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A COMPARATIVE STUDY OF THE ORGANIZATION, MANAGEMENT AND HUSBANDRY PRACTICES OF THREE SHEEP PRODUCTION UNITS IN THE CENTRAL SIERRA OF PERU

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PREFACE

This economics project report of the Small Ruminants Collaborative Research Support Program in Peru deals primarily with the description of three production units in the department of Pasco, over 4,100 meters above sea level in the Central Sierra of Peru. The environment, demographics, and production processes are discussed to provide a broad overview of High Andean sheep production, emphasizing the organizational framework developed following the land reforms conducted since 1968. Enterprises were selected to describe and compare the three main organizational forms that have been developed to manage the large grazing enterprises in the Highlands. These enterprises came under direct management of cooperatives following the land reforms.

This research represents a collaborative project started in 1979 by Domingo Martinez-Castilla with support from the Agricultural Economics sub-project of the Small Ruminants Collaborative Research Support Program.

A special acknowledgement is due to those responsible for the management of the Ucrucancha, Gaya, and Palcan production units. Workers in these cooperatives provided excellent cooperation and they were especially helpful as guides and advisors.

The members of the CRSP Economics team in Peru deserve special credit for their persistence, creativity, and patience. Corinne Valdivia, a lecturer in economics at the National Agrarian University, was in charge of the field work and was responsible for directing Roxana Diaz-Alva, Jesus Ruiton, Juan Machuca, Luis Peralta, and Ruben Velarde, all of whom did an excellent job, even though none had prior experience in field research. Benjamin Quijandria, Site Coordinator for the Small Ruminant CRSP also provided administrative support as did Dr. Loren Schultz, the U.S. AID Officer for this project in Lima.

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INTRODUCTION

Small ruminant production in Peru is concentrated in the puna region, where a wide variety of entrepreneurial organizations must be examined to understand the production dynamics. Most of these organizations have originated as a consequence of the Agrarian Reform, and their widely varying makeup seems to have been a deterrent to comprehensive analysis. This wide range of characteristics is even more complex in the case of the comunidades campesinas (peasant communities) that are experiencing a gradual transition into private use of the land. Although the problem of resource allocation is widely considered to be one of the most important issues, few efforts have even been made to define a concept of efficiency.

Within this complicated framework, the economic component of Small Ruminants Collaborative Research and Support Program in Peru chose to study three associative enterprises (representing basic types of production cooperatives) as an initial emphasis. Studies of family or traditional production units (so-called huacchilleros), located mainly in peasant communities, require patient and complicated work in collection of data and an in-depth review of theoretical aspects related to the peasant economy.

This report describes three production units in the Department of Pasco, in the Central Sierra:

- Ucrucancha, owned by the Central de Cooperativas Agrarias, Comunales y de Servicios "Pasco" (CECACOSPAS)
- Gaya, owned by the Cooperativa Comunal de Huayllayx
- Palcan, the sole estate of the Cooperativa Agraria de Produccion (CAP) "El Diezmo-Palcan".

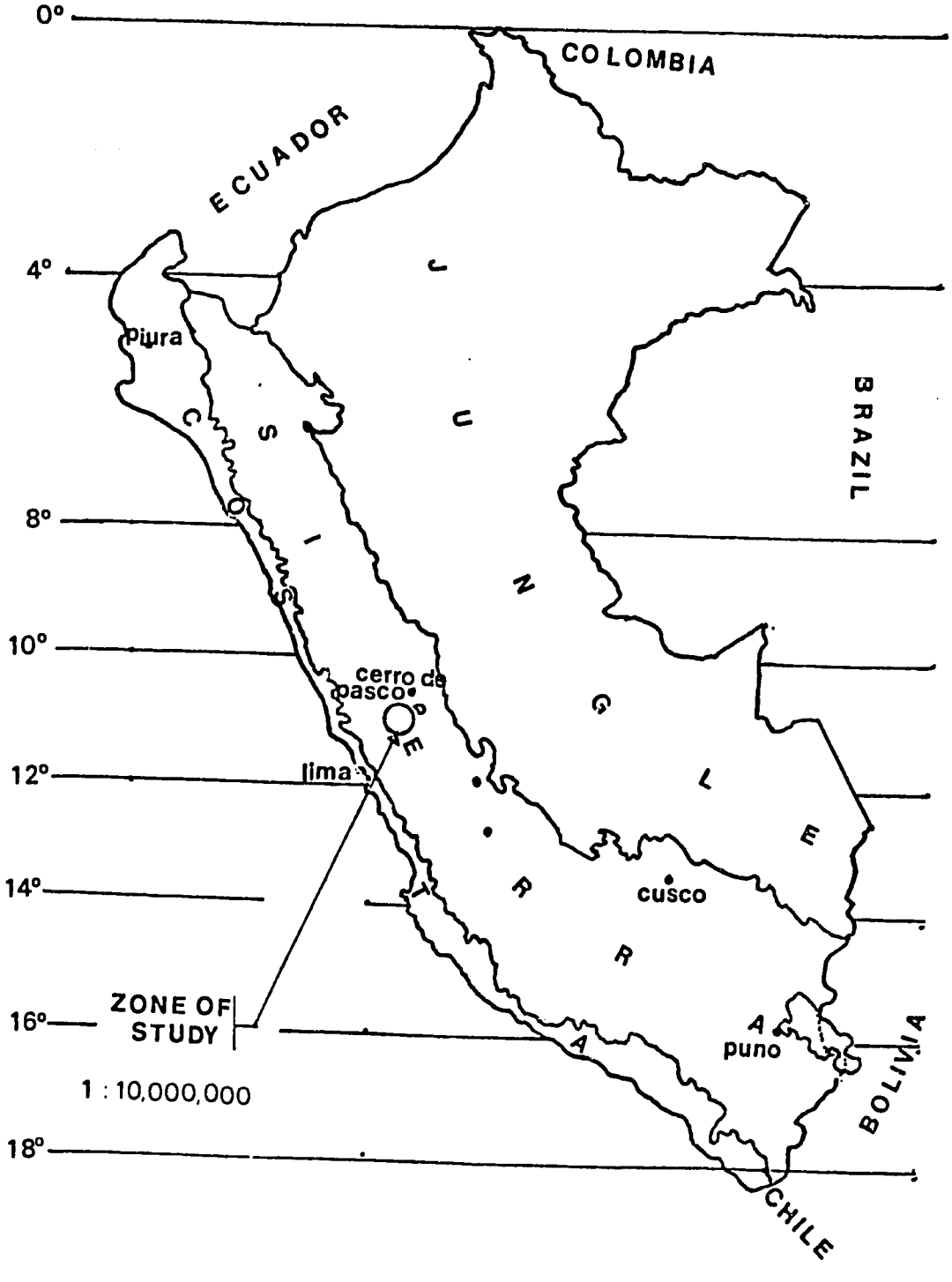
DEPARTMENT OF PASCO

The Department of Pasco is located in the northern Central Sierra region of Peru (Figure 1). The main road leading there is one of the most important in Peru, delivering a considerable portion of Lima's food requirements.

Pasco has two well differentiated zones: the humid puna and the jungle, although a large variety of ecological transitional zones can be found between them. The punas are ecosystems originating in the tropical Andes, beginning at about 4000 m (13000 ft). The puna extends to drier climates in lower altitudes, with the amount of precipitation ranging between 150 to 1400 mm annually. Pasco is one of the most humid areas in the puna, located in the tropical zone (around 11°S). Average annual temperatures range from 3°C and 8°C (37° and 46°F), but can vary sharply. During most of the dry season, the nightly frosts reach an absolute minimum of -10°C (14° F). Though not common, there are some frosts during the rainy season.

Seventy-five to eighty percent of the rain falls from November to April, accounting for between 800 and 1400 mm. In the dry season, temperatures during the daylight hours may reach 15°C to 20° C (59° to 68°F)

Figure 1: PERUVIAN REGIONS



Most of the puna is covered by a prairie dominated by graminae such as stipa, bromelaceae, and festucae. Poae, calamagrostis, and others are found also. Livestock usually prefer the seasonal species. Within the grasslands, some opuntiae and astragalus are likely to be found, becoming increasingly frequent as grazing pressure increases.

When the vegetative cover is tall, temperature changes do not easily affect the soil that is covered by some liliaceae and the humic coat, both of which serve as protection against erosion.

Slope of the terrain is not significant, with plains predominating[1/].

Major productive activities are mining and animal husbandry. Thus far, mining has been the main productive activity in Pasco, and historically this industry is associated with the beginning of the technological development of livestock based on western standards.

As in most of the country, Pasco's animal husbandry is managed within (1) associative enterprises (with a relatively high use of western technology) and (2) traditional family units (huacchilleros) linked to communities and sometimes existing on the same lands occupied by cooperatives. In the cooperatives, the animals are owned by, and usually managed by, the workers' families.

A major difference between these two livestock management systems can be found in the end-use of their production. The cooperatives' production is oriented primarily to the market, while the family units are linked to a subsistence peasant economy. Thus the criteria used to define efficiency must be differentiated, with (1) a market-efficiency criterion (based on accumulation), and (2) a natural criterion (based on survival). The different objectives may require different assumptions for analysis[2/]

Historically, the mining industry first introduced modern animal husbandry in Pasco. At the time of the first Peruvian Agrarian Reform (in the mid-1960s), three important latifundia were organized as stock companies in the Pasco puna.

The largest of these companies was Sociedad Ganadera Algolan (some 500,000 hectares or 1,235,000 acres), established by a family of arrieros (muleteers) working in the transport of minerals from the city of Cerro de Pasco to Lima, using llamas as cargo beasts. The growing number of animals in the herd owned by this family soon required more lands to produce feed. The family also began to develop livestock production to supply the mining center with food. The coming of the railroad to Cerro de Pasco appears to have contributed to the development of modern livestock production in Algolan, changing the course of sheep management and introducing important technological advances (such as the mechanical sheep shearing center in Ayarracra, the largest in Peru with 26 shearing machines).

Second in size was the Cerro de Pasco Corporation, then the largest mining enterprise in Peru. To supply meat to the mining centers, they extended a livestock program to Pasco in the department of Junin, which had begun around the smelting center of La Oroya. This expansion in Pasco has not been adequately studied, although the process is thought to have initiated important social conflicts between the peasant communities and the Corporation. The Corporation usually was supported and assisted by the government authorities in these conflicts which seem to have served as a sort of catalyst for the initial efforts at Agrarian Reform of the first Belaunde administration in the early 1960s. The government bought a part of Algolan (100,000 hectares) and distributed land among peasant communities and workers of the hacienda.

A third livestock society (smallest of the three) was the Sociedad Ganadera de Pasco. It was also owned by a family group and was located in two important haciendas: Pacoyan, between the property of Algolan and the Corporation, and El Diezmo, in the southwest part of Pasco and including some property in the department of Junin.

Today , cameloid production in Pasco is not commercially important, even though some llama cargo herds are still used and alpacas have been reintroduced by some cooperatives.

The Pasco zone is unique in that there are no SAIS (Sociedad Agricola de Interes Social) in the Puna area. This is notable since the SAIS is the prevailing form of associative organization in the rest of the high Andes grasslands. This institution also appears to have historical origins stemming from the Agrarian Reform of 1964. When the military government initiated the 1969 Agrarian Reform bill, affecting most of the country's haciendas, some cooperatives or communal business enterprises were already in Pasco. The introduction of the complicated SAIS form of organization faced much opposition from most of the members of cooperatives and communities that had become very independent by that time.

DESCRIPTION OF PRODUCTION UNITS

Ucrucancha, Gaya, and Palcan were the three production units studied in Pasco. Their selection took into account a comprehensive range of criteria, including: type of land ownership; development potential; environmental characteristics; and an interest of the cooperative's members in the studies to be completed. (Another factor in the choice of these units was that other SR-CRSP components planned to work in Pasco.)

The three were selected from among 23 associative enterprises (cooperatives) linked with the the Central de Cooperatives de Pasco (CECACOSPAS). General descriptive data are presented in Table 1.

Ucrucancha

The Ucrucancha production unit is owned by the Central de Cooperativas de Pasco (CECACOSPAS), which is an organizational grouping of 23

Table 1. General Data

Type of Organization	Ucrucancha Central of Cooperatives	Gaya Communal Cooperative	Palcan CAP
Ha	3636	10307	8464
Area Acres	8165	23146	19007
m	4300	4400	4400
Average Altitude ft.	14100	14450	14450
Membership	23*	464	18
People	60	61	114
Workers**	14	16	18
Coop's sheep	8511	12053	8682
Ha	3500	9294	5279
Grasslands Acres	8649	22965	13044

* Actually other co-ops, not individuals

**Permanent payroll

associative enterprises in Pasco, but does not include all cooperatives in Pasco as members.

The cooperatives associated with such Centrales are of three different types: Cooperativas Agrarias de Produccion (CAP), Cooperativas Agrarias de Servicios, and Cooperativas Comunales. There are also some Empresas Comunales. As mentioned, no SAIS exists in Pasco.

In general terms, the Centrales of associative peasant enterprises were conceived as service centers for the organizations created following of the Agrarian Reform Bill of 1969. Usually, the Centrales provide two main services: accounting and agricultural input marketing (fertilizers, chemical products for agriculture, veterinary products, etc.). However, original plans were more ambitious, including product marketing, training, technical assistance, agro-industries, etc. In legal terms, the peasant Centrales are autonomous enterprises owned by their members. Their main net income is supposed to come from marketing margins and the payments of the enterprises for services received.

CECASOSPAS has performed comparatively well: it provides for input and output marketing, provides an accounting service for most of its associates, develops training programs (at a training center opened in 1980), and gives some technical assistance. Occasionally, the Central provides for medical assistance to workers.

However, the most important service is related to the shearing activity. The Central manages four sheepshearing centers, with some 50 shearing machines. Three of these centers were established by the former hacienda (Algolan) and the other by the Lercari group. During the shearing season in February and March, most of the people participate enthusiastically; the shearing becomes a sort of contest for the participants.

CECACOSPAS is currently looking for some diversification to achieve better economic results. For example, the Central recently has done its own exporting of the wool sheared in its service units. This activity depends on the prices offered by the major national wool marketing enterprises.

The enterprise also has an important program to develop aquaculture that is based on trout and uses the cage system. To date they have implemented a pilot project in the Punrun Lake, adjacent to Ucrucancha, with expected production of 60 metric tons per year. The fish feeding is based on concentrates.

The Central manages an agricultural supply store in the city of Cerro de Pasco that primarily sells livestock-related items. Some of the member cooperatives use this service. The prices are lower than in other stores, but the Central is not able to offer noncash systems of payment. The Central has its headquarters and accounting unit in the same building.

CECACOSPAS is unique in that it is the only Central in Peru that owns land for production. With two production units (Ucrucancha and

Pariamarca) comprising some 10,000 hectares, CECACOSPAS plays an important role in both sheep and cattle production. It is intended that these sheep and cattle should serve as a sort of genetic bank for the member cooperatives amounting to another service.

Ucrucancha is located on the edge of Punrun Lake, which is at an altitude of 4300 m. The Ucrucancha grasslands are on mountains of intermediate slope, and there are some small plateaus and relatively warm valleys among the mountains.

Gaya

Gaya is one of the two estates allocated by the Agrarian Reform to the comunidad of Huayllay; these grasslands from Algolan were the basis for organizing the Cooperativa Comunal.

This communal cooperative is owned by 464 comuneros of Huayllay through a sort of stockholding; each associated member has contributed sheep. Most of the associates also work at nonagricultural jobs. Only 15 percent of the comuneros are estimated to depend exclusively on livestock activities and some 60 percent are mining workers for a French company; the rest engage in other activities ranging from commerce to transport. However, all associates own herds of sheep (and sometimes llamas) which are managed by their families. These herds graze some 15000 hectares of communal lands. There are 527 comuneros in Huayllay; they own a total of more than 20,000 sheep and 3,000 llamas, as well as some cattle and horses.

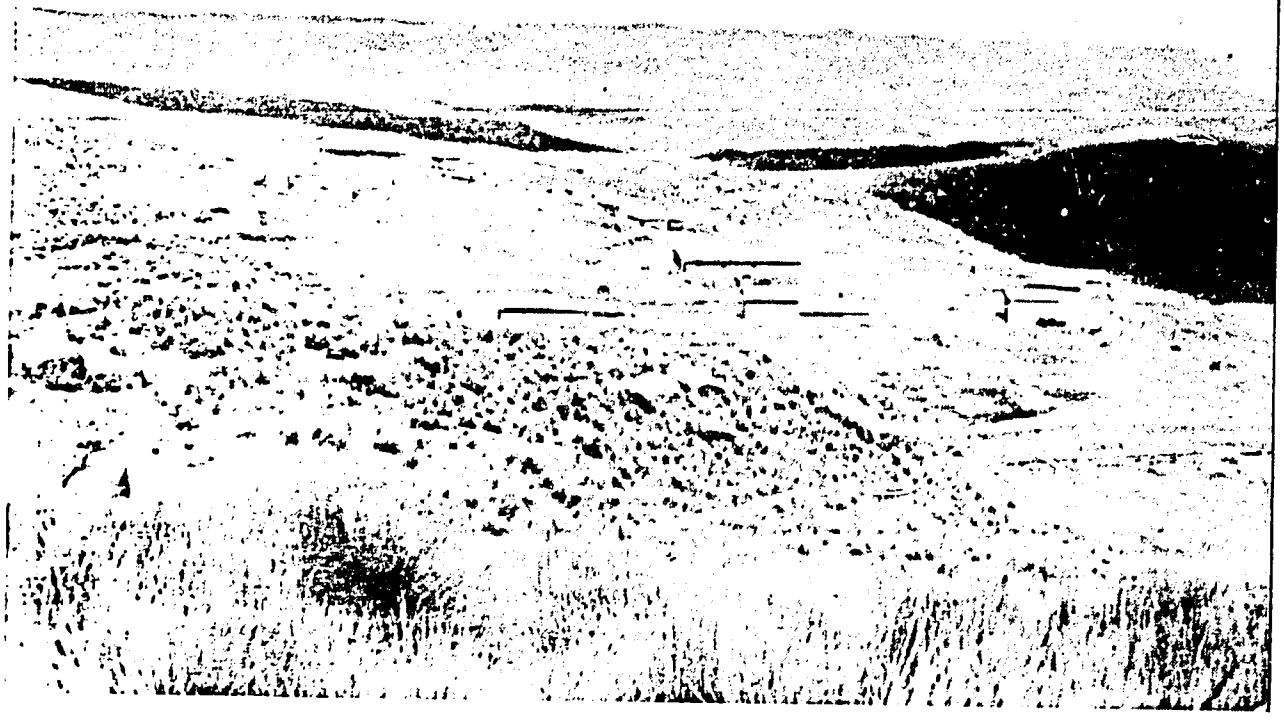
The cooperative consists of 14,353 hectares. Through the Agrarian Reform of 1968, Huayllay received 10,307 hectares with 5058 sheep to organize an Empresa Comunal Ganadera (Livestock Communal Enterprise). In addition, it received 3,600 additional hectares in 1969, and 446 hectares in 1973. In 1972, the Cooperativa Comunal was founded. Production is organized into two production units, Gaya and Cajoncancha. Only Gaya is discussed here; it has 10,307 hectares grazed by sheep, alpacas, and cattle.

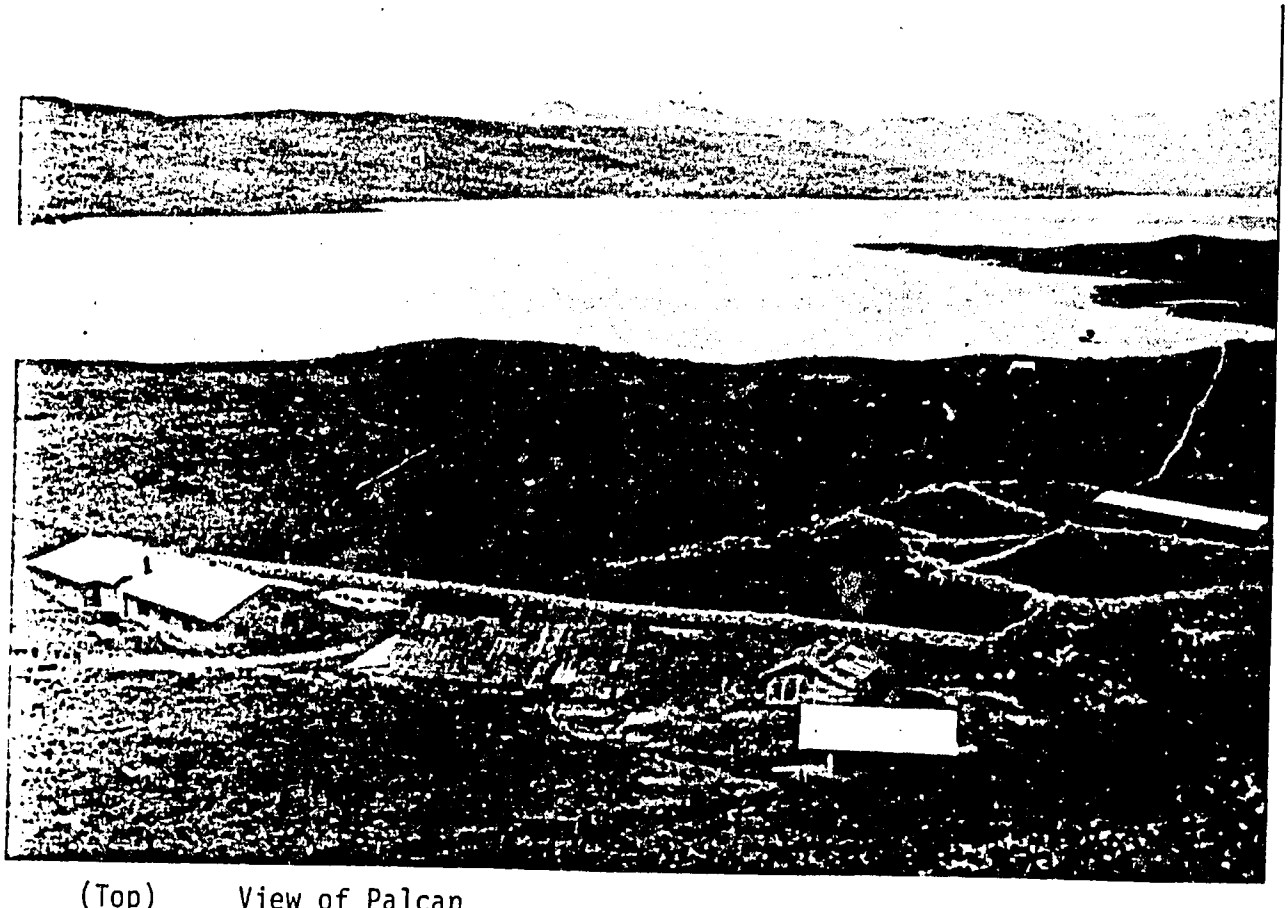
Physiographically, the most important characteristic of Gaya is that it is located on grasslands that are almost entirely nonmountainous. However, these plains are frequently interrupted by a curious stone formation named Bosque de Piedra (Stone Forest) that covers some 10% of the total area.

The plains are above an altitude of 4300 m. According to most Peruvian standard classifications, these lands should be used only for cameloids; however, sheep production prevails. The cooperative's herd of 450 alpacas has many health problems.

Palcan

The Cooperativa Agraria de Produccion (CAP) "El Diezmo-Palcan" is located on the estate of Palcan. All CAPs, including Palcan, are owned only by workers of the cooperative; a requirement is that a member may not work outside the cooperative. However, some Palcan workers are not





(Top) View of Palcan
(Bottom) Ucrucancha and Punrun Lake

members; their services are required only at the peak labor demand periods, such as shearing and parturition, and for some heavy work, such as building roads and facilities.

The Palcan estate was formerly a part of the hacienda "El Diezmo", which was also a part of the lands of the Sociedad Ganadera de Pasco. The Palcan grasslands were considered little more than useless (marginales) and served two primary purposes: as a sort of sheep hospital, and as grasslands for livestock owned by the hacienda workers (huacchilleros).

As a result of the first Agrarian Reform Law, Palcan was adjudicated only to the former workers of El Diezmo, who later decided to establish a CAP. (There also were attempts to create a SAIS, which would have been one of the smallest in the country.)

There are only 19 Palcan members (socios) and the village has 114 people, including families and some part-time workers. The CAP consists of 8,464 hectares, with only 5,279 hectares in grasslands. Its physiography is the most complicated of the three production units, because it is near the Andean western cordillera counterforts and at the same time lies at the boundary of the Meseta de Bombon (or Pampa de Junin, Junin Plains.) The Mantaro River, which originates at Chinchaycocha (or Junin) Lake, runs near Palcan and serves as part of the CAP's boundaries. The lands are especially craggy in that region.

The altitude ranges from 4000 m (at Mantaro) to 4650 m, the Bosque de Piedra covering a substantial part of the lower areas.

RESOURCES

Only productive resources native to the highlands are described here, the "imported" resources such as veterinarian products and other industrial outputs are used only for reference.

NATURAL RESOURCES

In small-ruminant production, the main resource is the pasture; this is the natural high-Andean grassland that is characterized by a delicate ecological equilibrium among over 500 native botanic species. Among the grazing plants, the most important are Festuca Dolicophylla (chilguar in Pasco, and chillihua in most of the country), Poa sp., Calamagrostis sp., Moulembhergia Peruviana, the so-called 'star-grass' (pasto estrella) and others. The ichu are best known of the highlands plants however. (Stipa ichu and Stipa Humboldtiana are the common varieties). Some varieties of all of these species (most of which are graminaceous) can be used as forage by the ruminants. Generally, animals of different species do not compete for these plants.

Those plants that are not important as forage play an important role in covering the soil, in protecting it from the weather, and in fixing nitrogen from the air.

Broadleaf species used for medicinal purposes are found near large rocks. A quick survey revealed that 16 different plants are commonly used; they appear to be quite important in the life of the people. Wild varieties of potato, tarwi (Lupinus sp.), and some Chenopodiaceae are also found.

Among the local undesirable species are Opuntia sp., and Astragalus sp. Ecologic equilibrium is frequently broken by overgrazing, a condition signified by the prevalence of these undesirable plants, mainly the garbancillo (Astragalus sp.). This plant fixes selenium from the soil and is very dangerous to sheep, causing disturbances in their nervous system, addiction, and is eventually fatal.

Vicunas are rare in Pasco, but there are some scarce wild livestock resources: partridges, ducks, yanavicos (an Andean ibis), aquatic frogs, viscachas, and deer.

There are also some predators, mainly foxes, that attack sheep.

In animal husbandry, another important resource is water. The study area has neither cultivated pastures nor irrigation facilities. Common sources of water are rain, small rivers, lakes and, for human consumption, natural springs. In some cases it is possible to find bofedales, a type of wet meadow that is used intensively during the dry season. There are also some hot springs, most of which are sulfurous and commonly used for medicinal and recreational purposes.

In most of the bofedales in Pasco it is quite common to find the so-called 'star-grass' (Cynodom sp.), a gregarious species that is burned as a source of energy for both cooking and heating. The peasants cut the sod (including the roots) and stack the pieces to dry; it is burned as their sole source of energy.

As indicated below, the percentage of grasslands varies in the three study areas:

	Grasslands (ha)	Percentage of total area %
Ucrucancha	3500	96.3
Gaya	9294	90.2
Palcan	5279	62.4

In Gaya, the idle lands are mainly the Bosque de Piedras; these large stones are also found in Palcan where much of the land is too steep to be grazed.

Not all the grasslands are of the same quality, and the majority have an estimated stocking rate of only one or two sheep per hectare.

HUMAN RESOURCES

Human population density is very low in the puna. The productive capacity of the environment is quite poor; thus increases in available jobs are unlikely, except in mining activities that are the main source of new jobs in the puna.

Tables 2 and 3 summarize the demographic characteristics of the study areas. There are slightly more women than men, which is probably due to the common structure in which male workers often live within a family that may include his widowed mother or mother-in-law. While the head of the family is alive, the wife does not leave his home; however, if he dies and the widow cannot find a job or is unable to be productive in that home, she often goes to live with her elder son or daughter.

Table 3 shows the populations grouped by age, revealing that the age group from 6 to 14 years old does not follow the expected national trend. This is because there are no schools in Ucrucancha and Gaya; their children of school age go to other villages and towns. However, Palcan does have a school and its population is relatively young.

In all three areas, the population resides permanently within the boundaries of the cooperatives. The relatively lower population in Gaya can be accounted for by the fact that some of the workers live alone, while their families live in the communal lands and houses and take care of their own animals.

Table 1 indicates that the percentages of permanent workers in the total population are Ucrucancha 23.3%, Gaya; 26.2% and Palcan; 15.8%. The remaining population consists primarily of the workers' families. Especially in the case of Palcan, some of these relatives work for the cooperative. (A more detailed demographic description is provided later.)

LIVESTOCK CAPITAL

Table 4 shows annual average herd composition based on data collected monthly and calculated for each of the three enterprises.

The Ucrucancha livestock serve a special function as the supplier of breeding stock for the associated cooperatives. Thus Ucrucancha's sheep are the best of the zone; they have no native criollo animals that are commonly raised by most cooperatives. The 10.02 percent of imported ewes suggests the higher quality of Ucrucancha sheep. Stud animals (ganado de plantel), make up 9.12 percent of these sheep, and the so-called mejorados (improved), 80.55 percent. The quality of stud animals is supposed to be the same as that of imported animals, and they are used only for breeding improvement purposes. (That is not the case of the improved sheep that are destined for the meat and wool markets.)

The Communal Cooperative of Huayllay manages two production units: the most important is Gaya, where 11,120 sheep are grazed; the other is Cajoncancha, with 3196 criollo sheep. The animals in Gaya are of better quality (Corriedale or improved by Corriedale).

Table 2. Population of Production Units by Sex (1980).

	Male	Female	Total
Ucrucancha	31	29	60
Gaya	26	35	61
Palcan	53	61	114
Total	110	125	235

Table 3. Population by Age Groups (1980)

Age Groups	0-6	6-14	15-29	30-44	45-65	Over 65	Total
Ucrucancna	19	10	18	8	5	-	60
Gaya	16	13	14	7	11	-	61
Palcan*	17	19	27	9	8	1	81
Total	52	42	59	24	24	1	202
%	25.7	20.8	29.2	11.9	11.9	0.5	100

*Sample

Table 4. Production Unit Herd Composition (annual average per class)

	Ucrucancha	Gaya	Palcan
	%	%	%
Total imported	10.33	1.87	0.11
Rams	0.31	0.52	0.11
Ewes	10.02	1.35	-
Total Improved	80.55	98.13	45.00
Lambs	5.20	18.03	4.70
Y. Ewes	116.64	8.79	7.11
Y. Rams	6.79	1.64	2.37
Y. Wethers	9.13	6.75	3.88
Ewes	35.22	50.00	22.43
Rams	4.21	4.05	4.29
Wethers	3.36	8.87	0.22
Total Others	9.12*	-	54.89**
Lambs	1.92	-	6.72
Y. Ewes	2.35	-	10.37
Y. Rams	1.39	-	-
Y. Wethers	-	-	3.41
Ewes	1.27	-	33.98
Rams	2.19	-	0.41
Wethers	-	-	-
TOTAL	100	100	100

*Stud
**Criollo

Only 0.11 percent of the animals in Palcan are imported; of the remainder, the original criollo sheep represent 54.89 percent and improved animals 45 percent. This Cooperative began without sheep, and each member has provided some of his own sheep to become a member.

In terms of livestock capital of the production units, only those animals that are destined for breeding are considered, i.e., ewes and stud rams. Table 5 summarizes the livestock capital of each enterprise. The percentages of each unit's total number of sheep are: Urucancha, 53.21%; Gaya, 55.92%; and Palcan, 61.22%. The relatively larger ram herd in Ucrucancha is related to the service this production unit provides for genetic improvement of sheep in the CECACOSPAS associates and other cooperatives. The stud rams are commonly used to obtain high quality animals that are sold as breeding sheep.

An important fact to be taken into account is that the quality standards are not necessarily the same for all enterprises. In most cases the production unit manager judges the quality of the animals, thus it is possible that an animal considered as improved in one enterprise would be considered criollo in another.

Other livestock capital includes:

Gaya: 452 alpacas, 218 cattle
Palcan: approximately 250 Shorthorn cattle and 150 meat llamas (both used only for internal consumption).

The production units also graze horses on their pastures. Some Ucrucancha horses are owned by CECACOSPAS and others by the shepherds. All Palcan horses are owned by the shepherds, although they are used for the work of the cooperative.

In the Palcan unit there are some huaccho animals (i.e., criollo animals consisting of about 600 sheep, 1,100 cattle, and some cameloids owned directly by the workers and not by the cooperative). There is no joint management of these livestock with the cooperative's animals.

The Ucrucancha cooperative does not permit huaccho animals due to the nonavailability of pastures and the necessity of protecting the genetic quality of the cooperative's animals. The huaccho sheep and cattle of Gaya's workers are grazed in estancias assigned to each comunero by the community and in its lands.

INFRASTRUCTURE

Facilities are a good measure of the capital investment in agricultural activities of livestock enterprises. In addition to the obvious capital of livestock, other investment should be considered, mainly related to livestock management.

The High-Andean associative enterprises have other important facilities, such as roads, that have been paid for by the cooperatives.

Table 5. Breeding Livestock Capital
(annual average per class)

	UCRUCANCHA		GAYA		PALCAN	
	Number	%	Number	%	Number	%
Rams	559	12.62	508	8.17	375	7.86
Imported	26	0.59	58	0.93	9	0.19
Stud	182	4.11	-	-	-	-
Improved	351	7.92	450	7.24	334	7.00
Criollo	-	-	-	-	32	0.67
Ewes	3871	87.38	57.10	91.83	43.98	92.14
Imported	834	18.83	150	2.41	-	-
Stud	105	2.37	-	-	-	-
Improved	2932	66.18	5560	89.42	1749	36.64
Criollo	-	-	-	-	2649	55.50
TOTAL	4430	100	6218	100	4773	100

Ucrucancha Facilities

To select, vaccinate, and mark the sheep, a system of corrals called brete (working and sorting chutes) is used, consisting of a funnel-shaped corral, an alley (generally wooden), and a door that is used to direct sheep to separate corrals. The channel has a light roof of galvanized steel.

There is only one brete in Ucrucancha. The first corral measures approximately 0.5 hectares, the alley is 5 m wide. Two other corrals are used for different groups of animals. The alley is used also to vaccinate animals according to the livestock management calendar.

Other features include:

A six-meter, funnel-shaped concrete vat to dip sheep, and two dams that form two small lakes.

A small portable sheepshearing shed that is largely unused because the largest Ayarracra sheepshearing service unit of the CECACOSPAS is nearby (8 km away).

An artificial insemination room in a small building (8 m x 4m) with mud walls and grass roof; it contains a microscope used to analyse semen, an artificial vagina for collecting semen, a speculum, and an insemination pistol.

An animal "hospital" used to manage and graze animals that are weak or ill. This area has an excellent pasture and is surrounded by a stone fence. In the same area, there is a room specifically designed for the quiebra (the accounting for dead animals and distributing of salvaged meat, at least twice weekly.)

Four corrals used to manage animals: two corrals enclosed by barbed wire and wood posts, and two enclosed by stones.

Eight of the eighteen grazing paddocks (canchas) with fences made of both barbed and plain wire and wood posts. In the canchas, the limits of each cancha are determined by natural ravines, large rocks, and (most commonly) by tradition.

Housing facilities in all canchas for the shepherd, who often lives there with his family. Facilities generally consist of a small hut with an earthen floor, walls of champa (the sod of the previously mentioned pasto-estrella,), and thatched roofs of ichu. This one-room hut is approximately 1.5 m high, with a small door to avoid loss of heat. However, the first garita was built a few years ago; this larger dwelling is about 8 m x 4 m in area, with mud walls and calamine roof. Eventually, all the huts are to be replaced by garitas.

Four buildings, including the managers office, warehouse, and some storage rooms, with a total of 376 m^2, having mud walls, a wood floor, and a galvanized steel roof. The buildings house the manager and some other workers, who are not shepherds.

Gaya Facilities

The Gaya production unit has three bretes (sorting chutes), including the most complex in Pasco. The fences are made of stones and enclose 6 corrals that range in area from 25 m^2 to 1,200 m^2. Chutes for one of the corrals are made of wood and galvanized steel. The others are fenced with wire and wood posts and have 100 m^2 corrals.

Other features include:

Two concrete vats having 10 and 5 m long chutes with floor areas of 50 and 200 m^2. One vat is connected to two corrals of 500 m^2 each.

Two dams that form two small lakes, measuring 0.6 hectares each, which are used almost exclusively for watering animals.

A newly built artificial insemination room made of mud and roofed with galvanized steel, with an area of 12 m x 6 m and minimum equipment to collect and use semen.

Nine corrals are used to manage animals: seven are in the canchas and two are near the village; four are enclosed by wire, and five by stone.

Grazing lands divided into 21 canchas, 11 of which are fenced with wire and wood posts.

Relatively good housing facilities with smaller, older huts to be replaced by garitas. (As of March 1980, 11 garitas had been built.) Each garita has mud walls, a steel roof, and measures 18 m^2. Fourteen sod huts remain that are similar to those in Ucrucancha, but are reinforced by stones.

Two 20 m x 5 m mud-walled and galvanized steel roofed buildings, each divided into 5 rooms, including housing facilities, two warehouses, and two offices.

Access to the production unit is commonly by horse paths. However it is possible to enter by car during the dry season (eight months).

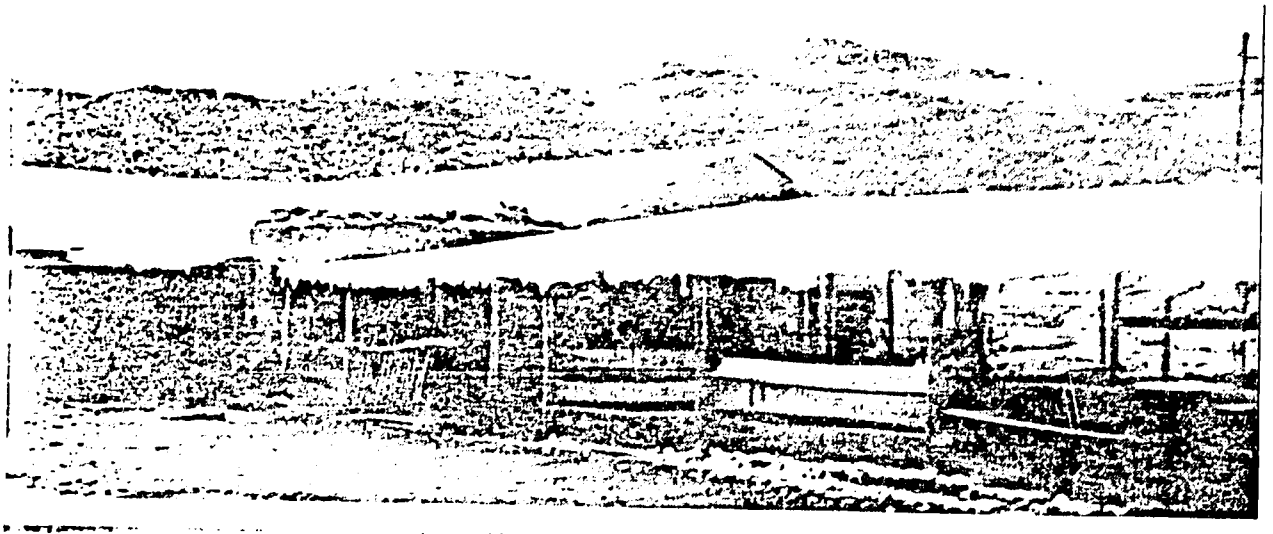
Palcan Facilities

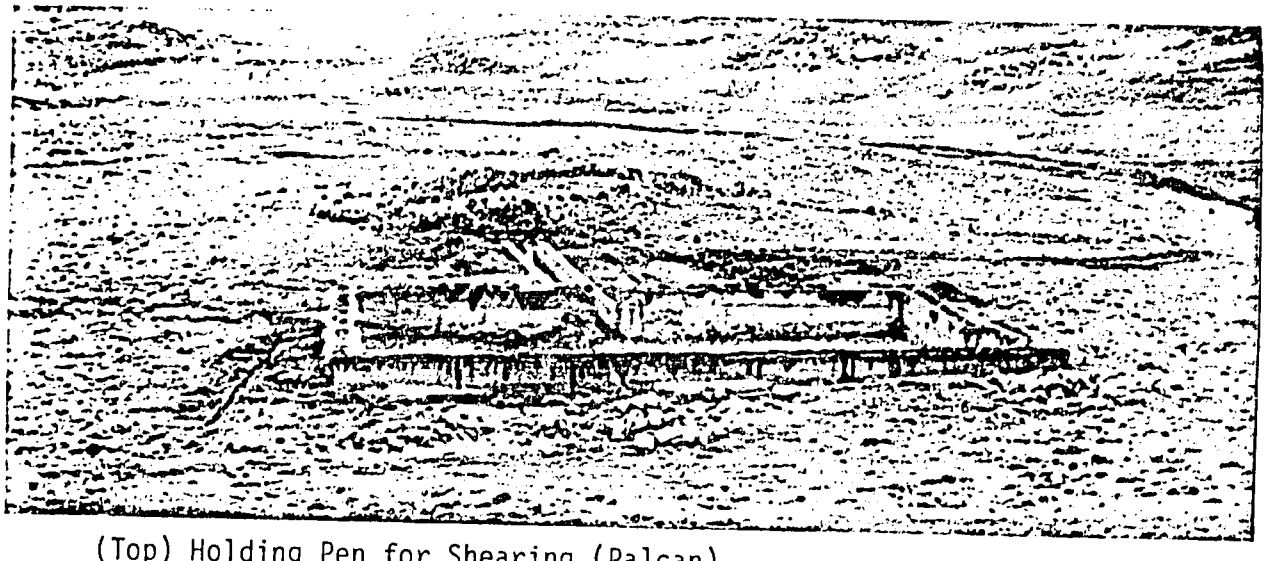
Palcan has only one brete, which is made of stones and is near the village. Three corrals, each about 250 m^2 are used for selection.

Other features include:

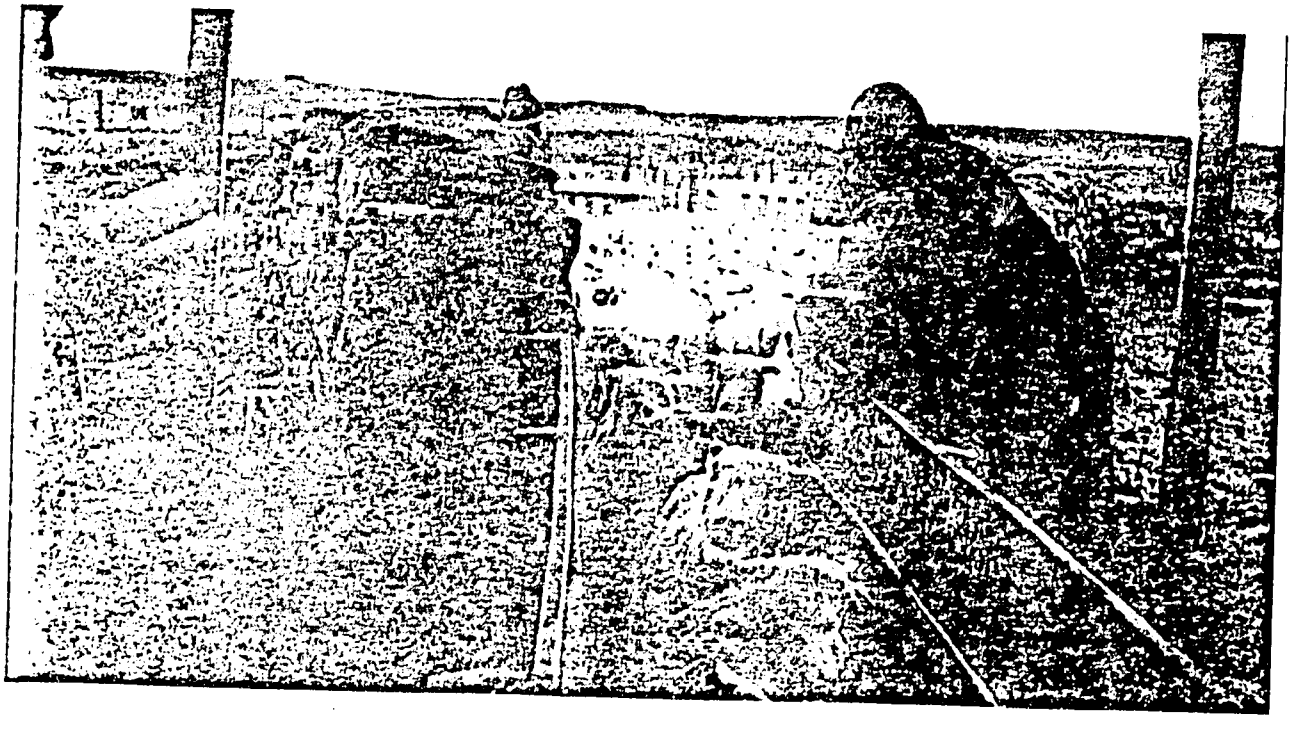
One dip vat built in 1979 and located in the village. It is made of concrete, including some 200 m^2 of open slab and a vat 12 m long. The corral walls are made of molded earth (tapia).

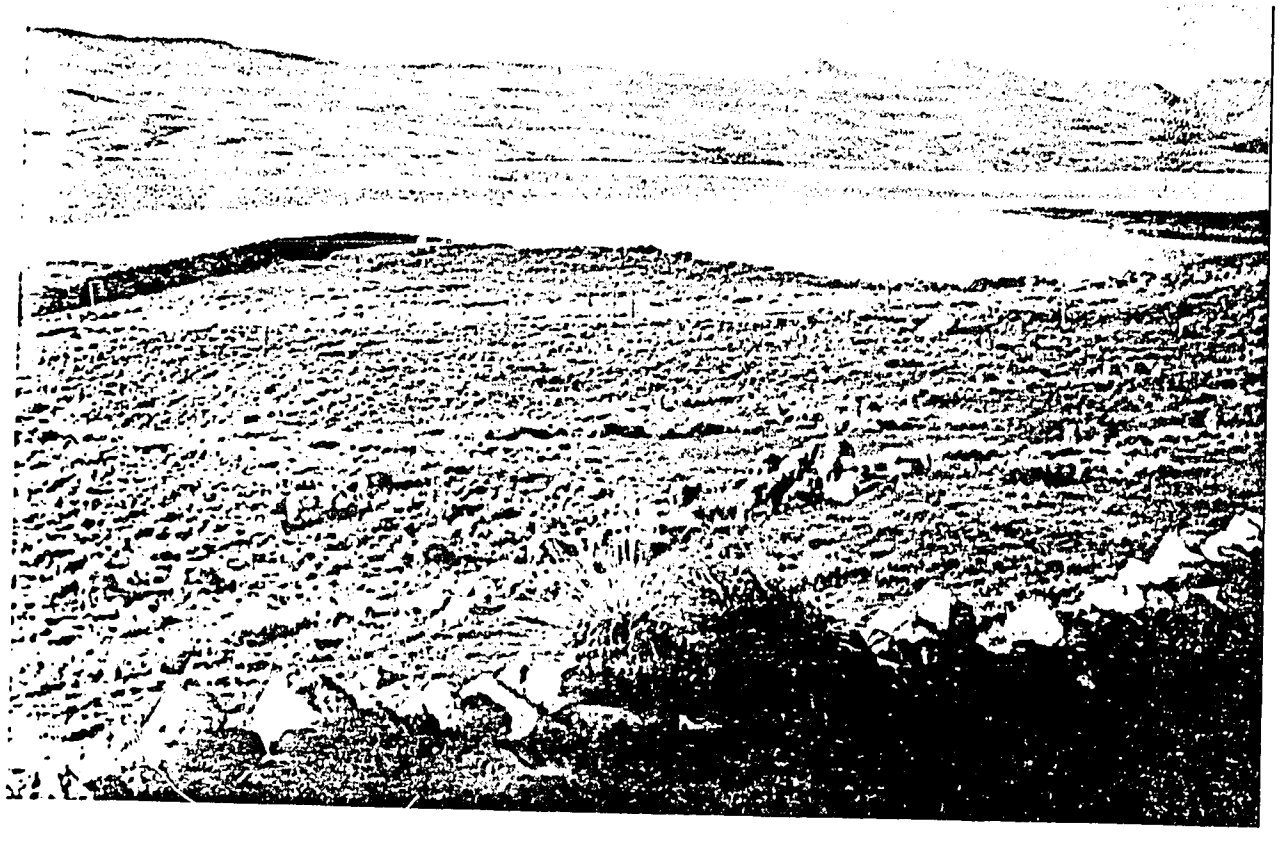
A 20 m^2 room for artificial insemination located in the main building, with the minimum equipment required for this task. Sixteen corrals distributed throughout 8 canchas, all made solely of



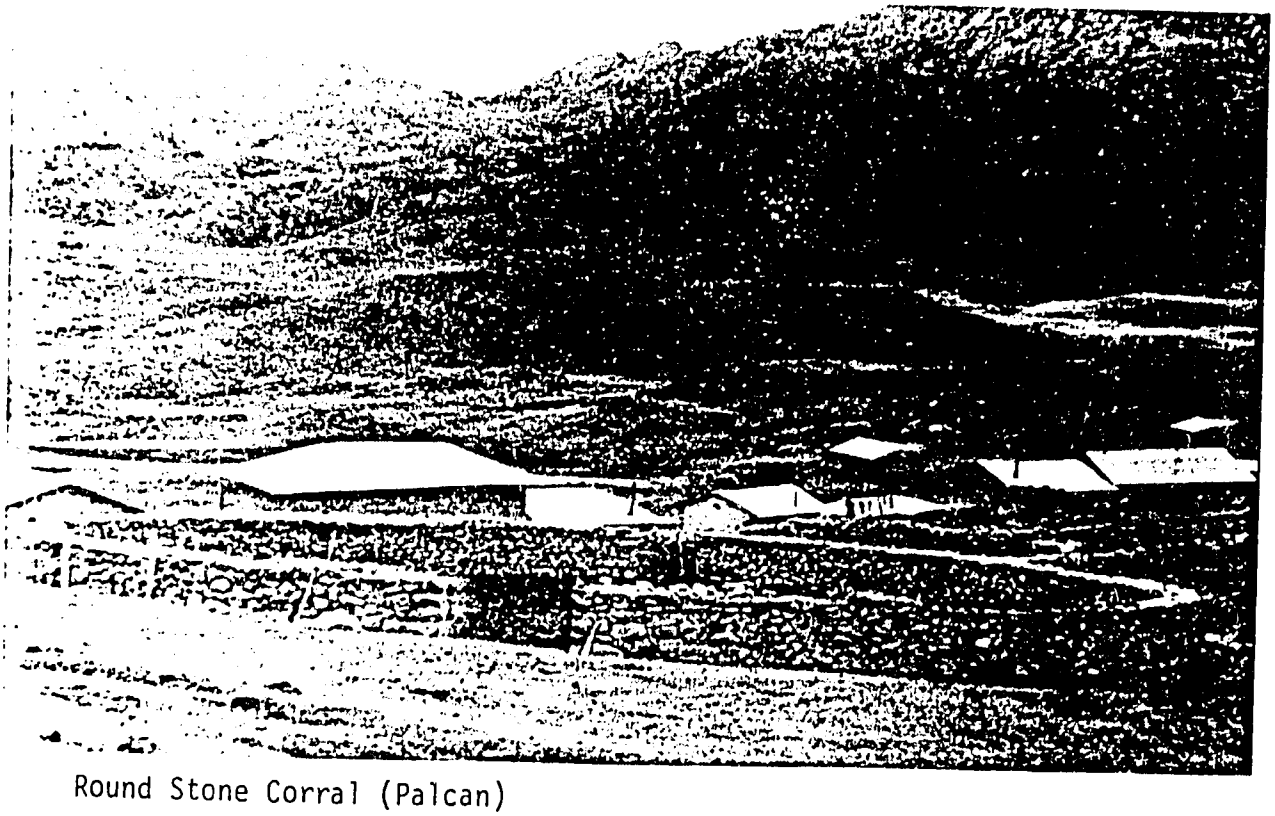


(Top) Holding Pen for Shearing (Palcan)
(Center) Dipping Facilities (Palcan)
(Below) Working in the brete (Gaya)





Stone Corral Used as "Hospital" (Ucrucancha)



Round Stone Corral (Palcan)

stone, as is common in the Pampa de Bombon or Junin. In the lower zones, adjacent to the Mantaro river, the Bosque de Piedras reaches Palcan's lands. Some of these unusual stone formations are used as parts of corrals, and even for huts for the shepherds. In mid-1980, a round corral was built in the village. It is used for bull fights during the CAP's festivities, as well as for sheep production.

Lands divided among the 18 canchas; four are fenced with wire and wood posts. Plans have been made and materials bought to extend the fencing.

A water canal built to activate a mini-hydroelectric generator and to irrigate the lower grasslands. (Construction errors resulted in insufficient water for the hydroelectric generator.)

Housing facilities consisting of 16 huts located in 13 of the canchas; the huts are built of common champa and stones. Thus, there are 17 individually owned homes in the village. These are built with adobe and tapia, with roofs of galvanized steel or red-clay tiles. Eight of the houses are two stories high, and the average area is about 50 m^2.

Other buildings in the village (including the CAP's headquarters which is the largest). The original design and a portion of the walls date from the hacienda era. As are most old Spanish-styled casa-haciendas (headquarters, including owner's housing), it is U-shaped, with a multipurpose patio in the middle. The construction has been improved with wood floors and roofs of steel or of red-clay tiles. The total area is about 120 m^2, with the main office and meeting room occupying 50 m^2. Three rooms are used as warehouses for skins, supplies, and a small food store, as well as merchandise for the members. In addition, there are two furnished rooms for guests and two for utility use.

Sheep-shearing facilities facing one of the wings of the headquarters (five mechanical shearers powered by a small two-stroke engine). These machines are in a wood-floored shed roofed with galvanized steel. The sheared and baled wool is kept there until the time of sale.

A hydraulic wool-press powered by a two-stroke engine, and located in the roofless patio.

An adjacent corral built to hold the animals to be shorn; with stone walls 1 m high and a roof of galvanized steel.

A small school, in which some 15 to 20 students are taught the first five grades of elementary school by one teacher, as is the case in most rural areas. There is also a small chapel for religious festivities.

Normal access to Palcan is from the west by foot or on horseback, through the town of Carhuacayan (mining activities). Carhuacayan is the

closest center for shopping and the Palcan people are accustomed to visiting there on alternate Sundays. Recently, however, a road was built from the north, connecting an old coal mine, Santo Domingo, with the Cerro de Pasco-Canta-Lima road. The cooperative (working without professional advice) built an additional 18 km road to connect the mine with the village; it is usually impassable in the rainy season.

Palcan also owns some vehicles: a four-wheel drive vehicle, a small Volkswagen and a recently acquired used dump truck.

MANAGEMENT

DEFINITION OF TECHNICAL MANAGEMENT

Technical management is the term used to describe the technology applied in most highland livestock production units in Peru. This is simply the technology commonly used in most extensive livestock production in countries such as Australia, Argentina, etc.

A major characteristic of this technology is that it is based on natural grasslands, with a major objective of maintaining the grasslands on a yearly basis with greater productivity achieved through genetic improvements, improved animal health, and nutritional supplementation.

Peruvian associative enterprises cannot increase their grassland area, because all of the lands are currently occupied and there is no land market. Thus, optimal pasture utilization should emphasize long- term results. Although overgrazing can undoubtedly offer good short-term results, eventually the nutritional capacity will diminish, making pasture recovery difficult. In the short term, pastures are being used at near full capacity--almost no forage is wasted even though it is possible to observe an abundance of forage during some periods. (Such pastures are, however, quickly stocked more heavily.)

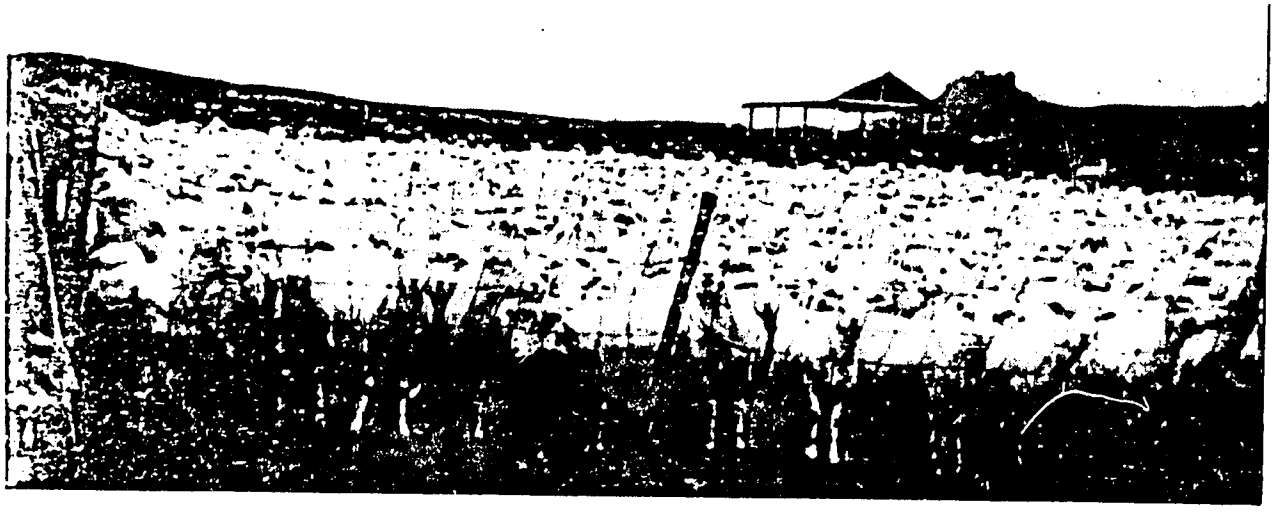
Because they usually have 50 or 60 years of husbandry experience in their families, the shepherds and managers are quite knowledgeable about how many sheep can graze in one zone and for how much time. Rainfall patterns will tend to cause changes in the stocking rate for each paddock, but our observations suggest that these changes would be very inflexible.

DISTRIBUTION OF GRASSLANDS

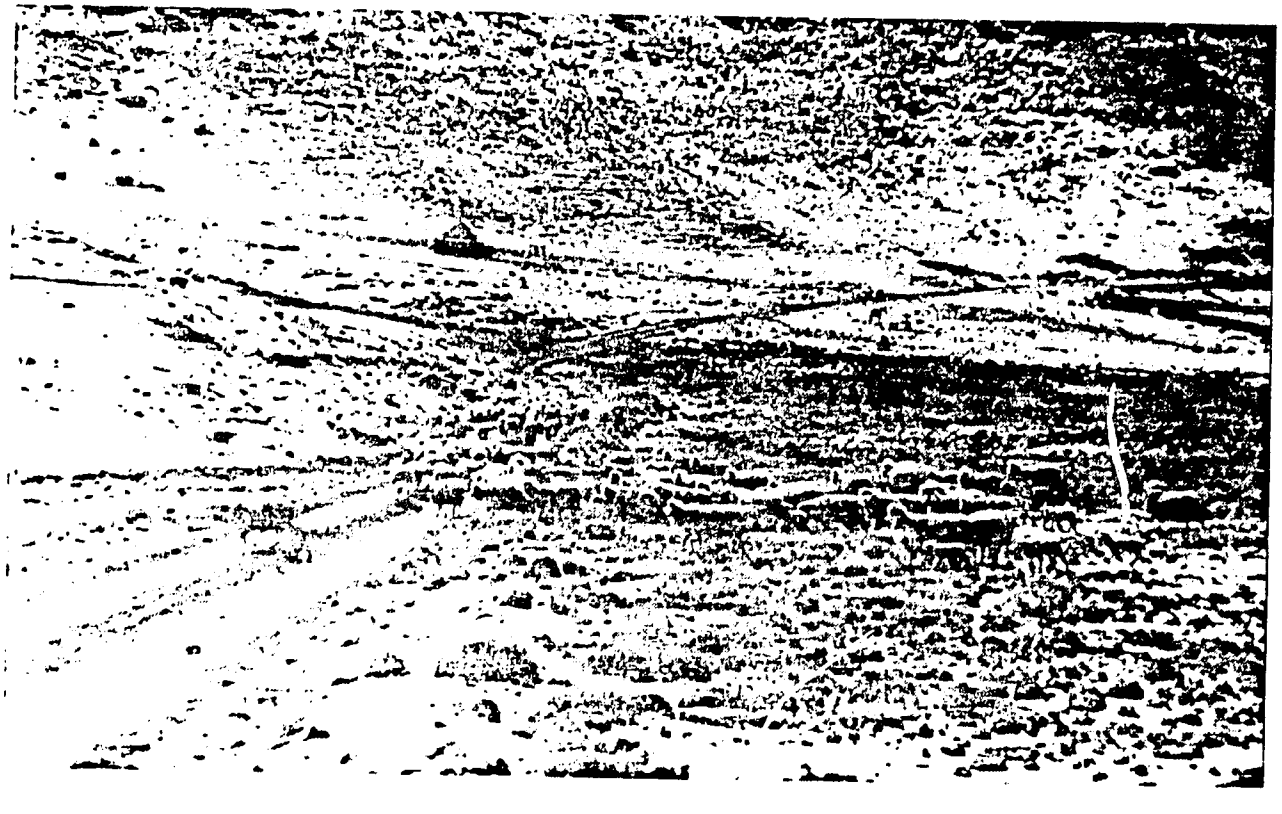
As mentioned above, the grasslands of each production unit are divided into canchas (paddocks), some of them fenced. The canchas vary in size, depending on their quality and use. However, the average size may be used as an index of the intensity of pasture management.

Table 6 summarizes this information for each of the three production units.

There are some technical difficulties in calculating the actual area of each paddock, because of imprecise boundaries. Each paddock usually has



Wire Corral (Gaya)



Wet Season Grazing (Palcan)

a specific function over the year, but rotation is also possible during the year. The system of rotation is made in two ways: inside the paddock, and from one cancha to another.

All canchas have some rotation inside the paddock to avoid overgrazing a given micro-zone. At this level, the shepherd's work can be defined as that of a 'moving fence'. This internal rotation is quite important in the canchas that are occupied year around (mainly by rams). Pasture recovery depends mostly on two interrelated factors: the yearly stocking rate and the rainfall.

Rotation from one cancha to another after intensive use provides a rest and recovery period. Such rotation is most commonly used for lambing paddocks and those used for wethers. The lambing paddocks are usually the best and are located in warm and low zones.

Our field work suggests the following hypothesis: relative changes in the stocking rate are very low, reflecting comparable changes in exogenous factors such as rainfall and prices. Measurements of these changes can be defined as stocking rate-rainfall and stocking rate-price elasticities, respectively. In most associative enterprises in Peru, the livestock capital has reached an upper limit; thus inelastic values are to be expected, and would be affected more by rainfall than prices.

Herd sizes could be increased through some of the following changes in current practices:

- advancing the selling date of the wethers, making it possible to have more ewes;
- irrigating grasslands, using water from small lakes and springs;
- fertilizing the natural grasslands;
- introducing complementary grazing, with either or both camelids and cattle;
- introducing exotic forage species to be cultivated.

Advancing the date of sale of wethers does not require a major capital investment; rather it requires a careful organization of the grasslands to obtain the minimum marketable weights in the younger animals. Among the three study units, only Palcan shows clear evidence of adopting this practice.

Natural grasslands are irrigated only occasionally, with small dams and springs used when rainfall is very limited. However, all three units have plans to develop more irrigation facilities; these are linked to the introduction of exotic cultivated forage species. In December 1980, none of the units had cultivated pastures. This finding is in contrast to that in most livestock cooperatives and in the SAIS in Junin and Puno (the two other important livestock departments in the Peruvian highlands) where small areas of cultivated pastures are found, mostly rye grass-clover associations and forage oats.

Natural grasslands are seldom fertilized. In Peru, this practice is being implemented on an experimental basis only.

Complementary grazing of several species, although common in some SAIS areas of Junin, is not practiced in Pasco. However, sheep and cattle are sometimes rotated in the same paddock (Gaya).

One of the better management objectives of the three production units is to divide all paddocks by fences. This task requires a large investment of both capital and work and does not seem to be in progress currently, probably as a result of economic and financial difficulties.

Table 7 outlines the paddock allocation as an example of these practices; however, these uses vary widely according to the recovery rate of the pastures. In Palcan, variations also arise from changes in the management practices, as mentioned above. Some of the canchas are not permanently occupied.

COMPOSITION OF HERDS

Tables 4 and 5 provide approximations of how the herds are divided in each of the three units. Divisions are made according to the quality of the livestock. Generally, there are two major groups: criollo and improved (mejorado).

Criollo Sheep

Criollo sheep are the "native" breeds, coming from the old Merino and other breeds brought to South America by the Spaniards. However, no single description fits all criollo sheep in Peru. The term apparently applies to any animal that does not fit any set of known and recognized breed characteristics.

Criollo animals are most abundant in the herds of small peasants, either private property holders or comuneros (member of an indigenous community, Comunidades Campesinas). The term huaccho signifies animals that are managed extensively, without division of the herds in flocks according to sex and age, with no selection for breeding, and with little health care. The meaning of huaccho has been extended to describe the animals owned by individuals --generally they are owned by the workers in cooperatives and SAIS. They are managed with some 'modern' technology--mainly health practices to avoid infesting the cooperative's herd, but rarely use selection and separation into flocks. Cooperative and SAIS workers sometimes agree to jointly manage their huaccho animals, with a shepherd paid by the enterprise. This arrangement obviously limits the quantity of animals to be owned by each worker. Each animal is branded and some more progressive enterprises assign lambs according to the quantity of ewes owned by each worker (without regard to ownership of the ewe). A substantial number of cooperatives have begun to build their flocks solely from criollo animals that were given to the new enterprise by the associates as a sort of share participation. Usually these animals receive technical management, including the division of the herd into flocks by sex and age, selecting the breeding animals,etc. Today, however, it is common to use Corriedale rams or other improved rams to 'improve' the quality of

Table 6. Division of the Grasslands

	Grasslands area (ha)	Number of canchas*	Average size of of cancha	Number of sheep canchas
UCRUCANCHA	3500	18	194.4	18
GAYA	9294	22	422.5	18
PALCAN	5279	18	293.3	15
TOTAL	188073	58	311.6	51

*Cancha is the Quechua word for paddock

Table 7. Distribution of Paddocks*

Type of Animals	UCRUCANCHA	GAYA	PALCAN
Rams	2	2	1
Ewes	3	7	5
Parturition	5	3	6
Lambs	2	1	-
Wethers	3	3	2
Cattle	-	2	1
Cameloids	-	1	1
Horses	-	1	**
Huaccho sheep	-	-	1
Other***	3	2	1
TOTAL	18	22	18

*Based in the period 1979-1980; not all the canchas are occupied permanently.

**There is a small area for horses, not considered as a cancha.

***Paddocks conceived as support or rotation units.

these sheep. There is no general standard for such management; however, the more an animal resembles a known breed (currently Corriedale) the greater the possibility of it being assigned to an 'improved' flock.

The coats of criollo sheep (the term is also applicable to cattle) have a finer fiber and are more resistant to adverse environmental conditions, a characteristic probably due to a process of quasi-natural selection begun three or four centuries ago. Black and brown animals are relatively common; however, they are being eliminated by the cooperatives to preserve the more easily marketable white color.

Development of appropriate technology based on criollo animals seem to be of little interest in Peru. Almost no research has been done on genetic characteristics, thus there are few suitable research animals among criollo sheep. Most research has assumed the necessity of introducing exotic varieties, despite a great deal of evidence to suggest that criollo animals have developed a hardiness or resistance to the difficult high Andean environment that is characterized mainly by the poor quality of the forage and the strength of the solar radiation.

Due to a breeding process begun some decades ago, the most broadly accepted breed in Peru is Corriedale, predominantly of Australian and New Zealand origin. Viewed over the short term, more economical production could be obtained through the introduction of technological packages already known and studied in-depth. But the productive efficiency of the criollo animal is an aspect that has not been thoroughly studied and is almost unknown. Most of the information about these animals stems from surveys conducted on huaccho herds that are managed almost as they were four centuries ago (no genetic selection, high breeding promiscuity, few health care practices--and, most importantly poor feeding). Therefore, the production rates obtained with this traditional management should not be used to compare the efficiency of the criollo animal relative to that of Corriedale animals that usually are technically managed. Several reports, however, support the validity and the necessity of further research on criollo animals [3].

Improved Sheep

The term mejorados applies to sheep that exhibit some phenotypical and/or genotypical characteristics of known breeds. Although most of these animals are now being improved by use of Corriedale rams, other qualities are sometimes obtained from the Australian Merino and Junin breed [4] developed by the former Cerro de Pasco Copper Corporation from several foreign breeds.

These animals are commonly separated from the criollo, with the improved breeds given the best forage, intensive care (and more rigorous selection. Since approximately 60 to 70% of Peruvian sheep are owned by huacchilleros (shepherds of huaccho animals) and taking into account that not all cooperative and SAIS animals are improved, it can be

calculated that improved animals represent 20 to 30 percent of Peruvian sheep.

Breeding Stock

Some enterprises also classify their animals as breeding stock (or de plantel,) which includes only sheep of high genetic quality and controlled standards, imported animals, or descendants of imported sheep. Usually, the breeding stock is only a small part of the total herd. Only in Ucrucancha were such animals an important part of the herd, accounting for 19.25% of the total, and 25.9% of the breeding animals (see tables 4 and 5). These sheep serve as a sort of genetic bank for the region; they are used mainly to produce breeding animals for the production unit and for sale as breeding stock.

FLOCK SIZE AND MAKEUP

Herds are divided into puntas (flocks) according to sex and age. Each flock is generally tended year-round by one shepherd and production data are calculated for each flock. In the Central Sierra, flocks rarely exceed 1000 sheep; small flocks are more common--no more than approximately 700-800 ewes, and 300 males.

There are no lamb flocks, as the young animals stay with their mothers until selected and assigned to flocks of yearling rams, ewes, or wethers. It is common for wethers (and also ewes) to be managed in flocks of the same age. All rams and the remaining ewes (according to their quality) are assigned as yearlings to the flocks of older animals. There are no criollo rams, as male animals are usually castrated as a technical management practice. (However, the huacchilleros maintain some criollo rams.) Criollo ewes are bred by improved animals.

Table 8 indicates the size of the flocks using average values of the annual composition in the three units. The maximum size of each class is also indicated. The composition of the flocks usually varies with changing environmental conditions; in Palcan, the variations are more clearly technical, as this cooperative is substituting ewes for wethers.

Table 9 lists the monthly variations of the herd composition, 5/ indicating a relatively greater number of yearling ewes and wethers.

Figure 2 depicts the managment calendar for breeding, births, and changes of classes, which accounts for the variation in Table 9. The figure was designed on the basis of the practices observed during the April 1979-March 1980 period (for Gaya, the preceding year). The calendar varied widely regarding the date of removal of animals for sale (wethers, old ewes, and rams); their sale depends directly on weight gain, which, in turn, is strongly related to forage availability.

The total calendar is adjusted to reflect environmental factors such as temperature and rainfall. For example, in the Sierra region, rain is concentrated in the months of the meteorological summer (December to March). Thus, the calendar is adjusted to allow the grasses to recover

Table 8. Organization of the Herds*

	UCRUCANCHA		GAYA		PALCAN	
	Flocks	Animals	Flocks	Animals	Flocks	Animals
	Average Values					
Rams	2	559	2	508	1	375
Ewes	5	3871	4	5710	4	4398
Wethers	1	280	1	987	1	17**
	Maximum Quantities during the Year					
Rams		855		605		592
Ewes		4635		6493		4833
Wethers		577		1060		202**

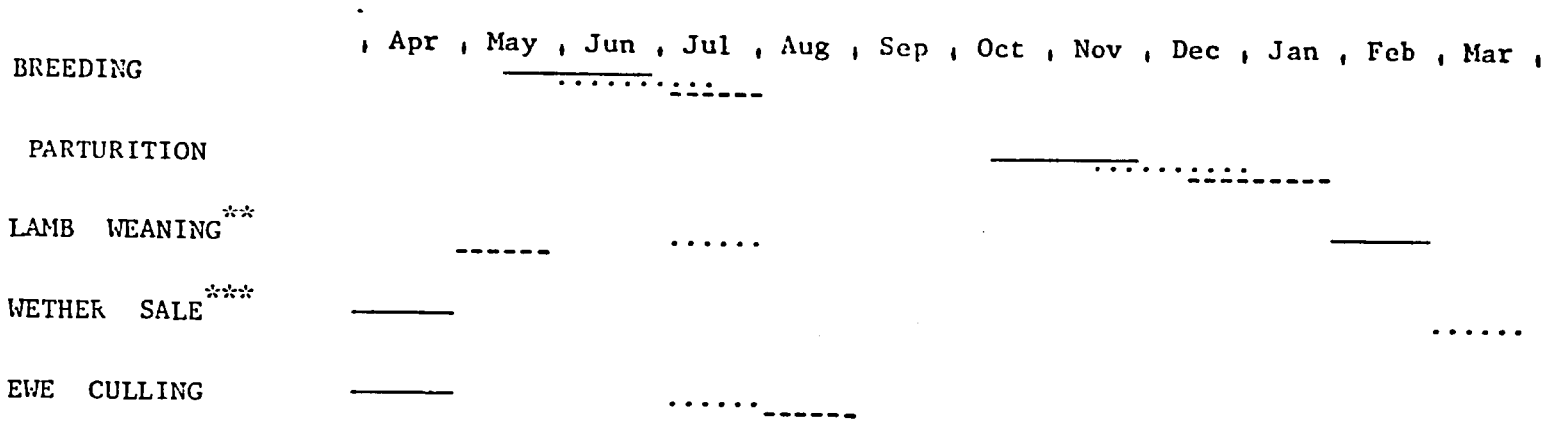
*Only adult sheep, based on the April 1979-March 1980 period, for Ucrucancha and Palcan, and April 1978-March 1979 for Gaya.

**The age of selling wethers is currently being advanced, and most castrated animals are being sold as young lambs, i.e., less than one-year old.

Table 9. Monthly Evolution of the Herd.

	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
I. UCRUCANCHA												
Rams	855	822	595	445	440	379	517	491	486	485	362	831
Yearling Rams	772	760	732	720	707	684	655	647	636	621	476	765
Ewes	4170	4158	4132	3833	3794	3749	3644	3594	3813	3755	3185	4635
Yearling Ewes	1674	1072	1632	1594	1575	1553	1526	1506	1493	1476	1465	1810
Wethers	57	49	49	44	44	1	577	575	564	560	21	813
Yearling Wethers	820	807	766	742	733	724	714	703	692	692	804	421
Lambs	16	3	-	-	-	-	-	-	2536	2301	2162	93
Total	8364	8271	7906	7378	7293	7090	7633	7516	10220	4890	8475	9868
II. GAYA												
Rams	543	532	526	524	500	483	481	480	476	474	472	605
Yearling Rams	-	-	-	288	285	284	279	271	269	261	254	-
Ewes	6493	6449	6413	5484	5457	5425	5389	5320	5265	5196	5206	6421
Yearling Ewes	-	-	-	1668	1650	1439	1433	1422	1393	1371	1353	4
Wethers	1060	1049	1042	1029	1003	989	962	948	932	924	912	989
Yearling Wethers	-	-	-	1343	1313	1110	1083	1056	1043	1037	1017	3
Lambs	3423	3392	3356	-	-	-	-	-	3694	3499	3389	3310
Total	11519	11422	11337	10336	10208	9730	9627	9497	13072	12762	12603	11332
III. PALCAN												
Rams	311	416	405	399	592	379	373	328	328	325	323	321
Yearling Rams	106	267	266	266	266	266	-	-	-	265	266	249
Ewes	3789	4833	4815	4768	4264	4396	4368	4343	4321	4309	4297	4288
Yearling Ewes	1102	1531	1488	1474	1437	1408	1359	1341	1323	1307	1295	1814
Wethers	-	202	-	-	-	-	-	-	-	-	-	-
Yearling Wethers	552	1137	1094	1068	620	458	522	510	490	202	170	-
Lambs	2970	-	-	-	-	-	-	-	-	2657	2533	2525
Total	8830	8386	8068	7975	7179	6907	6622	6522	6462	9065	8884	9197

Figure 2 : CALENDAR FOR REPRODUCTION, WEANING, AND SALE*



Legend: Ucrucancha ———
Gaya .....
Palcán ------

Notes:

* Based on the observed data from table 9.

** Separation of lambs from their mothers, and selection of such lambs, according to age, sex and quality.

*** Highly variable, mainly for Palcán.

following periods of high demand such as parturition and initial lamb raising. On the other hand, the minimum temperatures are higher in that period, while the maximum temperatures can be lower.

Figure 3 reflects the data in table 9 and refers to the total herd for each of the three study units. (The original data were normalized according to the mean [value 100], note displacement to the right.) In Palcan, such displacement is deliberate. Figure 3 should be used only as a very rough approximation of forage consumption, because it includes animals of different ages, thus different consumption capacities. For example, number of lambs could not be controlled, because each production unit includes sheep of different ages in that category: 3 months in Ucrucancha, 6 to 7 months in Gaya, and 4 months in Palcan.

Only in Palcan do all the variations come from the original sheep population. Because Ucrucancha and Gaya are production units of larger enterprises, they often have animals transferred to or from other production units. These tranfers are most common in Ucrucancha, which receives flocks of yearling animals from Pariamarca [6/]. Gaya receives transfers from Cajoncancha, where criollo sheep are raised.

STOCKING RATES

Both the quality of the grasslands and the care they receive are reflected in the stocking rates. Detailed agrostologic studies allow precise estimation of the potential stocking rate that can be supported by a paddock. (This predetermined stocking rate is affected, of course, by meteorological changes, with rainfall the most important factor to be taken into account.) Such studies are expensive, however, requiring skilled personnel. In Peru, most of those studies have been part of a research project, usually at a relatively detailed level. The National Bureau for Evaluation of Natural Resources, ONERN, has development of agro-edaphic studies throughout the country as one of its goals.

Experience and common sense seem to be the main criteria used in assigning a stocking rate to the paddocks, and this often imprecise procedure leads to both overgrazing and undergrazing. Overgrazing causes the most damage, but undergrazing can result in the proliferation of taller forage species (such as stipa sp.) that impede development of the smaller species that sheep usually prefer because of both size and palatability.

Flexibility in herd size is limited; given a short rainfall year, most production units tend to maintain herd size and thus are likely to overgraze.

Natural phenomena and ranch management practices continually change the potential stocking rate (both seasonally--dry season and rain season--and on a year-to-year basis). Our observations suggest that seasonal variations are taken into account more than are the long-term changes. A demonstration of this hypothesis could be achieved by an in-depth study of historical series of both herd sizes and rainfall.

Figure 3: MONTHLY EVOLUTION OF HERDS' SIZES
(Index = 100 for the average)

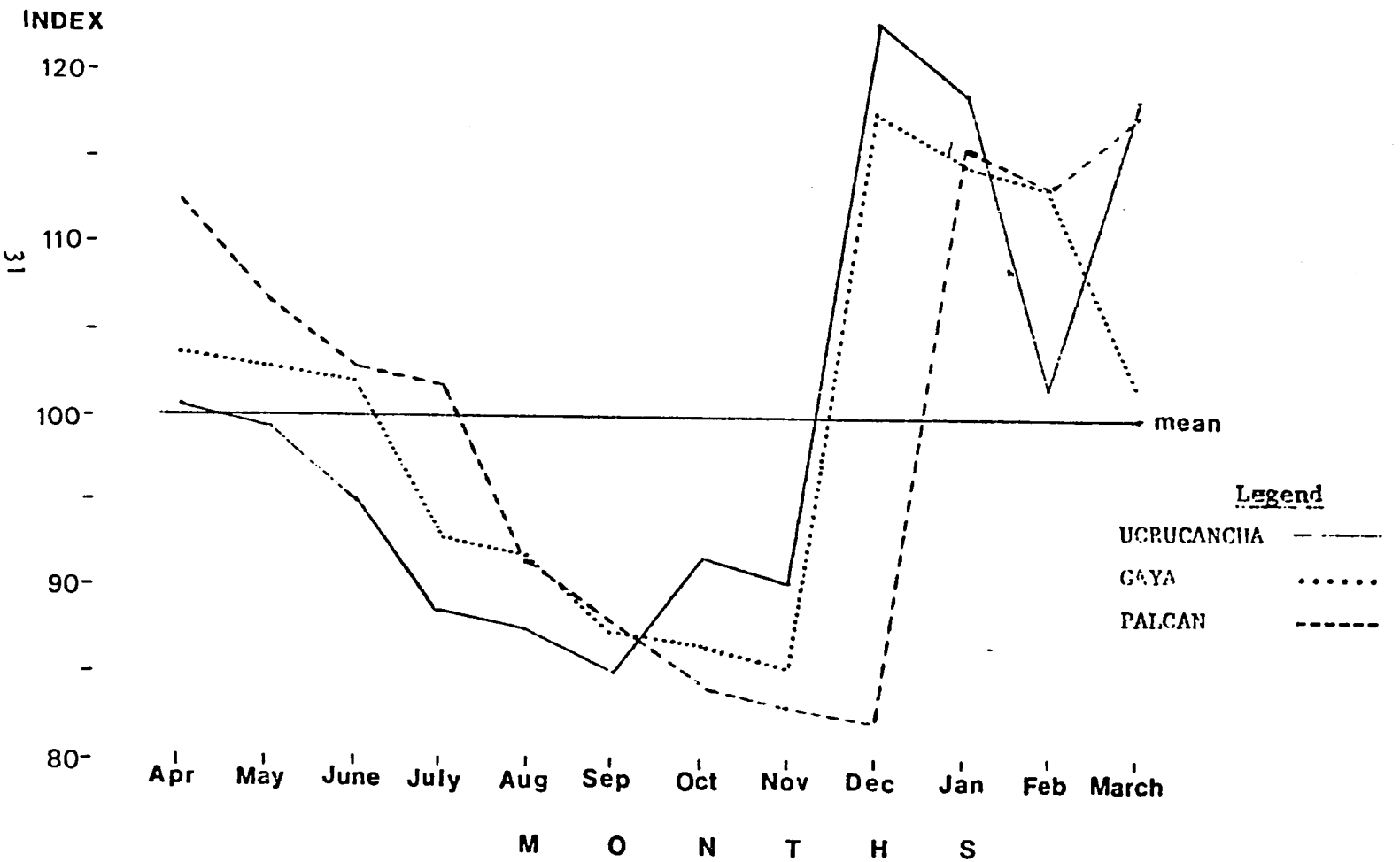


Table 10 shows the methods used in Ucrucancha, Gaya, and Palcan to exploit their grasslands. Stocking rates are listed for all ruminants raised within each production unit, including 452 alpaca and 218 cattle in Gaya; 150 llamas, and 250 cattle belonging to the Cooperative; and 600 huaccho sheep, and 100 huaccho cattle in Palcan. All animals are assumed to be raised in constant quantities year-round, except for the Cooperative's sheep.

Ucrucancha reports the highest stocking rate, which is probably the highest among all of Pasco's cooperatives. Gaya's stocking rate (1.27 sheep/ha average) seems very low considering that Pasco's Puna is one of the most humid in Peru. However, our observations of the pasture suggested that it is undergrazed. According to the grasslands classifications made by the Agrarian Reform Bureau before giving the lands to the peasants, Palcan should have had the worst grasslands; but its grasslands are presently more heavily stocked than those in Gaya.

Palcan's herd has been increased in the past few years, and the grasslands have not supported much stock during most of the Cooperative's twelve-year life. No information is available on the role of rainfall patterns relative to Gaya's poor pastures.

Figures 4 and 5 are designed to describe the seasonal variations in stocking rates. Figure 4 shows changes of the stocking rate on a monthly basis. Gaya shows an especially low rate of land use. The charts reflect changes of classes, as well as transfers to or from other production units (especially in Ucrucancha).

Figure 5 is a normalization of the data and variations are presented as indexes, with the annual average being used as the base. Variances can provide additional information and have the following values:

Ucrucancha	:	113
Gaya	:	15.7
Palcan	:	30.6

These variances indicate the degree of seasonal flexibility in the use of the lands. The reduced seasonal variation in Gaya may be due to the lower quality of pastures, plus this unit's reluctance to reduce the herd's size and thus permit the pastures to recover.

Considerations of these results should take into account the dry and the rainy seasons, as well as the lag in Palcan's management calendar.

Table 10. Variations in the Stocking Rate (in standard sheep units per ha)*

MONTH	UCRUCANCHA	GAYA	PALCAN
April	2.25	1.27	1.94
May	2.22	1.26	2.16
June	2.11	1.25	2.10
July	1.96	1.29	2.08
August	1.94	1.28	1.96
September	1.88	1.23	1.91
October	2.04	1.22	1.86
November	2.01	1.21	1.84
December	2.35	1.36	1.83
January	2.30	1.34	2.02
February	1.91	1.33	2.01
March	2.65	1.25	2.05
ANNUAL AVERAGE	2.14	1.27	1.98

*Defined in Table 2.

Figure 4 : CHANGES IN THE STOCKING RATE
(standard sheep units per Ha)

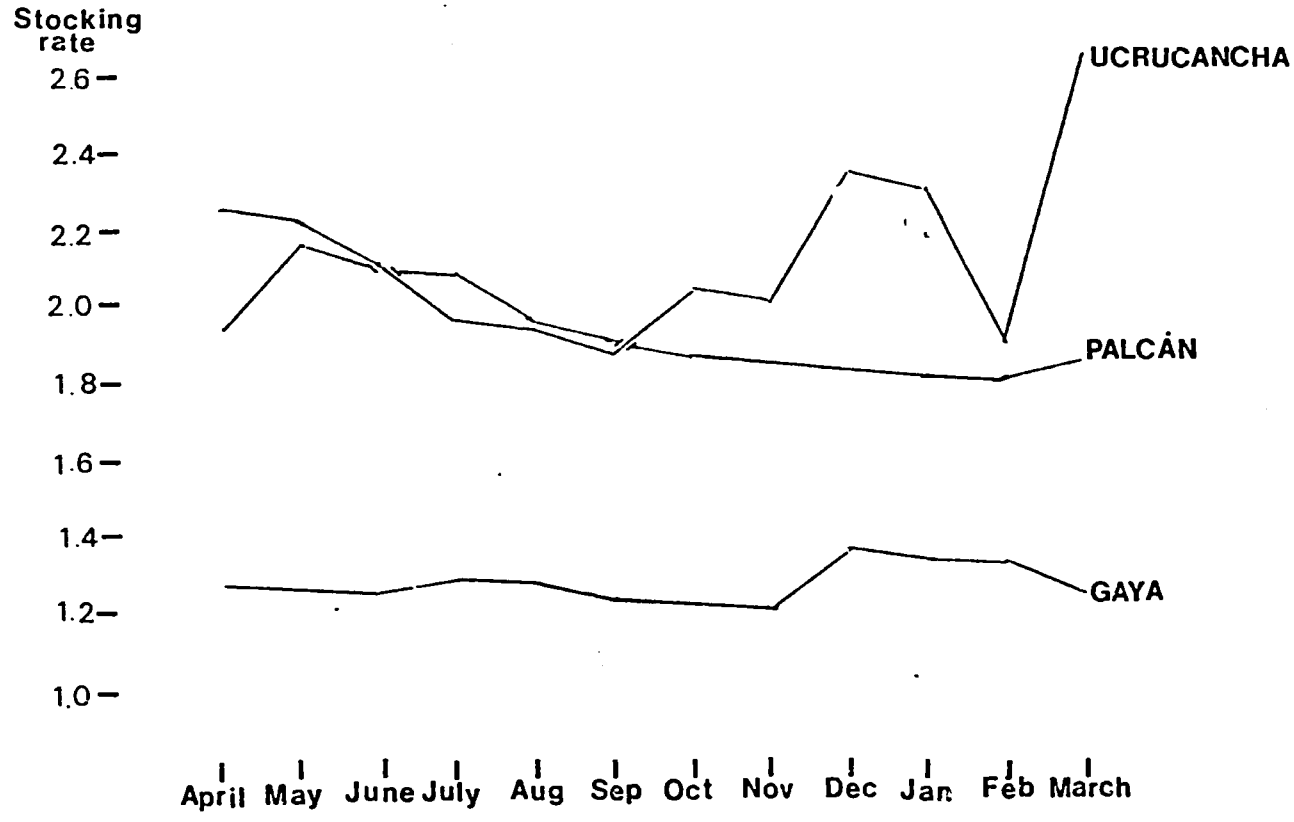
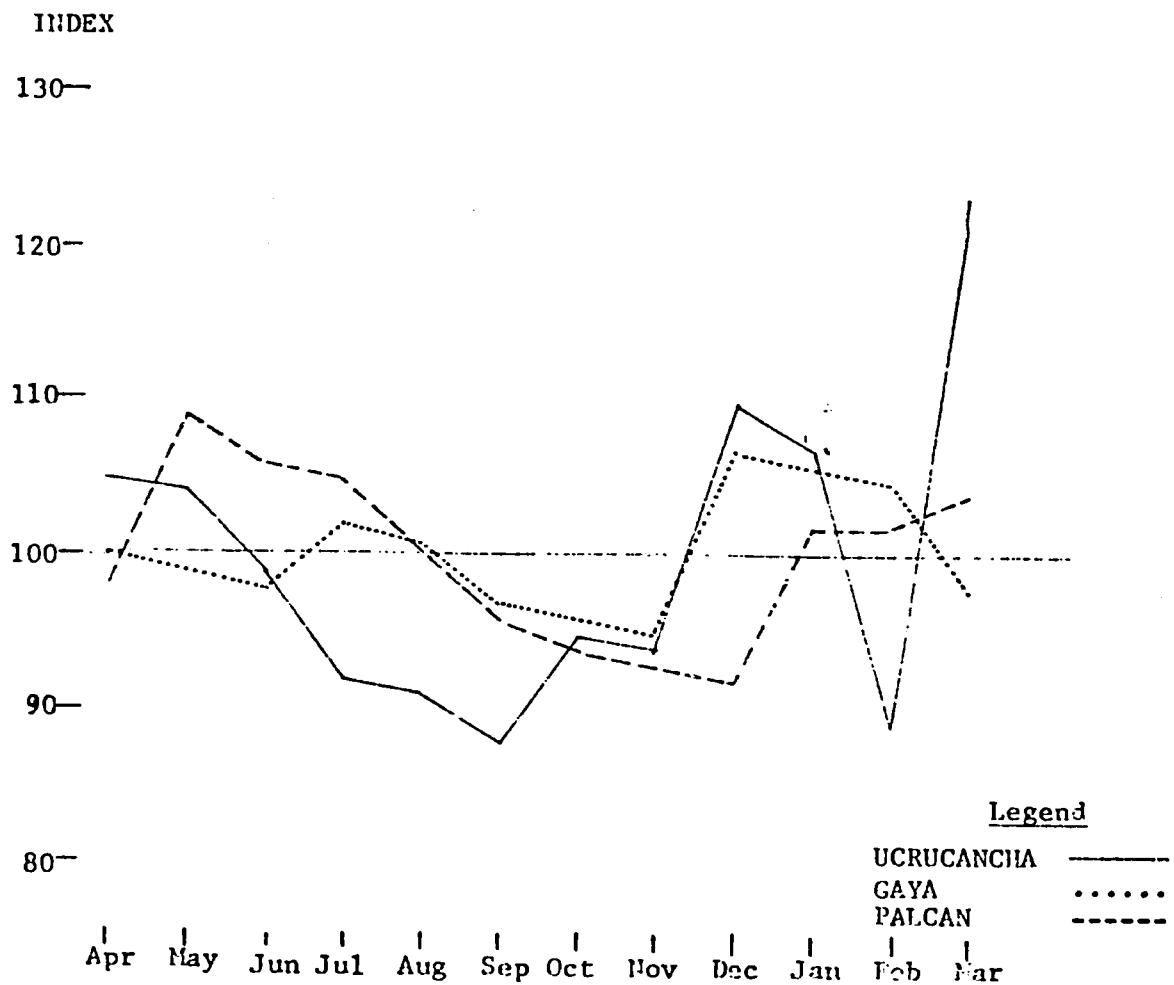


Figure 5 : RELATIVE CHANGES IN THE STOCKING RATE
(Index = 100 for the average)



DEATH LOSSES

Most cooperatives' production units attempt to maintain precise statistics of mortality and morbidity among the animals by performing a very rough autopsy (called the quiebra) twice a week. An autopsy is usually not required for accidents or other physical causes. The autopsy is performed by persons knowledgeable in the procedure, usually the administrator or an experienced worker. The diagnosis is rough, yet fairly accurate. In the case of accidents, the word of the shepherd is usually taken. (As mentioned before, the shepherd must present the carcass and the skin, or at least the latter.)

Dead animals (usually lambs) are frequently found after cold nights when frosts (heladas) occur. Lambs also account for most of the sheep drowned, especially during the rainy season. Other common accidental deaths are due to lightning, foxes, dogs, abortion, suffocation while penned during the night, and falls from which the sheep are unable to stand up again. Shepherds are usually charged as responsible for those losses.

Another environment-related sheep health problem is due to the strength of the sunshine that provokes skin photosensitization (called jacapo in the Central Sierra). This disease is more frequent among white sheep. Interestingly, the huaccho herds in Pasco are composed of an unusual number of black animals, which could be due to natural selection.

Overgrazing, as mentioned, causes proliferation of Atragalus sp. (garbancillo). Sheep may eat this plant and die as a result of addiction and subsequent intoxication. Bad feeding conditions can also provoke cachexia, anemia, colic, inanition, and bloat.

Infectious diseases also are frequent, primarily pneumonia, which is probably caused by drastic changes in temperature. Lambs also account for most of these deaths. Polyadenomatosis deserves special attention --this disease seems to be one of the main causes of death. Less frequent are enterotoxemia, diarrheas of different origins, pyo- and hemorrhagic septicaemias, carbuncle, etc. Lung-related causes of death are prevalent among sheep, probably due to the environment. The most frequent parasite is taenia, which can sometimes present an epizootic character. Pulmonary strongylus and distomatosis are also frequent, as well as a brain parasite that provokes the so-called torneo, which results in sheep walking in circles with poor equilibrium.

Detailed data related to causes of mortality in Palcan are shown in table 11. The data were transcribed from CAP records and some discrepancies are apparent.

Table 11. Causes of Mortality in CAP "El Diezmo-Palcan", 1978-79

Causes	Quantity	% of Population	% of Total Mortality
1. Physical Causes	283	3.66	30.0
Foxes	10	0.13	1.1
Lightning	8	0.10	0.8
Drownings	88	1.13	9.3
Asphyxia	18	0.23	1.9
Traumatisms	2	0.03	0.2
Abortion	33	0.42	3.5
"Tumbling"	24	0.31	2.5
Fractures	1	0.01	0.1
Frosts	101	1.30	10.6
2. Infectious Diseases	283	3.63	29.7
Polyadenomatosis	82	1.05	8.6
Pneumonia	184	2.36	19.4
Enterotoxemia	1	0.01	0.1
Diarrhea	5	0.06	0.5
Polyarthritis	1	0.01	0.1
Symptomatic Carbuncle	2	0.03	0.2
Hemorrhagic Septicemia	2	0.03	0.2
Pyosepticemia	6	0.08	0.6
3. Parasitic Diseases	69	0.88	7.3
"Torneo"	1	0.01	0.1
Distomatosis	7	0.09	0.7
Pulmonary Strongylus	14	0.18	1.5
Taeniasis	44	0.56	4.7
Bacillar Diarrhea	3	0.04	0.3
4. Intoxication Diseasea	29	0.37	3.0
Photo-sensitization	15	0.19	1.6
Astragalus (Selenium)	8	0.10	0.8
Dosage-related	6	0.08	0.6
5. Organic Diseases	285	3.66	30.0
Cachexia	9	0.12	1.0
Colics	21	0.27	2.2
Anemia	153	1.96	16.1
Hydropericardium	29	0.37	3.0
Urinary Retention	7	0.09	0.7
Inanition	36	0.46	3.8
Rectal Prolapsus	4	0.05	0.4
Arthritis	26	0.33	2.8
TOTAL	951	12.20	100.0

*Percentage from the average annual population, 7796 sheep.
**Percentage from the total mortality, 951 sheep.

RELATED SOCIAL, ECONOMIC, AND POLITICAL CONSIDERATIONS

ENTERPRISE ORGANIZATION AND MANAGEMENT

The administrative structure of the production process, and a brief description of the tasks performed by each worker, are listed next. Other aspects regarding the ownership structure and decision-making processes are treated briefly in a later section dealing with social aspects of the units. Hand labor is the primary requisite for production activities, except for the shearing which requires equipment.

Management activities are similar in most of the High-Andean livestock business enterprises. Two examples are provided here: (1) Ucrucancha's management is representative of large enterprises, such as the SAIS, and (2) Palcan, represents the majority of small sheep cooperatives found in Pasco. Gaya is an intermediate example that more closely resembles Palcan than Ucrucancha. Figure 6 depicts ranch management activities in Ucrucancha; Figure 7 shows these activities in Palcan. Grazing activities determine the work descriptions, although workers described in one activity occasionally engage in other activities, depending on the management calendar.

JOB DESCRIPTIONS

Ucrucancha

Administrator. Ucrucancha's administrator has two distinct tasks: clear-cut administrative issues and management of the production process.

His administrative work consists of accounting activities, such as keeping track of the sales book, payroll, expenditure statements, plus making a budget for each accounting period. His production work consists of taking care of the livestock book and making most of the decisions regarding the sale of sheep for both meat and breeding purposes. He is also in charge of all the relationships between the production unit and the CECACOSPAS that owns Ucrucancha.

The administration is solely responsible for all decisions concerning herd management in production activities, and also for the results stemming from such management. The Central (CECACOSPAS) does not usually intervene in decisions related to the production unit, thus the administrator is relatively independent. He assumes responsibility for specific production tasks, such as parturition, culling, marking, etc.

Sanitary Technician (Saniganadero). Although the name of the position seems to qualify activities closely related to the health care of sheep, in practice this individual carries out the tasks of a general foreman or a subadministrator. (The position of foreman (caporal) does not appear in figure 6, even though it is very common in most high Andean livestock cooperatives.)

Figure 6: UCRUCANCHA: MANAGEMENT SCHEME OF GRAZING AND RELATED ACTIVITIES

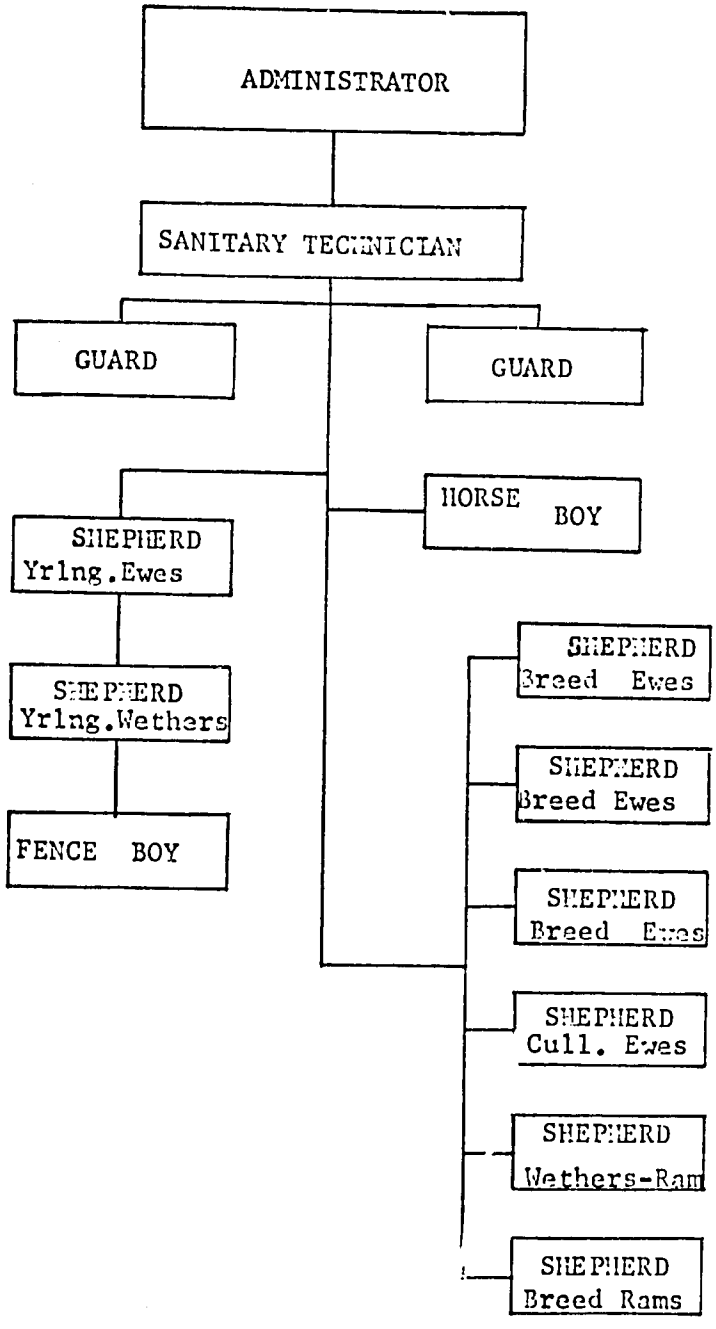
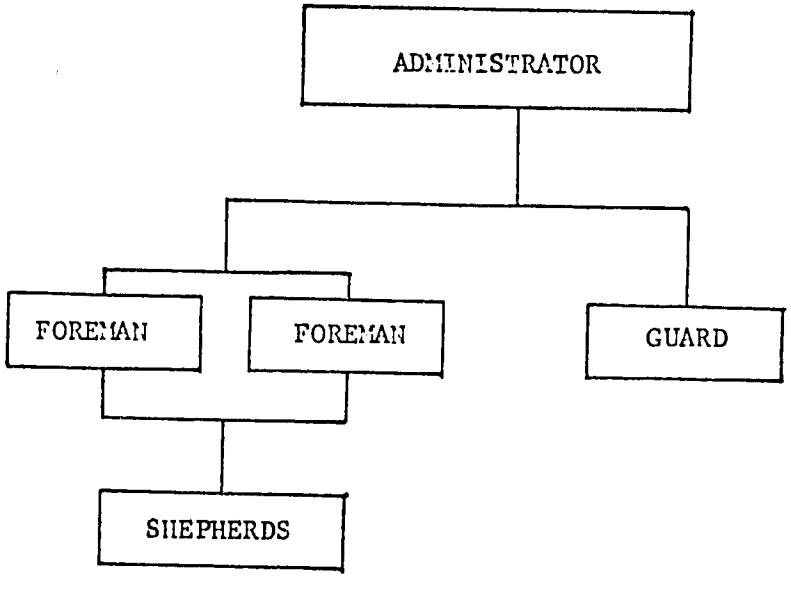


Figure 7 : PALCAN: MANAGEMENT SCHEME OF GRAZING AND RELATED ACTIVITIES



Guards (Vigilantes). Range management is a main responsibility of the guards, who are in charge of checking the fences and the quality of the pasture in each paddock. They make suggestions to the shepherds about grazing the sheep and are also in charge of controlling all issues related to the shepherds' work. They also guard the boundaries of the production unit to avoid pasaderos (neighboring livestock grazing the production unit's land).

Horse Boy (Mulero). The horse boy is in charge of the horses belonging to the production unit; usually such a position depends on whether the enterprise has its own horses. For example, in Palcan the horses are owned by the workers, thus there is no horse boy. In Ucrucancha, the horse boy has additional tasks when required.

Fence Boy (Alambrador). The fence boy's function is to maintain the fences dividing the paddocks; and he has other tasks related mainly to the foreman's work.

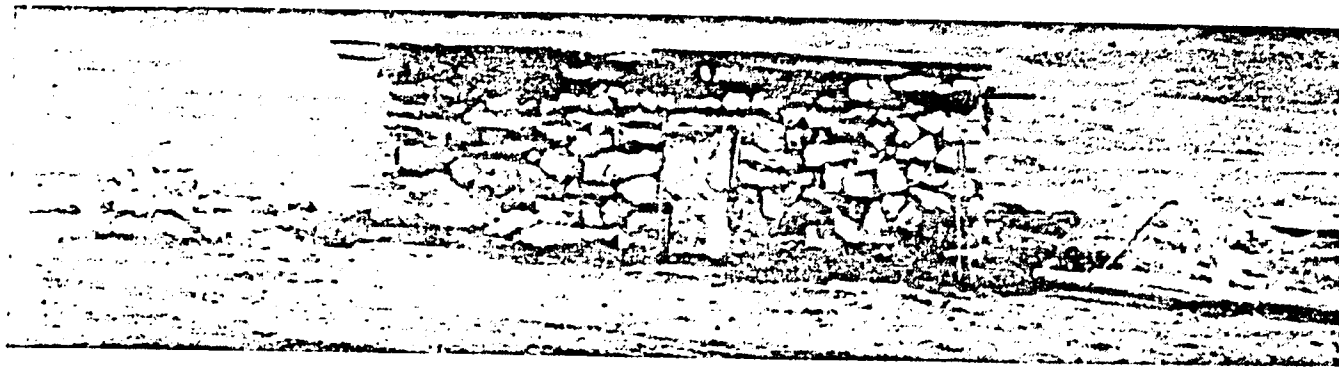
Shepherds (Pastores). Shepherds directly tend to the herd and their management of the flock and the paddock is probably the most important of the production processes The shepherd is responsible for the general physical condition of the flock and also for the losses of sheep attributable to bad management, such as drownings, falls from precipices, frequent attacks by predators (mainly by foxes), etc. In most cases, the shepherd assumes a nominal cost for each lost animal under these conditions. The shepherd also reports the general health conditions of the flock and the grazing state of the paddock. If necessary, either the Health Technician or the Administrator arranges for sanitary treatments or changes of paddocks.

A shepherd's work is especially heavy. His job keeps him busy 24 hours per day, seven days a week. He seldom leaves the flock alone; usually leaving only to attend the quiebra (the twice weekly report of dead animals) or to collect his salary, and to do some shopping for the week. On these occasions the shepherd's family remains in charge of the flock. The shepherd usually lives in the housing facilities found in most of the canchas.

Thus, the shepherd's labor can be described as family labor. The cooperative usually does not provide any help for this work. The horse and dog that are basic for grazing work in Pasco are usually owned by the shepherd. In Pasco, dogs are quite important in shepherding; this is in contrast to their use in Puno, where they serve only as guards. The training of dogs is a job in itself, a task that also is assumed by the shepherd. Prices of both horses and shepherd dogs are relatively high.

Palcan

Administrator. The administrator's formal responsibilities in Palcan are very similar to those in Ucrucancha but an important part of the work is shared with the Administrative Council of the Cooperative. The Palcan production unit is autonomous, belonging only to its workers.



Shepherd's Shelter (Palcan)

Two Members (socios) of Palcan

Palcan's Administrator

Farewell for SR-CRSP Researchers, CAP "el Diezmo Palcan"

Thus, the number of responsible members is greater, and the administrator is a sort of general manager. Because there are two foremen, other activities are shared also. In a cooperative as small as Palcan, with only 18 associates, most of the workers have been or are currently members of some of the councils. The law requires that the administrative Council have 7 members, and the Vigilance Council 5 members.

Foremen (Caporales). The caporales are directly in charge of the shepherds and are responsible for communicating all the administrative decisions to them. They also recommend the best way to use the pasture lands and manage the flock, having formerly worked as shepherds. They work closely with the guards and usually share their responsibilities.

Guards and Shepherds. Guards and shepherds to the same work and have the same responsibilities as those described for Ucrucancha.

Gaya

Administrator. Gaya's administrator is a subaltern of the manager of the whole cooperative. Until March, 1980, the manager (an agronomist) was rarely present in Gaya. Thus, as a management example, Gaya serves as an intermediate type. The ranch management scheme for Gaya is very similar to that of Palcan, as Gaya has a foremen and guards, plus a horse boy and two fence boys.

RELATED MANAGEMENT ACTIVITIES

Organization of management activities are about the same throughout the zone. Figure 8 outlines the sheep management calendar for the three production units, according to their respective programs (changes occur due to environmental conditions. The diagram does not predetermine the length of each activity; but only the period in which it is expected to be accomplished.

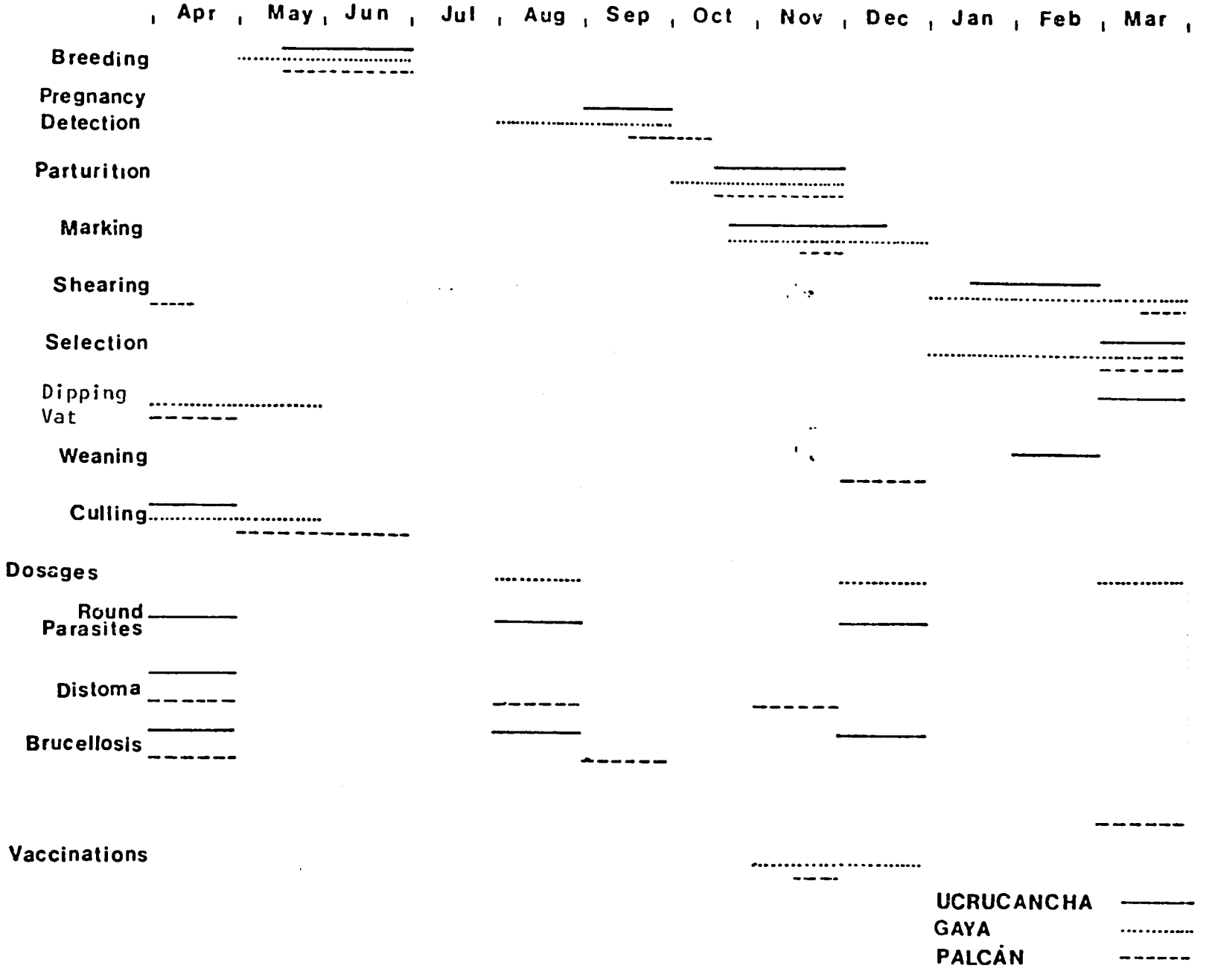
Breeding (Empadre)

Each of the three production units use both natural interbreeding and artificial insemination, depending on the quality of the ewes. For artificial insemination, all semen is collected from rams belonging to the respective production units. Frozen semen is not used.

Artificial Insemination

Artificial insemination of the ewes is a responsibility of the inseminador (inseminator). In Palcan and Gaya, he is in charge of collecting the semen and preparing the diluters. In Ucrucancha, this task is carried out by the health technician. All inseminators have received some training either in other production units, or in universities. The semen is analyzed by a microscope, then is treated by both chemical and mechanical techniques.

Figure 8: SHEEP MANAGEMENT CALENDARS
(PROGRAMMED)



Some assistants (usually shepherds, guards, and foremen) aid in manipulating and holding both ewes and rams. In some cases it is necessary to hire temporary labor.

Natural Interbreeding (Monta natural)

Natural interbreeding also is directed by the administrator of each of the three units, with shepherds and foremen (in Ucrucancha, the health technician) in direct charge.

Generally, this activity consists of selecting a certain quantity of rams according to both quality and quantity of the ewes, then grouping them together. A variation of natural interbreeding (called controlled interbreeding) is used in Ucrucancha, whereby a ram is assigned specifically to each ewe or group of ewes according to quality and blood lines. This avoids inbreeding and preserves quality. It is used mostly for high-quality sheep or studs. A ram (marcador) is used to detect ewes in heat; such ewes are caught and confined in corrals with the selected rams.

Pregnancy Detection (Perneo)

Barren ewes are separated from those that are pregnant to keep them from grazing in the parturition paddocks. Detection takes place in the sorting chutes (bretes) and consists of two different tasks. The detector (detectador) selected the ewes by touch only, while the holder (sujetador) holds the ewes still. The shepherds usually hold the animals while administrators and foremen select the barren ewes.

Parturition

Parturition is considered the most important activity in the calendar, because a production unit's success depends heavily on good parturition. Most of the production unit's workers participate in this task, and additional workers also are hired. Parturition is directed by the administrator and observers (vigilantes) and the administrator keep a close eye on the activity in each parturition paddock. The foremen, health technicians, and guards serve as observers.

Aides (asistentes) are usually the shepherds responsible for the respective ewes' flocks, and their main task is to help, if necessary, when the ewes give birth. Other assistants (ayudantes), usually are extra workers hired to pick up the placentas and dead animals and to move the ill or weak animals into certain corrals.

Branding, Tail Cutting and Castration (Marcacion, descole y castracion)

These activities are also done in the sorting chutes. A first selection is made among male lambs chosen to be either rams or wethers.

The task is directed by a controller (controlador), usually the administrator. The first task is to mark the lambs with the symbols of the cooperative, usually on the ears. The holders keep the lamb still to

facilitate the work of the marker (marcador). The assistants (ayudantes) castrate the lambs and cut their tails. If a lamb has horns, they also are cut away. Additional hired personnel are necessary.

Ewe Selection

On a yearly basis, all ewes are selected and assigned different categories, with an eye toward breeding them or culling them for sale. The ewes are commonly marked with different colors according to their destination and the administrator always serves as selector (seleccionador). He examines the general shape of the ewe, then determines whether she is prognathous, and if a blood analysis should be made.

The assistants manage the animals and distribute them to different corrals, usually with the help of the shepherd. At the same time, rams are selected and culled. The main examination is made to detect epididymitis.

Dipping(Banos)

To treat the sheep for parasites, large vats are used for dipping. All sheep over 1 year old are treated. This task also is supervised by the administrator. The assistants, usually the shepherds, drive the sheep into and out of the vat. One assistant is in charge of submerging the head of the animals.

Weaning (Desbarate)

At weaning, lambs are separated from their mothers and assigned to flocks of rams, of yearling ewes, or of yearling wethers. Simultaneously, lambs are vaccinated against keratitis. The supervisor's task is assumed by either the administrator or a foreman. A holder and a marker also are necessary.

Culling (Saca)

The animals are culled before being taken to sale. Some culled sheep are specially fed in good paddocks to gain weight. Wethers, old or sterile ewes, and rams are sold.

Dossages and Vaccinations (Dosificaciones and vacunaciones) Dosages

Figure 8 shows all the diseases for which the sheep receive vaccinations. These activities are directed by a supervisor, and in some cases, the same person is in charge of vaccinating the animals. Sorting chutes are used for this task. In the paddock, dogs are also vaccinated against taeniasis.

Shearing

Shearing is the most complicated of all activities in the management calendar. It is primarily a commercial process, rather than a task related to animal husbandry. Ucrucancha and Gaya production units shear their sheep in the Ayarracra sheepshearing center, which is owned by the

(Left)
Shearing in Ayarracra

(Below)
Shearing in Palcan

Central of Cooperatives. All 23 associated cooperatives (except Palcan) shear their animals at one of the three sheepshearing centers of the Central. The animals are brought in on hoof, as well as by truck.

Palcan does not use this service, because the sheepshearing centers are quite far away. Palcan bought its own shearing machines, which have been used in the last three shearing seasons. Previously , Palcan used only hand shears, or they rented shearing time in the neighboring Conocancha production unit belonging to SAIS Pachacutec.

ADDITIONAL LABOR ALLOCATION ISSUES

Demographic Features

Table 12 and figure 9 show the demographic feature of the zone as of March 1980. The Palcan data represent a sample. Palcan is a permanent human settlement and its school, chapel, and houses were built by the workers, thus it can be considered a village. Almost all of Palcan's workers own their own house. That is not the case of Ucrucancha and Gaya, where all buildings belong to the cooperative, with housing facilities assigned only to some workers (rarely the shepherds).

Table 13 shows the average age of the population in the three production units. In the overall Peruvian population the average woman's age is usually slightly greater than that of the average man. However, Ucrucancha and Gaya data indicate an opposite trend. Gaya can be thought of as a work center rather than a human settlement, as the workers' families live in the community of Huayllay. Ucrucancha has similar characteristics.

Educational Levels

Table 14 shows the results of a sampling of people 6 year old and above. The percentages of the population with an elementary school education, or above were: Ucrucancha, 42.1%; Gaya, 37.5%; and Palcan, 29.7%. These results can be can be cross-tabulated with the age distribution of the population.

As mentioned, only Palcan has a school. Ucrucancha school-age people commonly attend a school in Ayarracra, funded by the CECACOSPAS. Gaya's students attend several schools in Huayllay.

LABOR ALLOCATION

General Demographic Basis

Table 15 shows the labor allocation by age groups. Ucrucancha has the youngest workers, while Palcan and Gaya have only a few workers below 30 years of age. Interestingly, women usually become shepherds if their

Table 12. Population Structure -- 1980.

Production Unit	Age groups / Sex	0-6	6-14	15-29	30-44	45 and over	Total
UCRUCANCHA	Male	9	6	8	6	2	31
	Female	10	4	10	2	3	39
	Total	19	10	18	8	5	60
GAYA	Male	6	5	6	3	6	26
	Female	10	8	8	4	5	35
	Total	16	7	14	7	11	61
PALCAN*	Male	6	8	14	4	3	35
	Female	11	11	13	5	6	46
	Total	17	19	27	9	9	81

*Based in a sample of 14 out of 20 families. Actual total population is 53 men and 61 women.

Table 13. Average age of population (years)

	Men	Women	Total
UCRUCANCHA	19.2	18.2	18.7
GAYA	24.7	20.3	22.1
PALCAN	20.5	20.5	20.5

Figure 9: POPULATION BY SEX and AGE

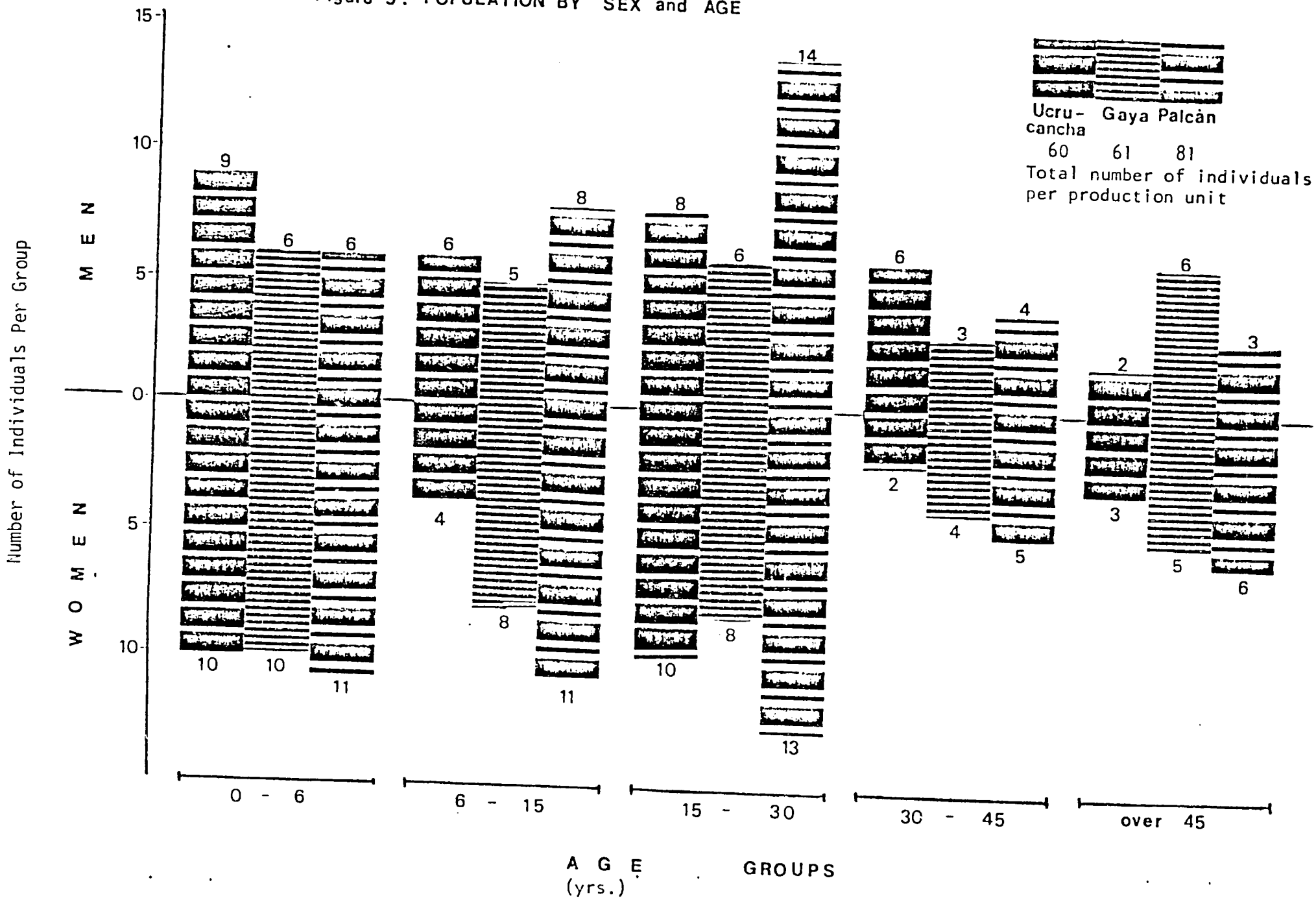


Table 14. Population Age 6 and over, by Sex and Formal Education Levels (1980 sample).

Production Unit	UCRUCANCHA			GAYA			PALCAN		
	M	F	Total	M	F	Total	M	F	Total
I. No education	3	5	8	3	4	7	2	8	10
II. Partial elementary	7	7	14	8	10	18	16	19	35
III. Completed elementary	2	6	8	2	3	5	7	4	11
IV. Secondary School[1/]	6	1	7	7	3	10	5	2	7
V. Superior[2/]	1	-	1	-	-	-	1	-	1
TOTAL	19	19	38	20	20	40	31	33	64

[1/] Both completed and partial, mostly the latter case.

[2/] In Ucrucancha, completed technical education; in Palcan, university education uncompleted.

Table 15. Labor Positions by Age Groups (1980 Sample).

Positions	Age Groups Production Unit	15-29	30-44	45 and over	Total
Administrators	U			1	1
	G		1	1	
	P		1		1
Health Technician	U		1		1
Guards or Foremen	U	1	1		2
	G		1	1	2
	P			1	1
Horse boys	U	1			1
	G			1	1
Fence boys	U	1			1
	G	1	1		
Shepherds	U	2	5[a]	1	8
	G	1	1	4[a]	6
	P	2	4[b]	4[b]	10
Others[1]	P	1	2	1	4
Total	U	5	7	2	14
	G	2	3	7	12
	P	3	7	6	16

[1]Administrative assistant, cook, "plantelero", chauffeur.

[a]One woman

[b]Two women

U = Ucrucancha

G = Gaya

P = Palcan

husbands die, and they inherit many responsibilities of their husband's positions. This finding suggests some remaining traditional behavior in cooperatives; such patterns are not common in other types of business enterprises. Table 15 indicates that the women shepherds are all 30 years or older. Both Ucrucancha and Gaya have only one woman each, while Palcan has four, accounting for 40% of the shepherds and some 25% of the total labor force employed.

Table 16 shows job descriptions according to educational levels. For the majority of the positions, no formal education was noted. Experience is the most important factor to be considered before assigning a position. Levels of education are generally very low, particularly so among the women--only one, in Palcan, had minimal education. Out of the total sample of 42 people, 24 had not completed elementary school. Of these 24, 17 were shepherds (71 percent).

Educational level is strongly related to the role of the administrative assistant in Palcan and that of the administrator in Ucrucancha. The administrative assistant in Palcan plays an important role because this CAP does most of its administrative work in the production unit itself. In Ucrucancha and Gaya, which are production units of larger enterprises, such work is done in the central offices of their respective enterprises.

The lack of mobility of the labor force is an additional indicator of the strongly traditional character of labor in these production units. Such behavior is obviously reinforced by the lack of opportunity to acquire jobs in the rest of the country (less than 50% of the economically active Peruvian population can be considered to be adequately employed). Table 17 shows that over 80% of the workers come from the province in which they work and it can be assumed that most of them come from stock-farming families.

On the other hand, 23 out of the total 42 of workers come from former haciendas. Gaya is in some ways exceptional: as a production unit belonging to a Communal Cooperative, most of its workers come from the community--10 out of the sampled 12. Aside from Gaya's special situation, workers with origins in neighboring communities are almost nonexistent (there are only two, both in Palcan, who became workers through marriage with workers' daughters).

Gaya's workers aside, 21 of 30 workers are shown to come from haciendas. This finding seems to substantiate a topic widely discussed in Peru, regarding the real beneficiaries of the Agrarian Reform process. It is said that comuneros actually receive few of these benefits, and when they do it is more as a way of ownership than in the form of jobs. However, comuneros do not like to work for someone else, prefering to raise their own animals and or to farm their own lands. To improve their income, they usually look for other types of jobs, such as mining in Pasco. Secondly, comuneros maintain their flocks that graze the communal lands even when they are working in other activities. Huayllay is an example: only 20% of the total number of comuneros have animal husbandry as a sole source of income (there is no cropland in Huayllay). The majority of the communeros raise livestock as a source of additional

Table 16. Labor Positions by Educational Levels (1980 sample).

Positions	Production Unit	Education Level* I	II	III	IV	V	Total
Administrators	U					1	1
	G		1				1
	P				1		1
Health Technician	U			1			1
Guards or Foremen	U		2				2
	G		1		1		2
	P			1			1
Horse boys	U				1		1
	G		1				1
Fence boys	U		1				1
	G		1		1		2
Shepherds	U	4[a]	1	1	2		8
	G	3[a]	1	1	1		6
	P	3[b]	5[a]	2			10
Others	P			3		1	4
Total	U	4	4	2	3	1	14
	G	3	5	1	3	-	12
	P	3	5	6	1	1	16

* See Table 14 for definitions

[a]One woman

[b]All women

U = Ucrucancha

G = Gaya

P = Palcan

Table 17. Labor positions by Origin of workers (1980 sample).

Origin Positions	Production unit	Same estate[1/]	Same Province: Communities	Same Province: Other haciendas	Other Communities	Total
Administrators	U				1	1
	G	1				1
	P		1			1
Health Technician	U			1		1
Guards or Foremen	U			1	1	2
	G	2				2
	P	1				1
Horse boys	U			1		1
	G	1				1
Fence boys	U				1	1
	G	2				2
Shepherds	U			4	4	8
	G	4		2		6
	P	8	1	1		10
Others	P	4				4
Total	U			7	7	14
	G	10		2		12
	P	13	2	1		16

[1/] In the case of Gaya, there is actually no worker born in the estate of Gaya, not even in the former Hacienda Algolan. For this production unit, data of this column indicate workers whose origin is in the Peasant Community of Huayllay. Gaya is a production unit of the Huallay Cooperative and 80 % of the comuneros of the Community of Huayllay are also owners of the Cooperative.

income or as sort of retirement fund since job tenure in some mining activities is quite short. Even under these conditions, the communal lands of Huayllay are overgrazed.

Few new jobs are created in high-Andean livestock enterprises, thus a solution to the unemployment problem probably could be found in places other than the Puna, at least as long as current technology is being used.

Table 18 complements table 17, showing the period of time each worker has worked in the production unit. Only the workers with more than 10 years experience can be considered as workers from the former haciendas.

Production Unit Allocations

Table 19 indicates the different positions and number of workers per position as related to the total permanent workers' staff. These data are tinct from the labor sample data summarized in Tables 14-18.

Of the total of 48 permanent workers, 29 are shepherds. Calculations can be made of the ratio of workers to number of sheep. The annual average of the cooperatives' sheep assigned to each shepherd are calculated as follows: Ucrucancha, 1041 sheep per shepherd; Gaya, 1390 sheep per shepherd; and Palcan, 866 sheep per shepherd. These averages include the lambs but excludes workers dedicated to huaccho sheep, cattle and alpacas.

Table 20 shows the ratios for each class of sheep. Such averages will vary--principally those determining the number of shepherds per ewe; the lambs remain with their mothers for only a few months--with a seven month maximum in Gaya. If lambs were omitted from the calculations, ratios would be: Ucrucancha, 968 ewes per shepherd; Gaya, 1142 ewes per shepherd; and Palcan, 880 ewes per shepherd.

Only the relatively high averages of Gaya seem to be unusual considering the common practices in the Central Sierra, where 1000 sheep is considered the maximum size of a flock if lambs are not included in the calculation.

Although shepherds of flocks of rams seems to have lighter work, these sheep are more costly, and therefore are a greater responsibility. Wethers, the least valuable animals, are grazed in larger flocks.

Puna Grasslands and Employment Opportunities

The capacity of the Puna grasslands to create job opportunities depends heavily on the size of the estates or production units, and also on the quality of the pasture. Economies of scale seem possible only in the case of administrative and supporting personnel.

Currently, this aspect of the Puna is quite important, for there are political expectations regarding a change in the so-called 'huge'

Table 18. Labor Positions by Seniority (1980 sample).

Positions	Production unit	Time of employment: Less than 1 year	One to 3 yrs.	3-6 years	6-10 years	More than 10 yrs	Total
	U					1	1
Administrators	G				1		1
	P				1		1
Health Technician	U	1					1
	U	1			1		2
Guards or Foremen	G				2		2
	P					1	1
Horse boys	U		1				1
	G				1		1
Fence boys	U	1					1
	G			1		1	2
	U	5	1	1	1		8
Shepherds	G			3		3	6
	P	1	3	2	1	3	10
Others	P		1	1		2	4
	U	8	2	1	2	1	14
Total	G			4	4	4	12
	P	1	4	3	2	6	16

U = Ucrucancha
G = Gaya
P = Palcan

Table 19. Workers by Position (total permanent workers).

Position	Production Unit: Ucrucancha	Gaya	Palcan	Total
Coop's sheep shepherds	8	8	9	25
Other shepherds	-	2	2	4
Guards or foremen	2	2	2	6
Horse boys	1	1	-	2
Fence boys	1	2	-	3
"Plantelero"	-	-	1	1
Health Technician	1	-	-	1
Administrators	1	1	1	3
Others	-	-	3	3
Total	14	16	18	48

Table 20. Sheep per Shepherd Ratios (averages)

Sheep Classes	UCRUCANCHA		GAYA		PALCAN		TOTAL	
	Shepherds	Ratio	Shepherds	Ratio	Shepherds	Ratio	Shepherds	Ratio
Rams & Yearling Rams	2	620	1	691	1	560	4	623
Ewes and Lambs	4	1116	5	1543	5	1058	14	1248
Yearling Ewes	1	1581	1	078	2	681	4	980
Wethers & Yearling Wethers	1	1039	1	1737	1	585	3	1120
Total	8	1041	8	1390	9	866	25	1090

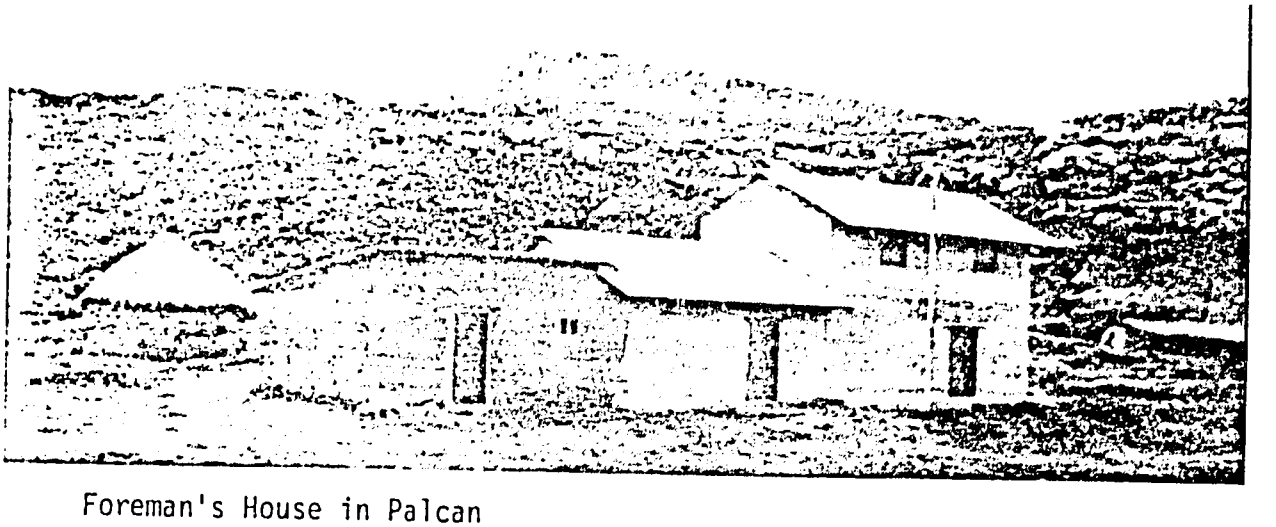
Table 21. Animals of Personal Property, Per Family (sample, 1980).

Production Unit	HORSES			CATTLE			SHEEP			GUINEA PIGS			FOWL			DOGS		
	Avg.	Max.		Avg.	Max.		Avg.	Max.		Avg.	Max.		Avg.	Max.		Avg.	Max.	
UCRUCANCHA	0.8	2	8	0.7	3	8	-	-	14	5.8	16	5	1.4	7	8	1.4	2	1
GAYA*	3.3	6	-	-	-	-	-	-	-	4.7	18	1	2.2	6	3	1.3	2	-
PALCAN	4.4	8	3	9.2	20.**	3	27.1	80	2	6.4	18	1	2.6	4	1	1.6	3	2

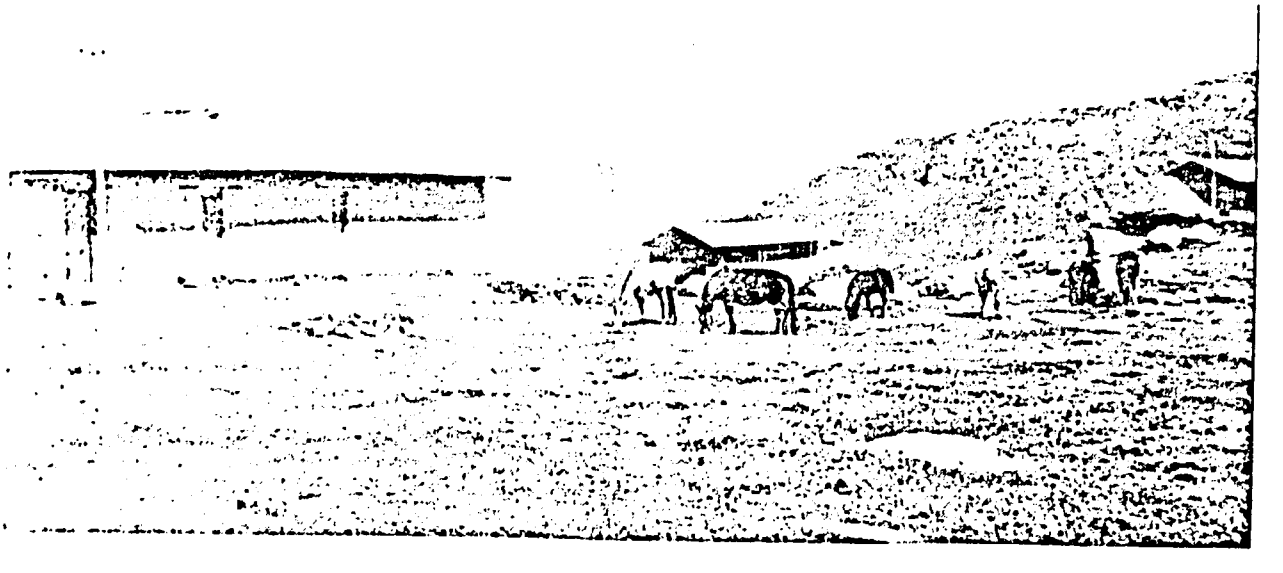
*Gaya's workers are very likely to raise animals in their houses in the community of Huallyay, mainly sheep. Comuneros' herds use to have over 50 sheep each, besides some cattle, and other animals.

**This maximum belongs to a shepherd who has these 20 cattle grazing <u>out</u> of the CAP's lands. The maximum <u>inside</u> the CAP is 14 cattle.

Shepherd's House in Palcan



Foreman's House in Palcan



Staff House in Palcan

livestock cooperatives and SAIS modus operandi. Comuneros are also invading the rangelands belonging to these enterprises. A redistribution of these rangelands to private managers or small producers (as in peasant communities) could provoke potential environmental problems such as have already occurred in most Peruvian communities due to overgrazing. Production of marketable wool and meat would probably decrease substantially.

It has been argued that (1) High-Andean grasslands are not being totally exploited as currently managed by associative enterprises, and (2) that stocking rates could be increased and therefore create more jobs for the increasing communal population. The current technological horizon, however, provides little evidence to support this view. Production of biomass in the Puna is limited by the ecosystem's fragility and susceptibility to irreversible damage due to overgrazing.

Creation of more jobs in the Puna would seem to depend on agro-industries and the introduction of cultivated pastures in the flatter areas. On steep lands, the current production alternatives appears to be limited to good ranch management.

The ratios of the total employment per grasslands area have been calculated, taking into account shepherds and total staff:

Ucrucancha	:	437.5 ha/shepherd; 250.0 ha/worker
Gaya	:	929.4 ha/shepherd; 580.9 ha/worker
Palcan	:	479.9 ha/shepherd; 293.3 ha/worker

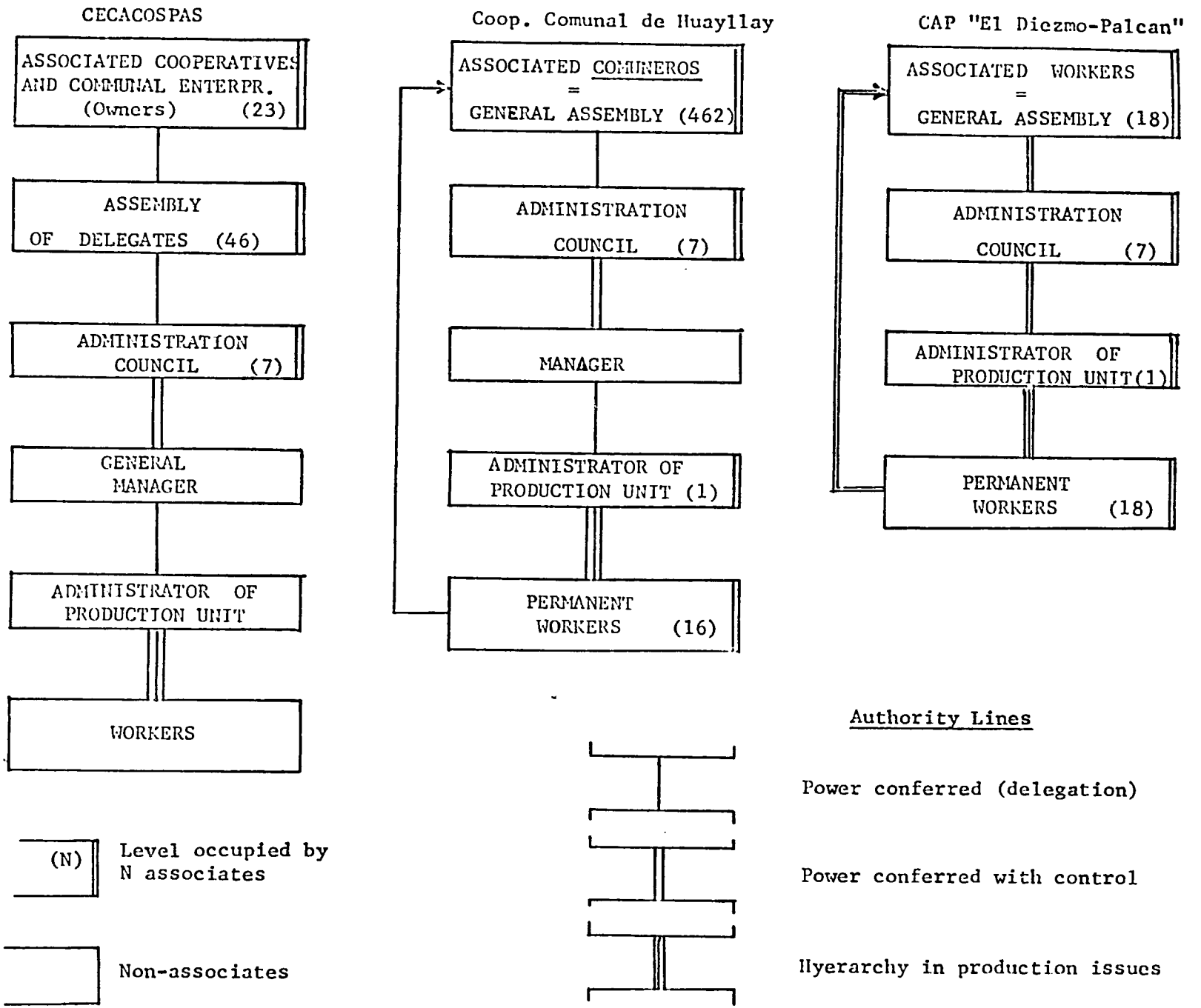
The average of the three production units is 632.2 ha/shepherd and 376.5 ha/worker.

DECISION-MAKING CAPABILITIES

Theoretically, in the associative enterprises based on the cooperative model in Peru, ordinary workers participate in the decision-making processes, as well as in the distribution of profits. Several scholars have noted, however, that self-management is a concept of doubtful utility among most Peruvian associative enterprises. It seems that the larger enterprises have less access by the worker to the decision-making process.

Figure 10 depicts the decision-making processes and also the characteristics of ownership as related to the workers in each of the production units. In all cases, the two top levels represent labor itself, while the lower levels represent the ownership. Lines connecting any two levels show the relationships between the levels. For example, no relationship is shown to exist between labor and ownership in Ucrucancha, while this particular relationship is quite weak in Gaya and very strong in Palcan. The proportion of workers participating in the decision-making process in any way is nil in Ucrucancha; 3.5% in Gaya; and 100% in Palcan. These percentages refer to permanent workers. Part-time workers are very few, and they do not account for more than 5% of the total man-hours employed.

Figure 10: SELF-MANAGEMENT AND OWNERSHIP



Separation between ownership and management receives even more emphasis. Most of the worker-owners in Palcan, a very small cooperative, participate in any directive position (in the Administration Council, 7 members, and in the Vigilance Council, 5 members--accounting for 12 out of 18). During the research team's visit to Palcan, they observed that not only did the consejeros (counselors, i.e. member of the councils) participate in the weekly meetings, but there were usually other workers present as well.

Interest in the progress of the cooperative is shared among most of its members. Symptomatic of this special behavior (not unusual, but necessary according to the philosophy of cooperativism) is the relative ease in which some difficult decisions can be made. For example, the reduction in the quantity of huaccho personal sheep and their joint management is not easily accepted by workers of other associative enterprises. A reduction requires separation of the owner and his animals, which is very difficult to achieve in other enterprises without imposing rules instead of arriving at them with workers' consent. Such self-management suggests that workers identify their interests with those of the enterprises.

Palcan has another rather unusual feature that is also associated with other communal organizations. Workers there participate in faenas or special tasks not directly related to production; these are programmed by the assembly and usually demand a huge quantity of labor. The faena method was used in Palcan to build the school, part of the road, the chapel, and other buildings. In such faenas, each and every worker is required to work at the same time; the cooperative supplies food and in some cases a symbolic payment.

Thus, at a certain level, the commune tradition remains in Palcan. However, this general atmosphere does not always create harmony among the workers and owners for disagreements often arise, and some workers are not happy with some management practices. In one case an associate had to be removed from the cooperative because of his support for the invasion of the cooperative's rangelands by some of Huayllay's comuneros in mid-1980.

In Gaya, because permanent workers and comuneros also are owners of the cooperative, the community's grasslands are accessible to them. But most workers do not participate actively in the day-to-day decision making activities that are reserved for the 12 members of the council (the council is chosen from 462 associates) and for the administrator of the production unit. The Cooperative's General Assembly is dominated by comuneros whose main activity is not animal husbandry, but commerce or mining. In this sense, the production unit itself constitutes another possible working center, for most of the workers' families are settled in the community's villages (sectores) or in the town of Huayllay. Nonetheless, the shepherds do need others in Gaya to help them with the grazing, because the shepherd must be able to leave the flock to report losses or to pick up his salary.

Finally, in the case of Ucrucancha, separation between management and ownership is almost absolute. The 23 owners are not individuals, but are cooperatives and other associative enterprises. Thus, the individual owners are the worker-owners, or owners of those cooperatives, who should delegate their representation into the General Assembly of the Central de Cooperativas. The only function of this assembly is to elect the members of Councils of Administration and Vigilance (12 members each) among its constituents.

Both councils meet at least once a month, and their presidents usually work in the offices of Cerro de Pasco. The General Manager is a professional hired by CECACOSPAS (usually upon the approval of the Ministry of Agriculture). His multiple responsibilities have almost no direct relationship with the production unit, despite the fact that the General Manager should attend closely to all the issues related to production. Thus, the administrator has almost total autonomy. The other workers have no access to the decision making process, nor do they have the right to graze their own animals.

SOURCES OF PERSONAL INCOME

The workers' incomes are derived from their salaries, as well as other sources. The most frequent of these additional sources is a form of a subsidy: workers have the right to a quota of fresh, inexpensive meat, normally costing between 20 to 50% of the market price. Additionally, on the day of the quiebra, they are allocated a portion of the edible meat from sheep that have died or have been killed. These particular subsidies are found in all three production units. In Ucrucancha, subsidies are the only source of income other than salary. In Gaya, as mentioned, workers have certain levels of income stemming from the management of their own flocks in the communal grasslands of Huayllay. These levels of income are quite difficult to estimate, for the size of huaccho herds varies widely. In Palcan, workers own some huaccho animals that are sold to cover some special expenditures requiring cash, such as medical attention, funerals, festivities, education, and the construction of housing facilities.

Salary levels are determined by the government through the Ministry of Agriculture. As of January 1980, almost all the workers in the three production units had very similar salaries, regardless of position.

Average salaries were:

Administrators:	Soles 28,872 (US$105) per month
Health Technician:	S/.27,000 ($98) per month
Guards or Foremen:	S/.27496 ($100) per month
Shepherds:	S/.27913 ($102) per month

When interpreting these salaries it should be remembered that, beginning with the economic crisis in the mid 70s, the military government approved some salary compensations applicable only as transitory remuneration, and not affecting the minimum salaries. Thus, salaries are dependent mainly upon seniority.

Workers complement their domestic food production by raising animals, such as cuyes (Guinea pigs) and some fowl. They also raise other animals to sell, such as horses, cattle, sheep, and even shepherd dogs, which are highly valuable in the Puna.

Table 21 lists those animals that are personal property, according to a sample taken in March 1980. These animals (except as noted) are raised on the production unit's lands.

Cattle, sheep, horses, and dogs are sold according to the cash requirements of the household. Both horses and dogs can be used to take care of the flocks.

FOOTNOTES

1/ See, for geographical data: Dollfus, Olivier: El reto del espacio andino, IEP, Lima, 1981.

2/ See, for example: Orlove, Benjamin: "Pastoralism in the Southern Sierra", in Andean Peasant Economics and Pastoralism, Small Ruminants CRSP, Department of Rural Sociology, University of Missouri, Columbia, 1980.

3/ As an example, in the shearing season of 1980 in Ayarracra, the cooperative Conoc-Quisque, in Pasco, acquired, from its criollo herd, average fleece weights distinctively better than most of those of 'improved' herds of other cooperatives. On the other side, SAIS "Tupac Amary", in neighboring Junin, is carrying out research on selection and management of 'pure' criollo herds (information of Dr. Maximo Gamarra, manager of SAIS).

4/ Some specialists prefer to consider the Junin sheep as a type, rather than a breed.

5/ For definitions of sheep classes, as used in this report, see Annex 1.

6/ These transfers are made in the traditional way. That is, sheep are driven along horse paths, on a 3 or 4 days' journey. Surprisingly, losses are very rare.

ANNEX 1

Definition of classes of sheep as used in this report

LAMBS (Corderos)	- from birth to weaning, any sex.
YEARLING EWES (Borreguillas)	- from weaning to first breeding, females.
YEARLING RAMS (Carnerillos)	- from weaning to first breeding, fertile males.
EWES (Borregas)	- fertile females from the first breeding.
RAMS (Carneros)	- fertile males from the first breeding.
YEARLING WETHERS (Caponcillos)	- from weaning to the first shearing, castrated males.
WETHERS (Capones)	- castrated males from the first shearing.

ANNEX 2

Equivalences Between Standard Sheep Units and Other Ruminants as Used in This Report*

Species or classes	Standard sheep units
Rams	1.2
Ewes	1.0
Wethers	1.0
Yearling Rams	0.8
Yearling Ewes	0.8
Yearling Wethers	0.8
Lambs	0.4
Llamas	1.5
Alpacas	1.0
Cattle	8.0
Huaccho sheep	0.8

*These equivalencies are very rough approximations, undoubtedly subject to large errors. We are aware that there is no way to give constant values for sheep in the process of raising. On the other hand, each class fits different definitions in different production units, notably lambs in Gaya. On the other hand, regarding *huaccho* animals, it has been considered a constant quantity of them, disregarding different classes.

Use of these equivalences was pointing only as a mean to *compare*, and there is no way to use them to measure the stocking rate.

Finally, there is no agreement among the ranch management experts upon such equivalencies.

ANNEX 3

Monthly Changes in Standard Sheep Units

Month	Ucrucancha	Gaya	Palcan
April	7,872	11,770	10,263
May	7,786	11,689	11,387
June	7,399	11,625	11,084
July	6,856	11,977	10,998
August	6,778	11,854	10,338
September	6,574	11,456	10,060
October	7,157	11,360	9,825
November	7,043	11,239	9,722
December	8,231	12,606	9,670
January	8,049	12,420	10,686
February	6,701	12,335	10,558
March	9,279	11,662	10,839
Average	7,479	11,833	10,455