that that of medium households (F = 2.39;df = 2; p = 0.010 and F = 3.28; df = 2; p = 0.046, respectively). The same pattern was observed in the summer consumption. The amount of fuelwood used by poor and wealthy households in summer was significantly higher than that of medium households (F = 9.30; df = 2; p = 0.003). The winter consumption did not show any significant difference amongst SES classes (F = 1.73; df = 2; p = 0.096), although it followed the same pattern as summer consumption. The average consumption of fuelwood in winter was higher (44.2%) than in summer across all households. This difference was statistically significantly different (T = -4.43; df = 50; p = 0.000) and was significantly so among all the socio-economic classes [poor households (T = -2.63; df = 12; p = 0.022); medium households (T = -3.13; p = 0.006) and wealthy households (T = -2.25; p = 0.038)].

5.4. COMPARISON OF THE HOUSEHOLD DIRECT USE VALUE FOR THE FOUR RESOURCES

5.4.1 Edible herbs

Mean direct use value of edible herbs, averaged across all 58 households, was R1935 per household per year, or R455 per person per year (Table 5). Although not statistically significant (F = 0.65; df = 2; p = 0. 53), the mean annual household direct use value of edible herbs increased from R1456 for wealthy households to R2222 for poor households. The mean annual per capita direct use value for poor households (R618) was significantly higher than that for the other two SES classes (F = 4.26; df = 2; p = 0.043).

5.4.2 Fruits

Mean direct use value of wild fruit was R1918 per household per year, or R378 per person per year (Table 5). Wealthy households had the highest household (R2486) and per capita (R402) direct use values of fruits and the medium households the least (R1572 and R281 respectively), but differences were not statistically significant ($F = 0.68$; $df = 2$; $p = 0.51$ and $F = 0.76$; $df = 2$, $p = 0.48$, respectively).

5.4.3 Edible insects

The average household consumed R208-worth of edible insects per year (R48 per person per year) (Table 5). Although household and per capita direct use values increased slightly with decreasing wealth class, these did not differ significantly ($F = 0.265$; $df = 2$; $p = 0.77$and $F = 0.232$; $df = 2$, $p = 0.79$ respectively).

5.4.4 Fuelwood

Averaged across all households, mean direct use value of fuelwood was R1875 per household per year, or R435 per person per year (Table 5). Because household consumption of fuelwood was significantly lower in households of medium SES, so was direct use value. Medium households had a total fuelwood direct use value of R1307, compared to R2414 in poor households and R2116 in wealthy households ($F= 2.94$; $df = 2$; $p = 0.034$). Per capita direct use value in medium households (R293) was also significantly lowers than that in poor (R625) and wealthy (R478) households ($F = 2.53$ $df = 2$; $p = 0.046$).

5.4.5 The household direct use value of the four selected resources combined

Poor households had the highest total direct use value of the four resources combined (R6438±908.5) compared with R4893±1020 and R6249±688.4 for medium and wealthy households, respectively. For poor households, fuelwood and edible herbs contributed 70% of the total household direct use value of the four resources (Figure 6). The percentage contributed by edible herbs was still high in medium households followed by wild fruits (Figure 6). Wild fruits contributed the most to the overall direct use value of the four resources of wealthy households followed by fuelwood (Figure 6).

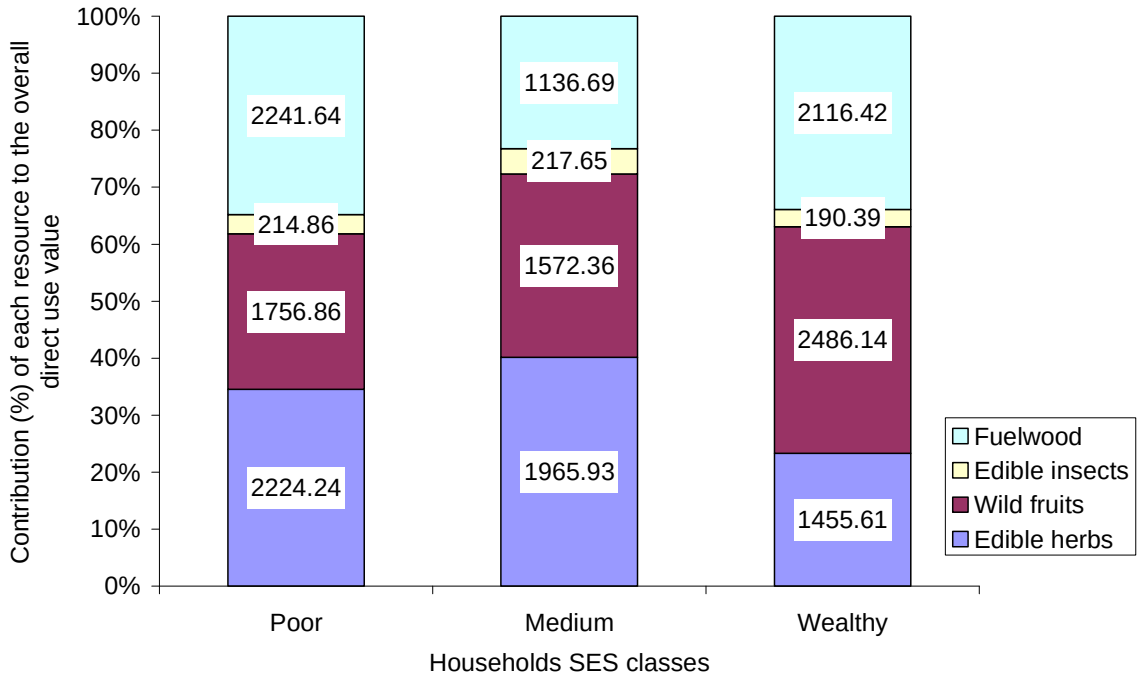


Figure 6. The contribution (in percentage) of each of the four resources to the overall household direct use values. The direct use values are given in Rands (R) and averaged across household socio-economic classes.

5.5. PERCEPTIONS OF RELATIONSHIP BETWEEN WEALTH AND RESOURCE USE

The large majority of the households, regardless of their wealth status, believed that poor households consumed more of the four selected resources (Figure 7). This was particularly so for fuelwood and edible herbs. However, eleven percent of respondents thought that wealthy households consumed more insects and 12% perceived no difference in consumption of wild fruit between wealthy and poor households. Two percent of respondents felt that wealthy households consumed more wild fruit. In the cases of edible herbs and insects, 2% believed that there was no difference between wealthy and poor household consumption.

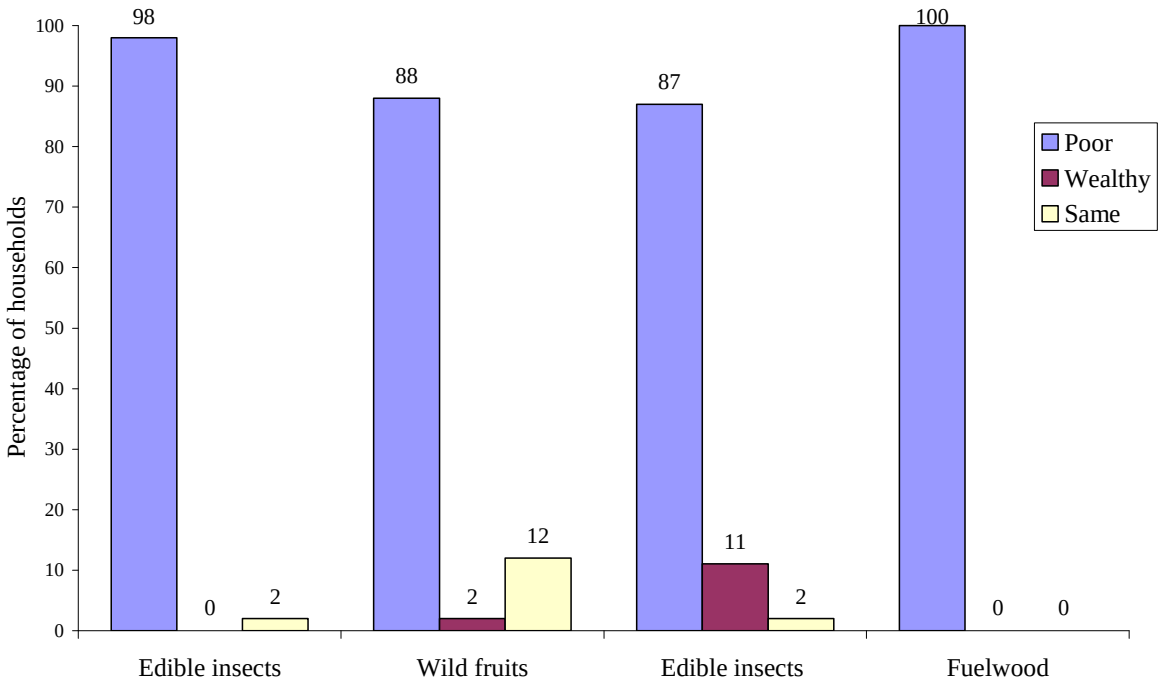


Figure 7. People's perception on the influence of wealth on the consumption of the four selected natural resources. People indicated which SES class (between poor and wealthy classes) they thought consumed greater quantities of a particular resource, or if they believed there was no difference ("same").

5.6. COMPARISON OF HOUSEHOLD' CHARACTERISTICS AND RESOURCE USE

5.6.1 Edible herbs

There was a significant positive relationship between per capita annual consumption of edible herbs and number of resources used per resident (R^2 = 0.33; p = 0.0001).. In other words, the higher the ratio of resources used to number of residents in the household, the higher the per capita consumption of wild herbs (Figure 8). The number of income sources per resident did not show any significant influence on consumption of herbs (p = 0.70).

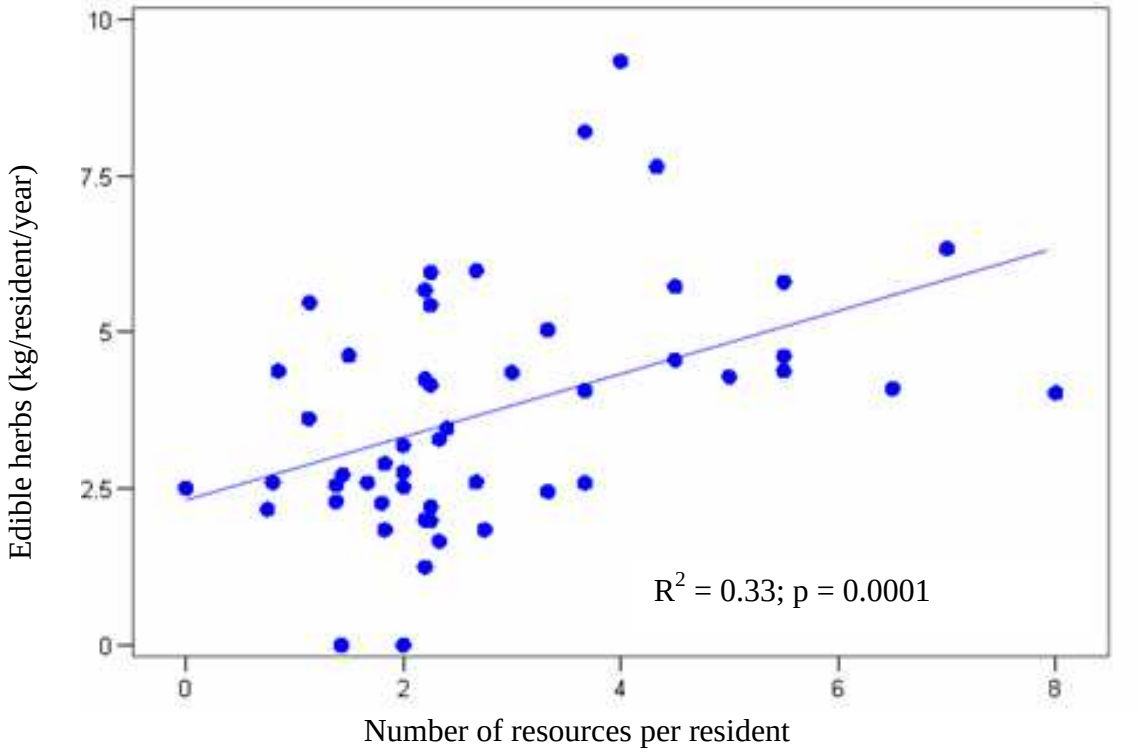


Figure 8. Relationship between the per capita consumption of edible herbs and the number of resources used per resident.

5.6.2 Wild fruit

Per capita consumption of wild fruit decreased significantly with number of resources consumed per resident, but the relationship was weak (R^2 = 0.22; p = 0.0197) (Figure 9).

Sources of income per resident did not significantly influence the per capita consumption of wild fruits (R^2 = 0.22;; p = 0.63), although there was a slight increase in the amount of wild fruits consumed as the number of sources of income per resident increased.

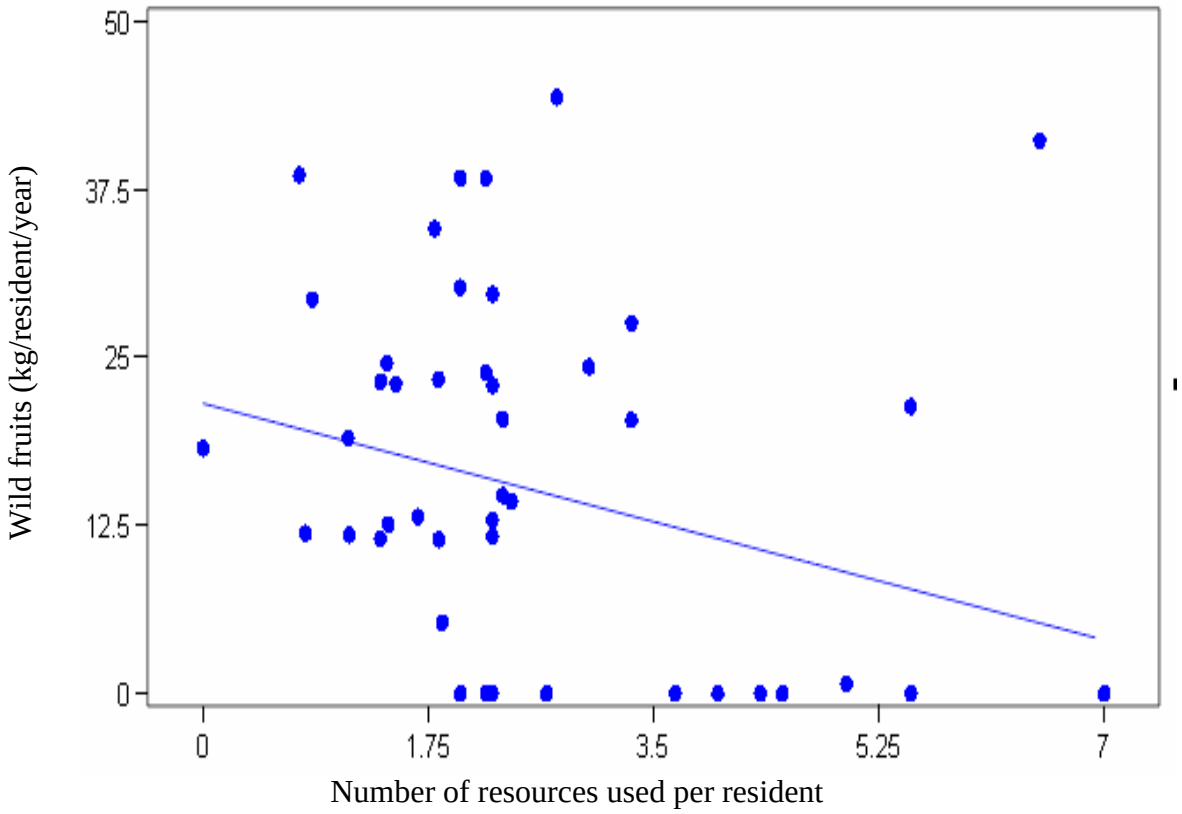


Figure 9. Relationship between the amount of wild fruits consumed per person and the number of resources used per resident.

5.6.3 Edible insects

The volume of edible insects consumed tended to increase with an increasing number of resources, but this was not significant (R^2 = 0.01; p = 0.72). The number of income per resident did not significantly influence the amount of edible insects the per capita consumption of insects (R^2 = 0.01; p = 0.80).

5.6.4 Fuelwood

The per capita consumption of fuelwood was positively related to the number of resources used per resident (R^2 =0.27; p = 0.0007) (Figure 10). There was a negative relationship between the amount of fuelwood consumed and the number of income sources, but this was not significant (R^2 =0.27; p = 0.22).

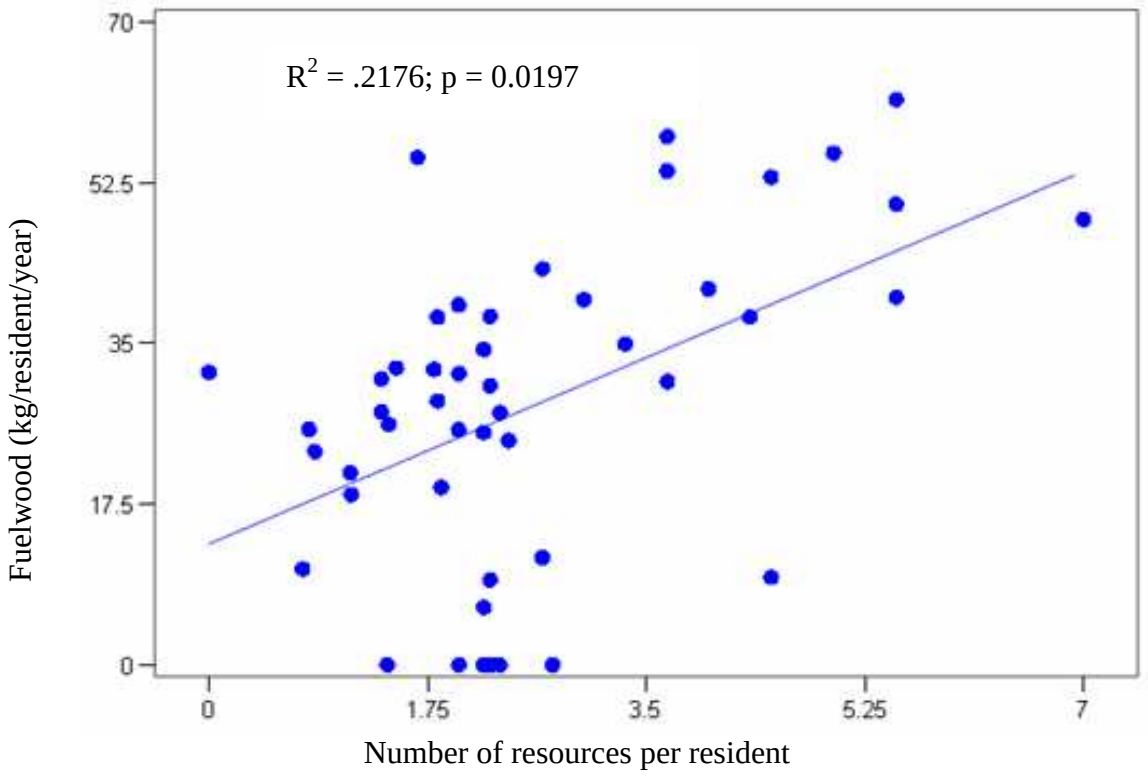


Figure 10. Relationship between the amount of fuelwood and the number of resources used per resident.

6. DISCUSSION

Previous studies have indicated that poor households rely more on, and derive greater benefits from, natural resources than do wealthy households (Cavendish 2000; Shackleton and Shackleton 2006). In turn, wealthy households use more natural resources in absolute terms, and a greater diversity of resources, compared with poor households.

This study investigated the influence of household wealth on household use of natural resources and the direct use value, a product of the household consumption value and the unit price, derived from natural resources. It focused mainly on the four mostly used resources namely, edible herbs, wild fruits, edible insects and fuelwood, and made reference to other natural resources.

6.1. MEASUREMENT OF HOUSEHOLD WEALTH

Despite the use of different methodologies to group households into wealth classes, the findings of this study were similar to that of Shackleton and Shackleton's (2006) study. Shackleton and Shackleton (2006) based their aggregation of households into socio-economic classes on monetary indicators (e.g. number of jobs per households and number of pensions) and possession of livestock. In this study, SES quintiles were derived from a households' asset index. Household assets are usually collected over a period of time and passed down through generations (especially houses and other dwelling) and might not represent the exact household's financial situation at the time of the survey. Households used in this study showed no significant difference in the number of temporary and informal employments, income sources and social grants and number of permanent jobs per resident. This is an indication that although these households might be poor in terms of possessed assets, they might not be necessarily financially poor.

Smith (1987) provided evidence that household possessions can in fact measure household wealth; but went on to add that "the material expression of household wealth is not a simple affair". This was because "different functional classes of goods reflect wealth differently and the natural of the relationship varies between and within socioeconomic systems." Takasaki *et al*. (2001) also found that it is very difficult to fully assess household wealth. This was after they realized that households classified as land poor were indeed rich in non-land based capital. Takasaki *et al.* (2001) used a combination of land and capita possession to group households into four wealth groups, namely land poor-capital poor, land poor-capital rich, land rich-capital poor, land rich-capital rich. Takasaki *et al*. (2001) used these classes to determine the influence of

household wealth on the use of natural resources. Their findings linked the level of participation in natural resources extraction and income generation (from natural resources) to the possession of land (whether land poor or rich), other capital assets (shot -guns and fishing nets) and extraction skills. Smith (1987) also suggested the use of more than one variable in assessing household wealth.

Involvement of local people (through rapid rural appraisal or participatory rural appraisal) in the determination of the wealth variable is recommended (Adams *et al.* 1997, Takasaki *et al.* 2000). Local community members are deemed equipped with the knowledge of all wealth measures or indicators considered important determinants of wealth. At times these indicators might not be given their right weight by outsiders. Adams *et al.* (1997) questioned the degree of confidence that can be attached to the way key informants make use of the wealth criteria in assessing household ranks. They suggested an investigation into the number of households that a group of key informants can successfully rank and the use of multiple criteria to deal with misinformation and misrepresentation (especially personal or culturally sensitive information) of facts by interviews.

6.2. RESOURCE USE AND HOUSEHOLD WEALTH STATUS

The study found no difference in the average number of resources used by households of different wealth status, although wealthier households had the highest range of resources used. Wealthier households had the highest percentage of households using bushmeat, honey and traditional baskets but only significantly so for bushmeat and traditional baskets. None of the poor households consumed bushmeat and honey. This suggests that there could be preferences in the type of resources used between wealthy and poor households, but the most likely reason is that poor households were restricted to certain type of resources by the lack of material resources. This supports the findings of Takasaki *et al.* (2001). In their study conducted in Pacaya Saminia National Reserve, northeast of Peru, Takasaki *et al.* (2001) found that hunting was limited to households possessing sufficient skills and tools, while the species of fish caught by local people depended on the possession of special nets and fishing skills.

The general perception of people interviewed was that poor households use more edible herbs, wild fruits, edible insects and fuelwood than wealthier households due to the lack of cash income to purchase alternative market goods, especially meat, fruits and electricity. Their perception was close to reality. Poor households used greater amounts of resources on per capita basis than wealthier households for three out of the four resources, namely edible herbs, edible insects and fuelwood, although the observed differences were only significant for edible herbs. Poor households used significantly more fuelwood than households of medium wealth atr the per capita and household levels. This was in line with the findings of Shackleton and Shackleton (2006) study's, which found that poor households in the Kat River Valley, South Africa, used greater amounts of resources than did wealthier households, particularly for herbs and fuelwood. Edible herbs and fuelwood were used mainly to meet daily needs of food provision and energy. The fact that poor households at Agincourt used more of these resources is an indication that poor households rely more on natural resources for daily subsistence than do wealthier households.

Poor households consumed edible herbs more frequently than wealthier households, although not significantly so. Edible herbs were consumed as an accompaniment to maize porridge, and form the bases for soup and stew. Fuelwood is regarded as the energy sources for the poor (Karekezi and Kithyoma 2002), and remains the most easily affordable energy source of the majority of rural people (Amacher *et al.* 1996, Dovie *et al.* 2004, Heltberg *et al.* 2000, Turker and Kaygusuz 2001). Madubansi and Shackleton (2007) revealed that this concept might be changing with an increasing number of households purchasing fuelwood in South Africa. Fuelwood provides the energy needed for cooking, lighting and heating in rural areas around the world (Karekezi and Kithyoma 2002; Madubansi and Shackleton 2007).

In winter, the demand of fuelwood increased to accommodate the need for boiling water and heating. The winter consumption of fuelwood was significantly higher than the summer consumption. This agrees with the findings of Dovie *et al.* (2004) and

Shackleton and Shackleton (2006). Based on observations, poor households did not use as much wood for warming compared with wealthier households. The lack of constructed kitchens prevented poor households from sitting around the fire at night for warmth. The fact that the significant difference observed in fuelwood summer consumption was not found in winter consumption indicated that the amount of fuelwood used by wealthier households (especially medium households) in winter increased much more than that of poor households. Another reason presented by poor households (in most cases) was the scarcity of wood. The fact that half of the poor households bought fuelwood is evidence that fuelwood is scarce around these villages; a situation wealthier households got round by hiring tracks to fetch fuelwood in neighbouring village. Dovie *et al.* (2004) showed that in the Bushbuckridge local municipality there was a decline in fuelwood for a period of ten years (between 1990 and 1999), while 63% of households interviewed stated that fuelwood was insufficient in the municipality. Dovie *et al.* (2004) demonstrated the complexity of the fuelwood crisis in the area and associated it not only with the use of wood for fuel, but also with the use of the same type of wood for other purposes, such as carving.

Most of the 58 households (92.9%) had electricity. Unfortunately, the influence of electricity on the usage of fuelwood could not be assessed in this study. However, Madubansi and Shackleton (2007) investigated the influence of the introduction of electricity on the use of fuelwood in Bushbuckridge. They found that the mean per capita consumption of fuelwood did not change between 1991 and 2002 despite the electrification of all households in four out of five settlements studied. Surprisingly though, the percentage of households purchasing fuelwood increased from 27% in 1991 to 31% in 2002 (a 15% relative increase was recorded despite the 4% absolute increase). This indicated the scarcity of fuelwood in the vicinity of the settlements (Madubansi and Shackleton 2007). More evidence supporting the scarcity of fuelwood was the 12% increase in the time spent on collection trips between 1991 and 2002. This is attributed to having to travel long distances to collect fuelwood.

The household and per capita consumption of wild fruits were substantially higher in wealthy households compared with other SES classes (particularly medium housholds), although the differences were not significant. Fruits are generally regarded as a luxury food and mainly eaten as snacks (FAO 1991). Wealthy households had more people and possessed more physical resources than poor households. In other words, they had more manpower and material resources (especially wheelbarrows) to collect more wild fruits. This did not hold true for the medium households although they had more people and physical resources. The latter could be explained by the fact that a third of the medium households did not harvest fruits themselves. Supporting the influence of number of people and material resources on resource use is the finding of Twine *et al.* (2003). Twine *et al.* (2003) associated the use of a greater diversity of resources by wealthier households to the availability of transport and people.

The fruit of *Diospyros mespiliformus*, *Sclerocarya birrea* and *Strychnos spinosa* are eaten raw, unlike those of *Strychnos madagascariencis* that require additional processing. *Strychnos madagascariencis* was refered to as being difficult to find and therefore used by fewer households. *Sclerocarya birrea* was mainly used to make beer and jam. All households indicated that they made beer. One household mentioned selling beer while the rest drunk it at social gatherings or ceremonies, a fact stated by Shackleton (2004). For poor households, jam making was restricted by the lack of sugar need to add to the mix. The nuts of *Sclerocarya birrea* were crushed and mixed with edible herbs but most households indicated throwing them away. For *Strychnos madagascariencis*, the seeds were dried before eaten raw and/or crushed to make a powered mixed with edible herbs.

The amount of herbs consumed by medium households fell between the consumption of poor and wealthy households, while they consumed the least amount of wild fruits and fuelwood compared with both households on a per household and per capita basis. This was contrary to the findings of Shackleton and Shackleton (2006). Shackleton and Shackleton (2006) found that intermediate households' consumption of the four resources used in their study (fuelwood, edible herbs, edible wild fruits and grass brushes) were between that of the poor and wealthy households.

6.3. INFLUENCE OF WEALTH ON THE USE OF SELECTED NATURAL RESOURCES

The amount of edible herbs and fuelwood consumed was higher in poor households supporting once again the principle that poor households rely more on natural resources for daily subsistence than wealthier households. Edible insects were not affected much by wealth. Edible insects are mainly collected by children on their way from school or playgrounds. Similar observation was made by Shackleton and Shackleton (2006)**.** Children related to each other by age groups and not necessarily by wealth. Although not the perception of interviewees from poor households, children regardless of the household wealth status collected edible insects. Children were the main consumers of insects. Two households mentioned that the whole household ate insects together.

The fact that the number of income sources per resident did not influence the quantity of edible insects a household consumed supports the fact that household wealthy did not influence the consumption of edible insects. The number of income sources did not influence the overall consumption of edible herbs either. Although sources of income do not reflect the exact amount of cash or income a household gets, it could be said that this agrees with the finding of Dovie *et al.* (2007). Dovie *et al.* (2007) found that the amount of consumed edible herbs is not necessarily influenced by cash income but rather by household size. The amount of edible herbs decreased with increasing number of permanent jobs per resident, confirming the influence of number of people on the amount of edible herbs consumed. In other words, the less people at home, the less the amount of edible herbs was consumed. Dovie *et al.* (2007) stated that the consumption of edible herbs was based mainly on cultural believes and not on financial resources. Fleuret's (1979) provided more evidence of the above. Fleuret study carried out in Lushoto, Tanzania indicated that the Shaba people prefer wild leaves over cultivated vegetables because of the better taste of wild leaves and their cultural importance. Dovie *et al.* (2007) mentions that wild edible herbs add variety, spice and taste to local people's meals too.

Culture also plays a role in determining the source of energy the household uses (Dzioubinski and Chipman 1999). Some believe that fuelwood improves the taste of food and provides a range of cooking options. Dovie *et al.* (2004) also associated the use of fuelwood to more than economic reasons, namely entitlement, tradition and accessibility. Gender is another factor influencing the source of energy use in rural areas (Dovie *et al.* 2004, Karekezi and Kithyoma 2002). Women usually collect fuelwood from communal lands and prepare most of the household meals. Women use, collect and manage household fuels (Dovie *et al.* 2004, Karekezi and Kithyoma 2002).

Most households regardless of their wealth status had a garden where they harvested wild edible herbs. In Dovie *et al.*'s study (2007) conducted in the Bushbuckridge, similar findings were observed. The majority of households in their study indicated a decline in the availability of wild edible herbs in the past decade but confirmed that there was still sufficient supply. This could explain why the majority of households in this study resorted to gardening. Home gardens play an important role in conservation of wild edible herbs and subsequently on the land they grow on, but only once the natural supply falls below critical level (Dovie *et al.* 2007). The importance of home gardens to rural livelihoods was also demonstrated by Hunter and Shackleton's (2000) study that compared the value of wild and domestic plants cultivated on home gardens. Of the total value of plants (R1694) per household, wild plants contributed 31% (R521±473) as opposed to 67% (R1173±1103) for domesticated plants, inclusive of fruit trees. Four to five wild plant species were planted in home gardens. This confirms the diversity and variety edible wild herbs provide to households mentioned by Dovie *et al.* (2007). The existence of home gardens though, has not diminished the importance of communal or open fields. The majority of households in this study harvested edible herbs from their home garden and fields and a small yet important percent of households (26%) harvested edible herbs from open and communal fields. Dovie *et al.* (2007) found no significant difference between the sources of edible wild herbs but indicated that arable fields had the highest yield followed by home gardens and lastly bushveld.

6.4. DIRECT USE VALUE THE SELECTED FOUR NATURAL RESOURCES

The direct use values of the four resources were in accordance with their consumption values. This was because annual consumption was multiplied by a common unit price to derive the direct use values. Focusing on the direct use value revealed that poor households derived more value from natural resources than did wealthier households on a per capita basis, but only significantly so for edible herbs and fuelwood. This is similar to the findings of Shackleton and Shackleton (2006). At the household level, poor households had the highest direct use value for edible herbs and fuelwood while medium households had the highest value for edible insects and wealthy households for fruits. This shows once again that poor households relied on, and derived more benefits from, natural resources for their daily subsistence.

Two similar studies in the Bushbuckridge local municipality that revealed the value of selected natural resources were reviewed for comparison purposes (Table 6), focusing on edible herbs and fuelwood. However, comparisons between studies are made difficult by different methodologies and convention used (Shackleton and Shackleton 2003).

Shackleton and Shackleton (2000) reported a direct use value of edible herbs of R 579 while Dovie *et al.* (2002) stated their value as R1308. The value of this study (R1935) is far higher. These values fall in the range of direct use values reported by Shackleton (2003). The higher direct use value of this study could be attributed to the highest amount of edible herbs consumed in the study site compared with other study (Table 6). Home gardens were well looked after and provided edible herbs year round (fresh in-season and dried and stored during winter months), increased the household annual consumption of edible herbs. Home gardens made edible herbs more available to people in the process reducing the trading unit price (Table 6).

Table 6. Comparison of the annual household consumption and direct use values of two selected natural resources from current and other studies in the area.

Resources	Sources	Percentage (%)	Annual household consumption (kg)	Annual direct use value (R)	Unit price (R/kg)
Edible herbs	Shackleton and Shackleton (2000)	92 (-)	18.4	1579[1]	85.7
	Dovie *et al.* (2002)	91.1 (41)	15.4	1308	84.7
	This study	100.0 (58)	80.3	1935	43.8
Fuelwood	Shackleton and Shackleton (2000)	94 (-)	3836	997.51	0.26
	Dovie *et al.* (2002)	95.6 (43)	4343	2225	0.50
	This study	93.4 (54)	4987	1875	0.38

Note: (Number) represents the number of households using a resource.

1. The annual consumption was calculated by dividing the annual direct use value by the unit price in accordance with the formula (1) in Shackleton and Shackleton (2000).
2. US$ values in Dovie *et al*. (2002) were multiplied by the November 2006 exchange rate (1 US$ = R 7.15); Shackleton and Shackleton' (2000) values in rand were adjusted to 2006 values using the inflation formula in Dovie *et al*. (2002).

Edible herbs in this study cost the least compared to Shackleton and Shackleton's (2000) study and much more less compared to Dovie *et al*.' (2002) study. The unit price of edible herbs in Thorndale was also reported to be the highest in the region by Shackleton (2003). The price of edible herbs could be influenced by a number of factors, such as distance from commercial centres and the availability of the resource in the area.

The highest direst use value of Dovie *et al.* (2002) was a result of the highest unit price (50 cents per kg) and not the highest quantity of fuelwood used per household (table 6). Thorndale is situated at the remote eastern part of Bushbuckridge (Dovie *et al.* 2002) and this might have influenced the high prices of both edible herbs and fuelwood observed.

7. CONCLUSION

This study explored the influence of household wealth status on the use and value of natural resources in the Agincourt rural district of South Africa. The study found no difference in the number of natural resources used by households in different SES

classes. However, wealthier households used a greater range or more types of natural resources, compared with poor households, while the type of natural resources used was likely restricted by the possession of material resources. The annual consumption and direct use values of edible herbs and fuelwood were higher in poor households compared with wealthy households. This is additional evidence for the reliance of poor households on natural resources for their daily subsistence than wealthier households. Wealth in isolation might not be enough to determine the use of natural resources in rural areas and culture and gender play a significant role too. The best methodology of assessing household wealth incorporates a number of criteria relevant to the research area in a proper livelihoods analysis.

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