

INSTITUTO NACIONAL DE INVESTIGACION Y PROMOCION AGROPECUARIA

INIPA

SMALL RUMINANTS COLLABORATIVE RESEARCH SUPPORT PROGRAM

SR-CRSP

Progress Report

**SMALL RUMINANTS PRODUCTION SYSTEM RESEARCH
AND TECHNOLOGY VALIDATION IN PEASANT COMMUNITIES
IN THE HIGHLANDS OF PERU**

(Community Project)

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Lima, November 1984

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1. BACKGROUND

The Small Ruminant CRSP since its beginnings was designed as an integrated and multidisciplinary approach for small ruminant production system research. The initial steps in research were primarily concerned with various aspects of individual areas of knowledge. As information and results were obtained, it was hoped that an integrated final product will come out of the effort. Integration as such, has not been completely achieved by the program and this has been the subject for major discussions at research sites, countries and M. E. level. The effort to provide some basis for integrated work in specific research sites, as well as specific strategies was attempted during at least two meetings in 1982. In the case of Peru, the Program started working in two major locations using facilities available in SAIS's and Cooperatives with individual projects independently setting their own research. Projects have reached a point where a serious integrated effort should be made to assure a coherent end product.

At the 1983 PI's meeting in Peru, an agreement was made to prepare a proposal for an integrated approach to small ruminant production system research, using results obtained to date, and also to validate technologies already generated by individual programs. It was agreed at that time that the best setting for this proposal were the peasant communities

of the highlands of Peru. This could provide an ideal setting to test technologies presented as integral systems, using the integrated resources of the program, which combine a socio-economic understanding of decision-making processes with technologies appropriate to resources available. In the end this could provide an increment in production and productivity that could raise the net income of community members and also improve their living conditions.

The present project attempts to develop a methodology that can be applied in communities, to test the program's capacity to generate and transfer technology and to evaluate the economic potential of technologies already generated under SAIS and COOP conditions. Support was requested for a successful completion of goals and objectives requiring a minimum of 3 years of field work and technology validation. To this end, an efforts were made to obtain additional and outside sources of economic support.

At the Peru PI's meeting held in Denver in July 1983 the project was approved, and a budget was assigned for the first 18 months of operation.

The present report covers Community Project activities for the period July 1983 to October 1984.

2. GOALS AND OBJECTIVES

The purpose of this project is to engage in "action-oriented" livestock research in Peruvian peasant communities.

The goals of the present project are:

- To improve the well being of peasants members of communities through an improvement in their net income obtained as a result of applying appropriate technologies to current production practices.
- To increase the understanding of the decision making process in Andean Communities.
- To validate under community conditions technologies already generated by the SR-CRSP. under community conditions.

The main objectives of this project are:

- To device a methodology by which generated technology can be adapted to community production conditions within an integrated production system approach.
- To increase knowledge on production systems of several communities in the central and southern region of Peru.
- To evaluate the economic and social impact of appropriate technologies on peasant communities.
- To train local technicians and professionals in techniques dealing with production systems for small ruminants located in peasant communities.

3. PEASANT COMMUNITIES IN PERU

3.1 General Aspects

The process of change in peasant communities is ongoing. Peasants are continually searching for means of bettering their livelihood, which is a combination of production for home consumption and marketing. The agro-pastoral system of production, in itself complex, is further diversified by salaried labor and artisan activities within family units. The Andean ecology presents challenges to both animal and plant species and is characterized by wide climatic variations. The diversification of the peasant economic system associated with ecological factors make the selection of technological alternatives difficult. Proposed innovations must fit into the overall system or generate only those side effects which the system is capable of absorbing.

Historical processes and a bilingual, bicultural heritage in the Peruvian Andes have left the peasant with a lack of information which might permit him to make decisions, as to the long-term consequences of one or another technical innovation.

Development projects since 1945 have attempted to suggest or impose prefabricated development schemes upon the Andean campesino, as part of a strategy of increasing'

food production for the urban populations of the country. As a result, the living standard of the peasant family, the relationship between the possibilities for technological change and the process of innovation in the context of the Andean peasant economy have been taken into account only peripherally.

Up to 1983, the Small Ruminant CRSP concentrated its efforts in associative enterprises. Since a third of the Peruvian population, and over 40 per cent of the small ruminants are found in peasant communities, an integrated effort towards improving production in these settings was clearly necessary.

3.2 Social and Economic Structure

The majority of the peasant communities in the Peruvian Sierra combine agriculture and livestock raising activities. Most communities are composed of from 100 to 300 families and control from 500 to 6,000 hectares of land, of which only 2 to 10 per cent are used for agriculture, the remainder being natural ranges and barren mountainside. On the land used for agriculture, only about one third is planted in any given season. Irrigation is very rare and dry-land farming is most common. Water resources are frequently available and some communal lands can be irrigated if the need is felt by the community. Community members are farmer herders whose production is destined to fulfill their own family needs

as well as to be marketed. The peasants raise cattle and sheep and plant potatoes, peas, wheat, barley, broadbeans, quinoa, olluco, and mashwa (traditional Andean crops), using mostly traditional cultivation techniques. Much of the community land is parcelled for individual family use. Plots are assigned to each family taking into consideration family size, soil quality and climatological factors, for periods of time agreed upon by community custom. The community retains lands for agriculture and/or livestock raising for the benefit of the community as a whole.

Decisions as to how the communal lands are to be used are made by the comunal general assembly which is led by a group of elected officials who represent the community for a period of two years. These officials are in charged of proposing the projects that they, in consultation with the community members, feel to be beneficial to the community as a whole. When a project is decided upon and approved by the general assembly, responsibility is divided among the community members so that the labor involved is provided by all in an equitable fashion. Most construction, agricultural, and herding work for community benefit is carried out in "faena", a form of joint labor common to peasant communities in Peru. The earnings from communally produced goods are used for roads, schools, medical and communal centers, etc.

Of the 53 per cent of the population of Peru that lived

in rural areas in 1972, 67 per cent formed part of peasant families. These families controlled 41 per cent of the natural pasturelands 41 per cent of cultivable lands, 52 per cent of the cattle, and 53 per cent of the sheep population of the country (Figueroa, 1981). It is estimated that over 80 per cent of the domestic camelids (alpaca and llama) are also raised by peasant communities. According to Figueroa, the community is not a simple aggregate of families, but rather a social sector in which specific economic relationships are established among its members and where collective economic activities and decisions take place. The economy of the peasant community is considered to be made up of three productive areas: agriculture, livestock raising and artisan activities.

Labor is shared by all active members of the family. Grazing is done mostly by the women and children while agricultural activities are carried out by the men, although women participate fully during planting, cultivating and harvesting periods.

3.3 Livestock and Crop Production

The development of technical systems which are appropriate to the social and economic organization of the peasant communities as well as to the specific characteristics of high altitude ecology (3,600 to 4,000 m.a.s.l.) has been relegated in an effort to

industrialize Peruvian agriculture. Although some advances have been made on the larger land holdings of cooperatives and SAIS (Agricultural Societies for Social Interest), the peasant communities of higher altitudes have been left to their own devices. The limited economic resources available to these communities have left them little space to innovate experimentally. The introduction by government agencies, commercial entities and international projects of imported animal breeds and foreign technologies with limited adaptability to highland conditions, have left the peasant farmer-herders with limited new or appropriate alternatives for agriculture products.

As regards agriculture, the need to place more products on the commercial market (especially potatoes and broad-beans) is causing the communities to engage in ever more exploitative agriculture, intensive use of chemical fertilizers and pesticides which slow down the process of biological recuperation. The shortening of fallowing periods which are traditionally used as a form of soil renovation are another result of overconfidence in chemical products or economic pressure.

Two thirds of assigned land is fallow at any given time and as such is used as pasture land. Fallowing periods range from three to seven years depending on altitude and soil quality. Peasant livestock is diversified in nature including cattle, sheep, swine, poultry, guinea pigs,

burros and llamas and alpacas. Grazing is done on fallowing and/or communal range lands according to use patterns established by the communal assembly. The total number of animals held by each family is associated with its wealth and is determined in part by the relation between agricultural and pastoral activities of the family. Most of the livestock held by peasants are either criollo or criollo crossed with imported breeds. As in agriculture, yields in meat, wool and dairy products are low, due to a combination of nutrition, health, management and breeding factors.

The peasant family labor force averages four people. Each family farms a variable number of small plots (sometimes totalling up to 85), reaching a total area of not more than 3 hectares, and most often less than one. Crops are frequently planted in associations such as maize with peas and beans, quinoa with canihua, barley with alfalfa and so on. A given community usually plants up to eight crops per growing season. Average potato yield per hectare was 9.6 tons in the Central Sierra and 5.3 in the Puno region in 1981 as compared to a commercial crop average yield of 12-16 tons.

Typical farm implements in the higher agricultural regions include the chaquitaqlla or Andean foot plow, pick, shovel and different types of hoes. Sowing and fertilization are done by hand. Cattle drawn plows are used where terrain permits.

4. PROJECT METHODOLOGY

4.1 Integrated Farming Systems Approach

The methodology used in the present report tried to emphasize an integrated approach. Integration occurred as a team of multidisciplinary researchers jointly develop appropriate technologies. The end product was characterized by the integration of different aspects of small ruminant production put together in a dynamic and flexible production system. To achieve this goal it was important to define clearly the ecological, social and economic conditions in which production systems take place. An understanding of the limiting factors which affect productivity as well as the social and economic pressures that are present in the prevailing system was required. The accomplishment of an improved small ruminant production system was based on the understanding of those elements affecting decisions of individual peasants and those of the community. Technologies should fit requirements that are defined by the small producers and their perception of problems which need new alternatives. The economic impact of technology is also a very important element of the methodology. The usefulness of an improved system will be measured not only by its biological outputs, such as meat, milk, wool, etc., but as its capacity to improve the net income of farmers and

the possibilities of application with limited capital investment.

4.2 Methodological Steps

Stages of development

- Site selection of peasant communities
- Characterization
- Diagnostic Research
- Synthesis
- On farm validation of the model in the community

Site selection of peasant communities

A group of four communities was chosen among the selected departments from where all 4 stages of work was carried out. The criteria that was used to select these communities were: willingness of the community members to participate, accessibility, representativity of ecological areas, homogeneity of production systems, etc. An important factor that determined the inclusion or rejection of a given community was the representativity of the community within the universe of peasant communities found in the sierra. Such factors as crop production, livestock production, location, size and population were used to select those communities considered as "representative" of the Andean peasant communities of Peru. Since the project was working in three departments, it was expected that an appropriate

range of communities should be selected in order to generalize about some of the findings from the base line studies as well as the aplicability of technologies generated and tested.

Three phases were involved in this stage. The first one consisted of the tabulation of existing information in communities to help define representativity. At this stage a preliminary list of communities was drawn up. The second phase included community contact and recognizance of the area. At this stage a multidisciplinary team visited the selected communities and checked those parameters used in the classification of typical communities. In addition, the willingness of the elected community authorities as well as of individual community members to participate in this program was detected. A very clear description of the goals and objectives of the programs was made to the community in such a way that their interest could also be taken into consideraton in the initial stages of the program. A team was sent to the community to gather basic information concerning general use patterns of community resources, history of other interventions or extension programs, land tenure, technologies currently in use, relationships among communities in the surrounding region, collective work habits, and most importantly, how the "comuneros" themselves perceive the future of the livestock sector within their community.

Characterization

The main objectives of the base line study were to:

- a) obtain an accurate description of community production system characteristics and socio-economic conditions;
- b) identify limiting factors for production and productivity;
- c) identify marketing channels;
- d) record the main environmental variables influencing agro-pastoral systems; and
- e) to define the geographical boundaries or specific area of applicability for the improved systems.

Base line studies are carried out in three stages:

- a) preliminary study of census data and other secondary information;
- b) a household survey; and
- c) follow up interviews.

Synthesis

Based on the system description and the main limiting factors identified by the base line study, a first approximation qualitative model was designed. The model described the possible options in management, resource allocation or system modifications required to overcome the major constraints and estimated the improvement level of the new system.

This stage is probably the most critical of the program. Results from research carried out by SR-CRSP has to be

summarized and set up in such a way that the multidisciplinary team could select options from existing information. These options was designed to overcome limiting factors, and at the same time being appropriate, given the community's social and economic restrictions. From the biological point of view, the model included sets of alternatives in range management, forage production, nutrition, animal health, animal genetics, reproductive pshysiology, etc, that were put together in a technological package that can be transferred to cooperating "comuneros". The options were evaluated at the design stage for their capacity to solve problems in production. At the same time an economic and social evaluation indicated the willingness of community members to adopt certain types of technologies. This stage began as an office type activity and subsequently findings were exchanged with comuneros to obtain their impression on the applicability of the proposed modifications and their capacity to implement them in the field.

Finally, a module was designed for each community to be adjusted in the field during the next stage.

On Farm Validation

A limited number of comuneros was chosen for training in livestock management techniques that can be applied to the improved model. Field researchers worked closely with

the comuneros to implement management techniques and closely monitored their application during the initial months of work. Later, as the comuneros became more familiar with the improved model, monitoring was spaced in time. The trained group of comuneros formed the treatment group.

Traditional management practices were studied simultaneously with those of the improved model.

Conceptual Framework

If the project objective is to generate small ruminant technology that will produce community-level development, it is obvious that some project resources must be allocated to understanding how sheep production systems function within the community system. There are many levels of organization between the sheep herd and the community. The conceptual framework adopted by the project must take into consideration these hierarchical levels or the identification of production constraints will be difficult and the design of alternative technology which have a high probability of adoption will be close to impossible.

Figure 1 is a set of hierarchical systems showing the relationship between sheep production and community-level processes. Sheep herds interact strongly with cattle and donkey herds and it may be impossible to separate these species. Livestock are tied so strongly to crop production that the primary research unit should

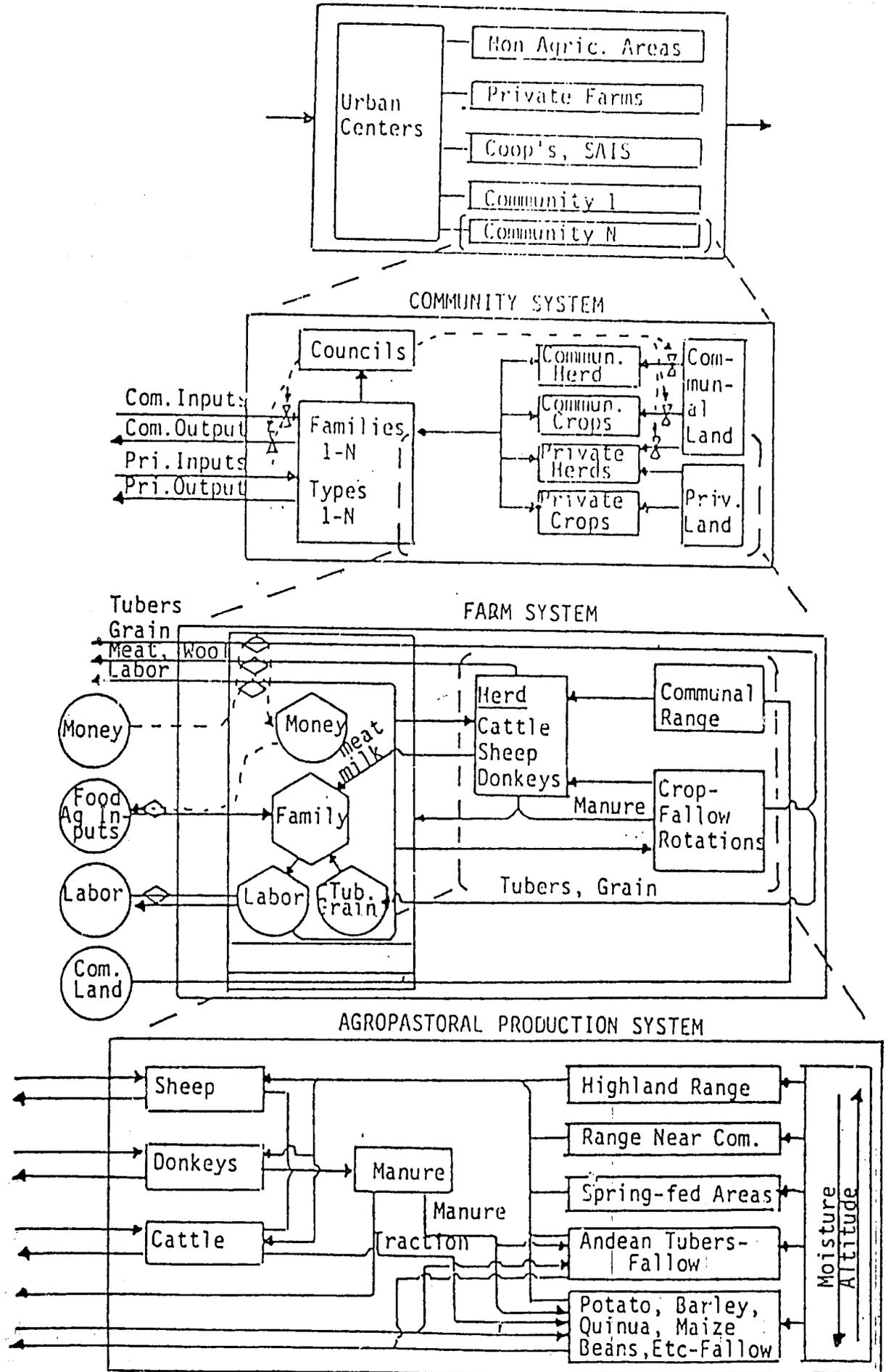


Figure 1. Conceptual Framework for an Agropastoral Research Project with Community Development Objectives

probably be the Agro-pastoral Production System (the bottom systems in the hierarchy). While both communal livestock and communal crop production occurs in some communities, the majority of both livestock and crop production is managed by individual families. Thus agropastoral systems are usually subsystems of farm systems or "family" systems (the next level up in the hierarchy). Farm systems are subsystems of the community. Communities are, of course, much more than the sum of the individual farm systems that form the community. In addition to complicated interfamily relationships, there are also communal processes that involve the allocation of land to families, communal buying and selling, and often communal herds and communal crop production. Communities function within larger regional systems with intercommunity exchange (livestock are moved to other communities in exchange for labor or agricultural products) and regional credit and market processes. The ultimate objective of the project is to have an impact on the region and for this reason, the regional system is included as the highest system of the set of hierarchical systems shown in Figure 1.

Research Strategy

The objective of the project is to generate alternative sheep production system technology by synthesizing existing component technology (e.g., animal health, range

management, etc.), which can be evaluated on basis of how the alternative technology affects family and community-level "well-being", and that consequently has a high potential of being adopted. The general research process followed by most area-specific or farm system-specific adaptive research projects (currently called "farming systems projects" by international donor agencies and the institutions that cover their funds) usually includes the following steps:

1. **Characterization.** This stage includes activities that produce a description of the present situation. It is often divided into a preliminary subjective initial reconnaissance and an objective statistically-designed survey of specific aspects that merit specific attention.
2. **Analysis.** This stage includes activities that produce an understanding of how systems function. This usually involves a more dynamic approach (with monthly, weekly, or even daily data collection) to the study of socioeconomic systems and biological experimentation.
3. **Design.** This stage requires the synthesis of the data produced during the analysis phase. Constraints and opportunities are identified and alternative technology is identified (hypothesized) that can resolve constraints and take advantage of opportunities.

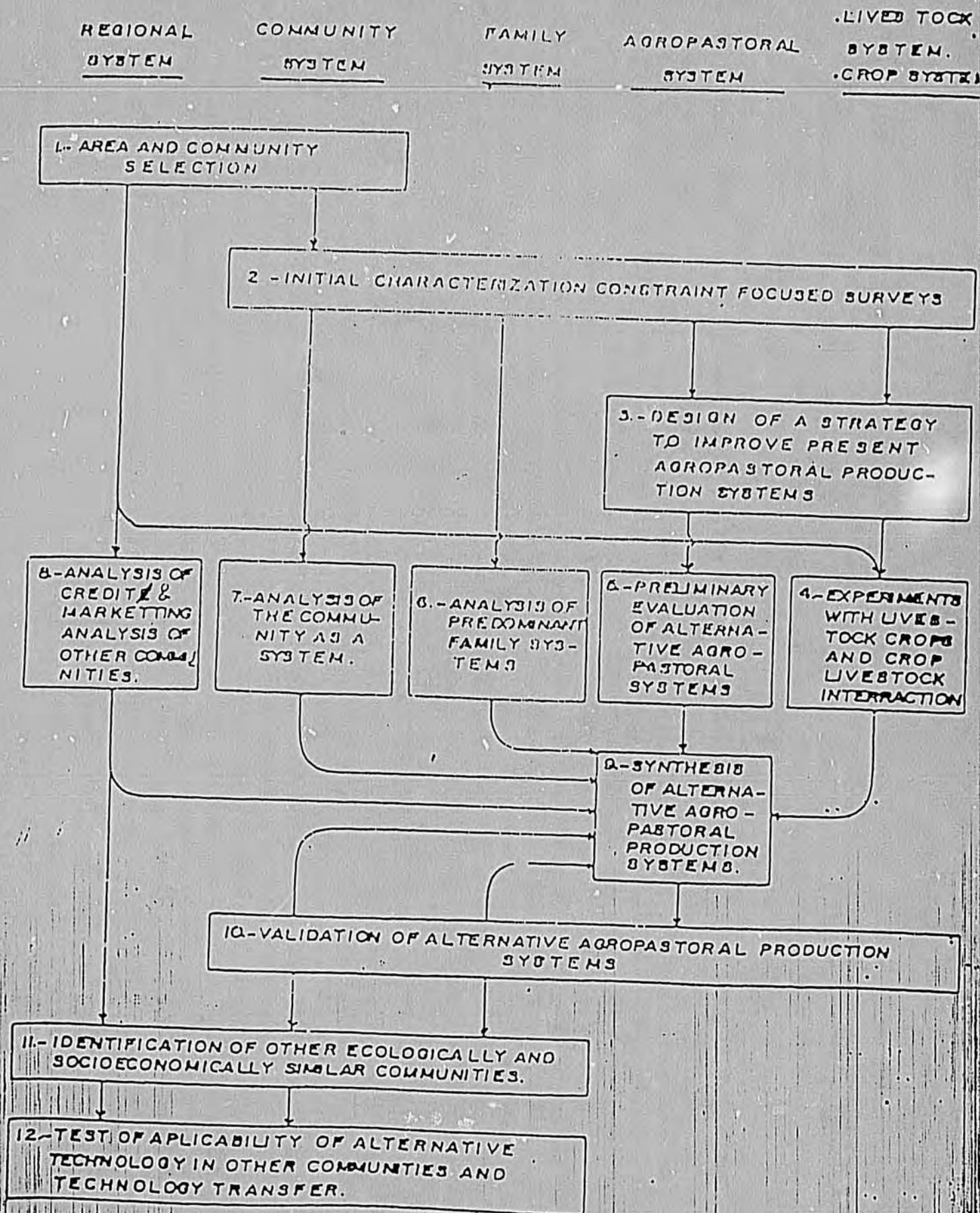
4. Evaluation. This stage involves the systematic testing of hypotheses identified in the design stage. Alternative technology that does not produce the results demanded by the farmer are discarded or modified.

5. Transfer. This stage includes activities to insure that all farmers with farming systems that are "similar" to those that were characterized and analyzed receive the alternative technology.

Figure 2 is an outline of a research strategy that was developed by applying the five steps described above to the conceptual framework presented in Figure No. 1. The strategy includes twelve activity sets. Activities 1 and 2 provide the information needed to design an analytical process (Activity 3). This process includes activities directed at the understanding of livestock, crop, and agro-pastoral production (Activity 4), the testing of a preliminary alternative Agro-pastoral system (Activity 5), dynamic studies of farm systems (Activity 6), community system analysis (Activity 7), and regional studies (Activity 8).

Activity-set 9 is the stage at which the analysis of the hierarchy of systems forming the conceptual framework is synthesized to produce alternative agro-pastoral systems that can be evaluated (Activity 10) by measuring impact on farm and community processes. If other communities that are ecologically and socioeconomically similar to the community where the research was conducted are

Figure 2. A general research strategy with parallel and sequential activities directed at a systems hierarchy with the objective of designing alternative agropastoral production systems that can lead to community development.



identified (Activity 11), then the technology can be transferred to other communities in the region (Activity 12).

One of the key activities in the above process will be the characterization and analysis of the agro-pastoral system managed by individual families. One of the first steps that must be taken in the characterization process is the classification of farming systems found in the community. Criteria to be used in classification will probably include access to different altitudinal (more precisely, temperature regimes), labor availability herd size and total crop land. As a guideline to farm system characterization and analysis, a characterization of one farm system in the community of Cuyo Grande near Cusco, is presented in Chapter 6.2.1.

5. PROJECT LOCATION

The Small Ruminant CRSP has chosen the Central and Southern parts of the Andean region of Peru as research locations. The central part covers the departments of Junin and in the southern part those of Cusco and Puno with some limited work in the highlands of Arequipa which borders with Puno in the highland area.

The importance of the direct impact of research results on SAIS and COOP production, which supply the largest share of mutton and wool to the markets of Peru is evident. Technology is most easily transferred on those sites where research is being done, so that the process of technology transfer is facilitated through direct observation by managers of the technologies being tested.

The departments of Junin, Puno and Cusco were selected for the Community Project because of the concentration of efforts by the SR-CRSP and other independent projects that are coordinating efforts with the Community Project. Communities within these departments were selected on the basis of consideration described in this document. Selected communities were located at a reasonable distance from major research sites in such a way that costs of transportation and activities can be minimized.

To provide a general background of the selected departments, a brief description of the research is presented.

5.1 Central Sierra

The department of Junin encompasses 43,000 square kilometers of the Central Region of Peru. Of the population of 849,000 (1981 Census), 40% are found in rural areas. The department is divided into eight provinces: Jauja, Huancayo, Concepcion, Junin, Tarma and Yauli in the highland region (above 3,200 m.a.s.l.) and Satipo and Chanchamayo in the eastern Amazon region. The climate in the highland region is cool and dry and wide thermic contrasts can be observed from sun to shade. Between the months of December and May, there is abundant precipitation. The most important rivers which originate in Junin and flow to the north and east of the country are those linked to the Tambo, Ene and Perené tributary system.

The department of Junin is considered to be one of the major food supply sources for Lima and Callao, the country's capital complex, which has a population of around six million. The capital and largest city of Junin is Huancayo, located 320 km southeast of Lima at an altitude of 3,200 m.a.s.l., with a population of more than 250,000. Huancayo is the major commercial center of the central region and connects Lima to Huancavelica and Ayacucho. The most important products of the highlands part of the Department are potatoes, maize, vegetables, wool, meat and minerals.

In the Mantaro Valley, climatic conditions change

abruptly over small areas. Together with changes in altitude, climatic changes have a strong influence on agricultural and livestock activity. The three major agro-life zones of the Valley are defined by altitude: the high (3,950-4,250 meters), intermediate (3,300-3950 meters) and low (3,000-3500 meters) agro-life zones. Internal differentiation of agro-life zones has three main dimensions: irrigation, farm type and crop dominance. In the intermediate agro-life zone the left margin of the river valley is dominated by tuber crops (potatoes, mashua, olluco, oca) while the right margin is dominated by cereal crops (Mayer: 1979).

5.2 Southern Sierra

Puno

Puno is the southernmost department of Peru and borders Bolivia to the south. It encompasses 72,382 square kilometers of which only 24,840 are exploitable land. The estimated population in 1968 was 819,000, 20 per cent urban and 80 per cent rural. Of the economically active population, 192,384 was employed in agriculture.

The department is divided into nine provinces, Melgar, Puno, Azangaro, Chucuito, Huancane, Lampa, Juliaca and Carabaya in the highlands and Sandia and part of Carabaya in the Amazon region. The terrain is extremely irregular and the highland climate is sub-humid cold, with precipitations between the months of December and May.

There are more than 50 lakes in the highland region, the largest of which is Lake Titicaca which covers an area of 8,300 square kilometers and has 29 islands in its interior. Lake Titicaca modifies the excessive dryness of the region and this modification results in the extensive high altitude pasturelands which are used for grazing alpacas, llamas and sheep. The altitude of the highland portion of the Department ranges between 3,912 and 5,200 meters above sea level. The higher levels, above 4,000 meters are dedicated entirely to grazing activities, while the lower levels, especially the lowlands around Lake Titicaca are used for agriculture. The products of the highlands include wool, meat, tubers and minerals. The most important rivers are the Coata, Ilave and Ramis which empty into Lake Titicaca. The largest cities of Puno are Puno, the capital with a population of 29,500 (1967) and Juliaca, the largest commercial center. Puno and Juliaca are linked to Bolivia, Cusco and Arequipa by rail. The distance to Cusco is 389 kilometers, to Arequipa 236 kilometers and to Lima 2,150 kilometers.

Cusco

The department of Cusco is located in the highlands of Peru, north of Puno, and has a total area of 76,224 square kilometers of which less than 1% is used for permanent agriculture, 3% constitutes fallow lands and 15% are range and livestock producing areas. The population of the department is over a million of which

75% is devoted to agriculture and live in rural areas. The department is divided into thirteen provinces: La Convencion, Urubamba, Calca, Anta, Cusco, Paucartambo, Quispicanchis, Paruro, Acomayo, Chumbivilcas, Espinar, Canchis and Caras. Three of those provinces are located in the upper amazon region, while ten of them are located in the highlands. The department of Cusco has an irregular topography, corresponding to several ecological regions which are devoted to different crops and different kinds of livestock production. Agriculture is practiced along the Vilcanota river, which constitutes the most important agricultural area. In the regions bordering with the department of Puno, there are large areas of rangeland which are devoted to sheep and alpaca production. Tourism constitutes one of the most important economic activities in the department, however, its influence is centered mainly around the city of Cusco and surrounding archeological sites.

6. PROGRESS REPORT

6.1 Central Sierra

6.1.1 Mantaro Valley

Background

The field activities of the Community Project in the Central Sierra were begun at the end of May, 1983 in a peasant community (Cruz Pampa) of 38 families which had shown special interest in participating in experimentation and validation of agricultural and animal husbandry technology within the community. During the following six months, three additional communities (Llacuaripampa, Quicha Chico, Aramachay) signed collaborative agreements with the Project.

The main object of the first year's work was to gather data which would provide the basis for an understanding of the rationality of the mixed agriculture and animal husbandry production system which is used in communities. At the same time and as a result of joint evaluations carried out with the groups of peasant collaborators (appointed by the respective community's General Assembly) the need for initiating some experiments and

agriculture, animal husbandry and soil conservation, as a complement to the gathering of basic data was identified. It is hoped that the results of these experiments will provide indicators as to the types of technology that could form part of improved models to be designed in the future.

The secondary objectives proposed for the first year included:

1. The consolidation of a professional-technical-peasant team that would permit the implementation of an integrated effort in the participating communities.
2. The design and evaluation of a methodology that would provide for the continuous planning-implementation-evaluation of systems models with the participation of community members.
3. The implementation of experiments as a means of validating technologies appropriate to the production system in use in communities.
4. The solidification of information and training channels which would insure a broad participation base.
5. The gathering of basic data on ecological, technological and production components of the system.

The methodology designed and evaluated through the

project is based on four assumptions:

1. The mixed agriculture and animal husbandry production system used in peasant communities has an internal rationale and is advantageous to the small producer.
2. The production unit is the family, where decision making and exploitation of plots takes place. Nevertheless, this base unit is complemented by decision-making and production activities on the community level.
3. The mixed agriculture and animal husbandry production system is concerned with the most efficient use of natural resources and labour.
4. The biological and productive experience of the farmer-comunero is basic for the carrying out of research which has the improvement of the system as its objective.

The concept of agricultural systems is not new in the Peruvian Andes. Pre-Inca and Inca social groups are known for their complex organizational systems which allowed them to exploit limited agricultural and pasture lands effectively. Nevertheless, in the past 150 years and more so in the past 60, agricultural development has been orientated toward the solution of specific production problems, ignoring the collateral effects that these solutions might have. The programs of national and

private institutions, in many cases, have tended to provide global solutions for specific ecological and productive situations which have not brought about the expected results. It is for this reason that we have determined that the Project for Research and Validation of Agricultural and Animal Husbandry systems for Peasant Communities should be carried out with the full participation of the farmers in all phases.

After the selection of the micro-region where the project worked, on the right margin of the Mantaro Valley at an altitude of between 3,500 and 4,000 meters, and made up of 10 peasant communities, we proceeded to identify four, two large (around 100 comuneros) and two small (around 40 comuneros each) where the intensive activities of the project would be carried out. Agreements were signed with these communities to establish the collaborative mechanisms between the Community Assemblies and Small Ruminants/IVITA. The collaborative agreements contemplate joint responsibilities: communities provide support for housing and food for the field personnel and professional collaborators and appoint five to ten comuneros to work on a continuing basis with the experimentation and research activities; Small Ruminants/IVITA provides technical support, consulting for the design and evaluation of experiments, materials and

complementary training.

Once the collaborative mechanism were defined, actions were begun in the areas of basic data collection, training and organization of the groups of peasant collaborators which resulted in the joint planning of the specific activities to be carried out during the first year. Periodically, joint meetings have been carried out with each of the community General Assemblies to evaluate the development of the project and to reinforce the group understanding of the basic concepts of long term experimentation as means of problem solution. Experimentation and basic data gathering have been complemented by veterinary assistance to individual herds of comuneros, members of the participating communities, as well as by a program of information training which should permit the communities as a whole, to follow the experimentation activities with a better understanding of the underlying biological and social principals.

At the end of the first year of activities, and parallel to the final evaluation of the experiments, meetings are being held with community members and among the professional collaborators to assess the problems and limitations encountered from a technical standpoint as well as to plan activities for next year. As the

Project has introduced the concept of experimentation-validation and joint data gathering into the communities for the first time, it is important to continue training the participants in the areas of:

1. Basic biological concepts
2. Techniques of experimental design
3. Techniques for systematizing data.

The team which carries out the project works on various levels. The nucleus is made up of six professionals who are tied directly to the Community Project in the Central Sierra. This team includes one animal husbandry specialist, one agronomist and one agrostologist, who live in the field and who are in charge of the continuing activities with the collaborating peasants, the gathering of basic data and the implementation of the experimental activities. Currently, two masters level students are completing research projects in one of the communities. These studies, one on non-monetary exchanges and one on labor use, will add to the base line data being collected by the permanent team. The field work is complemented by that of an economist and a communication specialist on a part-time basis: the former to work on the analysis of economic data and the latter to prepare training

materials to complement the experimentation-validation activities. The project is coordinated by an anthropologist and has the advantage of the services of an administrative assistant. The overall orientation is in the hands of the coordinator of the Small Ruminant Project in Peru and is advised by the sociologist of the University of Missouri and by the economist of Winrock International.

The Community Project is implemented in agreement with the Veterinary Institute for Tropical and High Altitude Research (IVITA), Principal High Altitude Station of the Universidad Nacional Mayor de San Marcos. Decisions concerning project activities and collaboration with other institutions are approved by a Technical Committee consisting of four members; the coordinator of the station, a representative of the area of animal production, a representative of the area of parasitology and the coordinator of the Community Project.

As a complement to the technical advisorship of IVITA specialists of local and national institutions in the areas of soil conservation and Andean crops.

During the first calendar year the project was supported by ten collaborating specialists.

In each participating community, there is a group

of between five and ten collaborating peasants (men and women) appointed by the respective General Assemblies, who participate actively in the planning, implementation and evaluation of the activities being carried out.

Project Personnel and Collaborators

a) Core group:

Maria Fernandez (until Sept.1984)	Coordinator	Anthrop.	Small Ruminants
Luis Coronado (since Sept.1984)	Coordinator	Veter.	IVITA
Nancy Kaajjak	Field Res.	Zoot.	Small Ruminants
Hugo Salvatierra	Field Res.	Agron.	Small Ruminants
Marcelino Inga	Field Res.	Agron.	Small Ruminants
Jenny Baldeon	Adm. Assist.	Student	Small Ruminants
Anne Swindale	Research	Econ.	IVITA/Winrock
Paula Bilinsky	Research	Sociol.	Univ. Missouri
Mercedes Barrera	Research	Econ.	Univ. Agraria
Elsa Huanuco	Field Ass.		Univ. Missouri

b) IVITA

Fco. Arevalo	Liason Paras.	Veter.	IVITA
Hernando Basalar	Res. Paras.	Veter.	IVITA
Juan Correa	Field Assit. Parasites	Lab. Techn.	IVITA

c) Small Ruminants Advisors

Ben. Quijandria	Asesor	Agron.Zoot.Small Ruminants
Keith Jamtgaard	Asesor	Sociol. U. Missouri
Domingo Martinez	Asesor	Econ. Winrock Int.

d) Collaborating Professional

Martha Abuaahdba	Sociologist	Fundacion para el Desarrollo Organizacion Int. de Trabajo
Cipriano Mantari	Agronomist	Proyecto de Conservacion de Suelos-Dir. Aguas-Ministerio de Agricultura
Mario Morales	Forestry	
Lorencio Herquinio	Agron.	Universidad Nacional del Centro del Peru-Cultivos Andinos
Lahuro Toribio	Agronomist	
Tolomeo Peralta	Entomologist	CIPA XII
Maria Scurrah	Geneticist	Centro Internacional de la Papa
Urs Scheidegger	Agronomist	Programa Nacional de la Papa
Soilo Maecelo	Agronomist	IICA scholarship
Robert Gilman	Physician	Instituto Nacional de Nutricion

* Training

The development of a project attempts to consider the multiple components of a production system, as well as account for the diverse experiences and formation of professionals, technicians and peasants, requires that training be carried out on various levels. During the first year of the project, conferences for the members of the participating communities, field training for the

peasant collaborators of each community and among communities and open short courses for collaborators and interested comuneros have been given. It has also been possible to send some of the collaborating peasants to regional as well as national-level short courses. The professional team has participated in congresses, workshops and courses that have helped to improve their working capacity from the point of view of agricultural systems.

a) Community Conferences

Liver Fluke in Sheep

Family Planning

Nutrition and Crop Planning

Insect and Pest Control in Potatoes

Project Objectives

Selection and Storage for Potato Seeds

Selection and Classification of Sheeps

Soil Conservation in the Andes

b) Intercommunity Short Courses

Use of Veterinary Medicine in Livestock

c) Short Courses

Congreso de la Asociacion Peruana de Produccion
Animal/ Zurita, Kajjak/October 1983

Curso Taller en Tecnologia Agricola Andina-

Instituto Indigenista Americano/Miguel
Campesino/August 1983
Curso de Energia Solar, CLA/Two Peasants/March
1984
IV Taller de Trabajo sobre Sistemas de
Produccion Animal, CIID/Fernandez/October 1983
Curso de Enfoque de Sistemas de la Investigacion
Agropecuaria, INIPA-IICA-Small Ruminants/Baldeon,
Bazalar, Coronado, Fernandez, Kaajjak, Swindale,
Zurita/May 1984
Salud Humana e Inyectables, IVITA/Baldeon, two
peasant men, two peasant women/March 1984

Technical Accomplishments

Basic Data

The gathering of basic data consisted initially in the description of the components of the system observed by the professionals in the field, as a means of arriving at a first approximation to the interrelations between them. Later on we began to gather data more systematically in the areas of pasture use, animal and crop production and product distribution as a base for the analysis of biological data and of the economic advantages of the system. This data is incomplete at this point in time but will be complemented during the present

harvest.

Experimentation-Validation

The process of prioritizing and designing began in the second month of the project and was based on the problems which had been pointed out by the peasant collaborators as limitations to the improvement of agricultural and animal production in the area. With them, a list was made of the problems which were then divided into five major groups, taking into account the project's work capacity, the agricultural calendar, the availability of land and animals and the organizational capacity of the community, for the determination of the experiments to be carried out during the year. Within the next six months a short report will be presented on the experiments that have shown results during one agricultural season (September to May).

Experiments in Progress

a) Agriculture

Andean Crops

Comparative yield among varieties of potatoes native to the area and improved clones.

The effects of anticipated land preparation on potato yields.

The effect of lunar phases at planting on

potato yields.

Comparative yields of different varieties of quinoa and tarwi.

Soil Conservation

Moisture conservation on slopes through the use of terracing and contour plowing

b) Animal Husbandry

Animal Nutrition

Recuperation of fallowed land for grazing

Improvement of crop residues by means of association with clovers

Projected yield of pastures native to the area

Animal Health

Use of native plants in the control of external parasites

Use of native plants in the control of intestinal parasites in sheep

Animal Management

Restructuring of herds of sheep on communal farms

Research

Research refers to the design and implementation of studies that will permit us to gather information on integrated processes or on specific components.

These studies have begun in May of 1984 and will continue during at least two agricultural periods.

The areas programed for study include:

1. Forms of product and labor exchange
2. Use and distribution of labor
3. Use of technological practices in agriculture and for animal husbandry.

Characterization

a) Regional

This step of the general analysis of the area has been completed. The working document will be published with the most relevant findings. Outstanding points of the report are summarized below:

The Mantaro Valley has 60 km of length, from north to south and a width with ranges from 2 to 24 km. Flanking the valley, to branches of the Andean highlands, known as the Central and Western mountain ranges. Within the valley, there are three agro-ecological areas, the lower, intermediate and the higher. Within these three areas, crops and livestock are distributed according to the adaptation to ecological conditions. Linked with this, production systems are distributed accordingly. In the lower area of the valley, agriculture is practiced under irrigation, while in the intermediate and higher areas it is done as dryland farming.

Two thirds of the lower area is devoted to corn, fava beans, and peas. One third is cultivated with potatoes. In the intermediate and higher areas, two thirds of agricultural lands are

planted with potatoes. Higher yields are obtained in the lower area.

48% of cattle, 40% of sheep and 23% of camelids are located in the lower area, while in the intermediate and higher areas the largest proportion (70%) corresponds to sheep. It is in this area where mixed agricultural and livestock systems are most common at the level of individual farmers or in peasant communities.

There is an uneven distribution of land throughout the valley. A total of 92% of the agricultural units have between 0 and 5 ha, however, they cover only 7% of the total area. In contrast, 7.3% of agricultural units (between 15 and 500 ha) own 92.9% of the territory. This includes mainly individual farmers and cooperatives. Peasant Communities own 36.7% of the agricultural area of the valley, SAISs 43% and the difference is owned by individual farmers.

In the Mantaro Valley there are 244 Peasant Communities. Most of them are classified as agropastoral communities, containing agricultural and livestock production systems. The community system of this valley comprises 39,039 families, which own 49.8% (70,363 heads) of cattle, 32.2% of sheep (313,615 heads) and 58.3% of camelids (14,064 heads). Livestock

production is based on the use of 39.46% of the rangelands (248,770 ha).

The internal operation of Peasant Communities responds to the model set by the Military Government during the Agrarian Reform, which includes administration and Vigilance Committees. Over time the Peasant Communities are showing a process of privatization of the resources. This is expressed in terms of acknowledgement of ownership and private property within the communities, and of individual decision making processes in individual or family plots. Communities still held small amounts of agricultural territory as communal land, which is used for the community wellbeing.

The introduction of new crops and livestock species, the demographic growth and marketing patterns have brought changes in the patterns of the production systems, soil conservation practices, fallowing of the land, crop rotation, and range use. Commercial potato production has become generalized in the area, and is indicated as the main cause of these shifts and changes. This also has brought changes within the communities by increasing the gap between the haves and the havenots, because of the

investment and monetary requirements that come together with commercial potato production. The lower the socio-economic situation of the peasants, the more complex the systems they manage, as a way of minimizing risks and protect their annual investments in crops. Within this situation livestock and small ruminants constitute one of the pillars of peasant economy.

b) Community Level

A general diagnosis of a sample of the Peasant Communities of the Mantaro Valley was completed by Anne Swindale, Economist, working with SR-CRSP (Winrock) and partially financed by a project with IVITA and the Interamerican Foundation. The report is on a final draft stage, and soon will be published as a technical report. This diagnosis covers community and family level on a static diagnostic survey. Some of the most important aspects of the report at the community level are:

- Of the total of 244 communities 89 were included in the community survey. The sample was ordered according to the agroecological areas where they are located, using criteria

developed by MAYER (1979) and JAMTGAARD (1983, forthcoming).

- Communities surveyed have a total average area of 3,747 ha, ranging from 260 to 34,760 ha. Over 70% of this area is natural ranges, and the agricultural territory only covers from 10 to 20% of the total area.

- The average number of families per community was 105. Households were headed by men in 80% of the cases, and by women in 20%. In most cases, men are considered comuneros if they fulfil community requirements, however only widows and unmarried mothers can be considered as comuneras. Under this condition, comuneros are supposed to provide communal work for specific assignments defined by the community. This includes agricultural labor, road repairs, school building, among others.

- Land ownership among communities still involves conflicts of boundaries. 36% of the communities have boundary problems with neighboring communities, private owners or SAIS or Coops. Other problems found within communities are: lack of irrigation facilities, drinking water, electric power,

medical assistance and transportation services.

- The general conclusions obtained from this survey are:

* Communities develop their agricultural activities in agropastoral systems worked at communal or family level.

* Communal work is normally practiced to improve wellbeing conditions in the community.

* Livestock are an important resource at family and community level.

* Land ownership at family and community level is highly variable, defining several strata between peasants within and among communities.

* Only 32% of the communities have some type of irrigation, however in 70% of the cases this irrigation is either restricted or seasonal.

* Only 41% of the communities have communal herds of sheep, livestock ownership is mostly individual in small herds.

c) Family level

Based on the survey mentioned above, a sample of families was surveyed within the communities studied for the community characterization. 846 families were surveyed. Families are mostly of the nuclear type.

Information on education, age, family structure, crop livestock, handicrafts and other activities were collected in this survey. A preliminary analysis has been completed and a first draft is already completed. In coming months a technical report will present the results of the characterization at the family level.

d) Agropastoral Systems

Characterization of agropastoral systems is underway through a continuous survey which was started in July 1984. Preliminary results of this survey will be presented by Dr Luis Coronado, Project Coordinator during the PI Meeting. It is expected that by the latter part of 1985 the first complete report will be published.

Diagnostic Research

The continuous survey is the principal activity for diagnostic research. A sample of ten families per community are being monitored in their productive activities and also in their social and community life. Preliminary information will be presented at the PI Meeting by the economics and social components of the project.

Three additional diagnostic research projects has been started within the community. These include: "Non monetary exchange in Peasant Communities in the Mantaro Valley", "Labor use and allocation in peasant families" and "Determination of range condition and grazing capability at Aramachay and Cruz Pampa". These diagnostic research projects are being carried out by Paula Bilinsky from University of Missouri as her Master Thesis; Mercedes Barrera, from UNA as her BS Thesis; and the third one by Enrique Flores, Faculty Member of UNA and member of the Community Project team.

Of the three projects, only the range evaluation has been completed and a map of the community showing range suitability for different livestock species has been completed.

The other two are in the field data gathering stage and will be completed by June or July 1985.

Experimental Evaluation

In the communities of the Central Sierra, the following research projects have been carried out:

- a) Management restructuring of the communal flock at Aramachay and Yacuaripampa
- b) Use of native plants for external parasite control
- c) Evaluation of dry matter yield in native grasses
- d) Use of fallow land and crop residues enriched with legumes in animal nutrition
- e) Terracing for soil and water conservation in Andean crops
- f) Comparative yield of several varieties of quinoa and tarwi
- g) Comparative yield of several varieties of potatoes and the effect of the moon on growth and yield.

6.1.2 Santa Barbara de Carhuacallan

Background

The peasant community of Santa Barbara de Carhuacallan, is part of the group of community members of SAIS Pachacutec. It has common boundary with the SAIS in the north western area, and many of the community members work as laborers or foremen at the SAIS. The range and cultivated forage programs were established at SAIS Pachacutec in 1980 and have been continued at that location for the last four years. Dr. Arturo Flores and Efrain Malpartida in their frequent trips to this location, contacted community officials. The community suggested to the group from Universidad Nacional Agraria the possibilities of establishing a sheep improvement program with their community flock. Ing. Manuel Carpio, Peruvian counterpart of the SR-CRSP Breeding Program, was contacted in order to participate in this project. A team of scientists from UNA was put together to prepare a proposal to work in the community flock. The proposal was included in the activities of the Community Project of the SR-CRSP, and budgeted according to resources available.

An agreement was signed between the community and

the SR-CRSP, and soon afterwards, field technicians moved to the community in order to start the general characterization of the community flock. The areas that were included in the working program were: range management, sheep breeding and sheep management. However, the general characterization included socio-economic information.

Characterization

a. Regional

No attempt was made to work a general characterization of the area, since information is already available in the Regional Corporation of Development of Pasco and Lima departments. Further, communities located in the surrounding area were included in the general survey made by Dirección de Comunidades Campesinas from the Ministry of Agriculture, information that is being processed by Mr. Keith Jantjaard from the Missouri Rural Sociology Program.

b. Community level

The characterization of the peasant community of Santa Barbara de Carhuacallan was completed in early 1983, and two volumes have been completed

and are available to those interested.

Based on that document the main characteristics of the community are:

* The peasant community of Santa Barbara de Carhuacallan was officially recognized in 1931 and through Agrarian Reform received the former Hacienda Conocancha in 1973. This community is located in the district of Carhuacallan, Yauli province, department of Junin, a distance of 86 km. from La Oroya, the town which is the provincial capital of Yauli.

According to the ownership map plan of the community the total land owned by the community is 14,992.45 ha, located over 4,124 m.a.s.l. Of this total amount, 9,172.45 ha were obtained by Agrarian Reform and 5,820 ha belong to communal land. The territory is devoted almost exclusively to extensive grazing of sheep and some cattle, with some alpacas grazing in the highlands also.

* Population

According to the Community Census of 1983, the community has a total of 934 inhabitants, distributed in 178 peasant community families. The population of children up to 8 years old represents 16.17% of the communal population;

the economically active population has been estimated at 40.68%. The illiteracy rate reaches 14.2%, with the rest of the population having some degree of basic schooling.

Each community member is supposed to devote some time to community official function, at least every six years and for a minimum period of two years, in a scheme of rotating positions. Comuneros are divided in two categories: active members (55.06%) and living members (44.94%). Those in the first category have the right of using individual plots for either agriculture or livestock grazing, even though some active members don't own any land because of land size restrictions.

Of those who own cattle, 39.02% have directed grazing control of their cattle, 15.86% have either a shared shepherd or a family member who grazes a group of family animals, finally 45.12% have some type of grazing arrangement with shepherds or other type of communal grazing.

Agricultural plots are either conducted by individual families (51.22%) or shared by two members of the community.

Of the total community, 60.20% of the active comuneros are devoted to livestock production, with the rest of them devoted to mining, laborer at the SAIS, laborers at the communal herd, or

in less numbers as teachers, clerks, or merchants.

Those who are called "living comuneros", have only rights to live within the communities boundaries and they don't own or work on community plots. This group is devoted mainly to seasonal laborers, shepherds at the community herd or at the SAIS, or merchants.

The community is organized according to government by-laws and regulations into: Asamblea Comunal, Consejo Administrativo y Consejo de Vigilancia. Within this structure special types of committees are appointed, dealing mainly with the communal herd, transportation, savings and loans, and textiles and tannery.

All members have to participate in livestock activities and communal work. Communal work is mainly devoted to road working and repairs, school constructions, and other activities related with the well being of the community. Within the community a Medical Post has been established through communal work. At a bi-weekly a communal fair on Sundays the comuneros and merchants from Tarma, Junin and La Oroya exchange, sell and trade goods.

* Communal herd

The livestock division of the community was established after Agrarian Reform gave the community the former Hacienda Conocancha with 9,136 ha and 2,400 heads of sheep. This area and its animals were established as a communal herd under the Livestock Division which include the communal herd and a service cooperative. The sheep flock has been increased and improved over the years, using Junin rams bought from SAIS Tupac Amaru and young rams of Corridale breed from SAIS Pachacutec. These acquisitions were made as part of a general improvement plan for the communal herd.

Management operations of this herd include seasonal breeding during the months of May through July. Matings are carried on at four specially prepared range areas, which have four categories of ewes according to wool quality. Matings are made when ewes are 1.5 years of age and an appropriate body size. Females that are not sexually mature at this age, are mated the next year. Young rams start the mating season at two years of age. Those males that do not reach minimum conditions at mating time are sold as mutton together with hoggets. Ewes and rams are normally discarded at six or seven years of age. Replacements are selected within the herd at the

time of identification and kept in a separate flock. The porportion of rams used in the herd is 4 to 6 %, adding an additional 4% in the mating season as reinforcement. After mating, ewes are moved to specially designated range areas with above average forage conditions.

The lambing season starts in October and lasts three months. At this time, the prevalent causes of mortality are pneumonia, hydropericardium, polyadenomathosis, anemia, "jacapo" and coernurosis.

Lambing is practiced in an open sleeping area. The incidence of twining is very low and on the average 90% of ewes lamb in any given year. Total lamb mortality reaches an average of 15%. Lambs are eartagged at 2.5 months of age, at this time the animals are also docked, castrated and lamb rams selected. Animals are not weighted either at birth or at this stage. Shearing is done during March and lasts seven days. Wool is marketed through regular commercial channels.

The communal herd recieves veterinary treatment which includes vaccination and treatment against external and internal parasites. Dipping is practiced in May before the mating season. Shepherds normally carry on standard veterinaty

procedures with the flocks under their responsibility. Major operations are implemented by the foreman and manager of the communal herd. The community started a cattle operation 5 years ago, purchasing 5 cows and 2 bulls of criollo breed. This herd is in state of semi-abandonment with no milking of the cattle and very limited management.

* Family livestock production

Each comunero handles his own herds according to individual practices. The herd is composed of several species which include sheep, cattle, alpaca and pigs. All species and sexes are grazed together, with non seasonal mating. Parturition of these species take place all year round.

Grazing is done on family plots, which are normally highly overgrazed. Family plots have on the average 50 ha, however some of them are shared by 2 or 3 comuneros. As a consequence, each one of them try to keep the larger number of animals on their plots. As a way of improving their sheep, comuneros normally buy lamb rams from the community flock. Because of their size, very careful extension program is needed to increase production and productivity at family level.

c. Family Level

Even though a large amount of information has been collected during the characterization of the community level, no attempt was made at this stage to start characterization at the family level. The agreement signed with the community included only activities at the communal herd and at this stage no authorization was made to complete information about family characteristics within the community.

d. Agropastoral systems

- Diagnostic Research

The diagnostic research was started at Santa Barbara de Carhuacallan community in the areas of range management, animal breeding and sheep management. An evaluation of the communal grazing areas was made by a team headed by Dr Arturo Flores from UNA. A detailed map of the community showing range conditions and carrying capacities by different livestock species has been prepared. Also a set of recommendations on range management and improvement was made.

Lamb rams and lamb ewes were evaluated at shearing time and a selection index was applied to all the population of ewes. Animals were stratified in categories for selection purposes. Body and fleece weights were recorded in 1983. A mating scheme was proposed for the mating season of 1984.

e. Cancellation of activities

After the range and breeding diagnostic research was completed, the top selected ewes, detected by selection index procedures were separated in an special flock. Animals were stolen from the community and comuneros blame the project as the major cause of this event. They indicated that since the animals were selected, that was the best reason for which they were stolen. After that the community decided to cancel the agreement and project activities were finished.

This experience is fairly valuable because indicates on one hand the potential fragility of relation with communities, and on another indicates the need to include a sociological analysis of the community previous to large commitments in biological areas.

6.2 Southern Sierra

6.2.1 Cusco Communities

Background

The Andean Cropping Systems Project (PISCA), started in 1980 in four communities located in Pisac, 30 km from Cusco City. Their main objective was to conduct system oriented research in andean crops. From the beginning of the project, a multidisciplinary team of agronomists was established on location with support from rural sociologists, agricultural economists and anthropologists. Preliminary surveys in these communities showed that, even though they were considered as crop oriented, they had a large livestock capital. Prominent was the sheep population, which has a total of over 14.000 heads. Also significant numbers of cattle, camelids, and swine were detected.

Initial characterization of the farming system indicated the important role of sheep in peasant economy, with barley and sheep as the main cash crops for the family economy. Coordination with Dr. Mario Tapia resulted in the need of mutual cooperation, with SR-CRSP participating in support

of PISCA activities in the livestock area.

Actually two institutions are participating in a coordinated way in the activities of these four communities:

- PISCA Project
- SR-CRSP

PISCA has a staff of 6 technicians at the community and SR-CRSP is supporting with an animal scientist, Ing. Marco Sotomayor. Activities in livestock systems were started in 1984.

Characterization

a. Regional

PISCA Project has published a detailed regional characterisation of the setting of the four communities that comprises the area of work. These publications are available to those interested. The four communities where the project is working are: Paru-Paru, Amaru, Sacaca y Cuyo Grande. General characteristics of the ecological zone, population, farming systems and marketing channels had been reported in these publications.

b. Community Level

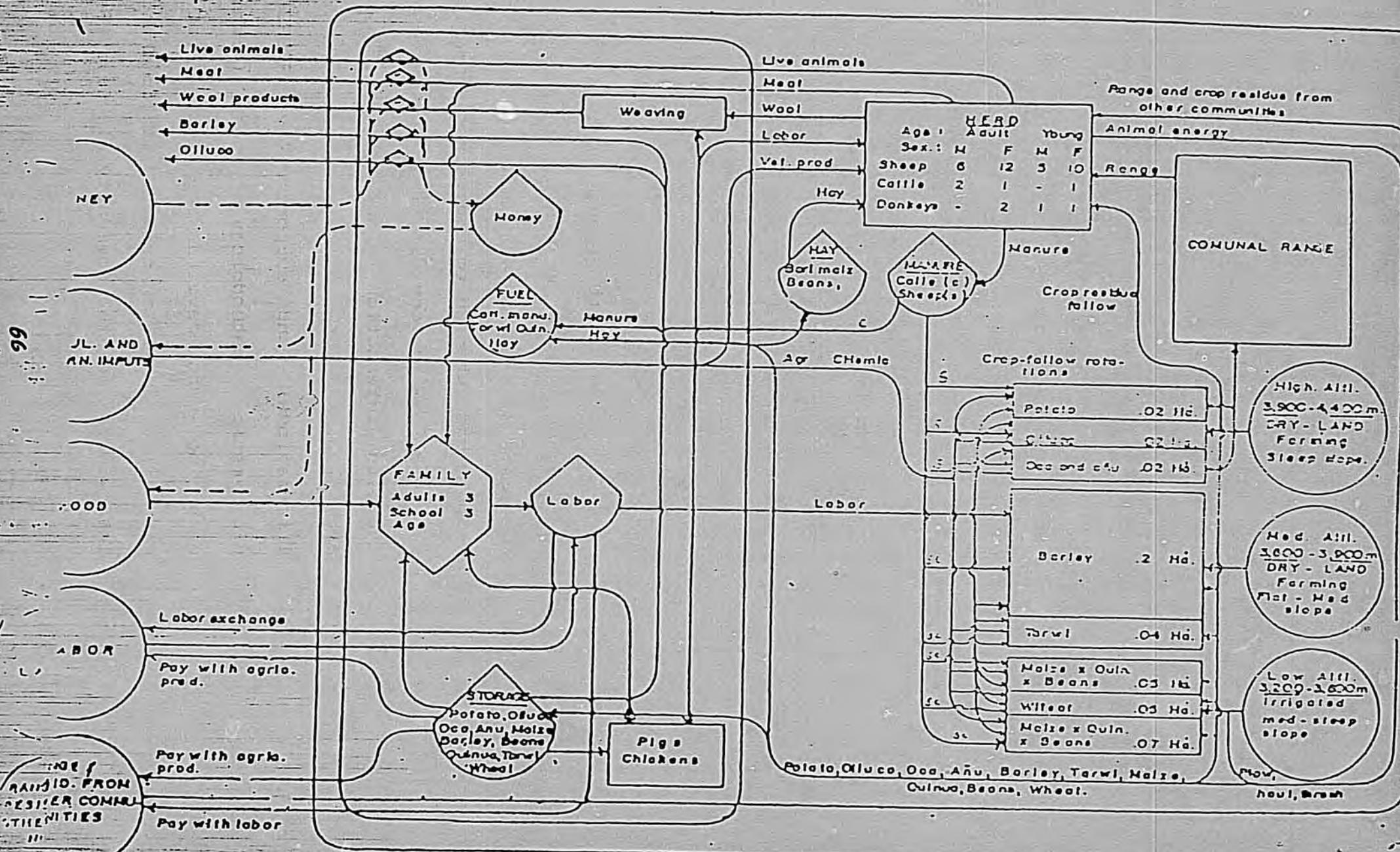
Also at the community level PISCA Project has published a general characterisation of the four communities, however, the main emphasis has been on cropping systems description and the socio-economic components directly related to this activity. After the evaluation of the livestock composition and herd number, it was realized that a substantial fraction of income was derived from animal production. Publications about community characterization are also available to those interested.

c. Family Level

Same as above, with strong emphasis on Andean cropping systems. In this area, with the cooperation of SR-CRSP Community Project, an effort has started to complete information to characterize in more detail livestock systems and its interaction with cropping systems. After a visit of Dr. Robert Hart, from Winrock International and supported by SR-CRSP, a diagramatic methodology for information gathering was devised and tested at the community. In that respect, a comunero was interviewed in the community of Cuyo Grande.

Best Available Document

Figure 3.—A Farming System in the Community of Cuyo Grande--Cuzco, Peru.



Scientists with experience in this community translated questions from Spanish to Quechua and volunteered information from their own experience as well. No attempt was made to determine representativity of the farm system that was described by the farmer.

Figure 3 is a diagram of a farm system in Cuyo Grande. On the right are circles representing the environmental inputs that determine the cropping system options. Eight plots are located on the temperature gradient. A herd composed of sheep, cattle and donkeys of different ages and sexes are grazed on communal range during the wet season, fed crop residue and grazed on fallow crop land during most of the dry season, and grazed in a nearby community at the end of the dry season (feed resources are often not sufficient to meet the needs of the herd for the entire dry season).

The farmer that was interviewed sells live animals, meat, wool products from the wool from his sheep, barley (bought by the beer industry) and olluco (andean tuber). Money obtained through these sales is used to buy food not produced in the community (sugar, salt, rice, etc.) and limited quantities of agricultural and veterinary inputs. Labor and grazing rights to land in other communities is

paid for with either labor or agricultural products.

Manure and crop residue are key components of the system. Cattle and sheep manure is collected. Sheep manure is used to fertilize the crops in the high altitude area, while both sheep and cattle manure are used in the mid and low altitude zones. Only cattle manure is used for fuel, and this is mixed with tarwi (legume) and quinoa (grain crop) crop residue. Barley, maize, and bean crop residue are combined, stored, and fed to livestock. Oxen are used to plow the land before planting in the mid and low altitude zones. Donkeys are used to haul products and to thresh grain.

Based on this methodology, a sample of twenty families are being studied in detail, first to complete a diagramatic and qualitative characterization and second, to obtain a dynamic year-to-year account of activities and their relationship.

d. Agro-pastoral systems

In June 1984 a characterisation of agro-pastoral system was started. Information on livestock management, animal health, breeding and

reproductive practices, marketing patterns and others are being gathered to obtain a clear description of the systems and their limiting factors. Also to assess potential areas of improvement, and priorities for validation research.

Diagnostic Research

Since information on cropping systems has been available for the last two years, diagnostic research was started only for the livestock systems and its relation with cropping systems. A survey sheet was devised to study a sample of twenty families within the four communities. Information gathered included a livestock census, age, sex and reproductive status of animals, breed and other additional information. Management practices, use of resources are recorded in order to determine constraints and limiting factors, as well as potential technologies available at the community. Information will help understand the function of different species within the family economy and the rationality of the family production system.

Range evaluation and characterization has been started. Evaluation of crop residues from a quantitative and qualitative point of view is being carried out, together with the appropriate

correlations between livestock and cropping systems. This information will be complemented with Ingeniero Theses, already completed by students of Cusco University. In one of those studies, chemical evaluation of residues has been made. A monthly calendar of available feeding resources will be completed and with information related to range carrying capacity, a total balance between animal population and nutritional resources will be made. Overlapping information from agricultural plots used in Andean crops, and use of residues left on the field will be conducted. After the grain harvest, the farmers harvest straw, which is carried to storage places close to the house for use during the dry season. After harvesting the straw, animals go to the field to consume completely the remaining stubble. This management practices provide feeding resources for more than three months after the harvesting season and before the rainy season. A year round feeding pattern will be evaluated.

Experimental Evaluation

Based on limiting factors and constraints identified during the characterization steps, experimental evaluation of technology potentially

capable of lifting constraints were set in place on farmers plots. Among them:

* Intensive utilization of "laimi":

"Laimi" are communal fallow lands located in the highest parts of the community and normally are used to cultivate bitter potatoes. Since soil is fairly poor, two years of crops are normally followed by 8-10 years as fallow lands. The proposed study will include forage oats and legumes as the last crop in order to increase soil fertility and provide an increment in quantity and quality of fodder for livestock. Surplus forage will also be preserved as silage.

* Improvement in nutrition for sheep and cattle:

Legumes and cultivated forages were incorporated in the cropping patterns as intercropping or terminal cropping to provide increased supply of high quality forage for sheep and cattle.

* Cultivated forages:

Plots of forage oats and barley, and cultivated legumes were established in fallow land to provide increased supply of cattle fodder. Three 1 ha plots had been seeded on comuneros land. Evaluation of yields, dry matter production and protein content will be made by May 1985.

* Range management and improvement:

An evaluation of the natural ranges of the Cusco communities is underway. Range condition and

carrying capacity will be determined. Based on maps of preference use by different types of livestock, a set of recommendations and guidelines will be presented to community members for range improvement.

* Animal Health:

Four community members are been trained in animal health practices as technicians to provide simple veterinary practices to community livestock. Techniques as dipping, drenching, injections, etc., are being taught to four "promotores", which later on will pass on their knowledge to their own communities.

6.2.2 QUISHUARA COMMUNITY

Background

The Community Project started its activities in the peasant community of Quishuara in September, 1983. Following the terrorist attack to La Raya Experimental Station in July of the same year, activities in this southern community were delayed until it was considered safe to work again in that area. As soon as the area was considered free of terrorist activities, sociologist Lidia Jimenez was established in the city of Ayaviri to start project activities. Previous activities, included coordination meetings with Dr. Mario Tapia, and Micro Region officials to start a coordinated group of activities in the selected area. Ms. Lidia Jimenez started several activities which included: contacts with community officials, preliminary survey of communal characteristics, field trials and activities.

Ms. Lidia Jimenez is an MS. graduate student from University of Missouri, Department of Rural Sociology, and has studied in this community as her graduate research project "Socio-economic aspects of alpaca production". Her objectives were to examine the actual production system, limiting factors and level of development of alpaca production activity. Special

consideration is given to the social structure of the community, as it affects alpaca production, division and forms of labor sharing. This study, which is about to be finished at Missouri, includes a general description of the setting, detailed description of the alpaca production system, and the dynamics and rationality of the current system. This study will constitute an important source of information for future studies in the Peruvian highlands, and will contribute to the understanding of peasant community system as stated in the goals and objectives of the Community Project.

Actually four institutions are participating in a very coordinated way in the activities of this community:

- Microregion Melgar (Branch of Puno Corporation of Development)
- PISCA Project
- University of Puno
- SR-CRSP

The following personnel have been assigned to the community:

Eco. Ruben Velarde, SR-CRSP, Community Project

Soc. Manuel Estofanero, Microregion Melgar

Agr. Luis Chavez, PISCA Project

Vet. Santos Zenon Choquehuanca, SR-CRSP Community Project

A Memorandum of Understanding has already been signed

with the community of Quishuara, spelling out project and community responsibilities for future research activities. Support in field activities was continued, including crop plots at the local school, short courses in animal health and production and the organization of a community agriculture, livestock and handicrafts fair.

Characterization:

a. Regional

Regional characterization of the Melgar Province was undertaken by Microregion Melgar. This study was made with the cooperation of a Dutch government group of experts stationed in Ayaviri. This report is available to those interested. This regional characterization report is very exhaustive and follows the format for regional reports, described previously in the chapter related to Project Methodology.

b. Community level

A first draft of the Community characterization report was completed by Soc. Manuel Estofanero from Microregion Melgar, with support from Soc. Lidia

Jimenez. Further information is actually being collected to complete additional aspects of this first draft. From this study, the main characteristics of Quishuara are as follows:

General Aspects

Quishuara was officially recognized as a Indian Community in 1946, later on during the Agrarian Reform undertaken by the Military Government, names were changed to Peasant Communities, and also substancial changes were made in the organizational structure of communities. Quishuara is considered one of the oldest communities in Peru, and the first documents refering to this community, are dated around 1543.

The ecological zone in which this community is located corresponds to the classification of alpine tundra, with an annual average temperature of 8.4C. Annual precipitation fluctuates between 600 and 700 mm in normal years. Average climatic data for rain level collected during the period 1970-79 is 1,142 mm and for 1983-84 was 736.6 mm. Rainfall patterns are highly irregular with strong variations within and among years. The community is located at 4100 m.a.s.l. with an uneven topographical profile, with a large percentage of the territory being hills and mountains with slopes greater than 25%. With this characteristic, the predominant activity is

livestock grazing, alpacas, llamas and sheep being the prevalent species. The topographic profile limits the use of farm machinery, and in some cases even the use of oxen, with agricultural plots disseminated and isolated from each other. Soils are of andean alluvial and marine origin, with predominance of sandy-clay and silty-loamy soils with gravel presence. Because of ecological and climatic conditions, only dryland farming is practiced, there is an ever present the risk of an stochastic rain pattern, periodical frost and hail. Unexpected sunny days increase the risks of pest and diseases in crops. The weather pattern determines the agricultural cycle planting between August and December and harvesting between June and July.

Demographic aspects

Quishuara is divided into two sectors, Quishuara and Santa Cruz. The total population is 1,496 persons, from 318 families, with an average of 4.7 members per household. The economically active population, between 15 and 60 years of age, represents 48.1%, however, this figure could be larger because younger and older people participate in productive activities. Population under 15 years represent 44.8 % of the total population.

With regard to education, 14.7 % of the population

older than 15 years and 30 % of those younger than 15 are illiterate; 42 % of the adult population have only incomplete grade school education, 11% have completed grade school and only 2.2% have a secondary education.

Temporary migration for over 15 days occurs in the community all year round and involves 6.7 % of the population, especially males from 15 to 44 years of age. The migratory flow goes toward Arequipa, Cuzco and Puerto Maldonado to activities such as mining, agriculture, building and others. Migration flows are generated because of seasonality of agricultural labor demand, limited labor demand related to low salaries and wages.

Distribution of resources

Based on the distribution and ownership of agricultural land, three different economic strata have been clasified. There are low, medium and high, with 70.5, 16.4 and 13.2% of the families classified as low, medium or high economic position, respectively. These three groups own 12.9, 19.8 and 56.0% of land resources respectively. Average land ownership is 5.3, 34.5 and 121.1 ha per family per stratum, respectively.

Livestock ownership is inversely related to agricultural land ownership, with low, medium and high economic groups owning 47.4, 23.7 and 27.0% of

the total livestock population, expressed as sheep units. The low economic stratum has the highest proportion of sheep and horses, somewhat more cattle and less alpaca than the high economic group. This reflects an uneven distribution of resources, livestock and agriculture within the community.

There is a comunal enterprise and communal land within the community. The first case uses 2.7 % of community land and the second one 8.4 %. Family plots comprises 88.79 % of the total area of the community. The total land for agricultural use is 8,555 ha, of which 98.6 % are natural ranges and 1.4 % agricultural plots. These figures underscore the relative importance of the pastoral activity in the day to day living and in comunal development. Over 77 % of the rangelands are located above 4,300 m.a.s.l. on very rough terraine. Here only livestock (sheep and alpaca, mainly) can live and produce. According to the latest census (1983), the livestock population of Quishuara was composed of 13,187 sheep, 884 cattle, 1,977 alpaca, 621 llamas and 215 horses.

Prevalent crops in this area are sweet and bitter potato and quinoa which comprises 78.7 % of the total cultivated area. Less important crops include "cañihua" (13.9 %) and minor crops as andean tubers, barley, oats, forage oats and cultivated forages

(7.82 %). Agricultural products such as potato, quinoa, barley and others are used for self consumption by community families, complementing their diet with imported products such as rice, spaghetti, sugar and flour, but in smaller amounts. The community owns, within their borders, some non metallic minerals, which are not now exploited, additionally fishing and hunting resources are sporadically used at the family level. There are some streams within the community, however, without adequate infrastructure no irrigated agriculture is practiced.

Farming Systems

- Labor use :

Even though each family has an assigned plot and manages their own resources and herds, the seasonality of the agricultural work and some livestock activities generates a seasonal demand for labour which is obtained outside the family. This is done through family, neighborhood and reciprocity links which are prevalent in the community. The following types of labour interchange has been identified:

- * Labor for labor (ayni, minka)
- * Share cropping
- * Salaried labor

* Labor for lands

This last exchange labor system has been established among community members which lend labor without salary to comunal plots, communal activities, road building, etc. and in exchange they receive the right to use either range or agricultural lands.

This combination of labor exchange situations is possible because of the uneven distribution of resources allocated to families within the community. This permits some surplus labor part of the year, which is reassigned in other family units or at the communal area.

- Cropping Systems

Several agricultural plots located at different ecological levels permits the management of a number of agricultural crops, characteristic of subsistence farming. This system allows maximum use of both micro climatic diversity and labor, while minimizing seasonal effects present on a single crop. This strategy is used minimizes risk, a permanent characteristic of subsistence farms. Topography, which limits the use of agricultural equipment, has required development of a very particular type of tools and gadgets. The farmers, using only human energy employ these

tools expertly to complete the agricultural job. These tools have been developed locally after many centuries of adapting traditional tools to the required agricultural operations. This situation also enhances the need for labor cooperation in the use of these particular tools.

- Livestock Systems

As it was already pointed out, livestock related activities are the most important within the community. Livestock raising and complements agricultural activities with the production of manure, produces food and clothing for the family, as well as cash when needed. It is one of the best ways of savings in an inflation ridden economy. Livestock also make use of child and female labor all year round, however, the head of the house and other members participates in specific activities such as shearing and dipping. Livestock activities are part of the total strategy which tends towards diversified production, maximum use of labor, family generation of food and resources, etc.

The main characteristics of livestock production in Quishuara community are the following:

The livestock are mainly of criollo type animals. Feeding is base mainly on natural ranges with some use of crop residues (barley, oats and quinoa

straws). The latter is used exclusively for cattle. Herds are grazed on family plots of natural ranges. They are grazed almost year round, except during the months of April and part of May during which they use communal land. During the rainy season, livestock normally graze on the highest lands, going to lower levels during the dry season. Only cattle are fattening before selling. Veterinary practices are not common, resulting in a prevalence of parasitic and infectious diseases in family and community herds. Very limited support in relation to animal health is received by the community or its members.

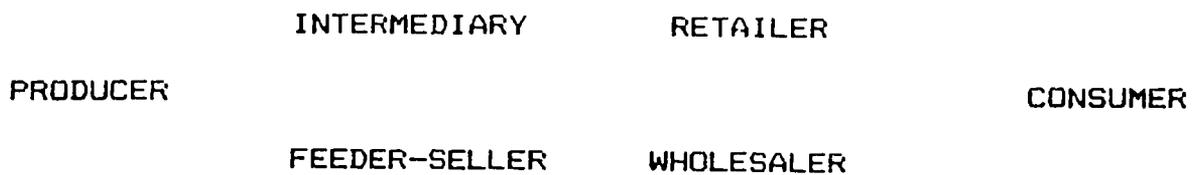
Breeding is practiced all year round in all species except cattle. The mating season for cattle is from February to April. In sheep and alpaca parturition is normally concentrated in two seasons, one between June and July and the other one between November and December. Weaning is done naturally with variable length of time and in many cases no participation from the herdsman. Shearing is done once a year for sheep in February and April, and every two years in alpaca in November and December.

- Storage and processing of agricultural products

Grains and tubers are stored in sacks made of llama fiber. Potatoes are processed into two varieties of dry powdered potatoes (chuffo and tunta) which are also stored the same way. Sacks of these products are normally stored in family quarters which have very limited ventilation. Potatoes stored for seed for next year are covered with layers of straw, and some people use in addition a characteristic Andean crop (mufta), as repellent of bugs. Potatoes of sweet and bitter varieties are transformed and processed into "chuffo" and "tunto" respectively, by the comuneros.

- Marketing of agricultural products

The main marketing channels are the so called "plazas" or weekly fairs, which are held in the two sectors of the community. Monetary transactions are common in these "plazas". However, bartering takes place in Cuzco, where comuneros exchange alpaca fiber and knitted products for corn, according to prestablished values. The marketing channels may vary, however they can be summarized as follows:



Potatoes, quinoa and "chuffo" and "tunta" are the main agricultural products being marketed, mainly from the communal enterprise. A substantial amount of the crops are consumed at the family level.

Livestock sales are basically related to temporary or pressing economic needs by the family. Wool and alpaca or llama fiber is either sold immediately after shearing or processed at home into cloth.

Importance of communal organization.

In Quishuara there are strong feelings toward the communal organization, evidenced by an internal operating and authority structure. There is a monthly meeting of the communal assembly. There are several supervising, organizing and controlling committees, which oversee activities agreed upon by the communal council such as communal labor, land use, school operation, communal enterprise and other rural and urban services controlled by the community. Comuneros are supposed to work on communal duties at least 45 days per year. As compensation comuneros are allowed access to communal range lands, and a plot in the communal enterprise fines are applied to

those who fail to comply..

There are some forms of a welfare system within the community, which provide special support for the elderly and widows. There is a retirement age for the comuneros at 60.

Through the year a series of local and religious festivities provide the proper environment to strengthen family and community ties.

c. Family level.

This part of the characterization process is still ongoing. A unified questionnaire has been designed and is currently being used in central and southern sierra. Special emphasis is assigned to analyze resources and labor allocation, income, family relations and interdependency of the nuclear and extended family. Also a detailed analysis of production systems at family level is being recorded.

d. Agropastoral systems.

This research line implies the dynamic surveying or monitoring of farming systems on a sample of families within the community to obtain a precise description of its components with limiting and

conditionig factors. This will increase the level of understanding of functions and interactions. This line is currently under way.

Diagnostic research

Several specific but interrelated research lines have been started in the community, with the objective of gathering quantitative information on productive activities within family and community systems. Diagnostic research will increase the level of understanding of farming systems obtained from the characterization phase. It will add the dynamic aspects of crop and livestock production, interactions among system components and the determination of socio-economic factors affecting production and productivity. The following diagnostic research studies are currently under way:

* Detailed livestock inventory and herd dynamics.

Using the communal herd and a representative sample of families within the community, a detailed herd inventory is being conducted. Species, breeds, sexes, age and reproductive categories are recorded. Bi-weekly observations of family herds are taken and births, sales, deaths, and purchases are recorded.

* Dynamic evaluation of livestock systems.

A continuous survey of communal and family herds is under way. Herds are followed on a bi-weekly basis to obtain information on: management practices

associated with sheep and alpaca. This includes the occurrence in time of these management practices with emphasis on selection practices, mating practices, and management of reproduction; evaluation of health status of the herd; and a detailed account of nutritional practices, which include range and crop residue utilization, seasonality in the use of nutritional resources, etc.

* Range evaluation and determination of range condition and carrying capacity. This study will be conducted in community and family range plots with the cooperation of Ings. Juan Astorga and Ramiro Farfan from UNTA and IVITA, respectively. Conclusions from this study will help set the basis for appropriate management and conservation practices.

* Mapping of Crop Plots

Using a contour map of the community, each family plot will be indicated in the map, showing type of crop and the arrangements among crops in a single plot. Over several years this map will give a detailed idea of rotation, fallow periods and livestock use of agricultural land. Also it will be used for soil conservation practices.

* Soil and Water Inventory

Soil analysis and classification will be conducted in agricultural plots. Also water resources will be evaluated and mapped. Future use of water sources for either agriculture or cultivated forages will be established.

* Research on Peasant Technology

Tools and practices used by farmer in agricultural and livestock production will be identified. Some of them will be evaluated, improved and incorporated in improved systems.

* Socio Economic Study of the Community

The objectives will be an indepth study of the socio economic factors affecting decision making processes within the community related to the agricultural and livestock production system. Limiting factors will be identified. Within this study, the following specific case studies have been selected:

- 1) Family Economy : Since 88.79 % of the community land is devoted to family farming, it is important to understand the internal organization and the underlying rationality of family economy. Resource, labor and capital allocation will be analyzed.
- 2) Social Stratification : It has been established that there are three economic levels within the

community, based on unequal distribution of land resources and livestock capital. The heterogeneity of socio economic conditions of different families within the community has a definite effect of production practices and income. An analysis of these factors will help determine those constraints related to economic situation that limit production and productivity.

- 3) Marketing: A study of the marketing channels that interconnect communal production with the regional and national markets will be analyzed with special emphasis on those factors affecting income and those that modify and affect cropping and livestock production patterns.

Experimental Evaluation

A set of experimental trials have been devised to evaluate existing technologies (some of it generated by the SR-CRSP) to provide on farm evaluation of biological, social and economic results. Later evaluated technologies will be incorporated into improved models or improved technology packs.

* Use of Cultivated Forages

Cultivated legumes will be incorporated into the natural range as a way of improving quality and

quantity in animal nutrition. This practice already evaluated by the New Zealand project and the SR-CRSP, could provide low cost improvement of natural ranges.

* Animal Health Diagnosis and Practices

Using the animal health project (World Bank - CORPUNO - UNTA - CSU), a detail diagnosis will be conducted in the community and recommended animal health practices will be established. Some of these practices will be tested in the communal and family herds.

* Production and Selection of Seeds

Production and selection of seeds for potatoes and cañihua will be tested as a way of improving production and productivity. An improved and selected seed bank will be organized within the community, and the project (PISCA) will provide the appropriate technologies and means. This will also be conducted in the school plots.