

RURAL ECONOMY

**Empirical Approaches to the Valuation of Small Wildlife
Resources in Communal Areas in Zimbabwe**

Laura Graham, William Phillips and Kay Muir-Leresche

Staff Paper 97-04

Staff Paper



Department of Rural Economy
Faculty of Agriculture, Forestry
and Home Economics
University of Alberta
Edmonton, Canada

**Empirical Approaches to the Valuation of Small Wildlife Resources
in Communal Areas in Zimbabwe**

Laura Graham, William Phillips and Kay Muir-Leresche

Staff Paper 97-04

The authors are respectively, former graduate assistant and Professor, Department of Rural Economy, University of Alberta, Edmonton, Canada; and Senior Lecturer, Department of Agricultural Economics and Extension, University of Zimbabwe, Harare, Zimbabwe.

Funding for this project was provided by the International Development Research Centre (IDRC) through the IDRC/University of Alberta/University of Zimbabwe Value of Trees Project.

This is Rural Economy Paper No. 5 in the University of Alberta - University of Zimbabwe Joint Working Paper series on Agroforestry.

The purpose of the Rural Economy “Staff Papers” series is to provide a forum to accelerate the presentation of issues, concepts, ideas and research results within the academic and professional community. Staff Papers are published without peer review.

FOREWORD

This research was conducted in 1994 under the auspices of the "Value of Trees" project. This five year project is funded by the International Development Research Centre, Ottawa, Canada. It is a joint project between the University of Alberta, Edmonton, Canada and the University of Zimbabwe, Harare, Zimbabwe. The project involves members of the Department of Rural Economy at the University of Alberta, and the Department of Biological Science, Department of Agricultural Economics and Extension, and the Centre for Applied Social Sciences, at the University of Zimbabwe. The objective of the "Value of Trees" project is to develop, test and assess the applicability of methodologies to quantify the benefits and costs of tree components in small farm production systems in southern and eastern Africa. Research is being conducted by numbers of graduate students and faculty members from the Universities of Alberta and Zimbabwe.

This paper contributes to the general purpose of the "Value of Trees" project by filling an information gap through the assessment of household use and values of small wildlife. These wildlife values contribute to the overall value of trees. This research provides background and preliminary work into wildlife use and valuation which should instigate further research into wildlife valuation. The suggested methodologies may be applicable to other non-timber resources and their recognition should enable better public management of these resources.

1. SUMMARY

Zimbabwe is a resource rich country. A disproportionate allocation of these resources, however, has created a dual economy. Only a small proportion of the population owns most of the resources and participates in the formal economy. The majority of the population is dependent on the remainder of the resources which are often of marginal quality and quantity. Population pressure on available resources is often high. This population-resource imbalance is resulting in over-utilization, degradation and depletion. Environmental problems, such as deforestation, are of increasingly urgent concern to local populations, politicians and the international community. However, not only are the problems environmental but they also have strong social implications.

Deforestation has serious ramifications because most households in communal and resettlement areas rely heavily on trees for a multitude of timber and non-timber goods and services. However, in order to demonstrate the full impact of deforestation, information on the value of these goods and services is required. One such non-timber resource is small wildlife, including the small mammals, birds and insects utilized by households in communal and resettlement areas¹. The importance of small wildlife is hypothesized to be significant but its use and value is relatively unknown. As a result, the value of small wildlife is generally not incorporated into policy analysis and resource allocation decisions. Project appraisal, policy analysis and even households tend to take these resources for granted without allocating resources to the environment necessary for their continued supply.

This study addresses the need to value small wildlife in communal and resettlement areas by assessing household use through preliminary field research. Framed within a developing country context, a suitable valuation technique and methodology are suggested for further systematic analysis of the hypothesis that small wildlife plays a significant role in household nutrition and drought management strategies.

An extensive literature review substantiated by field studies led to the development of the descriptive background. Compiled literature research on household use included small wildlife collection, use, nutritional content, marketing, as well as socioeconomic data extracted from various household surveys. Subsequent field research during the period from February to August 1994 provided descriptive and quantitative data about uses and quantities of small wildlife. In the process, a description of the socio-economic environment, relating to the use of natural resources and in particular small wildlife, was formed. Valuation techniques, questions and methods were explored. The purpose of the field research was not to collect a detailed data set, but rather to develop a general overview to contribute to the documentation of small wildlife resources and provide evidence for assessing appropriate analytic techniques.

The field studies focused on a main household study conducted in Goromonzi district supplemented by a study in Nyanga district. The results of the field studies found that nearly every household utilized

¹ Large game is excluded from this study because utilization of large game for tourism and commercial ventures provides market values for these species. Also, legal restrictions discourage use of large game by households in communal and resettlement areas, therefore this use is not likely to be accurately reported.

small wildlife to some degree. The quantity and variety of small wildlife utilized varied between households as well as between areas. The collection of small wildlife generally tended to be opportunistic and occurred while conducting other tasks, such as harvesting or herding cattle. However, certain species were seasonal and necessitated specific time allocation. In general, very little equipment or expense was involved in collection. The small wildlife was often used as a snack or an “extra” to provide variety to the main relish. When collected in bulk, it was used as a main relish, preserved, or marketed.

The extent of small wildlife utilization by households was influenced by factors such as wealth, remoteness, tastes, labour availability, religious beliefs and social controls, as well as seasonality and small wildlife availability. In general, people felt that wildlife resources had decreased in their areas. They attributed this to increasing human population which forced the wildlife to migrate to other areas such as state forests and commercial farms. While some households saw small wildlife as an agricultural pest, several households expressed an interest in increasing wildlife in the area. These households felt this was important, in terms of diet and income, or even to have in the environment because of existence value and spiritual reasons.

These field data as well as evidence from other studies suggest the widespread use and importance of small wildlife throughout Zimbabwe. However, the extent of utilization throughout the country may vary considerably. Different species and small wildlife in general may have different values in different areas. This variation should be considered in conducting valuation exercises, because study results and values may be quite site specific.

An examination of non-market valuation methods and the empirical results of this study suggest that methods of contingent valuation may have potential but travel cost modeling and hedonic price modeling may be limited in valuing small wildlife in the regions that were studied. However, application of contingent valuation techniques requires consideration of several factors in order to avoid potential biases and account for cultural and socio-economic influences.

Evidence suggests the importance of wildlife. However valuation provides the measure of this importance which can be incorporated into resource management decisions. The purpose of the study was to complement previous research and supplement future research by providing background information and a framework for subsequent valuation work.

2. THE VALUE OF TREES AND NON-TIMBER RESOURCES IN ZIMBABWE

Indigenous woodlands formerly covered 23 million hectares (60 %) of Zimbabwe's land (McNamara, 1993). However, increasing population has resulted in deforestation at a rate of 1.5% annually (Gore *et al*, 1992). The remaining 10 million hectares of woodlands, forests, and trees in communal areas is of variable quality and in some areas only consists of scattered trees. As a result, the problem of deforestation currently exists in some communal areas and may soon become evident in other communal areas.

The value of trees can be defined through the many roles they play in household use. As an important source of energy, they provide fuelwood for cooking, heating and lighting. Timber and other tree materials are used for building, fencing, and making utensils, crafts, furniture and ropes. Trees also represent savings and investments which may be required to meet social obligations. In addition though, trees supply many non-timber benefits. Forests provide important habitat for the various flora and fauna that play a significant role in local economies (Asibey, 1988; Murindagomo, 1988). Several foods can be obtained from the forests such as fruit, honey, wild vegetables and plants, insects and small wildlife. Trees also provide soil inputs, livestock fodder, medicine and several intangibles such as shade, climate control, even spiritual, aesthetic, and psychological value. All land use values including non-timber and non-market values, need to be considered when making land use decisions to prevent natural forests from being undervalued (Muir, 1990).

Throughout most of Africa, scattered evidence suggests the economic and dietary importance of the harvesting of non-timber products². However, research on the development of indigenous resources and non-timber values in Africa is essentially non-existent³ and the few existing studies on the utilization of flora and fauna are poorly documented (Muir, 1989; Chopra, 1993; Godoy, Lubowski & Markandya, 1993⁴). Literature on non-timber forest products recognizes the need to improve the valuation of social and economic benefits from these products (de Beer & McDermott, 1989; FAO, 1991; Scoones & Matose, 1992).

Non-timber resources, though, are hard to value because there are no organized markets for many of their benefits. The actual market value of these non-timber products may not even be as important as their non-market value as subsistence products (Campbell & Brigham, 1993). Women and children, in particular, may supplement their income or subsistence needs by collecting forest products⁵ (Appasamy, 1993). Exploiting these resources in their micro-environments, enables households to increase their risk-spreading capability (Wilson, 1990).

Non-timber uses of the forests in Zimbabwe are felt to be significant and contribute to the total value of the forest (Bradley, 1992; Campbell, 1993). The value of these non-timber resources may be greater for poorer households in Zimbabwean communal areas. These households tend to be more heavily dependent on woodland for non-timber resources (McGregor, 1991; Scoones, 1990; Wilson, 1990). Campbell *et al* (1991) estimated that the woodland provided products valued at Z\$200/hectare, with

²Studies include Asibey, 1974, 1988; Chimedza, 1989; FAO, 1989; Marks, 1973; Murindagomo, 1988; Murray, 1978; Peters, 1990; and Scudder, 1984. Keita (1993) provides an overview of non-wood forest products in Africa. Further studies are discussed in Falconer (1990).

³ Most research has focused on Latin America, but values may differ in Africa due to different harvesting methods, forest types, securities and economies (Godoy, Lubowski & Markandya, 1993).

⁴Godoy, Lubowski & Markandya (1993) review studies estimating the economic value of non-timber forest products and present a method for future valuation.

⁵Wild foods, one such non-timber resource, constitute an important part of the diet and contribute to household food security for most rural households in Africa, especially during times of food stress or in the diets of poorer households (Bradley & Dewees, 1993; Campbell, 1986; Campbell, 1987; Chimedza, 1989; FAO, 1989; Fleuret, 1979; Gibson, 1977; Kinsey, 1986; Malaisse & Parent, 1985; McGregor, 1991; Ogle & Grivetti, 1983; Poulsen, 1982; Wilson, 1990).

households receiving about Z\$1 000/year through the replacement value of these woodland products. However, such non-timber values may not be fully realized. Even communal area households seem to substantially undervalue woodland products, therefore decreasing their incentive to invest in woodland conservation (Campbell *et al*, 1991).

A major problem in this resource issue is the lack of information about the economic and biological aspects of the forests and their *in situ* resources. Considering these aspects may reveal that the *in situ* values of the forest are positive which would support increased conservation. Muir (1989) suggests that it is time to "test the hypothesis that unconventional and indigenous flora and fauna can increase incomes and/or reduce environmental pressure in marginal lands".

THE VALUE OF WILDLIFE IN ZIMBABWE

Wildlife resources represent the non-timber value provided by trees as habitat. Estimates of values for wildlife and wildlife products in various developing countries have uncovered significant values⁶. Ecological, economic and cultural benefits are derived from wildlife (Chimedza, 1989). Ecologically, wildlife species play a role in seed dispersal, soil processes and pest control. From a biodiversity point of view, the value of wild species is inestimable in its potential to provide genetic material for breeding or development of pharmaceutical and chemical products. National and international economic benefits accrue through tourism, hunting and export of by-products. Wildlife also plays an income-generating role at the local authority and household levels in communal areas. Wildlife is an important source of protein, particularly in remote areas. Culturally wildlife may be used in the performance of certain rites and traditions (Muir and Bojo, 1994).

It is hypothesized that small wildlife makes an important contribution to the Zimbabwean diet. Small wildlife resources contribute to the tastes, habits and needs of the traditional diet and supplement the agro-ecological situations where they occur (Chimedza, 1989; Gomez, 1989; Muir, 1989). As well as providing nutritional value, utilization of wildlife as a meat substitute saves income and can even provide additional income if marketed. The non-use values, such as existence, bequest and spiritual values, may also be significant. Nevertheless, the role of wildlife as a food source in Zimbabwe is not well researched and documented. (Chimedza, 1989, unpubl; Gomez, 1989; Muir, 1989; Murindagomo, 1988; Wilson, 1989). As a result, official statistics on household food supplies do not include wildlife consumption.

While researchers often ignore small wildlife resources in their household studies, scattered information is available, usually as a byproduct of other broader studies. A table in Appendix A compiles a list of species that have been noted in studies in Zimbabwe. Historical studies in Zimbabwe first mentioned the role of insects and small game (Baker-Jones, 1956; Carr, 1956; Duncan, 1933). More recent evidence still indicates the use of these resources (Campbell *et al*, 1991; Campbell *et al*, 1994; CASS, 1992; Chimedza, 1989; Dewees, 1992; Gomez, 1989; Hobane, 1994; Kinsey, 1986; Matiza *et al*, 1989; Wilson, 1987, 1990). These studies found that most households used wild foods, mainly wildlife and insects, in their main meals as well as for snacks. This food was particularly important to children

⁶For example, see Table 2.1 in Swanson & Barbier (1992).

as a supplementary food. Also, women and children often market surplus wildlife products. Therefore, in addition to contributing to household food security and playing a small role during food shortages, wildlife also provides additional income to many households.

In particular, studies such as Campbell *et al* (1994) quantified the use and market values of wild foods. The study of the commercialization of mopane worms by Hobane (1994) documented the collection, processing, consumption and distribution of this product. Gomez (1989) compiled a resource inventory of indigenous and traditional foods in Zimbabwe which lists several small wildlife products and discusses their preparation and use. The most comprehensive documentation of small wildlife use is found in key studies by Chimedza (unpubl.) and Wilson (1990). Wilson (1990) did not directly study small wildlife use, but detailed information on small wildlife use was gathered through his diet surveys and household case studies. This information is included in his appendix and is a very significant reference on the species consumed, methods of hunting and collection, seasonality, cultural factors influencing use, as well as information about particular wildlife. Small wildlife use was studied specifically in a study by Chimedza (unpubl.) documenting the uses, marketing and harvesting techniques of wildlife resources in communal areas.

Historically, there has been a bias against these indigenous products. Colonial administrations supported products which they produced and consumed, while neglecting unconventional indigenous resources (Muir, 1990). Therefore, while wildlife use appears significant, it has not been clearly determined if wildlife could provide a viable economic alternative to damaging land uses or be a complementary income generating activity (Muir and Bojo, 1994). Very little work has been done on wildlife values on communal land (Campbell, 1993). In particular, small wildlife has been ignored, but some market values for small wildlife are included in Campbell *et al* (1991) and Campbell *et al* (1994). Forthcoming studies by Murindagomo and by Bond should clarify some of the issues relevant to large mammals. The study by Hobane (1994) was probably the first to look specifically at the marketing of a small wildlife product. Research on potential markets for wildlife goods and services may increase the marketing of these resources locally as well as further abroad and could increase local incomes (Muir, 1987).

As time passes, though, the supply and demand of these wildlife resources is changing. Wildlife is decreasing due to population pressure and deforestation in communal areas. As economic and technological growth debilitates traditional cultural values and food habits, the use of traditional food resources is decreasing (Gomez, 1989). Associated with the loss and reduced use of these resources is the loss of a vast and ancient legacy of knowledge in recognition, identification, collection and preparation of these resources (Gomez, 1989).

Recognition and identification of wildlife food sources followed by systematic studies towards exploiting their potential could lead to development of these potentially valuable food resources (Gomez, 1989). Currently, very little time-saving technology has developed to aid wildlife collection because the market value and consumption is area specific (Chimedza, 1989). Technology may increase quality and quantity through selective breeding, and expand utilization (Gomez, 1989). Examination of practices throughout various areas may facilitate sharing of improved methods.

A problem in Zimbabwe is the lack of knowledge about the actual use of wildlife by households and its value. While this value may or may not already be recognized by household users, it is unknown to researchers. As the value of these resources is revealed, there may be the potential for welfare improvements in communities. As tree resources and, subsequently, wildlife resources are being seriously affected by population pressure, tradeoffs will occur, and management of these resources is of particular concern. Identifying the value that wildlife, contributes to the overall value and importance of the trees should aid management of resources.

NATURAL RESOURCE VALUATION

Natural resources supply the materials and energy necessary for every aspect of life. These resources are particularly important in developing countries' economies. However, in developing countries, these resources are also important at a household level. The majority of the poor tend to be situated on marginal land which is ecologically fragile and of low agricultural potential. These households depend on natural resources for food and products for household consumption as well as to sell for income. Often the sustainability of livelihoods of the poor is linked to the sustainability of natural resources and wildlife resources (Swanson & Barbier, 1992).

In Zimbabwe, natural resource valuation has not been adequately dealt with (Bojo, 1993; Campbell *et al*, 1991; Moyo *et al*, 1992). However this valuation is needed for land allocation and use decisions (Bojo, 1993; Moyo *et al*, 1992; Scoones & Matose, 1992). Knowledge of the underlying theoretical factors is necessary so that this valuation can be adapted and applied to a wide variety of issues including valuation of wildlife resources.

The value of a natural resource includes the market and non-market values that arise from the use or non-use of the natural resource (Pearce, 1993). Use value includes direct and indirect use values. Non-use values includes existence value as well as its sub-components, option and bequest value, and quasi-option value.

Use value of a natural resource results from direct and indirect use of the goods and services of a natural resource. Consumptive use results in the extraction or harvest of the natural resource. Non-consumptive use does not significantly alter the availability of the natural resource for future use. A direct use of wildlife includes hunting and trapping which is consumptive, and birdwatching which is non-consumptive. Indirect use is obtained from the ecological functions of the species ie. the role of species in the ecosystem.

Non-use values may be difficult to grasp, let alone value. Nevertheless, they are thought to represent a significant portion of total value. Non-use values, therefore, need to be included to avoid overexploitation that may occur to gain only use value. Existence value is knowing that a natural resource exists, even if an individual may never see or use the resource. This value is motivated by altruism or caring for other people or beings. It may have intrinsic and "stewardship" value as well as being a cultural or unique asset. Existence value may also include the value of retaining a natural

resource for future uses that may not yet be discovered or obvious. Similarly, bequest value is the value of conserving a natural resource so that it is available for future generations.

Quasi-option value represents the desire to prevent irreversible damage which would eliminate future known and unknown use of the resource. Irreversibility and uncertainty are crucial issues with quasi-option value. Irreversible damage occurs when use of a resource results in its permanent decline or degradation. For example, wildlife populations require a certain minimum viable breeding population to avoid extinction.

While it is desirable to derive a total value for a resource, it may be difficult. Many of the components of total value such as non-consumptive use, indirect use and non-use of wildlife, do not involve markets. Non-market valuation derives a money-based valuation of changes in quality or quantity of a good or service that is typically not priced in a market. The area of non-market valuation is a vast and growing field, however most of this research has been done in developed countries and may not be directly transferable to developing countries. These methods are based on the assumption that the individual is very familiar with market systems and therefore can state reasonable estimates of values for certain goods and services. In developing countries, markets may be weak or non-existent for certain products and the concept of value may be harder to determine in currency amounts. Even direct use of a resource in a subsistence community may not involve a market if all consumption is within the household with no external buying or selling. While subsistence use may not involve money transactions it may still represent great value to the household in terms of nutrition and saved income. Recognition of the differences between the economic systems where the research method was developed, and where it is to be applied is essential if relevant values are to be obtained.

The two main approaches to non-market valuation include the indirect or inferential approach and the direct approach. The indirect approach includes travel cost modeling and hedonic price modeling, while contingent valuation uses the direct approach.

Indirect methods rely on observation of existing behavior, usually market behavior (Adamowicz, 1991). This method assumes that an environmental good or service has a market price associated with it (ie. trip costs, property value, etc.). Consumers make an actual market choice (eg. decide to go on a trip or buy a house) and the value of the non-market environmental amenity is inferred from the market data for the goods (eg. the cost of the house reflects the surrounding quality of the surrounding environment) (Mitchell & Carson, 1989). However, because this type of valuation relates the value of the good to a market, it measures use value but can not be used to elicit non-use values.

Travel cost modeling (TCM)⁷ has generally been employed in developed countries to value recreational activities or environmental quality changes affecting these activities. Travel expenditure (distance, trip length, and other expenses) to reach the recreation site is used as an estimate of the benefits from the recreational experience (Pearce, 1993).

⁷This section is based on Adamowicz (1992). For further reference also see Mitchell & Carson (1989)

Hedonic price modeling (HPM)⁸ attempts to estimate an implicit price for environmental attributes by looking at real markets in which these attributes are effectively traded (Pearce, 1993). The environmental attributes of the area are reflected in the house or land price. Therefore this method attempts to incorporate market and non-market aspects of a good in the market price (Adamowicz, 1991). It is assumed that the property owners are aware of the environmental variables in their area and respond accordingly.

Contingent valuation, unlike the indirect methods, does not look at behavior. Respondents are presented with a scenario, description of the amenity to be valued, a hypothetical payment vehicle and a question to assess their willingness-to-pay (WTP) or alternatively their willingness-to-accept-compensation (WTA) for the outcome of the scenario. The individual's response to the WTP or WTA question represents the theoretical welfare measure or their value for that amenity. A variant of the CV approach involves a referendum approach. The respondent votes on scenarios with differing levels of various natural resource qualities. Votes for a particular scenario indicate resource tradeoffs. CV studies implicitly assume that people fully understand their preferences and are familiar with the concept of value through exposure to prices, trade, and consumption of marketed goods. Instead of making assumptions about behavior, as with the indirect methods, CV incorporates the individual's perceptions and decision-making process into the valuation process (Adamowicz, 1991).

With increasing environmental concern, policy makers in developed and developing countries need value estimates of environmental goods. Contingent valuation (CV) is often the only means of obtaining these values, particularly non-use values. CV is still the focus of ongoing research and debates and remains an evolving and significant tool. While it has been extensively applied and tested in developed countries, its application in developing countries has been limited. However, the studies that have been done have had promising results and suggest that CV can be applied in a developing country.

CV has been applied in developing countries to financing education (Jiminez, 1987; Tan, Lee & Mingat, 1984; Thobani, 1983), as well as to health (Birdsall, 1983; Jiminez, 1987), the water sector (Boadu, 1992; Briscoe *et al*, 1990; Hsu & Li, 1990; Whittington *et al*, 1987, 1990, 1991, 1992; The World Bank Water Demand Research Team, 1993), sanitation services (Whittington *et al*, 1993) and national parks (Abala, 1987; Shyamsundar & Kramer, 1993). Whittington *et al* tested the applicability and accuracy of CV methods in several of their studies and found that CV was practical and feasible. Further studies in developing countries, and in a cross-cultural context, have also supported the application of CV (Adamowicz *et al*, 1997; Altaf *et al*, 1993; Campbell *et al*, 1991; Murray *et al*, 1995; Singh *et al*, 1993). This study discusses the possibility of using CV in the valuation of small wildlife in Zimbabwe⁹.

⁸For further reference see Braden & Kolstad (1991), Mitchell & Carson (1989)

⁹Graham (1995) explores in detail the methodological considerations when applying CV in developing countries. This review of methodology considers study design, sampling, data collection, survey design, potential biases, and variables that may influence CV responses.

3. PRELIMINARY EVIDENCE OF SMALL WILDLIFE USE IN ZIMBABWE'S COMMUNAL AREAS: FIELD RESEARCH IN CHINAMURA AND NYANGA

The purpose of the field research was to gain some perspective on the importance of small wildlife to households. Documentation of which wildlife is used, frequency and quantity of use, collection methods, season of collection, uses of the wildlife and marketing aspects provides an idea of the role of this wildlife in household lives. Factors that may influence use were considered, including observations about wealth, remoteness of residence and the reasons people stated for not consuming certain wildlife. Also, people's attitudes towards wildlife and their WTP were explored. The results of the studies provide some useful insight into wildlife use through qualitative and quantitative observations. The results also provide insight into developing appropriate survey designs and the selection of relevant analytic techniques for more rigorous and detailed studies on the valuation of small wildlife in communal area household economies.

Primary data were collected through field research in several villages in communal and resettlement areas during the time period from February to August 1994. Due to time constraints and unfamiliarity with a foreign culture, rapid rural appraisal¹⁰ using unstructured interviews and observations, was seen as the most realistic approach to data collection. The descriptive and quantitative data¹¹ provided information on wildlife use and valuation methods.

During the field research, several questions and issues about wildlife use were investigated in order to determine the significance of small wildlife and the factors that affect its use. The interviews included questions about collection methods, frequency and quantity of collection, marketing of wildlife by the household, attitudes and perceptions, and village political processes. Some initial attempts were also made to test the applicability of contingent valuation approaches.

The research approach was mainly descriptive, although quantitative data were also collected where available from primary and secondary sources. On issues with little previous research, descriptive data can be used to capture dynamic social and economic processes and may provide a more complete picture of how households make resource allocation decisions. Quantitative data combined with the descriptive data can then be used to build a descriptive model as a basis for future statistical studies.

STUDY AREAS

The two field studies included several villages located throughout the main research areas¹². The initial and major field research focus was in Chinamura area within Goromonzi district. A second focus of study was located in Nyanga district. In addition, some opportunistic and supplementary interviews were conducted in the Wedza and Mutoko districts.

¹⁰For reference to rapid rural appraisal see Campbell *et al* (1994).

¹¹The quantitative data were not intended to be statistically accurate but only to be indicative.

¹²For detailed descriptions of the villages, refer to Graham (1995).

The purpose of selecting two main sites involving several villages was to broaden the focus and allow comparative work. Because no site is typical or representative, visiting different areas contextualizes the fieldwork and helps to develop an understanding, however superficial, of processes in different areas. The second study also gave a fresh perspective on the economic and social processes, particularly some aspects that were observed during the first study and subsequent literature review.

Chinamura Study Area

The first study was based in the Chinamura area, about 30 km northeast of Harare, near Domboshawa town. This communal area is within Goromonzi district in the Mashonaland East province. The Chinamura area was selected due to its close proximity to Harare which enabled easy access for this initial field study. This site also satisfied the desire for a site located near a city or major business centre in order to consider the influence of markets on uses and values of the small wildlife resources.

A total of six villages were visited in three of Chinamura's five wards. These included Chipatiko, Tagarira and Murape in Murape ward; Chidarikire and Bapatu in Mawanga ward; and Munyawira in Munyawira ward. These villages encompassed different levels of village organization, wealth, remoteness and a variety of other socio-economic characteristics. Interviews were conducted during day visits carried out intermittently over a week period in each area. A total of 38 households were interviewed. Five households were interviewed in Chipatiko, five in Tagarira, five in Murape, one in Chadarikire, and four in Bapatu village. The remaining 18 households were interviewed in Munyawira.

Nyanga Study Area

The second research area was located in Nyanga district. Nyanga district lies in the Eastern Highlands, east of Harare, in Manicaland province. With the assistance of the District Administrator, two wards were selected out of the 37 wards and a third was added later. Five villages in the three wards were visited. These included the three resettlement villages of Nyahumbe, Nhyari and Gukutu, in Ward 27-Sanyatwe; Nhonhegapundi village in the communal area of Ward 22-Gonde; and Nyhokwe, a resettlement village located in Ward 36-Ruchera. Eighteen interviews were conducted in these villages over a period of three days. Two households were interviewed in Nyahumbe, four in Nhyari and four in Gukutu. Six households were interviewed in Nhonhegapundi and two in Nyhokwe. This broad cross-section was intended to provide general comparison with Chinamura. Due to the small sample size, data analysis was not as extensive as with the Chinamura data.

SAMPLING

Various villages were purposively selected within the two areas to represent a variety of physical and socio-economic environments. Varying resource access, population densities, wealth and market access were considered to be factors that might influence wildlife use and values. The household was selected as the basic sampling unit.

In rural areas in developing countries, the household is the most common unit of production and consumption. (Devereux & Hoddinott, 1993; Casley & Lury, 1987). The majority of the population in these areas depend on agriculture and consume or sell agricultural commodities that they have

produced as an operating unit. Other products may also be collected or produced by the household for consumption or sale. However, increasing urbanization, and household members working and living elsewhere in order to generate household income, has caused the household unit to lose its coherence and become more difficult to define.

The following definition was derived from field observations and respondent classification of their household, as well as drawing from other definitions¹³. The household is defined as including those members, usually bound by ties of kinship, who live together on the same homestead, share a common food source and are answerable to the same household head. However, it is recognized that within the holding there may be several distinct households, which are related by kin but which function individually. This definition includes absent household heads, who may be working and resident elsewhere, but who contribute income to the household which is considered their permanent place of residence. Also, workers may be included if living and working with the family. However, this classification does not include other family members who permanently live elsewhere even if they do contribute remittances to the household.

The purposive selection of households to interview within the sample villages was intended to include as many different socio-economic and physical conditions as possible. Within each village area, scattered households were selected which portrayed varying apparent levels of wealth based on superficial and obvious assets, were located in different proximities to business centres or were remote, and which were located in different environments. These factors were considered so that any linkages between them and wildlife utilization and value could be considered.

Choice of households was also influenced by the presence of household members. Generally, any adult household members present were invited to respond, and input from children was also accepted. In some cases, multiple households were interviewed concurrently. These cases occurred in instances where a few villagers were gathered together or if visitors arrived near the start of the interviews. Multiple interviews could then be conducted in single sittings, long interview periods resulted while those involved waited for the responses of the others. Multiple interviews conducted at one household also did not allow for observation of the holdings of the visiting respondents.

Accurate information on wealth and income is difficult and time-consuming to obtain, therefore indirect measures were used. Whittington *et al* (1990) and Campbell *et al* (1989) also used this approach. The observations used in this study included the number of buildings and descriptions about their construction such as shape and size (round or rectangle, one or multiple rooms), building materials (brick, block, concrete, mud, stick), roofing material (asbestos, tin, thatch), concrete foundations and any extra features such as windows with glass, stone work or paint. Observations also included other structures in the yard, such as the presence of toilet structures, animal pens and storage buildings, and their construction and building materials (stick, wire, concrete). Vehicles, trailers and other possessions such as furniture and radios were also used as indicators of wealth. However, these observations only included what was apparent to the interviewer during the interview and there was no exploration or stock taking involved.

¹³Devereux & Hoddinott, 1993; Campbell et al, 1989; Casley & Lury, 1987.

INTERVIEW DESIGN

The collection of quantitative and descriptive data consisted of unstructured interviews¹⁴. Subsequent to the interviews, further quantitative and descriptive data were also derived through observation of the physical and socio-economic environment. The intent of these interviews and observations was to give insight into actions, behavior and motivation that may influence wildlife utilization. The alternative of a site-specific case study was rejected in favor of a broader 'cases' study which was considered to be more valuable due to the lack of information.

The unstructured approach was considered most appropriate. A semi-formal approach is used with unstructured interviews. While a formal questionnaire was not used, a standard set of key questions was prepared in advance and consulted throughout the interviews. The questions were ordered to allow a logical flow to the interview and this order was varied between different households. With the unstructured approach, all respondents are not considered equal (Whyte, 1977). Therefore, the choice of interview questions can be altered depending on how informed the respondent is and the relevance of certain questions to their situation. This less formal approach was also seen as less intimidating while still providing the desired information.

The flow of the interview was led by the researcher with suggestions from the research assistant, who translated the questions into Shona, the language of the study area. Some questions started at a more general level and then became more specific, in order to elicit greater detail, particularly with regards to frequencies and quantities. Small time frames such as weekly or monthly amounts were queried because these were considered to be more realistic in trying to elicit household amounts.

Initial questions involved listing the various small wildlife resources used. The wildlife was not specifically identified but was listed generally, ie. mice, birds, locusts. This list was then used to gather information on the collection methods, frequency and quantity of collection, marketing of the wildlife and any additional notes. The purpose of this line of questioning was to gain some perspective of the significance of the small wildlife use for households through the quantity used and the time involved in collection. The quantity and cost of meat consumption was also determined in order to assess substitution.

Further questioning also involved peoples' perception about the importance of small wildlife to their household, the status of the small wildlife populations, and if they would like small wildlife populations to increase. If wildlife was considered important by the respondent, exploratory WTP questions were asked to see if they were able to indicate any type of value. A general project to increase wildlife in the area was suggested and the respondent was asked what they would be WTP towards a project. These WTP questions were open-ended, and were not conducted in a rigorous manner, but were conducted to get an idea of the respondent's ability to respond and, perhaps, gain some insight as to why they may not be able to respond.

¹⁴For reference to unstructured interview techniques see Devereux & Hoddinott (1993) or Whyte (1977).

Questions on political processes in the village were also asked in the second field study to understand how decisions are reached and who has decision-making power. This information is necessary when considering the relevance of the referendum CV approach. In some cases, respondents were consulted about social and religious laws and customs which affected wildlife use. Finally, household composition was determined.

Throughout the interview, some data were collected on the quantity and quality of the holdings of the household based on visual observation. However this was not included in the questioning. These observations were to allow some general determination of wealth.

In summary, the research on households in the two areas, Chinamura and Nyanga, focused on information on the use of small wildlife, factors affecting this use, as well as factors that may affect the success of valuation approaches and in particular WTP questions¹⁵. These data can be used to assess the importance of small wildlife and as background for further research on valuation in the communal area setting.

RESULTS OF FIELD RESEARCH

Chinamura Study Area

The results of the field survey, while not conclusive, do provide several possible insights into wildlife utilization and importance. Although households generally did not utilize a large number of wildlife and did not use these in great numbers, some amount of wildlife did play a role in every household. There was large variation between households in the quantities and species collected. The main wildlife used (listed in terms of decreasing use) included species of mice, birds, hares, wild pig and buck, as well as insects such as ishwa, locusts, tsambarafuta, madora, mandere and makurwe¹⁶. The use of certain species, such as birds, mice and ishwa, did seem quite significant when they were available. The small wildlife were mostly used for home consumption. However, if they were collected in surplus, they were marketed. This small additional income was considered to be helpful.

Wildlife was generally collected from around the household and collection was usually undertaken in conjunction with other tasks. However, some respondents did make occasional trips elsewhere for certain species. Seasonality was also a strong factor in collection. While some species may be collected year round, others are only collected during a certain period. Seasonality is especially evident with the insect species, although mice are also subject to some seasonality in collection.

This study was conducted during the period of harvest and later in the dry season in 1994. The timing of data gathering, relative to the seasonality of collection, may affect the accuracy of responses when asking households to recall quantities for the year. During the harvest and during the rainy season, particularly at the onset of the rains, appears to be when the most wildlife collection occurs.

¹⁵For detailed study results and tables refer to Graham (1995).

¹⁶The common, scientific and indigeneous names are found in the Appendix.

A greater proportion of households in the higher wealth grouping utilized wildlife than in the lower wealth grouping. These higher wealth households also utilized a greater variety of wildlife. The higher wealth households, however, may not face labour constraints that may be connected with lower wealth households. Perhaps these households are also more ambitious, which may be why they are wealthier. These households may also be large and therefore require a greater food supply. Taste preferences do not seem to bias against wildlife with the higher wealth households.

While the higher wealth households cited lack of wildlife as a reason not to collect, this may be because these households also tend to be located near main roads and densely populated areas. However, lack of wildlife is also cited by lower wealth households which may suggest that they are located in environmentally degraded regions which do not attract wildlife. The environmental quality of the area was not explored in this study. Generally, though, most people felt that wildlife had decreased in their area. They felt that the decrease was due to habitat removal associated with increasing population pressure and not due to over-hunting.

Wildlife utilization in least remote areas was actually slightly higher than in more remote areas. However, this difference may not reflect availability of wildlife but may be due to other factors, such as lack of labour in households located in remote areas. Also, a greater number of people in the more remote areas did not consume small wildlife due to religious reasons. Therefore they are not utilizing the wildlife, even if it is available.

Taste preference was cited more often in the least remote areas as a reason not to consume wildlife. These households have greater access to shops and can purchase items, which may influence their tastes. Also, wildlife is hard to collect, therefore if the butchery is nearby, and the household is wealthy, it can be easier to buy meat. Several households mentioned that there was no one to collect the wildlife or that it was difficult to collect, so it was not used.

Religious restrictions and beliefs differed between households, which suggests that a variety of religions may occur in any area. This variety may be due to immigration of people from other areas or, possibly, even neighbouring countries. As a result there may not be a strong religious cohesion among the residents of any area, thus traditional religious controls and taboos may not be followed.

The amount of marketing varied throughout the area. Marketing of wildlife may reflect the abundance of wildlife in the area and the amount of surplus collected by households. Much of the wildlife is never bought or sold. If there was not a market for the wildlife in the area, households in the area often had difficulty stating what price they might charge if they sold. Where markets did exist, purchasing wildlife was practiced more often by higher wealth households, although selling by these households was rare. These households may have more cash income to spare and therefore can buy more wildlife. However, they may also have larger households and therefore require additional food. Large households may not have surplus to sell which could account for less selling. Remoteness may also be a factor influencing marketing. Most purchasing occurred in the most remote areas. Households in more remote areas do not have the same access to stores. Access to meat supplies and other products for variety may be

limited. Therefore, if these households do not collect the wildlife themselves, they may purchase it for variety or to supplement their protein requirements.

In terms of use, several households did indicate that they desired more wildlife so that they could substitute it for meat. The majority of these households were in the high wealth grouping. Households in the lower wealth grouping seemed more concerned with crop destruction by wildlife, perhaps indicating their greater vulnerability. However, several households in all wealth groupings also felt that wildlife was important to have in the environment for existence, spiritual, aesthetic and bequest reasons. The men seemed more interested than the women in having wildlife in the area.

From the limited attempts in this study, use of willingness to pay (WTP) questions for contingent valuation appear to be possible. It appeared that respondents were willing to pay some amount for increased wildlife although the accuracy of their responses was not tested. However, success with WTP questions may depend on the household's market experience. In areas without a market for wildlife products, households often had difficulty in stating a price they would charge to sell individual wildlife. Other households, however, were able to estimate a price.

Nyanga Study Area

The Nyanga results are of most significance in comparison or contrast to the Chinamura results. The findings in Nyanga suggest that, as suspected, different species have priority in different areas. While mice and locusts seemed to be utilized by a majority of households, other wildlife was much less commonly utilized. In general, wildlife use did not seem to be as prevalent as in Chinamura, in variety or quantity (although the limitations of the small sample size must be recognized). In particular, mice and birds were collected in much smaller quantities and frequency in Nyanga, and there was also less insect use.

However, if wildlife utilization is more limited in Nyanga, this may be due to limited availability of certain species and not to the lack of desire to consume. Nyanga district is heavily populated, therefore wildlife may not be present in large numbers. Several respondents felt that the wildlife had left. Another factor limiting wildlife utilization was if there was no one in the household to collect the wildlife. In many households the husband works and lives elsewhere and is only home occasionally. As a result, there is no one to hunt, which is traditionally the man's role. Wealth groupings and remoteness did not seem to influence use, however religious and social reasons did influence use by some households.

Very little wildlife marketing seemed to occur in Nyanga. However, if there is a lack of wildlife, there would be less marketing because it is usually the surplus that is sold. Remoteness or access to markets may influence marketing, however this was not determined in the Nyanga study. It is possible that households with less cash income would not buy wildlife, therefore markets for wildlife products may not exist, even informally. However, it is not known if households in Nyanga have a lower cash income than in Chinamura.

In Nyanga, there also seemed to be less interest in having more wildlife around. This lack of interest may indicate that wildlife does not have high use value to these households. Existence value may be a luxury. People may be richer in Chinamura and have greater freedom to hold non-use values. Long-term vs. short-term survival concerns will influence the values that are placed on resources. Several households in Nyanga mentioned that they would even prefer not to have wildlife in the area because it is destructive to crops. People in Nyanga may be more dependent on agriculture due to limited income or less market access. As a result they may be more affected by outside factors and be more risk adverse. Crop destruction by wildlife may be a big enough concern that they would forego wildlife, because they can not afford crop loss.

In addition to the regular questions about wildlife, several households throughout the various villages were questioned about political processes within their village. The purpose was to determine how community decisions are made about projects in order to see if people would be comfortable with a referendum approach to CV. In resettlement areas, the chairman is in charge of the resources and administers allocation of resources to projects. The villagers gather to make decisions on issues such as grazing or projects. The chairman acts as a monitor for the debate, however the group makes the decision. If a group consensus can not be reached, there is a vote. In communal areas the political setup is different than the resettlement area, however the political processes are similar. The villagers gather to discuss the facts with the headman as a chair. The final decision is made as a group. The decision is based on group consensus, however, if there is much debate, there is a vote. The headman of the village then presents the group's decision to the councillor who approaches the local government. The political setup of the communal and resettlement areas suggests that while the villagers generally function by consensus, they are also familiar with the voting process. Thus a referendum approach to contingent valuation should not be precluded.

CONCLUSIONS

Evidence suggests that the use of small wildlife by communal area households is significant. While large quantities may not be utilized, small amounts of various wildlife contributes to the household diet. The importance and actual extent of this use may not be fully recognized even by the households themselves. In particular, the role of these resources during drought or the importance of these snacks to children's diets may be particularly significant.

As expected, these studies show wildlife use differs between areas. Even within an area, use differs between villages and even between households. The availability and variety of wildlife will vary between areas for ecological reasons such as available habitat and climate. Human factors such as population density and agricultural clearing will also affect wildlife population. The actual time of collection also vary between different areas because the seasons of wildlife availability and agricultural activities also vary slightly throughout the country. As well as wildlife availability, use is also influenced by religion, social norms, taste and the availability of labour.

The amount of marketing also differs between and within areas and villages. A lack of wildlife may result in less marketing because there is no surplus to sell. However, limited access to formal markets such as at local business centres or cities does not necessarily result in less marketing. On the contrary,

informal trading may flourish because there is less access to substitutes at stores. In fact, access to markets may discourage wildlife utilization because it is easier to purchase meat, especially if wildlife is difficult to find.

The general belief is that the amount of wildlife in the communal areas has decreased due to agricultural clearing and increased residency. These are permanent factors which cannot be easily changed, therefore there may not be the potential to increase wildlife in an area. Also, there may be resistance against increasing wildlife by those who do not use the wildlife or see it as an agricultural pest. Therefore attitudes towards wildlife in an area are important to determine. However, many people however do value wildlife for its non-use values as well as its use, and would encourage attempts to increase the wildlife.

In areas with interest in wildlife, such as in Chinamura, WTP questions should be possible. However, in areas with little interest or use of wildlife, or where wildlife is seen as a pest such as in Nyanga, attempting WTP questions may be irrelevant. Differences between areas prevent a blanket approach to applying CV in different areas. Recognition of different conditions and factors influencing use in different areas of Zimbabwe will increase the success and accuracy of valuation.

4.0 PROPOSED FRAMEWORK FOR NON-MARKET VALUATION METHODS IN A ZIMBABWEAN CONTEXT

The field studies gave some insight into the potential of applying non-market valuation methods to the valuation of small wildlife in Zimbabwe. This discussion draws on knowledge of the local system based on the field research and a review of Zimbabwean literature.

Travel cost modeling (TCM) is limited because of the nature of small wildlife collection. TCM requires distinct trips with estimable time and expenditures. However, everyday trips and activities by a communal area household may not be easily identifiable and measurable in terms of costs. Field research showed that small wildlife, in particular, is often collected occasionally and opportunistically with much of the collection occurring in conjunction with other tasks. Unless a specific trip is being made to collect the small wildlife, it is difficult to determine collection time.

TCM could be used if the collection of the wildlife involved a tradeoff with agricultural or household activities. But, these tradeoffs may not necessarily result in lower yield or lost value. The time may be compensated for or agricultural activities may not really be interrupted. TCM does not account for multipurpose trips. It is likely that a trip to hunt or harvest wildlife may also involve other tasks, such as collection of timber or other non-timber products. Alternatively, the main purpose of the trip may not be to collect wildlife and this collection may just be a function of opportunity that arises on the trip. Children may collect wildlife, such as birds, while herding cattle. Collection of mice from the stalks during harvest may involve everybody but not interfere significantly with the harvest.

The value of time also presents a problem. The concept of time and the cost of time may be different than in developed countries. In developed countries there may be time tradeoffs with paid labour time. However in rural areas in developing countries, there may not be an opportunity cost of time such as

lost income because there is no alternative income. Also, wage rates are very low so the cost of the trip in terms of time costs would appear low.

People living at a subsistence or low income level are limited in their capital. Therefore, expenditure tends to be on necessary items that can not be produced by the household. Weapons or traps for hunting and collection are often made from household or local materials and seldom involve additional costs. Due to the nature of extended family and relationships, there are usually friends or relatives to lodge with along the way if on a hunting trip. As a result the actual costs of the trip would be low or non-existent.

The only potential for travel cost modeling would be with respect to specific hunting trips which are occasionally organized for hares and bucks and could perhaps be documented. The number of days, equipment, and food required for the trip could be used as variables. However, the time involved in the trip does not necessarily mean lost income or decreased agricultural production. Long hunting trips tend to be scheduled during the off-season when there is little agricultural work and therefore opportunity costs may be low. Also, most farmers work their land to provide for their household and therefore do not receive a wage. A hunting trip would be part of the many activities which provide for the household. Also as mentioned earlier, expenditure on equipment is minimal if not zero. Food expenditure is also minimal and perhaps zero because most food would either be brought from home, or received along the way although there may be some food purchases.

Because there may not be any substantial input costs or time allotments, TCM does not appear to be appropriate to apply to small wildlife valuation in communal areas in Zimbabwe. However, it cannot be entirely ruled out and could possibly be applicable for other resources which involve specific trips although low costs would probably still limit its application. It may be more appropriate to use TCM in Zimbabwe to value recreational areas such as the National Parks.

Due to a lack of private property rights, hedonic price modeling (HPM) also does not appear to be applicable in communal areas in Zimbabwe. In these areas land is held in customary tenure. The land is allocated to the household and is inherited by the sons. Unused land is reallocated to those who need it. While there are secure use rights to the land, legally land can not be bought or sold. There are no land or housing prices and no property markets, therefore environmental qualities can not be incorporated into a property price. This situation effectively precludes application of HPM.

HPM could only be applicable with modification. HPM might be applied in a ranking exercise of different areas or sites. An individual's preference for different qualities would be incorporated in their ranking of the site instead of through market prices.

Evidence from other developing country studies suggests that contingent valuation (CV) can be successfully applied to valuation in a developing country. It also appears to be the most appropriate of the non-market valuation methods to apply in the valuation of small wildlife resources in communal areas in Zimbabwe. The background knowledge and preliminary field testing of WTP questions suggests that CV could be possible. Application of CV would have to be closely tailored to the social and economic conditions of the research area. Variables that may influence values for small wildlife

may include income, household size, education, information and perception, age, gender, religion, ethnicity, market access and environmental conditions such as resource availability or drought effects, as well as factors influencing household food security.

The study design should consider the combination of methodologies that suit the study environment. An in-depth, long term study, with the researcher residing in the community is optimal. However, participatory rural appraisal, rapid rural appraisal or a survey approach may be more feasible. A well-developed informal survey delivered through an oral interview should be effective for obtaining the desired data. This survey approach would account for varying education and literacy levels as well as limited telephone and mail access. This informal interview would use informal questioning supported by direct observation in order to extract the data.

Random sampling may be appropriate. However, purposive sampling of villages or clusters of households within the study area might be best to ensure a variety of social and environmental conditions. Sampling of regions across Zimbabwe is also necessary in order to get a true picture. Varying environmental as well as economic conditions are expected to produce varying results between and within regions.

Within selected villages, full coverage of households is desirable but purposive sampling could be applied to ensure the desired variety of households. Because different household members may be involved in certain wildlife collection and use, responses from all the household members who are present should be encouraged in order to provide the most complete results.

Survey design could adapt WTP or willingness to accept compensation (WTA) questions. WTA questions infer compensation for loss of resources, however this may not be realistic since much loss of wildlife has already occurred and the likelihood of compensation is remote. WTP questions could be used to determine the willingness to pay for improved resources or increased access to wildlife resources, such as through licencing. Adopting a bidding format for the WTP questions is suitable because much of Zimbabwean trade occurs through bargaining. A possible format would be to introduce an open-ended question followed by a closed-ended question. Asking the closed-ended question last would prevent the suggested closed-ended bids from influencing the respondent's open-ended bid. The open and closed-ended bids could serve as a check on each other and a disparity between the two bids may highlight biases or unknown variables that are influencing the responses.

Alternatively, the referendum format may avoid some of the problems with respect to WTP and WTA questions. This approach may in fact be more suitable, particularly if a specific value is not needed. The field study found that community decisions tend to be made by group consensus rather than voting but voting does occur. A referendum survey does not involve voting against someone else but is a choice for a particular scenario. The survey could rank wildlife among other characteristics in the household's production function. This format generally precludes determining an exact value for wildlife. It may however be possible to use the value of the other household characteristics in order to derive the value of the wildlife based on its ranking.

Conditions vary greatly across communal areas and within the communal areas and villages themselves. Therefore a blanket approach to CV is not applicable and some modifications are needed. It is not suitable for researchers to import CV studies done elsewhere without careful consideration of differences in the research area. More specifically, the researcher should have a familiarity with the area where they are attempting to employ CV. Assistants should be employed that are familiar with the area and with what the researcher is attempting to achieve. Also, pilot studies can be an important determinant of the success of a survey. Feedback from individuals in the villages may suggest which type of survey questions will work best. After revisions then a pre-test can be used to determine the final version of the survey. In general, the success of the valuation study will depend on the researcher's understanding of the processes and conditions in the study area.

5. CONCLUSIONS, POLICY IMPLICATIONS AND AREAS FOR FURTHER RESEARCH

This study documented the use and explored the valuation of small wildlife in selected communal areas as one example of non-timber resource use. The field studies found that nearly every household utilized small wildlife to some degree. The wildlife was used as a main relish or snack and if extra was collected this was preserved or sold. Variation in quantities and species collected occurred between households as well as between areas. Collection of small wildlife was generally opportunistic, occurring while conducting other tasks. However, specific time was allocated for seasonal species. In general, very little equipment or expense was involved in collection.

The household's utilization of small wildlife was influenced by factors such as wealth, remoteness, tastes, labour availability, religious beliefs and social controls, as well as seasonality and small wildlife availability. Several households felt that wildlife resources had decreased in their areas due to increasing human population. Some households saw small wildlife as an agricultural pest. However, many households expressed an interest in increasing wildlife in the area for their diet and income or even for existence value and spiritual reasons.

While three main methods of non-market resource valuation, contingent valuation, travel cost modeling and hedonic price modeling, may be available, only contingent valuation appears to be feasible. Travel cost modeling and hedonic price modeling are likely less suitable due to the nature of small wildlife collection and the method of land allocation in Zimbabwe.

Contingent valuation may be the most suitable of the valuation methods, but it must be adapted to suit Zimbabwean conditions otherwise factors such as income constraints or cultural traits may limit its success. Variables that may influence values for small wildlife and possibly other resources, include income, household size, education, information and perception, age, gender, religion, ethnicity, market access and environmental conditions such as resource availability or drought effects, as well as factors influencing household food security. Therefore valuation studies need to sample from a variety of different biological and social environments. Even with careful modification, the appropriateness of applying CV to determine a monetary value for environmental resources such as small wildlife needs to be questioned.

A well-developed informal survey supported by direct observation should be employed. Purposive sampling of clusters of households and regions across Zimbabwe is necessary to capture varying economic and environmental conditions. WTP questions asked through a bidding format would suit the bartering system of trade in Zimbabwe. An initial open-ended question followed by a closed-ended question is suggested. Alternatively the referendum format may potentially be more suitable but may preclude determining an exact value. However, a ranking among goods and services may be more accurate than an ill-conceived monetary value.

The field studies gave a preliminary indication that although small wildlife do not play a major role in household income, they are widely used and do play a role in household nutrition, income and dynamics. These field studies were superficial and probably do not reflect the true extent of the use of small wildlife. However, the widespread and variable use of wildlife indicated that it would be well worth valuing the contribution to households under different environmental and social conditions.

POLICY IMPLICATIONS

If small wildlife is important then these values need to be incorporated into resource management decisions at the government or the community level. Government projects such as irrigation, boreholes, rural extension, afforestation and habitat improvement require benefit cost analysis to determine their feasibility. Benefit cost analysis requires values to assess tradeoffs. However, the lack of market values for particular resources such as small wildlife often means that these resources are excluded from the analysis. As a result, projects or policies may not accurately reflect actual tradeoffs and may distort investment away from social optima.

Recognition of small wildlife values may also help to expand government policy which may not currently be meeting the goals of households in the communal areas. Policy change may better support the communal way of life. Changes could be directed at reducing barriers to resource access. Removal of hunting restrictions on small wildlife, and possibly on large wildlife, and providing security of tenure and effective local institutions, could allow large and small wildlife resources to play a greater role in both food security and income generation, while at the same time contributing to the enhancement of biodiversity. In addition, allowing some form of controlled access to state forests could expand communal households' potential resource use and well-being as well as eliminating illegal access. Government support could be given to community projects which enhance habitat for wildlife in pursuit of its household food security, equity and sustainable development goals.

Community management of resources may be more effective than government management where costs and benefits can be closely related so that resource allocation decisions are more socially efficient. Small wildlife values may be significant in their role in community management. It is possible that, through identification of values, property rights may start to develop. Contingent valuation could be used to identify individual values. Making these values explicit to communities and allowing them to recognize and discuss these values may lead to better management of resources. The result may be better management of habitat for wildlife resulting in increased wildlife for households. While there is the threat with communal property that overexploitation may occur, there may be a strong enough recognition that restraint increases the benefits for everyone. However, if households do not realize the

value of wildlife or if tastes have already turned away from small wildlife use, then it may be hard to promote small wildlife conservation unless significant values can be demonstrated.

The value of small wildlife could also be important in terms of market values. These values may determine that marketing of small wildlife is a viable supplement or even alternative to household agricultural production. Prices are already well-established for some wildlife in areas where informal and formal markets are operating. Informal markets exist within villages between neighbours. Some households sell to formal markets in local business centres, towns or cities. A barrier to increased marketing, though, may be the amount of wildlife in the area. However, through community management it may be possible to enhance small wildlife resources. As well, formal or informal markets may emerge where they were absent before, therefore opening new opportunities.

There is, however, the possibility that increased marketing could increase the gap between high and low income households. Households with transport and market access may exploit small wildlife resources to sell these, while households that do not market, but use small wildlife for household consumption, may suffer as supplies are reduced. However, community controls and incentives to conserve habitat and small wildlife resources may reduce exploitation. Through community action it may also be possible to overcome other marketing barriers, such as transportation to distant markets. Removing barriers may allow more households to participate in marketing and improve overall community welfare. Government may play a role in reducing some of these market barriers.

While wildlife utilization patterns have changed over time due to historical and social factors, emerging factors may also influence use in the future. Household sizes and compositions may change due to increased employment off-farm and other factors. As a result, household production and consumption patterns may change to reflect the loss of labour and/or income. Use of small wildlife may decrease because there is no one available to collect it. Alternatively, households may become more dependent on environmental resources if their agricultural production or income decreases.

Environmental conditions such as changing weather patterns and frequent droughts may force communal households to look for alternatives to agriculture for food and income. The use of other environmental resources such as small wildlife may be more sustainable. In particular, small wildlife species that are drought-resistant may become more widely used.

Finally, political and social change could also lead to change in communal areas. Household patterns and tastes may change and therefore small wildlife use could change. Also, community cohesion and traditional controls may be breaking down. This breakdown may affect community control of resources and the potential success of community management projects. Alternatively, resettlement may ease resource pressures and allow increased utilization of resources. However, further population pressure on already strained resources may exacerbate resource degradation and depletion. As a result, resources such as small wildlife may become more necessary to meet household food requirements.

RECOMMENDATIONS FOR FURTHER RESEARCH

Very little prior research has been done on the importance and use of small wildlife by communal area households. Further studies should focus on the impacts of small wildlife use and decision making at the household level. These could examine the role of woodland resources in household allocative processes involving labour use, land use, income and expenditure and the relationship of these resources to household food security and risk-spreading.

Studies also need to consider the impacts of small wildlife use across groups of households as well as within the household. In particular, studies should identify not just how many, but which households are dependent on small wildlife resources. This information could be used to determine how access to these resources can be improved especially during times when they are needed. Overall communal use of resources should also be assessed. Resource access and control issues influence the household's freedom to use these resources. Insight may be gained by examining changes in traditional and institutional controls over time and the effects on resource use and value as a result of these changes.

A look at temporal and spatial changes in wildlife use may also be important and comparison of past use and factors influencing change over time may be useful. Information is needed to determine how wildlife values change in time and space as a result of the season or year, the environment and individuals' characteristics such as gender, wealth and age. Spatial distribution of the human population, compared to the wildlife population, and how this has changed over time may be important.

In practice an increase in wildlife numbers may not be possible due to human population pressure and irreversible changes in habitat. Therefore, the costs of restoring or conserving wildlife should be investigated.

In addition to analysis of wildlife use at a household level and within communal areas, comparison across Zimbabwe is also necessary. Wildlife use, or resource use in general, may be influenced by the status of timber and non-timber resources in an area. Further studies are needed to isolate the effects of local resource conditions on the use of non-timber resources such as wildlife.

Small wildlife may have potential market value that is under-utilized. Research is needed on market demand for wildlife and the factors influencing this demand. Any feasible opportunities to market wildlife may be capitalized on by resourceful individuals. Thus, lack of marketing may be due to costs or other barriers. These barriers may include lack of transportation, lack of a market or market information, seasonality in wildlife supply or perhaps a lack of supply of wildlife. Investigation into marketing may discover a potential value for small wildlife that could be developed by removing or lessening present barriers.

Also, the importance of small wildlife products may not be just in their individual value but in their contribution to the overall value of forests. Information on small wildlife values could be gathered as part of larger studies looking at non-timber valuation. In particular, it is recommended that these resources are studied along with all wild foods.

Valuation of natural resources is a relatively new area of investigation in Zimbabwe. The application of ideas and methodologies needs to be adapted and explored with Zimbabwean resource issues. Further research, though should have clear policy links and focus on issues that are relevant to policy decisions. In developing countries, research resources are limited and should be directed to areas where the research is most needed. In particular, research should provide information to guide policy decisions in the use of resources and social welfare.

LITERATURE CITED

- Abala, D.O. 1987. A theoretical and empirical investigation of the willingness to pay for recreational services: A case study of Nairobi National Park. *Eastern Africa Economic Review* 3(2):111-119.
- Adamowicz, W.L. 1991. Valuation of Environmental Amenities. *Canadian Journal of Agricultural Economics* 39(4, Part I):609-619.
- Adamowicz, W.L. , T. Beckley, D. Hatton MacDonald, L. Just, M. Luckert, E. Murray & W. Phillips. 1997. In Search of Forest Resource Values of Indigenous Peoples: The Applicability of Non-Market Valuation Techniques. *Society and Natural Resources* Forthcoming.
- Altaf, M.A., D. Whittington, H. Jamal & V.K. Smith. 1993. Rethinking rural water supply policy in the Punjab, Pakistan, *Water Resources Research* 29(7):1943-1954.
- Appasamy, P.P. 1993. Role of Non-Timber Forest Products in A Subsistence Economy: The Case of A Joint Forestry Project in India. *Economic Botany* 47(3):258-267.
- Asibey, E.O.A. 1988. Wildlife issues in sub-saharan Africa. In: *Proceedings of International Symposium on Wildlife Management in Sub-Saharan Africa: Sustainable economic benefits and contribution towards rural development*, October, 1987, Harare, Zimbabwe. IGF, Paris. pp 32-50.
- Asibey, E.O.A. 1974. Wildlife as a Source of Protein in Africa South of the Sahara. *Biological Conservation* 6(1): 32-39.
- Baker-Jones, E. 1956. Some nutrition problems in Central Africa. *Central African Journal of Medicine* 2:60-72.
- Birdsall, N. 1983. Strategies for analyzing effects of user changes in the social sectors. Country Policy Department, Discussion Paper 1983-9. The World Bank, Washington.
- Boadu, F.O. 1992. Contingent valuation for household water in rural Ghana. *Journal of Agricultural Economics* 43:458-465.
- Bojo, J. 1993. Economic valuation of indigenous woodlands in Zimbabwe. In: Bradley, P & K McNamara (eds). *Living with Trees: Policies for Forestry Management in Zimbabwe*. World Bank, Washington.
- Braden, J.B & C.D. Kolstad (eds). 1991. *Measuring the Demand for Environmental Quality*. Elsevier Science Publications, Amsterdam, The Netherlands.
- Bradley, P.N. 1992. The indigenous woodland of Zimbabwe and their role in CC production systems. Background paper for policy review.

- Bradley, P.N. & P.A. Dewees. 1993. Indigenous woodlands: agricultural production and household economies in the communal areas. In: Bradley, P & K. McNamara (eds). *Living with Trees: Policies for Forestry Management in Zimbabwe*. World Bank, Washington. U.S.
- Briscoe, J., P.F. de Castro, C. Griffin, J. North & O. Olsen. 1990. Toward equitable and sustainable rural water supplies: A contingent valuation study in Brazil. *The World Bank Economic Review* (2):115-134.
- Campbell, A. 1986. The use of wild food plants and drought in Botswana. *Journal of Arid Environments* 11:81-91.
- Campbell, B.M. 1993. The monetary valuation of tree-based resources in Zimbabwe: experience and outlook. Paper prepared for the FAO expert consultation on non-wood forest products.
- Campbell, B.M. 1987. The use of wild fruits in Zimbabwe. *Economic Botany* 41: 375-385.
- Campbell, B. & T. Brigham. 1993. Non-wood Forest Products in Zimbabwe. Paper prepared for the FAO expert consultation on non-wood forest products.
- Campbell, B, J. Clarke, M. Luckert, F. Matose, C. Musvoto & I. Scoones. 1994. Local-level economic valuation of savanna woodland resources: Village cases from Zimbabwe. The Hot Springs Working Group. Harare, Zimbabwe.
- Campbell, B.M., R.F. du Toit & C.A. Attwell (eds). 1989. The Save study. Relationships between the environment and basic needs satisfaction in the Save catchment, Zimbabwe. University of Zimbabwe, Harare, Zimbabwe.
- Campbell, B.M., S.J. Vermeulen & L. Lynam. 1991. Value of trees in the small-scale farming sector of Zimbabwe. IDRC, University of Harare. IDRC-MR302e, Ottawa, Canada.
- Carr, W.R. 1956. The preparation and analysis of some African foodstuffs. *Central African Journal of Medicine* 2:334-339.
- Casley, D.J. & D.A. Lury. 1987. *Data Collection in Developing Countries*. Oxford University Press, Oxford.
- Centre for Applied Social Sciences. 1992. The use of indigenous trees in Mhondoro district. CASS Occasional Paper-NRM 5/1992. University of Zimbabwe, Harare, Zimbabwe.
- Chimedza, R. 1989. Women, natural resource management and household food security: An overview. Working Paper AEE 2/91. University of Zimbabwe, Harare.

- Chimedza, R. The use of wildlife resources in household diets: Women's management of natural resources. Study carried out as part of the Women Environment and Development (WEDNET). Environmental Liaison Centre, Nairobi, Kenya. Unpublished report.
- Chitsiku, I.C. 1989. Nutritive value of foods of Zimbabwe. *Zambezia* XVI (i)
- Chopra, K. 1993. The value of non-timber forest products: An Estimation for Tropical Deciduous Forests in India. *Economic Botany* 47(3):251-257.
- de Beer, J.H. & M.J. Mcdermott. 1989. The economic value of non-timber forest products in Southeast Asia. Netherlands Committee for IUCN, Amsterdam, The Netherlands.
- Devereux, S & J. Hoddinott (eds). 1993. *Fieldwork in Developing Countries*. Lynne Rienner Publishers. Boulder, Colorado.
- Dewees, P.A. 1992. Social and economic aspects of miombo woodland management in Southern Africa: Options and opportunities for research. A discussion paper prepared for the Center for International Forestry Research. February 1992.
- Duncan, J.R. 1933. Native foods and culinary methods. *Native Affairs Department Annual* 11:101-106.
- Falconer, J. 1990. *The Major Significance of 'Minor' Forest Products. The Local Use and Value of Forests in the West African Humid Forest Zone*. CFN 6. FAO, Rome.
- Fleuret, A. 1979. The role of wild foliage plants in the diet: case study from Lushota, Tanzania. *Ecology of Food and Nutrition* 8:87-93.
- FAO. 1989. *Forestry and Food Security*. FP 90. FAO, Rome.
- FAO. 1991. *Non-wood Forest Products: The Way Ahead*. FP 97. FAO, Rome
- Gibson, G.D. 1977. Himba epochs. *History in Africa* 4:67-121.
- Godoy, R., R. Lubowski & A. Markandya. 1993. A method for the economic valuation of non-timber forest products. *Economic Botany* 47(3):220-233.
- Gomez, M.I. 1989. A resource inventory of indigenous and traditional foods in Zimbabwe. University of Zimbabwe, Harare.
- Gore, C., Katerere, Y. & S. Moyo (eds). 1992. The case for sustainable development in Zimbabwe: Conceptual problems, conflicts and contradictions. A Report prepared for the United Nations Conference on Environment and Development (UNCED). ENDA-Zimbabwe, ZERO, Zimbabwe.

- Graham, L.L. 1995. Economic Approaches to the Valuation of Small Wildlife Resources in Communal Areas in Zimbabwe. MSc. Thesis. Dept. of Rural Economy, Edmonton, Canada.
- Hobane, P.A. 1994. The effects of commercialization of mopane worms. Project No. 690-0251. Natural Resources Management Project, U.S. Agency for International Development.
- Hsu, G.J.Y & W. Li. 1990. Application of the contingent valuation method to the Keelung river, Taipei. *Water Resources Development* 6(3):218-221.
- Hughes, C.H. A Checklist of Names of Indigenous Mammals Occurring in Zimbabwe. Dept. of Natural Resources, Rhodesia.
- Jiminez, E. 1987. *Pricing policy in the social sectors: Cost recovery for education and health in developing countries*. The World Bank, Washington.
- Keita, J.D. 1993. Non-wood forest products in Africa-an overview. Presented at the Regional Expert Consultation on NWFP, Arusha, United Republic of Tanzania, 17-22 October 1993.
- Kinsey, B.H. 1986. The socioeconomics of nutrition under stressful conditions: A study of resettlement and drought in Zimbabwe. CASS, University of Zimbabwe, Harare.
- Malaisse, F & G. Parent. 1985. Edible wild vegetable products in the Zambebian woodland area: a nutritional and ecological approach. *Ecology of Food and Nutrition* 18:43-82.
- Marks, S.A. 1973. Prey selection and annual harvest of game in a rural Zambian community. *East African Wildlife Journal* 11:113-128.
- Matiza, T., L.M. Zinyama & D.J. Campbell. 1989. Household strategies for coping with food insecurity in low-rainfall areas of Zimbabwe. In: Mudimu, G. & R.H. Bernsten (eds). *Household and National Food Security in Southern Africa*. Proceedings of the Fourth Annual Conference on Food Security Research in Southern Africa, Oct 31-Nov 3, 1988. University of Zimbabwe/Michigan State University Food Security Research Project, Department of Agricultural Economics and Extension, Harare, Zimbabwe.
- McGregor, J. 1991. Woodland resources: Ecology, policy and ideology. PhD thesis. University of Loughborough, Loughborough.
- McNamara, K. 1993. Key policy issues. In: Bradley, P.N. & K. McNamara (eds). *Living With Trees: Policies for Forestry Management in Zimbabwe*. World Bank, Washington.
- Mitchell R.C. & R.T. Carson. 1989. *Using surveys to value public goods: The CV approach*. Resources for the Future, Washington.
- Muir, K. and J. Bojo. 1994 *Economic Policy, Wildlife and Land Use in Zimbabwe*. The World Bank, Environment Working Paper No 68, Washington, DC.

- Muir, K. 1990. Forest Policy: An African Perspective. *Journal of Business Administration* 19(1&2):121-134 University of British Columbia.
- Muir, K. 1989. The potential role of indigenous resources in the economic development of the arid environments in sub-saharan Africa. *Society and Natural Resources* 2(4):307-318.
- Muir, K. 1987. Marketing Wildlife Products and Services. In: des Clers (ed) *Wildlife Management in Sub-Saharan Africa* . Proceedings of the International Symposium, October 1987, Harare. International Foundation for the Conservation of Game (IGF) Paris, France.
- Murindagomo, F. 1988. Preliminary investigations into wildlife utilization and land use in Angwa, mid-Zambezi valley, Zimbabwe. MPhil Thesis. Department of Agricultural Economics and Extension, University of Zimbabwe, Harare.
- Murray, E., W. Adamowicz, T. Beckley, D. Hatton MacDonald, L. Just, M. Luckert & W. Phillips. 1995. Non-market Valuation Biases Due to Aboriginal Cultural Characteristics in Northern Saskatchewan: The Values Structure Component. Rural Economy Staff Paper 95-05, University of Alberta, Edmonton, Canada
- Murray, M.L. 1978. Wildlife utilization investigation and planning in Western Botswana. Dept. Wildlife, National Parks and Tourism. Government Printer, Gaborone, Republic of Botswana.
- Ogle, B.M. & L.E. Grivetti. 1983. Legacy of the chameleon: edible wild plants in the Kingdom of Swaziland, Southern Africa. A cultural, ecological, nutritional study. *Ecology of Food and Nutrition*, 16:193-208; 17:1-64.
- Pearce, D. 1993. *Economic Values and the Natural World*. Earthscan Publications Ltd., London.
- Peters. H.P.J. 1990. Wildlife utilization and rural development in the Central African Republic. *Nature et Faune* 9:3-7.
- Poulsen, G. 1982. The non-wood products of African forests. *Unasylva* 34(137):15-21.
- Scoones, I. 1990. Livestock Populations and the Household economy: A Case Study from Southern Zimbabwe. PhD Thesis, University of London.
- Scoones, I. & F. Matose. 1992. Woodland management in Zimbabwe: Tenure and institutions for sustainable natural resource use. A report for the Zimbabwe national forest policy review of forestry, tree and woodland resources.
- Scudder, T. 1984. Development and natural resource management seminar presented at Dept. Environmental Studies, UC, Santa Barbara.
- Shyamsundar, P. & K. Kramer. 1993. Does contingent valuation work in non-market economies? Centre for Resource and Environmental Policy Research, Duke University, Durham, U.S.

- Singh, B., R. Ramasubban, R. Bhatia, J. Briscoe, C.C. Griffin & C. Kim. 1993. Rural water supply in Kerala, India: How to emerge from a low-level equilibrium trap. *Water Resources Research* 29(7):1931-1942.
- Swanson, T. & E. Barbier. 1992. *Economics for the Wilds. Wildlife, Wildlands, Diversity and Development*. Earthscan Publications, London.
- Tan, J., K.H. Lee & A. Mingat. 1984. User changes for education: The ability and willingness to pay in Malawi. Staff Working Paper 661. The World Bank, Washington, U.S.
- Thobani, M. 1983. Efficiency and equity implications of user changes in social sector services: The financing of education in Malawi. Staff Working Paper 572. The World Bank, Washington, U.S.
- Whittington, D., J. Briscoe & X. Mu. 1987. Willingness to pay for water in rural areas: Methodological approaches and an application in Haiti. Working Paper, USAID/WASH, Activity No. 166.
- Whittington, D., J. Briscoe, X. Mu, & W. Barron. 1990. Estimating the willingness to pay for water services in developing countries: A case study of the use of contingent valuation surveys in Southern Haiti. *Economic Development and Cultural Change* 38(2):293-311.
- Whittington, D., D.T. Lauria & X. Mu. 1991. A study of water vending and willingness to pay for water in Onitsha, Nigeria. *World Development* 19(2/3):179-198.
- Whittington, D., D.T. Lauria, A.M. Wright, K. Choe, J.A. Hughes & V. Swarna. 1993. Household demand for improved sanitation services in Kumasi, Ghana: A contingent valuation study. *Water Resources Research* 29(6):1539-1560.
- Whittington, D., V.K. Smith, A. Okorafor, A. Okore, J.L. Liu & A. McPhail. 1992. Giving respondents time to think in contingent valuation studies: A developing country application. *Journal of Environmental Economics and Management* 22:205-225.
- Whyte, A.V.T. 1977. Guidelines for field studies in environmental perception. UNESCO, Paris.
- Wilson, K.B. 1987. Research on trees in the Mazvihwa and surrounding areas. A report prepared for ENDA-Zimbabwe. ENDA-Zimbabwe, Harare, Zimbabwe.
- Wilson, K.B. 1990. Ecological dynamics and human welfare: a case study of population, health and nutrition in Southern Zimbabwe. PhD Thesis. University of London, London, England.
- The World Bank Water Demand Research Team. 1993. The demand for water in rural areas: Determinants and policy implications. *The World Bank Observer* 8(1):47-70.

APPENDIX

INVENTORY OF WILDLIFE UTILIZED IN ZIMBABWE

Common Name	Indigenous Name ¹⁷ (Shona:Ndebele)	Scientific Name	Notes	Source ¹⁸
MAMMALS:				
Mouse (General name)	mbeva/mbewa			1, 2, 5, 7,
Mouse	cheramasikati	<i>Rhabdomys pumilio</i> (unsure)		11
Mouse	mbasi/mhatsi	<i>Dendromus melanotis</i>		11
House Mouse		<i>Mus musculus</i>		

¹⁷The names preceding the colon are Shona and the names following the colon are Ndebele. Variations in spelling are included.

¹⁸The following studies or sources were used. The notes with each species may be specific for the area the study was conducted in.

1. Campbell *et al* (1994)
2. Cavendish, W. Pers. Commn. Preliminary results of study In Shindi, near Masvingo.
3. Chitsiku (1989)
4. Gomez (1989)
5. Graham (1995)
6. Hobane (1994)
7. Hughes (no date)
8. Kinsey (1986)
9. Natural History Museum, Bulawayo. Mammal displays.
10. Natural History Museum, Bulawayo. Pers. Comm., Mrs. Rudo Sithole, Entomologist.
11. Wilson (1990). Other studies and reference books are also cited within Wilson's study.

Pouched Mouse	gviti/svugu	<i>Saccostomus campestris</i>		11
Striped Mouse	ninga/nhika	<i>Lenniscomys griselda</i>		11
Single Striped Mouse	nhanho/shori			11
Mole	shindi			1
Shrew	mudhende/chimudenge/matuna/mudendere	<i>Nasilio brachyrynchus</i> , <i>Elephantulus myurus</i>		11
Rat	banya/mbende/gonzo/gozho/goso	<i>Tatera leucogaster</i> (unsure)		7, 11
Vlei Rat	dapi	<i>Otomys irroratus</i>		11
Bush Squirrel	shindi/trindi	<i>Paracerus cepapi</i>	2. Eaten very much in the past, but now rare	2, 7, 11
Rock Rabbit, Dassie, Hyrax	mbira:imbila	<i>Procarria capensis</i> , <i>Procaviidae sp.</i> (unsure)		1, 2, 9, 11
Unknown	siriri		Larger than mbira, long tail with white end	2
Cane Rat	manyika/zezeru	<i>Thyromys gregorianus</i>	Not a member of the rate family	8
Greater Cane Rat /Grasscutter	tsenzi/senzi/wondo	<i>Thyromys swinderianus</i>		7
Hare (General name)	tsuro/shuro	<i>Lepus sp.</i> , <i>Pronolagus sp.</i>		1, 5, 11
Scrub Hare	tsuro:unvundhla	<i>Lepus sarcotillus</i>		7, 9

Red rock hare	gubwe/hubwe/pfori/ pfuru:untoletsho	<i>Pronolagus crassicrudatus</i> <i>P. randensis</i>		7, 9
Spring hare	nhire/mhire/gwizhu/ gwete/jengwa/ :unayelaine	<i>Pedetes capensis</i>		7, 9, 11
Honey Badger	tsera/sere/mantswane /chisere	<i>Melivera capensis</i>		7, 11
Genet	simba	<i>Genetta spp.</i>		11
Wild Cat	gora	<i>Felis libyca, F. caracal</i>		11
Civet Cat	jachacha	<i>Viverra civetta</i>		2, 11
Porcupine	njenje	<i>Hystrix africaeaustralis</i>		11
Pangolin	hamba kubvu	<i>Manis lemmincki</i>		11
Bushbuck	tsoma/dzoma/soma/ hwete/goho:imbabala	<i>Tragelaphus scriptus</i>		7, 9, 11
Duiker	mhembwe:impungi	<i>Sylvicapra grimmia</i> (Crown duiker), <i>Cephalophus</i> <i>monticoles</i> (Blue duiker)		1, 2, 5, 7, 9, 11
Steenbok	mhene:ingina	<i>Raphericus campestris</i>		5, 7, 9, 11
Klipspringer	ngururu:igogo	<i>Oreotragus oreotragus</i>		2, 9, 11
Dikdik		<i>Madoqua kirki,</i> <i>Rhynchotragus sp.</i>		11
Wildpig	nguruve			5

Warthog	mjiri	<i>Phacochoerus aethiopicus</i>		2, 11
Kudu	nhoru:ibhalabhala	<i>Tragelaphus strepsiceros</i>		1, 2, 5, 7, 9, 11
Impala	mhara:impala	<i>Aepyceros melampus</i>		2, 5, 9, 11
Wildebeest	mvumba:inkonkoni	<i>Connochaets taurinus</i>		9
Tsessebe	nondo:inkolomi	<i>Danaliscus lunatus</i>		9
Zebra	mbizi			2
Hippopotamus	mvuu	<i>Hippopotamus amphibius</i>		11
Monkey	shoko		Few people eat	2
Baboon	gudo:indwangu	<i>Papio ursinus</i>	Very rare to be eaten	2, 9, 11
Tortoise	kamba			1
Snake	nyoka			1
Leguaan	gwama			1
Birds	shire/shiri			1, 5
Dove	njiva			2, 5, 11
Guinea Fowl (helmeted)	hanga/hendele	<i>Numida meoligris</i>		1, 2, 5, 9 11
Francolin	chikware/chikwari/ hware	<i>Francolinus sp.</i>		1, 11
Harlequin quail	chihuta			11

Quelea/ Melba Finch	chikumgura/mazazo	<i>Quelea quelea</i>		1, 5, 11
Weaver bird	qwetura/majesa			11
Red-shouldered glossy starling	husvu			2, 11
Long-billed crombec	dhimba			11
Fork-tailed drongo	nhengure			11
unidentified	chidhiti			11
Pipits	ndondodza			11
INSECTS:				
Caterpillar ¹⁹	madora:amacimbi	<i>Coimbrasia belina</i>	General term for edible caterpillar, Mashonaland	1, 2, 4, 5 10
Caterpillar	magandari/gandari		2. Jan-Feb. feed on <i>C. mopane</i> ²⁰ & <i>B. spiciformis</i>	2, 4
Caterpillar	harati:amacimbi	<i>Cirina forda</i>	1. Dec-Jan feeds on <i>B. africana</i> 11. still common, but less times a yr	2, 4, 5 11

¹⁹Wilson (1990) mentions species found in other studies to include *globiflora* & *Brachystegia spp*, masenda, matyonza, ndambakurayira,

Imbrasia epinethea(madora) on *J. nhayataya*, pferepfe and zuvisi.

²⁰The following tree species are included in Table C.1, Appendix C.

Caterpillar/ Mopane worm	magandari/gandari: amapipi (mahonja is collective term for <i>G. maia</i> & <i>G. belina</i>)	<i>Gynanisa maia</i>	Dec-Jan, Mar-Apr	6
Caterpillar/ Mopane worm	matyonza:amacimbi,	<i>Gonimbrasis belina</i>	Matabeleland. Restricted to <i>C. Mopane</i> on clayveld regions IV & V. ²¹ 10. Dec-Jan, Mar-Apr	1, 6, 10
Caterpillar	nhemeteme	<i>Gonimbrasia belina</i> , <i>G. zambesina</i> (unsure)	very rare, feeds on <i>J. Globiflora</i> & <i>D. mespiliformis</i>	11
Caterpillar	nhemeteme		feeds on <i>C. mopane</i>	4
Caterpillar	tyonza	<i>Gonimbrasia belina</i>	rare, feeds on <i>C. mopane</i> , <i>S. birrea</i> & <i>D. mespiliformis</i>	11
Caterpillar	nhete nhowa njanjenjanje shongwa sinini tsambare	<i>Sphingida spp</i>		4
Caterpillar	avamukundu	<i>Imbrasia ertli</i>	11. now very rare. feeds on <i>J. globiflora</i> & <i>B. glaucescens</i> .	3, 9, 11

²¹Bradley (1992)

Caterpillar	fenje	<i>Bunaea alcinoe</i>	virtually extinct. feeds on <i>C. kirkii</i> & <i>C. natalensis</i>	11
Caterpillar	gandari/siriri	<i>Lobobunaea</i> , possibly <i>Pseudobunaea</i> & <i>Gynanisa</i> spp	still found, feed on <i>J. globiflora</i> , <i>B. spiciformis</i> , <i>C. mopane</i> & <i>B. africana</i>	4, 11
Caterpillar	hondokotowa	<i>Thanmatopoedae</i> sp	feed on <i>J. globiflora</i>	11
Caterpillar	nhova	<i>Herse convolvuli</i> , <i>Anaphe panda</i>	common. <i>H. convolvus</i> feeds on <i>Convolvus</i> spp. <i>A. pande</i> cocoons in <i>J. blobiflora</i> & <i>B. glaucescens</i> , feeds on <i>D. candylocarpon</i>	8, 11
Caterpillar	sindigwiza	<i>Micragone</i> spp. or <i>Goodia kunizei</i>	Feeds on <i>J. globiflora</i>	11
Caterpillar	motho			5
Cricket	makurwe	<i>Gryllidae</i> sp.		5, 10
Sand Cricket	gugwe/gurwe	<i>Brachytypes membranaceus</i>	2.Feb-Mar. 11. during rains, crop pest	2, 4 11,
Black cricket	chikugwemuroi chenya chikumbwe chikundywe	Chenya found in <i>U. kirkiana</i>	2. Eaten in drought	2, 4 11,
Mole Cricket	ndororo	<i>Curtilla africana</i>		4

Locust	zwiwiza:intethe	<i>Locustana sp.</i>		4
Locust	hwiza	<i>Acrididae sp. (green)</i>		5, 10
Locust (medium-sized, red, migratory)	bandairo		late rains & cold, dry season, rare	11
Locust (migratory)	chinjike		late rains & cold dry, rare	11
Locust (large, solitary)	mhashu/mapfunde/ barigango	<i>Cystocanthoseris sp</i>	rains, common	2, 4,11
Locust (winged)	mbumu	<i>Gastrimargus volkensi</i>		4
Locust (winged)		<i>Namadacris septemfasciata</i>		3
Grasshopper (general name)	gwiza			4
Grasshopper (green)	madhumbudya		Jan-Dec	2
Grasshopper (large, winged)	boromoro/bnoromhori		common	11
Grasshopper (wingless)	:boromhori	<i>Pamphagina lamarckiana</i>		4
Grasshopper (large)	bambamukota, bombomupota	<i>Pamphagina lamarckiana</i>		4

Grasshopper	bambamukota	<i>Ornithacris cyanea</i>	all year, common	11
Grasshopper (large, wingless, brown)	bupu/bhupu		during harvest, common	11
Grasshopper (small grey)	chindanga			11
Grasshopper (solitary)	njeru	<i>Nomadacris septemfasciata</i>	rains, rare	11, 4
Grasshopper	tsumwatsumwa			4
Grasshopper (long-headed)	mutsumwarumwa			4
Grasshopper	njororo	<i>Curtillia africana</i>	still found	11
Grasshopper	shumvashumva/ tsumavatsuava	<i>Truxaloides consiriclus</i>	rains, cold dry, common	11
Grasshopper	dhusbudya	<i>Ruspolia differens</i>	rains, swarms in 1988	11
True Bug	bembere		first rains	11
True Bug	harurwa	<i>Eucosternum delagorgnei</i>	cold, dry, common	11
True Bug	nharara		cold dry, common	11
Cicada	nyenze, nyezhe, nhyenze		2. Oct - Nov. Eaten in drought 11. hot, dry season, common. <i>C. mopane</i>	2, 11

Termites		<i>Macrotermes spp</i>		6, 8
Termite (soldier)	majuru:amagenga		Aug - Nov	1, 2, 4 5, 10,
Termite (flying, female)	ishwa:izinhlwa	<i>Termitidae sp.(unsure)</i>		1, 2, 4, 5 10
Termite (winged)		<i>Macrotermes natalensis</i>		3
Tree ant	dendemafuta			6
Flying ant	shwarara		Nov-Dec	1
Ant	harungwa mise		Mar-May	
(fat beetle-unsure)	Tsambarafuta:amahla busi	<i>Carebara vicua</i>	2. Nov-Dec. 11. rains, common	2, 4, 5, 9, 11
Beetle	ndere	<i>Eulepidida masnoma</i>	hot, dry, common, found on <i>J.Globiflora, B. spiciformis</i>	11
Beetle	mandere	<i>Scarabaiedae sp.</i>		5, 10
Chafer Beetle	ndere/marupwa	<i>Rutelida spp.</i>		4
Christmas Beetle	ndiza	<i>Eulepida masnona</i>		4
Goliath Beetle	maivendere			4