

## Poverty Dynamics and the Role of Livestock in the Peruvian Andes

P. Kristjanson<sup>1</sup>, A. Krishna, M. Radeny, J. Kuan, G. Quilca,  
A. Sanchez-Urrelo, C. Leon-Velarde

### Abstract

Livestock play an important role for poor rural households in regions such as the Peruvian Andes. Research methods leading to a better understanding of the role of livestock in household poverty dynamics, and what better targeted policies and interventions may enhance that role, however, are not readily available. We utilized multiple methods, including Stages of Progress and household surveys, which gave us a combination of qualitative and quantitative results. We examined how over the last 10 and 25 years households have moved into and out of poverty in 40 rural communities in two different highland regions of Peru. We also examined the role played in these movements by different livestock assets and strategies. We found a significant number of households had escaped poverty, while at the same time many households have fallen into poverty. The reasons for movements up versus down are not the same, with different strategies and policies needed to address escapes versus descents. Diversification of income through livestock and intensification of livestock activities through improved breeds has helped many households escape poverty and this method allowed us to explore what exactly this means in the diverse areas studied. These findings can contribute to better targeted livestock-related research and development strategies and policies, not only in Peru, but in other regions where similar livelihood strategies are being pursued.

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<sup>1</sup> Forthcoming, *Agricultural Systems*. Corresponding author: P.Kristjanson@cgiar.org

## 1. Introduction

Recent national household income and expenditure surveys in Peru show that in 2000, more than half the population were classified as poor in absolute terms, and 15% as extremely poor (UNDP, 2002, INEI, 2001). Almost half of the 1.7 million 'extreme poor' live in highland rural areas, where poverty remains an intractable issue. While there is a considerable amount of literature on poverty and related issues in Peru, very little information exists regarding poverty dynamics over time, particularly for rural Andean households. And since most of these households rely on livelihood strategies based largely upon livestock, information as to the role that livestock play in helping to alleviate poverty is another area where relatively little research has been done.

This paper addresses these two knowledge gaps, presenting a participatory poverty dynamics approach that examines households' pathways into and out of poverty over the long run, applied to 40 rural Andean communities in two different regions of Peru. The approach offered a unique opportunity to also study the role that livestock plays for households that have moved into versus out of poverty in these regions.

Estimates of income poverty have been derived from other poverty indicators for Peru's 194 provinces and 1,812 districts, and these disaggregated figures show considerable variability across space (Schady, 2002, Escobal and Torero, 2000). There are huge welfare disparities across the country, and a negative correlation between altitude, rainfall and temperature and household economic welfare, with access to public goods and services also playing a significant role in helping to explain some of these welfare disparities (Escobal and Torero, 2000).

Many of the existing poverty studies for Peru are based on the World Bank's Living Standard Measurement Survey (LSMS), and focus on determinants of poverty and the economic impact of specific policies and services (e.g. Escobal, 2001, Hill, 1988, Sabates, 2000, Schady, 2002, Laderchi, 2001). There are close to one hundred published works that use the Peruvian LSMS data, listed on the World Bank LSMS website (see [www.worldbank.org/html/prdph/lmsms](http://www.worldbank.org/html/prdph/lmsms)). The World Bank's most recent study focuses on indigenous peoples, poverty and human development in Latin America over the last 10 years. It concludes that poverty among indigenous households remained virtually the same, at 62.3% in 1994 and 62.8% in 2000. Of all extremely poor households, 52% are indigenous (Patrinos and Hall, 2005).

Herrera and Roubard (2003) analyzed panel data for 1720 Peruvian urban households over a period of two years in order to examine movements into and out of poverty. However, such a short period is insufficient to separate out stochastic, or short-term, movements as opposed to long-term or structural reasons for changes in households' poverty status (Carter and May, 1999).

Participatory poverty assessments have also been undertaken. In particular, a recent DFID and World Bank participatory poverty assessment for Peru was carried out in nine communities (in Lima, Puno, Ayacucho and Piura) and involved 730 participants (DFID and World Bank, 2003). This assessment asked respondents about their perceptions of a good and bad life; their most pressing problems and priorities; the nature of their interactions with public, market and civil society institutions; and changes in gender and social relations (see [www.worldbank.org/poverty/voices](http://www.worldbank.org/poverty/voices)). While considerable insights were gained from such an exercise, they do not include information on poverty dynamics, i.e. how households have managed to fall into, or escape, poverty over time.

Laderchi et al. (2003) compare poverty measures based on expenditures with more participatory approaches that focus on self-perceptions of poverty. They found that in their rural field site, 29% of those who declared themselves to be poor were not poor according to the monetary indicators, and 42% of those that were poor in monetary terms did not perceive themselves as being poor. Laderchi (1999) also explored whether monetary measures of poverty are a good proxy for multiple dimensions of poverty, captured by child stunting, illness and access to schooling. She concluded that targeting programmes based on monetary poverty measures result in significant targeting errors, a finding confirmed by Franco and Saith (2003).

These more participatory poverty studies have also tended to focus less on explaining poverty movements than poverty status. This study attempts to fill that gap by looking at household movements into, and out of, poverty over the last 10 and 25 year periods, and the reasons why particular households have experienced such movements. We employ a participatory method that has been used in four other countries with interesting results that allow improved targeting of poverty policies and interventions. Understanding the heterogeneous nature of the situations of poverty experienced by Peruvians, and their perceptions of the reasons for household-level movements into and out of poverty, will help contribute to appropriate targeting of interventions and improve the quality of delivery and sustainability of pro-poor initiatives.

Many poverty researchers are now advocating linking complementary qualitative and quantitative poverty approaches to more fully understand such a complex issue (Booth et al, 1998, Kanbur, 2001, Lawson et al, 2003, Kristjanson et al., 2002). This suggestion, as well others that propose an asset-based approach and consider the issues of poverty traps (Carter and Barrett, 2006, Barrett and Swallow, 2006), relate strongly to the Stages-of-Progress approach taken in this study (Krishna, 2004).

### **1.1 Role of livestock**

Crop-livestock systems vary considerably across the different agro-ecological zones of Peru, as a result of differences in water availability, altitude, risk of frost,

slope, and access to markets and market demands (Leon-Velarde et al., 2000). Livestock species important to rural households' livelihoods include cattle, sheep, goats, camelids (llamas, alpacas, vicuna and guanaco), pigs, guinea pigs, mules, donkey, horses and chickens. Livestock production in the highlands of Peru is largely based on grazing of pasture, supplemented with crop residues, particularly stovers, or agricultural by-products and, in certain cases, with improved feed resources. Thus rangelands, with native grass species, constitute the main feed resource for mixed crop-livestock systems with ruminant species (Leon-Velarde and Inquierdo-Cadeno, 1993). Households rely on livestock for a source of protein, energy, shelter, fertilizer, draught power, transportation, savings and insurance.

Household accumulation of Criollo (indigenous breeds introduced in Latin America from the Iberian Peninsula some four to five hundred years ago, adapted to harsh environments (Drucker et al., 2001)) cattle and sheep is a common practice in the Andes. For poor households, they serve as assets for investments, and sources of savings for consumption in the households (Valdivia and Quiroz, 2003). Improved breeds of cattle are used for dairy production and provide a regular source of nutrition for the household as well as income (Leon-Velarde et al., 2000). Llamas and alpacas are important species in some areas and their wool/fiber is sold. Pigs, chickens and/or guinea pigs are also kept by most poor rural households, for home consumption as well as for selling when household needs arise.

While we know that livestock play an important role in the many and diverse livelihood strategies observed throughout rural Peru (Valdivia and Escobal, 2004, World Bank, 1999), there is little empirical evidence of how important livestock are to the poor, or how they help households escape poverty (or indeed, if they play a role in descent into poverty).

This research evaluates the reasons that households have moved into and out of poverty over three periods – 25 years ago to now, 25 years ago to 10 years ago, and 10 years ago to now – in two quite different regions of Peru, Puno and Cajamarca. It also examines the role that livestock play in poverty dynamics in these two regions where poverty is a serious issue and livestock are important in terms of livelihood strategies.

## **2. Research Approach and Methods**

This study did not attempt to replicate the national representativeness of the large-scale household surveys that are the basis of poverty comparisons in Peru. Instead, selection of the two study regions, Puno and Cajamarca Departments, and the four Provinces within each of these regions, was made on the criteria of, first, high rural poverty rates, and second, areas where livestock plays an important part in rural livelihood strategies. Within the selected Provinces (see Figure 1), twenty diverse communities were selected. We attempted to capture

diversity with respect to five criteria that largely define rural households' livelihood options: altitude, agricultural activities, market access, size of community, and ethnic group and language. The site selection process followed was not designed to make inferences about the larger populations from which the samples were drawn. Rather, the purposive fieldwork selection procedure, from Departments to Provinces to communities, was designed to allow us to identify and describe a range of poor rural households engaged in agricultural activities ranging from mixed crop-livestock to primarily livestock-based systems. Studying livestock's role vis-à-vis poverty reduction was an important aspect of this project.

Returning to Figure 1, some brief observations about the regions and communities selected for research are made that will help in interpreting the results described later.

Puno Department is located in the Peruvian Altiplano, which is a high Andean plain centred geographically and socioeconomically on Lake Titicaca. The plain rises from the lake level at 3,800 meters to over 4,500 meters altitude and is bisected by the international border between Peru and Bolivia. There are four agroecological zones that vary with distance from Lake Titicaca (Swinton and Quiroz, 2001). These are the Lakeside zone, Suni zone A, Suni zone B, and the Dry Puna zone. The communities selected are located in the latter two zones. Suni zone B is characterized by a frost-free period of 3 – 5 months, relatively risky cropping (compared to the Lakeside and Suni zone A) and range-fed livestock production. The Dry Puna zone (Mazo Cruz in Figure 1) has a frost-free season of less than 3 months, and annual precipitation of under 600 mm., and the agricultural production systems are predominantly oriented towards grazing, primarily alpacas and sheep. District-level poverty in Puno ranged from 63% to 95% of households with at least one unmet basic need (INEI, 1994).

The Cajamarca area includes several micro watersheds within the region, which lies between 2,800 and 3,700 meters above the sea. Most households have around forty percent of their land on slopes. Land is classified into three agro-ecological zones: Jalca (upper hillsides), Hillsides and Valley (including lower hillsides).

The Hillside production system is based on the cultivation of diverse annual crops including cereals, legumes and Andean roots and tubers. In the past, lack of water between May and September did not permit farmers to grow perennial forages for their livestock on the hills. Recently, however, many farmers have obtained access to irrigation that permits them to grow ryegrass pastures and increase the number of dairy cows they manage. The use of oats and barley hay for animal feeding is also widespread. Cows are also used for animal traction, an important additional benefit for farmers. The feeding of livestock is based on crop residues, natural pasture and cultivated pasture.

Areas of the Jalca (above 3,500 meters) face lower average temperatures than Hillside areas and therefore many crops from Hillside cannot grow there.

However, the deep organic soils have formed there due to the lower temperatures favor water retention and the growing of annual and perennial pasture and off-season potato crops. The cultivation of rye grass for livestock feeding is significant as is supplementation in the dry season with oats and barley hay.

Land-use systems in Cajamarca are different from those found in the central and southern Andes of Peru. For example, unlike Puno, there is not much communally managed land in Cajamarca, and household access to different production zones is limited.

Characteristics of the selected communities (20 in Cajamarca and 20 in Puno) are shown in Table 1. The Puno communities, on average, are located at much higher altitude, and are located further from secondary schools and health facilities than are the Cajamarca communities. Livestock income is more important for the Puno communities, with roughly  $\frac{3}{4}$  of total community income coming from livestock and livestock-related activities compared to  $\frac{1}{2}$  in Cajamarca. In general, a greater percentage of Cajamarca communities have access to services within their communities, including access to clean water and telephone services. However, only 15% of the Cajamarca communities, and 10% of the Puno villages visited had electricity.

While virtually all communities in both regions were involved in livestock activities (only 2 out of 40 reported no livestock activities), 55% were engaged in crop agriculture in Puno, compared to 95% in Cajamarca, reflecting the greater agricultural options in the lower altitudes. Fifty-five percent of the communities in Puno describe casual labor as an important economic activity for their community, compared to 30% of the study sites in Cajamarca. Handicrafts are an important economic activity in Cajamarca, while livestock trade is equally important in Puno.

### ***2.1. Stages of Progress Approach***

The Stages of Progress approach is described in detail in Krishna, 2004 and Krishna et al., 2004. It is described briefly here. What is innovative about this particular study lies in the linking of the Stages of Progress with the livestock survey, allowing us to examine first the reasons in general that households have managed to escape or fall into poverty, and then to examine in greater detail the livestock-related factors associated with these poverty dynamics.

It is a highly facilitative and participatory approach involving a representative group of a community (or in some cases, the entire community) in an exercise that defines, for their particular village, the typical stages of progress that households make towards improving their levels of well-being. Community members are led by a trained facilitator to consensus on the stages, or assets, that households wish to purchase as they obtain incremental amounts of money,

starting from a baseline of an extremely poor household in their village<sup>2</sup>. These stages include purchases or investments in food, clothing, housing, education, livestock, land, etc. The group then draws their own poverty lines showing what stage households that are considered poor versus non-poor are at. They then are asked to describe what stage each and every household in their village is at presently, was at 25 years ago, and was at 10 years ago. The final and most interesting step of the stages of progress approach involves an in-depth exploration and triangulation, at both the community and household-levels, of the reasons that particular households have moved into and out of poverty.

A stratified random sample encompassing roughly 20% of households that had stayed poor, escaped poverty, fallen into poverty and remained non-poor over the last 25 years within each community were visited following the stages of progress exercise. A formal survey including questions regarding household characteristics and livestock holdings, livestock production and marketing, now and 10 years ago, was implemented.

Before applying these methods extensively in two regions of Peru, a training session and pilot tests were carried out in two communities. The full study was then implemented in 40 communities (with a total of 3,817 households), and the household/livestock survey was carried out with 1,041 households (Krishna et al., 2006).

## *2.2. Stages of Progress and Position of Poverty Line*

Representative community groups were facilitated through a process that led to a consensus on the stages of progress that a typical household in their community go through as they progress from having very little, to an improved state of well-being. They defined the kinds of expenditures, and the order in which they are typically made, as households gradually climb out of a state of acute poverty.

They were then asked to describe, based on previous discussions of the local terms that people apply to impoverished households, where the cut-off line is between those considered to be poor versus non-poor (Chambers, 1995).

## *2.3. Poverty movements of households*

A complete list of all households in the village was made and prominently displayed for the community meeting group. Next, researchers worked with the community assembly to identify a clearly understood and commonly remembered

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<sup>2</sup> We acknowledge that poverty has many dimensions – economic, psychological, social, etc, and can be defined in terms of outcomes (e.g. nutritional or health status) as well as in terms of assets. Attempting to capture all of these dimensions with a simple tool is perhaps impossible. For this reason, the Stages of Progress Methodology focuses solely on material aspects of poverty, i.e. assets.

milestone to denote the period of 25 years ago, and another to identify the period of 10 years ago.

The next step involved locating each household's location with respect to the Stages of Progress for the current period, for 10 years ago, and for 25 years ago. The results of this analysis gave the poverty status of each and every household in the 40 villages now, 10 years ago, and 25 years ago. A full examination of the poverty trends over the different time periods can be found in Krishna et al., 2006. Here we focus on the last 10-year period which also relates to the livestock issues pursued below.

#### *2.4. Reasons given by households for poverty status and movements*

Having established poverty status and movements for all households in our sampled villages, the next step was to probe in some detail as to the reasons that individual households had experienced their particular poverty trajectory. This step also required rigorous training of enumerators in terms of probing and recording techniques, followed by coding of responses. In particular, the sequence of events or factors mentioned as reasons for poverty status now and before was elicited, rather than a ranking of importance of reasons. This is because it is important to know, for example, whether a debilitating medical condition occurred before or after the acquisition of high-interest private debt. Knowing this sequence helps understand better whether health resulted in debt and contributed to the household's descent into poverty (which is a reasonable supposition if health comes first in the sequence of reasons), or whether deteriorating health results from (or accompanied) worsening family economic conditions, caused primarily by something else (in this case, debt).

It is important to note that present-day households were the unit of analysis for this exercise. This differs from panel data studies, which consider earlier-period households as the units of analyses. While panel studies lose households that participated in the earlier period but not in the later, this method fails to capture households of 25 years ago from which no single member still lives in the community at the present time, thus some bias may exist. When asking about conditions at the present time, we asked about the present-day household members; when asking about the previous time period, we asked about conditions faced by these same members (or their parents' households for younger families) 25 and 10 years ago. A time period of 25 years ago is roughly the equivalent of a generation, and was chosen to allow us to explore the reasons for movements in chronic, as opposed to transitory, poverty movements of households. While we also explored the last 10-year period, the reasons for movements are presented for the longer term period. With this approach, the time periods chosen can vary if there is good reason to do so (Krishna et al., 2004).

The community group was asked to describe the circumstances, and the critical reasons or events (and sequence of those events) behind particular households' poverty movements. Household level inquiries (for a random sample of households from each category) delved further into the sequence of events or actions that household members perceived as leading to escapes or descents into poverty.

## 2.5. Logit Analysis

A binary logistic regression analysis (SPSS, 2002) was undertaken to determine which factors were significantly associated with upward and downward poverty movements. The binary logistic regression is most useful when modeling the event probability for a categorical response variable with two outcomes. It is a type of generalized linear model that extends the linear regression model by linking the range of real numbers to the 0-1 range. The model directly estimates the probability of an event occurring. The binary logistic regression is specified as:

$$\pi_i = \exp(z_i) / (1 + \exp(z_i)) = 1 / (1 + \exp(-z_i)) \quad (\text{Equation 1})$$

or

$$z_i = \log (\pi_i / (1 - \pi_i)) \quad (\text{Equation 2})$$

The variable  $\pi_i$  is the probability of the  $i^{\text{th}}$  case experiencing the event of interest and  $z_i$  is the value of the unobserved explanatory variable for the  $i^{\text{th}}$  case. The model also assumes that  $z$  is linearly related to the predictors. Equation 3 is expressed as:

$$z_i = b_0 + b_1x_{i1} + b_2x_{i2} + \dots + b_px_{ip} \quad (\text{Equation 3})$$

The variable  $x_{ij}$  is the  $j^{\text{th}}$  predictor for the  $i^{\text{th}}$  case,  $b_j$  is the  $j^{\text{th}}$  coefficient, and  $p$  is the number of predictors.

In the logistic regression model, the relationship between  $z$  and the probability of the event of interest is described by the logit link function. Unlike a common linear regression based on Ordinary Least Squares (OLS), the regression coefficients are estimated through an iterative maximum likelihood method (i.e. the coefficients that make our observed results more likely are selected).

## 2.6. The Empirical Model

Using the binary logistic regression procedure in SPSS, we ran four separate regressions to model the probability of escaping poverty and probability of falling into poverty for each region. First, the analysis was restricted to households that had stayed poor over the 25-year period (classified as 0), and households that were poor 25 years ago but had managed to escape poverty (classified as 1). In

other words, we grouped all households that started out poor in order to examine which factors help explain why some previously poor households escaped poverty, while other poor households continued to remain poor.

Similarly, households that were non-poor 25 years ago but were now poor (classified as 1), and households that had stayed non-poor over the 25 year period (classified as 0), were analyzed together in order to look at the most important factors that explain why some previously non-poor households fell into poverty, while other non-poor households continued to remain non-poor.

In the first case, the reasons for staying poor and factors mentioned as pertinent to household escapes out of poverty, as well as important household-level characteristics such as age of household head, level of education, number of income-earning activities, size of land holdings and gender of household head, were used as explanatory variables in the regression for each region. In the second case, reasons given for descent into poverty and staying non-poor and similar household-level characteristics were used as explanatory variables. The reason/factor-related independent variables were measured as binary variables, i.e. equal to one if the reason was mentioned, and 0 otherwise<sup>3</sup>.

### **3. Results and Discussion**

#### *3.1. Stages of Progress and Position of Poverty Line*

Although there were considerable differences found across the villages studied, remarkably all these communities described virtually the same Stages of Progress (Table 2). This implies a commonly known and agreed-upon understanding of poverty for these villagers. Working with this local, yet common and comparable, definition of poverty is very useful for better understanding the strategies that households pursue in order to deal with poverty and the reasons that some households are able to escape poverty over time and why others fall into poverty.

#### *3.2. Poverty movements of households*

The poverty dynamics differ somewhat in these two different regions of Peru (Table 3). Puno households have been more successful in lifting themselves out of poverty in the last decade (25% of households), compared to Cajamarca (13% of households). More households slid into poverty in Cajamarca (11%) than in Puno (5%) in the last 10 years as well, based on our sample of communities.

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<sup>3</sup> Since the reasons were first elicited at the community level, then followed up at the household level, the research team met each evening to finish recording the results and discussed cases where there was a discrepancy (which turned out to be a very small percentage of cases, <5%), at which point they made an informed decision as to the final set of reasons that went into the logit analysis.

Based on the communities own perceptions of the percentage of households that were poor, Puno went from a poverty incidence of 40% to 21% (Categories A+C) in the last decade, whereas Cajamarca's percentage of poor households declined from 36% to 34% during the same period.

The reasons for Puno's apparent relative success at reducing poverty compared to Cajamarca over the last 10 years were not readily apparent to the study teams and are likely to be quite complex. Further research is needed in order to be able to address some of the pertinent issues. For example, a closer look at the relevant social programmes in Puno versus Cajamarca, their coverage and timing would be very useful. Although we don't have all the necessary information to address the reasons behind aggregate regional poverty trends, what we can do with the Stages of Progress Approach is to gain a better understanding of the reasons that households within and across the different regions give for helping explain their own poverty movements.

### *3.3. Interpretation of binary logistic regression results*

The results of the logit models are given in Tables 4 and 5 for the households that escaped poverty and those that fell into poverty, respectively. When households were being probed regarding the events, factors and reasons behind their particular poverty trajectory, they gave both positive and negative influencing factors. In Table 4, for those households that escaped poverty, the positive factors outweighed the negative ones mentioned, and they were able to progress upwards. In Table 5, for those that fell into poverty, the 'positive factors' associated with falling should in fact be interpreted as factors that increase the probability of falling into poverty, whereas the 'negative factors' were reasons associated with keeping them from falling.

Measures of goodness of fit of our logit model include the log pseudolikelihood and Wald  $\chi^2$  statistics, shown in Tables 4 and 5, which show that the models are all significantly different from the null or intercept-only (i.e. know-nothing) model. How well the models correctly predict where households are classified (those that stayed poor versus those that escaped poverty in Table 4, and those that stayed non-poor versus those that fell into poverty in Table 5) is another indication of goodness of fit. These measures are presented in Tables 4 and 5 and all suggest good predictive power. The parameter estimates of the variables that are significant differ across regions. The meaning of logistic regression coefficients is not straightforward. While the  $\beta$  is convenient for testing the significance of the predictors,  $\exp(\beta)$  is easier to interpret. The  $\exp(\beta)$  represents the odds ratio, or the ratio-change in the odds of the event of interest, in our case of either escaping or falling into poverty, for a one unit change in the predictor (it is calculated as  $\text{Exp}(\beta)$ ). For variables that are significant, an odds ratio greater than one indicates that the relevant factor tends to accelerate escape (Table 4) while an odds ratio lower than one indicates that factor tends to deter ascents. In Table 5, for variables that are significant, an odds ratio greater than one indicates

that the relevant factor tends to accelerate descent, while an odds ratio lower than one implies the factor tends to avert descents into poverty.

### *3.4. Reasons for Escaping Poverty*

The major factors contributing to household escapes in the two regions have very few commonalities, suggesting targeted intervention and policy responses are needed. Gains from business showed up as an important contributing factor in household escapes in both Cajamarca and Puno. The odds of escaping poverty are 13 and 16 times greater than for staying poor in Puno and Cajamarca, respectively, for households that have gained from starting up their own businesses. As may be expected, size of landholdings also show up as highly significant, thus those with more land are more likely to escape poverty over time.

Additional factors significant in Cajamarca (but not in Puno) include improved market access – the odds of escaping poverty are 70 times greater than for staying poor for households that have seen their market access improve – followed by diversification of income through crops and off-farm sources. Fifty-nine percent of Cajamarca households that had escaped poverty cited gains from non-farm diversification as an important factor, while 43% mentioned crop diversification strategies. Help from relatives and friends and a higher proportion of children in school are other factors helping to explain ascents out of poverty in Cajamarca. Somewhat non-intuitively, having relatives working outside of the community appears to deter ascents from poverty (with an odds ratio less than one), although this variable is only significant at the .1 probability level. Perhaps the loss of labour outweighs the transfer payments from these relatives working away from their home communities.

Other circumstances important for explaining poverty escapes in Puno include the ability to improve the quality of livestock (e.g. through breed upgrading) – the odds of escaping poverty are 17 times greater for households that had improved the quality of their livestock herd. Diversification of income through livestock-related activities was also significant in Puno, with an odds ratio of 2.5. The percentage of households in Puno that had escaped poverty mentioning livestock-related diversification strategies was 57%.

Assistance from community organizations and someone in the household with a private sector job were other important contributing factors for families that had escaped poverty in Puno.

#### *3.4.1. Cargo net strategies for helping household escapes*

In terms of development strategies, what do these findings imply? Barrett (2003) refers to policies and strategies that help households climb out of poverty as 'cargo net' policies. For communities at lower altitude, with relatively good access to services, with some cropping potential and less reliance on livestock as the primary livelihood option, strategies for helping to lift rural households out of

poverty should focus on: income diversification strategies, including crops, livestock and non-farm options (e.g. small businesses). Community-level organizations are currently not playing an important role, so looking at the challenges to improved collective action, particularly in market and income-generating projects may be in order.

For areas of higher altitude (over 4000 metres) on the other hand, with more reliance on community rangelands and livestock as the primary livelihood strategy and fewer crop-related options, investment strategies aimed at improving market access, livestock production and marketing may help more households escape poverty. An entry point here may be through the community organizations that successful households have mentioned as being important to their upward movements out of poverty.

### *3.5. Reasons for poverty descents*

The major factor affecting families that had descended into poverty over the last 25 years common to both areas is health and health-related problems and expenses. The odds of falling into poverty were 14 times greater for households with major health issues in Puno and 3 times greater for households facing health-related challenges in Cajamarca.

Age and gender of household head were additional reasons showing up as important in Puno but not in Cajamarca, implying that households headed by men and older people are much more likely to fall into poverty than female-headed households (a somewhat surprising finding) and younger families. Another interesting finding in Puno is that households involved in multiple income-generating activities are less likely to fall into poverty, suggesting that many households have been successful in their pursuit of additional income sources.

Unique to Cajamarca are marriage-related expenses that contribute greatly to the probability of households' falling into poverty. The likelihood of falling into poverty increases, with an odds ratio of 5, for households where expenses related to marriages were considered an important contributing reason to their descent. Large family size and crop-related losses also show up only in Cajamarca as significant contributing factors to household descents into poverty. Larger households, and those that have suffered crop-related losses, are 7 and 3 times, respectively, more likely to fall into poverty (mean family size for those that had fallen was 5.2 compared to 4.4 for those that stayed non-poor). Size of landholdings and proportion of children in school are negative and significant, as may be expected, suggesting the likelihood of descent is greater with less land and education.

Mitigating factors helping households from falling into poverty are seen in Table 5 for those variables with a negative  $\beta$  coefficient. In Puno, diversification of

income through livestock shows up as significant, and in Cajamarca, inheritance does.

### *3.5.1. Safety net strategies for keeping households from descents into poverty*

In addition to cargo nets, which help carry households out of poverty, these regionally differentiated findings suggest that stronger 'safety net' strategies and investments will also be required that can prevent or slow down descents into poverty (Barrett 2001, Devereaux, 2002, Lipton, 1997). Perhaps the biggest message is that investment and attention to increasing access to health care and reducing its costs to poor households is universally needed. Assisting new households seems to be another safety net strategy that cuts across regions that could help households from descents into poverty.

For our sampled households, our results suggest that safety net strategies for lower altitude, higher potential crop areas could focus on reducing crop- and livestock-related losses, e.g. through increased investment in research and development and promotion of sustainable crop-livestock systems. Issues surrounding land division arise in the higher altitude regions where households are more dependent on livestock for their livelihoods, so exploring possible collective action approaches (since these are also areas where community organizations and practices such as collective grazing are stronger) may have potentially high payoffs in these areas.

### *3.6. Livestock Findings*

The livestock survey component was applied to 1,041 households. Information was gathered on livestock holdings by species and indigenous (Criollo) versus improved breeds, now and 10 years ago, and livestock production and sales, now and 10 years ago.

Following up on the stages of progress approach with a fairly detailed livestock questionnaire allowed us to examine the differences in livestock holdings and recent changes in those holdings for households that had escaped versus those that had fallen into poverty. Given the inherent limitations of recall data over such a long period, the objective was to look for broad trends regarding intensification (shift to improved breeds) versus extensification (larger herds), and diversification strategies (shifts to new species, products) being pursued by these different categories of households. This allows us a rather unique opportunity to directly address the issue of the role that livestock may play in poverty alleviation; a complex question that is challenging to answer, particularly in a quantitative manner, and one that few livestock studies address (Kristjanson et al., 2004). It should be noted that this relatively brief livestock survey does not allow us to address issues of productivity or returns to the various livestock-related activities. It would therefore be useful to revisit these communities and supplement this information with such data, plus take a more in-depth look at marketing issues.

Table 6 summarizes the findings regarding livestock holdings in Puno and Cajamarca, 10 years ago and now. It shows the importance of cattle, sheep, chickens, alpacas and llamas for households in Puno, and beef, dairy, sheep, guinea pigs, chickens and pigs in Cajamarca.

### *3.6.1. Role of intensification strategies in poverty escapes*

Focusing in on households that had escaped from poverty, we examined evidence of intensification by looking at shifts from indigenous (Criollo) breeds of cattle and sheep to improved breeds. These detailed tables are not presented here for space reasons, but are available upon request from the authors.

In Puno, we found evidence of such a strategy playing a role for households that had escaped poverty: more than twice as many of these successful households now own improved dairy and beef cattle breeds in comparison to 10 years ago.

Similarly, we found declining livestock assets for households that have fallen into poverty. Fewer of these unsuccessful households own indigenous breeds of sheep, dairy and beef cattle, and they have smaller herd sizes. In addition, ownership of improved breeds has actually declined for these households compared to 10 years ago.

In Cajamarca, for households that have escaped poverty, ownership of improved breeds of cattle (beef and dairy), however, is insignificant and has not increased over the last decade. More of these successful households now own indigenous dairy cows (an increase from 58% to 70%) and indigenous beef cattle than did 10 years ago (an increase from 36% to 44%). And small animal ownership has declined for this category of households,

It is not totally clear why such a shift towards improved breeds can be seen in Puno and not in Cajamarca for successful households and it likely relates to past and current development projects that focused on beef development in Puno, whereas dairy has been the focus in Cajamarca, and in particular areas of Cajamarca that this study did not cover. It does raise some interesting questions that further research should address, however, to see if there are some lessons from livestock development efforts ongoing in Puno that may be transferable to Cajamarca, or vice versa.

### *3.6.2. Role of extensification strategies/increasing herd size in movements out of poverty*

In Puno, for households that escaped poverty, we see evidence of larger herds of improved dairy cows (which increased from an average herd size of 6.4 to 10.4 per household compared to 10 years ago), but average alpaca herd sizes have not increased. However, the number of llamas increased from an average of 9.7 to 13.8 per household (Table 7). Alpaca is generally more important for these

households than llamas (used mainly for meat), and in the drier Mazo Cruz, alpacas are more important than cattle and sheep as well.

In Cajamarca, on the other hand, households that had escaped poverty did not accumulate larger herds of cattle or sheep, and they own fewer chickens and guinea pigs than they did 10 years ago (Table 7). So, it does not appear that increasing the number of livestock assets has been a pathway out of poverty for these communities in Cajamarca. Given the frequency of non-farm diversification and crop diversification as important reasons for escaping poverty in this region, this supports the argument that these factors have played a much more important role than has livestock in terms of a pathway out of poverty.

Thus it appears that policies and strategies aimed at helping households increase their herd size could be a critical poverty strategy in higher altitude, livestock-reliant areas, and not just by providing a safety net, but also in the sense of helping households climb out of poverty (a cargo net strategy).

### *3.6.3. Role of marketing and diversification strategies in movements out of poverty*

We looked at how households were diversifying their livestock activities in comparison to 10 years ago (as was reported as being an important reason for households' poverty escapes). In Puno, for households that escaped poverty, we found that production and sales of milk, wool and alpaca fiber have increased significantly over the last 10 years; milk production has doubled, with four times as many households selling milk (over twice as much) than was the case 10 yrs ago; a large number of these successful households were new at producing fiber, cheese, eggs, milk and mutton (i.e. they had diversified into new livestock products); and significantly more of these successful households own alpacas than 10 years ago.

In Cajamarca, for these relatively successful households, the percentage of sampled households that produce milk increased from 47% to 73% over the last 10 years. The data also show significantly increased milk production and sales for these households. There were no significant changes in the percentage of households that had escaped poverty with respect to producing other livestock-related products.

Another indicator of diversification strategies is evidence of a large number of households that were not engaged in particular livestock activities 10 years ago, but are undertaking them now (Table 8). We see such evidence in Puno for alpaca fiber production, camelid hides and meat, eggs and milk. In Cajamarca, a significant number of households are now engaging in production of eggs, guinea pigs, milk and wool compared to 10 years ago.

Unfortunately, while we asked what households were doing now compared to 10 years ago, we were not able to pursue exactly how it was that these households were able to successfully diversify (another area for follow-up research to pursue, i.e. what policies and interventions led to this successful diversification). However, it is quite striking how dairy enterprises have been an important option in both regions, suggesting that it has been an important pathway out of poverty for many rural Peruvians.

#### **4. Conclusions**

Linking the stages of progress approach with a targeted livestock survey turned out to be a useful way in which to address some complex issues surrounding the role that livestock and other factors play in poverty pathways, and we see opportunities for applying it more broadly in very different regions (and in fact, have received several queries already for doing so) where rural poverty remains a huge challenge.

In each of the forty Peruvian communities investigated here, while some households are coming out of poverty, others are falling into poverty. New poverty is being created even as old poverty is being destroyed. The reasons why people are becoming poor are different from the reasons why people are coming out of poverty. The implications of this finding are that the policies that are needed to stop people from falling must deal with the reasons for falling. The policies that are needed to help people escape poverty must address the reasons households escape. Because these reasons are different, two different sets of policies are needed – one to halt descents and one to promote escapes.

These policies are region-specific and may often even be community-specific. We found that some reasons for falling into poverty, or for escaping poverty, are similar in both places, but some are different. National policies are important, but our study shows that there are very good reasons for having regional and local pro-poor policies.

480 households in these Puno communities and 253 Cajamarca households have escaped from poverty, and for them, escaping poverty has in large part been due to successful diversification of income sources. This finding is supported for rural Peruvian households in Swinton and Quiroz, 2003 and Escobal, 2001. We found that diversification of income sources through livestock and off-farm activities was particularly important for helping households to escape poverty in Puno and Cajamarca, and also through crops in Cajamarca.

Improvements in livestock quality are also related to movements out of poverty. Households that were able to improve the quality of their livestock were much more likely to escape from poverty as those that were unable to invest in this

strategy<sup>4</sup>. Employment in the private sector, gains from small businesses, improved market access, community organizations and inheritance from parents were also found to be positively and significantly associated with escaping poverty.

Our data show quite a bit of evidence supporting the notion that livestock (via intensification strategies or increasing productivity and marketing, rather than through increased herd sizes) have helped Puno households get out of poverty; but little evidence that this has been the case in Cajamarca. The number of households that escaped poverty and are producing milk in Puno not only doubled in the last 10 years, but these families are also selling more than twice as much milk as they were previously. A significantly larger number of these successful households are also selling more cheese, wool and alpaca fiber.

Thus intensification of livestock strategies (i.e. moving to improved breeds) seems to be happening for households that have escaped poverty in Puno, but not in Cajamarca. Livestock production and marketing has appeared to suffer in Cajamarca over the last 10 years, in fact, according to our household survey evidence, although there is some evidence of livestock diversification happening for households that have escaped poverty there.

Helping prevent households from falling into poverty will require improvements in access to affordable health care, improvements in access to appropriate crop and livestock technologies and perhaps access to insurance to limit catastrophic crop/livestock-related losses, and improved safety nets for the disabled and elderly.

Improved rural roads is one way to help households diversify (Escobal and Ponce, 2002). Helping households escape poverty will also be aided by investments in improved market access to support income diversification efforts, and collective action efforts (e.g. strong community groups) in the areas of crop and livestock production and marketing activities.

The above approach has allowed us to provide information on how rural people define and deal with poverty and an opportunity for them to share their situation with policy makers. By linking the Stages-of-Progress method with a targeted livestock survey, we have been able to address some interesting questions about the role that livestock play in pathways into and out of poverty in areas that have varying market access, altitude, and degree of reliance on livestock. Follow-up

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<sup>4</sup> While beyond the scope of this paper, a reviewer suggests that evidence of a shift towards non-indigenous breeds for families that move out of poverty and a decline in indigenous breed numbers for households falling into poverty, has implications for programmes aimed at the conservation and sustainable use of indigenous breeds/livestock diversity, and that attention to programme design needs to be paid in order to ensure that in-situ efforts to conserve/sustainably use indigenous breeds do not end up "conserving" poverty too.

action-oriented research is needed, however, to examine in more detail what programs and specific policies help households diversify their income sources, for example, and escape poverty. Exploring ways in which to better incorporate intra-household differences, particularly those based on gender, is an area for further research, perhaps through adapting a method such as the one used by Ravnborg et al. (2004). What we have obtained from these community and individual interviews are only the 'proximate' reasons for escape and descent, i.e. the reasons as they were experienced by individuals within communities. More remote and macro-level reasons, operating at national and international levels, are also important to tackle within any overall strategy for dealing comprehensively with poverty and its causes. Different methods will help to identify important macro-level causes, complementing what has been learned through the Stages-of-Progress methodology.

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Figure 1. Location of study sites



Table 1. Characteristics of surveyed communities (20 in Puno and 20 in Cajamarca)

	<i>Units</i>	<i>Cajamarca</i>	<i>Puno</i>	<i>Both regions</i>
<b><i>Average for communities surveyed</i></b>				
Altitude	metres	2879	4093	3486
No. of households	number	100	106	103
No. of households with land	number	90	101	96
No. of households without land	number	11	6	9
No. of primary schools	number	1	1	1
Distance to secondary school	km	4.1	7.6	5.8
Distance to health facility	km	5.1	6.6	5.8
Distance to the nearest trading center	km	13.9	13.2	13.6
Area of community	hectares	1605	3095	2369
Percent of income from livestock	%	53	76	65
<b><i>Percent of communities with:</i></b>				
Access to clean water	%	90	35	67.5
Telephone services available	%	60	25	42.5
Access to electricity	%	15	10	12.5
Regular transport services available	%	75	85	82.5
Veterinary services available	%	90	100	95
Accessible village link road (number of months in a yr)	number	10	9	9
<b><i>Percent of communities citing these economic activities as important:</i></b>				
Livestock production	%	100	90	98
Crop agriculture	%	95	55	75
Trade in livestock products	%	30	35	33
Casual labor	%	30	55	43
Handicrafts	%	35	15	25
Business	%	25	35	33
Livestock trade	%	0	25	8

Table 2. Stages of Progress

1	Food	
2	Clothing	
3	Basic housing/house repairs	
4	Small animals (chickens, guinea pigs)	
5	Basic education for children	
6	Purchase small plot of land	
7	Indigenous breeds of livestock (sheep, cattle, alpacas, llamas)	<b>Poverty Cut-off</b>
8	Purchase larger plot	
9	Improve/expand house	
10	Improved large breeds of larger animals	
11	Secondary/Tertiary education	
12	Small business	
13	Buy plot/ house in city	

Table 3. Poverty movements in the last 10 years in Puno and Cajamarca

Poverty Category	Cajamarca		Puno	
	Number of households	Percent of households	Number of households	Percent of households
A: Stayed Poor	447	23	309	16
B: Escaped Poverty	249	13	471	25
C: Fell into Poverty	212	11	103	5
D: Stayed Non-Poor	1040	53	1037	54

Table 4. Results of the binary logistic regression for poverty escape (households that were poor 25 years ago and escaped poverty in comparison to those that stayed poor) in Puno and Cajamarca

	Puno			Cajamarca		
	B	Odds Ratio	Robust Std. Err	B	Odds Ratio	Robust Std. Err
Constant	-1.64*	0.19	0.99	-2.59*	0.07	1.440
<b>Factors (reasons) that increase the probability of escape from poverty (expected sign positive)</b>						
Improved livestock quality	2.86***	17.48	0.83	0.43	1.54	1.08
Community organization	1.19*	3.28	0.64	-0.88	0.41	0.87
Business gains	2.58*	13.15	1.41	2.77***	16.04	0.65
Diversification (crops)	0.65	1.91	0.69	1.74***	5.67	0.54
Diversification (livestock)	0.90*	2.45	0.49	0.85	2.35	0.57
Diversification (non-agric./off-farm)	0.55	1.73	0.55	1.60***	4.97	0.51
Improved market access	0.38	1.46	0.70	4.24***	69.62	1.03
Private job	1.83**	6.23	0.92			
Gains from inheritance	1.06	2.88	0.84	0.99	2.70	0.62
Help from relatives and friends	0.14	1.15	0.64	1.23**	3.41	0.58
<b>Factors (reasons) that decrease the probability of escape from poverty (expected sign negative)</b>						
Land division	0.16	1.17	0.67	1.48	4.41	1.51
Large family size	0.00	1.00	0.54	-1.39	0.25	0.93
Death of income earner	0.75	2.12	0.66	-1.83	0.16	1.81
Polygamy	-1.66	0.19	1.24	-1.18	0.31	1.39
No inheritance				1.13	3.10	0.99
Heavy expenses related to death	-0.29	0.75	0.67	-0.12	0.88	0.91
Health	-1.14**	0.32	0.48			
<b>Household characteristics</b>						
Gender	0.60	1.82	0.50	-0.63	0.53	0.97
Age2	0.00	1.00	0.00	-0.00	1.00	0.00
Level of education	-0.20	0.82	0.49	0.66	1.94	0.76
Household landholdings (Logland)	0.57**	1.77	0.28	1.24***	3.44	0.39
Influence of relatives working outside the community	-0.57	0.56	0.46	-1.03*	0.36	0.61
Proportion of children in school	0.31	1.36	0.45	0.85*	2.35	0.53
Involvement in multiple income generating opportunities	0.12	1.13	0.49	0.63	1.88	0.54
Wald chi2 (df)	88.1 (23)			95.9 (22)		
Prob >chi2	0.000			0.000		
Log pseudolikelihood	-92.1			-60.9		
Pseudo R-square (McFadden's)	0.46			0.57		
N	289			206		
% Correctly Predicted:						
Escaping poverty	90.4			89.6		
Staying poor	78.8			89.0		

\* Significant at 0.1 probability level; \*\* Significant at 0.05 probability level; \*\*\*Significant at 0.01 probability level. Note: Factors that were mentioned by fewer than 10% of households in a given region were dropped due to large standard errors. To correct for possible problems of heteroscedasticity in our model above, we used a robust standard errors option; we then tested for the possibility of omitted variables/specification errors using the *linktest* option (both in STATA), which showed that this was not a problem.

Table 5. Results of the binary logistic regression for falling into poverty (households that were non-poor 25 yrs ago and stayed non-poor compared to those that fell into poverty) in Puno and Cajamarca

	Puno			Cajamarca		
	B	Odds Ratio	Robust Std. Err	B	Odds Ratio	Robust Std. Err
Constant	-0.94	0.39	1.48	-0.46	0.63	0.92
<b>Factors (reasons) that increase the probability of falling into poverty (expected sign positive)</b>						
Land division	1.92	6.82	1.13	0.94	2.56	1.25
Large family size	2.29	9.85	1.75	1.96**	7.10	0.87
Marriage expenses				1.57**	4.81	0.72
Crop losses				1.02**	2.78	0.69
Livestock losses	-0.93	0.40	1.31	0.71	2.03	0.73
Death of income earner	-1.79	0.17	2.65	0.91	2.49	0.74
Disability	2.42	11.29	3.38	1.65	5.18	1.26
Health	2.61**	13.58	1.23	1.03**	2.79	0.47
Lack of/no inheritance	3.09	21.93	2.06			
<b>Factors (reasons) that decrease the probability of falling into poverty (expected sign negative)</b>						
Business gains				-1.02	0.36	0.83
Diversification (crops)				-1.01	0.37	0.64
Diversification (livestock)	-2.62***	0.07	0.86	-0.03	0.97	0.60
Diversification (non-agricultural/off-farm)	-1.30	0.27	0.98	-0.61	0.55	0.52
Inheritance				-1.96**	0.14	0.86
Private job	-0.51	0.60	0.99			
<b>Household characteristics</b>						
Gender	-3.44***	0.03	0.91	-0.16	0.85	0.64
Age2	0.00***	1.00	0.00	0.00	1.00	0.00
Level of education	-1.77	0.17	1.41	1.44	4.24	1.15
Household landholdings (Logland)	-0.43	0.65	0.32	-0.69**	0.50	0.27
Influence of relatives working outside the community	-0.91	0.40	0.61	0.19	1.21	0.49
Proportion of children in school	-0.57	0.57	0.84	-0.94**	0.39	0.48
Involvement in multiple income generating opportunities	5.20*	181.56	2.72	0.81	2.25	1.21
<b>Interactions</b>						
Sex and education	2.27	9.68	1.39	-1.47	0.23	1.26
Age and diversification	-0.07	0.93	0.06	0.01	1.01	0.02
Wald chi2 (df)	91.1 (19)			89.7 (22)		
Prob >chi2	0.000			0.000		
Log pseudolikelihood	-33.9			-82.3		
Pseudo R-square (McFadden's)	0.63			0.54		
N	240			281		
% Correctly Predicted:						
Falling into poverty	61.3			84.0		
Staying non-poor	98.1			91.4		

\* Significant at 0.1 probability level; \*\* Significant at 0.05 probability level; \*\*\*Significant at 0.01 probability level. Note: Factors that were mentioned by fewer than 10% of households in a given region were dropped due to large standard errors. To correct for possible problems of heteroscedasticity in our model above, we used a robust standard errors option; we then tested for the possibility of omitted variables/specification

errors using the *linktest* option (both in STATA), here the addition of 2 interaction variables corrected the problem.

Table 6. Livestock holdings by region, 10 years ago and now

Livestock Species	Percent of households			
	Puno (n=538)		Cajamarca (n=505)	
	Now	10 years ago	Now	10 years ago
Beef, indigenous	55	46	46	38
Beef, improved	12	24	2	2
Dairy, indigenous	59	53	56	58
Dairy, improved	18	38	5	8
Sheep, indigenous	81	68	64	49
Sheep, improved	12	31	2	5
Alpacas	32	37		
Llamas	36	34		
Chickens	57	55	83	78
Guinea pigs	12	6	83	80
Pigs	33	28	66	54

Table 7. Mean herd size (number of animals) for households that escaped poverty, Puno and Cajamarca, 10 years ago and now

Livestock species	Puno (n=125)				Cajamarca (n=73)			
	10 years ago		Now		10 years ago		Now	
	Mean Herd Size	Valid n*	Mean Herd Size	Valid n	Mean Herd Size	Valid n	Mean Herd Size	Valid n
Beef, indigenous	3.1	58	4.5	55	2.2	26	2.1	32
Beef, improved	4.3	15	3.7	34	-	-	1.0	1
Dairy, indigenous	3.4	77	4.0	78	2.4	42	2.5	51
Dairy, improved	6.4	18	10.4	47	2.5	2	3.5	2
Sheep, indigenous	18.0	95	14.7	85	4.5	43	3.4	39
Sheep, improved	49.6	15	17.1	45	5.0	1	7.0	3
Alpacas	22.0	34	20.4	45	-	-	-	-
Llamas	9.7	29	13.8	35	-	-	-	-
Chickens	5.3	70	3.3	81	6.9	58	5.4	56
Guinea pigs	13.6	12	7.6	7	14.7	61	9.8	62
Pigs	3.4	41	1.7	47	1.6	48	1.4	43

\* Valid n – households raising this type of livestock

Table 8. Households engaged in livestock production activities that they were not engaged in 10 years ago

Species	Puno		Cajamarca	
	Percent of households	Valid n*	Percent of households	Valid n
Alpacas fiber prod lbs/yr	24.3	140		
Beef prod kgs/yr	81.6	38		
Camelid hides prod no/yr	27.5	131		
Camelid meat prod kgs/yr	22.5	120		
Cheese prod kgs/wk	22.8	246	32.4	37
Chickens prod no/mo	27.6	272	12.5	256
Dried meat prod kgs/yr	40.3	67		
Eggs prod no/wk	27.7	264	16.3	306
Guinea pigs prod no/mo	44.4	36	12.8	397
Milk prod litres/day	16.2	420	30.6	294
Mutton prod kgs/yr	18.4	320	14.6	48
Pork prod kgs/yr	36.6	41	27.6	29
Wool prod lbs/yr	14.5	407	24.7	190

\* Valid n – households raising this type of livestock