Pathways into and out of poverty and the role of livestock in the Peruvian Andes

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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 (WB, 1999). While there is a considerable amount of literature on poverty and related issues in Peru (e.g. Escobal and Torero, 2000, Herrera and Roubard, 2003, Laderchi, 1999, Mayer, 2002, Patrinos and Hall, 2005, Schady, 2002), 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 (Leon-Velarde et al., 2000).

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. By linking this innovative poverty dynamics approach with a more traditional household survey focusing on livestock issues, we were able to study the role that livestock plays for households that have moved into versus out of poverty in these regions.

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 roles 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. 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 ¾ of total community income coming from livestock and livestock-related

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activities compared to ½ 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 55% were engaged in crop agriculture in Puno, compared to 95% in Cajamarca, reflecting the greater agricultural options in the lower altitudes. 55% 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.

Stages of Progress Approach

A bottom-up methodology, termed the Stages-of-Progress method, was adapted and linked with a formal household-level livestock survey, allowing us to examine the role that livestock plays for households that have fallen into poverty, and for those that have escaped poverty. The Stages-of-Progress method is a rigorous quantitative-qualitative approach that has been applied in extensive field investigations in five countries to help examine movements out of and into poverty at the grassroots level and examine what households are doing by themselves to deal with poverty in their midst (Krishna 2004, Krishna et al., 2004, Krishna et al., 2005).

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. 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, at

both the community and household-levels, of the *reasons* that particular households have

moved into and out of poverty.

A random sample encompassing roughly 20% of households that had stayed poor,

escaped poverty, fallen into poverty and remained 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,

production and marketing, now and 10 years ago, was implemented. The study was

implemented in 40 communities (with a total of 3,817 households), and the

household/livestock survey was carried out with 1,041 households.

It is important to note that present-day households were the unit of analysis for

this exercise[1]. 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

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[1] 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.

about conditions faced by these same members (or their parents' households for younger families) 25 and 10 years ago[2].

Logit Analysis

As we are interested in examining only two categories in the response variable at a time, a simple binary logistic regression procedure in SPSS was chosen for the analysis. 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

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[2] 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. We also explored the last 10-year period, but the reasons for movements are presented for the longer term period. The pros and cons of choice of time period are discussed in detail in Krishna et al, 2004.

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.

Results and Discussion

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). The order of stages varied slightly from village to village, but with the same stages found below versus above the poverty cut-off, implying 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.

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. 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.

Logit 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 (and the sequence of those factors), 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 contributed to their fall, whereas the 'negative factors' were reasons associated with keeping them from falling further.

Measures of goodness of fit of the logit model include the likelihood ratio statistic, which approximately follows the chi-squared distribution. If the model χ^2 as

represented by the likelihood ratio statistic indicate that the model fits the data significantly better than the null or intercept-only (i.e. know-nothing) model, the model is considered capable of explaining the response variables. 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, allowing us to move on to interpret the parameter estimates.

The parameter estimates of the variables that are significant differ across regions. The meaning of logistic regression coefficients is not straightforward. While the β is convenient for testing the significance of the predictors, exp(β) is easier to interpret. The exp(β) 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. 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.

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 (a similar finding to Escobal, 2001). 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. A higher proportion of children in school is another factor 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. As found in a similar study in Kenya (Kristjanson et al., 2004), diversification of income through livestock-related activities was also significant, 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.

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, 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.

Reasons for poverty descents

Factors affecting households that had descended into poverty over the last 25 years common to both areas include health and health-related problems/expenses and large family size. In both regions, the odds of falling into poverty were roughly 8 times

greater than staying out of it for large families compared to smaller households (mean family size for those that had fallen was 4.4, compared to 5.2 for those that stayed non-poor). Health-related reasons were strongly significant in Puno, where the odds of falling into poverty were 13 times greater for households with major health issues, and only marginally significant in Cajamarca. An interesting and non-intuitive finding in both regions is that households involved in multiple income-generating activities are more likely to fall into poverty, suggesting that not all income diversification activities are successful.

Disability and lack of inheritance were additional reasons showing up as important in Puno but not in Cajamarca. Age of household head was also significant, implying that households headed by older people are much more likely to fall into poverty than younger families.

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.

Mitigating factors helping households from falling into poverty are seen in Table 5 for those variables with a negative β coefficient. These include diversification of income through livestock, larger household landholdings, and somewhat surprisingly, female-headed households were less likely to fall into poverty in Puno.

In Cajamarca, diversification of income through crops, receiving an inheritance, more land, and a higher proportion of children in school were factors that helped mitigate poverty descents.

Safety net strategies for keeping households from descents into poverty

What do these regional differences and similarities tell us in terms of strategies and investments towards keeping more households from falling into poverty more generally? Perhaps the strongest 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.

Safety net strategies for lower altitude, higher potential crop areas should 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.

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

- 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)

and diversification strategies (shifts to new species, products) being pursued by these

different categories of households[3]. 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, and one that most livestock studies do not address.

Table 6 summarizes the findings regarding livestock holdings in Puno and Cajamarca, 10

years ago and now. It shows large proportions of Puno households owning beef and

dairy cattle, sheep, chickens, alpacas and llamas. While 24% and 38% of surveyed

households held improved beef and dairy cattle, respectively, in Puno, only 8% and 2%

did so in Cajamarca. Smaller animals, including chickens, guinea pigs and pigs were

held by much higher proportions of Cajamarca households than seen in Puno.

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[4].

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:

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[3] This relatively brief livestock survey does not allow us to address issues of productivity or returns to the various livestock-related activities. It would be useful to revisit these communities and supplement this information with such data, plus a more in-depth look at marketing issues.
[4] These tables are not presented here for space reasons, but are available upon request from the authors.

- Fewer of these unsuccessful households own indigenous breeds of sheep, dairy and beef cattle, and they have smaller herd sizes

- 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.

Clearly livestock are playing a different role in pathways out of poverty in different regions, thus regionally-differentiated pro-poor livestock-related policies are required.

It is not obvious 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, for example, that focused on beef development in Puno. 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.

Role of marketing and diversification strategies in movements out of poverty

We looked at how exactly 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:

- Production and sales of milk, wool and alpaca fiber have increased significantly over the last 10 years

- Milk production has doubled, with 4 times as many households selling milk, and 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. had diversified into new livestock products)

- 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 show significantly increased milk production and sales for these households

- There were no significant changes in the percentage of households producing other 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 7). 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.

Conclusions

This 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. 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. 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 plays in pathways into and out of poverty in areas that have varying market access, altitude, and degree of reliance on livestock. This approach can continue to be built upon, for example, to examine in more detail what programs and specific policies help households diversify their income sources, for example, and escape poverty. The method, as was applied in this study, was not able to examine in detail past and current programs that helped contribute to poverty alleviation across each region, thus follow-up research could address this. More widespread geographical application of this approach could contribute significantly to the development of better targeted, regionally-differentiated livestock-led poverty reduction strategies.

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Figure 1. Location of study sites
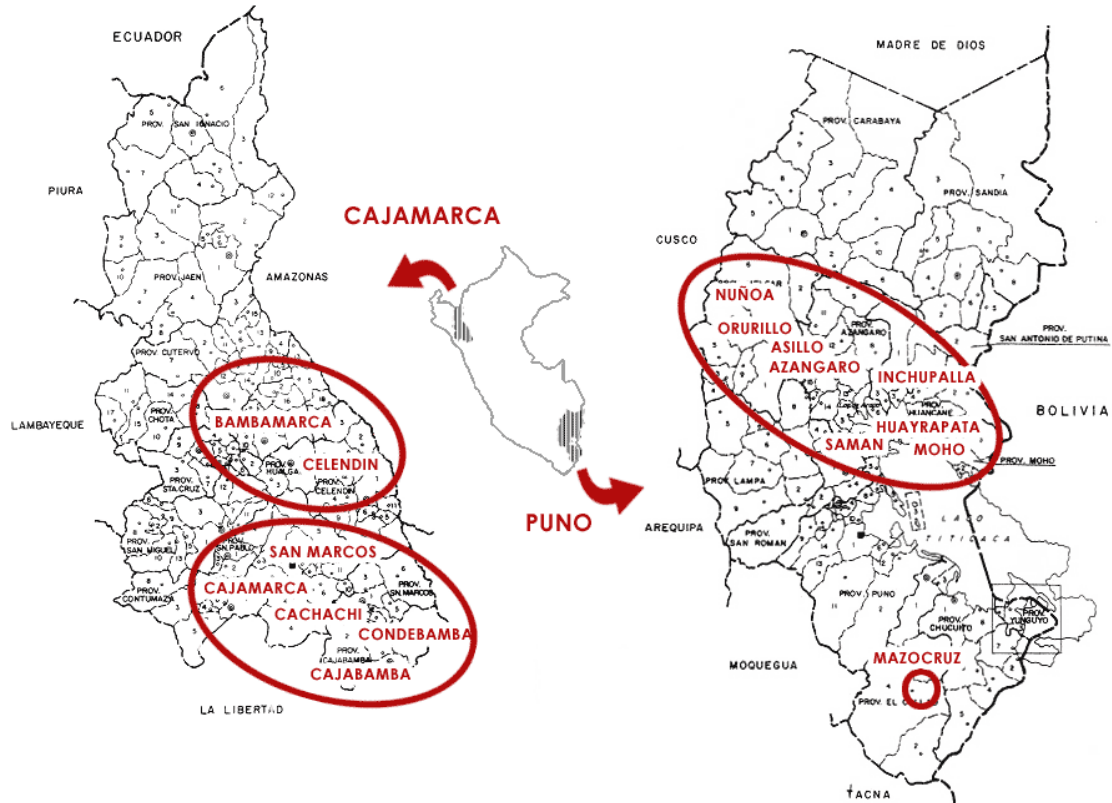
Table 1. Characteristics of surveyed communities (20 in Puno and 20 in Cajamarca)

	Cajamarca	Puno	Both regions
Average for communities surveyed			
Altitude (m)	2879	4093	3486
No. of households	100	106	103
No. of households with land	90	101	96
No. of households without land	11	6	9
No. of primary schools	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	1605	3095	2369
Percent of income from livestock	53	76	65
Percent of communities with:			
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)	10	9	9
Percent of communities citing these economic activities as important:			
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		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)	**Poverty Cut-off**
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

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

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

	Puno			Cajamarca		
	B	Sig.	Odds Ratio	B	Sig.	Odds Ratio
Constant	-1.64	*	0.19	-2.59	**	0.07
Positive factors associated with escape						
Improved livestock quality	2.86	***	17.48	0.43	n.s.	1.54
Community organization	1.19	*	3.28	-0.88	n.s.	0.41
Business gains	2.58	**	13.15	2.77	***	16.04
Diversification (crops)	0.65	n.s.	1.91	1.74	***	5.67
Diversification (livestock)	0.90	*	2.45	0.85	n.s	2.35
Diversification (non-agric./off-farm)	0.55	n.s.	1.73	1.60	***	4.97
Improved market access	0.38	n.s.	1.46	4.24	***	69.62
Private job	1.83	*	6.23			
Gains from inheritance	1.06	n.s.	2.88	0.99	n.s.	2.70
Help from relatives and friends	0.14	n.s.	1.15	1.23	**	3.41
Negative factors associated with escape						
Land division	0.16	n.s.	1.17	1.48	n.s.	4.41
Large family size	0.00	n.s.	1.00	-1.39	n.s.	0.25
Death of income earner	0.75	n.s.	2.12	-1.83	n.s.	0.16
Polygamy	-1.66	n.s.	0.19	-1.18	n.s.	0.31
No inheritance				1.13	n.s.	3.10
Heavy expenses related to death	-0.29	n.s.	0.75	-0.12	n.s.	0.88
Health	-1.14	**	0.32			
Household factors						
Gender	0.60	n.s.	1.82	-0.63	n.s.	0.53
Age2	0.00	n.s.	1.00	0.00	n.s.	1.00
Level of education	-0.20	n.s.	0.82	0.66	n.s.	1.94
Land (Logland)	0.57	***	1.77	1.24	**	3.44
Influence of relatives working outside the community	-0.57	n.s.	0.56	-1.03	*	0.36
Proportion of children in school	0.31	n.s.	1.36	0.85	*	2.35
Involvement in multiple income generating opportunities	0.12	n.s.	1.13	0.63	n.s.	1.88
χ^2	156.8			163.6		
degrees of freedom	23			22		
P-value	<0.000			<0.000		
-2 Log Likelihood	184.2			121.8		
Pseudo R-square	0.60			0.73		
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; n.s. not significant
Note: Factors that were mentioned by fewer than 10% of households in a given region were dropped due to large standard errors.

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	Sig.	Odds Ratio	B	Sig.	Odds Ratio
Constant	-0.74		0.48	-0.23	n.s.	0.79
Positive factors associated with falling						
Land division	1.33	n.s.	3.77	0.88	n.s.	2.40
Large family size	2.17	*	8.78	2.03	***	7.61
Marriage expenses				1.51	**	4.53
Crop losses				1.03	n.s.	2.79
Livestock losses	-9.92	n.s.	0.40	0.64	n.s.	1.90
Death of income earner	-2.18	n.s.	0.11	0.93	*	2.55
Disability	3.18	*	23.98	1.61	n.s.	4.99
Health	2.59	***	13.28	0.97	*	2.65
Lack of/no inheritance	3.10	**	22.24			
Negative factors associated with falling						
Business gains				-1.06	n.s.	0.35
Diversification (crops)				-1.08	*	0.34
Diversification (livestock)	-2.44	**	0.09	0.00	n.s.	1.00
Diversification (non-agricultural/off-farm)	-1.59	n.s.	0.20	-0.58	n.s.	0.56
Inheritance				-1.97	**	0.14
Private job	-0.14	n.s.	0.87			
Household factors						
Female household head	-2.59	***	0.07	-0.41	n.s.	0.66
Age2	0.00	**	1.00	0.00	n.s.	1.00
Level of education	-0.18	n.s.	0.84	0.15	n.s.	1.16
Household landholdings (Logland)	-0.56	*	0.57	-0.65	**	0.52
Influence of relatives working outside the community	-0.93	n.s.	0.39	0.16	n.s.	1.18
Proportion of children in school	-0.62	n.s.	0.54	-1.00	**	0.37
Involvement in multiple income generating opportunities	2.03	**	7.58	1.06	**	2.88
χ^2	114.4			192.6		
degrees of freedom	17			20		
P-value	<0.000			<0.000		
-2 Log Likelihood	70.3			165.5		
Pseudo R-square	0.71			0.69		
N	244			281		
% Correctly Predicted:						
Falling into poverty	64.5			84.0		
Staying non-poor	98.6			90.4		

*P<0.1; ** P< 0.05; ***P< 0.01; n.s. not significant

Note: Factors that were mentioned by fewer than 10% of households in a given region were dropped due to large standard errors.

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

Livestock species	Puno (n=538)				Cajamarca (n=505)			
	10 years ago		Now		10 years ago		Now	
	No. of hhs	Percent of hhs	No. of hhs	Percent of hhs	No. of hhs	Percent of hhs	No. of hhs	Percent of hhs
Beef, indigenous	296	55	245	46	234	46	193	38
Beef, improved	62	12	128	24	9	2	10	2
Dairy, indigenous	317	59	287	53	284	56	295	58
Dairy, improved	98	18	207	38	27	5	39	8
Sheep, indigenous	436	81	366	68	325	64	249	49
Sheep, improved	64	12	167	31	11	2	25	5
Alpacas	174	32	197	37				
Llamas	191	36	185	34				
Chickens	304	57	294	55	421	83	394	78
Guinea pigs	64	12	34	6	421	83	404	80
Pigs	178	33	151	28	335	66	274	54

Table 7. Households engaged in livestock production activities that they were not engaged in 10 years ago

| Species | Puno | | | Cajamarca | | |
	No. of hhs	Percent	Valid N	No. of hhs	Percent	Valid N
Alpacas fiber prod lbs/yr	34	24.3	140			
Beef prod kgs/yr	31	81.6	38			
Camelid hides prod no/yr	36	27.5	131			
Camelid meat prod kgs/yr	27	22.5	120			
Cheese prod kgs/wk	56	22.8	246	12	32.4	37
Chickens prod no/mo	75	27.6	272	32	12.5	256
Dried meat prod kgs/yr	27	40.3	67			
Eggs prod no/wk	73	27.7	264	50	16.3	306
Guinea pigs prod no/mo	16	44.4	36	51	12.8	397
Milk prod litres/day	68	16.2	420	90	30.6	294
Mutton prod kgs/yr	59	18.4	320	7	14.6	48
Pork prod kgs/yr	15	36.6	41	8	27.6	29
Wool prod lbs/yr	59	14.5	407	47	24.7	190