Land Use Alternatives and Livelihood Viability in Ecosystems at Risk of Emergent Animal Diseases

Final WCS AHEAD Seed Grant Report

Gregory Parent[1]
Jessica Musengezi[2]
Brian Child[1]

University of Florida
[1]Department of Geography
[2]Food and Resource Economics

Introduction

The dry woodland biomes of southern Africa are home to large numbers of charismatic megafauna. Animal biomass in these systems is limited by the metabolite production of the plants, and these plants are, in turn, limited by water (Cumming, 1982; Bell, 1982). The natural system, typified by the diverse mix of browsers and grazers at varying levels of food selectivity, has been supplanted by the uniformity of ranching and agricultural systems. This has severely altered the dynamic nature of the ecosystem that has evolved between vegetation and high herbivore diversity (Du Toit & Cumming, 1999), heavily contributing to desertification, bush encroachment and ultimately a reduction in yields of cattle and crops (Brown, 1992; Child, 1989). Yet there exists few livelihood alternatives to ranching and rain-fed agriculture (Murphy & Mulonga, 2002).

The lack of sustainability and developmental potential of cattle and agricultural systems has been a stimulus for many southern African countries' move towards a focus on wildlife utilization as a development and conservation tool. While countries have taken different strategies, the ultimate goal of the various policy approaches is to capture wildlife's biophysical and economic advantage to generate a steady stream of benefits to local communities, thereby incentivizing the conservation of wildlife and the ecosystems in which they are present (Barnes et al., 2002). As 73% of the land in South Africa is privately held (Bond et al, 2004), much of the non-park conservation movement has been through private industry. Kruger National Park (KNP) has substantial impact to South Africa, with direct and indirect economic impacts of R496.5 million, and direct and indirect regional impacts to the Province of Mpumalanga of R235.0 million (Saayman & Saayman, 2006). These numbers however, do not include the impact resulting from private game areas around KNP. Eloff (2002) found that together the Limpopo and Mpumalanga Provinces have 2,685 game farms with a mean area of 1340.4 hectares. No economic study has looked at the area around the KNP, but this region undoubtedly receives substantial benefit, as the hunting industry alone contributes R417 million annually and five to six thousand jobs (Lindsey et al, 2007; Cloete et al, 2007).

As wildlife utilization and conservation programs expand in southern Africa, ecosystems and land use are changing. This in turn alters the interaction between disease pathogens and various hosts. Such changes can lead to emergence of infectious animal diseases that have substantial economic and biological costs (Daszak et al., 2000; Deem et al, 2001). For example, the emergence of canine distemper is believed to have brought on the 1991 extinction of African wild dogs in the Serengeti (Rupprecht et al, 1995). Understanding the extent of the human, wild and domestic animal interface requires not only determining the likelihood of a given population being affected by a disease, it must also include an analysis of the types of livelihoods and land uses that people engage in, and the differing impacts of emerging disease on them (Cannon et al, 2003). This study aims to address the question of tradeoffs between alternative livelihoods raised within the AHEAD-GLTFCA conceptual framework. The study will do this by identifying and valuing existing land uses on both private and communal land and determining the potential effects of disease on these land use systems through the evaluation of the vulnerability of the household to shock events.

Project Objectives

This project address unknowns within the WCS AHEAD program theme number four, on: human health and livelihoods, animal and ecosystem health. Specifically, the project will focus on:

- evaluating the trade offs between agro-extractive (i.e livestock and agriculture) and bio- experience (i.e. tourism and hunting) land-use enterprises; and
- the influence of institutional policy (i.e resource use restrictions, and especially rights to use and benefit from resources) on the magnitude and adaptability of enterprises and livelihood systems; and
- assessing the vulnerability of land-use enterprise to disease emergence in a system of covariant shocks.

The following report is broken into two parts:

1) the formal analysis of the the game ranching and tourism sector and
2) the evaluation of the rural livelihood system and household vulnerability to shock events.

What emerged from this study is two distinct projects. This was due to the vastly differing constraints and objectives of the two systems involved.

Section 1

Land Use Alternatives: Wildlife Utilization of Private Land

Jessica Musengezi

Introduction

Valuing wildlife utilization requires that as many of costs and benefits associated with the resource are identified and captured. Private game reserves in South Africa are market driven entities where inputs and outputs are identifiable and priced in the market. This presents a unique situation in which the values can be evaluated. Game ranches as business entities keep financial records for management and tax purposes. The vertical integration of wildlife activities means that the bulk of wildlife activities take place on a single farm unit e.g. producing and marketing of animal products and services. Focusing on game ranches captures direct wildlife values associated with conservation and tourism.

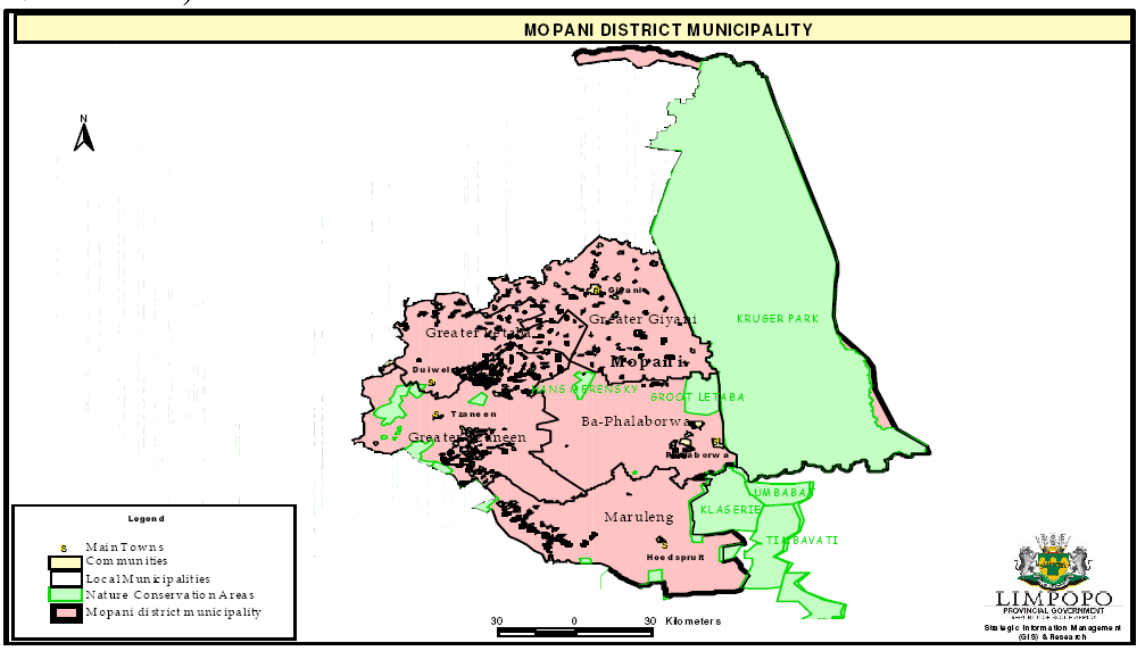
Methodology

Study Area

Study area focused on wildlife based land uses taking place on private farms Lowveld of Limpopo province. The objective of the research is to identify and describe different wildlife based land uses taking place and their associated costs and revenues. Data collection for the study was collected through three approaches; semi structured interviews of game ranch owners and managers, key industry informant interviews and database information. Additional information on the game industry, operating and policy, environment was collected through key informant interviews and locally available documents.

Study Design

Figure 1 Mopani District: Local Municipalities and District Management Area (Kruger National Park)



Questionnaire design

The survey targets game ranch and commercial cattle ranch owners/managers. The questionnaire is designed to capture information to assess the profitability and management of game ranches. Survey questions were complied by reviewing survey instruments used in analysis of game farms and livestock farms. The questionnaire includes sections on the following topics;

- Demographic information,
- General land unit and land use information,
- Livestock enterprise costs and revenues,
- Wildlife enterprise costs and revenues,
- Conservation and management activities, and
- Enterprise threats and opportunities.

The questionnaire was pretested on two game ranches in Mopani district. The review provided perspective on the concerns of ranchers, and issues that are foremost in their concerns. Issues raised include costs of land reclamation, the effect of land redistribution claims on farms, and lack of recognition by government officials of the contribution and potential of wildlife-based land uses. The questionnaire was revised accordingly to improve question comprehension and allow for ease of self completion.

Sampling and Participant Selection

Referral sampling also lends itself to collection of sensitive information. Referral from a trusted peer helped to foster trust with the respondent and encouraged willingness to divulge accurate financial information. This would have been less likely than had a random selection of ranches been chosen from a list and sent a questionnaire or visited. In addition to this the absence of a comprehensive list of game ranches in the province prevented a priori sample selection. A referral approach was used to identify key informants in the game ranching sector who in turn provided contact information for game farmers in Eastern Limpopo province. A combination of self completion and face to face interviews were used to collect the data. Questionnaires were distributed via email for self completion through the Agricultural Research Center rangeland management unit to encourage responses. The unit has longstanding relationship with game ranches in Lowveld area and performs annual vegetation monitoring for many game reserves. Questionnaires were emailed to 20 private game reserve owners and managers in the Lowveld area. Non- responses were followed up with telephone reminders and face to face interviews to complete the questionnaire. Each game farmer was then asked to recommend three peers for interview. In person interview of game farmers consisted of in depth discussion of their game farm operation and completion of the 11 page questionnaire. Four farms were visited for direct observation of wildlife enterprises visits including extensive tour of property facilities, observation of farm activities (tourism, breeding, and rangeland management) and extended interview. Fourteen responses were received, these included ten responses at farm level and three at the conservancy level and one state owned provincial reserve for comparison purposes. Farms ranged in size from 1700ha to 14500ha and conservancies ranged in size from 1500ha to 60 000ha. Due to the sensitive nature of information of requested in some sections farmers were guaranteed confidentiality, farms will be identified by code and financial data aggregated where possible.

Many of the private farms in eastern areas of Mpumalanga and Limpopo province have been converted from cattle farms to game farms. This has created some difficulty in locating commercial cattle farmers as those that were previously identified as cattle farms have since been converted to wildlife. To overcome this 2008 cattle production enterprise budgets were provided by the Limpopo Department of Agriculture.

District game farm statistics

Establishing the number of game farms present in the districts proved difficult due to the lack of a comprehensive provincial register of game farms. Statistics were collected for Mopani district which houses one key game ranching areas of the province. Statistics on the number of game ranches are recorded through exemption permits that allow landowners to hunt, buy sell and convey wildlife in accordance with the provisions of the permit. Exemption data for Mopani district was complied from three service center databases, Klaserie, Phalaborwa and Tzaneen. Exemption data base provides information on the; farm name, farm size, municipality, presence of accommodation, and game species present. A total of 166 farms were identified as exempted. Previous studies {{49 van,der Waal 2000; 55 Sutherland,E.A. 2003}}have raised concerns that exemption permits issued may not be an accurate reflection of the number of game farms in existence. The fear is that use of exemption permits alone for a will bias the results towards operations that engage in hunting while properties that engage in non-consumptive may be excluded from the sample. It remains that exemption is still the best available measure. In the case of the numbers presented here for Mopani district, exemption records are considered an accurate reflection of the number of game farms. Service center officials indicated that the majority of game farms in the district have exemption permits and this number can be considered an accurate proxy for the number of game farms in the district.

Principal Findings

Distribution of game ranches: Mopani District

Data covers Mopani district total of 166 game ranches. Exempted farms are dispersed through four municipalities; Maruleng (75), Ba-Phalaborwa (49), Greater Tzaneen (30) and Greater Letaba (12). Notably there are no exempted farms in Giyani the fifth municipality of the province which consists largely of rural settlements. The district has experienced a strong shift from cattle production to wildlife on commercial farms. Based on area we estimate that exempted farms cover approximately 35% of the municipal land area.

Data shows a wide range in farm sizes in the district farms range from a minimum of 300 ha to maximum 38 000 ha with an average size of 2,476 ha (Figure 2). Very large farms e.g. 38 000 ha are conservancies where a number of farms have joined together to manage resources collectively. The landscape is characterized by variations in size and changing organization structure. While there are older established reserves that now form part of greater Kruger National Park (KNP) network the organizational landscape is not static, new collective arrangements continue to be created.

Figure 2: Exempted farm size (n=124)

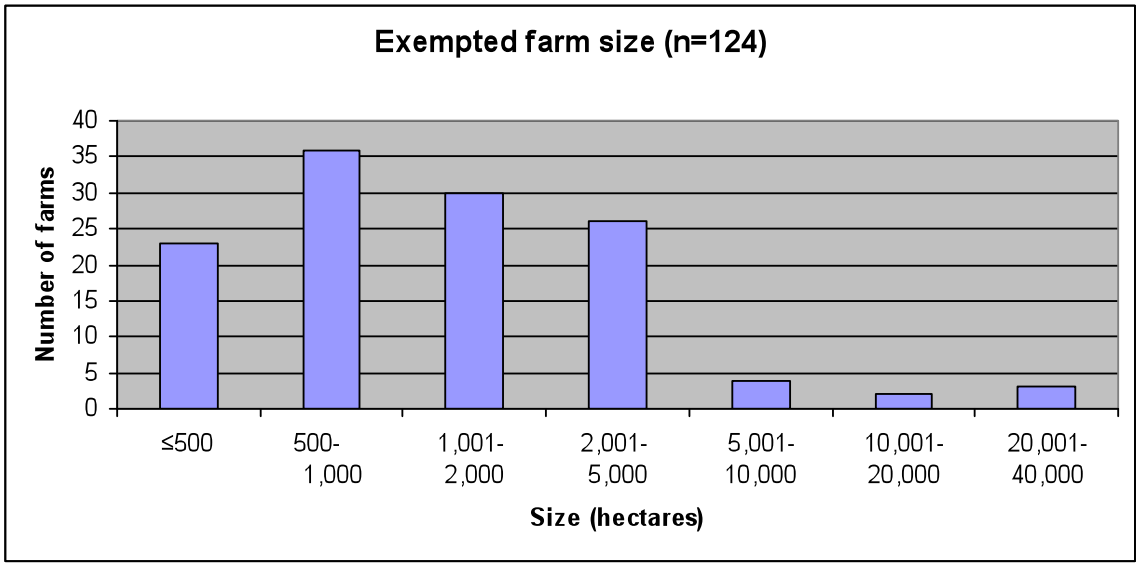
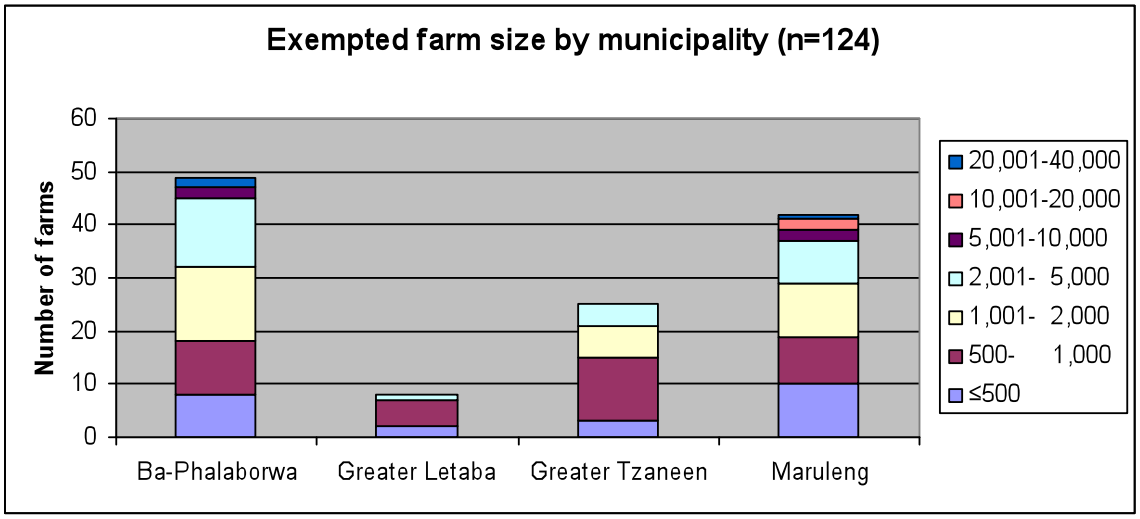


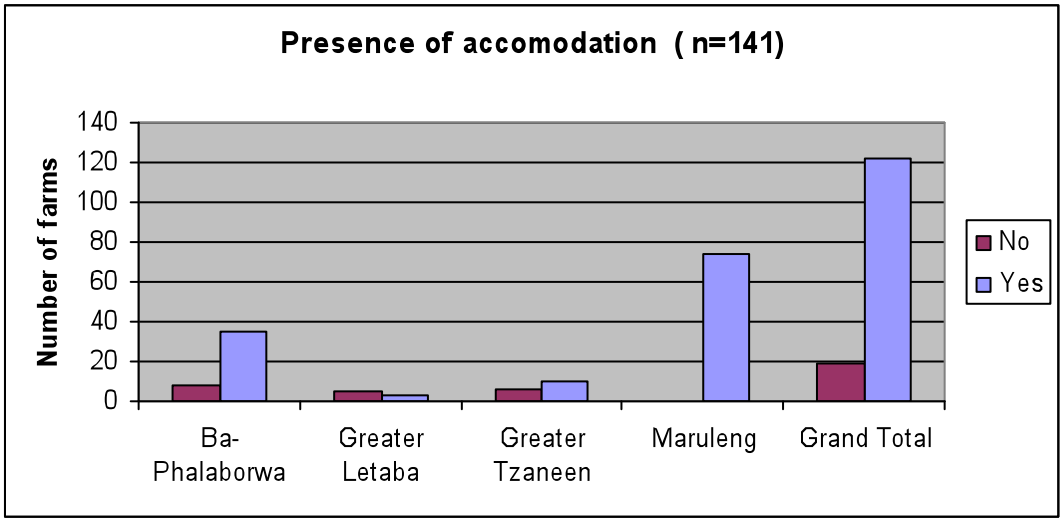
Figure 3: Exempted farm size by municipality



Wildlife enterprises

Exemption permits data also contains information on whether or not there is any form of accommodation on the property. Accommodation refers to some type of lodge or visitor accommodation. A total of 86% of exempted farms in Mopani district have visitor accommodation on the property. (Figure 4) this suggests a trend towards tourism either viewing or hunting in the district. However this overview of the district belies the complexity that exists at the farm level.

Figure 4: Presence of accommodation on exempted farms by municipality



Farm level: Emerging Themes and Perspectives

Interviews were conducted with game ranch owners/managers. During the interview managers owners were asked to describe their farm operation, the wildlife activities, and their thoughts on government authorities and regulations. A total of seven game ranch managers were interviewed. Interviews generally lasted forty-five minutes to an hour, and longer where tours of the game ranch properties were included.

The information from these interviews is described below. The following section presents the perspectives of the ranchers.

Financial values of wildlife based land use

The increase in the number of exempted farms suggests that there are economic incentives that are attracting new entrants into the sector. Land owners are attracted by rents that can be extracted from the game ranching sector. At farm level landowners indicate a financial benefit from wildlife after conversion from domestic livestock ranching. It is these financial benefits that attract farmers. Many have found it to be a more financially rewarding option than extensive a cattle production. Improved values under wildlife are reflected in farm revenues, employment level and land values. This result was found across different wildlife enterprises including ecotourism, wildlife breeding and on less intensive leisure operations. For example following conversion form cattle to wildlife enterprises it has been found that land values increased. Three key informants specifically stated that they had observed changes in land values with conversion from cattle to wildlife; two of the examples are given here. A large private game reserve concentrating in ecotourism found that prior to conversion it consisted of 9 cattle farms with a gross turnover from cattle of R150 per hectare and employed a total of 61 people at average salary of R150 per month. After conversion to ecotourism the reserve experienced a gross turnover of R1500 per hectare and increased employment of 350 people with minimum starting salary of R300 per month (pers. records Les Carlisle &Beyond 2009).

In situations were land use is not business focus as is and conservation of nature is the main objective landowners use land as a peaceful getaway from city life. While there is little in the way of intensive commercial activity similar increase in land values has been observed. A large private game reserve formed in 1993 with the primary focus of

conserving nature observed a similar increase in value of land after switching from cattle production to wildlife conservation. Under cattle land price was R 800 per hectare in 1993 and now under wildlife land is worth R 8,000 per hectare a with R 2,500 per hectare of that value generated by game (pers. comment reserve manager). The values of R 8,000 per hectare apply to land with plains game and it is expected that this value increases up to R 20,000 per hectare if 'big five' game are present on the property (pers comment reserve manager, pers comment wildlife specialist Pam Golding). While there are other factors that go into increased value of land such as infrastructure developments (roads, lodges, dams etc.) the presence of game remains a large factor and the developments themselves are driven by the desire to exploit the wildlife present on the land.

These examples illustrate some of the benefits that are generated from wildlife. They suggest that wildlife can generate benefit even when there is no extensive commercial exploitation of the resource. This demonstrates how exemption regulations have effectively allowed land owners to capitalize the value of wildlife into land and reap the benefits. Increased returns to wildlife in both these cases suggest at the potential for wildlife to generate significant benefits across different enterprises if at the one extreme high end eco tourism produces increased revenues and at the other seemly idle wildlife land at the very least results in increased land values over ordinary range land.

Motivation behind wildlife enterprise type

The objectives of ranchers vary. Owners cited a number of different reasons from profit to pure conservation. Motivation can rarely be narrowed down to a single objective and often ranchers are concerned about both profit and conservation objectives. From ten ranches that responded all but one cited conservation and lifestyle as motivation for entering game ranching. Three of these also explicitly cited financial benefits as a motivator in conjunction with conservation and lifestyle. The love of nature and the need to sustain a lifestyle that allows close contact with nature means that often owners have to balance these two objectives.

Reasons for the type of wildlife enterprise chosen are complex; driven by market forces, environmental factors and regulatory environment. Analysis performed by a game rancher prior to selecting the type of wildlife enterprise to undertake demonstrates the level of returns that can be achieved. Returns on investment in 1993 prices revealed extensive cattle production had the lowest return on investment 5 percent, eco tourism had a return on investment of about 12 percent (without big five) and game farming surpassed both of these generating the highest return in excess of 25% (pers. records game ranch manager). He chose game farming due to the high expected returns. Farmers respond to price signals and adjust their enterprises according to market prices. For example the increasing buffalo and sable prices is encouraging farmers to diversify into species specific breeding. This is reflected in the desire by farmers to begin or expand disease free buffalo and sable breeding.

There are also non-market factors that influence the decision to engage in wildlife enterprises. Size of the property and game present influence the enterprise type, for example if the farm is small and cannot support large animals such as elephant or

predators such as lion comfortably, then this is taken into consideration when selecting the enterprise type. Lack of big five may make ecotourism less attractive and favor other activities such as game farming and hunting. Veterinary restrictions for the prevention of disease spread (foot and mouth disease). Veterinary control areas are divided into three zones; the red zone where no cloven hoofed animals can be moved out of the area without permits and meeting specific veterinary requirements. These regulations together with market forces and the rancher's lifestyle preferences influence the type of wildlife activities that take place on the farm.

Regulatory and policy environment

The overwhelming impression presented by the ranchers interviewed is one of poor relations with government authorities both at the local level and at the national level. Ranchers generally perceive that there are too many regulations for them to adhere to. The difficulty with regulations manifests as lengthy permit processing and a large number of permits required for wildlife related activities, hunting, breeding, selling, translocation etc. Farmers also feel that government policy prejudices wildlife. For example after the most recent drought in Limpopo province was declared a disaster which enabled farmers across the province to receives assistance and compensation for losses suffered from the drought. However this assistance did not extend to game farmers. Cattle and other traditional livestock farmers received compensation for animals lost and support in supplementing feed for the remaining animals while game farmers had to fend for themselves although they too had suffered the effects of drought and lost animal stock (farmer comment). The value of wildlife is not recognized. Ranchers are aware of the negative perception held by government of the industry as an elite, rich, white industry. This perception causes ranchers to be a weary of the government and the future of the sector. Ranchers sense the need to demonstrate to the government the positive impacts of game ranching and its legitimacy as a land use option.

The concerns of farmers are echoed by Wildlife Ranching South Africa (WRSA) a national organization representing to 15000 game ranchers across the country ,echoes these concerns having found that these a problems faced by their members country wide. WRSA states that the biggest problems facing the ranches are high number of regulations, the perception of industry by government as an elite white activity and poaching. The focus of WRSA is to work with the government on new and existing regulations and negotiating for a move for ranching from conservation to agriculture classification. A move to agriculture is viewed a solution to overcome policy restrictions facing ranchers. A move to agriculture would; give ranchers access to subsidies that are widely available in agriculture but not in wildlife; avoid the many regulations in wildlife and give ranchers tax benefits afforded to other agricultural activities.

Changing views and future plans

Originally framers entered game ranching primarily for lifestyle reasons; love of nature and the outdoors. Overtime the operating costs of the ranch have increased leading to greater pressure to generate higher incomes. “Increasing operating cost may force a change in view…”; “Pressures of the cost of living and the high running costs of a reserve such as this place more pressure on the owners to find a way to make the

reserve financially self sustaining". From the ten ranches interviewed, five currently view the ranches as equally a business and three considered more of a business and two considered it as primarily a way of life. Focusing on increasing revenues to meet rising costs has meant farmers have taken a more business like view of game ranching. Concerns of managing costs and generating income have become more important.

This perspective is also reflected in future plans for the wildlife businesses. Seven farmers planned to expand their operations and three planned to continue in the same way, without any plans to reduce or exit the industry. Farmers planned to expand their enterprises by acquiring more land, taking up breeding of rare species (disease free buffalo and sable) or introducing more species. All of which are actions geared towards increasing revenues or reducing costs. As ranchers manage their businesses they considered the market and changes they anticipated in the future in game prices. Ranchers did not seem to be concerned about a potential fall in prices for sable in the future. Many had a positive outlook on future of sable prices and stated that sable prices had already exceeded their expectations. They expected sable prices to remain high for the foreseeable future. There was less certainty regarding the future of disease free buffalo market. While many indicated a desire to expand this area of enterprise they also indicated that there was some uncertainty in its future. Buffalo prices continue to increase but some believe the actions of unscrupulous farmers who do not take adequate care with their animals and push through 'unclean animals' were a threat to this market. Their activities may cause regulators to take notice and rethink the feasibility of producing disease free animals and repeal the ability to do so. Ranchers were pessimistic about the white rhino market.

Business opportunities and challenges

All of the respondents had positive visions of their business and felt that there were opportunities still to grasp. Diversification and into breeding of buffalo and sable was considered one of the key opportunities available to ranchers. Five ranches indicated a desire to increase the breeding component; one ranch was in the process of converting from tourism to breeding of high profile species and eliminating the tourism component of the business altogether. Three tourism focused ranched expressed the desire to expand their tourism enterprises by breaking into new markets and acquiring more land. The felt that existing tourism industry is very competitive one way to get ahead was to break into markets such as Asia and South America that are not the traditional clientele for the industry. Other opportunities cited were; employment creation, development of a wildlife estate.

The challenges cited by farmers related largely to the policy and economic environment. The biggest challenge cited was land claims and the policy environment both in terms of legislation as well as the negative perception of white farmers. Seven farms interviewed were under land claim. Land claims impacted negatively on businesses by stalling long term plans and reducing capital investment. Farmers hold back on major infrastructure developments such as new building and roads in the face of uncertainty. It has also slowed down the expansion of wildlife enterprises as purchase of additional land is complicated by the presence of a claim. Two

respondents stated that claims process also places substantial financial burden on land owners in terms of legal fees paid while claims are processed.

The economic climate is also of concern. Appreciation of the South African rand has made South Africa a relatively more expensive destination for international hunters and tourists. Farmers feel they are losing clientele to other countries where prices are cheaper. Farmers are also concerned with over development of natural areas reducing the bush feel which detracts from the safari experience, increases in roads and urban construction poses a considerable threat. In addition one farmer cited sectoral determination as a major problem particularly for tourism enterprises with lower price range targeted at local visitors. The sectoral determination levels set were much better suited to large high end operations, such that this type of enterprise struggled to maintain profitability.

Economies of scale

Farmers were asked if they would be willing to remove fences and manage resources collectively. The views on conservancy membership are divided between those who are open to the idea and those who are opposed to the idea. The reasons cited for establishing a conservancy was to strengthen the negotiating powers of farmers with government and other wildlife entities by forming a group and as well as taking advantage of economies of scale (*pers comment* conservancy manager); traversing rights for game dives, and joint rangeland management reduce the cost borne by individuals. Ten responded; five would not like to join a conservancy, two were already part of a conservancy and three were in the process of negotiating membership to a conservancy. Those against the idea however did not find the loss of autonomy that comes with joining a conservancy appealing, “we would lose our identity” (famer comment). Being part of a conservancy means adhering to constitution with set objectives. One of the difficulties is the ability to adjust operations and explore other activities is often limited in the conservancy set up. As with any collective organization there are difficulties associated with identifying goals that all members can agree on, more so with wildlife management due to the diversity of enterprise activities and motivations. As one famer put it the conservancy is a complex arrangement that must be well thought out “All parties concerned must believe in a single goal and have the exact same management styles and principles for this to work. Opposites do not attract in this field. This is also a very delicate sector and requires intense thought and planning.” (farmer comment).

Impact of veterinary regulations

Farmers are aware of the importance and necessity of veterinary regulations to prevent spread of disease. The Lowveld region is nestled against Kruger Park to the east which is considered endemic for foot and mouth disease, as a result many farmers in the Lowveld fall within veterinary control or surveillance areas. These areas entail additional veterinary oversight and regulation compared to areas in ‘free zones’. Although farmers understand the necessity of the regulations they also feel that hey impact negatively on their operations. On further discussion it appears it is not so much the regulations themselves but the process of obtaining permits that is the problem. Farmers cited slow processing of permits and the large number of permits required which when combined make compliance a long drawn out and unpleasant experience “

it's not so much the regulations as the permits and the hassles surrounding them" (farmer comment). The hassles are partly due to the lack ok of manpower as local service centers to process permits (pers. comment Les Carlisle &Beyond). Farmers encounter backlogs at service centers that mean their requests take longer which is not ideal for time sensitive operations such as movement of game.

Ecological management

All ten game ranches stated they had a formal ecological management plan. All monitored wildlife populations and vegetation. Six ranches stated that they took measures to control soil erosion and remove alien invasive species such as guava, prickly pear, sisal trees and lantana.

Financial Information

The following section gives a case study of 8 farms from the survey sample. The case study shows that complexity on the ground that is obscured by district level statistics and examines financial aspects of the farms, costs, revenues and profitability.

In most cases capital costs were difficult to obtain because capital developments such as roads, dams, and fencing were made over a number of years and it was difficult to recount all the developments that had been made an their associated costs. Four farms proved information on capital costs excluding land and these ranged from 2,222 rand /ha to 4,845 rand/ha. The respondents were asked to refer to financial records to ensure accurate values for all the accounting categories. Capital costs included buildings, fencing, dams, wildlife introductions, vehicle and machinery etc.

Operating costs

Operating costs ranged from 407 rand/ha to 3608 rand/ha. Costs of tourism centered farms were incurred from the provision of the safari experience; that is lodge accommodation, game drives and the service staff to cater to tourist needs. The four operations that stated ecotourism as the primary purpose operation budgets analyzed show that the wage bill forms the greatest category of expenditure from 20% to 73% of operating expenses.

Table 1: Operating costs (percentage of variable costs)

Farm	Primary Activity	Employees	Animal care	Administration	Fuel & Transport	Safari costs	Maintenance	Utilities
A	Tourism (Top End)	77.3	0	7.7	1.7	3.3	6.7	3.2
B	Tourism (Mid level)	20.5	51.3	3.5	10.8	0.8	7	6
C	Tourism (Mid level)	42.7	4.9	24.1	5.6	9.8	11	1.8
D	Tourism (Mid level)	63.3	0.2	11.6	0.2	0	13.2	11.5
E	Breeding	51.2	12.7	0.5	8.6	0	23.6	3.2
F	Breeding	18.2	47	9.5	9.8	1	11.5	3.1
G	Mixed	19.3	58.8	0.9	13.7	0	6.8	0.6
H	Conservancy	17.9	40.1	1.5	19.4	0	18.3	2.9

Maintenance, administration and utilities accounting for less than 24 percent of running costs. Animal care and movement costs are minimal less than 1%. This partly explained by membership to a conservancy. Depending on the particularly conservancy, one of the case farms is a member of a conservancy and the costs of animal care, rangeland and road maintenance are borne by the conservancy that is responsible for providing those services at the conservancy level rather than the individual farm level.

Enterprises with a consumptive game use component incur expenditure associated with the care and management of wild animals. Animal care comprised the largest expenditure accounting for 40 % percent to 65 % of farm running costs. Labor is also an important costs but to much smaller extent than for strictly ecotourism farms.

Revenue sources

Wildlife based enterprises generate revenue from visitor accommodation, entry fees, retail sales, trophy hunting, biltong hunting, live animal sales and game meat sales. Visitor accommodation dominates revenue earnings for tourism enterprises. Strict tourism enterprises generate revenue from non-consumptive uses (accommodation, entry fees and retail sales). Farms with a wildlife breeding component derive revenue from, live animal sales, biltong hunting, trophy hunting and to limited extent meat sales (Table 2). The sources of revenue show the different proportions by which a particular activity contributed to farm income. It also reflects the flexibly in wildlife use that does not exist with livestock farming. The different revenue streams allow farmers to diversify and cope with changes in the market and in the farms' development by shifting focus from one enterprise to another. Budgets showed variation in profitability (Table 3). These differences can be explained by a number of reasons; level of development of the farm, size of the tourism enterprise (number of beds), management

Table 2: Revenue sources as percentage of total revenue 2008/09

Farm	Primary Activity	Visitor accommodation	Live animal sales	Trophy hunting	Biltong hunting	Game meat	Retail	Cattle
A	Tourism (Top End)	94.5	0	0	0	0	5.5	0
B	Tourism (Mid level)	2.1	91.8	6	0	0.1	0	0
C	Tourism (Mid level)	78.7	2.4	15.8	0	0	3	0
D	Tourism (Mid level)	94.9	0	0	0	0	2.2	0
E	Breeding	0	100	0	0	0	0	0
F	Breeding	5.1	71.1	6.1	17.1	0.6	0	0
G	Mixed	0	14.3	1.5	0.5	0	0	83.7
H	Conservancy	0	100	0	0	0	0	0

etc. Gross margin values allow comparison across farms and The gross margin levels vary from as low as 4 rand per hectare to just over 8 000 rand per hectare.

Table 3: Gross income and gross margin 2008/09

Farm	Primary Activity	Gross Income rand per hectare	Gross Margin rands per hectare
A	Tourism (Top End)	8,706	8,282
B	Tourism (Mid level)	4,936	2,886
C	Tourism (Mid level)	2,231	856
D	Tourism (Mid level)	105	4
E	Breeding	1,643	1,434
F	Breeding	1,099	768
G	Mixed	2,906	1,947
H	Leisure(conservancy)	150	90
	Cattle*		717

* based on Limpopo Dept. of Agriculture enterprise budget 2007

Employment

A total of nine farms and three conservancies provided information on labor. Labor costs appear to vary with type of enterprise, ranches with a tourism component tended to hire more employees service is a key component of the product being offered. Farms with a primarily game farming focus require less labor and less specialized skills; most of the labor amount to general farm hands whereas tourism operations require, rangers, cooks, multiple managers etc. This translates into a lower wage bill for game breeding operations. At the conservancy level jobs are created for rangeland management and wildlife management. These are the jobs are created in addition to

Table 4: Skilled and unskilled labor use on game ranches

Primary Activity	Labor			Labor per hectare
	Skilled	Unskilled	Total	
		Farms		
Tourism (top end)	32	162	194	0.037
Tourism (mid level)	4	80	84	0.049
Tourism (mid level)	2	17	19	0.009
Tourism (mid level)	1	5	6	0.003
Tourism (mid level)	3	6	9	0.003
Breeding	1	16	17	0.006
Breeding	1	9	10	0.003
		Average	*48.4*	*0.016*
Mixed (cattle& breeding)	3	72	75	0.005
		*Conservancy**		
Leisure	1	9	10	0
Ecotourism	12	27	39	0.001
Eco tourism	4	80	84	0.007
		Average	*44.3*	*0.003*

* Conservancy labor numbers refer to labor used at the conservancy level for range and wildlife management. It excludes labor employed by individual farms within the conservancy.

the labor hired by the individual farms in the conservancy for lodge and other tourism operations. In all cases employees also received non-monetary benefits such as, food rations, accommodation, uniforms and game meat. Eight farms provided information on labor costs; wage bill ranged from 87 rand/ha to 2 788 rand/ha with an average of 672 rand /ha.

The differences noted above suggest differing economic impacts for wildlife utilization that vary with type of enterprise. Ranch operations generate multiplier effects through purchases of food and provisions from other sectors of the local economy and has a larger impact on households through salaries paid to larger staff which can in turn be spent on purchasing household needs inside and outside the local community. The presence of relatively developed markets in surrounding small towns and tourist centers mean that greater proportion of tourism impacts can be felt through local multiplier effects. Game breeding operations on the other hand hire less labor and so less impact is expected for local households. Economic impacts are transmitted through services and goods purchased for the farm such as animal translocation, feed, veterinary services etc.

Work to be done extensions

The preliminary findings from Mopani district suggest game ranching is a sector that reflects diversity; in farm size, enterprise mix, and management. While farms can generate positive returns from wildlife, they receive little support or recognition form local and national authorities. The existing regulatory environment impact negatively at the farm level with high degree of bureaucracy involved in compliance. A further extension in this area will be to examine the regulatory frame work and link this to activities observed at the farm level and how this operating environment compare to that for livestock.

Section 2

Rural Household Vulnerability and Coping Behavior in Systems of High Risk
Gregory Parent

Introduction

While entitlements and factor endowments affect a rural household's income level and constrains their coupled production-consumption decisions, household poverty cannot be explained by only these parameters. Vulnerability to risk events is also a critIcal factor in the poverty equation. Vulnerability influences the household choice matrix by altering constraints. Vulnerable households face significant uncertainty that often results in the alteration of production-consumption choices away from maximizing benefit towards the mitigation of risk. Social vulnerability can be thought of as the interplay between economic entitlements and the environment, which includes: social aspects, such as proximity to urban centers and health facilities; natural resource endowments, such as access to fertile land, forest resources, minerals, etc.; and climate, including frequency of droughts, flood events, and other weather events. While communities have been shown to establish informal insurance mechanisms to aid in risk mitigation, these informal mechanisms are often brittle in the face of widespread regional or village-level shocks. Formal insurance mechanisms have the greatest security, but few people/ communities in developing countries have access to formal insurance. As such, to fully understand the potential benefit of any policy aimed at poverty alleviation (like nature-based tourism or CBNRM), an understanding of rural vulnerability and its associated influence on household decisions is crucial.

Vulnerability

Vulnerability is the interplay between social and environmental factors that affect the decision matrix of the household (Craddock, 2000; Adger, 1999). Much of the current writing on social vulnerability draws much from Sen's (1981) work on poverty and famines. A household's vulnerability and coping behavior are based on the system of entitlement relations that a household experiences, or the legitimacy and strength of relationship a household has over a productive resource. Sen (1981) identifies 4 key entitlements: trade-based entitlements, production based entitlements, own-labor entitlements, and inheritance and transfer entitlements. A trade-based entitlements is an ability or right of a household to exchange commodities. A production-based entitlement is an ability or right to use resources owned by the household or rented from another to produce goods for consumption or exchange. An own-labor entitlement is the ability or right of a household to use one's own labor when conducting exchange or producing products. An inheritance and transfer entitlement is the ability to own resources and goods that are willingly given to the household. Households who either do not have these entitlements or have them in a weak manner are more vulnerable shocks, hence, more likely to remain in poverty or move to lower welfare levels in response to a shock (Sen, 1981).

Social vulnerability is the probability that a risk event would reduce the well-being of households or individuals, resulting in a state of poverty and destitution (Dercon, 2005). Blaikie et al. (1994) provides a more in-depth explanation of vulnerability, stating that it is "the capacity to anticipate, cope with, and recover from the impact of a natural hazard." Essentially, vulnerability alters perceived future utility in households exposed to uninsured risks, thus affecting the decision-making process (Dercon et al., 2005). Poverty cannot be

viewed as being the sole causal effect of a household's lack of income and/or factor endowments, but also a result of the decisions that households make in response to being exposed to possible risks (Sen, 1981; Dercon et al., 2005). Research has illustrated that households often choose lower levels of welfare (often in the form of production decisions) as a risk-mitigating response in the state of stress (Dercon et al., 2005; Alderman et al., 2003; Ellis, 1998; Blarel et al., 1992). A generalized theory of vulnerability extracted from Watts and Bohle (1993) and Sen (1981) has three elements: 1) the level of exposure of the household to risk events and stressors; 2) the capacity of the household to cope with risk; and 3) the related risk of slow recovery.

Environmentally, communities and individuals are constrained by place. Individuals operate within a defined geographic area with a given basket of natural and social resources. The mixture and level of these resources affects the ability of households to cope with shocks (Cutter et al., 2003). Environmental factors, both natural resource-based and climatic, have the potential to mitigate or enhance shocks by altering vulnerability of households (Cutter et al., 2000). This, in-turn, alters the households decision-making process, especially in areas without any type of formal insurance mechanisms.

Insurance mechanisms interplay with household vulnerability. Households with secure informal and formal insurance mechanisms at their disposal are more likely to absorb and/or recover from shocks (Cutter et al., 2000). This, in-turn, alters the production decision as households will or will not have alternative mitigation mechanisms at their disposal. Insurance mechanisms are influenced by the social nature of the system. Communities respond to shock events by pooling available assets to assist households in need as well as the community as a whole (Adger, 1999). This, however, is very place-specific and changes across cultures. It is generally agreed that those in poverty are less likely to deal with shocks (Dercon, 2005). Individuals with more resources at their disposal can plan for shocks through investments, savings, or the purchase of insurance policies. As such, the level of poverty of the individual/household impacts their engagement in insurance mechanisms and in turn their vulnerability.

This study investigates the constraining environmental conditions facing communities within the GLTFCA, highlighting the impacts of animal and human health on livelihood vulnerability.

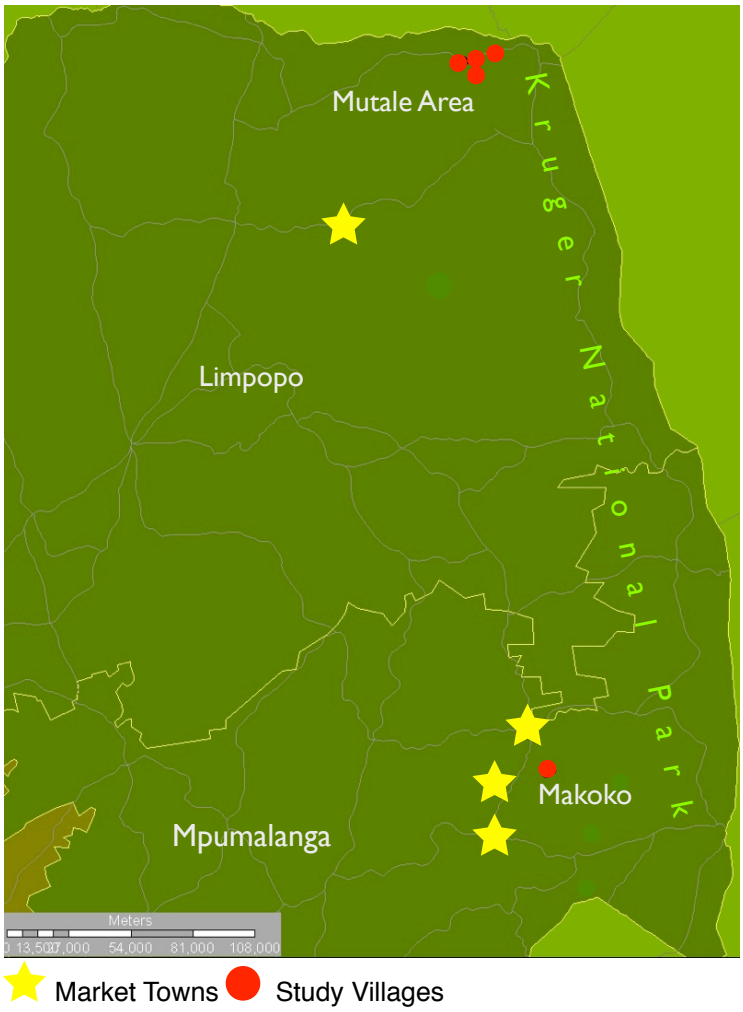
Methodology

Study Area

The study area (Figure 1) consisted of five villages: Bende Mutale, Tshikuyu, Beleni and Duluthulu in the north, and Makoko in the south. The northern cluster of villages are in the Limpopo Province within the Mutale Municipality. Makoko lies near the Numbi entrance gate to Kruger and is in the Mpumalanga Province, Mbomela Municipality. The Mutale region receives on average 300-500mm of rain annually while Makoko receives 1000-1500mm annually.

Sustainability of livelihoods in this region is a matter of great concern. A significant portion of households are engaged in agricultural production in both provinces, particularly in Limpopo Province where 51.9% of all households are smallholder non-commercial producers. In Mpumalanga 25.2% of households are non-commercial producers (Directorate of Agricultural

Figure 1: Study area



Statistics, 2008). The main constraints to production are the agro-ecological conditions, particularly lack of rainfall. As such, intensification of agriculture in semi-arid rural areas is unlikely to produce a significant increase in potential livelihoods (Kirsten, 1996). This highlights the importance of identifying livelihood alternatives decoupled from primary production (Child, 1989) to minimize the impacts of shocks on the current livelihood system.

Within the Mutale village cluster (Mutale) the dominant ethnic group is the Vende who historically have been pastoralists. During the early 1900s the South African government began concentrating the Vende into homelands, forcing them into a village structure that was never there before (Chief Mutale, 2009). While Bende is located next to the fence of Kruger, the Mutale population derives little benefit from wildlife in terms of income or employment. As such, the people extract revenue from land the only other way they can--ranching, farming, and resource extraction. Livestock, especially cattle, have great cultural and economic importance to the Vende.

Makoko is a significantly larger community than any of the Mutale study villages. Yet, at about 1,100 households, it is not considered a large village in the south. Like Mutale, it is located adjacent to Kruger and is comprised of an ethnic group, the Swati, that has historically been pastoralist in nature. However, inhabitants of Makoko tend to be more centered on agriculture. This is likely a factor of increased land fertility and a higher regional population density. Makoko has the advantage of being within 45 minutes of three large cities (Nelspruit, White River, and Hazyview), in addition to several towns with ample establishments for providing household inputs, a viable labor market, and a greater diversity of coping mechanisms. If households are able to shift to opportunities in the surrounding areas in Makoko, they will not be forced into divesting assets or reducing consumption.

Study Design

Questionnaire Design

Data collected during village household interviews was fed into an econometric model to establish vulnerability and risk. Preceding the data gathering process, the researcher interviewed key informants to establish the inclusion of proper variables, such as specific shocks and coping strategies. Additionally, key informants were central to the identification

preliminary entry into study communities. After gaining regional and local permission, local research assistants, three each in the north and south, were trained over the course of 3 days in general interview techniques and on the specific survey instrument. The survey instrument was refined in terms of question design, vocabulary and variable inclusion/exclusion. The survey was then tested over the course of 12 household interviews (these interviews were not included in the analysis sample).

After the establishment of a final questionnaire, 403 randomly selected household interviews were conducted, 233 from Mutale and 167 from Makoko. The detailed questionnaires consisted of 5 modules:

- household demographics;
- water, market and health services access;
- detailed income, which looked at both the household production of products and formal and non-formal employment;
- comprehensive consumption, including questions on household food, non-food, and durable good consumption; and
- shocks and coping strategies.

Sampling

Prior to the selection of a sample, a sampling frame had to be established. In the four northern villages, the researcher either formed the sampling frame from preexisting village lists or created the list with the aid of village committees. In both cases the list was verified by key informants within the villages. After entering household names into a computer, a random number generator assigned a number to each household. This number was used to order the households; the sample included households numbered from one until the sample quota was filled. The remaining households retained their assigned random number and could be included in sequence if households from the original sample refused or were not present after two attempts.

Due to information constraints, a village list was not available for the southern village of Makoko, nor was it feasible to construct one because of time and size constraints. Unlike the northern villages, Makoko has an estimated household population of 1,100 spread throughout 4 blocks. A frame was established by modifying vegetation transects approach to a village environment. Makoko has the unique feature of having a fairly defined road grid with each household having road frontage. Key informants assisted in the stratification of the sample by blocks. The researcher then numbered each street in the block and assigned each street a random number. Household interviews were conducted according to the number order generated along one edge established through a coin flip. Interviews continued until reaching the end of that particular street edge. Upon the conclusion of a street edge, the next highest ordered street was selected. This continued until the sample quota was reached for each block.

<u>Quantitative Method</u>

To evaluate vulnerability, the study used the econometric method Vulnerability as Expected Poverty (VEP) that allows the researcher to establish the likelihood that a household will fall below or further below the poverty line in the future. Like all models, VEP has strengths and limitations. The main limitation of VEP is a result of its definition. Vulnerability infers an uncertainty in the future welfare level of a household. If the VEP model utilizes time series

data, deriving the temporal nature of the model is possible through observed distributions of consumption. However, in this study, the inclusion of time series data was not possible due to budgetary and time constraints.

As the researcher is not omnipresent about future events, a modified VEP model is utilized that Chaudhuri et al (2002) determined could be used with cross-sectional (versus time-series) data. The main limitation is that it uses the assumption that cross-sectional variability approximates inter-temporal variability. The model Chaudhuri established is:

$$V_{ht} = \Pr(C_{h,t+1} = c(X_h, \beta_{t+1}, \alpha_h, e_{h,t+1}) \leq z | X_h, \beta_t, \alpha_h e_{ht})$$

where vulnerability (V_{ht}) is the probability that a household's welfare in a future time period ($C_{h,t+1}$) will be below the poverty line with $C_{h,t+1}$, which is a function of the following: household characteristics (X_h) such as location, household population, access to resources, shock experienced, etc.; B_t, a parameter vector describing the state of the economy; a_h, a household-level time invariant effect; and e_h, a disturbance term with a mean of zero. The future level of consumption is established by estimating the distribution of consumption for the sample through a three-step feasible least squares process applied to the households that hold similar characteristics (a detailed description and model derivation can be found in Chaudhuri et al., 2002).

For the purpose of the study, welfare was established through a detailed consumption index that incorporated food and non-food items that the household either purchased or produced for home consumption. In addition to this model's advantage of estimation via cross-sectional data, it also allows researchers to derive a baseline figure to identify vulnerable groups and evaluate factors that coincide with vulnerability.

To provide additional information, this study examines mechanisms that households utilize to deal with shocks. This provides information on coping outlets and insight into potential future problems due to an over-reliance by groups on coping mechanisms that could result in future welfare losses, such as the sale of assets or reduction of consumption.

$$R_{htv} = \sum_{tv} \delta_{tv}(D_{tv}) + \sum_i \beta_i S(i)_{htv} + \gamma X_{hvt} + \varepsilon_{hvt}$$

The above model is a logit regression with R being a zero/one variable that indicates whether or not a coping strategy was incorporated by a given household. The likelihood that a coping mechanisms was used (R) is estimated using both household characteristics (X) and shock experienced (S).

Results

Livelihood Structure

Tables 1 and 2 illustrate the differences in the livelihood system between the northern and southern study areas. The tables display the frequency of household participation in the given activity, as the important information is often not how much is produced, rather it is the choice to produce a a given product. This became clear in the north as most households experienced a shock in the form of late rains. The choice to plant a crop was established before the household experienced the shock. What became apparent between these two systems is the greater diversity in participation within planting choices which expanded to all livelihood activities. Most of the participation in cropping in the Makoko is centered around

Table 1: Mutale Community Activities

Activity	Household Participation (%)
Agriculture	
Maize	47.0
Groundnuts	41.4
Watermelon	46.1
Beans	44.0
“Spinach”	14.7
Sorghum	22.8
Livestock	
Cattle	27.6
Goats	34.5
Chickens	46.2
Pigs	10.8
Natural Resource Extraction	
Thatch	28.0
Wood	97.4
Reeds	0.4
Employment	
Wage Work	43.4
Piece Work	37.1
Household Market Activity	
Animal Sales	28.4
N.R. Sales	9.5
Trad. Beer	7.3
Other Household Revenue	
Remittances	8.6
Government Grants	79.7

Table 2: Makoko Community Activities

Activity	Household Participation (%)
Agriculture	
Maize	69.9
Groundnuts	11.4
Watermelon	1.2
Beans	3
“Spinach”	9
Sorghum	0.6
Sweet Potatoes	15.7
Cassava	12.7
Vegetables	7.8
Livestock	
Cattle	22.2
Goats	14.5
Chickens	52.4
Pigs	18.6
Natural Resource Extraction	
Thatch	22.9
Wood	65.0
Reeds	6.0
Employment	
Wage Work	44.6
Piece Work	25.0
Household Market Activity	
Animal Sales	6.6
Natural Resource Sales	9.0
Trad. Beer	1.2
Product Transformation	5.4
Other Household Revenue	
Remittances	9.6
Government Grants	86.7

Maize, (69.9%) with only sweet potatoes being grown by over 15% of the households. In Mutale, four crops are grown by over 40% (maize, groundnuts, watermelon, and Beans) with two more, sorghum and “spinach” close to or above 15%. Diversity of activities is an informal insurance mechanism in high risk environments, so it is not surprising to see a greater diversity in the north which experiences substantially lower rainfall, compared to that of the south. When looking at the total number of crops that each household planted, the mean for Mutale is 2.13 and 1.31 crops per household in Makoko, this is a significant difference between the means as determined by a t-test ($p = 0.000$). Additionally, the average Mutale household derive their livelihood from a greater diversity of activities, with households either earning income or consuming products from an average of 6.24 livelihood activities versus an average of 4.78 for Makoko (t-test $p = 0.000$). What was surprising with the Mutale area was the high level of formal and informal (piece-work) amongst the households. The area is a hard 2 hour drive from the nearest large city and, with the exception of one small scale tourist tree camp, has little in the way of tourist facilities. The majority of the employment comes from two

sources: one, the Tshikondeni coal mine located close by; and, two, a construction project for a new community run lodge adjacent to Tshikuyu. As such the local inhabitants do have local labor demand.

Shocks and Vulnerability

Table 3 lists the self reported shocks experienced by the sample. The table illustrates the vulnerable nature of the Mutale area which, as stated earlier, is both substantially dryer and devoid of much infrastructure relative to Makoko, such as markets, electricity, regular cell service and clinic access. Nine shocks were experienced by over a quarter of the population over the last five years, while only 4 shocks were self reported by a quarter of the Makoko residents. It is interesting to note the high percentage of households self reporting to have been impacted by economic shocks, primarily increase in input price (64%), unemployment (50%) and inflation (65%). While recall questions do have to be treated carefully, within the last several years there has been issues with inflation around the world. Inflation has the potential to erode income through an increase in input price to household production or through increased expenditure on consumption goods. This was echoed through conversations with villagers in Mutale who were concerned with the recent 50% rise in combi fees to and from the main market town as well as food price increases both within Mutale and in town. Overall the mean number of shocks experienced per household in Mutale was 8.4, while Makoko households on average experienced a significantly smaller number of shock at 5.1 per household (t-test $p = 0.000$).

To begin deriving vulnerability through the VEP method, one first runs a regression on log consumption with the inclusion of household characteristics and shock information as dependent variables. This intermediate output is listed in Appendix B (a description of all model variables are given in Appendix A). The output table can give you a sense of the system in terms of impact on consumption by various household factors and shock events. After completing the VEP process, one attains a headline figure for each household. This value can then be utilized to identify potentially vulnerable groups through the grouping of variables. Table 4 is a selection of variables. Note that groups can be organized in any way to attain a mean vulnerablity figure. The below table is a small selection of what can be accomplished. The correct interpretation of these figures is as the mean probability for households within each group has for falling below or further below the poverty line in the future. Case in point, households in Bende Mutale have a 27% probability of becoming impoverished in the future, while households in Beleni have an 18% chance. Tables, as in table 4, can be used to identify vulnerable groups in order to target interventions or to establish the impact of an event or a project as to maximize benefit or minimize costs as it pertains to vulnerability.. While Bende Mutale has the highest vulnerability score in the village grouping, this difference is not statistically significant and inferences should be drawn cautiously. In looking at the other variables, one sees that household size has a significant interaction vulnerability, with larger households, 6 and above, having a 55% probability of falling into poverty in the future. Not surprisingly households under the poverty line have a greater vulnerability than ones above it as they have less option space. While there is not a significant difference in vulnerability between male and female headed households, when you unpack the female households by dependent ratio (the number of children under 16 remaining in the household) this changes, increasing the vulnerability of these female run households. Other literature has shown that poor households tend to have greater diversity in livelihood structure, this is illustrated here and is likely a coping mechanism or risk mediating

Table 3: Household Self Reported Shocks, 5 years

Shock Event	Household reporting Shock (%)	Makoko Households Reporting Shock (%)	Mutale Households reporting Shock (%)
Drought (lack of rain)	35.52	22.51	**38.96**
Too much rain	30.98	**50.65**	2.60
Erosion	3.02	1.30	**3.90**
Flooding	35.52	**31.60**	29.00
Timing of rain	26.95	7.36	**38.53**
Loss of livestock	7.30	5.63	**6.93**
Pest or diseases that affected crops before harvest	15.37	4.76	**21.65**
Pest or diseases that led to storage losses	2.02	**2.60**	0.87
Other, Agriculture	0.25	0.00	**0.43**
Death of Livestock, Disease	24.94	14.72	**28.57**
Death of Livestock, Predation	20.91	10.39	**25.54**
Theft of tools or inputs for production	7.81	5.19	**8.23**
Theft of livestock	7.56	4.33	**8.66**
Theft of cash	5.79	3.46	**6.49**
Theft of stored crops	2.52	0.87	**3.46**
Destruction or theft of housing	4.53	**6.93**	0.87
Destruction or theft of consumer goods	1.01	0.43	**1.30**
Death of working adult household members	1.26	**2.16**	0.00
Death of other household members	2.27	**3.03**	0.87
Disablement of working adult household member	0.00	0.00	0.00
Disablement of other household members	1.76	0.00	**3.03**
Confiscation of land	0.00	0.00	0.00
Confiscation of other assets	0.00	0.00	0.00
Land reform	0.50	**0.87**	0.43
Resettlement, villagization or forced migration	0.00	0.00	0.00
Bans on migration	0.50	**0.87**	0.00
Forced labor	0.50	**0.87**	0.00
Employment refusal based on social or ethnic reasons	0.50	0.00	**0.87**
Forced contributions or arbitrary taxation	0.00	0.00	0.00
Imprisonment for political reasons	0.00	0.00	0.00
Discrimination for political reasons	0.00	0.00	0.00
Discrimination for social or ethnic reasons	0.76	0.00	**1.30**

Table 3: Household self reported shocks, 5 years (Continued)

Contract dispute or default affecting access to land	0.00	0.00	0.00
Contract dispute or default affecting to other inputs	0.00	0.00	0.00
Contract dispute or default affecting sale of products	0.00	0.00	0.00
Lack of financing/capital	39.55	3.46	**64.07**
Lack of access to inputs	16.88	2.16	**26.84**
Increase in input prices	64.23	27.27	**82.68**
Decrease in output prices	0.76	0.43	**0.87**
Lack of demand or inability to sell agricultural products	2.02	1.30	**2.16**
Lack of demand or inability to sell nonagricultural products	0.25	0.00	**0.43**
Unemployment (loss of a job)	50.13	24.24	**61.90**
Inflation	65.49	**58.44**	54.11
Other (Specify):	1.01	**1.73**	0.00
Death of husband	6.80	**6.49**	5.19
Death of wife	1.51	**2.16**	0.87
Death of other household members	22.92	**20.35**	19.48
Illness of husband	9.07	6.49	**9.09**
Illness of wife	16.62	13.85	**14.72**
Illness of other household members	13.10	9.52	**12.99**
Divorce	2.02	0.00	**3.46**
Abandonment	0.00	0.00	0.00
Disputes with extended family members regarding land	0.00	0.00	0.00
Disputes with extended family members regarding other assets	0.00	0.00	0.00

Note: Percentages in bold used only to help viewer distinguish hight % between Makoko and Mutale, does not signify significance.

mechanism. Households planting 4 or more crops have a greater vulnerability score. Cattle holdings interplay with vulnerability. Households with more head of cattle are less vulnerable to shocks. Cattle are the main asset of households in this system with households in Mutale on average holding over R19,000 of value in cattle, representing 74% of total assets. In Makoko cattle is an important storage of value, but not quite to the degree as in Mutale with households holding a mean value of over R7,500 representing 48% of total assets. Cattle function in these systems as an insurance mechanisms that can be leveraged in times of stress to minimize the impact that shocks have on a household.

Table 4: Household vulnerability using poverty line of R3,252 per capita per annum[1]

Household characteristics and Shocks	Mean Vulnerability
Village	
Bende Mutale	0.27
Beleni	0.18
Duluthulu	0.23
Tshikuyu	0.22
Makoko	0.26
Household Population[A]**	
2 or less	0.0006
3 to 5	0.07
6 and above	0.55
Household below poverty line[B]**	
Yes	0.41
No	0.12
Household head	
Female	0.25
Male	0.24
Female headed households[B]*	
with dependent ratio less than 50%	0.23
with dependent ratio greater than 50%	0.31
Crops Planted[A]**	
0	0.2
1	0.27
2 to 3	0.19
4 and above	0.33
Cattle Head[A]**	
0	0.28
1 to 2	0.16
3 to 6	0.22
Greater 6	0.11
Raise Goats	
Yes	0.23
No	0.25
Raise Pigs	
Yes	0.28
No	0.24
Raise Chickens	
Yes	0.27
No	0.23
Derive Income through selling natural Resources[B]*	
Yes	0.18
No	0.26

Table 4: Household vulnerability using poverty line of R3,252 per capita per annum[1](Continued)

Household characteristics and Shocks Experienced	Mean Vulnerability
Drought[B]*	
Yes	0.28
No	0.23
Flooding	
Yes	0.24
3 to 5	0.25
Livestock loss due to Disease	
Yes	0.24
No	0.26
Livestock loss due to Predation[B]**	
Yes	0.18
No	0.27
Theft of livestock	
Yes	0.3
No	0.24
Inflation	
Yes	0.26
No	0.23
Death of husband	
Yes	0.28
No	0.25
Death of Wife[B]*	
Yes	0.43
No	0.24
Total shocks experienced[A]*	
Less than 4	0.23
4 to 10	0.25
Greater than 10	0.26

[A] Difference between group means tested using ANOVA
[B] Difference between group means tested using t-test
* Statistically significant at the p = 0.10 level
* * Statistically significant at the p = 0.05 level
[1] Oosthuizen, 2008.

The exposer a household has to shocks impacts household vulnerability. While households may be able to cope with a few shocks, if they continue in frequency it reduces the capacity of a household to mediate shock impacts. This is reflected in table 5 where vulnerability is

significantly less in households that experienced less than four shocks. Livestock disease had no significant impact on vulnerability and households who experienced livestock loss due to predation were less vulnerable. The issue with livestock holdings and shocks are that these shocks are disproportionately experienced by households who own livestock. The animal that has the most value in the system is cattle valued locally at about R5,500. The ownership of cattle is highly skewed in these villages with only 30% of the household owning cattle and only 16% of households in Mutale owning more than 6 heads of cattle and 10% in Makoko. Households with sufficient livestock assets have a greater capacity to deals with these shocks.

Vulnerability and Risk Coping

Table 6 reports the likelihood that a coping strategy is used in response to a particular shock. Each column represents a particular coping strategy. These categories were aggregated from 23 specific individual coping mechanisms variables into 6 categories. Due to a lack of variation in responses two categories, formal cash loan and informal cash loan, had to be dropped. The dependent variable was whether or not a household employed the coping strategy and estimates were based on the inclusion of household characteristics and all shocks (The full logit regressions output are in appendix C through F). The interpretation of the table is straight forward, a + sign indicates an increased likelihood that a household undertakes a particular coping mechanism during a shock event, while a - sign indicates a decreased likelihood that a household undertakes a certain coping mechanism during a shock event. Case in point, the shock events theft of livestock, lack of financing / capital, increase in input prices, and inflation are all significantly associated with an increased likelihood of employing reduced consumption as a coping strategy.

Discussion

While livestock disease and predation were not associated with an increased level of vulnerability, it is crucial to recognize the importance of livestock to the livelihood structure in terms of consumption, animal sales, and, primarily, asset formation. Currently, livestock oriented shocks are not significantly associated with an increased level of household vulnerability, however the system is constantly shifting and future events coupled with other shocks have the potential to change this dynamic. The loss of livestock without an associated reinvestment in the heard has the potential to harm both future income and the ability to cope with shocks. The sale of assets (mainly livestock) is a major coping mechanism, as illustrated in table 6, if an event occurs that reduces this capacity, an impacted household could find its welfare reduced substantially over time as it is no longer able to cope sufficiently. Once a household is forced to reduce consumption as a primary coping mechanism, poverty and increased destitution becomes a likely outcome.

Any potential policy intervention aimed at improving livelihoods, must understand the dynamic nature of livelihoods. As illustrated in this study and previous research, households do not make choices only to maximize income or minimize cost. In an environment of constant shocks they attempt to minimize risk through their household production - consumption decisions. If a policy does not recognize this dynamic and promotes and activity or a strategy that harms a households coping behavior without providing an alternative coping mechanism, the intervention could have the unintended consequence of increasing vulnerability, potentially reducing future household welfare. Example, if a community tourism operation were promoted in an area and this operation needed land to provide wildlife habitat,

Table 6: Household response to shocks

Risk Coping Mechanism (Binary Dependent Variable)				
	Reduced Consumption[C]	Sale of Assets[D]	Change in Work Habits[E]	Help from Gov't / NGOs[F]
Drought	+	+**	-**	+
Too much rain	-	+	+**	-
Erosion		-	-	-
Flooding	-	+	+	-
Timing of Rain	+	-	+	+
Pest or diseases that affected crops before harvest	+	-	-	+**
Pest or diseases that led to storage losses	-*	+	+*	-
Loss of Livestock, Disease	-*	-	+	-
Loss of Livestock, Predation	-*	+	+	+*
Theft of tools or inputs for production	-**	-*	-	-
Theft of livestock	+**	+	-	-
Theft of cash	-	-	-*	-*
Theft of stored crops	+	-	+	-
Destruction or theft of housing	-	+*	-	+
Lack of financing/capital	+**	-	-	-**
Lack of access to inputs		-	-	-
Increase in input prices	+**	-	-	-
Lack of demand or inability to sell agricultural products	+	-	+**	-
Unemployment (loss of a job)	-	-	+	+
Inflation	+**	-	-	-
Death of husband	+	+	-	-
Death of wife	+		-	+
Death of other household members	-**	+	+**	-
Illness of husband	+	+**	+	-
Illness of wife	-**	-	+	+**
Illness of other household members	-	+	+*	-**
Divorce				+

* Statistically significant at the the p = 0.10 level

* *Statistacally significant difference at the p = 0.05 level

households may no longer have sufficient land for raising cattle. If this scenario were to cause households to to move away from livestock raising, this possesses a potentially serious problem if these households were no longer able to access livestock assets to mitigate a shock. Any policy needs to work to understand the multi-dimension nature of livelihoods to ensure that interventions either do not harm the risk mediating nature of livelihood choices or improves the capacity of the local system to mediate risk.

References

Adger, W. N. 1999. Social vulnerability to climate change and extremes in coastal Vietnam. World Development, 27(2), 246-269.

Alderman, H., Hoddinott, J., and Kinsey, B. 2003. *Long-term Consequences of Early Childhood Malnutrition*. Food Consumption and Nutrition Division Discussion Paper No. 168. Washington DC, International Food Policy Institute.

Barnes, J. I., J. MacGregor, & L. C. Weaver. 2002. Economic efficiency and incentives for change within Namibia's community wildlife use initiative. *World Development*, 30(4): 667-681.

Blaikie, P., Cannon, T., Davis, I., and Wisner, B. 1994. At Risk: Natural Hazards, Peoples Vulnerability and Disasters, Routledge, London.

Bell R.H.V. 1982. The effect of soil nutrient availability on community structure in African ecosystems. In: Huntley B.J. and Walker B.H. (eds), *Ecology of Tropical Savannas*. Springer, Berlin, pp. 193– 216.

Blarel, B., Hazell, P. Place, F., Quiggin, J. 1992. The economics of farm fragmentation: Evidence from Ghana and Rwanda. World Bank Economic Review, 6(2), 233-254.

Bond, I., B. Child, D. De la Harpe, B. Jones, J. Barnes, and H. Anderson. 2004. Private land contribution to conservation in South Africa, In Child, B. (Ed) *Parks in Transition*. IUCN, Earthscan: UK and USA.

Brown, C. J. 1992. *Namibia' s Green Plan to Secure for Present and Future Generations a Safe and Healthy Environment and a Prosperous Economy*. Republic of Namibia, Ministry of Environment and Tourism.

Cannon, T., J. Twigg and J. Rowall. 2003. *Social Vulnerability, Sustainable Livelihoods and Disasters*. report for DFID's Conflict and Humanitarian Assistance Department (CHAD) and Sustainable Live- lihoods Office.

Chief Mutale. 2009. Personal interview with Chief Mutale. Chief of the Mutale Area, South Africa.

Chaudhuri, S., J., Jalan, A., and Suryhadi 2002. A*ssessing Household Vulnerability to Poverty: A Methodology and Estimates for Indonesia*. New York, Colombia University.

Craddock, S. 2000. Disease, social identity, and risk: rethinking the geography of AIDS. Transactions from the Institute of British Geographers, 25, 153-168.

Child, B. 1989. *The Economic Use of Wildlife in Zimbabwe and its Effect on the Supply of Wildlife Products*. A paper presented at SADCC/GTZ workshop on Processing and Marketing of Wildlife Products in the SADCC region.

Cloete, P. C., P. C. Taljaard, and B. Grove. 2007. A comparative economic case study of switching from cattle farming to game ranching in the Northern Cape Province. *South African Journal of Wildlife Research*, 37(1): 71-28.

Cumming, D. H. M. 1982. The influence of large herbivores on savanna structure in Africa. In: B. J. Huntley and B. H. Walker (eds) *Ecology of Tropical Savannas*. W. Junks, The Hague (Ecological studies number 42), 217-245.

Cutter, S. L. 1996. Vulnerability to environmental hazards. Progress in Human Geography, 20, 529-539.

Cutter, S. L., Mitchell, J. T., and Scott, M. S. 2000. Revealing the vulnerability of people

and places: A case study of Georgetown County, South Carolina. Annals of the Association of American Geographers, 90(4), 713–37.

Daszak, P., A. A. Cunningham and A. D. Hyatt. 2000. Anthropogenic environmental change and the emergence of infectious diseases in wildlife. *Acta Tropica*, 78 .

Deem, S. L., W. B. Karesh and W. Weisman. 2001. Putting theory into practice: wildlife health in con- servation. *Conservation Biology,* 15(5).

Dercon, S. 2005. Risk, poverty, and vulnerability in Africa. Journal of African Economics, 14(4), 483-488.

Dercon, S., Hoddinott, J., & Woldehenna. 2005. Shocks and consumption in 15 Ethiopian villages, 1999-2004. Journal of African Economies, 14 (4), 559-585.

Directorate of Agricultural Statistics. 2008. Abstract of Agricultural Statistics 2008. Pretoria.

Du Toit, J. T. and D. H. M. Cumming. 1999. Functional significance of ungulate diversity in African savannas and the ecological implications of the spread of pastoralism. *Biodiversity and Conservation*, 8: 1643-1661.

Eloff, T. 2002. The economic realities of the game industry in South Africa. In: Ebedes, H, Reilly, B, van

Ellis, F. 1998. Household strategies and rural livelihood diversification. The Journal of Development Studies, 35 (1), 1-38.

Kirsten, J. 1996. The potential for creating additional rural livelihoods in agriculture and the rural non- farm sector in semi-arid areas: A case study in the Northern Province. In: Lipton, Michael, De Klerk, M and

Lindsey, P.A., P. A. Roulet, and S. S. Romanach. 2007. Economic and conservation significance of the trophy hunting industry in Sub-Saharan Africa. *Biological Conservation*, 134: 455-469.

Murphy, C. and S. Mulonga. 2002. *A Profile of the Livelihoods of People in Two Conservancies in Ca- privi, Wildlife Integration for Livelihood Diversification Project,* Working Papers. Namibian Minis- try of Environment and Tourism.

Oosthuizen, M. 2008. *Estimating Poverty Lines for South Africa,* Discussion Document. Development Policy Research Unit, University of Cape Town.

Rupprecht C. E., J. S. Smith, M. Fekadu, and J. E. Childs. 1995. The ascension of wildlife rabies: A cause for public health concern or intervention? *Emerging Infectious Diseases,* 1(4).

Saayman, M. and A. Saayman. 2006. Estimating the economic contribution of visitor spending in the Kruger National Park to the regional economy. *Journal of Sustainable Tourism*, 14 (1): 67-80.
8

Sen, A. 1981. Poverty and Famines: An Essay on Entitlements and Deprivation. Clarendon Press, Oxford.

Watts, M. J., & Bohle, H. G. 1993. The space of vulnerability: The causal structure of hunger and famine. Progress in Human Geography, 17, 43-67.

Appendix A: Model variable description

Variables	Description
ns	Location of village area (1 = North, 0 = South)
gendhhhed	Gender of Houshold head (1 = Female)
hhpop	Household Population
grwmaize	planted maize (1 = yes)
grwsorghum	planted sorghum (1 = yes)
grwbeans	planted beans (1 = yes)
grwwtmel	planted watermelon (1 = yes)
grwgrnd	planted groundnuts (1 = yes)
grwmod	planted modimbo (1 = yes)
grwswtpt	planted sweet potato (1 = yes)
grwcssv	planted cassava (1 = yes)
grwveg	planted vegitables (1 = yes)
cttlown	number of cattle owned
goatown	number of goat owned
chickown	number of chickens owned
pigown	number of pigs owned
frwdcollmn	number of bundles of firewood collect per month
thatchcoll	number of bundles of thatch collected per year
fdnrpurrat	ratio of food / nat. resource purchased to total food consumption
lvstconrat	ratio of livestock consumed to total food consumption
ownprodrat	ratio of total own product consumption to total consumption
totassts	Value of total household assets
lvstkasstrat	ratio of livestock assets to total assets
rem	received remitance (1 = yes)
grnts	recieves government grants (1 = yes)
empl	household member employed (1 = yes)
manufact	household recieves income from value added activity (1 = yes)
incsrclvst	number of livestock sources household recieves income from
deprat	ratio of children under 16 to total household population
cttlasstrat	ratio of cattle assets to total assets
incsrcagnr	number of ag & nat. res. sources household recieves income from
totallivlsrc	total number ofsources household recieves income from
The below variables (S400-S806) are self reported household shocks (1 = experienced in last 5 years)	
S400	Drought (lack of rain)
S401	Too much rain
S402	Erosion
S403	Flooding
S404	Timing of rain
S405	Loss of livestock
S406	Pest or diseases that affected crops before harvest
S407	Pest or diseases that led to storage losses
S409	Other
S411	Death of Livestock, Disease
S412	Death of Livestock, Predation
S500	Theft of tools or inputs for production
S501	Theft of livestock

Appendix A (Continued): Model variable description

S502	Theft of cash
S503	Theft of stored crops
S504	Destruction or theft of housing
S505	Destruction or theft of consumer goods
S506	Death of working adult household members
S507	Death of other household members
s508	Disablement of working adult household member
S509	Disablement of other household members
S602	Land reform
S604	Bans on migration
S605	Forced labor
S606	Employment refusal based on social or ethnic reasons
S610	Discrimination for social or ethnic reasons
S700	Lack of financing/capital
S701	Lack of access to inputs
S702	Increase in input prices
S703	Decrease in output prices
S704	Lack of demand or inability to sell agricultural products
S705	Lack of demand or inability to sell nonagricultural products
S706	Unemployment (loss of a job)
S707	Inflation
S708	Other
S800	Death of husband
S801	Death of wife
S802	Death of other household members
S803	Illness of husband
S804	Illness of wife
S805	Illness of other household members
S806	Divorce

Appendix B:: Baseline Regression Model Output

Source	SS	df	MS	Number of obs =	396
				F(73, 322) =	4.04
Model	63.4319754	73	.86893117	Prob > F =	0.0000
Residual	69.3375169	322	.215333903	R-squared =	0.4778
				Adj R-squared =	0.3594
Total	132.769492	395	.336125297	Root MSE =	.46404

lconsump	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ns	-.3396539	.1227681	-2.77	0.006	-.5811828	-.098125
gendhhhed	.0179892	.0561595	0.32	0.749	-.0924967	.1284752
hhpop	.053676	.0116547	4.61	0.000	.0307471	.076605
grwmaize	.1180941	.102209	1.16	0.249	-.0829876	.3191758
grwsorghum	-.0416276	.1201855	-0.35	0.729	-.2780756	.1948204
grwbeans	-.0174072	.173423	-0.10	0.920	-.3585924	.3237779
grwwtmel	-.2925205	.1860028	-1.57	0.117	-.6584548	.0734138
grwgrnd	-.0649078	.1121522	-0.58	0.563	-.2855513	.1557358
grwmod	-.0418965	.1534761	-0.27	0.785	-.3438389	.260046
grwswtpt	.0527796	.1283036	0.41	0.681	-.1996396	.3051989
grwcssv	.0934338	.1452541	0.64	0.521	-.192333	.3792007
grwveg	.0131091	.1072475	0.12	0.903	-.1978851	.2241034
cttlown	-.0196564	.0121278	-1.62	0.106	-.0435162	.0042034
goatown	.0145218	.0078388	1.85	0.065	-.0009	.0299436
chickown	.0005148	.0031957	0.16	0.872	-.0057722	.0068019
pigown	.0170504	.0121714	1.40	0.162	-.0068952	.0409959
frwdcollmn	.0013401	.000855	1.57	0.118	-.000342	.0030222
thatchcoll	.0001127	.0000733	1.54	0.125	-.0000315	.0002568
fdnrpurrat	-.3431552	.3208386	-1.07	0.286	-.9743597	.2880494
lvstconrat	1.861156	.3191705	5.83	0.000	1.233233	2.489079
ownprodrat	-1.557993	.421862	-3.69	0.000	-2.387947	-.7280393
totassts	3.96e-06	1.91e-06	2.08	0.039	2.09e-07	7.72e-06
lvstkasstrat	-.063026	.0964361	-0.65	0.514	-.2527504	.1266984
rem	.0036572	.0926469	0.04	0.969	-.1786125	.1859269
grnts	-.0459235	.0820282	-0.56	0.576	-.2073024	.1154554
empl	.0535533	.0451355	1.19	0.236	-.0352445	.1423511
manufact	.0511383	.1102434	0.46	0.643	-.1657501	.2680267
incsrclvst	-.1552953	.0774423	-2.01	0.046	-.3076521	-.0029386
incsrcagnr	-.0928767	.0986186	-0.94	0.347	-.2868948	.1011414
totallivlsrc	.0481359	.0293418	1.64	0.102	-.0095901	.1058618
s400	.0552856	.0542703	1.02	0.309	-.0514835	.1620548
s401	-.1867146	.0867604	-2.15	0.032	-.3574034	-.0160257
s402	.2120993	.1510471	1.40	0.161	-.0850645	.5092632
s403	-.063085	.0597871	-1.06	0.292	-.1807078	.0545377
s404	.1629086	.068119	2.39	0.017	.0288941	.2969232
s405	-.245751	.1131429	-2.17	0.031	-.4683436	-.0231583
s406	-.0965139	.0905865	-1.07	0.287	-.27473	.0817022
s407	.0506347	.213853	0.24	0.813	-.3700909	.4713603
s409	-.0211178	.5046997	-0.04	0.967	-1.014043	.9718074
s411	.0333997	.0686858	0.49	0.627	-.1017298	.1685292
s412	-.0256871	.07136	-0.36	0.719	-.1660779	.1147037
s500	-.1375503	.1017337	-1.35	0.177	-.337697	.0625964
s501	.0360974	.1016757	0.36	0.723	-.1639352	.23613
s502	.2034353	.1149497	1.77	0.078	-.022712	.4295826
s503	-.099124	.168387	-0.59	0.556	-.4304016	.2321535
s504	-.0622027	.1241523	-0.50	0.617	-.3064548	.1820493
s505	-.2028547	.2927187	-0.69	0.489	-.7787374	.373028
s506	.1166161	.2241378	0.52	0.603	-.3243432	.5575755
s507	-.161114	.173486	-0.93	0.354	-.5024231	.1801951
s509	-.3490546	.2545016	-1.37	0.171	-.8497504	.1516413
s602	-.1198063	.3566609	-0.34	0.737	-.8214861	.5818735
s604	-.6161479	.3634189	-1.70	0.091	-1.331123	.0988274
s605	.5533164	.4007767	1.38	0.168	-.2351552	1.341788
s606	1.077409	.4439911	2.43	0.016	.2039192	1.950899
s610	.3251461	.2886289	1.13	0.261	-.2426905	.8929827
s700	.0440547	.0717627	0.61	0.540	-.0971283	.1852377
s701	.129142	.0811493	1.59	0.112	-.0305078	.2887918
s702	.0728637	.068874	1.06	0.291	-.0626363	.2083636
s703	-.2739991	.2899744	-0.94	0.345	-.8444827	.2964845
s704	.1376901	.1961524	0.70	0.483	-.248212	.5235921
s705	-1.28519	.5110816	-2.51	0.012	-2.290671	-.2797092
s706	.0084507	.0670423	0.13	0.900	-.1234455	.1403469
s707	.0471164	.0694421	0.68	0.498	-.089501	.1837339
s708	-.270395	.264759	-1.02	0.308	-.7912709	.2504809
s800	.0580217	.1054474	0.55	0.583	-.1494311	.2654744
s801	-.3800851	.2076181	-1.83	0.068	-.7885444	.0283742
s802	-.0513638	.064042	-0.80	0.423	-.1773573	.0746297
s803	.1179245	.0949535	1.24	0.215	-.0688831	.3047322
s804	-.0796793	.0727246	-1.10	0.274	-.2227546	.063396
s805	-.0305936	.0788864	-0.39	0.698	-.1857913	.1246042
s806	.0047915	.1813741	0.03	0.979	-.3520363	.3616194
deprat	-.0076824	.1346906	-0.06	0.955	-.2726671	.2573023
cttlasstrat	.1223182	.1261887	0.97	0.333	-.1259402	.3705765
_cons	9.789036	.3451941	28.36	0.000	9.109915	10.46816

Appendix C: Logit Regression Output, Dependent variable Reduced Consumption

Logistic regression

Number of obs = 301
LR chi2(61) = 226.12
Prob > chi2 = 0.0000
Log likelihood = -53.683438
Pseudo R2 = 0.6781

reduccon	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lconsump	.1063317	.7491791	0.14	0.887	-1.362032	1.574696
ns	2.018082	1.81913	1.11	0.267	-1.547348	5.583512
gendhhhed	-1.872576	.834576	-2.24	0.025	-3.508315	-.2368368
hhpop	-.2061895	.1771906	-1.16	0.245	-.5534768	.1410978
grwmaize	.8320845	1.161514	0.72	0.474	-1.444442	3.108611
grwsorghum	-18.42695	.	.	.	.	.
grwbeans	1.142834	2.507716	0.46	0.649	-3.7722	6.057868
grwwtmel	18.32845	3.213169	5.70	0.000	12.03075	24.62614
grwgrnd	-.9236705	1.613857	-0.57	0.567	-4.086772	2.239431
grwmod	.5507217	1.599158	0.34	0.731	-2.583571	3.685014
grwswtpt	2.208095	1.32765	1.66	0.096	-.3940521	4.810242
grwcssv	-5.959404	1.756665	-3.39	0.001	-9.402405	-2.516403
grwveg	1.729167	1.581049	1.09	0.274	-1.369631	4.827966
cttlown	-.9495855	.3706276	-2.56	0.010	-1.676002	-.2231688
goatown	.205872	.1782021	1.16	0.248	-.1433978	.5551418
chickown	-.0394495	.0541836	-0.73	0.467	-.1456474	.0667484
pigown	.4194247	.3252776	1.29	0.197	-.2181077	1.056957
frwdcollmn	.0078691	.0439006	0.18	0.858	-.0781745	.0939128
thatchcoll	-.0002931	.0009728	-0.30	0.763	-.0021997	.0016135
fdnrpurrat	-6.640499	6.053798	-1.10	0.273	-18.50572	5.224727
lvstconrat	.4543597	5.086586	0.09	0.929	-9.515165	10.42388
ownprodrat	-10.16928	7.460686	-1.36	0.173	-24.79195	4.453398
totassts	.0001239	.0000607	2.04	0.041	5.07e-06	.0002428
lvstkasstrat	3.835572	2.203881	1.74	0.082	-.483956	8.155101
rem	3.0584	1.723936	1.77	0.076	-.3204519	6.437252
grnts	-2.826522	1.560557	-1.81	0.070	-5.885157	.2321142
empl	.6040449	.5318689	1.14	0.256	-.4383991	1.646489
manufact	3.086788	1.652493	1.87	0.062	-.1520392	6.325615
incsrclvst	-1.36692	1.163582	-1.17	0.240	-3.647499	.9136581
incsrcagnr	1.523858	1.643749	0.93	0.354	-1.697831	4.745547
totallivlsrc	-.5798573	.4326356	-1.34	0.180	-1.427808	.2680929
s400	1.014977	.8540772	1.19	0.235	-.6589838	2.688937
s401	-1.005428	1.060564	-0.95	0.343	-3.084095	1.073238
s403	-.0378203	.7186908	-0.05	0.958	-1.446428	1.370788
s404	1.985153	1.978735	1.00	0.316	-1.893097	5.863403
s405	-1.092014	1.200615	-0.91	0.363	-3.445177	1.261149
s406	2.19935	2.305015	0.95	0.340	-2.318396	6.717096
s407	-5.130534	2.966865	-1.73	0.084	-10.94548	.684415
s411	-2.056972	1.097307	-1.87	0.061	-4.207655	.0937115
s412	-2.506412	1.447689	-1.73	0.083	-5.34383	.3310062
s500	-3.868513	1.736965	-2.23	0.026	-7.272901	-.464124
s501	4.453088	1.75901	2.53	0.011	1.005491	7.900684
s502	-.5476678	1.607401	-0.34	0.733	-3.698116	2.60278
s503	1.857837	3.297531	0.56	0.573	-4.605206	8.320879
s504	-.2860261	1.468798	-0.19	0.846	-3.164817	2.592765
s506	-.4301203	1.403149	-0.31	0.759	-3.180242	2.320002
s507	2.753208	1.842559	1.49	0.135	-.8581409	6.364557
s700	3.890238	1.489273	2.61	0.009	.971316	6.80916
s702	2.549249	1.096724	2.32	0.020	.3997091	4.698789
s703	1.923616	122.9376	0.02	0.988	-239.0297	242.8769
s706	-.7644008	1.130287	-0.68	0.499	-2.979722	1.45092
s707	.7911739	1.496011	0.53	0.597	-2.140953	3.723301
s708	1.597518	6.179109	0.26	0.796	-10.51331	13.70835
s800	1.05864	1.254605	0.84	0.399	-1.400339	3.51762
s801	.277589	1.764537	0.16	0.875	-3.180839	3.736017
s802	-2.36962	.8581842	-2.76	0.006	-4.05163	-.68761
s803	.915278	1.34647	0.68	0.497	-1.723755	3.554311
s804	-4.504674	1.250613	-3.60	0.000	-6.955831	-2.053517
s805	-1.173977	.9819951	-1.20	0.232	-3.098652	.7506977
deprat	5.932879	2.379899	2.49	0.013	1.268363	10.59739
cttlasstrat	.8546345	2.502601	0.34	0.733	-4.050374	5.759643
_cons	9.876081	9.511193	1.04	0.299	-8.765514	28.51768

Note: 0 failures and 42 successes completely determined.

Appendix D: Logit Regression Output, Dependent variable Sale of Assets

Logistic regression — Number of obs = 362; LR chi2(63) = 108.84; Prob > chi2 = 0.0003; Log likelihood = -140.48446; Pseudo R2 = 0.2792

asstsale	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lconsump	1.425983	.4144832	3.44	0.001	.6136108	2.238355
ns	1.463074	.8224859	1.78	0.075	-.1489688	3.075117
gendhhhed	.5720089	.3744145	1.53	0.127	-.1618301	1.305848
hhpop	-.1659416	.0739207	-2.24	0.025	-.3108235	-.0210597
grwmaize	.9233292	.6766916	1.36	0.172	-.4029619	2.24962
grwsorghum	2.00163	.9246908	2.16	0.030	.1892693	3.813991
grwbeans	-2.253302	1.348951	-1.67	0.095	-4.897198	.3905941
grwwtmel	-.3315645	1.162676	-0.29	0.776	-2.610368	1.947239
grwgrnd	-.0170115	.7340481	-0.02	0.982	-1.455719	1.421696
grwmod	2.251515	.8917733	2.52	0.012	.5036714	3.999359
grwswtpt	.3407366	.8680885	0.39	0.695	-1.360686	2.042159
grwcssv	-1.412741	.982084	-1.44	0.150	-3.33759	.5121084
grwveg	1.388994	.7226997	1.92	0.055	-.0274713	2.80546
cttlown	-.2076525	.0772322	-2.69	0.007	-.3590249	-.0562801
goatown	-.0071023	.044499	-0.16	0.873	-.0943187	.0801141
chickown	-.0041393	.0222728	-0.19	0.853	-.0477932	.0395146
pigown	-.0019717	.0825963	-0.02	0.981	-.1638574	.159914
frwdcollmn	.0067891	.0049488	1.37	0.170	-.0029103	.0164886
thatchcoll	.0000589	.0004536	0.13	0.897	-.0008301	.0009479
fdnrpurrat	-1.121774	2.171473	-0.52	0.605	-5.377783	3.134235
lvstconrat	-2.428312	2.156365	-1.13	0.260	-6.65471	1.798085
ownprodrat	-1.264274	2.993122	-0.42	0.673	-7.130685	4.602137
totassts	.0000405	.0000129	3.14	0.002	.0000152	.0000658
lvstkasstrat	.4616677	.6666855	0.69	0.489	-.8450119	1.768347
rem	.3235052	.6088455	0.53	0.595	-.8698101	1.51682
grnts	.540973	.5404461	1.00	0.317	-.5182818	1.600228
empl	-.0696475	.401747	-0.17	0.862	-.8570572	.7177622
manufact	-1.060804	.8279375	-1.28	0.200	-2.683532	.5619236
incsrclvst	.0823815	.4881677	0.17	0.866	-.8744096	1.039173
incsrcagnr	-.8513149	.6632244	-1.28	0.199	-2.151211	.4485811
totallivlsrc	.0161187	.1868781	0.09	0.931	-.3501557	.3823931
s400	.7545112	.3476721	2.17	0.030	.0730863	1.435936
s401	.5721487	.5684558	1.01	0.314	-.5420042	1.686302
s402	-.8797624	1.018951	-0.86	0.388	-2.876869	1.117345
s403	.3485925	.4044653	0.86	0.389	-.4441449	1.14133
s404	-.1141993	.4410213	-0.26	0.796	-.9785851	.7501865
s405	-.4615857	.7395587	-0.62	0.533	-1.911094	.9879228
s406	.3894452	.6056014	0.64	0.520	-.7975119	1.576402
s407	.0906706	1.367647	0.07	0.947	-2.589868	2.771209
s411	-.1013474	.4440003	-0.23	0.819	-.971572	.7688772
s412	.2661242	.4838286	0.55	0.582	-.6821625	1.214411
s500	-2.303195	1.319119	-1.75	0.081	-4.888621	.2822305
s501	.83126	.6227736	1.33	0.182	-.3893539	2.051874
s502	-1.424193	.9333567	-1.53	0.127	-3.253539	.4051526
s503	-.201502	1.349193	-0.15	0.881	-2.845872	2.442868
s504	1.350367	.717622	1.88	0.060	-.0561464	2.75688
s505	.6389487	2.383649	0.27	0.789	-4.032918	5.310815
s506	-.4698897	1.49223	-0.31	0.753	-3.394606	2.454827
s507	1.860202	1.049505	1.77	0.076	-.196791	3.917195
s700	-.172816	.4583372	-0.38	0.706	-1.07114	.7255084
s701	-.1537041	.5659241	-0.27	0.786	-1.262895	.9554868
s702	-.0681096	.4660537	-0.15	0.884	-.981558	.8453388
s704	-.3199022	1.378856	-0.23	0.817	-3.02241	2.382605
s706	-.1333011	.4530621	-0.29	0.769	-1.021287	.7546843
s707	-.1743705	.4590566	-0.38	0.704	-1.074105	.725364
s708	-.9257111	1.677493	-0.55	0.581	-4.213537	2.362115
s800	-.4162632	.7094242	-0.59	0.557	-1.806709	.9741827
s802	.2953932	.4410091	0.67	0.503	-.5689687	1.159755
s803	1.253056	.5565369	2.25	0.024	.1622637	2.343848
s804	-.0294385	.471947	-0.06	0.950	-.9544376	.8955605
s805	.061761	.5152784	0.12	0.905	-.9481661	1.071688
deprat	-1.332025	.8954167	-1.49	0.137	-3.087009	.4229597
cttlasstrat	.206678	.8363419	0.25	0.805	-1.432522	1.845878
_cons	-15.89352	4.656656	-3.41	0.001	-25.0204	-6.766643

Appendix E: Logit Regression Output, Dependent variable Change in Work Habits

Logistic regression — Number of obs = 315; LR chi2(63) = 149.00; Prob > chi2 = 0.0000; Log likelihood = -72.923239; Pseudo R2 = 0.5053

workhab	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lconsump	1.520457	.5714298	2.66	0.008	.4004751	2.640439
ns	-2.100036	1.308822	-1.60	0.109	-4.665279	.4652083
gendhhhed	-.8244629	.6040075	-1.36	0.172	-2.008296	.3593701
hhpop	.0264281	.1175295	0.22	0.822	-.2039255	.2567818
grwmaize	-.4108897	.855957	-0.48	0.631	-2.088535	1.266755
grwbeans	-1.773365	2.518286	-0.70	0.481	-6.709115	3.162386
grwwtmel	4.205238	2.181735	1.93	0.054	-.070884	8.48136
grwgrnd	.406498	.9668784	0.42	0.674	-1.488549	2.301545
grwmod	2.854559	1.269018	2.25	0.024	.3673286	5.341789
grwswtpt	.6755528	.9343018	0.72	0.470	-1.155645	2.506751
grwcssv	.1292397	1.102815	0.12	0.907	-2.032238	2.290717
grwveg	.3566144	1.133869	0.31	0.753	-1.865727	2.578956
cttlown	.1178468	.3330995	0.35	0.723	-.5350162	.7707097
goatown	.0334612	.2047574	0.16	0.870	-.3678558	.4347783
chickown	.091267	.0385985	2.36	0.018	.0156154	.1669186
pigown	-.1033064	.2307857	-0.45	0.654	-.555638	.3490252
frwdcollmn	.0098954	.0120725	0.82	0.412	-.0137664	.0335571
thatchcoll	-.0007117	.0012796	-0.56	0.578	-.0032197	.0017963
fdnrpurrat	-11.25693	4.322921	-2.60	0.009	-19.7297	-2.784162
lvstconrat	5.017086	3.739483	1.34	0.180	-2.312166	12.34634
ownprodrat	-13.89422	6.037623	-2.30	0.021	-25.72774	-2.060696
totassts	-.0000725	.0000426	-1.70	0.089	-.0001561	.0000111
lvstkasstrat	-3.481858	1.770797	-1.97	0.049	-6.952557	-.0111599
rem	-.196668	1.142957	-0.17	0.863	-2.436823	2.043487
grnts	-.2991867	.9399558	-0.32	0.750	-2.141466	1.543093
empl	.6723576	.4988505	1.35	0.178	-.3053715	1.650087
manufact	.8002145	1.454942	0.55	0.582	-2.05142	3.651849
incsrclvst	.7551349	1.177548	0.64	0.521	-1.552817	3.063086
incsrcagnr	-.4579637	1.275966	-0.36	0.720	-2.958812	2.042885
totallivlsrc	-.5034505	.3435581	-1.47	0.143	-1.176812	.169911
s400	-1.375623	.6930074	-1.99	0.047	-2.733893	-.0173538
s401	1.380864	.6700292	2.06	0.039	.0676314	2.694098
s402	-.1796588	1.428662	-0.13	0.900	-2.979785	2.620467
s403	.1668942	.6063049	0.28	0.783	-1.021442	1.35523
s404	.2721411	1.027214	0.26	0.791	-1.741161	2.285443
s405	.8896119	1.170402	0.76	0.447	-1.404334	3.183558
s406	-3.296253	2.084729	-1.58	0.114	-7.382246	.7897398
s407	5.165722	2.661829	1.94	0.052	-.051368	10.38281
s411	.8248332	.7935753	1.04	0.299	-.7305457	2.380212
s412	.6990764	1.080117	0.65	0.517	-1.417915	2.816067
s500	-2.397135	1.650107	-1.45	0.146	-5.631285	.8370148
s501	-.7601897	1.467049	-0.52	0.604	-3.635553	2.115173
s502	-3.611077	1.926755	-1.87	0.061	-7.387446	.1652928
s503	2.745975	2.699193	1.02	0.309	-2.544346	8.036295
s504	-.1199267	.9755886	-0.12	0.902	-2.032045	1.792192
s506	4.191718	1.64842	2.54	0.011	.960875	7.422561
s507	-.1962987	1.553379	-0.13	0.899	-3.240866	2.848269
s602	6.255844	3.706708	1.69	0.091	-1.00917	13.52086
s700	-.8461935	1.075777	-0.79	0.432	-2.954678	1.262291
s701	-.434277	1.139539	-0.38	0.703	-2.667733	1.799179
s702	-.5497313	.7193756	-0.76	0.445	-1.959682	.8602191
s703	5.68682	2.018608	2.82	0.005	1.73042	9.643219
s706	.7626143	.7799028	0.98	0.328	-.7659672	2.291196
s707	-.9016074	.8072611	-1.12	0.264	-2.48381	.6805953
s708	3.616456	2.13936	1.69	0.091	-.5766121	7.809523
s800	-.348111	1.158417	-0.30	0.764	-2.618567	1.922345
s801	-1.367399	1.609371	-0.85	0.396	-4.521708	1.78691
s802	2.288959	.7640561	3.00	0.003	.791437	3.786482
s803	.875665	1.09169	0.80	0.422	-1.264007	3.015337
s804	.6713717	.7509267	0.89	0.371	-.8004177	2.143161
s805	1.44739	.8345546	1.73	0.083	-.1883068	3.083087
deprat	1.945895	1.58899	1.22	0.221	-1.168469	5.060259
cttlasstrat	2.697228	2.103474	1.28	0.200	-1.425506	6.819961
_cons	-3.792909	7.246228	-0.52	0.601	-17.99526	10.40944

Note: 3 failures and 0 successes completely determined.

Appendix F: Logit Regression Output, Dependent variable Help from Government / NGO

Logistic regression — Number of obs = 382
LR chi2(68) = 146.50
Prob > chi2 = 0.0000
Log likelihood = -191.48471 — Pseudo R2 = 0.2767

hlpindorg	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lconsump	-.8979653	.3330948	-2.70	0.007	-1.550819	-.2451114
ns	-2.519736	.7088198	-3.55	0.000	-3.908997	-1.130474
gendhhhed	.2667345	.3129235	0.85	0.394	-.3465844	.8800533
hhpop	-.0622228	.0679644	-0.92	0.360	-.1954306	.070985
grwmaize	-.5652713	.5764378	-0.98	0.327	-1.695069	.564526
grwsorghum	-.2063704	.6293897	-0.33	0.743	-1.439952	1.027211
grwbeans	2.667107	1.231303	2.17	0.030	.2537972	5.080417
grwwtmel	-1.407094	1.266093	-1.11	0.266	-3.888591	1.074404
grwgrnd	-.1266476	.6151653	-0.21	0.837	-1.332349	1.079054
grwmod	2.082214	1.029913	2.02	0.043	.0636213	4.100806
grwswtpt	-.992484	.6756862	-1.47	0.142	-2.316805	.3318365
grwcssv	.7816143	.807349	0.97	0.333	-.8007606	2.363989
grwveg	.5075212	.5955735	0.85	0.394	-.6597813	1.674824
cttlown	.0370732	.0657231	0.56	0.573	-.0917416	.1658881
goatown	.0004725	.0441741	0.01	0.991	-.0861072	.0870522
chickown	.0029325	.0179297	0.16	0.870	-.0322091	.038074
pigown	.0459532	.0658874	0.70	0.486	-.0831838	.1750902
frwdcollmn	.0031357	.0045721	0.69	0.493	-.0058255	.0120969
thatchcoll	.0000947	.0003867	0.24	0.807	-.0006632	.0008526
fdnrpurrat	.4149017	1.890386	0.22	0.826	-3.290188	4.119991
lvstconrat	-1.118175	1.980803	-0.56	0.572	-5.000478	2.764128
ownprodrat	.4947731	2.553972	0.19	0.846	-4.51092	5.500466
totassts	4.12e-07	.0000104	0.04	0.968	-.00002	.0000208
lvstkasstrat	-.3115239	.522258	-0.60	0.551	-1.335131	.7120829
rem	.1187185	.5023428	0.24	0.813	-.8658554	1.103292
grnts	.3770968	.4546731	0.83	0.407	-.5140462	1.26824
empl	.0440414	.2323053	0.19	0.850	-.4112687	.4993515
manufact	-.6794386	.6355423	-1.07	0.285	-1.925079	.5662015
incsrclvst	.1732715	.4292102	0.40	0.686	-.6679649	1.014508
incsrcagnr	-.2132178	.5272223	-0.40	0.686	-1.246554	.8201188
totallivlsrc	.0170557	.1609262	0.11	0.916	-.2983538	.3324652
s400	.074727	.2896804	0.26	0.796	-.4930362	.6424903
s401	-.2137045	.5143714	-0.42	0.678	-1.221854	.794445
s402	-1.51006	.9641521	-1.57	0.117	-3.399763	.3796438
s403	-.1303033	.3308312	-0.39	0.694	-.7787205	.5181139
s404	.1877418	.3599625	0.52	0.602	-.5177718	.8932554
s405	-.7002187	.6275351	-1.12	0.264	-1.930165	.5297275
s406	.8153375	.4518418	1.80	0.071	-.0702561	1.700931
s407	-.9086282	1.08199	-0.84	0.401	-3.02929	1.212034
s411	-.3227818	.3801321	-0.85	0.396	-1.067827	.4222634
s412	.7131035	.3781459	1.89	0.059	-.0280487	1.454256
s500	-.3452516	.5378326	-0.64	0.521	-1.399384	.708881
s501	-.15042	.5546483	-0.27	0.786	-1.237511	.9366707
s502	-1.07307	.6330973	-1.69	0.090	-2.313918	.1677778
s503	-.363216	.8881911	-0.41	0.683	-2.104039	1.377607
s504	.3858744	.7060845	0.55	0.585	-.9980259	1.769775
s505	2.136516	2.498905	0.85	0.393	-2.761247	7.03428
s507	.0801088	.9757477	0.08	0.935	-1.832322	1.992539
s509	-.1425926	1.39576	-0.10	0.919	-2.878231	2.593046
s602	-.6215214	1.657336	-0.38	0.708	-3.86984	2.626797
s606	.7589916	3.507247	0.22	0.829	-6.115086	7.63307
s610	.2639297	1.615835	0.16	0.870	-2.903048	3.430907
s700	-.8797311	.3700749	-2.38	0.017	-1.605065	-.1543975
s701	-.152961	.4182785	-0.37	0.715	-.9727719	.6668498
s702	-.2430706	.379623	-0.64	0.522	-.9871179	.5009768
s704	-.4799043	1.148293	-0.42	0.676	-2.730517	1.770708
s706	.2189352	.3770848	0.58	0.562	-.5201375	.9580078
s707	.2818126	.3746781	0.75	0.452	-.452543	1.016168
s708	-1.188905	1.258509	-0.94	0.345	-3.655537	1.277727
s800	-.6901749	.5911323	-1.17	0.243	-1.848773	.4684231
s801	1.020392	1.281336	0.80	0.426	-1.49098	3.531765
s802	-.0632167	.3534962	-0.18	0.858	-.7560564	.6296231
s803	-.2363514	.5427419	-0.44	0.663	-1.300106	.8274031
s804	1.048406	.407593	2.57	0.010	.2495384	1.847274
s805	-.978025	.4583221	-2.13	0.033	-1.87632	-.0797302
s806	.6690366	.9171963	0.73	0.466	-1.128635	2.466708
deprat	-.0651833	.7272757	-0.09	0.929	-1.490618	1.360251
cttlasstrat	-.2491489	.6830548	-0.36	0.715	-1.587912	1.089614
_cons	9.904215	3.894089	2.54	0.011	2.271941	17.53649