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## PREFACE

This publication contains the invited papers presented at The Symposium on Andean Peasant Economics and Pastoralism held at the University of Missouri-Columbia, January 16-18, 1980. Also included are an introduction describing the background and purpose of the Symposium and a bibliography of publications relevant to the Andean region.

The Symposium was carried out as a part of the United States Agency for International Development Title XII Small Ruminants Collaborative Research Support Program under Grant No. AID/DSAN/XII-G-0049. Additional support was also provided by The University of Missouri-Columbia.

By drawing from their own research and experience as well as the published reports of others, it is our belief that the three keynote papers provide a framework for understanding the nature of small ruminant production in the Southern highlands of Peru. While the papers focus on topics of special interest to social scientists, they contain much material which should also be relevant to those in the animal production/animal health fields. Rather than serving as the "last word" on the subject, we hope this report will stimulate discussion, questions and comments. It will be through these interchanges that the Small Ruminants Collaborative Research Support Program will become a truly collaborative, integrated program.

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## INTRODUCTION

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JERE GILLES

The three papers and literature review contained here are products of the Symposium on Andean Peasant Economics and Pastoralism which was held at the University of Missouri-Columbia January 16-18, 1980. The conference was made possible by UMC's participation in the Small Ruminants Collaborative Research Support Program (Small Ruminant CRSP) -- a research program designed to increase the production and utilization of sheep, goats and alpacas by small producers in developing nations. This publication is designed to serve as an introduction to some of the problems of peasant pastoralists in Peru.

Peru has been chosen as one of the research sites for the small ruminant research program because of the importance that sheep and alpacas have for the nation and for the poorer highland populations. Presently there are approximately 13 million sheep, 2 million alpacas and 2 million goats in Peru. Sheep and alpacas make an especially important contribution to the well-being of Indians/peasants in the high Sierra.

The highland Indian populations of Latin America number among the poorest inhabitants in the region. In Peru a very large portion of the Indian population lives in the *comunidades campesinas* or indigenous communities in the high Sierra. It has been estimated that approximately 345,000 families belong to these communities and that about 75 percent of all agricultural land in the Sierra is owned by these *comunidades*. Most communities are located at elevations above 3,600 meters and their land extends up to the permanent snow line. Less than five percent of this land is suitable for cultivation leaving the rest of the communities' land holdings suitable only for pasturing livestock. Crops are grown at the lower elevations but members of the communities are

largely dependent on their livestock, especially sheep, alpacas and llamas, for food as well as for income.

A significant portion of the land not held by the *comunidades* is made up of lands formerly belonging to large haciendas. Under agrarian reforms in the early 1970's they were organized into Sociedades Agrícolas de Interés Social (SAIS). The former haciendas have not been subdivided and are operated as single large economic units. They are, however, "owned" by the *comunidades* that surround them and by the former workers on the hacienda. The research conducted by the Small Ruminant CRSP is designed to improve the level of living of community residents through the development of improved small ruminant husbandry.

#### THE SMALL RUMINANT COLLABORATIVE RESEARCH PROGRAM

The Small Ruminant Collaborative Research Program represents the first of a number of agricultural research programs made possible under Title XII of the International Development and Food Assistance Act of 1975. This legislation created a Board for International Food and Agricultural Development (BIFAD) that was charged, together with USAID, with overseeing the new category of agricultural research funds that were intended to improve food production and utilization throughout the world.

In the past, most support for international agricultural research from the United States government came in the form of short term contracts to individual researchers or research institutions, or through support of the various international research centers such as the International Rice Research Institute (IRRI) and the Wheat and Maize Improvement Center (CMMYT).

The research of the international centers has led to sizeable increases in the production of many food crops and will continue to be supported in the future. The contracting approach appears to have been less than satisfactory. Few U.S. agricultural research institutions were willing to commit their best scientists for the long periods of time needed for successful agricultural research programs. Funding from federal sources was of a short term nature and was perceived as being peripheral to the research programs of state agricultural experiment stations. As a result, much of the United States' vast agricultural research talent did not contribute directly to the elimination of hunger in the Third World.

The idea of the Collaborative Research Support Program (CRSP) was born to create an incentive for U.S. scientists to develop long term cooperative research arrangements with researchers in the Third World. The purpose of the program is to link institutions with common research interests in problems of world food production rather than encouraging the creation of new research programs totally dependent on outside funding. In addition, the research emphasis was to be upon technology that would increase the production and utilization of food by small holders and the poor in developing nations.

Small ruminant research was identified as one of the first CRSPs. There are approximately 800,000,000 sheep, goats and alpacas in the developing world and the bulk of these are held by pastoralists and by small and medium sized farmers. These animals provide meat, milk, fiber and hides for home consumption and sale. Meat and milk are particularly important as sources of protein in diets often deficient in protein. In addition to small ruminants being important to small producers, small ruminant research was given priority by BIFAD because there is not currently an organized international research effort on small ruminants. Although there is some research conducted by ILCA (the International Livestock Center for Africa) and by some national governments, additional research funds were needed to supplement these efforts.

Another reason for choosing small ruminants as a problem area was the great potential for improving their production through research. For example, small ruminants are little used in the humid tropics where large amounts of forage exist which is suitable for goats and tropical sheep breeds. There is in these regions a tremendous potential for increased small ruminant production if certain constraints can be overcome. In arid and semi-arid regions, overstocking and/or improper management have resulted in poor pasture conditions and sub-optimal nutritional levels for animals. These conditions result in low levels of productivity. A combination of improved pasture, feed and herd management could improve production of sheep, goats and alpacas.

A consortium of thirteen U.S. institutions with research interests and strength in small ruminant research were selected to participate in this program.<sup>1</sup> This consortium is headquartered at the University of California at Davis. If agreements of cooperation can be reached between the consortium and foreign research institutions, research will be conducted in five sites -- two areas of the humid tropics -- Indonesia and Kenya; one high altitude site -- Peru; and two semi-arid sites -- Northeast Brazil and Morocco.

Research in each site will be multi-disciplinary, and integrated through a site coordinator and a committee of researchers. For example, in Peru there will be seven disciplines conducting research -- range management, forage crops, animal health, breeding, systems analysis, economics and sociology. The program is to be collaborative in two senses -- it involves both collaboration between U.S. and Third World scientists of the same discipline as well as interdisciplinary collaboration.

The sociological component of the program is the responsibility of the Department of Rural Sociology at the University of Missouri-Columbia. Sociological research will have an important place in the research conducted in all research sites. Before the mid-1970's, social science research in agriculture was begun some time after the initiation of production research. Once biological researchers developed more productive technologies, economists were asked to determine their profitability and sociologists were asked how the new technology could become acceptable to farmers. This "traditional" approach to social science research in agriculture had several drawbacks. Experience with the Green Revolution has shown that this led to unexpected and unwanted consequences for the rural poor. In some cases the improved production practices produced by agricultural research establishments were adopted only by the richest rural residents. These persons in turn often used the profits from improved practices to dispossess the rural poor. In other cases, reduced employment opportunities for the landless resulted. Considerable suffering resulted from the development of agricultural technology inappropriate to the needs and means of the rural masses.

The initiation of social and economic research before or at the same time as biological research can reduce the probability of undesirable effects of the introduction of improved technology. By collaborating with social scientists, the livestock researcher can be made aware of the social and economic constraints faced by small producers. Social scientists can in turn benefit by learning the technical limits faced by peasants who try to improve production. This mutual understanding should permit the development of technology which is suitable for the small producer. At the very least, it should be possible to predict some of the difficulties that the adoption of improved techniques will pose and then to recommend ameliorative strategies. Thus, the social sciences have three important objectives:

- a) to gather baseline information on the current organization of small ruminant production and the utilization of small ruminant products,
- b) to use this information to identify constraints to the acceptance of more productive practices, and
- c) to identify potential problems that new technology may pose to small holders and to poor urban consumers.

#### SMALL RUMINANT RESEARCH IN PERU

Seven disciplines are actively involved in field work in Peru -- animal breeding, range management, herd health, forage crop production, systems analysis, economics and sociology.<sup>2</sup> Researchers in these disciplines from the United States and Peru will cooperatively conduct research on small ruminants. Research is to be coordinated through the Small Ruminant CRSP's management entity and the Instituto Nacional de Investigaciones Agrarias, (INIA) American researchers will work with collaborators at the Universidad Nacional Agraria -- La Molina, the Instituto Veterinario de Investigaciones Tropicales de Altura (IVITA) at San Marcos University and at Centro de Estudios Andinos -- Cusco.

Eventually, studies will be conducted in both Central and Southern Peru. Research in Central Peru will be conducted in the Departments of Cerro de Pasco and Huancavelica and will be oriented toward sheep production. Research in the South will be concentrated in the Departments of Cusco and Puno and will be concerned primarily with alpaca production. However, comparative studies of the two species will be conducted in both regions.

Much of the high altitude land in Peru is made agriculturally productive by the grazing of small ruminants which convert forage into useful animal products. Sheep and alpacas are valuable meat and fiber producers; however, their productivity is limited by a number of factors. Among these are a harsh natural environment, a deteriorating feed supply caused by overgrazing, low animal productivity due to a lack of nutrients, health problems and a low genetic potential of a large proportion of the native sheep population. In addition, poor market conditions, the lack of information and/or resources may prevent small producers from adopting more productive techniques. For the production of alpacas, the lack of almost any scientific information on the production of meat and fiber by this species and the lack of knowledge concerning the animal's basic nutritional requirements prevents the development of improved husbandry.

Increasing the productivity of the high altitude pastures in terms of animal production depends primarily on the combined effects of the land's forage producing capacity and the ability of the animals to effectively harvest and utilize the forage. Land and animal management are closely related. Thus, healthier animals, improved breeding, better pasture management and supplementary feeding by themselves may lead to negligible improvements in productivity; fewer, but more highly productive, animals on properly managed land can lead to increased productivity per acre with less grazing pressure.

Likewise, productive management strategies are not likely to be followed if there is no economic incentive to do so, or if the management of communal grazing lands is not socially or politically feasible. Thus, any research which has the objective of improving small ruminant production in the high regions of Peru must be multi-disciplinary. To the extent possible, the biological researchers will share the same research facilities, flocks and pastures. The economic and social research components will be coordinated with the biological research but research will be conducted in locations "uncontaminated" by the presence of a sophisticated livestock research operation.

It is the goal of the production scientists to increase the production of small ruminants by improving the nutritional levels of animals through controlled grazing of highland pastures, through supplemental feeding, and through improved herd management. In addition, improved breeding, improved management and better animal health should, with improved nutrition, lead to better quality meat and wool production and a dramatic increase in the number of lambs and young alpacas produced from a given number of female animals. Social scientists must provide crucial information if these goals are to be realized.

For example, increased production from native pastures requires management both of the number of animals and of the frequency which the animals graze on communal pastures. For a range management strategy derived from research to be successfully implemented, a socially acceptable means of managing communal pastures must be found. This in turn implies that a large number of empirical questions must be answered. First, baseline information on the composition of herds and the present practices of grazing and supplemental feeding must be gathered. Then differences in herd composition and management between different socio-economic groups must be examined. Once this information is available, then the factors that encourage and/or inhibit

over-stocking must be examined. For example:<sup>3</sup>

- 1) What is the relationship between increased human and animal populations?
- 2) What are the social and cultural incentives to increased herd size? For overstocking?
- 3) Are there already ethno-classifications of pastures and plant types?
- 4) What are the traditional mechanisms that regulate both access to pastures and the number of animals in pastures?
- 5) Are there production bottlenecks that presently limit the size of herds "naturally"?
- 6) Is the alteration of present patterns of communal grazing a precondition for the introduction of increased productivity from sheep and alpacas?
- 7) If an alternative grazing pattern is required, what are socially acceptable alternatives?

Any attempt to improve the genetic quality of animals assumes that desirable traits to be achieved through selected breeding are known. Desired traits from the point of view of the international wool markets or large ranchers are known. The sociologists must help the geneticist identify what are desired animal traits for the small producers living in the indigenous communities. For example:

- 1) What are culturally important livestock traits for highland *campesinos*?
- 2) What are the qualities of fiber that are required for handicraft production?
- 3) What are the types of animals preferred for meat by rural and urban low income consumers?
- 4) What types of animals are best suited for charki and other traditional methods of food processing?

It is up to the sociologists and the economists to provide information about desired animal traits.

In addition to narrow production questions, there are questions that are largely social and economic in nature. An important assumption of the production scientists -- both Americans and Peruvians -- involved in the project is that small producers in highland Peru will find it desirable to adopt new production strategies. If they find it desirable, will they find it within their means to do so? For example, do the peasant producers possess resources necessary to adopt the improved management practices? For example:

- 1) Do peasants have access to the capital and/or information needed to adopt new practices?

- 2) Will there be adequate returns to the investment of capital and livestock or do there exist more profitable alternatives?
- 3) Do the labor requirements of improved small ruminant management conflict with the requirements of agriculture?
- 4) How dependent is improved small ruminant production on labor inputs from women and children? If it is, is there a conflict between small ruminant production and educational attainment by children?

Types of technology that are of little interest to peasants should not be developed unless the potential returns from them are sufficient to warrant a significant restructuring of the organization of peasant life. By working with the animal breeders and range managers, social scientists should be able to help identify approaches that have the best chance of acceptance by peasants under existing economic and social conditions.

In addition, it is important for the social scientists to help other researchers and policy makers to decide whether or not the improved productivity of sheep and alpacas will result in better nutrition or better standards of living for the people living in the high Sierra. Some questions regarding this have been:

- 1) Are there markets for increased amounts of meat, fiber and hides?
- 2) To whom will the benefits of increased production of these products accrue -- to middlemen?, to the government?, to urban consumers?, or to the small producers?
- 3) Will innovations displace or create unemployment for significant portions of the rural or urban poor?

Lastly, if the present social and economic conditions in the high Sierra make it difficult for the benefits of increased production to accrue to the peasant herder, what are the institutional and/or policy constraints to the improvement of peasant life? If these constraints are identified and alternatives suggested, it may be possible to create conditions under which the results of livestock research can benefit the poorer residents of rural Peru. Possible constraints might be:

- 1) the land tenure system,
- 2) government marketing policy,
- 3) organization of livestock credit, and
- 4) access to technical information.

All of the above questions require considerable amounts of research. Fortunately for the Small Ruminants CRSP, Peruvian and American social scientists have already done considerable work on peasant livestock production --

particularly in Southern Peru. In order to take advantage of this experience, the Symposium on Andean Peasant Economics and Pastoralism was organized.

#### THE SYMPOSIUM

The Symposium on Andean Peasant Economics and Pastoralism was designed to bring together persons who have considerable research experience in the Southern Andes of Peru with the social, plant and animal scientists involved in the Small Ruminant Research Program in Peru. This was done in order to begin answering some of the questions raised above and to establish common points of reference between the social and biological scientists involved in the project. All American scientists involved in Peruvian research were invited to attend the conference. In addition, most were contacted by phone and invited to give a brief outline of their research goals and invited to submit questions for discussion by the symposium's participants. A list of participants can be found at the end of this volume.

Three American researchers were invited to give papers during the three day symposium. Each day was devoted to the discussion of a different topic. The first day was devoted to a paper by David Guillet, of the University of Missouri-Kansas City, entitled "Peasant Economics and Risk Taking in the Southern Sierra." Special emphasis was given to peasant decision-making. The second day featured a paper by Gordon Appleby, of the California Institute of Technology, on "Markets and Marketing Systems in the Southern Sierra." The Appleby paper gave particular attention to the effects of the development of wool marketing on the development of the region. The third day was dedicated to a paper by Benjamin Orlove, of the University of California at Davis, entitled "Pastoralism in the Southern Sierra." This paper focused on the herd and resource management strategies employed by pastoralists in high altitude areas of Southern Peru.

The format of the conference was designed to facilitate the maximum amount of discussion about Peruvian small ruminant production. Each morning was devoted to the presentation of one paper. Afternoons were dedicated to discussing applications of the papers to the problems of small ruminant research and development in Peru. Morning sessions were open to the public while afternoon sessions were limited to participants in the small ruminant research project.

In addition to those researchers who presented papers, three Peruvian scholars were invited to participate as discussants. These were Jorge Flores-Ochoa, Felix Palacios-Rios and Domingo Martinez de Castilla.<sup>4</sup> All are social scientists who have already done research on small ruminant production in Peru. Dr. Flores-Ochoa, who heads the Centro de Estudios Andinos -- Cusco, is recognized as the forerunner of anthropological research on Andean pastoralism. Mr. Palacios-Rios is presently at Cornell University completing work toward a doctorate in anthropology on alpaca pastoralism in Southern Peru. Mr. Martinez is an agricultural economist on the staff of the Universidad Nacional Agraria -- La Molina. He is presently doing research on sheep and alpaca production in Peru's Central Sierra.

The Peruvian scholars, the contributors of papers and the other American participants worked closely together during the symposium to identify critical research areas for social and biological scientists related to small ruminant production. All who attended benefited greatly from the interchange. In order to extend the benefits of the conference to those who were unable to attend the symposium, it was decided to produce this volume. It contains each of the three papers presented at the symposium as well as a short review of the anthropological and sociological literature on Andean pastoralism. It is hoped that these papers can serve as an introduction to the lives and problems of small peasant livestock producers in Southern Peru for biological and social scientists wishing to learn about the area.

## FOOTNOTES

<sup>1</sup>These institutions are: University of California at Davis, California Polytechnic Institute-Pomona, Washington State University, Utah State University, Montana State University, Colorado State University, Texas Technical University, Texas A&M University, Winrock International Livestock Center, University of Missouri-Columbia, Ohio State University and North Carolina State University.

<sup>2</sup>The universities involved are: Montana State University - animal breeding, Texas Technical University - range management, Colorado State University - animal health, Ohio State University - forage crops, Texas A&M University - systems analysis, Winrock International Livestock Center - economics, and the University of Missouri-Columbia - sociology.

<sup>3</sup>Special thanks are owed to Connie McCorkle and Terry West for their help in putting together this section.

<sup>4</sup>A fourth discussant was Dr. David Browman from Washington University-St. Louis.

## RISK MANAGEMENT AMONG ANDEAN PEASANTS

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DAVID GUILLET

This paper is concerned with the microeconomic parameters of the Central Andean peasant economy and the behavior of peasants in the face of risk and uncertainty. Rather than enter directly into these issues, however, I wish at the outset to discuss briefly the general nature of peasantry in the Central Andes and the manner in which it is incorporated into the nation/state. My reason for doing so is to counteract a tendency in studies of economic change among peasants to accord the individual too much freedom of action and to ignore the manner in which national and regional political economic structures restrict possibilities for expansion of production (cf. Long 1977:142).<sup>1</sup> This tendency is exemplified in the economic and anthropological literature by presenting behavior under risk and uncertainty as a problem of the maximization of production inputs under the constraint of a given level of information about outcomes. In perhaps the best example of an anthropological study of this genre, Frank Cancian analyzed the response of Zinacantan corn farmers in southern Mexico to opportunities created as a result of government roadbuilding and corn buying programs. His contribution was to relate behavior under uncertainty to rank in an economic stratification system, a theory which has subsequently, been amplified and debated in the agricultural economics literature (Cancian, 1972, 1967; Gartrell et al, 1976). In an important, but often overlooked, appendix to his book, Cancian explains his position on the economic motivations of peasants. He argues against the notion of a "tradition bound" peasantry in contrast to a pure "economic man." According to Cancian, there are no "pure" economic men in the sense of an actor obeying strictly economic motives: all human groups

are embedded in a cultural matrix which specifies the values to be maximized and therefore affects their maximizing behavior. Since economic factors are always dependent on the prior definition of non-economic factors, "it is impossible to state that noneconomic factors are more or less important than economic factors (Cancian, 1972:197)." His position on the issues of economic motivation allows him to construct a theory of behavior in economic change that can apply to both peasants and Midwestern farmers.

I am in basic agreement with Cancian and others on the cross cultural application of maximization principles. I would like to suggest, however, factors of a different order which distinguish the performance of peasants from Midwestern farmers. Peasants differ in their freedom to select alternatives to existing ones. Their relative lack of freedom derives from the manner in which surplus time, labor, cash, and kind are appropriated by other social groups. Turning to the Andean area, then, I wish to ask two inter-related questions: (1) to what extent are peasants able to expand production, and (2) are constraints on production due in full or part to the form in which peasants are incorporated into the larger society?

In order to understand the difference between peasants and "primitives," on the one hand, and peasants and Midwestern farmers, on the other, it is useful to examine the disposition of surplus labor, time, cash, and kind above subsistence needs. In the case of primitives who produce a surplus, notably that range of societies which anthropologists classify as chiefdoms and tribes, such surplus is generally expended on ceremonial activities. In contrast, peasants devote at least a large portion, if not all, of their surplus to superordinate social groups which constitute classes in agrarian societies. Midwestern farmers can be thought of having significantly lesser demands on their available surplus and access to the latest agricultural technology for improving production and productivity. They are thus able to expand production up to the optimal limits set by a given agricultural technology.

One finds in the recent history of Andean peasantry several mechanisms for appropriating surplus. They include the following: (a) Rent paid in labor services. The incidence of the exchange of labor for a usufruct plot or pasture rights from an hacienda, once common, has declined in Peru after 1969 and in Bolivia following the 1952 Revolution due to the enactment of agrarian reforms. A continuing variant, however, is the draft of peasant

labor by government representatives to maintain roads and **construct public works** projects such as soccer stadiums and urban market places. (b) Rent in kind. A return of a share of the harvest to the landowner in exchange for the rights to use land. This pattern is common, particularly in the higher ecological zones. (c) Extraction of surplus value. Semiproletarian peasants work for wages which are kept low since the peasant provides his own subsistence needs. Cheap peasant labor is a major means of surplus capture. (d) Extraction via the terms of trade. Unfavorable prices received by peasants for the commodities they sell relative to the commodities they purchase. Low agricultural product prices may result from a variety of causes including competition from capitalist agriculture, international transmission of prices, government price policy, and monopolistic merchants capturing high profit margins (cf. Deere and de Janvry, 1978:12). (e) Usury. Although little research has been done on the subject, it is my impression that usurious interest rates are rather insignificant as a form of surplus capture in the Andes as compared with, say, South Asia. (f) Land rent paid in cash. This is relatively rare among small scale peasants due to the scarcity of available cash. (g) Head taxes. Taxation occurs through levies on certain production and distribution processes such as that levied in Bolivia on the manufacture of *trago* (cane rum).

The cumulative effect of these forms of surplus extraction is to place exorbitant demands on peasants (Deere and de Janvry, 1978). They are unable to utilize available surplus to expand production with traditional alternatives. Further, while new alternatives, in the form of fertilizer, insecticides, fungicides, and improved seeds, are available, of which peasants are, in fact, aware, they have little if any monetary capital to take advantage of them. One does not need, then, to explain their lack of responsiveness by "tradition", but rather a general imbalance in the mix of production factors and a specific lack of capital. Performance, then, is only barely sufficient to maintain current consumption levels, meet claims on surplus, and reproduce the household. While there is evidence that peasant expenditures on ceremony, i.e., the ubiquitous "cargo" system, are decreasing (Isbell, 1971; Guillet, 1974a; Gow, 1973), I would argue that the reason is not necessarily a shift toward other more modern forms of status emulation as I, at one point, and others suggested, but rather a decline in the quantity of available surplus. The structure of peasant societies like

those of the Central Andes and the demands on peasant surplus result in an extremely limited ability to expand production.

But would Central Andean peasants expand production if they could? This question relates directly to models which have been constructed of peasant household production strategies, or the peculiar type of economic behavior which Polanyi referred to as "householding" (Polanyi, 1957:254). These models lie at the heart of a debate over the efficiency of peasant production. Schultz (1964) argues that peasants are "poor but efficient" farmers who allocate the factors of production at their disposal in a most rational and efficient manner. A contrasting position is that of A. V. Chayanov (1966); it holds that the basis of the peasant economy is the family farm, an economic unit which exploits the members of the family as its primary labor source in producing for a level of subsistence and satisfaction, a "constant state of well being" that is consistent with the perceived needs of the family. Once this level is reached, any additional production becomes superfluous and distasteful because of the drudgery involved. The level set by the equilibrium between the perceived needs of the family and the labor required to meet those ends is a crucial point; beyond it the family farm will not strive to maximize productivity or profits in the neoclassical sense of the firm.

Unfortunately, with one exception that will be discussed below (Ortiz, 1973), microeconomic models of behavior have not been tested among Andean peasants. Instead, one finds economic behavior analyzed most commonly under the rubric of adaptation. This concept comes from biology where it has a rather specific meaning of "differential reproduction." In the Andean literature, it is utilized to examine peasant response to economic and environmental constraints. Perhaps the most typical example is the explanation of a pattern of production or exchange as "adaptive" to the peculiar vertical ecology of the Andean mountains. The concept of adaptation does have certain advantages: it implies a dynamic rather than a static response to constraints and it helps to reveal the multifaceted manner in which Andean peasants use cultural resources to survive in a very difficult environment. But, the concept is extremely imprecise and non-operational. First, one searches in vain for examples of non-adaptation. Second, the manner in which it is used makes it difficult to determine if one alternative is more or less adaptive than another. Third, adaptiveness becomes

tautologically true for any situation. And, fourth, and most important for our purposes, the concept of adaptation mystifies the actual manner in which peasants allocate resources in a given production or exchange strategy.

One can conclude, then, that intensive analysis of production and exchange strategies among Central Andean peasants would be an extremely fertile subject for study. Such research need not rely on sophisticated formal models which have been criticized as artificial and overly complex (Fjellman, 1976). There are a variety of approaches, including flow models (Guillet, forthcoming), satisfying models (Simons, 1957), "rules of thumb" (Baumol and Quandt, 1964), decision trees (Gladwin, 1979), indifference analysis (Edel, 1969), and others, which more closely approximate the manner in which real people make decisions in real situations.

In lieu of available studies of microeconomic behavior it is difficult to make more than the most general and facile observations. It is even debatable whether one model of peasant production strategies is sufficient to explain all peasant allocative behavior. One marvels for example at the attempts to extend the Chayanov model to several very different domains of peasant allocation. Never having been one to heed my own warnings, however, I would like to share with you a rather impressionistic model of the manner in which Andean peasants allocate their production inputs. It is based on my experience as an anthropologist and development worker in Peru, Bolivia, Ecuador, and Colombia. In my view, such behavior contains two stages: the first is to ensure that subsistence needs are met, and given that, the second is to allocate inputs to production for exchange. This orientation is based on the smallness of scale of production factors and the generally uncertain and exploitative natural and social environment in which peasants live.

Available data does not allow one to reconstruct peasant notions of subsistence in precise quantitative terms. What data do exist suggest that such notions are instrumental in peasant allocation decisions. For example, in my work in a community in the Department of Cuzco, I found that peasants were quite able to name the strategies they were following in a particular agricultural cycle. Mario seeded in 1972 three parcels of varying size in a sectorially fallowed puna with the staples of *habas* (broad beans) and potatoes. He seeded a total of one topo in potatoes, in two separate plots, and two and a half topos of *habas*. He was "banking on the *habas*" to

allow enough of a surplus to meet his cash needs. If he was successful in producing the expected four sacks of habas, he would hold them until prices rose and middlemen visited the community from the Convencion Valley. In my experience, production strategies given by peasants will invariably state the quantities that they are expecting to set aside to consume until the next harvest; these quantities are based on the consumption requirements of the household.

One important notion of subsistence is in the continued use of the term "topo" as a measurement of land. This term has been found through ethno-historical investigation to refer to the amount of land considered to meet the subsistence needs of the household (Rostworski de Diez Canseco, 1962). Contrary to the efforts of colonial and republican authorities, the amount could not be quantified absolutely, but varied according to the size of the household, the quality of land, and its location in one of several micro-ecological zones. The same author suggests further that there was a fixed quantity of *chicha*, the fermented corn beverage, that was set for daily use, in fiestas, and in ritual libation. This accords with at least one contemporary use of *chicha*, in the *hurk'a*, which is a fixed quantity of *chicha*, as well as coca leaves, rum, and cigarettes, that is consumed during the morning and afternoon break from work in the fields. Thus while we cannot be absolutely certain of the content of contemporary "ethno" notions of subsistence, there is both observational and ethnohistorical data to suggest that such notions exist.

Obviously, such a model is but a working hypothesis that seems to fit with some kinds of observable behavior in the Central Andes, and, together with other models, needs to be tested in the field. Its basic parameters, though, conform to those suggested by Ortiz (1973) for the Northern Andes, Bartlett (1977) for Costa Rica, and elsewhere (Day, 1971). Thus, household heads will assure in their production mix that sufficient inputs are allocated toward meeting the subsistence needs in kind for the household. Such needs obey local definitions of a satisfying lifestyle and are adjusted to the age and sex composition of the individual household. This basic orientation derives not from production or profit maximization, but from what might be called reproductive maximization: the goal of security and survival of the household. As a result, the value of the subsistence staples is set at above the retail price for these commodities (see Chibnik, 1978). Once the

household head is satisfied that sufficient productive inputs are designated for subsistence needs then he will allocate the remainder for exchange. Exchange can involve either barter or market transactions. There is evidence that the former, however, are regulated by market pricing mechanisms, so that market forces enter indirectly into the valuation of use values for barter.

With respect to labor use, it would appear that peasants are rather efficient (Brush, 1977; Guillet, 1976b). This work suggests that peasants are fully employed during the agricultural cycle but experience dead periods between the end of harvest and the beginning of the next cycle. There is thus little if any underemployment and certainly no unemployment during the agricultural cycle. One can conclude that if labor were removed from the household during this period, production would stop. The relative efficiency of labor use is a reflection of the push to intensification by the scale of production and the low level of capital available to small scale peasants.

While these rules govern small scale production, it should be recognized that considerable variation can be found. Within communities there is substantial differentiation, producing the classic range of landless to land poor to land rich peasantry (Fonseca Martel, 1976). On the latter end of the spectrum, one finds increasing evidence of shifts to production for exchange and profit maximization. A complete shift would seem to be rather rare, however, as some subsistence production continues to exist even among wealthier peasants (Fuenzalida et al, 1968). Between communities there is an additional element of variation. Brush and others have found that communities will select an overall production strategy based on their access to resources and, in some cases, specialize in production for exchange (Brush, 1977:10-16; Forman, 1978). The latter obtains among communities that are pushed into or decide to specialize in the products of a particular ecological zone. This, then, will force individual peasants into production for exchange and increase the risks of distribution.

### RISK AND UNCERTAINTY

I would like to turn now from a general discussion of peasant production to a more explicit concern with risk and uncertainty. I will consider both agriculture and pastoralism as interrelated aspects of peasant production and exchange, since, with some exceptions (see Webster, 1973), peasants

follow a mixed agro-pastoral strategy: i.e., growing food crops and keeping domesticated animal species for use and exchange. My usage of the terms certainty, uncertainty, and risk will follow that of Luce and Raiffa (1957: 13):

(Decision problems can be grouped into three categories)...  
Certainty if each action is known to lead invariably to a specific outcome...risk if each action leads to one set of possible outcomes, each outcome occurring with a known probability. The probabilities are assumed to be known to the decision maker...uncertainty if either action or both has as its consequence a set of possible specific outcomes, but where the probabilities of these outcomes are completely unknown, or are not even meaningful.

Peasants experience risk and uncertainty in traditional production and exchange decisions and in response to new economic opportunities. There are significant differences, however, between the two types of decisions. In traditional agro-pastoralism, because of past experience peasants are able to assign probabilities to courses of actions: their decisions can be characterized as risky. In situations of economic change on the other hand, new production and exchange alternatives produce weak probability assignments or none at all. Note that it is quite possible for a crop or an animal scientist to assign probabilities to a new technique or crop variety but for a peasant to be completely uncertain about such outcomes. Given the differences between the two types of situations which will be explored below, I will refer to the former as endemic risk and the latter as innovative risk.<sup>2</sup>

Endemic risk factors are widespread in the natural environment of the Central Andes. In fact, mountain agriculture and pastoralism are extremely hazardous throughout the world. One finds, in particular, in the Central Andes considerable variation in crop yields due to disease, pests, saline soils, frosts, drought, and other factors. It has been estimated, for example, that the southern highlands of Peru suffer crop failure equal to the loss of one complete crop every seven years (Plan Regional Para El Desarrollo Del Sur Del Peru, 1959:8). Llamas, alpacas, and sheep are susceptible to predation (from puma, fox, and condors), straying, exposure, theft, lack of adequate pasture of sufficient quality, and disease. While purchased inputs are at a minimum, there is considerable variability in the costs of seed, fertilizer, insecticide, fungicide, etc. Lastly, the prediction of prices

obtained for commodities has to take into account variation caused by monopsony situations, availability of transportation, government price policies, and other obstacles in the marketing channels (Bromley, 1975; Slater et al, 1969; Esculies Larragure, 1977; Orlove, 1977a; Appleby, 1976).

Normally, one of the functions of development policy is to lower risks for the producer. In Peru, however, government efforts have been largely ineffective in controlling variability for the small scale producer in the two areas over which it has most control: costs and prices. In part, this derives from agrarian policies which in the past favored the large scale "rationalized" export enterprises. These policies continue in the present with their expropriation and incorporation into the reform sector. As a result, the small scale sector continues to be ignored (Bayer, 1975; Fitzgerald, 1976, 1979).

The example of guano, on the cost side, comes to mind. Guano is a very rich organic fertilizer mined from islands off the Peruvian coast. Guano has been in the past one of the relatively inexpensive means through which highland peasants could improve the productivity of their land. Beginning in the latter part of the 19th century, however, guano began to be exported in large quantities (Bonilla, 1974), and later, following a drop in demand, was diverted to large scale export enterprises on the coast. Government policy at present is to replace guano in highland agriculture with chemical fertilizer manufactured in plants such as Cachimayo in Anta province of Cuzco department. Yet the shift creates a dilemma for the highland peasant: chemical fertilizer is much higher in cost than guano and is very susceptible to cost fluctuation. This became dramatically apparent when all petroleum based agricultural inputs, including chemical fertilizer, insecticide, and fungicide, increased substantially in price following the 1974 oil embargo.

Price variability is always difficult to control since most agricultural commodities are produced on a seasonal basis unlike products of industrial manufacture which can be more easily adjusted to regulate supply. For this reason, government pricing programs for agricultural commodities have been a common and pervasive form of intervention in many countries. Peru came around only in the last decade to a serious attempt at creating a consistent marketing and pricing mechanism through its Empresa Publica de Servicios Agropecuarios (EPSA). Most of EPSA's efforts have been to create channels and favorable prices for the marketing of the products of the government-run

reform enterprises. It has been largely ineffectual, if not detrimental, for the small scale farmer intent on obtaining a fair price for his products and reasonable information about market swings.

Government effort has been least successful in controlling yield variability for the peasant producer. Research and development directed toward the small scale sector has been insufficient. Extension efforts, outside of the reform sector, have been plagued by a lack of involvement with peasants on site and outside the confines of the office (personal communication, Andre Michaud Black). In fairness, it must be admitted that controlling yields in Peru is extremely difficult because of high endemic risk factors and the problem of bringing produce to market caused by the remoteness and inaccessibility of many of the highland valleys.

Innovative risk involves different factors from those found in traditional agro-pastoralism. Let us reflect for a moment on innovative risk in production. We have a fairly good idea of the overall risk parameters involved, for example, in the introduction of a new cash crop. These factors cluster around a lack of knowledge of the cultural practices needed to grow the crop and the lack of an experimental basis against which to predict its local rate of success or failure. Growing tomatoes for market in place of potatoes for subsistence would include, in this sense, such variables as method of seeding, humidity control, spacing, as well as knowledge of processing, storage characteristics, and packaging. The introduction of improved breeds of native animals, i.e. alpacas, llamas, and vicuna, and of introduced exotic breeds of sheep and goats, carries with it somewhat different risk factors. While production practices, including feeding, herd management, and processing, would be very similar if not identical to traditional patterns, the major question is the adaptability of introduced animals to the natural environment. While exotic species have been introduced historically into lower altitudinal zones with some success, the higher zones are much more unstable and problematic.

Risk factors associated with new exchange opportunities (including barter and sale transactions) are less well understood. Entering into market transactions through sale is a particularly risky decision for the subsistence producer. He is faced with such factors as: the determination of the effect of demand on price, optimum principles of market location, the correct use of volumes and quantities, optimum merchandising techniques, the

rules for social interaction in the market place, and the symbolic aspects of money use (Codere, 1968).

These risk factors must be taken into consideration by a peasant contemplating a new economic opportunity which has emerged through traditional communication channels. They are also attached to alternatives created by programs of planned change fostered by an outside agency. In the latter case, however, there are two additional risk factors which are not usually considered. First, change agents often belong to different socio-cultural reference groups, if not social classes, from the target peasant population. Second, planned economic change is based on policy decisions which too often reflect political rather than sound economic motives; as such they are subject to frequent shifts of a political nature.

I found these two factors to be extremely relevant to explaining peasant behavior under risk and uncertainty in my study of the 1969 Agrarian Reform cooperatives (Guillet, 1979). In the first case, cooperative administrators and advisors were recruited from outside the highlands, usually from graduates of agricultural colleges on the coast. Peasant beneficiaries were quite suspicious of these "criollo" administrators who stressed social distance and were unaware of the role that social change could have in their performance. Even their questions designed to explore the range of local agricultural practices were interpreted as "criollo" ignorance. There is no question that the social composition of middle and local level change agents increased risk in a very important way. In the second case, frequent policy shifts at the local level in response to political decisions taken by the military junta played havoc with peasant perception of the economic alternatives created by the reform. These shifts and historical awareness of reversals of agrarian policy associated with the changes of government, increased risk even further.

### RISK REDUCTION

One of the difficulties with decision models of risk and uncertainty is their static quality: they assume that the quantity of information available about outcomes is given and unchanging. This bias is similar to the view that peasants respond negatively to opportunities created by economic change because of the overwhelming degree of risk and uncertainty contained in such opportunities, i.e. they are risk averse (Wharton, 1971:160). While our

review of risk factors does suggest their enormity in the face of the smallness of scale of peasant production, one should not automatically conclude that peasants resist innovation. In fact, Andean peasants do respond to economic opportunities and part of this response is based on mechanisms for reducing endemic and innovative risk. I would like to turn now to some of the means through which risk is managed.

### DIVERSIFICATION

If one were to consult a financial adviser in an industrial capitalist country for a personal investment portfolio, he would be strongly advised to build diversity into his selection of stocks, bonds, precious metals, and highly liquid savings accounts. Depending on his age and composition of his household, he would be counseled to spread his assets across economic sectors, to ensure a mix of short term highly liquid assets and long term "lock in" assets, and use precious metals to hedge against economic and political uncertainties. His advisor would continually monitor the state of the economy to ensure that his client is well served and that there is sufficient turnover of assets to keep himself well fed and happy; as the client grew older and his household changed in composition he would further adjust his assets. This underlying principle of diversity which we take for granted in our investment decisions is the basic principle through which peasants manage risk in their own economies. I would like to now examine some of the mechanisms of diversification.

1. Mixed subsistence strategies. In communities which lie adjacent to the high puna and the lower tuber and maize zones, a mixed agro-pastoral subsistence strategy is followed. While observers have noted that this is a basic Alpine adaptation and is essential to the rejuvenation of the lower Andine puna through the recycling of organic matter (Custred, 1973; Brush, 1976), it has the effect of spreading risk across two very different subsistence strategies. Within the agricultural zones, where peasant homesteads tend to be located, agriculture is combined with the keeping of small animal species, notably guinea pigs. Bolton's work has shown that guinea pigs, in conjunction with the scheduling of their consumption through the fiesta cycle, are an important source of protein and an optimal use of amino acids (Bolton, 1979).

2. Mixed staple production. There are a wide range of staple items

available to Andean diets that have specific functions in managing risk. While the bulk of research has been oriented to the well known combination of potatoes and maize (see, for example, Grobman et al, 1961 and the publications of the International Potato Center), some information is emerging on the lesser known but equally important staples such as quinoa, tarwi, and canihua. I am not aware of a body of research on Andean camelids that examines herd management from the perspective of risk reduction in production. In my view, a mixed set of staples allows nutritional and dietary levels to be maintained through the combination of traditional cultivars highly adapted to the vertical environment of the Andes. In the upper reaches of the slopes, for example, up to 3600 meters in altitude, canihua can be grown in protected sites and tarwi can be grown in the open (Gale, 1969, 1970). Canihua, in particular, is an important source of protein in a diet heavily laden with starches.

Besides diversification of staples across vertical space, one finds diversification in horizontal space: varieties of cultivar adapted to peculiar environmental conditions found in a particular ecological zone. In my fieldwork in Peru and Bolivia, I have found peasants continually distinguishing among micro-zones based on such features as protection from wind, drainage, humidity, salinity, etc. Utilization of these micro-zones is seen as contributing to the success or failure of an overall zonal production strategy. Associated with these micro-zones and variability in climate within a macro-zone are varieties of cultivars with special characteristics. Mitchell has described, for example, three varieties of quinoa, each of which is adapted to a certain altitudinal range within a puna ecological zone (Mitchell, 1976:9). Brush concluded that a typical peasant household grows between 35 and 50 local varieties of potatoes (Brush, 1976). These varieties can also be used in a dynamic response to environmental change. For example, in the case of maize cultivation in the Pampa de Anta, the usual seeding is from 25 August to 15 September. If a particular seeding does not germinate due to poor seed or climatic conditions, then a second seeding is done as late as the first week in October. In the second seeding a special seed called *pucutu* is used; although the yields from this seed are reported to be lower, it is more resistant to frost. If frost continues to fall as late as 15 October, then wheat or barley, which are more frost resistant, will be seeded.

Mixed subsistence strategies and staple production in the mountain environment of the Andes involves separate agricultural regimes, including herding, sectorial fallowing, long term fallowing, intensive irrigated agriculture, and specialized horticulture as well as specific forms of land tenure and labor use (Guillet, 1979, forthcoming). In essence, diversification is based on a complex interdependent system of land use, technology, choice of crop and animal species, carefully tailored to the characteristics of a specific vertical ecological zone. In fact, "verticality", first discovered in its relation to land patterns by the ethnohistorian John Murra (1976), is a characteristic of mountain agriculture in general and most specifically of mountain agriculture located in the tropic latitudes where the influence of altitude is great (Brush, 1976).

Aside from vertical and horizontal diversification, there are several other practices designed to reduce risk in agriculture which should be mentioned. They include: short cultivation cycles (Brush, 1977:98); intercultivation of crops such as broadbeans, maize, and tarwi or maize, peas, and broadbeans (Gade, 1969; Guillet, 1979:61); the growing of an aromatic herb around the edges of a plot (Guillet, 1979:61); and, the surveillance of fields during particularly hazardous periods of the agricultural cycle (Brush, 1977:95).

Diversification of production activities in both vertical and horizontal space forces the household head to obtain land in a variety of locations. Often these locations must change from year to year because of factors such as the selection of subsistence and cash crops to be grown, the availability of seed, fertilizer, etc. This explains, in part, the extreme parcelization noted among peasants in the Central Andes.

One common means to gain access to strategically located land in contemporary communities is through the use of social relations. Brush in his work in a peasant community (1975) in the northern highlands of Peru, found that sharecropping was of major importance in equalizing access to resources distributed among the local mix of ecological zones. In his sample of the composition of sharecropping arrangements, an overall average of 69% of kinsmen were selected to be sharecroppers as compared with 31% for nonkinsmen. Interestingly, fictive kinsmen were relatively unimportant in the selection of sharecropping partners. Custred, on the other hand (1973:44), finds that *compadrazgo* relations are important in the linking of peasants

living in different ecological zones. And, finally, Burchard suggests that marriage endogamy and exogamy may closely adjust to the location of and access to strategic types of land (Custred, 1973:43-44).

3. Polyvalency. Another mechanism for reducing risk is based on the need to control variability across economic sectors of the economy. One finds, in this regard, the combination within households of several forms of productive activity in addition to classically "peasant" production. These forms include: seasonal labor for wage opportunities in highland cities, coastal cities, and colonialization zones in the humid tropics. Others include: the sale of dairy products, taxi and trucking enterprises, cattle fattening, pig breeding, artisan, and a host of other small scale activities. Feder has termed this aspect of peasant production "polyvalency" (Feder, 1971:134-142). It is a major means of spreading risk across economic sectors and geographical space and securing alternative sources of income.

I have argued elsewhere (1978; forthcoming) that the Andean peasant economy contains a supra-household sphere of production that functions in several ways, one of which is to supply information concerning the impacts of an innovation. I find the collective social relations associated with the supra-household sphere operate in much the same way that Baily and his colleagues described for European peasant communities. In the remainder of this paper I wish to discuss two additional forms of social relations, the dyadic contract and the broker relationship, and the manner in which they enter into the risk management problem. My reason for doing so is that social relations have not been discussed in this sense in the Andean literature yet they offer an important insight into the behavior of peasants in economic change.

I would like to turn now to an examination of two cases of economic change drawn from my earlier work in southern Peru (Guillet, 1979). The first is a concomitant of the diffusion of market forces: the shift by peasants from subsistence agriculture to the cash cropping of onions. Here the focus is on the transition period when peasants in a community are just beginning to cultivate onions, i.e., the "early adoption" period. This is an extremely crucial stage in the shift to cash cropping: it is characterized by the emergence of entrepreneurs who allocate production inputs including land and labor under uncertainty, at worst, and high risk, at best. The second case is the response of peasants to the formation of a producer's

cooperative in which they were offered the opportunity of joining as part of an agrarian reform.

#### THE SHIFT FROM SUBSISTENCE TO CASH CROPPING

Rumipata is a community of approximately one thousand subsistence peasants located in the Pampa de Anta region of southern Peru. Subsistence involves the cultivation of land in two separate ecological zones: the floor of the valley, the *pampa* in which the community is located, and the *puna*, the slopes of the surrounding mountains. Each household possesses land in the puna held in usufruct from the community and a plot averaging .46 hectares in size in the pampa. Traditionally, maize is grown in the pampa and potatoes and other Andean tubers in the puna. Puna agriculture is based on the indigenous foot plow, the *chakitaclla*, while the oxen and plow and, most recently, the tractor, have been introduced into the soil preparation phase of pampa agriculture.

Following a series of events in the 1950s related to the urbanization of Cuzco, a major regional political and market center, a community in the entrance to the valley began to grow onions oriented to the Cuzco market. Onions proved well adapted to the local ecology, the market proved stable, and within a few years, all of the fertile bottom land in the community was cultivated in onions.

Anteño peasants were keenly interested in the shift to the cash cropping of onions and the first attempts began in Rumipata in the late 1960s. Initially a classic diversification strategy was followed based on a crop sequence of *maway* potatoes followed by onions. Maway potatoes are seeded early in the agricultural cycle to yield a crop which is harvested in time for the carnival fiesta period before the tuber has matured. Maway potatoes are consumed largely in a ritual meal served during the carnival fiesta. Introducing onions into the cycle following the maway harvest also had the advantage of extending the utilization of land and labor through the production of two pampa crops in place of the traditional wet season maize crop. By 1972, approximately 15% of the irrigated pampa land had been devoted to onion cultivation.

The cash cropping of onions in a subsistence economy is a classic case of innovative risk. First, yield availability was extremely risky although not completely uncertain since peasants had observed the success in the

initial community to adopt onions. The risk derived from the lack of knowledge of the cultural practices of growing onions, and the lack of an experiential base against which to predict the local success of onion cultivation. For example, onion cultivation is highly dependent on transplanting from seed sown in a seedbed when seedlings are about fingersize. This is a specialized technique which is not followed for any of the subsistence crops. Preparation of the seedbed, correct application of water, spacing, fertilization, and other factors are extremely important to successful transplanting. Cost variability and risk is involved in the pricing and in series of transaction necessary to obtain quality seed and fertilizers from purveyors in Cuzco. Price variability is based on the determination of the market return at a given point of time and the complexities of market sale. Although surpluses have been sold on occasion, volumes are usually low and transactions occur through middlemen in the community. The decision to enter into the market on a large scale, where sale replaces consumption as the production orientation, is an extremely uncertain action for the subsistence peasant. Quantities, accounting concepts, optimum market locations, and other elements of successful distribution strategies must be considered by peasants contemplating production for sale.

An attempt was made to compare the socio-economic characteristics of onion growers with the total population of household heads using household census data. The average age of onion growers, 49.6 years (N=22) is slightly older than that of the larger population of household heads, 44.8 years (N=218). No major differences were found in levels of education and the ability to speak Spanish. Onion growers possessed almost four times the average amount of puna land held by the total population, an indication of the breakdown of the redistributive function of the community in this ecological zone. In the pampa zone no major differences in land access were found. We can conclude that onion growers are a more prestigious and influential grouping and in a somewhat better position to take risks.

Initial adopters are not enormously wealthy in absolute terms, however. Their wealth is land lying in the puna zones; since these lands are relatively low in productivity and require enormous amounts of labor, using traditional technology, this wealth is not readily transformable into liquid capital. There is another qualification on wealth in Rumipata. Because of the channeling of available surplus into the cargo system, real wealth has been

exchanged for the social wealth and prestige associated with the effects of the cargo system. Thus, while onion growers are wealthier in terms of puna land and more prestigious in terms of "social capital", they are still constrained by the relatively high amounts of capital and labor required for onion cultivation.

I was led in my 1972 research on onion cultivation to examine the role of social relationships in risk management through an indirect path. I had administered a census to uncover land tenure patterns in the pampa and discovered that arrangements for onions were quite different from those for maize. In maize cultivation approximately 83 percent of the plots were operated in a direct manner by their owners, and only about 17 percent were indirectly operated through one of a variety of arrangements. Direct land use is to be expected in the pampa: plots are located next to the home of their owners thus minimizing the distance constraints so crucial in arriving at plots on the slopes of the puna and rarely do pampa holdings exceed the labor capabilities of an household. However, in the pampa zone, almost half of the onion plots were cultivated through indirect arrangements. This rather unexpected finding led me to examine more closely the functions of indirect land use and I found it to be a response to capital requirements and the management of risk.

Onion cultivation requires large amounts of cash together with the necessary knowledge of the cultural practices, both of which were scarce during the early stages of adoption. The most common indirect usufruct arrangement, *compania*, is particularly propitious for the acquisition of these inputs. Through *compania*, the owner of a plot is able to seek out a partner who can provide the necessary cash. In six out of twelve cases of *compania* the owner of the land sought out an individual who held an occupation with a regular cash flow, such as a small store proprietor, a blacksmith, or a hat maker. In these cases, it proved more profitable for the owner of a prospective onion plot to enter into a *compania* arrangement in the first stages of the transition to onion cultivation when capital is scarce. Even on a 50-50 split, the return from an onion harvest is greater than the returns from a maize harvest.

Technical knowledge of onion cultivation is similarly an input that must be acquired like cash, and indirect usufruct facilitated this transfer as well. Some peasants had experience in the use of specialized techniques

such as the application of fertilizer, transplanting, and water control; while others had friends and fictive or real kinsmen in other communities whose knowledge of onion cultivation they could draw upon. In my conversations with onion growers it became clear that sharing of expertise, particularly of techniques that could only be learned through close observation in a common enterprise, was an important aspect of the process and that *compania* facilitated it through the opportunity for matching talents that presented.

Lastly, indirect usufruct is a logical mechanism for reducing the potential losses involved if one's initial experiments fall awry. Again, *compania* is particularly attractive in this sense. Where indirect usufruct is found in the Andes among small scale peasants, sharecropping arrangements, such as *compania*, are usually preferred over renting (Fals Borda, 1961:83-84; Universidad Nacional, 1965: 37, Haney, 1969: Table IX-8, p. 245; Havens et al, 1965). Aside from the advantage of not requiring large cash outlays as opposed to renting, the partners share equally in the success or failure of the enterprise. Furthermore, these arrangements have historical depth in the Andes. In Lockhart's study (1972) of the Spanish residents of Cajamarca during the Colonial period, he describes the *compania* as a "buddy" system in which partners held property in common and interacted together on a regular social basis and in so doing pooled their resources enjoying greater security in a fluid situation. Thus, the *compania* falls within that class of sharecropping arrangements, which, economists argue (see Cheung, 1969), are preferred for their insurance value.

The indirect usufruct arrangements of Rumipata onion growers are a form of dyadic contract which is a basic building block of peasant social structure in the majority of peasant societies which are not organized into corporate kinship groups such as lineages and clans. There are two key elements in this arrangement. First, they are based on choice, i.e., on a mutual recognition that the interests of each actor are best served in a bond of this nature. Second, they involve, over time, a generalized exchange of goods and services. The terms of the exchanges may be either informal and implicit or, as in sharecropping, formal and explicit, depending on the degree to which a legal code specifies the terms of the contract and they are legally and/or ritually validated. But where formally constituted, they are often underlain with an informal pattern of generalized exchange (Foster, 1961).

The elements of choice and exchange enable capital and information to be shared and risk reduced in a situation where one has considerable capital invested. We would further expect that their usefulness in this regard would diminish as the returns to capital following sale of onions enables an owner to build up capital reserves and knowledge concerning onion cultivation becomes disseminated.

It is important to realize that apart from the formal terms of the contract, informal ties have usually been established through customary means such as gifting, visiting, drinking together, and other forms of social interaction. There are thus costs, of both a material and a social nature, that enter into the formation of these relationships which are often not considered.

When I left the field in late 1972, I was sanguine about the prospects for onion farming in Rumipata. I knew that the community had the potential to produce yields comparable to those obtained in Pucyurac which had so successfully shifted to onion cultivation ten years previously. This optimism was shared by the onion growers I talked to in Rumipata. I felt it would be only a short time before Rumipata would follow in Pucyurac's lead and the tin roofs, new two story buildings, bicycles, potable water systems, and electricity, which denote an Andean village on the move, would be found. It seemed to me I had stumbled on an unusual example of peasant response to market incentives which had occurred independently of government effort.

On my return to Rumipata in 1977, I was disheartened to find only two plots of onions being cultivated. It is difficult to reconstruct the turn of events that led to this failure due to a lack of time. I was able to elicit some factors, however, which illustrate the dimensions of risk facing peasants and their relation to the larger structure of things. On the cost side, onion seed had increased dramatically in price, making it out of reach of any but the wealthiest peasant. Further, overproduction in the Cuzco area had resulted in low prices and some onion growers had been unable to recover production costs. Informants attributed the price fall to competition from large scale onion plantings by the agrarian reform cooperative that had been formed in 1970 in the Pampa de Anta region. At the time of my visit, nevertheless, onion prices were high but Rumipatinos were reluctant to plant. The few that were willing said they would seed onions in their irrigated pampa plots after maize had been harvested, in effect, a

continuation of the diversification strategy of 1972 and less than a commitment to the specialized onion agriculture of Pucyurac. Thus, while onion growers said they had been able to reduce the risk of yield variability through the amassing of knowledge of onion cultural practices and experience in local trials, they were unable to do anything about cost and price variability. Interestingly, price variability was attributed to competition from the agrarian reform cooperative, organized ostensibly to work in the interests of the small scale farming sector, but in practice run as a large scale, profit-oriented, state farm (see Guillet, 1979, especially pp. 185-202).

#### PEASANT RESPONSE TO AN AGRARIAN REFORM COOPERATIVE

Rumipata is made up largely of peasants who cultivate individual plots either owned privately or obtained through a number of indirect usufruct arrangements. This is the "independent" community type in the region. Another major type, prior to 1970, was the hacienda, a relatively large unit of land usually held by an absentee owner and farmed by his administrator, the *mayordomo*, through a resident labor pool of peasants, the *feudatarios*, who exchanged their labor for subsistence plots. Data in this section come from fieldwork in Rumipata and two other communities: a small hacienda, Tukiwasi, and an independent community, Antapampa,<sup>3</sup> with a rather large number of feudatories who worked on an adjacent hacienda. Following a series of events at the national level, an agrarian reform was decreed in 1969. In August of 1970, a team of civil engineers and topographers arrived in Cuzco to begin implementing the agrarian reform in the Department. The first expropriations in the Pampa de Anta were finished in December, and by the early part of the next year virtually all of the haciendas had been expropriated. The method of distribution selected was that of a large production cooperative to which all expropriated land, cattle, installations, and equipment were transferred. These resources, it was planned, were to be owned and exploited in common by members recruited from among the regional peasant population. No member was to receive an individual allotment of any resource to exploit as his own, notably land. Members were to be recruited from among legally recognized beneficiaries of the agrarian reform--in practice, virtually all peasants were granted this status.

In order to become a member, a peasant beneficiary was required to register with cooperative officials, to agree to uphold the responsibilities of cooperative membership, and to pay an initial sum of money in order to purchase shares in the cooperative. These costs would appear to have been quite low in relation to the return: joining the cooperative gave the member access to pasture on cooperative land, a salary which at this point in time was approximately twice the ongoing rate paid for day labor, and the promise of dividends paid annually on capital investment in the forms of shares held by a member.

Nevertheless, the option to join the cooperatives was fraught with considerable uncertainty. At base, the cooperative was a new form of production organization and knowledge about its functioning was non-existent. Where information was to be had in the laws, annexes, and other documents drawn up in connection with the agrarian reform and the creation of the cooperative, it proved incomprehensible to the peasant. The documents were written using complex, legalistic phrasing, and contained a myriad of rules, regulations, exceptions and references to preceding legislation. Most importantly, these documents were written in Spanish for a basically illiterate beneficiary population speaking Quechua, an unwritten indigenous language. A radical change in social relations further clouded the picture; hacienda owners and other members of the landowning class and its mestizo dependents were replaced by agrarian reform bureaucrats largely recruited from the coastal criollo sphere of Peruvian society.

In the following table, data are presented on the number and percentage of peasants who became members of the cooperative in each of the three communities and in the region. The response was less than expected; particularly since it

TABLE I  
Beneficiary Participation in Tupac Amaru II Cooperative

	Beneficiary Population	Members	Percent
Rumipata	218	22	10.1
Tukiwasa	53	36	67.9
Antapampa	143	37	25.9
Pampa de Anta	5074	2277	44.8

was estimated (Kawata and Lobstein, 1972:59) that over fifty percent of the members were feudatarios. Response from the numerically more numerous free holding peasant population was extremely low.

My research has revealed a number of factors which were instrumental in explaining peasant response to the cooperative (See Guillet, 1979). In this paper I will concentrate on one of these factors: the role of peasant brokers in the communication of the cooperative option.

The planners of the agrarian reform were aware of the problem of uncertainty facing the beneficiary and designed a communications program based to a large extent on the diffusion of innovations model propounded by Everett Rogers and his followers (see Rogers and Svenning, 1968). An expansion of the agrobureaucracy, the use of small group discussions, a radio forum, and government trained agents which contacted each community, were some of the techniques employed in the program.

An important part of the program was an effort made to establish the support of key individuals in each community who could explain the ongoing changes and the complicated production system of the cooperative to the peasant beneficiaries. These individuals were sought out on an informal basis by the government agents working in the communities. It became clear during the research that these individuals were much more influential than other elements of the communications program. Although well planned and apparently well funded, the program in general failed in communicating a complicated and overly legalistic reform plan, which originated in the larger Spanish speaking society, to an essentially illiterate and Quechua-speaking beneficiary population.

The importance of key individuals in acting as linkages in the flow of information between the local level and the larger society is one dimension of the broker relationship. This role or set of roles was first referred to as the "broker" by Wolf (1956:1075) to mean those individuals who "stand over the critical junctures or synapses of relationships which connect the local system to the larger whole." More specifically, we are discussing what Schaedel (1972) has referred to as the culture informational link between the community and the macrosociety; it refers to the role the broker plays in the flow of information between societal segments which bind culturally distinct systems.

The transmission of information through the broker is subject to a basic

dilemma, however. In societies like Peru, with a large characteristically illiterate, indigenous population, the ability to manipulate information originating in the larger society can be an important source of power for the broker operating at the local level. In southern Peru, in particular, control over information has been one of the primary means by which the hacendado class and its dependents has maintained its superordinate position with respect to the peasantry.

In the Pampa de Anta following the 1969 Agrarian Reform, the ability to process information became a resource in competition in local level political arenas. One group of contestants included mestizo middle holders who felt threatened by the agrarian reform and sought to enter into the affairs of peasant communities in order to establish a "peasant" identity. A second group consisted of return migrants. In the past, out-migrants who had left the communities to live in cities had maintained control over their land through various forms of indirect usufruct. These forms were prohibited in the Agrarian Reform Law, thus motivating their return if they wished to retain their land. On return, the migrant was faced with readapting to life in the community, and solving an "identity" crisis resulting from his perceived downward mobility. One solution was for migrants to become active in the ritual and political spheres of community life (Guillet, 1976). These spheres are optimum locations in the local social structure for return migrants to best manipulate the resources at their command, including a knowledge of "urban" culture and institutions, a higher degree of education and language skills, and the reputation of having lived in the city. Unfortunately, mestizo middle holders possessed these same resources. The competition which ensued did not always pit mestizos against return migrants; each community has a different population composition including these and other groups. But, given the nature of post-agrarian reform change, groups which have been able to wield these resources have been extremely active in local level political contests.

The effect that these political changes had can be seen through a brief review of events in the three communities. In Tukiwasi, the only individual who was capable of articulating the new production system was the hacienda administrator. With no real competition from other individuals or groups in the community he became the link to the agrobureaucracy, and through negotiation was able to accommodate the organization of production of the hacienda to the cooperative, with few changes in basic structure. Ex-feudatarios perceived

the cooperative as merely another kind of hacienda in which the same individual continued to act as patron in an ongoing patron-client relationship. Every ex-feudatario joined the cooperative and during the first year of operation continued to work in the same groups as he had before the reform. This situation contrasts with that found on other ex-haciendas in the region. On many, the extent to which the government was willing to legitimize the mayordomos accounts for variations in feudatario participation in the cooperative. In Rumipata, a bitter struggle emerged between mestizo middle holders threatened by the agrarian reform and Rumipatinos who had returned to the community after having lived in metropolitan areas (Guillet, 1976). This struggle was focused on elections for positions in the community political hierarchy caused by a new set of laws regulating the organization of recognized peasant communities. An elementary school teacher emerged as the winner of the struggle; he, together with a core group of followers, managed to seize the major contested positions. From his newly won political base, he moved into the position of spokesman for the agrarian reform to the community and its representative in meetings with government officials. When peasants were finally given the opportunity to join only a few were willing, with the majority holding back. Close analysis of the initial group revealed a core of supporters of the school teacher; later, as factionalism set in and the school teacher lost control of his faction, actual participation in cooperative activities, never really strong, decreased and for all intents and purposes the local nuclei of members became defunct.

In Antapampa, the individual that emerged was a long time resident who had held major positions in the cargo system and was well respected. He came forward mainly out of a sense of duty but did not actively follow up in linking the local membership with the cooperative. Nevertheless, his presence was sufficient to induce a sizeable body of the community to join the cooperative. During the first year of operation, strong criticism of the cooperative from mestizo middle holders who felt threatened by the agrarian reform created a split in the community between a defensive group of cooperative members and the remainder of household heads. No individual emerged from the ranks of the cooperative members to articulate the workings of the cooperative to the community. This was especially detrimental since there was a number of issues involving the community and the cooperative that begged resolution. Mestizo middle holders sought to benefit from the situation by explaining how they might rectify the matter by contacting key individuals,

placing it before the courts, and in general using political processes that they were aware of, to gain resolution of issues that normally should have been handled by the political organization of the cooperative.

I do not wish to suggest that the performance of the broker is sufficient to explain peasant response to the agrarian reform; there were a number of factors involved (see Guillet, 1979). In relation to the information problem, however, it is clear that peasants sought out their spokesmen, as they had in the past, to make some sense out of the complex set of unfolding events and to assist them in arriving at a decision to join or not to join the cooperative. Part of their response can be explained by the role of these spokesmen. Due to the nature of the selection process, a spokesman could emerge who was either less than qualified from the perspective of the community (Rumipata), or only weakly motivated at best (Antapampa). The selection process thus affected the quantity of information in the hands of prospective members and its credibility.

In one sense, it should come as no surprise to find that peasants utilize social relationships to meet information constraints during the course of economic change. In traditional agriculture, when labor is short the peasant puts his resources into obtaining labor and when land is short he makes efforts toward obtaining land. In adjusting factor proportions, social relations offer one of the few resources at the disposal of the peasant. The same process obtains among peasants during the course of economic change.

These materials illustrate the potentials as well as the limitations of the two forms of social relationships in economic change. Indirect usufruct in Rumipata proved to be a viable mechanism for the reduction of uncertainty and the sharing of risk in the decision to grow onions. Through such an arrangement, a peasant can choose a partner who has had experience in the new crop, thus acquiring firsthand knowledge and experience. Risk sharing occurs through the pooling of land, labor, and capital. Close inspection of the arrangement reveals a formal dyadic contract which overlies a generalized pattern of exchange between the two parties. Both exchange and choice are crucial to the dyadic contract in either its formal or informal versions and it is precisely these elements which were instrumental for the onion growers. I would suggest that where economic change involves changes in the mix of traditional factors of production or the acquisition of a skill that can be

learned through scrutiny, observation, and close personal interaction, dyadic contracts seem particularly appropriate.

In the response of Rumipatinos and their neighbors to the economic alternative provided by the cooperative, the role of local brokers proved quite important. A similar broker function can be expected to be found in the course of economic change in other societies where the source of information is outside the naturally interacting social system of the peasant, particularly where there are basic linguistic, cultural and social differences between the local system and the larger society.

The actualization of these forms of social relationships during situations of economic change is subject to certain constraints. The first of these is the ease with which information is acquired in the relationship. As in any calculated decision making, the goal, information, has a cost (see Tsukahara, 1970). In the industrialized societies, technical specialists provide information upon which individuals act. There the cost, whether it be direct as in the purchase of a consumer information magazine or indirect as in the agricultural agent whose salary is paid with taxpayer's funds, usually involves the material exchange of goods for information. Information acquisition in non-industrialized societies operates on different principles. Ideally, it is based on direct experience, but in situations of rapid economic change the peasant does not usually have direct experience of the alternatives upon which to act. Instead, he seeks out individuals who he perceives to have such experience, and, through the transaction of a social relationship, acquires access to the information they possess. The cost in the latter case is the time, effort, cash, and kind that must be expended in order to establish the relationship.

The costs of indirect usufruct in the Rumipata case were deemed fair and reasonable. However, had the formulas for the arrangement been different, or social concerns such as cross class recruitment of partners been involved, then the calculation of cost-benefits might well have resulted in a different statistical pattern. The same basic calculation enters into the actor's evaluation of other kinds of social relations, such as the broker and the collectivity, although in these instances social costs may enter into the calculus as much as material costs. For example, utilization of a broker relationship involves few real costs other than political support; the returns are higher though, for the reasons we have given, than those for

media sources which likewise are low in cost.

A second constraint, intimately related to the first, is the freedom of the peasant to select others in the social relationship. There is a basic difference between the dyadic contract and the broker. The broker is structurally more "distant" than a partner recruited in a dyadic contract such as indirect usufruct. Further, because of socio-economic change and the politicization of information, selection may be essentially out of the ability of peasant collectivities to control, thus affecting the ability of the broker to transmit information about economic alternatives emerging in the larger society.

The data presented here suggest that the communication flow model of social change presents obstacles rather than facilitates the analysis of the role of the broker in economic change. In this model, the broker is essentially congruous with the "opinion leader": an individual who is particularly influential in the diffusion of information because he occupies a special place in the social structure of a target group. The empirical tests of the model have rested largely on studies carried out within the United States of the diffusion of agricultural innovations by an extension agent working with a target group of farmers.

In developing societies, the ability to manipulate information originating in the larger society can be an important source of power for the broker operating at the local level. In southern Peru, in particular, control over information has been one of the primary means by which mestizos have maintained their superordinate position with respect to the peasantry. These societies with large, characteristically illiterate and indigenous peasant populations, are often marked by relations between peasants and the larger society which Richard M. Adams (1970) has referred to as a domain structure: a relationship in which one set of actors has greater control over another set than the latter over the former. In the domain structure, brokers usually are instrumental in the exchange of power. Such situations can be contrasted with those in which domains are weak and levels of articulation between actors are flexible. In this case, access to power is facilitated by "career mobility systems."

In societies in which domain structures prevail, information may be a very important source of power manipulated by superordinates in the domain relationship. Where this is the case, programs of applied social change based

on the communication flow model will encounter obstacles with respect to their application of the "opinion leader" concept. Such models, in order to be effective, must confront the dynamics of complex societies with respect to their range of social structures, forms of mobility, and sets of actors.

Lastly, implicit in all of the foregoing is our contention that economic change is dynamic rather than the static process often implied in formal models of decision making under risk and uncertainty. In order to understand economic change, one must examine behavioral strategies designed to acquire information and reduce risk and uncertainty.

### CONCLUSION

I would like to conclude with a brief comment on the implications of two themes in this paper for expanding small ruminant production in the Central Andes.

1. Agricultural and animal development schemes are by their nature specialized. When plant or animal species are selectively improved through genetic techniques and a technological package is designed to accompany them, the enterprise takes on the character of an intense, highly focused and specific attempt to maximize yields. In the move from field and laboratory research to application, the same perspective at least is unconsciously promoted. This tendency to specialization is clearly at odds, however, with the orientation of Central Andean peasants who, because of the factors previously mentioned, build diversification into their production strategies. If an animal development program ignores this dimension and measures its success by the degree to which peasants shift from diversification to specialization, it is doomed to failure. On the other hand, if new animal species and improved technological inputs can be designed to fit into peasant diversification strategies then the chances for success are substantially increased. One should not expect that because research has demonstrated that an animal production scheme has enormous potential for turning around traditional pastoralism that it will automatically result in a specialized highly productive pastoral economy. Peasants are not mid-western farmers and our expectations of their behavior should be adjusted accordingly.

This implies several practical considerations. Improved breeds should be able to be incorporated into mixed herds of traditional species. Traditional mixed uses of animals should be built into the characteristics of an improved breed rather than its engineering for one specific end, e.g., the provision of high quality wool. It should also serve as pack animal and producer of leather, food, and combustibles. Improved breeds should be able to subsist on traditional forage as well as improved forage. Animal products should be able to be processed with traditional techniques. In sum, we must be aware of how traditional animal species fit into overall diversified production strategies and make allowances, even at some loss in yield, in developing improved strategies.

2. In designing a program to disseminate the results of research in small ruminant production, social factors should be closely examined. As we have seen, dyadic, group, and broker relationships have very important functions in information transmission and risk management. These relationships derive from the general nature of peasant societies and the peculiar socio-cultural matrix of Andean rural communities. I do not feel that the existing communication of innovations model of social change, elaborated largely on diffusion research among North American farmers, is fully applicable to peasant contexts such as those found in the Central Andes. New ideas must be generated and new strategies adapted to this setting.

One of the more interesting mechanisms for reducing innovative risk is used by the Centro para el Desarrollo Social y Economico (DESEC), a private development agency in Bolivia. This system is employed in their programs for disseminating improved potato seed and technology among highland peasants. DESEC enters into a partnership with an individual in which DESEC provides improved seed and a technological package and the peasant provides land and labor. The harvest of new potato seed is split 50-50. DESEC then uses the seed to enter into partnerships with other individuals. This arrangement is somewhat similar to traditional sharecropping in which one individual will provide land and the other labor and the proceeds are split evenly. Traditional sharecropping can lead to absentee ownership and exploitation and is prohibited in Bolivia. The DESEC arrangement differs, however, in that

DESEC provides monetary capital and technological knowhow and assumes an equal burden of risk with the individual. DESEC's program has proven quite successful in the Cochabamba region and there is considerable demand for it. It is an example of innovative thinking in using dyadic contracts to disseminate information and manage risk that could help to increase the success of small ruminant production efforts.

## FOOTNOTES

<sup>1</sup>While such a fact may surprise orthodox economists, it is standard operating procedure for Marxist and neo-Marxist analysts who begin their analysis with examining the mechanisms of surplus extraction. However, for the latter, once these mechanisms are determined, the further analysis of the economic logic of peasant household behavior becomes trivial (Deere and de Janvry, 1979). This is debatable. It assumes that if peasants were not a dominated class within a social formation and if surplus demands were lowered considerably then peasants would maximize production (see Becker, 1977:96). While one cannot agree with the search for a general model of peasant economic behavior, Chayanov's work (1966) at the very least suggests that in some cases peasants do possess an economic logic based not on production maximization but on satisfying level of wellbeing.

<sup>2</sup>My usage of innovative risk is similar to Rutz' "unfamiliar uncertainty" (1973:245).

<sup>3</sup>The names of the communities are fictitious.

## MARKETS AND THE MARKETING SYSTEM IN THE SOUTHERN SIERRA

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GORDON APPLEBY

The department of Puno in southern Peru is one of the most underdeveloped regions of South America. The situation there is so desperate that twenty years ago one United Nations commission declared the region "one of two permanent disaster zones" on the continent. That characterization is no less apt today. Yet Puno has had a long and eventful economic history based for more than a century on the export of wools. This paradox of dynamic change leading to stagnant growth raises two fundamental questions. First, in historical perspective, one must explain why the department remains so technologically stagnant despite veritable transformations that have occurred since Independence. Second, although wool export is no longer the great dynamo it once was, the legacy of the export era continues to influence the socioeconomic trajectory of the region. Thus, one must lay out the contemporary patterns of underdevelopment in terms of the changes that occurred during the export era. In Puno, this means showing how an urban commercial system structured for the flow of goods to and from the industrialized nations of the world was transformed into a domestic marketing system where goods flow among centers within the region. These two questions involve a consideration of the internal dynamics of underdevelopment and, then, of the implications of that developmental trajectory for directed change.

If we want to explain contemporary underdevelopment, we would do well to listen to our Latin *confreres* who have fashioned dependency theory from personal knowledge of their national experience. Andre Gunder Frank (1959) has most forcefully sketched the structure of dependency that leads to under-

development. In his words (1969:20),

. . . the occasional hired worker is connected to the tenant farmer who employs him (or more usually to the landowner directly), the tenant to the landowner and merchant (or merchant/landowner), who is connected to the provincial metropolis wholesaler (or sometimes to a large national or international merchant), who is connected to the national industrial/financial/commercial/import metropolis which is connected to the world metropolitan center, and so the most "isolated" toe bone is connected to the world, capitalist head bone.

Spatially, this international commercial hierarchy resembles a tree or dendrite. The base represents the port or entrepot, which is the major regional receiving and shipping center, and each node is a lower-level center; the branches represent commercial flows. Three features of this simple dendritic model are most relevant to an understanding of export commerce. First, there are more lower level centers than higher level centers. Second, the commercial links between centers are wholly vertical, as goods flow either up the hierarchy and out of the region or down the hierarchy and into the region. There are few or no links between centers at the same level. Third, the level of centers declines with distance from the major center.

This regional structure of wholesale commerce serves to drain the region of resources. Frank (1969:6-14) discusses this drain in terms of three contradictions: between metropolis and satellite, between expropriation and appropriation; and between continuity and change. These catchy phrases express a basic chain of ideas. Because the metropolitan centers expropriate surplus from the producing regions and appropriate this surplus for their own use, the economic gap between the metropolis and the satellites widens, which continues the dependency of the satellite, despite socioeconomic change occasioned by export production. In other words, prices are determined in the industrialized nations, which are the only consumers of the primary commodities and are the very producers of the manufactured exports. Yet, surplus is drained off at every level, which deprives the producing region of the resources to develop. Consequently, the fate of the producing region depends on fluctuations in price for its primary commodity in the

international market. In the worst case, the industrialized countries discover a better or cheaper substitute for the primary commodity, whereupon the peripheral regions are abandoned "to develop the underdevelopment" they now live.

In neoclassic terms, the dependency argument implies that the return to producers--the expected income stream from investment in production--is below that from other opportunities. The two concepts--actual return and expected income stream--are distinct but allied concepts. The first denotes the portion of value received by producers in a particular socioeconomic situation; the latter, the future expectations of return if technological improvements are made within the context of that situation.

Dependency theorists have never quantified the drains that they claim are so crucial in thwarting development in peripheral regions. The reasons why these theorists have avoided quantitative estimates of exploitation are not hard to find. In the archetypical colonial plantation, value flows are typically incalculable (Oxaal, 1957:37) because the vertical integration of operations in one firm makes it nearly impossible to disentangle the financial operations of each level. As Best and Levitt (1968; quoted in Oxaal, 1957:37) point out, this difficulty

. . . stems from the processes of provisioning and disposal which are associated with a hinterland economy which is structurally part of an overseas economy and institutionally organized by total economic institutions. Almost all intermediate and final supplies of goods and services are either produced within the complex or advanced by associated merchant bankers. Since the latter also receive the bulk of the staple for sale in the metropole and re-export, the commodity flow from stage to stage does not involve any considerable money flows. Accounting takes the form of imputing prices. There is thus a large measure of price indeterminacy.

In the Peruvian wool business, however, independent firms at each level of the hierarchy bought and sold wool at known estimated prices. Even where wool shipments skipped a level or two, it is nonetheless possible to estimate costs and profits from the operations of other firms at that level.

Table 1 presents estimates of the increase in value of wool at each level of the hierarchy for 1863 (Jacobsen, n.d.), 1933 (Barreda, 1934:44),

TABLE 1

## RETURNS TO PRODUCERS AND INTERMEDIARIES, 1863, 1933, 1971

Price to (in sole of the time per quintal)	1863 <sup>1</sup>	1933 <sup>2</sup>		1971 <sup>3</sup>	
	Sheep's Wool (F.O.B. Mollendo)	Sheep's Wool (Wholesale Value, England)		Alapaca Wool	
Producer					
- Estate	70%	32-40	28%		
- Indian	28%	20-24	15%	750	47%
- Direct Export		110	85%		
Rural Buyer	30-40%			100	6%
Regional Buyer				100	6%
Exporter				650	41%
TOTAL		129.30 (merino)		1600	100%
		81.40 (inferiors)		1800 (white)	
				3200 (classified)	

1. Nils Jacobsen, pers. comm.

2. Barreda 1934: 44.

3. Lora Cam 1976: 31. By the late 1930s, alpaca was the only fiber usually exported. Most sheep's wool was then already consumed by national mills.

and 1971 (Lora Cam, 1976:31). These estimates are not strictly comparable. They give the percentage returns to different number of intermediaries, handling different types of fibers, based on different end prices. Nevertheless, even this haphazard collection of price estimates illustrates several fundamental facts about the operation of the Peruvian wool business.

First, the return of value to producers was comparatively low. In 1863, a producer who sold locally might expect to receive 30 percent of the value of his wools, F.O.B. Mollendo. The producer's share computed on the basis of English wholesale prices would of course be much lower. According to Barreda, who did calculate returns on the basis of wholesale prices in England, a producer who sold locally in 1933 might receive between 15 and 30 percent of the end value, depending on the quality of the wool. Although the wool sale on which Barreda based this estimate involved a large amount of washed merino which had a higher price than most altiplano wools, the local price was for wool placed in Ayaviri. Producers who sold to local buyers would receive 10 to 15 percent less for their wool. Thus we may infer that producers who sold in the department usually received 20 percent or less of the English value of the wool in both the mid-Nineteenth Century and during the Great Depression.

Second, it is clear that the return to producer increased directly with the point up the chain where he sold. According to Jacobsen, an Indian producer who sold locally might receive 30 percent of the value, F.O.B. Mollendo. A hacendado who sold locally to a provincial buyer might receive 40 percent of the total value. And if he sold in Arequipa, he would be paid 70 percent of the F.O.B. price for unwashed wools, 80 to 90 percent for washed wools. The advantage of selling up the export hierarchy are clear: a producer received twice as much for wool placed in Arequipa as for wool placed in the provincial center, and perhaps half as much more when sold in the provincial center rather than locally.

There are no comparable calculations on the return to alpaca producers for any but the contemporary period. It is more likely that returns also averaged 15 to 20 percent during the export epoch, rising in the last decade to nearly 50 percent. Whatever the actual rate of return, it is certain that the size of the return varied directly with the place at where one entered the chain. In response to an inquiry from Messrs. Fosters, one of the leading English alpaca manufacturers, Dr. Graham, a doctor living in

Peru during the mid-nineteenth century, described the alpaca trade in his times (Sigsworth, 1958:237).

A great part of all the alpaca wool is bought in Arequipa in small lots directly from the Indians and for cash down. However, at a fair held at Bilqui in the Sierra, near to Puno, certain Indians or natives, creoles, enter into contracts to deliver the wool in Arequipa at from 8 to 12 months and receive half down in advance in cash, at the same time, it is to observe that the alpaca which, if they were to bring it in and sell at 50 dollars in Arequipa, in this method they are only paid at the rate of 40 dollars.

Inasmuch as these Indians or natives were provincial and local buyers, who earned about 15 percent each on their purchases, alpaca producers probably received less than \$30 per hundredweight for their wool, which would fulfill the \$40 contract. With an actual price of \$50 placed in Arequipa, this wool might be valued at about \$75 F.O.B. Mollendo. So the Indian who sold in Arequipa might receive 66 percent (\$50) of the F.O.B. price, he who sold at the fair, 53 percent (\$40), and he who sold locally 40 percent (\$30) or less.<sup>1</sup>

These rates of return, which are calculated on the basis of value on board in Mollendo or at market in England, would be lower if any group of agents at a higher level in the hierarchy managed to depress prices artificially. This does not seem to have been possible in the sheep's wool market, where the producers and the manufacturers were many. The sheep's wool market did indeed divide into many specialized manufacturers, each with its own wool requirements. But there were nonetheless so many manufacturers and sellers, that no single agent or group of agents could long influence the market price. The sheep's wool market was open and competitive from the beginning.

The same cannot be said for the alpaca market. Three firms dominated the English alpaca market: Foresters, which bought between one-third and one-half of all alpaca; Titus Salt, the original firm, which consumed a like amount; and G. & J. Turner, which bought the remainder. All three of these firms manufactured and marketed their own textiles. Because yarn constituted 50 percent of the cost of alpaca textiles,<sup>2</sup> it was advantageous for these manufacturers to buy the primary commodity as cheaply as possible.

Nonetheless, competition had its advantages: if one firm could buy cheap while forcing the other firms to buy dear by competing in the market, the first firm would have a cost advantage in the product market. But cooperation also had advantages: by either alternating purchases or dividing lots amongst themselves, all could buy more cheaply, thus expanding the product market. In Sigsworth's (1958:269) opinion, the history of Nineteenth Century commercial diplomacy is one where:

. . . co-operation usually began when prices were rising or were already at a high level. The collapse of co-operation appears to have come at about the time when prices had declined to a low level, though here, as has been seen, the immediate cause was often a disagreement between the co-operating firms.

Yet the price of alpaca was probably of less immediate concern to the manufacturers than the state of the international yarn market. When this market was strong, all might profitably compete in selling woolen goods, as well as in buying fiber. But should the outlet market weaken, as it probably did in the late 1850's and certainly did in the late 1870's, when the lustre vogue in European women's fashion waned, these manufacturers could compete for supplies of wool only at the risk of narrowing their already soft outlet market. Thus it should occasion no surprise that Forsters, Turners, and Salts fitfully coordinated their buying policies between 1852 and 1864, between 1872 and 1878, and again in the 1930's.

The entry of the Farr Alpaca company, the sole American alpaca manufacturer, into production in the 1860's did not change this situation. In the Nineteenth Century Farr was forced to purchase at least a year's supply in the narrow English market held in Liverpool (Hutner, 1951:14), which was controlled by the Big Three in Bradford. Later, at the turn of the century, when the company instituted the policy of buying raw material from Grace & Company, the treasurer made sure to buy "large amounts, sometimes a three years' supply, at favorable prices" (Hutner, 1951:34) in order to save Farr Alpaca substantial sums.<sup>3</sup> Needless to say, such a policy held no benefit for local alpaca producers.

At the turn of the century, the Arequipa exporters considered manipulation of the wool market to be much more easily done in England than in Peru. Ricketts, one of the leading exporters in Arequipa, detailed his reasons for this opinion in a letter to his consignment agent in England

(Ricketts, Arequipa, International, 12 July 1902).

Control of Peruvian Wool Supply might perhaps be arranged by combination among importers on your side, on the same lines as the Nitrate Combination; but I think it would be extremely difficult to establish on this side. To collect the wool here would entail immense labour, and to obtain the preference from the seller it would be necessary to be always prepared to pay the highest price, which, in the absence of anything like stability in prices on your side, implies great risk. The Notes of Export I sent do not show that any practical effort is being, so far, made in the direction. Altogether I am not disposed to attach great importance to the report you mention, but shall keep watch, to see if anything comes of it.

Ricketts was of course quite correct. But when the depressed wool market after World War I threatened all exporters, the Arequipa commercial houses found the means to cooperate. "In Alpaca Fleece," Ricketts wrote Gibbs in early August 1927 (Ricketts, Arequipa, International, 12 August 1927), "there is now a tacit understanding between all the principal exporters to hold for 16d per lb. for one or two months to come." The following month, Ricketts (International, 2 Sept. 1927) noted in self-congratulation:

. . . we are glad to see that this figure (16d per pound) has been reached. It is particularly satisfactory to us because we were instrumental in bringing the agreement about by asking all the firms to join. For reasons given in previous correspondence to you, we had the impression that 16d could be obtained for f.a.q. if only exporters held together. - It occurs to us that your cable of 23rd ulto was influenced by Messrs Thomas & Cook and if so it looks strange that they should recommend to sell below 16d when as brokers of S.C. wool they must have had instructions before that date to hold for that price.

The agreement to maintain a base price survived at least until mid-1928, for when Ricketts received a cable informing him of the sale of 90 bales of Alpaca M FH average at 220 per lb., he wrote Gibbs (Ricketts, Arequipa, International, 8 June 1928) that

The sale was reported here the previous day and we understand

that the M FH exporters were much upset about it specially as they were not consulted. - They approached us with a view of making a combined effort to restore the price to at least 24d per lb. and we believe other exporters have also agreed. - We have only the 150 bales per s. "Ebro" and shall not be able to ship any more until the middle of July, after completing our new contract to Japan for 200 bales. - There is therefore no hurry to sell the "Ebro" shipment and we confirm our cable of 31st ulto in this sense: -

"Referring to our Invoice No 319 our opinion is to hold for 24d other holders of fair average Arequipa fleece are asking . . . per lb at this price.-"

The success of the exporters agreement hinged on the ability of firms to hold ranks, regardless of individual firm's financial situations. Thus, in this same letter, Ricketts immediately noted, with some pique, his opinion of the M.F.H. firm.

We do not see the reason why the M FH brokers in Liverpool should have accepted a reduction of 3d per lb on a parcel just arrived, when stocks in that market are negligible and the quantity afloat very limited. - A waiting policy would have been more in accordance with the situation but we have noticed for some time past that M FH holders show weakness in their sales of Alpaca and Sheep's Wool. - In the present case they should have adopted a firmer attitude (sic) if only to keep up the value of interiors. - They are now very eager that all exporters should hold for 24d when they have been instrumental in turning the market against sellers.

Such problems led to the demise of the exporters ring, probably late that same year. But there were other problems also, as Ricketts detailed to Gibbs in a series of letters in 1932 discussing exporter's ring. First, the English bankers who financed the export firms had absolute control over the prices the client firms could seek (Ricketts, Arequipa, International 30 March 1932).<sup>4</sup> Second, even with the authorization of the bankers, it was difficult to maintain the allegiance of some buyers who wished to increase their percentage share of the exports in a rising market (see also,

Ricketts, Arequipa, International, 5 August 1933; Appendix B). Third, the Arequipa houses faced competition from regional exporters in Puno who stayed outside the ring, though they benefited from its impact.<sup>5</sup>

The collusion among manufacturers, and later among export houses, had a simple consequence. The returns to producers were generally low. But they could be made lower. In a rising market, intermediate and final users of fiber generally competed amongst themselves, which meant that the local market was good. But in a declining market, collusion appeared at one, then another level of the commercial hierarchy, which only further depressed local prices. Thus when times were good, local conditions were just good, but when times were bad, local conditions were very, very bad.

The different structures of the sheep's wool and alpaca markets and their consequences at the local level are themselves reason enough to predict that, despite low rates of returns, sheep production would be the more dynamic sector. Such a summary statement, however, ignores the socioeconomic fact that in Puno estates specialized in sheep's wool production while the natives retained control over alpaca production. The different size of the production unit for each fiber is itself a factor in the organization of distribution. So, one must ask the question: Why did estate producers in effect leave the production of alpaca in the hands of native producers?

Pedro J. de Noriega, President of the League of Hacendados and Industrialists of Southern Peru and a major wool producer and exporter, claimed that alpaca raising was so complicated and difficult that hacendados had avoided these animals (Lora Cam, 1976:244). For this reason, production was almost exclusively in the hands of Indians, who maintained a backward and fragmented production on their small properties in the highest altitudes.<sup>6</sup> Alpaca production is indeed complicated and difficult, but hacendados might still have learned the technology of production had alpaca production been significantly more profitable than sheep production.

Therein lies the key. Although alpaca wool was usually quoted at twice the price of sheep's wool, the nature of production--rates of animal reproduction, land requirements, amounts of wool--and the possibilities for auxiliary products all figured into the hacendados' preference for sheep. Under modern conditions of selective breeding and veterinary care, the birth rate for sheep is 80-90 percent and that for alpaca but 50 percent. Moreover, the death rate for newborn animals is but 10 percent for sheep and

15 percent for alpaca (Alvarez Catro, 1973: 7-9). Under usual conditions in Puno, however, the birthrates are likely lower, and the mortality rate for off-spring from alpaca runs 50 percent. In the early Nineteenth Century, when the estates were recuperating from decades of political and economic turmoil and when there was only an export market for sheep's wool, hacendados would naturally incline toward sheep, which would multiply more quickly and provide an income with little cash investment.

The economics of wool production give a clue to the continuing preference of estates for sheep. Generally, two-and-a-half to three sheep can be run on the same territory as one alpaca. The inferior sheep of this period, which, in the words of one specialist at the turn of the century, "did not even have hair on their bellies" (Heqc, 1906: 12), yielded but a pound or two of wool apiece. The estate owner could thus expect three to six pounds of sheep's wool each year from the same land that could be occupied by one alpaca. An alpaca yields three pounds of wool only every two years (Coro, n.d.: 13). Thus, given the relative prices paid, there was a near parity in income, because of the specific requirements for production.

In this situation, the decisive factor in production decisions concerned the possibility of auxiliary products. However inferior the stock, sheep are meat animals. Estate owners could either sell to buyers who drove the animals to Arequipa for fattening or slaughter their cull and sell locally (Ricketts, Arequipa, International, 29 December 1910).<sup>7</sup> If they sold the meat locally, they also obtained other products, including sebo. During bad times in the wool-export market, the value of the meat was twice the value of the wool (Barreda, 1931: 21). Alpaca meat, by contrast, had no sale value. Urban consumers not simply disliked the stronger taste of this meat, they actually believed that alpaca carried syphillis. Thus the only outlet for alpaca meat was, until recently, the barter trade between highland and lowland peoples, who were not so foolish.<sup>8</sup>

The economics of pastoral production and marketing thus explains the organization of production into two segments, each dominant in a different fiber. Although historical data are scanty, this division in production had probably developed by the mid-Nineteenth Century. Before that date, according to Choquehuanca's 1830 Estadística de Azangaro (Table 2), the Indians in the province owned twice as many sheep as the estates and almost all the alpacas. As the estate economy recovered in the second quarter of the Nineteenth Century,

TABLE 2

## ANIMAL POPULATION, BY SECTOR, BY YEAR, 1830-1972

YEAR	AREA	SHEEP			ALPACA		
		Estates	Indians	Total	Estates	Indians	Total
1830 <sup>1</sup>	Azangaro	123,315	210,675	345,215			4,925
1906 <sup>2</sup>	Azangaro Huancane, Lampa, & Ayaviri	546,580 191,000			3,800 96,000		
1921 <sup>3</sup>	Department			6,015,201			
1928 <sup>4</sup>	Azangaro	792,600	377,065	1,169,665			
1959 <sup>5</sup>	Azangaro Department			1,322,200 6,258,900			54,400 1,273,900
1967 <sup>6</sup>	Department			6,580,000			2,000,000
1972 <sup>6</sup>	Department			4,957,000			1,600,000

1. Frisancho Pineda 1975: 38; Nils Jacobsen, pers. comm.

2. Heqc 1906: 12-13.

3. Sociedad de Prop yanda del Sur 1921: 193  
Stordy 1921:21

4. Barreda (1928) in Lora Com 1976: 157

5. Plan Regional para el desarrollo del sur del Peru 1959: 239-40

6. Lora Cam 1976: 24

hacendados restocked with sheep. So, a century later, the estates owned twice as many sheep as the Indians, who nonetheless remained dominant in the production of alpaca wools. There were of course some hacendados that ran only alpaca--for example, Francisco Saravia on his estate in Cojata, just as there were some Indians who owned only sheep, especially in the lower flatlands. But there did develop a general division in the organization of production, with two-thirds of all sheep in the department owned by estates, and two-thirds of all alpaca owned by Indians (Humire Sotillo; quoted in Hazen, 1972).

The types of changes that occurred in the rural sector during the export economy are well explained by the rates of return to producers, which were generally low, but lower still for alpaca, and by the local organization of production into an estate sector specialized in sheep and a small-hold sector dominant in alpaca. The Indians, who were demonstrably more disadvantaged economically, definitely responded to price differentials in the alpaca markets, as long as the changes in the technology of production did not involve sizeable outlays of money. For example, they changed their method of shearing to meet the more stringent demands of manufacturers, as William Ricketts (International, 11 March 1911) attested.

In the interior it used to be the custom to leave the skins in the sun for 2 or 3 days and when in a state of fermentation to pull off the wool with the hands. This is what we call here 'dead' wool, which is easily detected and has of course a lower price.

Shearing techniques were nonetheless primitive. Colonel Stordy (1921: 121), Director of the experimental farm at Chuqibambillas in the 1920s, once described the operation for an English audience. "In place of shears a knife is used, but, should the knife prove blunt, then a piece of glass suffices . . . surely a knife and fork would have turned out better class workmanship." Yet even at this time, scissors were already among the merchants' most saleable hardware items. Enrique Carceres, the largest retailer in Juliaca at the time, made this clear to Ricketts (Interior, 361, 14 August 1929).

The scissors with painted handles don't interest me. I want only the iron ones indicated in my letter because they are well-accepted and much bought. The Indians buy them because

of their expensiveness and appearance, so it would be profitable for you to order these scissors in both sizes. I would want to buy up to one hundred dozen.

Innovation, though sporadic and little noticed, was occurring in the countryside.

The Indians also changed the color composition of their herds. The alpaca textile market in the Nineteenth Century could use any color fiber, for the wool was all dyed black before processing. This market was in fact moribund by the first decade of this century. But World War I revived demand for any and all Peruvian wools, which were outside the controls instituted on the sales of Colonial wools, thus delaying the impact of the shift in manufacturers' requirements until the 1920's. When this change in the market requirements hit, it hit hard. After World War I, alpaca prices plummeted to below the levels that obtained at the turn of the century (Appleby, 1978:49). Even so, there was little market for wools, and that small market was restricted to white and light-colored wools (Appendix C). The Indians responded intelligently to this change in their market. They bred selectively for white alpacas (Miller, 1977:195-96), and, probably more commonly, they culled colored animals out of their herds. They did this, it should be noted, against their own cultural preference for colored wools.<sup>9</sup>

In the long run, the least expensive means of increasing income without costly investment outlays was simply to increase the number of animals. Despite the scarcity of historical data, the available information indicates that both the estates and the native small holders did in fact increase the number of their animals. In his *Estadística*, Choquehuanca estimated that there were nearly 350,000 sheep in Azangaro province in 1830, one-third of which were owned by estates (Table 2). In 1906, there were more than a half million sheep on the estates of Azangaro province alone (Heqc, 1906:12). By 1928, the figure for estate sheep had reached more than three-quarters of a million sheep in Azangaro Province, with another 375,000 in the hands of small producers. Interestingly, the number of sheep and, presumably, the distribution of animals between the two productive sectors, remained constant between the 1920's and the 1950's, precisely the years of stagnation in the wool market. The history of the alpaca population is much more difficult to infer because there exists only the Choquehuanca estimate before the modern period. Even so, there has been at least a ten-fold increase in the number of alpaca in

Azangaro province since 1830, and Azangaro, as Heqc's figures demonstrate, was not a primary production zone for alpaca.

The increase in the number of animals inevitably meant competition over land, for more animals required more space. In the first half of the Nineteenth Century there was little problem because the population of the department was at its low point and the animal population had been decimated by wars since the 1780's. The period 1820 to 1850 essentially marks the reestablishment of the estate economy, with the reallocation of church and other estates to private individuals through government sales. There was in these years very little alienation of Indian land to the estate sector.

That situation changed, however, about mid-century, when all available estates had been reallocated and the need to increase herds in order to gain larger incomes increased pressures for more land. Contrary to Martinez-Alier's (1977:67-68) suspicions, the extraction of greater profits from estates did involve both the extension of the boundaries of existing estates and the creation of new estates. In the province of Azangaro, the 110 estates in 1830 had increased in number to 178 by 1876, with the largest increase presumably occurring after 1850. By 1915, the number of estates in that province totaled 611 (Romero, 1928:426). In the department as a whole, there was a similar increase in the number of haciendas from 696 in 1876 to 3,375 in 1915. Although it is much more difficult to quantify the extent to which estates encroached upon what had been Indian lands, we do know that the process effectively ended before World War I and that in the 1950's estates owned much of the land surface of the department.

Although haciendas gained title to most of the pastoral zone through formally legal means, compressing the indigenous communities into ever smaller, interstitial spaces, the estate owners were never able to monopolize the use of their lands because they needed labor. As Martinez-Alier (1967) has argued for the central sierra, the cheapest means of obtaining labor was through a form of pastoral share-cropping. That is, estates owners allowed shepherds to herd their animals on estate lands, and often also granted use rights to agricultural lands, so that the workers essentially produced all their own requirements. In return, the hacendado exacted labor rights. The workers herded estate animals, sheared the wool and transported it to Arequipa, and helped at lambing time, among other obligations. This system avoided the necessity of cash wages, which would have greatly increased the

costs of production. Indeed, this system so greatly reduced the costs of production that, when wool prices plummeted in the 1920's and 1930's, Peru could still export wool at near cost, even though Australia and New Zealand producers were then exporting at a loss.

The hacienda economy during the export era was not a feudal economy, for the workers were not legally bound to the land (Maltby, 1973; Martinez-Alier, 1977). The shepherds could and did leave the estates when conditions became oppressive. But at least in the Nineteenth Century, it was advantageous for the Indian to remain on the estate (Bertram, 1974). His children could easily manage watching the estate animals in his charge. The shepherd could effectively run all of his animals on the estate. And the hacienda provided an umbrella from legal harassment.

Whereas in the Nineteenth Century, the easiest means of increasing productivity and profits was through the expansion of the estate in order to run more animals, increases in productivity and profits by the early Twentieth Century were more easily made through technological innovation, for the amount of land not already taken up by estates was small and the probability of Indian resistance and revolt was great. The larger, more progressive hacendados attempted a number of innovations in the early years of this century, importing pure-bred stock, fencing-in land separating *huaccho* from estate herds. Rey de Castro even began direct exports to England, through the Ricketts commercial house, in 1903.

These limited attempts at rational, capitalist production failed for three reasons. Rightly or wrongly, the Indians perceived almost every technological innovation in this century as a threat to their position and opposed them. The hacendados found it extremely difficult to impose these changes precisely because the estate economy was based on a form of collective bargaining. Second, the export houses in Arequipa opposed every attempt by hacendados and the railroad company to institute direct imports. Yet the progressive men among the hacendados might nonetheless have preserved and succeeded had not the international wool market collapsed in the 1930's. "With this exogenously-determined weakening in the profit incentive, the willingness of large landowners to incur the financial and social costs implied by modernisation rapidly evaporated" (Bertram, 1977:15). Several redoubled their efforts to export directly, but even most of those who had attempted to institute wage labor and the like in the 1920's abandoned these

attempts at the onset of the Great Depression. As a consequence, the estate sector remained moribund right up to our day.

The socioeconomic trajectory of the department of Puno closely follows that outlined by Frank. Puno was a peripheral region producing a primary commodity for the international market. The organization and operation of the international commercial hierarchy served to drain surplus out of the region, thus retarding change in regional development. Nevertheless, the income streams were sufficient that haciendas extended across space in the nineteenth century and began to rationalize production during the period of high prices in the first two decades of this century. When the international wool market entered a prolonged period of volatile stagnation in the 1920's, the relations of production on most estates regressed to what is perhaps misleadingly termed semi-feudal. Yet in this way, the estate sector was able to survive not only three decades of poor market prices but also the collapse of the international market in the 1950's, with the introduction of synthetic fibers.

Although dependency theory sketches the structure and operation of the international system that conditions change in the nature of rural production during the period of exportation, it fails utterly to provide any clue to the course of underdevelopment in the period subsequent to the collapse of the export market. This failure is nowhere more patent than in Puno, where, about the middle of this century, a domestic marketing system arose phoenix-like from the ashes of the wool-export system. To understand this rapid transformation of an externally oriented regional system for the export of wools to an internally oriented regional system for the exchange of commodities requires a consideration of the internal dynamics of underdevelopment during the export era, specifically, a consideration of the nature of the urban system that linked the rural productive sector to the international economy and of the demographic movements within the rural and urban sectors, as well as between them. In other words, to understand the development of underdevelopment subsequent to the export epoch requires study of the internal dynamics of underdevelopment in the regional system, rather than just of the rural sector of that system.

This emphasis on urban systems in peripheral producing regions is paradoxical, for the urban system is essentially dependent on the rural sector. In agrarian regions, administration and commerce are the basis for urban life.

In spatial perspective, the administrative hierarchy is distinctive, for each higher level center encompasses all the territory and only the territory of all lower level dependent centers. This is equally true of a dendritic commercial hierarchy. But, importantly, the administrative and commercial hierarchies may not be isomorphic. In that case, commerce may reshape the administrative system, as economically strategic towns petition for higher administrative status. Although there is a significant time lag for such adjustments, the most viable centers usually perform both administrative and commercial functions. They are consequently the most attractive regional nodes for internal migration, which sets up a new condition for change within the regional system. Which centers attract most population can change over time, as the commercial system is itself transformed. The intensity of these changes is, of course, always dependent on the state of the international market.

In spatial perspective, Frank's hierarchical model of export systems resembles the classic dendritic model of wholesale systems depicted by Johnson (1970:85). That is, there are fewer centers at each higher level in the commercial hierarchy, and the level of centers declines with distance from the port or entrepot center, the highest-level center in the producing region. This classic expression of the dendritic model arises only under specific conditions, namely, the participation of many scattered small-holders in export production, and a disjunction in transport within and between the region. The first condition, the participation of many small-holders, creates the necessity of amassing stocks of the primary commodity. The second condition, a disjunction in transport efficiency, which arose historically with the construction of railroads, makes it economic to amass those stocks in strategic regional centers.

Where one or the other of these conditions does not obtain, other expressions of dendritic wholesale systems arise. Thus, where a few large firms dominate production, these firms themselves undertake the transport of the primary commodity to the port or entrepot. The extreme example of this pattern is, of course, the point-to-point model which most accurately characterized mining. Here, the commodity is moved by the firm directly from the point-of extraction to the point-of shipping and there is no urban commercial development in the producing region. Quite similar patterns of direct export arise where transport is uniform across the landscape.

Where, for example, transport is everywhere by beast of burden, there are no economies of scale to be gained by amassing stocks locally, so that producers and intermediaries may transport the primary commodity at approximately the same cost. Where trucks have penetrated everywhere in the region, loads may be amassed locally but are hauled directly to the port.

The evolution of urban commercial centers in Puno well illustrates the importance of the organization of production and of the levels of transport efficiency in reshaping regional urban systems. From the very beginning of the wool export trade, production had been in the hands of estate owners and native smallholders, whether they lived in indigenous communities or on haciendas. Until the late Nineteenth Century, the only means of transport was beasts of burden, either mules or llamas. Estate owners transported their wools directly to Arequipa, using the animals and labor on the estate in order to reduce actual costs. The small holder clip sometimes also went directly to Arequipa, as Dr. Graham attested. But small holders could also sell locally, in which case the wool might pass through the hands of four levels of middlemen--the local buyer, the provincial buyer, the regional buyer, and the Arequipa export house (Jacobsen, 1979:4).

There were two institutional arrangements for the movement of locally purchased wools to Arequipa. First, local hacendados acted as buying agents, forwarding the wool to one of the commercial houses in Arequipa. These men, who acted as provincial buyers, obtained stocks from fellow hacendados, from local rural buyers, and directly from Indians. Second, there were annual fairs, a colonial institution that collapsed at the end of the colonial period only to revive with the development of the wool export economy in the early nineteenth century.

These fairs were held in several towns on the altiplano, the most famous being those at Vilque, Pucara, and Rosaspata. Here, local buyers could contract for the future delivery of stocks paid for with from the advances of regional buyers and exporters. Moreover, both Indians and estate producers could sell their clip to regional buyers or to agents of the Arequipa firms themselves, and muleteers would then transport the stocks to Arequipa.

The financial breakdown of wholesale business at the 1850 Vilque fair demonstrates that wool was the commodity most actively bulked, though the rural economy even at this early time was diversified. Large amounts of

metals, worth an estimated 120,000 pesos, and tremendous quantities of cascarilla, valued at 150,000 pesos, were amassed. (Some of the metals were mined on the altiplano; gold and cascarilla were extracted by small producers who seasonally migrated to the jungle area.) But wool, the major product of the altiplano, contributed most value to the local economy. Buyers obtained some 220,000 pesos worth of sheep's and alpaca wools from small producers at the Vilque fair. This represents almost half of all wholesale transactions by value and over a quarter of all business at the fair.

Financial transactions at the Vilque fair of 1850 also indicated that while indigenous producers were already caught up in the export trade, they sold more goods at wholesale than they bought at retail (Gonzales Ormachea, 1937). The commercial value of this two-week long fair totaled an estimated 861,219 pesos, 60,000 pesos of which involved miscellaneous expenses such as religious expenditures, house rent, animal pasturing fees and police fines. Although a tremendous array of goods was available at this fair, the sale of imports to the indigenous population accounted for less than half of the business, approximately 300,000 pesos in all. Wholesale purchases by merchants accounted for more than half of the total business at the fair, about 490,000 pesos. The Vilque fair thus represented a net flow of some 130,000 pesos into the rural economy.

Although the export of wool brought money into the rural economy, there was in the second and third quarters of the Nineteenth Century little urban commercial growth because the export channels largely bypassed local towns. The direct export of wool by hacendados and Indians to Arequipa wholly avoided the regional urban system. The purchase of wools by provincial hacendados acting as provincial buyers provided little impetus to urban commercial development, for these were still largely home operations. And, the annual fairs, though they brought a remarkable commercial life to a few places for a few weeks each year, did not constitute the basis of a permanent urban commercial development. As a consequence, administration was the sole major support for the urban system in the department up to at least 1870, and the administrative hierarchy at the end of the colonial period essentially defined the urban hierarchy in this period.

The construction of a railroad in the 1870's led to the development of a network of strategic towns along the rail line, where merchants bulked stocks of wool for shipment to Arequipa and received orders of merchandise

for local distribution. In fact, the Wars of the Pacific so disrupted the local economy that urban commercial development probably dates to the 1890's. But by 1901, Ricketts could appraise Gibbs that wool was now mostly bought by agents in the interior, for which reason "I have not been able to buy any quantity" (Ricketts, Arequipa, International, 18 March 1901; also 6 July 1901).

Urban-based commercial development in the department ran on two legs: the wholesale buying of wool and the retail sale of merchandise, mostly to native small producers. The railroad offered economies of scale to merchants who could amass car loads of wool for shipment to Arequipa. (Indeed, the railroad was of interest only to the merchants, for large producers could still ship wool to the entrepot much more cheaply by taking advantage of the labor and animals on their estates.) No less importantly, the railroad from the coast drastically reduced the costs of transportation for imported goods. Until the 1870's, import orders had to be packaged in units that weighed no more than 65 pounds, so that they could then be loaded onto mules for the trip to Arequipa. This packaging added to the already high costs of interior transport, which equaled the intercontinental trip. With the railroad, however, transport costs fell, and other economies could be realized. The fall in the costs of merchandise likely is one factor in the increasing commercialization of the active population, which had since the beginning of the export era participated in the cash economy.

The participation of the mass of producers in the commercial economy was crucial, for the consumption of basic and luxury goods by the small white and mestizo population, which nowhere comprised more than 10 percent of the population, provided too narrow a base for commerce in the department. The business correspondence between the mercantile houses of Arequipa and the retailers in Puno documents the fundamental importance of the rural small producer in the business of the altiplano. Ricketts, for example, would not substitute better quality merchandise to fill an order of a Puno merchant because the goods would not have sufficient demand to sell quickly; in their words, the goods were "not for the Indian but for the rural mestizos" (*gente del campo*) (777, Interior, Urquiaga, Azangaro 22 June 1912). In a similar vein, Parodi, a large merchant in Puno City, returned a shipment of lamps, explaining that "the article would not be salable here because the native workers (*colonos indigenos*) are not even aware of this item" (340, 15 January 1921).

The commercial vitality of towns along the rail line led to a restructuring of field administration within the department, as residents of the boom towns petitioned the national government for administrative status on a par with their commercial development. The reasons for these local initiatives were simple enough: the allocation of municipal funds was centralized in the higher-level administrative centers, which retained most of the tax monies. Proponents of the petition to raise Juliaca to the status of provincial capital, for example, noted that the Provincial Council on Puno City disbursed only one half of the budgeted funds to the District of Juliaca between 1906 and 1916 (Torres Juarez 1962:263). Furthermore, these proponents complained that the Provincial Council actively thwarted the aspirations of people in lower-level administrative centers. "The action of the Provincial Council of Puno City," notes the memorial of 1910 (cited in Torres Juarez 1962:263), "hinders the achievement of desirable goals, for rather than foster decentralization whenever possible, it complicates procedures and duplicates the dependency without expediting administration." Due to these problems, only two district capitals in the highland area of the department succeeded in gaining the higher status of provincial capital during the wool-export epoch. Ayaviri was made a provincial capital in 1901; Juliaca was created a provincial capital in 1926.

Urban commercial development also extended to lakeside towns away from the rail line. Steamboat service was first established on Lake Titicaca in the 1860s and was later taken over by the rail company and integrated into a single transport network. Thus lakeside towns, including Huacane and Moho, to the north, and Ilave, Juli, Yunguyo, and Desguadero, to the south, all boasted a lively commercial trade based on their lacustrine connection to the rail terminus in Puno City. Merchants in these port towns, like their counterparts in towns along the rail line, purchased wool from altiplano producers and from itinerant peddlers, shipping their purchases by boat to Puno City for later rail transport to Arequipa. In return, they received imported merchandise for distribution across the altiplano and, in several cases, beyond. The hinterlands of several of these towns--Moho, Desaguadero, and, especially, Yunguyo--extended into Bolivia, giving life to an extensive contraband trade that supported a phenomenal commercial florescence in these towns. In the 1920's, for example, Yunguyo boasted several major mercantile establishments purveying radios, American automobiles and motorcycles, French

champagne, and English textiles, besides the more mundane flour, lard, sugar, and salt (Cuentas, 1929:n.p.).

In sum, the railroad transformed the spatial structure of the urban wool-export system in the department in the last quarter of the nineteenth century. A corridor of strategic commercial towns that consolidated purchases of primary commodities and broke wholesale lots of consumer goods (Johnson, 1970:85) arose on the altiplano along the route of the railroad and along the lakeshore, where towns were serviced by steam freighters. Some secondary centers that had earlier performed these functions also continued in the more distant areas of the altiplano, though these necessarily shipped the commodities to on-line rail and lake-port towns. All of these centers very much depended on the continued participation of the native smallholders in wool production, for large-scale producers usually transported their wool clip directly to Arequipa. Small producers in the immediate hinterland of each center brought in their stocks themselves; peddlers based in each center conducted this trade in the more outlying areas. Thus, during the period 1890-1918, efficient interregional transport structured the spatial distribution of urban commercial centers in the producing region, while the less efficient intraregional transport effectively defined exclusive trading areas, each dominated by a single urban center. This spatial organization of wool-export system is, of course, the classic dendritic pattern, and notably, it existed only during the heyday of wool exportation.

Depressed conditions in the international wool market after World War I and the consequent social unrest caused a severe contraction in the import-export business in the department. The decline of commerce in the interwar period, however, was accompanied by a revolution in intraregional transport that further reduced the urban commercial system in the department. Merchants owned most of the few trucks operating on the altiplano in the late 1920's and 1930's. At first, large merchants in the strategic towns, in concert with the buying houses of Arequipa, thought of establishing branch firms in the outlying towns of the producing region. In 1929, for example, the Moho merchant, J. Escolastico Angeles, drove Ricketts' traveling agent to the town of Cojata on the northeastern altiplano, where, as he reported to Ricketts in Arequipa, "we were well received because the first motor vehicle had arrived" (547, Angeles, Moho, 23 December 1929). The possibility of branch offices in distant altiplano towns posed a real threat to the established

merchants there, who consequently contracted truckers to haul their wools directly to the major rail heads. (549, Saravia, Cojata, 10 December 1929; 556, Saravia, Cojata, 11 June 1930).

Trucking made such rapid inroads that the Peruvian Corporation abandoned its boat service to lake-port towns in 1932 (619, Garnica Flores, Santa Rosa de Juli, 17 May 1932), less than ten years after the advent of trucks on the altiplano. With that blow, the port towns lost all commercial significance in the export trade, and the mercantile establishments there were largely reduced to dry-goods businesses, which they are today.

Trucking also eliminated many of the strategic rail centers, as wools now moved directly from distant bulking centers to Puno City or Juliaca for transshipment to Arequipa. Contemporary assessments of these changes note that the closing of many branch stores was due to the increasing concentration of trade into a few, large centers and the rise of local buyers in distant producing areas. Ricketts' traveling salesman so informed the home office of the situation in Santa Rosa in 1930 (556, Lazarte, Santa Rosa, 11 February 1930), noting:

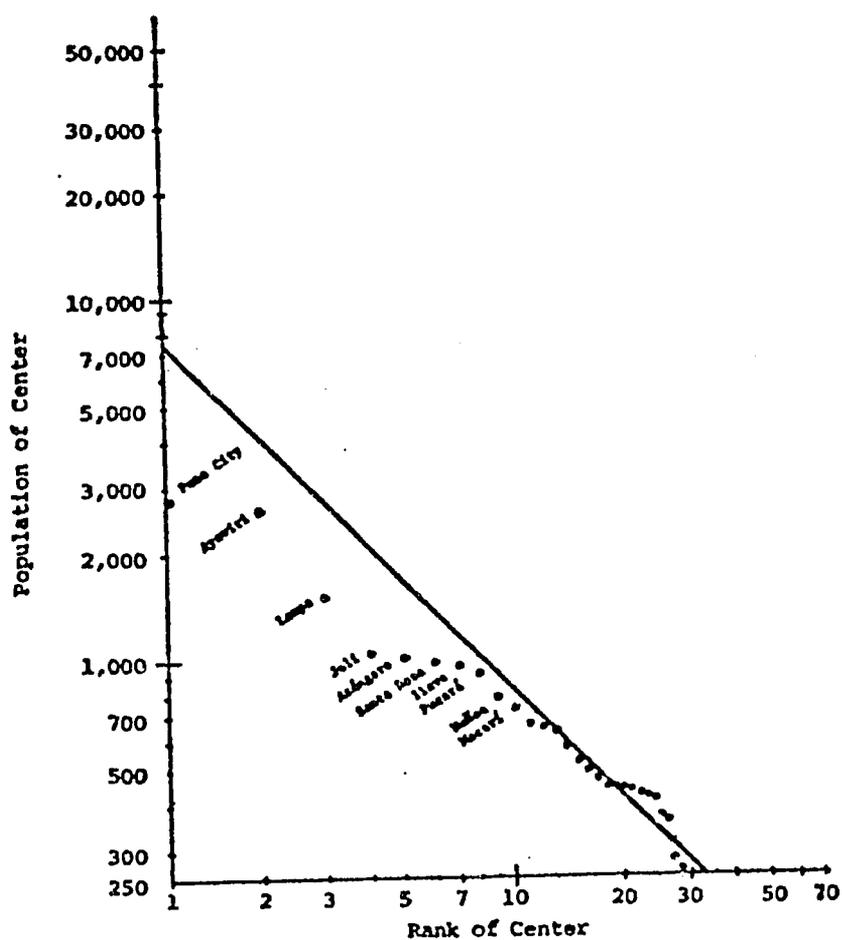
The market was much better to what it is now, since with the establishments of Gibson and Stafford in Ayaviri and Sicuani, and the buyers in Nunoa, Santa Rosa has declined a great deal. At present there are various unoccupied buildings, including those of Stafford, Gibson, Iriberry (sic), and others, all of which were in the wool trade before.

Trucking, then, allowed local buyers to ship directly to the more centrally located rail centers in the department, which undercut the position of many of the smaller strategic rail towns that had arisen when internal traffic was carried by llama train. By World War II, trucking had reduced the number of strategic cities in the department of Puno from some 15 to perhaps four--Puno City, Juliaca, Ilave, and Ayaviri--and these were the only viable commercial centers in the department at the time. Indeed, precisely because of the concentration of trade into fewer centers after the advent of trucks, commercial development in these centers continued to grow at the expense of other centers, despite the continued stagnation in the international wool market.

The evolution of the Puno urban system provides a framework for an analysis of the demographic consequences of exportation. The level of urbanization, that

Figure 1

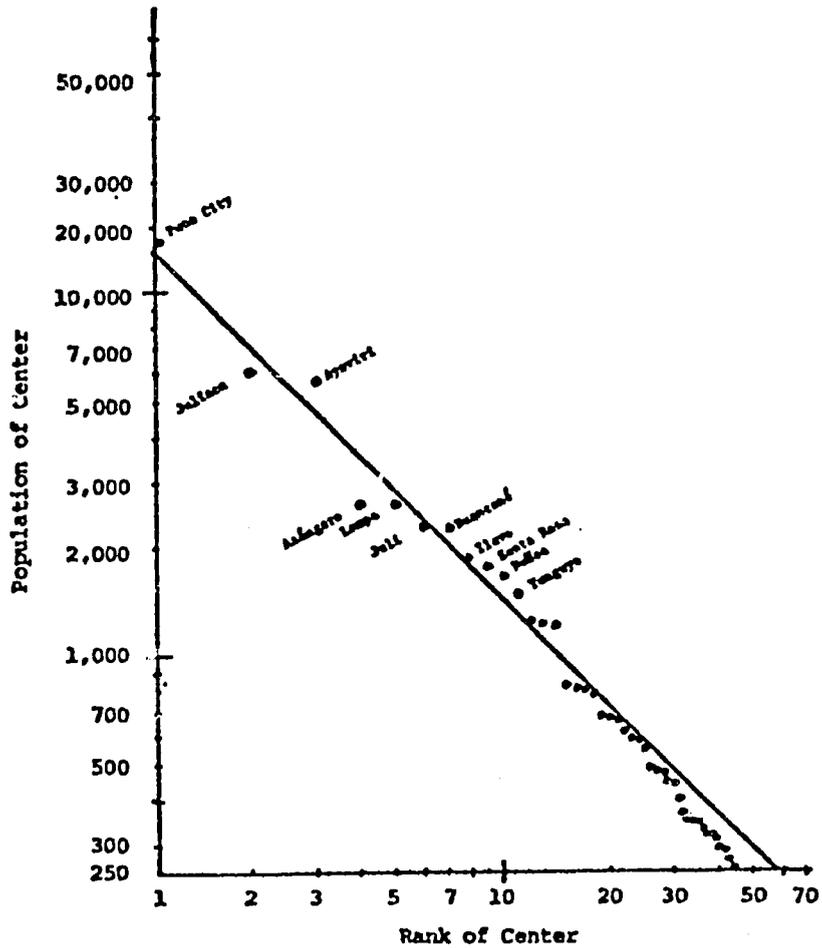
RANK-SIZE DISTRIBUTION OF CENTRAL PLACES,  
HIGHLAND WINDO, 1876<sup>a</sup>



<sup>a</sup> The -1 slope is drawn from the estimated number of nucleated urban and rural settlements with a population of at least 250 inhabitants. The rationale for this approach is discussed below in the text.

Figure 2

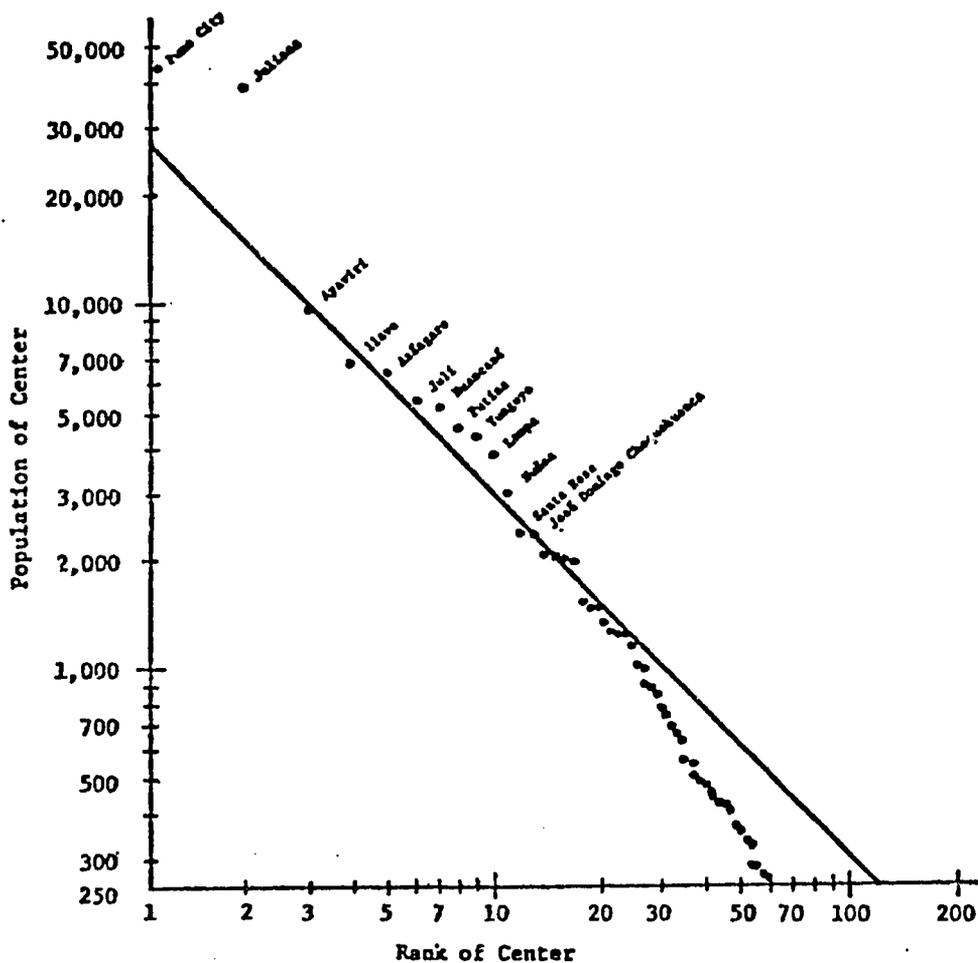
RANK-SIZE DISTRIBUTION OF CENTRAL PLACES,  
HIGHLAND PUNO, 1940<sup>a</sup>



<sup>a</sup> The -1 slope line is drawn from the estimated number of nucleated urban and rural settlements with a population of at least 250 inhabitants. The rationale for this approach is discussed below in the text.

Figure 3

RANK-SIZE DISTRIBUTION OF CENTRAL PLACES,  
HIGHLAND FUNO, 1972<sup>a</sup>



<sup>a</sup>The -1 slope line is drawn from the estimated number of nucleated urban and rural settlements with a population of at least 250 inhabitants. The rationale for this approach is discussed below in the text.

is, the proportion of the total population that resides in town, provides a general measure of the demographic balance between the urban and rural sectors. But, it is also important to examine the distribution of population within each sector. For the rural sector in Puno, this means a measure of the proportion of the rural population that resided in indigenous communities, as opposed to estates, at each point in time. For the urban sector, the appropriate measure is an index of the concentration of population into particular centers.

The level of urbanization in the first years after Independence was uncommonly low, as many elite had fled the area for political or economic reasons. According to the Choquehuanca Estadística, only 6 percent of the total population of the province of Azangaro resided in towns in 1830. Although there are no comparable censuses for the other provinces, it is likely that the towns of the department were everywhere "underpopulated." At least, that is the implication from a rank-size plotting of town populations for 1876.<sup>10</sup> Even though the proportion of urban population had increased to 9.2 percent, the largest centers were much smaller than expected, given the number of centers in this system (Figure 1). Indeed, the population of the administrative centers was minuscule. The department capital, Puno City, boasted only 2,729 inhabitants in 1876; the provincial capitals had about half that population; and the district capitals, with the exception of Ayaviri, were smaller still, averaging but 500 residents. Thus, during the first fifty years of the export epoch, the urban system in Puno recovered to its previous level of about 10 percent, but the system was still essentially "underurbanized."

Importantly, there was in Puno no appreciable increase in the level of regional urbanization during the second half of the wool-export era: 9.2 percent of the total population lived in towns in 1876, compared to 11.8 percent in 1940. Though the absolute population had doubled by 1940, the relative stability in the proportion of the population that was urban reflects the priority of rural population in the growth of the region at this time and the dependence of urban growth on the rural sector. Agricultural exportation supported proportionately more employment in the rural sector than in the urban sector during the boom years, and even during the subsequent years of economic stagnation.

The seeming stability of urban population masks two fundamental changes

that began in this century. First, the collapse of the international wool market after World War I caused an exodus of tenants from estates. Many of the more capitalized hacendados now attempted to institute more rational relations of production. In an extreme case, Munoz Najjar, a national senator from Puno resident in Arequipa, converted his Hacienda Collacache into the Negociacion Ganadera Titicaca and had the national guard evict several of his labor tenants, now workers (Hazen, 1974:135). Other large hacendados opted to try again to institute new measures that would increase the productivity of their estates without severely prejudicing the interests of their tenants. The Lopez de Romana family, through their administrator, continually and unsuccessfully attempted to upgrade the bloodline of their flocks, which in practice were intermingled with the tenants' flocks (Maltby, 1973:11). Even this progressive and paternalistic family, however, let the size of the average flock increase from 504 in 1925 to 806 in 1926 to 1013 in 1927 (Maltby, 1973:13). As the number of sheep under the care of each shepherd increased, both the work obligations and the risks to shepherds increased, and many left the estate,<sup>11</sup> which only compounded the problem for the remaining colonos. The less capitalized hacendados, usually owners of smaller estates, did not have the funds to modernize their estates or to finance their own exports to Europe. These hacendados were able to survive only by reviving various older institutions of peonage in order to force more of their costs of production onto the native work force. Thus, after 1920, there began a slow process of depopulation of the estates.

At first, the ex-colonos would move to the indigenous communities where they had kin and other ties. However, these rural communities were caught in a fatal scissors. They had continuously lost land to the estates from the mid-Nineteenth Century through the first decade of this century. The influx of fellow herders only exacerbated the already serious pressure on the land. Thus, with deteriorating conditions on the estates and in the rural communities, the only remaining alternatives were the towns of the department.

The shape of the urban system had itself changed in the years between 1876 and 1920, with the rise of urban commerce. Although the level of urbanization remained constant, there was a redistribution of urban population within that sector. Whether on the rail line or around the lake, strategic bulking centers burgeoned. Meanwhile, towns away from the new transport system proportionately lost population or stagnated. For example, Juliaca, which is the central rail

junction for the entire altiplano, experienced a veritable population explosion, going from 519 residents in 1876 to some 3,000 in 1919 (Torres Juarez, 1962:14). Meanwhile, Lampa, which had been a major colonial center, did not even keep pace with the overall departmental rate of growth (213%). Its population of 1,496 in 1876 had not yet even doubled by 1940. Other more distant or minor centers experienced even slower rates of growth.

The concentration of population into ever fewer centers gained momentum in the 1920s with the advent of trucking, which eliminated a number of strategic centers and all of the port towns from their role in the wool-export economy. Although there is no population census in the department for the 1920s, the few available data indicate a rapid growth in the few favored centers, at the same time that formerly strategic centers stagnated. Santa Rosa, for example, did not even double its 1876 population of 983 by 1940. By contrast Juliaca, which in 1919 had some 3,000 residents, counted almost 5,000 in 1930, and 6,034 in 1940 (Torres Juarez, 1962:14-15). And, Puno City, which counted some 2,700 residents in 1876, boasted over 13,000 in 1940. That these centers did not grow disproportionately large at this time bespeaks the relative vitality of the rural producing sector in the wool-export epoch, for the growth of these regional centers was still based on international commerce, and remained attuned to developments in the rural sector of that region.

That this relationship was fundamental to the nature of this regional system became apparent in the 1950s. Collapse of the international wool markets, compounded by a devastating drought, precipitated dramatic demographic change within the department. The total population in the highland area had increased by half again between 1940 and 1972, from 503,804 to 706,258 inhabitants. However, the rural population increased by only one-third while the urban population tripled. As a consequence, the level of urbanization in the department more than doubled between 1940 and 1972, going from 11.8 percent to 24.5 percent. Although some of this increase must have been due to "pull" factors--virtually all secondary schools, medical clinics, and transport are sited in the administrative capitals--most of it has been due to "push" factors--the increasing overpopulation of the rural sector (Martinez, 1969:22).

Urban growth in the department since 1940 has not been even throughout the urban hierarchy. Two centers, Puno City, the highest-level administrative center, and Juliaca, the highest-level commercial center, absorbed most of the migrants. Puno City, which in 1940 counted 13,786 inhabitants,

had more than tripled its population for a total of 44,166 in 1972. The growth of Juliaca was even more spectacular, its population of 6,034 inhabitants in 1940 increasing six-fold during the subsequent 32 years. This growth has been greatest in the years since the failure of the international wool market. Juliaca counted 9,248 residents in 1950, 20,403 residents in 1960 (Torres Juarez 1962:169), and 38,475 residents in 1972. Very few other centers experienced such rapid growth during the last three decades, and none of those that did is more than a fifth the size of Puno City or Juliaca. Thus, Puno developed a primate urban system only after the collapse of the export economy (Figure 3).

These demographic changes created a wholly new internal dynamic in the development of the department. From some time in the colonial period until the middle of this century, towns in the department had been provisioned by imported foodstuffs and regional staples from the surrounding countryside. The imported foodstuffs--Chilean bread, Maryland oysters, California salmon, French sausage (Orton, 1875:424)--were available from stores in town. The regional foodstuffs--potatoes, chuno, chilies, charqui, quinoa (Orton, 1875: 423)--were sold in local marketplaces. Because there were alternative channels of supply, most specifically from haciendas (c.f. Rivera Cusicanqui, 1978), markets were limited not just to towns, but to just those towns which had, or had had, a sizeable non-food producing population (Appleby, 1976). But by 1940, as the population of a few centers in the department continued to grow, urban food demand in those centers outstripped the ability of their local areas to provision them, ultimately giving rise to a domestic marketing system.

The development of a regional marketing system is of course much more complex. Between 1915 and 1935, the Adventists founded a number of rural markets for what were essentially reasons of refuge. They had suffered any number of legal and illegal abuses due to their beliefs, and, in defense, they founded their own markets in the countryside. This was economic heresy, for all markets then were sited in administrative capitals. But the addition of Adventist markets on the landscape did not change the nature of marketing, which remained an isolated affair for local provisioning. Similarly, the foundation of contraband markets along the international border between 1935 and 1945 entailed several portentous changes--the importance of trucking and the introduction of weekday schedules--but these markets were illicit affairs attuned to the requirements of international trade, even though they also served the local area.

Radical change in the traditional organization of marketing came only during World War II. First, the volume of commerce in Puno City and Juliaca increased in response to the buoyant wartime wool market. To accommodate this increased trade, these centers added complementary days to their customary Sunday schedule. Puno City authorized a Saturday market, with a secondary market on Sunday; Juliaca kept its Sunday market and added a major market on Monday. Second, several markets were established on the inner periphery of the pastoral zone. These markets were essentially bulking markets for wool merchants. Nevertheless, their appearance signals a revolution in marketing, for traders who did not reside in these places attended the markets. These traders included wholesale buyers of wool, meat and regional staples, as well as retailers of foodstuffs and merchandise. Because these traders would not forego the assured profits of their hometown markets, the new pastoral markets started with weekday schedules. This temporal articulation of markets was of course due to the new mobility afforded traders by trucking. Further, there was now an incipient differentiation among markets, for the older markets proffered far more goods than the newer markets, which performed a new function, wholesale bulking.

These changes came to fruition in the 1950's, with the demise of the export economy. As the urban population of a few towns exploded, these towns experienced severe food shortages. However, some of the people who created this situation helped solve it, by going out to large urban markets in outlying areas to buy food staples that could be resold in their urban center. This trade of course required the coordination of market schedules. Thus, Thursday markets came to be instituted in those centers that lie between every pair of higher-level and more populous centers. The weekday markets in Acora, Coata, Taraco (Martinez, 1962:57), Moho, and Jose Domingo Choquehuanca all date to the mid-1950's.

Thus, by the end of the 1950's, the higher levels of the contemporary domestic marketing system were already in place. The highest-level centers were precisely those centers that had been most commercially viable at the end of the export era. The intermediate level centers were sited interstitially between every pair of higher-level centers. In terms of central-place theory, this is a  $k=4$  or traffic pattern, which gives priority to the imperata of transport. Yet, in terms of central-place theory, the Puno system was still nowhere near complete. It very much lacked a complement of lower-level, local centers.

The marketing system in Puno fleshed out in the 1960's, but not for the reasons usually given in theory. Geographers suppose that once some critical threshold in the number of marketplaces is reached, the system grows geometrically until some hypothetical point of saturation. This interpretation of cumulative market development is most succinctly summarized in terms of an "S"-shaped curve, which has two critical points, the initial "take-off" point and the final saturation point. In Puno, however, the first critical point marks no significant change at all--Adventists and contrabandists alike founded markets for their own reasons. The critical point--the appearance of temporal synchronization and hierarchical differentiation--occurred in the middle of the great surge in market foundation, in the late 1940's. Further, the continued increase in the number of markets was not a natural or necessary consequence. It depended in Puno on a very particular, though common, conjunction of events.

The same factors that led to the demise of the wool-export economy--the loss of international demand and a severe prolonged drought--led to the rapid completion of the Puno marketing system. With no alternative economic opportunities available in the department, the men who remained in the countryside began going down to the coast in search of temporary wage labor. Even though the men returned with perhaps only half their total wages, the infusion of cash into the rural economy fostered the appearance of numerous small markets in the pastoral zone. With this development, which continues today, the Puno marketing system has come of age.

The aftermath of exportation was, then, the rise of a domestic marketing system. This system, as might be expected from its developmental history, serves to draw regional products out of the countryside at the same time that it moves imported foodstuffs and merchandise into the countryside. For a number of reasons, these transfers of wealth work against the countryside people, who must work in auxiliary occupations in order to finance their purchases. Nevertheless, the marketing system has provided numerous jobs for small-scale traders, most of whom are urban. The growth of marketing, which now involves perhaps 15 percent of the total adult population of the department in any week, is but one factor in the explosion of the urban service sector. But, as this detailed examination of the socioeconomic history of Puno demonstrates, the forces that lead to a stagnant agriculture and a bloated urban service sector do so only through a complex process that is by

no means adequately treated in dependency theory, as we know it today.

The principal theoretical task in Latin America is, as it was fifteen years ago, "the construction of a model based on the experience of the last decades which can be used effectively to understand, interpret, and direct the processes of social and economic change" (Veliz, 1965:8). This model must be built from detailed case studies of the changing socioeconomic organization of those areas. These case studies require a perspective and a method intermediate between the macroscopic studies of dependency theorists and the microscopic studies of anthropologists. Regional analysis of functional systems provides that middle ground. Here, international and local studies can be combined into a comprehensive understanding of the evolution and transformation of regional systems, thereby elucidating the causes, as well as the consequences, of the so unconscionably oppressive conditions of life for the rural lower class.

## FOOTNOTES

<sup>1</sup>These rates of return are even lower if one considers the amount paid to producers in relation to the wholesale value of alpaca yarn rather than fiber. According to Clapham (1907: 142), alpaca and mohair fiber worth a million pounds sterling in 1905 was exported from England as yarn worth more than five and three-quarters millions sterling. The failure of Peru to develop a national alpaca textile industry, which was partly the result of successful lobbying by the English commercial houses (Appleby 1978: 56), obviously cost the Puno region dearly.

<sup>2</sup>Yarn accounted for half of the manufacturers' production costs in the 1840s, when alpaca textiles were hand-woven in England. Once alpaca textile manufacturing became common, labor costs fell, and yarn costs constituted an even larger proportion of overall production costs.

<sup>3</sup>There was even a corporate rationale for low prices paid to producers. As Hutner (1951: 35) recounts from an interview with one Farr Alpaca Company officer:

The alpaca clip is brought down from the Andes to market in the coastal regions once a year; the supply is small, constant in amount, and insensitive to price fluctuations. In fact, an increase in price may lead to a decrease in supply because the Indian producers are not concerned to enlarge their income beyond some customary level.

Compare this opinion on the peasant producer's mentality, which is curiously parallel to that propounded by the Russian agricultural economist, A. V. Chayanov, with the remark of William Ricketts, a large alpaca exporter, to his English consignment agent, Antony Gibbs and Sons (Ricketts, Arequipa, International, 10 March 1896)

Alpaca wool has been sold in the last day or two at 52\$ and is quoted at 52\$ to 54\$. There is very little arriving, however, sellers are holding back (because of low prices).

(All references to correspondence in the Ricketts Archive, held by the Archivo de Fuero Agrario in Lima, include the writer's name, his resident, the letter series, and date of the letter.)

<sup>4</sup>The relevant pages of this interesting letter are included in Appendix A.

<sup>5</sup>In a letter to Gibbs (no number, International, 30 March 1932), Stafford maintains that

The arrangement come to between the principal houses here to buy alpaca at fixed limits is working smoothly. We naturally do receive complaints from our agents, and others outside the arrangement, such as Cardenal, and Patten & Mitchell, continue to pay slightly higher prices than those fixed...We may say that the farmers and Indians are still holding up their clips of alpaca and very little wool is coming in. Our purchases this year are only 25 percent of what is bought in normal times. The situation of all the other houses is the same as ours. Therefore, future shipments of all marks will be small. We feel confident that once the farmers cannot afford to hold on, or should the market improve, we shall obtain our normal share of alpaca and sheep's wool.

6 "...la crianza de la alpaca es muy complicada y dificil, por variadas circunstancias que seria muy largo explicar, por cuyas razones los hacendados evitan poblar sus fundos con este animal; pudiendo decirse que dicha crianza esta, casi exclusivamente, en manos de los indigenas, quienes la conservan, muy fraccionada y sin ningun progreso, en sus pequenas propiedades de las cimas de las cordilleras."

7 "We acknowledge that the quality of the Sheep's wool sent by us during the present year has not been up to the standard grade and the reason is because most of it was secured from 'sierra' sheep brought to be fattened in the country round about Arequipa and then slaughtered for consumption. Sheep are sent from the interior all the year round but during the first 6 months they are slaughtered on arrival whereas in the second part of the year they are left to fatten for months. It is especially during this latter period, owing to the exceptional dry climate here, that the wool loses its natural grease and becomes coarse and kempy."

8 The urban disdain for alpaca meat was maintained until very recent years, when the rise in the urban price of beef forced consumers to reconsider their preferences. The urban market for this meat today may well be changing local production decisions in the highlands.

9 Of course, the Indians, being at the bottom of the commercial hierarchy, also reacted to the machinations of merchants. One observer (Sociedad de Propaganda del Sur 1921: 209) noted four common forms of price discrimination used by merchants against the Indian:

(1) reduction in price a fortiori (for allegedly inferior quality wool); (2) theft at the scale at the time of weighing; (3) discount of one pound in every twenty-five for filth, wetness and weight of rope; (4) the forced sale by the merchant of diverse articles such as alcohol, sugar, figs, corn, flour, etc., whose prices and weights leave a new margin of profit for the merchant or forestaller.

The Indians reacted appropriately to these abuses: they rubbed their wool with anything that would increase its weight. Dung, dirt, grease, and even sugar water were hidden in the wools in order to get weight increases of up to 40 percent (Pujault, Interior (229) 18 November 1917). Even though these retaliatory practices were widely known, they were skillfully enough done that they would miss the attention of even a watchful merchant. Ricketts (International, 25 February 1911) once wrote Gibbs about just this problem.

It occurs sometimes however that the wool, even when carefully washed, retains a large proportion of dust and looks always dirty. - The reason of this is because the indians, whenever possible, put inside the wool, to make it heavier, a fine slimy earth which clings to it and does not wash out and is difficult to detect when buying. - We will watch the washing more carefully during the present year and hope that in the future a decided improvement will be obtained in this respect.

<sup>10</sup>The rank-size and primate measures are discussed in detail in Appleby 1978: 97-157.

<sup>11</sup>Shepherds were customarily obligated to repay hacendados for lost animals. Because grazing ranges were unfenced, the risk of losing animals increased significantly with the size of the flock under the shepherd's care (Jacobsen 1979). Thus, as hacendados increased the size of flocks in response to depressed market conditions, the remaining shepherds were apt to incur sizeable debts at the very time that they themselves were least able to pay. This deterioration in the conditions of hacienda life naturally made other alternatives seem more desirable.

APPENDIX A:

EXTRACT OF LETTER FROM WILLIAM RICKETTS  
TO ANTONY GIBBS & SONS, 30 MARCH 1932

Dear Sirs,

We confirm our letter of 16th inst and beg to acknowledge receipt of yours of 24th February dealing with ALPACA FLEECE only. We very much appreciate your full and valuable information on the projected agreement among exporters here to fix for the time being a selling price in Liverpool on account of exceptional circumstances and statistical position. Your remarks about Messrs Balfour Williamson & Co's attitude towards this plan have been read with great interest.

We have already written you at some length commenting on the cables exchanged between us. Now in view of your letter the following points stand out clearly:

- (1) Neither Messrs Huth nor Messrs Balfour Williamson had knowledge of nor had given their authority to any agreement on this side to hold for 13½d.
- (2) Messrs Gibson had no power to bind themselves to selling prices which are absolutely controlled by their Bankers in London.

The situation was therefore quite misleading as we were given to understand there was a joint sanction among the Bankers to uphold the agreement. Otherwise the step taken on this side was premature and without any binding force.

We must however make it quite clear that we acted under the intelligence that the plan to fix a selling price was to be merely a temporary one and in no way with a permanent character. In the latter case we would have placed the matter entirely in your hands for approval and final decision.

We concur with you in the opinion that taken all things together it would not be desirable, for the present at least, to attempt a control in the selling prices of Alpaca, but on the other hand we rather doubt the assertion of Bradford buyers that Alpaca today at above 13d per lb. can be easily replaced by other wools. An important point to bear in mind is that growers cannot produce Alpaca on the basis of 12d per lb. for fleece considering present exchange.

As regards the Bankers right of sale we submit that it cannot be unconditional and may vary according to circumstances. In our own case with your goodselves the question has never been raised nor do we expect there will be occasion to raise it in future. It is a matter of "bonna fide" and we have implicit confidence in your handling of our consignments to the best of our interests. Whenever you have consulted us about offers, prices etc. for goods already consigned we have invariably left the final decision to your goodselves only making such observations as might modify the aspect of the situation viewed from this side.

Messrs Antony Gibbs & Sons (30/3/1932)

Mr. Fitz-Gerald is at present in Lima and on his return in the course of a few days we shall have occasion to discuss with him the various points mentioned in your letter under reply.

Sales. We thank you for your cable of 22nd inst reading:

"A sale of 236 bales of Alpaca S.G. average has been made  
"at 12 3/4d per lb. keep this strictly private except for  
"Stafford & Co S.A. Arequipa."

We are informed that 300 bales Y.C. Fleece are also being offered at 12 3/4d.

Messrs Stafford & Co, S.A. have shown us a cable from you making a combined offer for 2,000 bales AWF and WRA, in Liverpool, in transit and for shipment at 12d per lb. We mentioned that the price offered held no inducement. The fact that there are buyers for 2,000 bales had some significance. It will be interesting to know if Messrs Huth will eventually accept 12d to get rid of their stocks.

## APPENDIX B:

### EXTRACT OF LETTER FROM WILLIAM RICKETTS TO ANTONY GIBBS & SONS, 5 AUGUST 1933

Regarding the break up of the price fixing ring at our end, through the extended outside competition, your interesting comments have been carefully noted. Competition, as a consequence, has been very severe and the unfriendly spirit, coupled with eagerness to increase stocks at any price in view of the favourable expectations, and in several cases with the object of fulfilling uncovered forward contracts, has had the incredible effects of offering higher prices than the Liverpool parity. With no margin of profit and a probably loss through reaction of exchange, or drop in values on your side, has made us proceed with caution and prefer under these circumstances to abstain from making any new purchases and only limit these to keep up our connections with our Interior Agencies on as a reduced scale as possible.

Needless to say, we shall always endeavour to cooperate as closely as possible with Messrs. Stafford & Co. in the matter of buying prices, as also with the Y.C. exporter, but you can readily understand our difficulty in this sense considering the reflection of the mad competition at the hands of the other exporters, who are bent on a fierce fight to capture what little wool is offered in this off season. Unfortunately we cannot see any improvement in this unreasonable ruinous competition, as all attempts to induce those responsible for this state of affairs, to reconsider their attitude, has not been successful. Messrs. Stafford & Co. have kindly shown us their private letter to you on this point and we can only fall in with their views and endorse their important opinion on the present situation, and only hope that through your valuable influence something can be done at your end to change for the better the dangerous position in which all exporters are placed through unscrupulous competition.

Messrs. Stafford and Co. have also kindly transcribed to us your comments on Spain and we note there is little probability of wool business developing in that country, owing principally to terms of payment which are not satisfactory.

Regarding your insinuation to renewable information of sales of other marks, we hardly think this is necessary, except perhaps of some very important and striking transactions, such as the sale of 400 bales SEL. "to arrive" you advised us lately, which we shall always be pleased to receive. Usual sales of other marks generally leak out here and we generally get information through one or other of our competitors. With economy as the main object in view, we would thank you only to continue cabling advice of our sales, and those of minor quantities only when they indicate a change of values for our knowledge.

APPENDIX C:

EXTRACT OF A LETTER FROM WILLIAM RICKETTS  
TO ANTONY GIBBS, SEPTEMBER 1, 1926

The following transcript of a letter, lately addressed by Messrs. Tattersfield Company, Philadelphia, to their wool buying agents here will be of interest to you:

"We received your letter of .....for which we are extremely  
"obliged, and we thought that it might be advisable to write  
"to you personally giving you the reasons why it is impossible  
"for us to do anything in Alpaca Fleece at the present time,  
"particularly as you refer to this matter in your letter.-  
"For your personal information the writer was at the Mills  
"of one of the most important Alpaca concerns a few days ago,  
"and they informed him that their present stock of Alpaca  
"Fleece is approximately 630,000 lbs., and that prior to this  
"year their annual consumption was approximately 500,000 lbs  
"weight, whereas this year their entire consumption of Alpaca  
"was less than 5,000 lbs, or 1% of their normal consumption.-  
"This, in a very few words, explains to you the reason why it is  
"absolutely impossible for these people to take any interest in  
"Alpaca Fleece.- One of the principal reasons why Alpaca  
"has not been consumed in any appreciable quantity for almost  
"two years is the fact that the bulk of the linings that are  
"required today are light colours, and it is impossible for  
"our friends to make a light coloured lining out of Alpaca,  
"probably due to the fact that the bulk of the colours in  
"Alpaca are too dark in shade, consequently they have to make  
"their light colours out of White Wool such as New Zealand.-  
"Practically all the Alpaca that is used by our friends is used  
"for linings, and, as you are probably aware, the tendency for  
"some time past in both men's and women's wear has been for light  
"colours, and of course they must have the linings to match.-  
"We are exceedingly sorry that this business has practically gone  
"dead, but we do not see how we can do anything in the matter  
"and until there is some revival we do not see any prospect of  
"being able to place Alpaca except in the light colours, which  
"we are not able to buy.-"

The above mentioned agents have given us a copy of the letter authorizing us to make use of it.

# PASTORALISM IN THE SOUTHERN SIERRA

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BENJAMIN ORLOVE

## INTRODUCTION

This article has a specific audience and a specific task. It seeks to inform individuals concerned with development programs for small ruminant production of highland Peru about basic aspects of pastoral groups in the Andes. It presupposes some familiarity with economic or technical aspects of livestock production but relatively little acquaintance with the ecological, economic and political conditions of the Andean rangelands and their inhabitants. Other sources provide a more complete anthropological analysis of these people (Bolton and Mayer, 1977; Brush, 1977; Orlove, 1977a).

To many outsiders, the herders of the high Andean grasslands appear to be backward or irrational. The systems of livestock production might seem inefficient and unproductive, and it is hard to explain why the local herders resist technological improvements, such as the introduction of stud rams, or fencing, which would permit the cultivation of improved varieties of forage. Some production units appear to be well below or above some maximally efficient size. Development personnel may be frustrated with a lack of concern with a raising of productivity. One could simply dismiss the herders as uninterested in economic change because they are Indians. Their culture, rooted in a pre-Hispanic past, simply favors values different than those of Western society with its market orientation, and there is therefore no possibility of change. However, the highland Peruvian herders are responsive to programs of change, if properly conceived and directed. It is the purpose of this article to demonstrate that point. Two concepts that will be used are "rationality" and "adaptation." They are not intended to be used in a rigorous precise academic manner, but rather in a rougher more commonsensical fashion.

Rationality can be seen as the allocation of scarce resources to a series of ranked goals under a set of constraints; phrased differently, it is the way in which individuals work out the most satisfactory compromise between limited means and unlimited desires. The closely related concept of adaptation refers to the way in which individuals or populations establish and maintain ways of life that provide them with adequate living conditions in the face of external conditions which are often harsh.

This article, then, offers an introduction to the adaptation of highland Peruvian herders to their biological, social and economic environment. It tries to demonstrate that this adaptation is rational; that is, granted some simple goals of subsistence, security and profitability, the adaptation is a successful pattern of resource allocation. It focuses on herds of llamas, alpacas and sheep (when the species of animals is not named, the reader may assume that the description applies to all three).

The article briefly describes the production units in which the herders live and summarizes the physical environments and characteristics of the herd animals. It presents the technical, social and economic aspects of herding activities. Particular attention is paid to traditional practices which raise the carrying capacity and limit the expansion of herds.

### THE HERDERS

This article refers primarily to the herders of the central and southern highlands of Peru. The author's principal research areas have been the departments of Cuzco and Puno in Peru and La Paz in Bolivia, although he has also traveled in the departments of Arequipa, Apurimac, Ayacucho and Ancash in Peru and Potosi and Chuquisaca in Bolivia. Information on central Peru is derived primarily from secondary sources.

There are a large variety of kinds of production units in the Peruvian highlands, reflecting the different forms of communities and estates before the Agrarian Reform Law of 1969 and the new kinds of units created after it. The most important of these are:

- a) communities. These are bounded territorial units with well-defined members. Within them, the herders or comuneros live in isolated homesteads or small groupings of related households. Most animals are owned by individuals. Each household manages as a unit the animals belonging to its members. All members of the community may use the

temporary or rainy season pasture; the scarcer dry-season pasture is often controlled by households or small groups of households.

b) haciendas. Haciendas were the privately-owned estates that existed in Peru up till the implementation of the Agrarian Reform Law of 1969. Some haciendas still exist. The work force that lives on the hacienda may be termed *colonos*, *aparceros*, *huacchilleros*, etc; *colonos* will be the term used in this article. In general, the workers receive the right to cultivate plots of land within the hacienda or herd their own animals (*huacchos*) on hacienda land. Many haciendas also hired temporary workers for wages, paid in cash or kind. In many cases there were absentee owners. The administrators and foremen (*mayordomos*) lived in a central complex or *caserio*.

c) cooperatives or CAPS (Cooperativas Agrarias de Produccion). There are generally composed of one or more haciendas which were expropriated by the Agrarian Reform. The members of the cooperatives are the *socios*, most of whom had been the permanent workers on the haciendas before expropriation. The *socios* meet in general assemblies to choose the main officers, the *comite de administracion* and *comite de vigilancia*, who dictate policy, redistribute profits and the like. The payments which *socios* receive are technically not termed salaries but *beneficios* or benefits. Most of them own *huacchos*. (It should be added that if several ex-haciendas are joined to form a cooperative, each ex-hacienda is a production unit or *unidad de produccion*. In addition, the lands of some haciendas were turned over to communities rather than transformed into cooperatives.)

d) SAIS. These initials stand for *Sociedad Agrícola de Interés Social*, or Agricultural Society of Social Interest. They link cooperatives and communities into single units, in an effort to share some of the benefits of Agrarian Reform with the community members who did not benefit as directly as the *socios*. The profits are supposedly directed into social interest projects such as health, education and community projects. Like the cooperatives, each SAIS has a *comite de administracion* and a *comite de vigilancia*, selected in a general assembly. In the SAIS, however, each community and cooperative or production unit sends delegates in proportion to its land.

In addition, some medium-sized herders do not fall readily into any of these categories; they may be termed medium ranchers or *medianos propietarios*. In a few areas, other units such as communal cooperatives and social property enterprises may be found; these other post-Agrarian Reform units comprise a small portion of the total population, however.

Despite this apparently confusing variety of kinds of organization, there are several important similarities that run through these units. One is that Andean herders, unlike those in East Africa and certain other areas, eat a diet which includes non-pastoral products such as grains and tubers; they must have regular access to these products whether they purchase them, barter for them or produce them directly. In most cases the herds serve a variety of purposes; the animals provide food, fiber, fuel and fertilizer in the form of dung, and a means of transport. These different units have adapted to generally similar environments, so that production techniques may vary less than patterns of ownership and control of land and animals. Finally, most households whether comuneros, colonos or socios own some of their own animals, so that they are all in a sense small-scale producers.

In much of the central and southern sierra, the herders are different socially and culturally from the majority of the Peruvian population. It is in the high pastoral zone that the highest percentages of monolingualism in the native languages, Quechua and Aymara, are found. Many elements of the pre-European way of life continue in areas such as technology and religion. In some places, a sharp line separates Indians and mestizos.

### THE PUNA ENVIRONMENT

Environmental constraints strongly affect the production systems of the herders. The Andes are relatively young mountains, and are still in the process of formation from the interaction of the South American and Pacific plates. Great uplift has formed high, undulating surfaces that contrast with the more continuous extreme relief of many other mountain systems. Nevertheless, faulting, folding and volcanic activity have produced a more rugged and mountainous surface topography, while glaciation and erosion have generated many deep valleys. As Bowman noted many years ago (1916), the complex geological history of the Andes has produced a landscape of rolling, relatively flat plateaus with occasional mountain chains rising above them and deeply incised gorges cutting into them. The term puna is used in both

Spanish and Quechua to refer to this intermediate zone ranging in duration from 3500 to 5200 meters in elevation, with relatively low relief, and characterized by bunch grasses and low forbs. It is in this zone that pastoral activity is concentrated.

Puna soils are varied in quality. Many are poor in nitrogen. Intense mechanical weathering breaks down parent rock matter, but the cold, dry climate prevents rapid decomposition and accumulation of organic matter. On some areas alluvial and colluvial deposits are very thick, and in others they are quite thin. Many areas have very porous soils which overlay extensive deposits of tuff.

The climate of the Andean highlands resembles that of other tropical mountain systems in certain ways. The average annual temperature variation is low, but diurnal temperature variation is great. Rainfall patterns in the Andes are dominated by the position of the area in relation to two major air masses. The Southern Pacific anticyclone to the west passes over the cool waters of the Humboldt Current in the Pacific Ocean, generating a belt of fog along the coast but giving rise to virtually no precipitation. On the eastern slopes, moist air from the South Atlantic anticyclone drops large amounts of rain as it rises over the Andes. The intensity of this rainfall follows the seasonal movements of the Intertropical Convergence Front. It brings high and steady amounts of rain to the northern portion of the Andes. The precipitation further south is more seasonal and lower in total amount. Precipitation and climate in the Andes may therefore be seen crudely as a combination of the three perpendicular spatial axes: increasing elevation is associated with moister, cooler climates. As one moves from north to south, annual rainfall decreases and becomes more concentrated in a rainy season from November to March. There is also a sharp gradient of rainfall from west to east. Average rainfall ranges from about 600 to 1100 mm. annually. However, there is also considerable variation in rainfall; droughts of several years' duration, with precipitation well below normal, have occurred in recent decades. Such droughts are usually accompanied by severe frosts, since the lack of cloud cover permits the nocturnal loss of heat through radiation.

The most common form of vegetation in the puna is the perennial bunch grass in *Ichu*, *Festuca*, and *Calamagrostis* genera. Associated with it are small forbs, often found in the moist areas at the base of the grass tussocks where dew deposition on the grass raises available moisture. In

moister areas there are other forms of vegetation, including cushion and rosette plants. In very moist areas *Distichia muscoides* known locally as *khenkina* forms a continuous mat. These plants grow close to the ground in a dense growth form, exposing little surface to cold. These cushion and mat plants in moist areas are known as *bofedales*. These moist areas are of particular importance, since they contain green relatively succulent vegetation throughout the year. In contrast, the bunch grasses and associated forbs offer forage only during the rainy season. Native trees, particularly a *Polylepis*, can occasionally be found at elevations up to 4600 m.

The animals grazed in the puna include sheep, llamas, alpacas, cattle, and, to a lesser extent, goats, horses and donkeys. The former have a number of traits in common as ruminants. However, I will focus on the native camelid species, the llama (*Llama glama*) and the alpaca (*Lama pacos*) and the Old World domesticated sheep, (*Ovis aries*). The first two will be referred to as camelids. These two sets of animals were domesticated in different parts of the world and in different types of economies. Current differences between the two can be traced both to differences in their wild ancestors and differences in the characteristics selected by the human populations which exploited them. Similarities, in turn, may be traced to their common phylogenetic origin (they are both members of the order Artiodactyla and the suborder Ruminantia) and common features preserved or developed by the groups that herded them.

There are certain similarities between the Andes, where llamas and alpacas were domesticated, and the Near East, the site of domestication of sheep. As Kent Flannery states, "Like some of the other areas where early civilization arose--...the Central Andes, for example--the Near East is a region of 'vertical economy,' where exchanges of products between altitude zones are more feasible and desirable..." (1969:73). Both areas also have markedly seasonal climates. The particular details vary greatly: cultivation of wild grasses and domestication of wild herd animals in the Near East, and in the Andes a more complex pattern of fishing and cultivation of associated plants in the Pacific littoral, and gradual domestication of grain and root crops in the highlands and Amazon lowlands. The data and location of camelid domestication remain unclear, although it appears to be associated with hunting of migratory herds (Lanning, 1967; Flores, 1977).

Table I. Classification of Pasture Species According to Quality

Scientific Name	Quechua Name
	High Palatability
<u>Alchemilia pinnata</u>	<i>Sillo sillo</i>
<u>Bromus unioloides</u>	<i>Cebadilla</i>
<u>Calamagrostis heterophylla</u>	<i>Sora sora</i>
<u>Distichia muscoides</u>	<i>K'unkuna</i>
<u>Festuca dolichophylla</u>	<i>Chillihua</i>
<u>Hypochoeris</u> sp.	<i>Pilli pilli</i>
<u>Hordeum muticum</u>	<i>Cola de raton</i>
<u>Muhlenbergia ligularis</u>	<i>Gramma dulce</i>
<u>Cyperus</u> sp.	----
<u>Poa candamoana</u>	<i>Gramma</i>
<u>Trifolium amabile</u>	<i>Trebol</i>
<u>Erodium</u>	<i>Auja auja</i>
<u>Gnaphalium</u> sp.	<i>Januncara</i>
	Moderate To Low Palatability
<u>Calamagrostis vincunarium</u>	<i>Napa pasto</i>
<u>Calamagrostis rigida</u>	<i>Mula pasto</i>
<u>Calamagrostis</u> sp.	<i>Huaylla ichu</i>
<u>Geranium</u> sp.	<i>Ojotilla</i>
<u>Muhlenbergia peruviana</u>	<i>Llapa</i>
<u>Juncus</u> sp.	<i>Junquillo</i>
<u>Stipa</u> sp.	<i>Ichu</i>
<u>Plantago</u> sp.	<i>Llanten</i>
<u>Oxalis</u> sp.	<i>Anas cebolla</i>
<u>Gomphrena</u> sp.	<i>Pilli plateado</i>
<u>Scirpus</u> sp.	<i>Totorilla</i>

Sources: Deustua, 1971; Baker and Little, 1976:54.

The ruminant ungulate herds which were the wild ancestors of the camelids and sheep were preadapted to domestication. Since they fed on grasses and wild plants of relatively low nutritional quality, they required large amounts of food. They tended to graze in open grasslands. The physiology of rumination allowed them to make use of low-quality food; it also facilitated domestication, in that the animals were preadapted to periods of rest. In this context, social organization based on sizeable herds rather than solitary individuals or small groups offered several advantages, such as aiding the movement between the different zones of pasture which became available at different periods. These features of seasonal grassland habitat and herd organization are common to many domesticated animals. Cattle, buffalo, goats, camels and reindeer are also ruminants, and they tend to exist in areas with seasonal climates and extensive grasslands (Grigg, 1974). They were domesticated in areas where lands with considerable agricultural potential were located close to grasslands. Their herding behavior made it easier for them to be domesticated.

However, there are differences in the particular details of the herd behavior of the camelids and the sheep. Speculating somewhat on limited material, it appears that the sheep are smaller and tend to use flight as a predator avoidance strategy. Their behavior patterns are allelomimetic; that is, individual sheep tend to imitate neighboring animals (Rafez et al., 1969). In this fashion, an alarm response from any individual could trigger a flight on the part of the entire herd. (This characteristic also favored huddling in cold weather and other adaptive behaviors). The camelids are larger than sheep, perhaps in response to harsher climate and less abundant food resources in the Andes. Average adult weights are 45 kg for sheep, 90 kg. for alpacas and 115 kg. for llamas. In addition, there are fewer larger carnivores in the Andes than in the Middle East. Herd behavior in the camelids seem to be associated with intraspecific competition for food resources rather than with predation pressures. Territorial defense of scarce resource is an evolutionary common strategy. In the case of the camelids, it is applied to dry season pasture. The camelids therefore differ in several ways from non-territorial sheep. The territoriality is most strongly documented for the wild Andean camelids, the vicuna (Franklin, 1974; Koford, 1957), but similar patterns are found in the alpaca and llama. Dominance hierarchies are more important than among sheep. A few adult males are the leaders of each herd.

Since the other animals follow their actions, the herds act coherently. Although the camelids engage in flight responses, they are more likely to face and challenge enemies than sheep are. The famous "spitting" behavior of llamas and vicunas is an example of this pattern. Certain other behaviors are associated with the territoriality. These include communal dust bathing in fixed sites and the use of *defecatorios* or common dung heaps. The usual form of the latter behavior is for the lead male to defecate in the common site, and for all the other members of the herd to follow suit. Such marking behavior is common in territorial animals. These herd behaviors in sheep and camelids facilitated domestication. They have presumably been reinforced by millenia of conscious selection. Selection has also taken place for wool quality and other physiological features.

Other forms of behavior also differ somewhat between the camelids and sheep. In both animals, estrus in females is seasonal and timed so that the young will be born at the most favorable time of year. In the case of sheep, estrus is triggered by photoperiodicity. When the number of hours of daylight reaches a certain level, the females enter estrus so that the young will be born early in the rainy season. Camelid estrus is triggered (by as yet unknown mechanisms) so that the young are also born at the beginning of the rainy season. Sheep transported to tropical areas in the Andes as well as those in Africa and Australia, where day length does not vary greatly, have a relatively aseasonal estrus. Lambs thus tend to be born throughout the year. The behavioral patterns of the animals also affect the way in which their resources are utilized. Sheep in general require more labor per animal; since they are smaller, the effort per unit area is considerably higher. The aseasonality of estrus leads many herders to keep adult males in separate herds from the estral ewes at times when they wish to prevent conception. Ewes have an inconvenient tendency to give birth at night (perhaps an adaptation to pressure from diurnal predators in the Middle East). The camelids give birth early in the morning, so that neonates have a maximum number of hours before they must face the rigors of the cold Andean nights. Newborn lambs thus require more attention. The *defecatorios* also make the collection of camelid dung more efficient than the comparable task for sheep. The allelomimetic behavior of sheep makes it difficult to work with the animals in complex systems of corrals. Herds of sheep tend to get restless if they are divided among several corrals for shearing.

The sheep and the camelids tend to occupy generally similar habitats in the Department of Cuzco, for instance, they are found in the high Andean grassland or puna between 3500 and 5200 meters. (In pre-columbian times, llamas were found on the coast and in the upper reaches of the Amazon rain forest as well as in the highlands; the Spanish raised sheep on the coast as well as in the highlands.) The camelids tend to be located at higher elevations. The incidence of respiratory tract infections among sheep increases when the animals are taken above 4400 meters. Camelids suffer from external parasites at elevations below about 3400 meters. At low elevations, alpacas are susceptible to intestinal worms. The use of communal dust baths and *defecatorios* may hasten the spread of diseases within herds. At higher elevations, the parasites may not survive as well. The animals also appear to benefit from the hard ground and tough grasses at high elevations. The lack of hard rock surfaces at lower elevations promotes foot infections.

#### HERDING ACTIVITIES

The environmental constraints and the requirements of the small ruminants place limits on pastoral adaptations in the Andes. Several patterns of activity are common in the different kinds of production units:

- a) daily cycles. Herds are generally kept in corrals at night for protection and warmth. They are taken out to pasture during the day by adult members of the households that own them or by children. Conscious rotation of pastures is practiced in some areas. When labor is available, pastoralists keep their animals in different herds, separating the adult males from the females with young. This practice requires the allocation of more than one household member to herding tasks or the joint herding by one person of similar animals of different households.
- b) annual movements. As previously mentioned, forage availability varies greatly throughout the year. Rainy-season pasture is relatively abundant and dry-season pasture scarce. The herds are moved to the moist permanent pastures or *bofedales* during the dry season and back to the seasonal pastures in the rainy season. In general, these movements are a form of vertical transhumance. The *bofedales* often occur in higher areas among glacial moraines; in the lower areas, aquiferous strata which might give rise to *bofedales* are

often covered by alluvial or tuffaceous deposits. Climatic factors also favor this movement, since the most severe storms of the year occur at higher elevations during the rainy season. In some areas where there are virtually no herders will construct fences, usually of mud brick (*adobes*) to keep some reserves of rainy season pasture for use in the dry season. These fenced pastures are known as *moyas*.

This transhumance also permits a mixed agricultural-pastoral economy. Agricultural activities tend to be concentrated at lower elevations during the rainy season, so that herders who engage in agriculture can avoid scheduling conflicts. The use of fallow fields for pasture and the alternation of corrals between animal shelters and gardens (Orlove, 1977b) make these connections stronger.

c) other annual cycles. Certain other activities are strongly constrained to certain times of the year. Most animals are sheared at the beginning of the rainy season. Their coats can grow back more rapidly during the following months because of greater availability of forage, and risk of exposure to frost is less because of the greater cloud cover during the rainy season. Alpacas and llamas also bear their young around this time. Females become receptive soon after birth, and the mating, supervised by the herders, takes place then, and the gestation period of over 11 months assures the birth at the same season in the following year. A simple separation of adult males and females prevents mating in other months, allowing the herders good control over this timing. Ewes tend to go into estrus throughout the year, making the scheduling of birth more difficult, and a portion of lambs are born during the months when risk of neonatal death is higher due to frost or scarcity of pasture for lactating females.

The animal slaughter takes place late in the rainy season. The herds are at their maximum weight, and this practice permits the adjustment of herd size to available fodder. It also facilitates the preservation of meat by salting and exposure to sun and frost. This dried meat, known as *charqui*, is an important element of the pastoral diet and an item which is in demand for trade and barter. The timing of these activities is an important part of adaptations of Indian herders to the puna environment.

This simple description of pastoral activities indicates that there are

two major scarce resources in herding systems. These are the limiting factors which prevent increase of production of particular households. They are the dry season pasture and the peak labor for shearing and slaughter. I will return to these points in a following section. However, at this point I will address the issue of the carrying capacity.

Biological and human ecologists (Orlove, 1980a) have criticized the notion of carrying capacity as being difficult to operationalize and assess and as resting on inaccurate conceptions of ecosystem maturity. Nevertheless these problems are less severe in the case of range management, where the concept was first developed, than in other production systems such as agriculture, fisheries and even forestry. It has often been argued that the carrying capacity of the puna is fixed. I wish to show that it is relatively fixed although it can be raised by several means:

a) Irrigation. Until recently, the descriptions of irrigation in the Andes were limited to cases of agricultural systems at lower elevations. Recent studies (Palacios Rios, 1977; Flores, 1977) have shown a variety of complex systems which extend old bofedales and create new ones. These are generally constructed and maintained by groups of related households. The description of these systems is still in its infancy; there is no complete inventory of such techniques, let alone a mapping of their distribution.

b) Burning grasses. Herders burn bunch grasses on different occasions. In some cases the location and timing of burning are relatively fixed by rituals, as in the fires which spread from mountain top bonfires late in June in association with St. John's Day and the winter solstice. Herders also report burning grasses for more pragmatic reasons. They will burn *Festuca* to encourage *Stipa* to return. This alteration of successional patterns also deserves further study.

c) Articulation of agriculture and pastoralism. The crop rotation patterns facilitate the use of agricultural lands for forage. In most areas of the Andes, for instance, potatoes are planted after a field has lain fallow and then grains or legumes are planted in following years. Potatoes must be dug from the earth but grains and legumes are harvested with sickles, which leave the furrows intact. The presence of furrows favors the return of grasses, as comparisons of plots shows. (Well-designed experiments would be

necessary to confirm this initial impression.) The spacing of fields also favors the articulation of herding and agriculture, since cultivated fields tend to be concentrated rather than dispersed reducing the total field perimeter and hence the need for supervision of animals. This is managed through the use of laymi systems.<sup>1</sup>

d) Planting of forage. In some areas, barley is planted explicitly as a fodder crop. Herders also plant reeds (*Scirpus sp.*) in lakes and marshes for use as animal feed. There is no use of silage in the highlands.

These techniques appear to increase the carrying capacity of the puna somewhat although it would be difficult at the present time to quantify this increment.

#### MULTIPURPOSE HERDING

Outside observers of highland Andean pastoralism may unconsciously view it through a set of assumptions which they have developed through years of contact with livestock raising in other, more industrialized countries. One major difference between small ruminant production in Peru and in other countries is the number of products and uses of the animals. We are accustomed to think of ruminants as producers of food and fiber, but they serve other purposes as well in the Andes.

a) Meat. Llamas, alpacas and sheep are valued for the meat which they produce. It is consumed both fresh and in freeze-dried forms such as *charqui* and *chadona*. (The dried meat is prepared by various methods. One involves soaking the meat in salt water or covering it with salt, then pressing it under heavy rocks and finally exposing it to sun and frost. Other individuals eliminate all except the last step.) The freeze-dried meat, if prepared properly, can be stored for a year or longer without spoilage. It can be consumed by the herders, sold, or bartered. There has been a long-standing prejudice against llama and alpaca meat on the part of the inhabitants of towns and cities in Peru, but rising meat prices and the difficulty of distinguishing freeze-dried llama or alpaca meat from other sorts of charqui have increased the urban demand for this meat. The preference for the more tender meat of young animals seems much less marked in Peru than in the United States or Europe.

b) Fiber. The same three species produce wool, though of different qualities. Alpaca wool is the most lustrous and commands the highest prices. Llama wool has a strong tendency to felt, which makes it useful for weaving of sacks and rope. Peruvian sheep wool tends to be greasy, short and of low quality by international standards. Like meat, wool can be sold, bartered or used for home consumption. In some areas, such as the relatively commercialized Sicuani region in the Department of Cuzco, about 90% of the wool is sold, primarily in the form of fleeces shorn from living animals or "pulled" from hides. For the herders in these areas, the sale of wool is their major source of cash income. In other areas, this percentage is lower, and a higher percentage goes to weaving of cloth, blankets, ponchos, ropes, sacks and the like. These items still form an important part of a barter economy in many areas; herders travel from the puna to lower agricultural valleys, where they exchange their meat, sacks and rope for maize and other crops. Even in remote areas, however, the herders are involved with the cash economy. This fact is shown by the strong preference that herders have given for white alpacas. Such animals are less disease-resistant, but their wool has consistently commanded higher prices on the international market than colored wools, since it can be dyed. Herders have culled non-white animals and the percentage of white animals in alpaca herds has steadily grown during the twentieth century. This fact is particularly striking because it contravenes traditional preferences for maintaining herds of mixed color composition in order to be able to produce multi-colored weavings.

The herders are faced with choices of obtaining certain goods and services through cash only (notebooks, metal implements) but others either through cash or through fields of social relations with kin and community. They frequently choose to use cash only for the former and to obtain animals and labor through their social ties. In a similar fashion, some herders prefer to obtain potatoes, maize and other agricultural products through barter rather than through cash sale. Though they may receive less, the relations may be more enduring and secure. They have the choice of obtaining these products either by purchase or barter, and might reserve cash for

those items which can only be bought. In the case of barter as in the case of the social relations of kin and community, the herders are faced with a significant choice. Certain social ties, once abandoned, are difficult to re-establish. In years of high wool prices, a herder might be able to obtain more potatoes by selling wool and purchasing potatoes than by trading sacks, rope or fleece for potatoes. The barter relations, however, are often described by the herders as stable and enduring, and that they offer a guarantee for years when potatoes are scarce because of poor harvests. (Barter rates do appear to follow market price fluctuations, although with considerable lags and variation. For further discussions, see Orlove, 1980b.)

There is also some demand in urban and rural areas for unshorn hides, which are used as blankets, rugs and cushions. The soft fleece of animals less than three months old is used by furriers to make rugs, slippers, toys and the like.

c) Dung. Dung is an important source of fertilizer and fuel in the puna. It adds valuable organic matter to the soil and improves its texture as well. (Winterhalder et al., 1974). For the poor agricultural peasants of the area, commercial fertilizer is expensive, and wood ash and other local fertilizers is also scarce. Dung is also an excellent source of fuel. The stoves which the herders use make efficient use of the heat generated by burning dung. Despite Western assumptions, dung is clean and sanitary as a fuel. In some cases, corrals are used in alternative years to keep animals and as gardens; in other cases, the dung is collected in the open range. Llama and alpaca dung provide more heat per unit weight than does sheep dung, and they are also more easy to gather, because of the habit of the herds of defecating in a common site.

d) Transport. Llamas are important beasts of burden. They can carry up to 35 kg and can subsist on poor forage. They are particularly useful at higher elevations, above 4000 meters, where donkeys and horses do not perform as well. They are also often found in particularly rugged areas. Their social organization makes them excellent pack animals, since the animals tend to follow a lead animal with little tendency to stray. They are a critical

element in interzonal exchange, in which herders from puna zones travel to lower agricultural areas to barter wool and meat for agricultural products. Some herders rent their herds out to transport other goods as well.

The importance of llamas as pack animals varies from region to region. Without detailed animal censuses, it would be difficult to estimate their distribution, but it is complex. Altitude is one important factor but not the only one, as the greater concentration of llamas on north rather than the south side of Lake Titicaca demonstrates.

Unlike ruminants in many other parts of the world, small ruminants in the Andean highlands are not used for milk production. This fact is due in part to the lack of the enzyme lactase among adult native populations, which makes it difficult for them to digest milk and milk products. This lack, in turn, may be seen as the result of a long period of coevolution of humans and herd species. The areas of the world in which lactase deficiencies are not present among adults, such as Europe and East Africa, are zones of long-standing domestication of animals for use in milk production. Llamas and alpacas do not produce sufficient milk to produce in large quantities for human consumption, but they have not been bred for this purpose. There is, however, some consumption of fresh cow's milk cheese in the highlands, and certain regions are famous for their cheeses; goat cheese is consumed on the coast.

#### THE ORGANIZATION OF PRODUCTION

The discussion of multi-purpose herding in the Andean highland environment has shown that several resources are necessary for individuals and households to practice pastoralism. These include the animals themselves, dry and rainy season pasture, and daily peak labor. With the relatively low levels of capitalization present in most parts of the Andes among household and community herders, capital is not a problem; in the larger units such as haciendas, cooperatives and SAIS, it is.

1. Animals. Although purchase of small ruminants is not unknown, it is rare. Most comuneros acquire their animals through inheritance, the colonos and socios obtain their own animals, the huacchos, in

this manner as well. Animals are owned individually and may be owned by males and females. Typically, individuals are given a few animals by parents, relatives or close associates at birth or in the first few years of life. These animals are herded with other animals of the household, but are recognized as belonging to the child. They are frequently marked by making small cuts in the ears. Adults receive additional animals at marriage. It is frequent for a family to divide the herd into one more portion than there are children; a family with four children would divide the herd into five sections, with each child receiving one-fifth of the parents' animals at marriage. The additional portion is reserved for the child, often the youngest, who remains with the parents to care for them in their old age. This mechanism provides an incentive for children to take good care of the animals that they herd, since they will one day receive them. It also leads to conflict between parents and children, since the children often want to receive their animals when they are relatively young, and the parents want their children to delay their marriage to prevent a reduction in their herds.

There are cases of share-herding, where an individual with few animals can receive a number of animals from another herder, frequently a wealthy one. The one who receives the animals cares for the animals, and returns them, but keeps a portion, of the natural increase of the herds.

2. Pasture. As mentioned before, rainy season pasture is not scarce. Individuals usually have access to it as members of communities, cooperatives, haciendas or SAIS. They are permitted to graze their animals on these lands, both land that is always used for pasture and fallow fields. Natural season pasture is much scarcer. In many cases it is controlled by groups of families, with the heads of households related as parent-child, sibling-sibling, or cousin-cousin, usually but not exclusively father-son, brother-brother or the sons of brothers. In this fashion the dry season pastures can be kept as units, rather than being divided up as inheritance into increasingly small fractions, as agricultural fields are. Irrigated pastures are similarly often the property of specific groups of families. When a couple marries, they choose between the dry-

pasture group of the groom or the bride to establish residence; they are unlikely to maintain grazing rights in both. In cases where population pressure is low, several distantly related individuals may try to insist on their rights to graze their animals on vacant or underutilized pasture. Where population pressure is high, disputes may also arise between relatives over the use of this scarce and critical resource. For haciendas, cooperatives and SAIS, dry season pasture may also be a limiting factor; it can be maintained through natural bofedales or by their extension through traditional or modern irrigation systems.

3. Labor. Much of the labor in routine daily tending of animals is performed by household members, often women and children. In some cases, households in communities, haciendas, cooperatives or SAIS's will divide their herds, consisting of the animals owned by the different members, into several herds, separating females with young from adult males. In this case, the herds of several households may be combined under the supervision of one herder. In some cases, herders may be contracted for monthly or yearly wages or on the system of share-herding mentioned above.

The yearly labor peaks, particularly the shearing and slaughter, require additional hands. Within communities and for the huaccho herds of residents of haciendas, cooperatives and SAIS's, additional workers may be hired for a *jornal* or wage, but it is more common to arrange for workers through traditional arrangements of reciprocal labor exchange. In some cases, an individual will come to perform a day's work for a herder with the understanding that he will be recompensed with a day of similar labor; if A requests that B, C, and D come help him shear his alpacas, he will spend a day with each of B, C, and D helping them shear their animals. In other cases, the return is in goods, either through festivities, where the workers are treated to abundant meal, with maize, beer, alcohol and perhaps music, or the payment is in kind, such as wool or meat. The partners for these exchanges often tend to be relatives. Haciendas, cooperatives and SAIS's tend to make up their labor deficits through hiring individuals from nearby communities for daily wages. In some cases, though, hacienda owners make use of reciprocal labor exchange.

When pack caravans are being organized, it is also common for labor to be drawn from household or immediate family; usually, but not exclusively, it is men who travel on long trading expeditions. In all these cases of resources, one may notice the strength of kin ties among communities herders and among herders on other units for their huaccho animals. This may be explained as follows: certain resources are scarce, and individuals want to limit the number of individuals who have access to them. Under the circumstances a kin-based system of inheritance of animals and pasture, reliance of household for bulk of labor is self-maintaining. Herders find that their children are available and motivated work force, and offer better quality and less expensive work than that of hired workers or share-herders. Similarly share-herding is a relatively unattractive proposition for all except the poorest herders. The strong loyalty that one may observe to kin and community emerge in part from the way in which these social ties have assured relatively steady access to resources for long periods.

The strong desire of herders to own animals individually also follows from this adaptation. Although Andean herders are not as extreme as those in some other parts of the world in desiring ever-larger numbers of animals, they do wish to have sizeable herds. Browman summarizes some studies to show that "poor families have 0-50 animals (llamas, alpacas and sheep); the average herder has 70-150 animals, and rich families run 400-600 animals." (1979:9). Sex ratios tend to be fairly even. The animals themselves, however, form part of the participation in social system which supports herding; phrased differently it is problematic to leave herding for a few years at a time. Individuals will find it difficult, in particular, to re-establish claim to dry season pasture if they have not been used for several years. An individual with few animals may be unlikely to make advantageous marriages for his or her offspring and thus acquiring potential partners for reciprocal labor exchange. In addition, the marginal labor costs for a herder with few animals are low. A member of the household that owns 10 animals can equally well care for 30.

These motivations of the herders are important to consider further. The aggregate consequences of these individual cases influence the overall number of animals in a particular area. The Andes might appear a prime target for a "tragedy of the commons" situation. With collectively owned pasture and social and cultural incentives on maintaining and increasing herd size, Andean pastoralists might overexploit their delicate resource base. This problem does not always occur. One may find several reasons. Peak labor and dry season pasture are scarce resources, and the herders are aware of the problems that stem from carrying out the annual slaughter with too few hands (restless animals are difficult to manage, work performed late yields poor quality charqui), and they know that animals which are overcrowded into bofedales tend to be thin, disease-prone and have lower quality wool. Losses are proportionally greater from larger herds; as a herd increased beyond an optimal size, predation and straying are more difficult to control. The inheritance system also keeps maximum herd size down; parents with larger herds may have greater difficulty in preventing their offspring's early marriages, so that the marginal utility of additional animals decreases as herd size increases. Other cultural factors may also mitigate against overly large herd sizes. Palacios Rios (1977), for instance, reports that wealthy herders may be the target of gossip and envy, and that many individuals conceive of themselves in terms of supernatural affinities towards certain species or sexes of animals, and will not attempt to raise others.

#### LARGER PRODUCTION UNITS

Much of the previous discussion has focused on the household as the unit of herd management. The larger units in which the households are involved are also important.

- 1) Community. As previously described, many herders live in communities. These function as units which define areas of rainy-season pasture. Extended family ties for dry-season pasture and reciprocal labor exchange also tend to occur within the community boundaries. The rainy season pastures and most dry season pastures have herds, belonging to several owners, being grazed side by side.
- 2) Haciendas. The haciendas, as commonly existed until 1969 and continue to the present in some areas, also have herds belonging to

several owners, grazing side by side, and this fact has continued to the present in the cooperatives and SAIS's. Herders tend to be paid in grazing rights, and they seek strongly, for the reasons mentioned in the previous section, to maintain these huacchos or independent herds. This issue has been one of the strongest conflicts between the hacendado and his representatives on the one hand and the herders on the other. Herders who have shifted to relying entirely on wages fall to a low position similar to that of the poor community herders who own no animals of their own and must accept disadvantageous relations with others; herds are capital which offer the herders considerable autonomy.

Within the haciendas, the hacendados have consistently pushed for the introduction of fencing. Fencing would permit the improvement of breeds, particularly in the case of sheep but also in the case of alpacas, by keeping the improved animals separate from the unimproved ones. It would also increase the effectiveness of veterinary medicine by reducing the amount of reinfection from untreated animals. It would also make the artificial planting of forage crops more profitable by allowing the owner to restrict access to the forage. The herders have resisted it to maintain their autonomy and mobility. Fencing was seen by the herders, accurately enough, as part of a campaign to reduce huaccho herd size.

In some haciendas in the 1940's in the southern sierra and earlier in the central sierra, the hacendados shifted from payment of wages in grazing rights to payment in cash. The accounting of this system was, and remains, tricky: the herders can be charged for various fees such as the grazing fees for their animals, for the alleged damages they committed by losing animals, and the like. Nevertheless, the herders both wanted higher wages and to retain their huacchos. By and large, they have succeeded, even in the most capital-intensive estates of the central sierra. The differences between the cooperatives and SAIS's on the one hand and the haciendas on the other are large. The former involve a much larger degree of linkage between the herder and the state. The state in many ways is richer and more powerful than the individual hacendados were, but it is also unable to exercise its force against the herders so

readily. Herder-cooperative conflicts and herder-SAIS conflicts involve national politics in a way that herder-hacendado conflicts rarely did. Nevertheless, there are important similarities, particularly the role of the huacchos and the resistance of the herders to fencing.

The outcome of all these cases are similar. By and large, the opportunities for capital investment in small ruminant production have been limited, because of the multiple access to pasture issue in all units. Thus, granted the factors mentioned in the section on herding activities, the carrying capacity of the puna is fixed. The total herd size for the sierra has fluctuated, though (Jacobsen, 1979b). It would appear to have declined in the late eighteenth and early nineteenth centuries with the political unrest of the major Indian rebellions and Wars of Independence, built up in the late nineteenth and twentieth centuries, and declined again sharply with the Agrarian Reform. Hacendados fearing confiscation and herders confused as to the nature of the proposed changes slaughtered and sold many animals.

The limited carrying capacity and the relative lack of opportunities to invest capital has generated the following source of conflict. If total wool production is the product of average yield of wool per animal times the density of animal per unit area of land times the total land area, and the first two factors are hard to alter, then anyone attempting to increase wool production will attempt to increase landholding. This factor has led to the intense competition for land in the sierra. Conflicts between haciendas and communities are common, as haciendas have occupied community lands and vice versa. The external expansion of the hacienda and the internal expansion (reduction of huaccho herds in favor of hacienda ones) are closely related. In other cases, communities come into conflict with cooperatives and SAIS's.

The examination of specific cases may illustrate these points. Picotani was one of the largest haciendas in the department of Puno and is now the largest SAIS in the department. It developed in the 1920's when several haciendas were consolidated to form a single one with an area of over 54000 hectares. Maltby's recent study (1980) documents the difficulties that the owners had in controlling the labor force. Their efforts to reduce huaccho herds led frequently to resistance, as in the years 1925-27. It took the owners six years to install successfully a program in which the herders' rams would be castrated, permitting the herders' flocks to improve by

insemination of introduced rams. The herders were determined to maintain their huacchos and through them, direct access to pasture and economic autonomy. The neighboring communities also fought to maintain their lands and to introduce their animals onto hacienda land. These conflicts have continued after the Agrarian Reform in 1969. The SAIS links communities and ex-haciendas such as Picotani together. The families who had been the herders of the haciendas now have higher wages, but even the full force of the government has been unsuccessful in achieving the elimination of the huaccho herds. In fact, huaccho herds in Picotani have increased, and the distribution of huaccho herd size is now more egalitarian than in the past (Rojas and Rojas 1979, Quiroz 1979). The conflicts between communities and the ex-haciendas continue in disputes over animal incursions across boundaries.

#### SUMMARY

To review the previous discussion, several points may be highlighted.

- 1) Small ruminant production in the Peruvian highlands serves a number of ends. The animals provide not only food and fiber but also dung for fertilizer and fuel and a means of transport. Much meat and fiber is bartered as well as sold.
- 2) In virtually all areas pastures are used simultaneously by herds of different owners.
- 3) There is a strong kinship orientation to pastoral society, reflecting the importance of family ties for access to scarce resources such as dry season pasture and peak labor.
- 4) There are factors which encourage individuals to increase the size of their herds; however, other mechanisms serve to reduce if not eliminate these pressures as herd size increases beyond certain points.
- 5) Local herders possess a detailed knowledge of their animals and the pastures. Techniques to increase the carrying capacity of the puna grasslands exist, although they are still poorly studied by Western-trained production and social scientists.
- 6) Herders have a strong desire to retain autonomy and control of their resources. This tendency can translate into a willingness to adopt new technologies which they perceive as beneficial; it also generates a distrust of government officials.

7) Herders show a desire to increase pastoral production, since they have a market for their products through cash sale and barter exchange.

This discussion has attempted to present the small ruminant production as an adaptation to harsh environmental, economic and political conditions in the Peruvian highlands. It suggests that these adaptations deserve considerable respect. Individuals who seek to increase small ruminant production would do well to consider the production system from the point of view of the small producers to understand what they perceive as advantageous and disadvantageous. The importance of the huaccho animals, for instance, might make veterinary medicine programs easier to implement than herd consolidation. Expansion of irrigated bofedales could be better received than fencing pasture lands. However, all programs should involve at all points collaboration and participation of the planned beneficiaries, the herders themselves.

## FOOTNOTES

<sup>1</sup>Custred and Orlove describe laymi systems as follows: A laymi system is carried out on the lands belonging to an individual community. The agricultural lands of the community are divided into named sections. A laymi system refers to a set of laymis on the lands of a community. The laymi average between 50 and 250 hectares in area. Each one is divided into a number of smaller, individually owned plots of land. Both the laymis and the plots have boundaries, but they are not fenced.

The laymi sections in a laymi system go through the same sequence of planting and fallowing. In any given year, all the plots in each laymi are either uniformly planted with the same crop or left to lie fallow. For example, a community with a six-laymi system might have one laymi entirely planted with potatoes, a second one sown with barley, and the remaining four lying fallow. The plots within the laymis are privately owned by individual peasants. During fallow periods, however, pasture rights are open to all community members. In the next year, barley would be sown in the laymi which had been planted in potatoes the previous year. The laymi with barley would then pass into fallow, and the land in the laymi which has been lying fallow longest would be plowed and planted with potatoes. The rotation continues until, in the seventh year, the first will again be planted in potatoes. Ideally the members of each household own at least one plot of land in each laymi, so that they will have access to all the different crops that are planted. In some communities there are two laymi systems in different areas.

The particular sequence of crops and fallowing varies from community to community and between systems in communities with two systems. Several general characteristics applicable to all these sequences may be observed:

1. Potatoes are always the crop that is planted when a laymi is first planted after laying fallow.
2. Maize is never planted.
3. Variation in the number of years that each laymi spends in fallow takes place only in the systems with a large number of sections. (Custred and Orlove, 1974:1-2).

## ANDEAN PASTORAL PRODUCTION: A REVIEW ESSAY

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KEITH JAMTGAARD

One of the recurring themes throughout the ethnographic literature on the Andes is the importance of small animal production for rural residents, yet discussion of livestock production seldom appears as a subject in itself. Instead, the literature tends to emerge in the course of elaborating topics more familiar to social scientists, such as patterns of social organization, regional marketing structures, peasant economics, and the discussion of ritual and ceremony. Rather than review the literature in its entirety, the intention here will be to discuss the literature in terms of certain topics which are relevant for the production of small ruminants. While these topics are by no means exhaustive, they provide a descriptive scheme for some of the important considerations associated with small ruminant production in the Andes.

### ACCESS TO AGRICULTURAL PRODUCTION

The direct utilization of animal products is of crucial importance for Andean pastoralists. Small ruminants are highly valued as sources of meat, fiber, manure, and transport. However, pastoral production as a sole means of subsistence is probably inadequate for the nutritional requirements of the herding communities of the high puna (Thomas, 1976). An essential feature of Andean pastoral production are the strategies whereby herders gain access to the agricultural products of other ecological zones. The importance of such strategies for pastoralists may be judged by the preponderance of models which refer to this practice.

The dominant model for understanding pastoral production in mountainous Andean communities has been Murra's notion of "vertical archipelagos" in which communities seek to maintain control over a vertical array of ecozones (1972). This notion has been expanded somewhat by Brush (1977), who suggests three different patterns of verticality. In his "compressed type", one village is able to exploit a steep incline which has many different ecozones in relatively close proximity. An example of such a community is Q'ero (Cuzco). This community is described by Webster (1972) and is one of the few communities practicing mixed agro-pastoralism with alpacas.

A second pattern suggested by Brush resembles more closely Murra's "vertical archipelagos". Here ecozones tend to be larger and separated by greater distances. Migrations from the principal settlement to the other ecological zones may occur three to four times a year. Brush (1977) notes that such systems can be found in the upper Marañon River region. The migrations may be reduced in frequency by establishing small settlements in each of the regions.

In the third pattern ecozones are sufficiently distant that specialized market systems have developed. Such markets are based both on barter and on monetary exchange. Brush (1977) describes this pattern of zonation as the "extended type". The Vilcanota Valley of Southern Peru is a good example of such a pattern. Gade (1975) describes the exchange relationships that have developed between communities of different economic specializations in this valley. A number of authors have looked at communities specializing in camelid pastoralism and at the exchange relationships which have developed between them and agricultural communities at lower elevations (Flores, 1968; Palacios Rios, 1977; Browman, 1979).

Orlove (1977a) outlines another approach by which the production and exchange of products may be analyzed. Individuals engaged in the same economic or political activities within a given geographical context are referred to as sectors. Orlove focuses on three principal strategies of economic interaction between sectors. The first is a dual production strategy in which the same individuals engage in more than one economic activity, for example herders maintaining agricultural plots. A second form of economic strategy is barter, where goods and services are directly exchanged between distinct production sectors. The third pattern is articulated through the cash economy and requires the inclusion of external influences as

actors in the relations between production sectors.

Due to the inability of agriculture to prosper at high altitudes, Appleby (1976a) sees herding communities as generally being in a condition of food deficit, necessitating exchanges with agricultural communities. This exchange relationship is strongly conditioned by the existence of an export market for commodities derived from pastoral production. Where such external markets exist, the combined influences of transport and trade requirements will increase the dependence of the pastoral sector upon the agricultural sector. As expansions of the export market occur and are accompanied by increased investment opportunities, the producers of export commodities will tend to consolidate into fewer and larger production units, while the agricultural production that sustains the exporting region will remain in the hands of small producers.

#### CULTIVATION

It is not certain to what extent small ruminants live on lands devoted only to their production as opposed to the numbers that graze on land which is cultivable. The production of crops and animals on land which is not ideally suited for either form of production seems to be quite common throughout the Andes, yet comparatively little has been written about these mixed systems of production compared to literature on purely pastoral systems.

Custred (1977) suggests that as one descends from the high Puna (4000 meters) into the low Puna (3300 meters) sheep tend to replace alpacas as the main providers of wool and meat, while the transport by llamas is substituted by horses, mules, and donkeys. Here, agricultural production is commonly found in conjunction with animal herding. The soil in this mixed agro-pastoral zone is often unable to support cultivation every year, and must be put into fallow. During the fallow periods, animals are allowed to graze the land, thereby adding valuable nutrients to the soil.

According to Guillet (1979a), two closely related fallowing systems may be distinguished in this production zone. Sectoral fallowing is a system adapted for cultivating tubers, in which land is divided into sectors which are planted for two years and then allowed to fallow for up to four years. A variant of this system is long term fallowing where the land is not divided into sectors and the rest period between cultivation cycles is longer than for sectorial fallowing systems. In both cases, at any given time most of the land is in fallow.

In sectorial fallowing systems crops are rotated during the years of cultivation, potatoes are planted first, followed by other tubers and cereals. Custred and Orlove (1974) indicate that plots within sectors are privately held for cultivation, but communally grazed during the fallow years. All members of the community have grazing rights to the fallow plots. This pattern provides an important source of regeneration of land through the depositing of animal manure. Gade (1975) indicates that the sections of fallow land, called *lamyi*, have rest periods of between 3 and 7 years. The length of the rest period may vary according to the population pressure and the proximity of the fields to the community.

An essential feature of this system, from Guillet's perspective (1979a), is the existence of communal controls over the timing of cultivation, rotation sequences, and fallow periods. These rules make necessary the coordination of agricultural and pastoral activities between individual members of the community and may be the critical means by which overuse of the environment is avoided.

### FENCING

Orlove (1977a) notes that fencing is usually required in order to implement measures intended to raise the livestock productivity. He observes that fencing is not only a technology which requires a relatively high degree of capitalization, but also that fencing has important political consequences since it is frequently the case that grazing rights over the same pasture are held by a number of animal owners.

Without fences, breed improvement becomes problematic since the ewes of one herder cannot be separated from the unimproved rams of another herder. Individual initiatives at pasture improvement would be unlikely since such improvements cannot be restricted to a specific herd. Similarly, many veterinary improvements, such as parasite treatments, also require the isolation of the animals to avoid reinfection.

Certain plant species appear to be used as field barriers and property demarcations according to Gade (1975). He notes the use of certain plants to serve as fences to keep people and livestock out of fields in the upper Vilcanota valley, especially in Canchis. Also in use are adobe walls with thorny plants densely planted along the top. At lower altitudes (below 2800 meters) hedgerows are planted to serve boundary, fencing, and materials purposes.

Stone fences are the most common type of fencing, especially for building corrals and holding pens. Perhaps because they are so common and ubiquitous, they are not discussed specifically in this literature. (Examples of such fences can be seen in van den Berghe and Primov (1977) and Orlove (1977a) ).

### LABOR

One of the dominant themes in the Andean literature is that of the variety of traditions which exists for the purpose of providing and receiving labor power beyond that which can be provided by a household. The most comprehensive source of information regarding mechanisms for reciprocal labor exchanges can be found in the anthology edited by Alberti and Meyer (1974). Guillet (1978a) provides a broad framework for discussing the labor needs of Andean households. He identified four general types of labor recruitment: familial labor, reciprocal labor where work is exchanged for work, festive labor where work is performed for food and drink, and an unwritten contractual form of labor recruitment. He argues that what is remarkable about reciprocal forms of labor recruitment is that they are widespread in the face of the pressures of commercialization, which were expected to replace traditional forms of recruitment.

The labor requirements associated with herding sheep, alpacas, and llamas are generally quite low for daily management. However, at certain critical periods, such as shearing, slaughter, and marking, the herds must be handled quickly due to difficulties which accompany confinement. The animals become restless and difficult to control, and fodder is not often stored for such occasions due to its low nutritional quality. This requires that a reliable supply of labor be available to perform these operations within a short period of time. Orlove (1977a) has an interesting account of the ways in which comuneros in Canchis and Espinar were able to withhold their labor to hacienda owners and other rich *comuneros* in order to maintain access to the pastures of these wealthier individuals. The expansion of large herds has necessitated the acquisition of further landholdings in order to grant grazing rights to those who are retained to provide the additional labor needed during the critical periods in the animal production cycle.

In such situations, labor-intensive or capital-intensive stock growing is constrained by the insistence of labor to be rewarded by grazing rights on

the land controlled by wealthier individuals.

#### HERD MANAGEMENT

Palacios Rios (1977) gives an excellent description of alpaca herding activities for the pastoral community of Chichillapi (Puno). He reviews the daily activities of household members, as well as the seasonal variations in these activities. Included in his work are detailed descriptions of such key aspects of herding as: selection and breeding, marking, shearing, culling, and the birth of the young animals.

Of critical importance for each herding household is the necessity of maintaining at least three separate herds: one of the female alpacas and llamas, a second of male alpacas, and another of male llamas. For approximately four months of the year (September through December), it is necessary to maintain an additional herd consisting of the young animals. Each of these herds requires the vigilance of a shepherd.

While the ways in which children acquire their own herds may vary among communities, Flores (1968) and Palacios Rios (1977) describe roughly similar procedures. A few animals are given to a child at birth and kept in his name until the child marries. These animals serve as an incentive for children to learn the skills of livestock management. Animals are distributed among family members at occasions such as marriages and deaths.

The number of animals generally found in Peruvian herds is not well known. Orlove (1977a) suggests that a trained herder can manage up to 1000 alpacas or 400 sheep, while Browman (1979) puts the herd sizes of wealthy families at 500-700 animals per family. He also gives a good summary of the available information regarding the variation found in herd sizes and ratios of alpacas to llamas and sheep.

Among the traditional husbandry practices which will likely attract the attention of those interested in increasing herd productivity is that of the herders maintaining nearly equal ratios of male and female animals. Browman (1980) presents some of the reasons given by alpaca herders for retaining relatively large numbers of male animals. Males are thought to provide better wool, and herders are more reluctant to take a full clip from pregnant females for fear of harming the fetus. Palacios Rios (1977) notes that the handling of females during shearing is thought to contribute to the high rate of abortion. He also gives valuable information on the proportions and

numbers of male and female animals desired by the herders of Chichillapi.

Llamas are highly valued in the Andes as beasts of burden. Llama caravans are still in use as the means by which distant communities exchange commodities, although llamas are being replaced by truck transport. Castrated male llamas are the preferred animals for these journies and are said to be capable of carrying up to 35 kilos for a distance of 15-20 kilometers per day for extended periods of time (Browman, 1979).

#### DRY SEASON PASTURE

The lengthy dry seasons found in Southern Peru constitute one of the chief bottlenecks of small ruminant production. Transhumance is practiced so that during the rainy season animals are allowed to graze land which is predominantly rain-fed. These pastures are usually plentiful and carry few if any restrictions on their use. At least some of this pasture is likely to be communally held (Gomez, 1977; Orlove 1977a) or rights to graze this pasture may be allocated on a seasonal basis (Palacios Rios, 1977).

The location of these natural pastures appears to vary according to locality. Orlove reports that they are most often found at lower altitudes, while Palacios Rios notes that they are usually said to be at the higher reaches, although he suggests that this can be misleading.

During the driest period, June through August, herders must rely on the most critical of resources for the survival of their herds, that of dry season pasture. This is land which, due to natural or man-made irrigation, is able to remain productive throughout the driest months. Such marshy areas, called *bofedales*, differ in their form of tenure in that they are often exclusively held by families or small groups of households (Palacios Rios, 1977; Gomez, 1977; Orlove, 1977a). It is therefore unlikely that a herder will be able to maintain more animals than can be sustained on his bofedal during the dry season.

Orlove (1977a) reports attempts by individuals in the province of Espinar to extend the critical dry season pasture by digging depressions which would maintain green pasture for longer periods than would be otherwise possible. He also notes that adobe fences are used to enclose sections of pasture which are then allowed to grow during the rainy season, and are consumed during the dry season. Palacios Rios (1977) also provides an interesting account of the construction of *bofedales* in Chichillapi, a process which can take many

years to complete.

Gade (1975) says that the teeth of llamas and alpacas remain in better condition if the animals are grazed on natural forage than would the case if fed the softer cultivated fodder. Still, forage crops have been planted in the Vilcanota valley since the introduction of the Old World domesticates, as these animals cannot survive on the poor dry season grasses. Many homes have fodder-storage areas where weeds, straw, and stems from plants are kept for domestic animal consumption.

### OVERGRAZING

Perhaps the most difficult of all the constraints to improved animal production in the Andes is that of overgrazing. Browman has commented on the severity of the current problem (1980) and notes that overgrazing may have been a problem as long as 2000 years ago (1974). Eckholm (1975) is concerned about the exploitative nature of existing social systems in the Andes and the effect that this, combined with growing population pressure, will ultimately have on the future rate of environmental deterioration.

Orlove (1976) argues that the high elevations of Southern Cuzco deserve further investigation to understand why more severe environmental degradation is not taking place. This region would be ideal for the kind of situation suggested by Hardin's "The Tragedy of the Commons" (1968), in which commonly held pasture will lead to overgrazing under conditions of private ownership of animals. Orlove suggests that the very factors which usually have caused degradation in other remote areas are the same as the factors which in Peru act to preserve the grasslands. These factors are: harsh climate, long history of human exploitation, and the social and economic pressures which often encourage the overuse of forage resources. It is the harsh climate which has maintained stable numbers of animal populations through high mortality rates. The history of irrigation and terracing has tended to raise the "maximum sustainable yields of the region". Finally, community rules exist regarding the timing of cultivation, rotation of crops, and length of fallow periods. The existence of the *laymi* system discourages the introduction of animals belonging to outside individuals. The community, acting as a united group would be more effective in limiting such incursions than would individual households acting alone.

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