Rural Livelihood Strategies, Assets, and Economic Portfolios in Coping With Climatic Perturbations: A Case Study of the Bolivian Andes.

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Abstract

Production strategies pursued by households and individuals in a rural community of the Bolivian Altiplano are shaped by access to resources, social networks, non market institutions, monetary resources, and the ability to develop non farm/rural-urban linkages. Household livelihood strategies change through time due to many factors, markets, new technologies, and climate perturbations being major ones. A framework that combines household economics, political economy, and sociology, is developed to identify changes in land use patterns and crop-livestock activities resulting from several "exogenous" conditions that include climate perturbations such as drought and El Niño events; market incentives for dairy peri urban markets; and increased commercialization of potato production. Changing household strategies of 1993, 1995 and 1999 are analyzed with this framework. In times of climatic stress, such as the low rainfall of 1995, household economic portfolios increase activities less vulnerable to climate, as well as ex-post coping mechanisms, depending on the ability to develop multi-local strategies. Both the ability and type of shift are conditioned by access to resources, social capital, life cycle, and networks off the farm. Changes in consumption, income and diversity are measures that capture impact of shocks and ability to adapt to the perturbations. The flexibility and access to networks and non market institutions are key to coping with perturbations and adapting to change.

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Introduction

Natural hazards, market uncertainties, political unrest, and government policies are among the many forces that individuals, households, and communities have to negotiate to reduce their vulnerability and improve their welfare. What are the conditions, factors, and behaviors that favor negotiations that benefit them? In the following sections the aims are to review the approaches that inform the framework developed for the study of livelihood strategies; study the livelihood strategies of households in an Andean community between 1992 and 1999 to understand the patterns of change; and draw lessons from this case study on local and introduced mechanisms to deal with perturbations.

The purpose of this research is to construct a framework that contributes to an understanding of changes in household strategies through time, to draw some lessons on the constraints and opportunities to improve rural household welfare in a sustainable manner. A peasant household portfolio approach unveils distinct livelihood strategies, and their relationship to access to climate information. In light of the strategies identified and corresponding diversity measures, current changes in production patterns and urban-rural interactions are discussed. Finally, the impact of changing strategies of identified groups is analyzed in terms of increase or decrease in vulnerability. We aim to answer the following questions: 1) Which household strategies cope with climatic perturbations in the Andean region; 2) What is the impact of these strategies on income and diversification; and 3) What are the implications for individual empowerment in the management of productive and reproductive activities.

The theoretical framework will be presented first, followed by the methods used to elucidate the strategies of rural households. The data, definition of the variables, and the theoretical framework imbedded in the chosen variables are discussed as well as the techniques to identify strategies. The next section discusses the findings, and the last provides conclusions and recommendations.

A Theoretical Framework for Rural Household Strategies

Rural livelihood strategies are shaped by several factors. In the Andean region climate is important for both production and consumption decisions. Other factors affecting rural household decisions are: access and control of human, natural, productive, cultural and social capital (Bebbington; de Hann; Valdivia, 2001b), markets, institutions, and the political environment (Ellis, 1993; de Haan; Ferguson; Reardon et al).

Livelihood strategies are diverse (Ellis), influenced by linkages in and outside agriculture (Bebbington; de Haan; Reardon et al), and life cycle family characteristics such as age, education, and the number of family members (Kusterer; Valdivia and Jetté). The degree of

diversification of the household portfolio is determined by these characteristics, and by the household's and individual's objectives, such as risk management practices, and/or strategies available to cope with shocks. In areas of greater risk household strategies are expected to be more diversified as a mean to minimize possible shocks from negative climate events, especially when loss-management strategies are limited (Dunn et al).

Households with portfolios of economic activities that are diversified and have less covariant activities will be better able to cope with climatic risk (Reardon et al; Dunn et al). As income grows, and families move away from food insecurity, some expect that households will specialize and use insurance markets, instead of diversification, to negotiate risk (von Braun et al.). Others argue that diversification will grow (Kusterer), also as a strategy to maximize use of resources (Ellis), and may exist with greater levels of commercialization and wealth (Cotlear).

Diversification is also affected by stage in the life cycle. Households in their initial stages start to accumulate and their ability to expand or diversify their portfolio is limited. Diversification in agriculture and in non agricultural activities may take place as accumulation grows. As families become old and resources are bequeathed, these become less diversified (Kusterer). The tangible resources - natural, human, cultural, social and productive-, and the claims and access- intangibles (de Haan; Chambers and Conway)- are factors that impact the ability to negotiate, the if and how households may diversify their portfolios.

When climatic perturbations or any idiosyncratic risk realize non market relations may be key to coping. Households may access resources through networks of families and friends. This is an ex-post consumption-smoothing management strategy (Morduch; Dunn et al). Conversely in years of surplus this may be shared or exchanged, building the social capital of households. Besides accessing networks to negotiate perturbations, other strategies may include liquidation of assets and temporal migration (Dunn et al.; Valdivia et al.; Ellis; Bebbington).

Figure 1 represents the relationship between assets/resources, and activities (see Figure 1) in the household portfolio. The choice set of the household is constrained by the combination of different assets, resources, and forms of capital (natural, human, productive, and social) (Bebbington; Conway and Chambers) that can be accessed. History, economic conditions, cultural and social realities impact on the household's capabilities (de Haan). This, and the ability to command intangibles, shape decisions which are expressed in the combination of activities the household pursues (right hand side of the figure). The household portfolio is an expression of the choice sets and activities.

Households with differing varieties and densities of networks can build relations in and outside of agriculture. Depending on the event and the wealth in capitals, the family may be able to build only an agricultural portfolio or a combined one -rural/urban and agricultural-, during times of stress or shock. Stress is understood as an event that imposes difficulties on the

strategies such as a drought, while a shock is a more difficult event, and example may be a death in the family. The framework proposes that coping ability may be explained by these tangibles and intangibles, and how these articulate in a context- structure. Agency of the households, individuals and communities are the hinges or articulation between these and the structures in which they negotiate (de Haan; Valdivia, 1997). The methods and setting are addressed in the next section, followed by an analysis of livelihood strategies through time in the Andean Altiplano community during an average and drought years.

Rural Livelihood Strategies

A livelihood encompasses not only the income generating activities pursued by a household and its individuals, but the social institutions, intrahousehold relations, and mechanisms of access to resources through the life cycle (Ellis). The purpose of understanding livelihood strategies is to shed light on how and when individuals, households, and groups negotiate among themselves, with their communities, markets and society to improve their well being or reduce food insecurity by appropriating the benefits from their assets, activities, and investments. de Haan points out that processes of social inclusion and exclusion remain the focus of development studies, a dimension of this is the interaction between actor and structure. The exclusion of groups refers to lack of access of groups or individual in order to achieve a sustainable livelihood, therefore sustainability implies resilience and social inclusion (de Haan, p:343). Human, natural, financial, social, and physical capitals are resources or what de Haan defines as vital capitals and "... 'access and claims' come close to 'social capital,' because if social capital in the broadest sense "includes institutions, the relationships, the attitudes and values that govern among people and contributes to economic and social development" (World Bank, 1998, p.1), then access to a resource could also be considered as part of social capital." (De Haan, pp.345-6). de Haan though keeps it separate, which should if we include non market institutions as means to access resources or assets (Valdivia and Jetté; Ellis, 1993)

Adapting to shock and stress is one dimension of rural livelihoods. Some adaptation occurs ex-ante, in choosing activities in the portfolio that take into account seasonality and income generation. Some take place ex-post, while adapting to a stress or shock. In any situation human agency is the hinge between actors and structure (de Haan, pp.349). Agency is defined as the capacity of people to integrate experiences into their livelihood strategies and to seek outlets for ambitions and solutions to problems, embodied in the individual but embedded in social relations through which agency becomes effective (Ibid). de Haan points to a change from an actor oriented micro perspective of livelihoods based on Chambers and Conway, to one of understanding that this is not sufficient and recognizing structural bottlenecks and barriers, and

the quest for the hinge between actor and structure. (Ibid pp. 349). He defines structure as the shell in which the five capitals are embedded, with a social part of structure consisting of the rules governing common norms (social capital), an economic which he defines as supply and demand, and a political containing power relations. Structure determines the direction of the outcome according to de Haan, though also agency can change direction of outcome. Determinism of structure is no longer, nor is it solely of the individual. Two perspectives on exclusion are set forth by the author, one in which in order for a group to succeed other is left behind on purpose, while a second view is that of being left behind because of bottlenecks. Globalization is a more meaningful context than national scale of the recent past, in the study of livelihood strategies as similar strategies can be observed in far away localities, or similar phenomena, such as structural adjustment can bring about two different outcomes (Blumberg et al; Valdivia and Gilles).

Social relations, access and control of resources, and individuals

The ways in which the forms of production and the social relations and agency of individuals, households, and communities in their interaction with markets and society at large, have experienced two opposing outcomes, expropriation or accumulation (Ferguson, 1994; Blumberg et al). In this context grass root organizations and social capital are believed to assist/strengthen individuals agency, especially women, in negotiating to their advantage, in welfare improving ways.

Access to resources means that individuals, households or groups are able to use these, and in doing so these become assets that create a stream of benefits (Bebbington). Resources that are accessed and generate value are also defined as a form of capital to individuals pursuing their livelihoods. These also give meaning to the person's world, as it expresses what he or she aims at through their strategies (Bebbington; Ellis). Access gives them capability (Bebbington) to build their livelihoods. "Assets are not only "things" to allow survival, but they are also the basis of agents of power to act."(Bebbington, p. 2022). Access, though, differs from control, in that the later implies a form of ownership or rights to the resource (Zwarteveen and Meinzen-Dick; Agarwal; Valdivia, 2001). For example, often women have access, through male mediation (Zwarteveen and Meinzen-Dick). Differences in control and property rights (Agarwal) may lead to inefficient management, and threaten the welfare and food security of rural families (Quisumbing et al.; Zwarteveen and Meinzen-Dick), therefore the importance of agency in affecting structure so that strategies are sustainable in their impact on the environment for example.

Control over resources may empower individuals, to be and to change towards sustainable lifescapes and landscapes (Flora). Gender as a central layer of analysis in livelihoods

underscores the importance of close relationship between control and voice (Zwarterveen and Meinzen-Dick; Vázquez; Valdivia) in order to manage natural and other resources in a livelihood improving/resilient way (Ximenes; Valdivia; Rimachín et al). The ability to negotiate with others and with markets, in order to capture the stream of benefits generated through the use of capitals/assets accessed and the labor invested through the life cycle, are shaped or mediated by culture, society, policies, environment, and global markets.

Water, land, livestock, crops and knowledge are essential resources/assets in generating the livelihoods of families in rural areas of the world. Although agriculture may not be the sole source of their income, it is a mayor component in the Tropics. Access, control, and management of these resources contribute to shape which activities are pursued, which goods produced, and the ability to retain the benefits of their labor. Access and control of resources and capitals, through diverse cultural, political, economic, ecological and agricultural settings, the nature of the relation between access and control of diverse assets allow individuals to negotiate their livelihood strategies and improve well being in rural areas (Valdivia and Gilles). When access is limited or opportunistic due to lack of institutions supporting this access by individuals, the ability to sustain the natural resource base and other human assets is endangered.

Location and Methods

Droughts, frosts, floods and El Niño Southern Oscillation (ENSO) events have an important impact in the agriculture of the Altiplano of Bolivia and Peru. In the case of Bolivia, El Niño of 1997-98 resulted in a drought that contributed to 53% of the $527 million losses this country suffered (Jovel). Production of food crops fell during El Niño year and carried through in 1998-1999, as farmers were unable to recuperate production to cover their seed needs. Among these were potato and quinoa, two important traditional food crops grown in the Andes (Jovel).

Household producers in highland semiarid production systems of the Andes negotiate climatic variability through various livelihood strategies that are shaped by economic, social, cultural, and biotic factors. These strategies can be identified through the mix of activities of activities and the land use patterns of farm household (Valdivia and Jetté; Valdivia et al.; Bebbington). Many argue that with improvements in forecast skill such as ENSO's, the negative impacts of climatic variability on the food security of vulnerable populations could be decreased, by improving disaster preparedness at the policy level, and by informing production decisions at the small-holder farm level. This requires understanding of household strategies, their dynamics through time, and identifying which groups of households have the capacity to access information and technologies.

The Altiplano and Climate Variability

The area of study, is San José Llanga (Province of Aroma, Department of La Paz Bolivia), an agropastoral community 116 km south of La Paz, Bolivia's capital, is located in the central Altiplano, at 3,786 m above sea level. Mean annual precipitation between 1943 and 1990 was 402 mm, with a coefficient of variation of 31%. Periodic droughts and ENSO events affect this area (Washington-Allen). This community exhibits diverse production strategies, growing traditional food crops such as potatoes and quinoa, as well as raising animals, cattle and sheep.

The community controls 7,200 ha of land, with six settlements or neighborhoods. (Valdivia and Jetté). Fallow agricultural land and crop residues are important in the integration of crop and livestock production. During the1983 and 1990 (El Niño events) total rainfall was 197.6 mm, and 231 mm, respectively. The differences in total rainfall during El Niño years show the inherent variability of this event in the highlands. Even if producers are aware of an El Niño year, the variation as expressed by the range in outcome is large. In non ENSO year rainfall is also erratic. Annual rainfall in 1992-1993 was 388.5mm, and in 1994-1995 was 241.9 mm. Farmers also deal with uncertainty of the onset and variation in rainfall throughout the growing season. Frost events are an added risk to many crops, potato and quinoa being more vulnerable (Le Tacon et al.). Spatial variation, with several plots of different soil types geographically dispersed, staggered planting, and use of several potato varieties, are mechanisms to deal with variability (Le Tacon et al.).

Other Events of the 1990s

Several events took place during this decade. Starting in the 1980s Bolivia went through a process of structural adjustment. During the 1990s, dairy production was an activity promoted to improve access to milk in cities like La Paz (Markowitz and Valdivia). With the support of the Danish government dairy production became a stable source of income as prices were supported by this initiative, and credits in kind provided to improve breeds and produce forages. Towards the middle of the 1990s a change towards a dis-centralized government was promoted, giving more power to the municipalities. Dairy production was the event that impacted the region the most and can be seen in the changing landscape of the Altiplano. Policy wide, government agencies believed that a move towards the establishment of extensive areas of alfalfa was a more appropriate use of the land (Markowitz and Valdivia; Baldivia).

Methods

Household surveys captured production, consumption, income, and resources of the with the household as the unit of analysis. Survey were conducted of 45 families (50% of the population) in San José Llanga in 1993, 1995 and 1999, to identify the types of production

strategies pursued by households during a drought year. The sample in 1995 contained 39 of the originally selected families, and 29 in 1999. Families were lost in the sample due to migration and deaths. Two families chose not to participate in 1999.

Nine variables are selected and cluster analysis is performed with each of the data sets of 1993, 1995 and 1999 (Valdivia and Jetté) to identify groups of households with similar strategies and characteristics. The set of variables is built using a household peasant economics framework. The variables chosen capture stage in the life cycle, social capital, types of technologies used (either intensive or extensive), market integration, accumulation (investment capacity) in technologies less vulnerable to drought and frost, household consumption, and rural urban linkages (income from outside of agriculture). The operational variables chosen are: a. household labor available measured in adult equivalents (Valdivia and Jetté); b. age of the head of the household; c. number of criollo/local sheep; d. number of improved sheep; e. criollo cattle; f. improved cattle; g. forage irrigated area; h. assets for investment (cattle numbers that can be liquidated); i. wages received and income transfers; and j. consumption (estimated from in-kind production and cash expenditures). The variables do not include some that are relevant because of correlations among them that need to be avoided for the cluster analysis.

Age and access to labor capture life cycle effects on rural livelihood strategies. Irrigated land, captured by forage area, represents resources owned less vulnerable to drought. Criollo sheep and criollo cattle represent indigenous technologies resilient in times of drought, but with lower returns. Social capital is imbedded as it also includes animals accessed such as share grazing. Improved sheep measures an intensive technology, along with improved cattle; both reflect market integration and production of a cash crop, in this case dairy. An important dimension of keeping sheep and cattle separate is that the former are the income domain of women in this region (Valdivia et al., 1993). Wage is a source of off-farm income, and this variable captures non-agricultural activity to diversify income sources. Remittances, an indicator of networks outside the community in also a rural-urban linkage indicator. Finally consumption (in-kind and cash production for consumption) measures the ability of the household to secure food for the household. Net income from cattle measures the ability to capitalize and invest in new opportunities, as well as migrate through pull effects to other areas. The results of cluster analysis are presented in Tables 2-4.

To measure diversity of the household economic portfolio, an index is constructed. The Inverse Sympson[3]Where: D is diversity index, pi is the income share derived from activity i in

[3] $D = 1 / \sum_{i=1}^{n} p_i^2$

the n portfolio of economic activities. (Valdivia et al., 1996) is used to calculate the number of activities and their share on the income being generated. The index measures number of activities and evenness in the contribution to income of each activity. The diversity index for each strategy is calculated. The values are presented in the last row of Tables 2-4.

By analyzing the household strategies, a pattern is revealed as to how families produce in a climatic variable zone. The meaning of these activities is explored in the next section to understand households in a non negative climate year, 1993, the response to 1995's drought, and a year of production following El Niño event of 1997-1998. First the findings of the cluster analyses are presented, followed by a study of the income sources and changes in each identified group and year (Table 5-6). Implications for households, and the individuals in those households, are discussed in the next section.

Findings

Livelihood Strategies in 1993

Table 2 presents the values of the cluster variables at the mean. The dendogram shows that there are two large groups, each one subdivided in two subgroups. The strongest factors in formation of the groups are age and access to labor. This defines two large groups, the productive and the elderly (Valdivia and Jetté). Within the productive, access to resources explains why there is a group dedicated to innovating technologies, mostly dairy and improved sheep. Major income sources of the productive innovators are cattle and dairy (Table 5) while the extensive have greater proportion of income from food crops and sheep and livestock sales. Households that do not have access to resources, such as alfalfa, rely mostly on extensive grazing to feed their cattle and criollo sheep. The elderly, the second major group, also subdivides by the numbers of adult equivalents (labor) available. It is a group that relies mostly on income transfers (other income) and some potato production (Table 4).

Livelihood Strategies in 1995

Households during this year faced delayed rains and a major drought (Valdivia, 2001a). As a consequence a group with linkages outside the community and with large sums of money emerged (Table 6). Another group depended mostly on agriculture to cope with the climatic perturbation. This group coped by selling livestock. Table 6 shows the clear growth in income from outside by those defined as the rural option, due to their linkages to other localities, while the extensive, less wealthy, depend on the sales of sheep and cattle to cope. The elderly seem to be the most vulnerable. The household members in this group do not have the capacity to work as before. Their main source of income are the transfers (other income), which seems to be under-reported. A study of livelihood strategies (Materer) shows that indeed these elderly people

resort to very diverse strategies to maintain a level of income to sustain them.

Livelihood Strategies in 1999

Three clear strategies are identified in this year that follows El Niño event of 1997-1998. The elderly is a group that follows a similar strategy every year. Strategies in a year without perturbations, though constrained by the outcome in the previous year show two strong and different economic activities being pursued in agriculture. One is dairy which has grown consistently through the 1990s. The other is commercial potato production, which has grown from production for consumption, to production for both consumption and market. A shift is observed towards these two major activities as the incomes in Table 6 illustrate.

Changing Strategies and Individual Domains

At the individual level, and looking at income trends from Tables 5 and 6, we observe a drop in the income generated from sheep, the income domain of women (Valdivia et al, 1993) as a consequence of the increase in dairy. Sheep income is traditionally used to facilitate purchase of household products, and guarantee daily sustenance. In terms of assets we observe a decrease in the number of sheep, and an increase in the area of alfalfa. Regression of sheep assets on consumption of the household found this to have a positive effect (Valdivia, 2001a).

Another interesting effect of the growth of potato production is the reduction in the production of other food crops. As a result a problem of income domains to improve food security arises, and bargaining may decrease. Also it should be noted that the vulnerability dur to increase is not only the reduction of diversity in the diet, but the effect of placing all income in one source, as will be addressed in the next section.

Diversification

Our findings show that between 1993 and 1995 there are no significant differences in the growth or drop of diversification (Tables 2-4). In 1995 there are no significant differences within the productive in the degree of diversification of the economic portfolio. We find that there is a direct correlation between wealth and diversity, which mostly explains greater access to resources. There is an inverse correlation between elderly and diversification, explained by the fact that resources and assets are already bequeathed by the parents to their children. In 1999 it is clear that potato producers have become a strong group. Mostly the main potato producers are in the zones that are far away from the center of the Cantón[4]. It is an area of poorer land resources. Potato producers have also become more vulnerable to climatic variability and market fluctuations. Households concentrating mostly on potato production have a riskier income strategy, and more vulnerable with difficult access to credit when losses occur, while dairy producers have easy access to credit (Materer).

[4] San Jose has six neighborhoods. It was recognized as a Cantón in the middle, or over the 1990s.

Land use patterns have changed favoring forage production. The number of cattle assets has also increased. What has not grown in real terms is sheep income, the domain of women, and a crucial contributor of animal proteins and cash for household food security. Competing economic activities with clear market incentives, activities more resilient to climate perturbations such as forages, prevail at this point in time. The growth of income from a few sources has also decreased diversity, and increased the vulnerability of the elderly and the potato producers.

Conclusions

The theoretical frameworks used to identify livelihood strategies shows consistent results, which show that these change and are flexible. Households less vulnerable had a larger amount of assets, and a better ability to insure or obtain credit with the income from milk production. Although potato production grew as a commercial activity, this activity is vulnerable to frost, floods, and drought. Alfalfa on the other hand, once established, withstands these natural hazards, so the group relying on this resource was in a better position to withstand a drought or any other climatic perturbation. The market incentives in place have contributed to the boom of dairy production. It is important to gauge the consequences on diversity and on empowerment of the individuals that manage the environment.

Though not explored in this article, another useful aspect of this approach is that it allows to identify the networks within households in a community (social capital) and how it may relate to accessing technologies or information. This is important as it helps to measure the impact of non income forms of capital on negotiating perturbations. The non market institutions analyzed here were imbedded in livestock and land, by including not only area or animals owned, but those managed. The results from the cluster analyses were consistent because of the careful definition and measurement of these variables, which highlights the necessity to define these carefully when studying livelihood strategies.

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Table 1. Periodicity and scale of climatic perturbations in the Bolivian Altiplano.

Disturbance Type	Temporal Scale	Spatial Scale
Drought	45% Frequency	Regional
ENSO	2-7 years	Global
Floods	2-7 years	Regional
Frost	June –March >80% frequency	Regional
Hail	January-March 3% frequency	Regional
High Winds	July-October	Regional

Source: Washington-Allen, R. A. (1994)

Table 2. Identified Groups of Households and Their Characteristics in 1993 in San José Llanga, La Paz, Bolivia

Rural Livelihood Strategies in 1993 in San José Llanga			
	Productive Innovators	Productive Extensive	Elderly
Age (years)	45.7	41.6	65
Labor (adult equ.)	3.4	3.3	1.5
Criollo Sheep (head)	4.2	20.2	3
Criollo Cattle (head)	0.3	2.5	0.7
Improved Sheep (head)	27.2	6.9	1
Improved Cattle (Head)	4.8	1.3	0.2
Forages (has)	4.9	1.6	0.6
Consumption Bolivianos	5,981	2,743	1,337
Off-farm Income Bolivianos	1,000	299	120
Diversity Index*	3.57	3.24	2.26

Source: Valdivia and Jetté (1996)

Table 3. Identified Groups of Households and Their Characteristics in 1995 in San José Llanga, La Paz, Bolivia

	Rural Livelihood Strategies in 1995			
	Productive Rural	Productive Agricultural Less Resources	Productive Agricultural More Resources	Elderly
Age (years)	41.9	49.0	47.7	67.0
Labor (adult eqv.)	2.9	2.8	3.9	1.4
Criollo Sheep (head)	4.7	16.0	19.1	1.2
Criollo Cattle (head)	1.3	4.4	0.4	0.6
Improved Sheep (head)	42.3	12.4	10.1	6.2
Improved Cattle (Head)	5.8	5.3	5.2	0.6
Forages (has)	4.1	4.2	7.3	1.6
Consumption Bolivianos	9,703.0	4,253.0	5,837.0	1,944.0
Off-farm Income Bolivianos	4,809.0	333.0	952.0	301.0
Diversity Index*	3.3	2.95	2.97	2.64

Sources: Surveys of rural households in San José Llanga in 1995
*Valdivia et al. 1996.

Table 4. Identified Groups of Households and Their Characteristics in 1999 in San José Llanga, La Paz, Bolivia

Livelihood Strategies in San José Llanga, 1999				
	Productives Young - Livestock	Productives Dairy	Productives Potato Producers	Elderly
Age (years)	43.2	46.7	51.3	72
Labor (Adult Equivalent)	3.09	5	3.3	1.54
Criollo Sheep (head)	0	3.3	8.2	6.2
Criollo Cattle (head)	.25	0	3.5	0.31
Improved Sheep (head)	21.6	53	13	2.2
Improved Cattle (head)	6.8	6.3	2	0.7
Forages (has)	11.2	4.6	2.7	1.6
Consumption (Bs.)	18,000	10,360	13,720	3,000
Non Ag Income (Bs.)	0	0	316	134
Diversity Index*	5.5	4.8	2.68	1.67

Source: Household Survey of 1999, San José Llanga.

Table 5. Income Sources by Strategy, in San José Llanga. 1993. (Bolivianos)

	Rural Livelihood Strategies in San José Llanga 1993			
Strategy	Productive Improved 1	Productive Criollo 2	The Elderly Couples 3	The Elderly Widows 3
Food income	2,534	1,279	530	571
Sheep income	1,338.8	847	310	260
Cattle income	2,700.9	1,414	24	88
Milk income	916.66	271	16	0
Wages	1,000	299	99	141
Other incomes	192	47	54	695
HH. Consumption	5,981	2,743	1,008	1,656
Investment*	5,476	1,954	426	339

Source: Valdivia and Jetté (1997)

Table 6. Income Sources in 1995 and 1999 by Strategy, in San José Llanga.(Bolivianos)

Income Source	1995			1999		
Strategy	Rural	Agricultural	Elderly	1	2	Elderly
Food Crops	1,784	1,475	802	5,630	5,301	1,450
Sheep	2,081	1,477	489	1,059	776	97
Cattle	2,431	3,886	683	7,850	2,929	118
Milk Sales	932	1,179	58	2,678+	4,090+	371+
Wages	4,809	681	301	275	200	123
Other Income	104	352	284	0	0	172
Welfare Expense	9,703	5,045	1,944	9,642	10,367	2,213

Source: Surveys 1995 and 1999. Exchange rate: $1=4.5Bs in 1995; $1 = 6Bs in 1999.
+ Estimated, not actual.

Figure 1:
Household Economic Portfolio