Contents

On Quechua Orthography

I am not a trained linguist. In the case of historical documents, I have used the spelling as found. When variant spellings of the same word are encountered, I used the most common one. Quechua words in common usage today were spelled according to the dictionary of Cuzco Quechua by Antonio Cusihuamán G. (1976). This accords well with the Cuzco Quechua variant of the language spoken in the Colca Valley. For comments on dialectical properties of the Quechua spoken in the valley see Valderrama and Escalante 1988:26.

Chapter 1

Introduction

This inquiry represents the end of a voyage which has taken me full circle from a traditional village study set in a Peruvian valley, to regional comparisons of highland Andean peasantry, to cross-cultural studies of montane subsistence strategies, to return, finally, to the intensive study of a village. It began in the late 1960s when, as a Ph.D. student, I went to Peru to conduct fieldwork for my dissertation in three adjacent villages in the Pampa de Anta of the Department of Cuzco. I was intent on trying to understand the surprising failure of agrarian reform beneficiaries to join a cooperative set up by the government to manage the lands of the hacienda they once worked as *feudatarios*.[1] The book resulting from the research was published in 1979 (Guillet 1979).

When an opportunity arose to spend a period with the Interamerican Institute of Agricultural Sciences in its Andean office in Bogota, Colombia, I accepted, carrying out a regionwide study (Colombia, Ecuador, and Peru) of the role of associative production strategies in peasant production. By documenting the rationality and cost-benefit considerations of these strategies, I hoped to counter what I perceived to be an excessively romantic notion of rural cooperation. I came to see these forms as common Andean patterns of adaptation to vertical production zones and a reflection of the peripheral position of peasants in larger regional and national systems.

The experience in regionwide comparative studies was exhilarating and encouraged me to cast my net still farther. I suspected that many economic and social patterns of Andean peasants were not unique to the Andes but represented common adaptations to mountain environments. Yet, many Andeanists in a search for the unity of Andean culture seemed reluctant to look beyond the borders of the Andes and confront non-Andean parallels.[2] It occurred to me that if parallels existed they would most likely be found in the Himalayas, a region, like the Andes, of tropical high mountains. In 1977 I spent a summer in libraries in India and France working out some specific Andean-Himalayan comparisons. The results of the research were presented, initially, as a model of the human ecology of tropical high mountains (Guillet

1983) and, later, as part of an effort to compare systematically the social organization, intellectual history, agro-pastoral production, regional history, and belief systems of the two mountain areas (Orlove and Guillet 1985).

From Household Production to Communal Resource Management

During my comparative inquiries, a fresh set of questions arose. One was triggered by the now-famous paper published in *Science* in 1968 by Garret Hardin, a biologist and human ecologist, on his theory of the "Tragedy of the Commons." In its essentials, the theory argued that individual self-interest prevails over communal well being; in practice, it challenged the efficacy of communal resource management. The Himalayan region, containing numerous villages with communal management of forests, pastures, water, and agricultural lands and experiencing massive environmental degradation, became a testing ground for the theory. Many observers were placing the blame, unfairly it turns out (Ives and Messerli 1989), for the degradation of natural resources on the mountain villages that managed them.

The ongoing debate over communal resource management and environmental degradation has led Andeanists to reconsider the nature and efficacy of communal resource management in the highlands of Peru, Bolivia, and Ecuador. In the Andean context, the debate has been over the causes, strengths, and effects of constraints on household allocation of production factors by communal resource management. Initial attention centered on a widespread, but poorly understood, agro-pastoral regime of the middle altitudinal belts known as sectorial fallowing. Sectorial fallowing was similar to the English common field systems, both in the grouping of land into sectors, of which some are in cultivation and others in fallow, and in an agreed-upon sequence of field and crop rotation.[3] At the end of the harvest, the entire land area becomes one large grazing commons.

One set of observers argued that, over the long term, Andean environmental parameters have been rather stable and communal resource management contributed to this stability.[4] While the Andean systems had resisted the dramatic enclosures and intensification of their English counterparts, reports began to mount of enclosures, parcelization, and degradation, clouding the picture. Were we beginning to witness another, belated, example of a tragedy of the commons, in the form of fertility declines and land erosion caused by injudicious shortening of fallow?[5] The debate over the relationship between land use, communal management, and environmental degradation, while far from resolution, was salutary and brought about an awareness of a possible environmental downside to economic development.

The debate over the efficacy of communal resource management in the Andean context uncovered deficiencies in our understanding of the rural economy. The one aspect on which there was a consensus was the ubiquity of the household as the unit of production.[6] Household heads allocate the factors of production at their disposal over the short term in meeting the consumption needs of their families. Allocation decisions are carefully designed to reduce risk through mixed subsistence strategies, mixed staple production in vertical and horizontal space, and polyvalency—the inclusion of other forms of productive activity in addition to subsistence production. Allocation decisions also reflect Chayanovian principles (Deere and de Janvry 1981). Increased consumption needs triggered by household growth or market forces would be met by a change in the allocation of land, labor, and capital.

This conception of the Andean peasant economy assumed a short-term perspective for peasant production, one that extended only from field preparation to harvest, marked by an intermediate "dead" period when, freed from agricultural labors, peasants could migrate elsewhere to engage in wage labor. While superficially accurate, such a conception denied a longer-term side to the economy. Many constraints on household production, however, have a long time horizon and lie outside the control of the household and its personal network. Through the allocation of collective labor, pasture, water, and firewood, the setting of rules regarding the use of these resources, the scheduling and coordination of the agricultural calendar, and the negotiation of long-term production strategies, communal resource management responded to these constraints and acted as a long-term, facilitating adjunct to the household (Guillet 1978, 1981; Brush and Guillet 1985).

Focusing on communal resource management raised a series of unanswered questions. Of particular importance was the nature of the relationship between household production and communal resource management. It seems apparent that each sphere depends on the other for its existence: the household cannot survive and reproduce itself without communal resource management, and communal management would cease to function without the property relationships that bind together and motivate households to monitor and maintain their joint resources. But the principles on which this relationship operates are not clear. Such principles include the implicit expectations that households share when they show up for collective labor parties, agree to rotate plots and crops, elect communal representatives, and agree to limit water for irrigation or animals on communal pastures.

How are these communal resource management principles put into operation? To take one common example, much effort has been expended to document an ideal of the control over a maximum of the range of vertical production zones (Brush and Guillet 1985). How would communal management incorporate this principle into a long-range strategy of providing households with access to each of these zones? Would it institute restrictions on membership, prohibit the sale of land to outsiders, institute a lottery, rent out assets? How does communal management institute compliance with a common agricultural calendar, recruitment of collective labor, or the rotation of crops and plots?

There is also a need to understand the process and implication of simultaneous and interactive shifts in the household and communal management spheres associated with agrarian change. In particular, to what extent are resource management principles retained or modified under pressures for agrarian change? This question relates to issues such as the following: How do collective concerns hinder or facilitate acceptance or rejection of innovations by individuals? In agro-pastoral regimes, does population pressure result in a willingness to allow animal numbers to increase, with subsequent overgrazing, in order to increase the availability of manure for the intensification of agriculture? When faced with pressures from market penetration, is capital allowed to be accumulated by sale or transfer of some (or all) resources in order to finance new enterprises or educate children? How do communities maintain control over resources in the face of pressures to individualize production?

Such questions take us outside the boundaries of the local resource management community. If we have learned anything in the last three decades, it is that localities are caught up in the dynamics of more inclusive systems, be they region, state, or world-system. In particular, Andean states are responding to the need to feed growing populations by expanding their role in natural resource management. Their efforts include codifying and updating resource management laws, expanding agricultural ministries to implement the new laws, charging agricultural universities and research stations with finding better ways to manage natural resources, training extension agents to acquaint farmers with the new laws and procedures, and designing ways to resolve conflicts. The expansion of state power in the sphere of resource management provokes important questions concerning linkages between the state and the locality, the efficacy and impact of these linkages on the autonomy of existing local resource management systems, and the features of regional systems that inhibit or facilitate their implementation.

The Colca Valley and the Village of Lari

It seemed that the questions I was now asking could only be answered by turning away from regional synthesis to fine-grained ethnography and the traditional field setting of the community. In 1982 I returned to Peru to explore research possibilities and visited the Colca Valley, one of several that descend the western escarpment of the Andean Cordillera in southwestern Peru, in what was, at the time, virtually a *tierra incognita* on the Andean ethnographic map.[7] Published aerial photographs from an expedition to Peru in the 1930s revealed complex, well-maintained agricultural terraces (Johnson 1930; Shippee 1932, 1934). A recently discovered collection of early colonial documents promised to be an excellent early historical resource.[8]

I returned to the Colca Valley in 1983 intent on embarking on a year-long study of a village. At that time, the valley was still reeling from disruptions caused by the Majes irrigation project to dam the Colca River upstream and channel the water along the south side of the valley toward the coast, where it would be used to irrigate a stretch of desert. Townspeople in Chivay, the provincial capital, had been killed by trucks rampaging through the town, and the brothel on the main plaza that replaced the tourist hotel was causing discontent. Irate authorities posted signs at the entrance to Chivay prohibiting the ingress of the bright yellow project trucks.

In searching for a village on the north side of the valley, to avoid the disruptions caused by the Majes project on the south side, I noticed photographs of Lari in the Shippee-Johnson collection, a nucleated village situated midway between Chivay and Tapay and perched on a river terrace with magnificent agricultural terraces stretching above and below it.[9] Lari had been the center of Lari-Collaguas, one of two main divisions of the Collaguas people. Among the documents in the parish archive at Yanque was a complete Visita, tribute-list, of one of the moieties, Lari-Hurinsaya, and a partial one of the other moiety, Lari-Hanansaya, from 1604.

During my initial visit to Lari in the company of a geographer, William Denevan, also on a reconnaissance trip to get his own project on long-term agrarian change underway, we climbed up to the village from the river bottom. Immediately below the top of the alluvial terrace on which the village is situated, we encountered numerous human remains in loose, sandy soil. They turned out to have been deposited by a recent landslide that affected the village cemetery on the front of the alluvial terrace on which the village sits. The landslide and the continued danger in which it placed the village was a constant topic of conversation during the fieldwork period.

When we finally arrived in the plaza, hot and dusty from the climb, we walked into the first small retail store (*tienda*) we could find for a drink and got into a conversation with the owner. He seemed very knowledgeable about land use and was able to provide focused and reasoned answers to my inquiries about terracing and irrigation. I remember Bill and I remarking how great it would be to find a village full of informants like the tienda owner. Little did we know at the time that we had happened on the agricultural extension agent (*sectorista*) for the village!

Communal Water Management

The most important limiting factor in agriculture in the Colca Valley, like all valleys that descend the western slopes of the Cordillera, is insufficient moisture. Irrigation systems with complex rules for water rights and distribution have evolved to transport ground and surface water to agricultural fields and natural pastures. These systems are managed by village assemblies or smaller groups of irrigators that share a ground or surface water source. Water is of such importance, and so much of day-to-day existence is organized around it, that it came to be the focus of my fieldwork from 1983 to 1984 and the window through which I view life in the village.

In focusing on water, I hope to expand our knowledge of Andean highland irrigation systems. As yet, there is a limited corpus of ethnographic references to highland Andean irrigation and water control systems, surprising since water management, in the form of canal irrigation, terraces, raised fields, and sunken fields (*cochas*), among others, has been one of the most creative and productive technologies employed by Andean peoples to render their challenging environment so bountiful. I hope through this study to present the first in-depth ethnographic treatment of a contemporary highland Andean canal irrigation system.

Water Management and Human Organization

The relative lack of interest in Andean highland irrigation is also unfortunate since these systems can help to illuminate the relationship between water

management and human organization, an issue of more than passing interest. In one form or another, it has provided a test of several theoretical paradigms. Marx recognized the distinctiveness of irrigation-based societies in Asia and incorporated them as a special case—the Asiatic Mode of Production—in his materialist theory of historical developmental change.[10] Wittfogel, as early as 1926, proposed that the distinctiveness of such "Asiatic" societies, in particular despotic control over the densely populated ancient states, was attributable to the exigencies of water control in arid environments (Wittfogel 1957). Both theories have fallen into disrepute. Scholars recognize that a lack of accurate ethnographic descriptions of these societies kept Marx from making sense of them. Wittfogel's model of the Hydraulic Society has been challenged by numerous examples of extensive irrigation works without accompanying despotism and autocracy (the Hohokam in Arizona, Sri Lanka, Bali, and highland Peru).[11]

Once the dust settled from the criticism of Marx and Wittfogel by archaeologists, ethnographers, and ethnohistorians, something of a fragile consensus emerged. While the contribution of irrigation to the development of large-scale civilizations has been accepted in several instances, notably coastal Peru, Mesopotamia, China, Egypt, and Mexico, there remained a rather large residue of irrigation systems tending to be small in scale, indigenous, long-lasting, and local in scope and knowledge. Intense study of these systems can answer important questions concerning the social and political forms to which organization for irrigation leads, the forces behind their emergence, the relationship between water management and household production, and their sustainability.

The Andean highlands of Peru, Bolivia, and Ecuador are an excellent locale to appraise these questions. Rather than the centralized hydraulic bureaucracies of the Central Andean coast (Steward 1955), prototypes of Wittfogel's Hydraulic Society, in the highlands one finds small-scale village and intervillage irrigation systems that draw water from rivers, springs, and runoff from high altitude seeps and snowmelts into open canals for transport directly and indirectly, following storage in reservoirs, to fields. Canal and reservoir construction and maintenance, water allocation and distribution, and conflict resolution are often managed collectively through consensual decision making.

The Andean highlands are particularly appropriate for the investigation of the association between irrigation and sociopolitical organization for two reasons. On one hand, the unity of language, culture, and society across the highlands is remarkable. Two indigenous languages, Quechua and Aymara, dominate, although one finds small groups still speaking aboriginal languages such as Uru, Kauke, Tupe, and Chipaya; in many other ways Inkan hegemony was strong. The cultural unity of the Andes is striking, particularly in comparison with the diversity of language, culture, and society in the Himalayas.[12] On the other hand, variation in the Andean highland water management systems is great: within the same drainage basin, water flow patterns, physical irrigation infrastructure, and the sociopolitical organization of irrigation can diverge substantially from one village to the next. The diversity in water management systems suggests complex interactions of technology and environment with social, economic, and political organization.[13] Variation in irrigation systems in a setting of relative cultural homogeneity allows unique opportunities for carefully controlled comparisons that can address the priority of idealist versus materialist factors in culture, a subject of heated controversy.

The Interaction of State and Locality in Water Management

Much of the history of the dynamics of small-scale irrigation systems has resulted from the interplay of the state and the locality, mediated in important ways at the regional level. Today, more than ever in the Third World, the state has moved into the sphere of local water management. Faced with the need to feed growing populations, states increasingly attempt to improve water use by codifying and updating water management laws, expanding agricultural ministries to implement the new laws, charging agricultural universities and research stations with finding better ways to transport, allocate, and distribute water, training extension agents to acquaint farmers with the new laws and procedures, and designing ways to resolve conflicts. The efficacy of these managerial innovations is becoming a much discussed aspect of irrigation today (Coward 1990; Merry 1987; Uphoff 1986; Uphoff, Wickramasinghe, and Wijayaratna 1990; Chambers 1988; Nobe and Sampath 1986; Hunt 1989).

The impact of state intervention on indigenously organized irrigation is an issue highly relevant to the Peruvian context. Efforts in Peru to improve water management date to the enactment of a national water code in 1902. Designed in response to upstream-downstream problems endemic to large-scale river-based irrigation systems of the coast, the law had a rather limited impact in the highlands. This changed dramatically with the enactment of a radical water law by a decree of the reformist government of President Velasco in 1969. This law strengthened special-purpose irrigation associations at the local level and linked them to a hierarchy of canal and regional levels of water management. It reversed a trend since the Spanish Conquest of transferring water management responsibility from *ayllus* to multipurpose civil and municipal administrative bodies. It also contains provisions to reorder highland small-scale irrigation systems. For example, new mechanisms of conflict resolution could either strengthen ineffectual local-level procedures or weaken them by the transfer of adjudicatory power to regional bodies susceptible to influence by elites. Attaching water rights to land tenure legislation could also have unforeseen effects on regional political economy.

The implementation of this law presents an interesting opportunity to analyze the dynamics of locality, region, and state. Implementation of the 1969 Water Law has been highly variable, with some highland communities adopting it wholeheartedly, others in piecemeal fashion, and still others rejecting it out of hand. I will address in this book the response to the implementation of the law in Lari.

Organization of the Volume

Every community has a history that makes descriptions of the present suspect. By abstracting from the present for purposes of linking water management with human organization one runs the risk of slighting the short-, middle-, and long-term temporal contexts within which belief and behavior are situated. In chapter 2, I attempt to isolate key historical forces that inform the present in Lari. I find these to include geographical isolation, a Collaguas polity, Inka provincial reorganization, the discovery of rich mineral deposits above the valley during a very sensitive period in Andean history, and recent changes in transportation and communication networks. It will be a frustrating enterprise, marred by the fact that the rather good (some would say spectacular) documentation for the early colonial period is followed by a relative hiatus until this century.

The review of land tenure and use in chapter 3 confronts the anomaly of there being measurable inequities in land distribution but a lack of perception by villagers of land-based class differences. Could the allocation and distribution of water have something to do with this? This question initiates my inquiry into irrigation that begins with an analysis of the transport and delivery of water to irrigators in chapter 4. This chapter and the next, on crop production, emphasize the household as unit of production: gaining access to land, showing up at meetings to claim water shares, and allocating labor and capital to land in order to meet house hold production goals.

Chapter 6 is the first of two chapters treating the communal dimensions of water management, beginning with a consideration of its history in highland Peru. This provides a temporal backdrop for the analysis of the principles informing communal water management, their relationship to household production, and their modification during agrarian change in chapter 7.

In chapter 8, I explore how conflicting pressures of agriculture and pastoralism lead to different forms of social organization and how these forms are integrated in an agro-pastoral society. No account of Lari that addresses the economy would be complete without a consideration of pastoralism. This is taken up in chapter 9. In chapter 10, the focus is on the politics of water—the stakes, resources, and arenas within which water is contested. The next two chapters deal with communal water management in two historic time contexts. The first looks at the adoption of alfalfa into the system as a long term response to perceived water scarcity. In the second, I show how water transport, allocation, and distribution respond over the short term, recounting events during the drought year of 1983–84. The last chapter sums up the material and relates it to what we know from other studies of Andean highland irrigation and wider cross-cultural issues in the relationship between irrigation and sociopolitical irrigation.

Chapter 2

The Historical Roots of a Colca Valley Community

> In the heart of Peru lies a volcanic area of forgotten towns and deserted villages.
>
> —Shippee 1934:113

In 1928, Lieutenant George R. Johnson, chief photographer of the Peruvian Naval Air Service, flew from Mollendo, a port serving southern Peru, across the dry coast and the high desert and up over the snowcapped volcanos. After having flown northward from Pichu-Pichu, the plane prepared to swing westward for photographs of the volcanos Ampato and Chachani. All of a sudden Johnson and his pilot were staring over the edge of a deep gorge.

> Around them, stretching away on all sides to the horizon, lay the smooth slopes of the plateau summit—cold, monotonous, and lifeless, broken here and there by narrow irregular ranges and isolated peaks, their ragged crests capped with snow. Beneath them a steep-walled canyon dropped away thousands of feet to a narrow valley floor filled from wall to wall with a patchwork of fields in countless shades of vivid green set close with neatly-laid-out villages. The photographs caught thus by accident were the most spectacular of the whole series and perhaps the most interesting. (Johnson 1930 :27)

A dramatic photograph of the valley replete with small villages and isolated herders' shacks was shown to New York historians, among whom was probably the noted Andeanist Philip Means.[1] The New York group was quite interested and helped to gather funds to outfit an expedition that included Lieutenant Johnson, Robert Shippee, a pilot and historian, and four others. In Peru, the Shippee-Johnson expedition floundered, losing one of its two planes, which forced a decision to reconnoiter the Colca Valley by land.[2] Setting out from Arequipa, the expedition took two and a half days of arduous travel by train and muleback to reach Chivay, the transportation and communication center of the valley. In the first leg of the journey, by train, the group departed Arequipa, in a warm valley at about 8,000 feet, and ascended the volcanic slopes to the east leaving behind the green valley floor. They descended the train at Sumbay, a stop in the Pampa de Cañaguas, a desolate windswept plateau known to nineteenth-century travelers. From there they traveled north by mule, coming to the edge of the gorge from which they descended into Chivay.

The bulk of the time in the Colca was spent searching for a stretch of level ground on which to land their light aircraft. About a day's ride from Yanque, in a sparsely populated village with an enormous church, they came upon a long, hard, fairly level span of land ideal for a landing strip. Under the direction of local authorities, 165 men, women, and children labored for six days to divert irrigation canals, fill in depressions, and move heavy boulders to build a landing strip nearly 4,000 feet long.

The publication in *National Geographic Magazine* of a photograph of villagers feting the landing of the airplane in Lari focused attention on this remote Andean village, if for only a short while (Shippee 1934). Today, villagers walk across the landing strip, known as the Pampa de la Aviacíon, on their way to terraced fields below the village but recall nothing of its origins. The subject of this book is an ethnographic description of Lari, half a century later.

Geographical Setting

The Colca Valley lies in the western branch of the Andean cordillera (fig. 1).[3] The physiognomy of this area is a complex of unusually high plateaus and well-graded, moderate slopes, created by uplift and glacial erosion, and cut by deep canyons with steep sides and narrow floors. Spectacular volcanos arising from the broad surfaces were active during the Pleistocene and Holocene epochs. In 1600, one of them, Huaynaputina, erupted and caused much loss of life; and as recently as the eighteenth century, villagers in Achoma, across the Colca River from Lari, could see smoke and flames issuing at night from a volcano, either Ambato or Sahuanca (Bueno [1764–79]1951:88). This may have been the eruption that buried agricultural terraces of the neighboring Andagua Valley in lava (Shippee 1932). Other evidence of eruptive activity includes explosion calderas, eroded cinder cones, lava flows, and tephra deposits. These disruptions of normal, well-graded, broad sur-

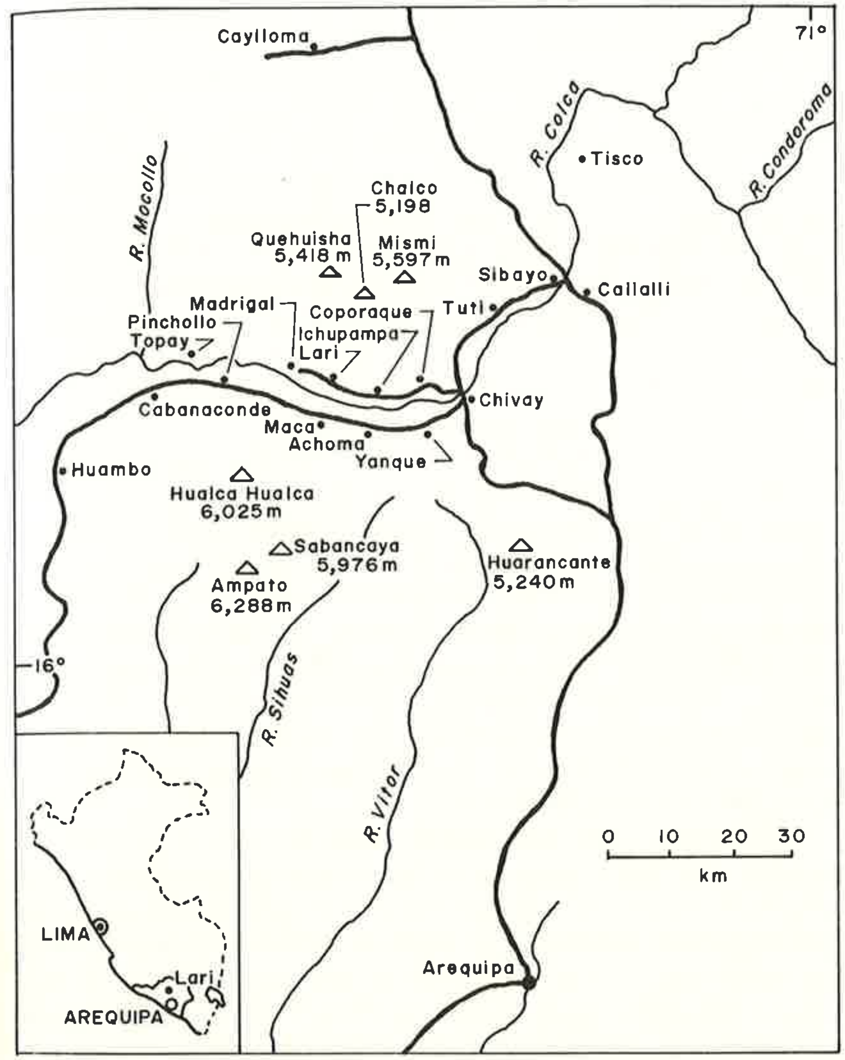

Fig. 1. Lari and the Colca Valley

faces have made travel to and from the Colca Valley difficult, helping to explain its historic isolation.

From its source high in the Andes near Laguna Lagunillas west of Puno, the Colca River descends into the upper valley, passing through the towns of Sibayo and Tuti. It then enters a narrow canyon flanked by alluvial terraces, the middle Colca Valley. Leaving the western flanks, the river passes through a dramatic deep gorge cut by a change in the river's gradient. From there it enters its lower course, changing in name to the Majes River, as it crosses the Majes pampa, and the Camaná River, as it empties into the Pacific Ocean. On the north side of the valley, waters that originate in snowcaps above Lari feed streams argued by some to be the source of the Amazon (Majcherczyk 1983) .

The middle Colca Valley can be characterized as a series of stepped geomorphic surfaces separated by steep scarps or hill slopes. The surfaces are alluvial terraces of the Colca River and its tributaries. Denevan and his colleagues (Denevan, Treacy, and Sandor 1986:49; Sandor 1989) have identified eight separate surfaces, all of which can be found within the territory of Lari: the narrow channel and floodplain of the river, a low alluvial terrace subject to flooding, and the remainder, consisting of either gravel fills, sand, and fine-grained sediments or erosional surfaces underlain by thin alluvium over bedrock. Villages tend to be located on an older, extensive, alluvial terrace that overlooks the inner valley.[4] Population centers are almost entirely absent in the high plateaus above the valley. At 5,000 to 5,200 meters above the valley, glaciers occur.

Farmers refer to the canyon and the agricultural zones of the valley and the inner valley floor as the *quebrada,* in contrast to the high, sloping or flat, areas above the limits of agriculture, the *puna* or *parte alta* (fig. 2). Within both the quebrada and the puna are relatively flat sections known as *pampas* and *laderas* (slopes). In geomorphic terms, pampas in the puna refer to high plateaus that predate the incision of the Colca Valley and to surfaces of relatively level to gently sloping alluvial terraces in the valley.

While landslides are found throughout the Colca Valley, they are most extensive in the area around Lari. Many factors contribute to this phenomenon, including naturally steep slopes, undercutting of slopes by the Colca River, unstable sediments, saturation of sediments from seepage or high precipitation events, and earthquakes often associated with landslide activity. Landslides are indicated by features such as headwall scarps, rumpled topography from rotational slumps and earthflows, and landslide blocks and depressions. While most of the landslide activity is Pleistocene in origin, events

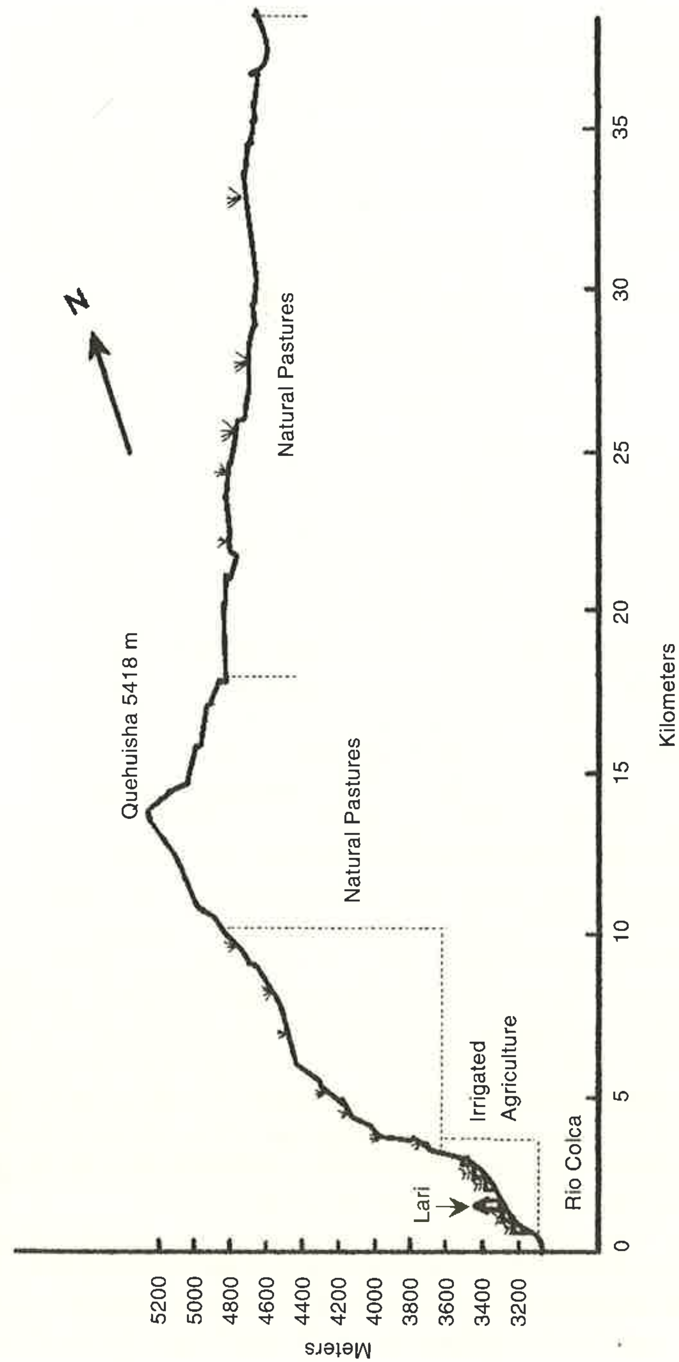

Fig. 2. Lari transect

continue into the present. Large landslides in 1978 on the unstable lower slopes caused extensive damage and loss of cultivable area. Landslides have been and continue to be a significant influence on agricultural land use (Sandor 1989).

The natural vegetation of the valley is sparse, consisting of perennial grasses, semi-woody shrubs, and various cacti.[5] While the Colca Valley is virtually treeless today and was so during the sixteenth century, relics of *quinuar* (*Polylepis* sp.), *quishuar* (*Budleia incana*), *qasi* (*Haplorus peruviana*), and *aliso* (*Alnus Jorullensis*), the use of tree names for place names in early documents (e.g., *quishuarqata*) and the successful introduction of semidomesticates such as *Eucalpytus globulus* suggest a potential for forestation.[6] The lack of trees today may be a reflection of changes in vegetation associated with long-term grazing, agriculture, and fuel gathering (Guillet 1985a). On the other hand, there are no soil features indicating forest vegetation (Sandor 1987).

The altitudinal limits of the Colca Valley (3,100 to 3,900 m.) place it within the Montane Steppe ecological formation. Altitude increases as one moves east along the valley from Cabanaconde, its westernmost population center. By the time one reaches Sibayo, the easternmost extension, the increase in annual rainfall produces an ecological formation more akin to Humid Montane Forest (ONERN 1973). It is in the middle section of the Colca Valley, from the villages of Chivay to Cabanaconde, that the main population concentrations occur: they are survivals of a prehistoric Collaguas polity, subsequently conquered by the Inka under Mayta Capac and then hispanicized as a result of the Spanish Conquest.

The Collaguas

The Collaguas were one of several ethnic groups in and around the borders of Lake Titicaca—including the Cana and Canchi south of Cuzco, the Pacaje south of Puno along the Rio Desaguadero, and the Qolla and the Lupaqa—that may have been structured as independent kingdoms or chiefdoms. These ethnic and political units flourished following the decline of Tiahuanaco culture and were in existence when the zone was incorporated into the Inka Empire (Lumbreras 1974:200–205; Julien 1983).

One of the traits they shared was the use of Aymara or Hak'e-aru (language of people). In the earliest known grammar and dictionary of the Aymara language, dating from 1603, the Jesuit Ludovico Bertonio reported that Aymara was spoken in the area from about 30 miles south of Cuzco to what is now southern Bolivia (Bertonio [1612]1879:10; see also Julien 1983:46). According to Bertonio, the peoples, or *naciones,* who spoke Aymara included the Collaguas, Canas, Canchis, Qollas, Lupacas, Pacajes, Carangas, and Charcas, among others.

An important indicator of Qolla ethnicity was a tall brimless hat that narrowed at the top. Illustrations of the Qolla hat can be found in Felipe Guaman Poma de Ayala.[7] This particular style of headdress was worn in the entire Lake Titicaca region, from the northern Lake Titicaca basin to the southeastern limits of the Pacajes province. The Collaguas territory is the only location outside of the Lake Titicaca region where the Qolla headdress was worn (Julien 1983:42–43). Heads were deformed by the Qollas to conform with their headdress. The Collaguas shared this practice and the description of the method of head deformation suggests that it followed Qolla practice (Julien 1983:43). Other traits that indicate an identification of Collaguas and Qolla culture are technology, settlement type, and burial pattern, utilizing the famous funerary towers (*chulpas*) (Lumbreras 1974:201).

According to Ulloa Mogollón, the Collaguas descended from a snow-capped volcano, called Collaguata. Deformation of children's heads to resemble the volcano kept alive the memory of their ancestors (Ulloa Mogollón [1586]1965:327). The importance of volcanos in Collaguas origin myths attests to their potential for disruption in southwestern Peru. Volcanos were also the subject of cults that enabled indigenous peoples to control their anxiety over this powerful force. Because such beliefs were heavily repressed by the Spanish priests, we may never be fully able to reconstruct their content.[8]

The Cavana people, at the southwest end of the middle Colca Valley, were not, on the other hand, ethnically related to the Qollas. While the people of Yanque-Collaguas and Lari-Collaguas spoke Aymara, the Cavana spoke Quechua, the language of Cuzco (Ulloa Mogollón [1586]1965:328–29). Other traits linking Collaguas with Qolla culture—origin myths, hats, and mode of head deformation—were different among the Cavana. Today, the distinctions between Cabanaconde and the other higher villages of the middle Colca Valley remain. Villagers from Cabanaconde speak Quechua with a different pronunciation and vocabulary from their Colca neighbors, wear a distinct folk dress, and are separated by a natural topographical boundary.[9]

The Collaguas under the Inkas

According to most chroniclers, the Collaguas were incorporated, by conquest, into the Inkan empire during the reign of Mayta Cápac (ca. A.D.

1220).[10] Inkan administrators chose Coporaque, on the north side of the valley, as their provincial center and constructed a palace covered with sheets of copper and a bridge to connect the town with Chivay on the opposite bank of the river (Benavides 1983a:23). An Inkan settlement was also established at Lari.

In their approach to empire building, the two great New World empires, the Aztecs of the Basin of Mexico and the Inka, differed radically. The Aztecs were content with allowing newly conquered states to maintain their sociopolitical organization largely intact as long as they provided tribute (Sanders and Marino 1970:65). The Inka reorganized their conquered peoples into repetitive images of a symmetrical, centralized formal order. The archetype of Inkan cosmology was the imperial capital, Cuzco. From a central point in Cuzco, the Coricancha, now the monastery of Santo Domingo, radiated forty-one sightlines (*ceques*) oriented to a distant landscape feature on the horizon, such as a mountain, spring, or a rock. The wedge-shaped divisions created by these lines bounded social groupings known as *ayllus* and *panacas*. The ayllu was a corporate descent group that collectively owned resources such as land and water and practiced endogamy. The panaca was a royal ayllu that fulfilled special, higher-level functions for the Inka state. Ayllus and panacas were assigned specific landscape features (*wakas*) and venerated them as their mythical place of origin. Each group of three ceques and associated wakas was ranked: *Collana* (upper), *Payan* (middle), and *Cayao* (lower). Panacas were always assigned higher ranking ceques than ayllus.

Overlaying the radial ceque organization was a dual organization between an upper half (*saya*), Hanan Cuzco, and a lower half, Hurin Cuzco. Each of these sayas was further bifurcated creating a quadripartion (*suyu*). Thus, Hanan Cuzco and Hurin Cuzco were divided into Chinchaysuyu/Antisuyu and Collasuyu/Cuntisuyu, respectively.

The Inkan organization of Collaguas province has been heralded as an unusually clear and faithful application of these principles (Zuidema 1964; Rostworowski de Diez Canseco 1983:121–23.[11] The Collaguas people were divided into halves, known as Lari-Collaguas and Yanque-Collaguas. Each half was ruled by a *curaca principal* and a *segunda persona*. The capital of Yanque-Collaguas was the town of Yanque; Lari, the capital of Lari-Collaguas. Yanque-Collaguas, located on the right side of the Colca River, looking toward the rising sun, was of higher status than Lari-Collaguas, on the left side of the river. Each half was further subdivided, creating the quadripartitions of Lari-Hurinsaya, Lari-Hanansaya, Yanque-Hurinsaya, and

Yanque-Hanansaya. Collaguas social organization was similar in this regard to the Lupaqa, an Aymara kingdom in the region of Chucuito. According to a Visita of Garci Diez de San Miguel from 1567 (Diez de San Miguel [1567]1964), the Lupaqa were organized into two moieties, Hanansaya and Hurinsaya, each governed by a curaca principal. Don Martin Cari, the curaca of the Hanansaya, enjoyed greater prestige than Martin Cusi, his counterpart, the curaca of Hurinsaya. In villages such as Acora, Illave, and Juli, there were two curacas, one each for Hanansaya and Hurinsaya.

There were nine ayllus, grouped into threes and ranked according to the Inka order. Each ayllu had a counterpart in one of the nine ceque in each of the four suyu of Cuzco and in the groups linked to these ceque.

Andean origin myths often build on a belief that an underground sea surrounds the world and erupts to form lakes and streams on the earth's surface (Sherbondy 1982:120ff.). From these sources emerged the ancestors of present-day peoples and the water that they use for irrigation. Lake Titicaca is of special importance in these myths for from this, the largest and most important highland lake, the deity Viracocha created the sun, moon, stars, and ancestors of each of the Andean peoples. Viracocha ordered the ancestors to travel from Lake Titicaca via the underground sea to emerge from lakes, springs, rivers, hills, caves, and the roots of trees and to found ayllus. At their deaths, ancestors returned to the underground sea, their source of life.

Inkan myths connecting the origins of social groups with their emergence through streams and lakes from an underground sea differ significantly from Collaguas beliefs in their emergence from a volcano. The successful diffusion of their origin myths was an adroit move by the Inka from the perspective of state building and the consolidation of local ethnic groups following the Inka Conquest. The myths shifted emphasis to the water that was essential to the expansion of an irrigation-terracing-maize complex throughout conquered Inkan territories. Collaguas myths tracing their origin to a volcano provided a sense of cultural identity but supplied little ideological justification for the intensification of irrigated maize agriculture carried out under the Inka. Myths connecting the origins of the ayllus to local sources of water gave these groups preeminence. Lastly, Inkan myths carried a subtext of control over nature through ritual appeasement of water spirits that was lacking in the fear and unpredictability of Collaguas volcano cults.[12]

Inkan state building is apparent in other ways. Ulloa Mogollón reported in 1586 that the Indians of the Colca Valley, with the exception of the Cavana, were still speaking Aymara. He also was able to record an origin myth for the Collaguas that was distinctly local and not Inkan. Yet today, only four of eighty local names of archaeological sites in Caylloma Province are of Aymara origin (Linares Málaga 1982), and origin myths collected by Hurley (1978:30) in Colca Valley villages are predominantly Quechua with Inka themes, suggesting the recreation of origin myths with little basis in history. The virtual absence today of Qolla culture is remarkable and suggests an important, but yet-to-be-understood role for the Spaniards as agents of the diffusion of Inka culture after the conquest.

The Spanish Conquest and the Colca Valley

The Colca Valley first began to experience the impact of the Spanish Conquest when the Crown became interested in establishing a maritime link between Lima, Cuzco and Charcas.[13] The coastal port of Camaná was established to this end in 1539 but quickly proved inhospitable and in 1540 was bypassed with the founding of Arequipa, farther up in the highlands. From this date until 1570, Arequipa served as the main link between Lima and the highlands, particularly the mines of Potosi. While Arequipa's intermediary role declined when the port of Arica was opened in the 1570s, it remained instrumental in the transport and commerce of goods to and from the highlands.

The Colca Valley played an important role in the solidification of a coast-highlands transportation and communications network because it lay along the Inkan road connecting Arequipa with the imperial capital of Cuzco. While travel between the Colca Valley and Arequipa has always been arduous, the valley was sufficiently close and productive to supply the city with foodstuffs and to offer investment opportunities to Arequipa bourgeoisie. The date of the first entry of Spaniards into the valley is still unclear, but it is known that Gonzalo Pizarro, the half brother of Francisco Pizarro, visited the valley around 1547 (Cook 1982:3). Some of the first and largest *encomiendas* to be distributed in Peru were located in the Colca Valley.[14] The Collaguas encomiendas were granted "for two lives" and with the death of the last encomendero, reverted to Crown control (Davies 1984:25). They were highly prized because of the dense Indian population and diverse productive resources they harbored. Lari-Collaguas was divided by Francisco Pizarro into two encomiendas, along moiety lines.[15] Hanansaya was assigned to Marcos Retamoso, who was succeeded at his death in 1563 by his son Francisco Hernández Retamoso. Alonso Rodriguez Picado, one of Francisco Pizarro's secretaries, was bestowed Hurinsaya. He was replaced at death by

his son Alonso (Málaga Medina 1975:301–2, 1977:111–12). Francisco Pizarro gave his half brother Gonzalo the encomienda of Yanque-Collaguas.

The Toledan Reforms and the Visita of Lari-Hurinsaya, 1604

The encomenderos were in general a sad lot who, because of a singular incapacity to civilize and Christianize their charges, forced the Crown to appoint administrators (*corregidores de indios*) and secular clergy.[16] The need for reform led to the arrival in Peru of the Viceroy of Toledo charged with implementing an administrative agenda, including the resettlement of the dispersed Indian population into nucleated villages (*reducciones*). The policy was a natural follow-up to the application of European concepts of urbanization and population administration in the territorial organization of the 1560s.

Resettlement of the Collaguas was carried out between 1571 and 1574 by Lope de Suazo. Twenty-five *pueblos,* including Lari, and five *repartimientos* remained in the Collaguas *gobernacion* after the policy was instituted.[17] The imposition of the Toledan resettlement policy wrought significant changes in population distribution and settlement location. It carried the trend toward population concentration and consolidation, initiated under the Inka, to a finale. In many instances, new towns were constructed on already nucleated settlements: Coporaque, the capital of the Inka province of Collaguas and Lari and Yanque, the capitals of Lari-Collaguas and Yanque-Collaguas.

The Visita of Lari-Hurinsaya from 1604, carried out some thirty years after the reorganization, is helpful in reconstructing the consolidation of the ayllus.[18] The Visita is a household census of the residents in the village who belonged to the quadripartition of Lari-Hurinsaya, led by Marcos Guacallo, *gobernador,* and three segunda personas or second-in-command, Felipe Caquia, Bartolome Guaamque, and Felipe Pacotinta.

Of the ayllus listed in the Visita of Lari-Hurinsaya (table 1), three are major ayllus, headed by a curaca, of the nine into which the quadripartition of Lari-Hurinsaya was divided. Internally, a major ayllu was segmented, with each segment led by a *mandon* or overseer.

The largest and most important major ayllu is Ayllu Curaca Collana, whose members lived in the section of the village known as Qawatambo. Its curaca, Marcos Guacallo, was also the gobernador of Lari-Hurinsaya. Two of the three segunda personas, Felipe Pacotinta and Felipe Caquia, also belong to Ayllu Curaca Collana. Ayllu Curaca Collana is made up of six unnamed ayllus resident in the Lari reduccíon. Mandones for each of them are listed.

The second major ayllu is Ayllu Chacha Collana. Its curaca, Bartolome Guaamque, was also the third segunda persona of Lari-Hurinsaya. It consists of three ayllu segments: Ayllu Chacha, Juan Hanco, mandon; Ayllu Capa, Miguel Quicaña, mandon; and Ayllu Cupi, Cristobal Pura, mandon. The third major ayllu is Ayllu Pahana Taype Pataca, whose curaca is Pedro Apachicayo. It again consists of three segments. Two are resident in the reduccion of Lari: Ayllu Pahana Taype Pataca, mandon, Alonso Alpaca, and Ayllu Collana Taype Pataca, mandon, Alonso Guaamque. The third, Ayllu Tia Pataca (also called Ayllu Vilcamarca), mandon, Diego Pilapucra, is resident in the reduccion of Madrigal, neighboring Lari.

Ayllu Collana Caylloma and the Ayllu de Pastores de la Estancia de Challacinqa represent a common settlement pattern among the Collaguas antedating Toledan policy for a major ayllu with a seat in one location where the curaca lived, to possess outliers in other locations, controlled through mandones.[19] Ayllu Collana Caylloma (mandon, Juan Vititica) was an outlier of one of three major ayllus resident in the reduccion of Caylloma, Ayllu Collana Capa, Ayllu Chacha Collana, or Ayllu Cupi Collana. The Ayllu de Pastores de la Estancia de Challacinqa, with two mandones, Juan Mamani and Pedro Piñani, is an outlier of another major ayllu resident in the puna. In both of these cases, a major ayllu located in the upper puna controlled fertile maize land in Lari.

Two other examples should suffice to show that a pattern of ayllus in the puna with access to land in the valley was common. Ayllu Curaca Collana had an ayllu segment in the reduccion of Caylloma in the puna above Lari.

TABLE 1. Ayllus Listed in the Visita of Lari-Hurinsaya, 1604

Ayllu	Kuraka	Population
Curaka Collana	Marcos Guacallo	654
Chacha Collana	Bartolome Guaamque	
Chacha		102
Capa		36
Cupi		97
Pahana Taypepataca	Pedro Apachicayo	
Pahana Taype Pataca		111
Collana Pataca (Tia Pataca in Madrigal)		126
Collana Caylloma		39
Ayllu de Pastores de la Estancia de Challacinga		256
Ayllu Cumbis, Plateros, Carpinteros . . .		122

Its mandon was a grandson (*nieto*) of Marcos Guacallo, the curaca of Ayllu Curaca Collana and gobernador of Lari-Hurinsaya. In the neighboring valley reduccion of Madrigal, there was a small outlier of Ayllu Pahana Caylloma whose seat was the Collana Pahana Pata in the Caylloma reduccion.

Lastly, we encounter the Ayllu Cumbis, Plateros, Carpinteros, Olleros, an ayllu made up of craft specialists (weavers, silverworkers , carpenters, and potters) assembled from other ayllus (*de todos los ayllus de este pueblo*) into a special tribute category in line with reduccion policy. No mandon is listed for it.

We can see, then, that the ayllus listed for the village of Lari in the Visita of Lari-Hurinsaya include three major ayllus, two segments of major ayllus whose seats were elsewhere in the upper herding zones of the puna, and a composite ayllu made up of craftsmen from other ayllus. Major ayllus in Lari similarly had segments resident elsewhere, both in the puna and in the valley.

Another of Toledo's charges was to survey the native population to help in the reassessment of tribute.[20] At that time, the province was among the richest in Arequipa, providing 35 percent of the total tribute of all the Arequipa encomiendas there and enriching its encomenderos. This wealth derived from the extremely high tribute obligations levied on Collaguas encomiendas. Of the tribute assessment of the Lari encomiendas, 40 percent was in cash and 60 percent in kind.[21] The proportion in kind was higher than encomiendas closer to the coast and commercial circuits, such as Cavana, which afforded them greater access to cash.

The most important form of tribute in kind was ordinary woven Indian clothing (*ropa de abasca*). This was a valuable tribute item because labor contracts between Spaniards and Indians in Arequipa specified that each laborer was entitled to two sets of clothes every year (Takahashi 1986:110). Lari was a likely candidate for the provision of woven goods because it was known for its weaving, in particular the fine clothing (*ropa de cumbe*) produced by a special ayllu of weavers and worn by the indigenous nobility.[22] The next tribute item in order of importance was the Andean camelids, llamas, and alpacas (*ganado de la tierra*) produced in the region in abundance.[23]

Arequipa came to be the destination of many Lari Indians forced to search for wage labor to pay their cash tribute obligations or included in coerced labor drafts.[24] Indians settled in Chimba, a settlement on the right bank of the Chiri River opposite the city of Arequipa.[25]

The Visita of Lari-Hurinsaya of 1604 provides information on the economy of Lari about thirty years following the Toledo reforms. Crops grown at the time include, in order of importance, maize, quinua, and potatoes. All are grown today and are representative of those usually cultivated at this altitude; what are unexpected are references to the cultivation of the native peppers (*ají*) (*Capisum* various species) (fol. 50), *coca* (*Erythroxylum coca* probably var. *coca*) (fol. 29v), and the introduced *membrillo* (*Cydonia vulgaris*) (fol. 71), all crops usually found at much lower altitudes and warmer climatic zones than those of Lari.[26] Coca is recorded growing in a warm and protected section of lower terraces close to the Colca River. *Erythroxylum coca* var. *coca* is cultivated today in the moist, montane tropical forest on the eastern slopes of the Andes and in the wetter inter-Andean valleys, in the ecological zone of the montaña. It is primarily grown between 500 and 1,500 meters in elevation but may reach 2,000 meters in some areas (Plowman 1986). One also encounters references in the Visita to maize cultivation in upper areas that, according to informants, are too cold at present for maize. Most of the locations in use in 1604 are still in use today. Some, however, are in areas that have been abandoned or used as natural pastures.[27] The cultivation in 1604 of coca, peppers, and membrillo in the lower terraces and maize above the current upper limits of agriculture raises the possibility of shifts in humidity and temperature over time.[28]

Each farmer grew crops in several locations in the village and also outside of Lari, in the warm Arequipa and Pitay valleys, and the nearby reducciones of Madrigal, Ichupampa, and Tapay. While the vast majority of the fields were being cultivated, some were in fallow, indicated by references to *lucri de papa* (fol. 145v), *lucri de maize* (fols. 53 and 145v) and *lucri de quinoa* (fol.145v) . Since /r/ and /l/ represent the same phoneme in Quechua, *lucri* can be read as *rucri,* defined in a Quechua dictionary of the period as cleared, probably fallowed, land (Goncalez Holguin [1608] 1952:280).[29]

One also finds land listed by household held under a variety of forms of access. First, a frequent means for a household to come in to land was to be assigned a field by an ayllu following the death of a usufructor lacking heirs (for example, fols.145, 101, 100, and 99). Juan Tumicha, an unmarried lad of eighteen at the time of the census, held four fields: one left by the death of a usufructor without heirs (*de las bacas*); a second he had inherited; another vacated (*bacó*) by one Pedro Ansa for having reached fifty years of age (*por aber salido de tasa*); and a fourth vacated by the death of Catalina Guacacha (fols. 100 and101v). The practice of assignment by an ayllu is known to have been a common usufruct arrangement. It was not an annual practice but rather persisted until death or on the out-migration of an usufructor.[30]

On obtaining use rights to a field, it came under one's control with limited rights to pass it on to one's heirs, to exchange, and to sell it. Fields could be inherited separately from the mother (fols. 97v and 99v) or the father (fols. 32v and 35), and inherited prior to the death of a parent (fol. 99v). One would change to another ayllu because of a lack of land in the old ayllu (fol. 86).

A rather free flowing land exchange ensued, in which individuals traded (fol. 55v), bought and sold fields (fols. 32, 47, 129, and 62) and houses (fol.155). These transactions are testimony to the monetization that permeated the economy of Lari at all levels just fifty years after Gonzalo Pizarro's visit to the valley.

One of the most common forms of land use was *compañía,* a private arrangement or partnership. Compañía took a variety of modes. Brothers would hold a grove of membrillo trees in common (fol. 71) and individuals would enter into share contracts (*de partir, por mitad*), as, for example, the sharing by Juan Casani and Lorenco the innkeeper (*tambero*) of a quarter topo maize field por mitad (fol. 64). These arrangements were extremely common among early Spanish colonialists of which the archetype for Peru was probably the long-standing partnership of Pizarro and Almagro. Lockhart suggests that it has its origins in the commercial companies of Seville and the Indies, the maritime societies, or a trait of frontier life (Lockhart 1972:74). At any rate, it was an efficient method of gaining security in fluid situations through the pooling of capital and risk. In some transfers, limits were set on the amount of time a person could use a plot (fol. 54v).

Also appearing in the Visita is land held in common by identified ayllus, the *bienes de comunidad del pueblo de Lari* (fol. 159). This refers to Toledo's policy of ordering reducciones to designate parcels of land as *chacras de la comunidad* whose yields were to feed the village poor.[31]

The complement of craftsmen and artisans in Lari-Hurinsaya was greater than that found today. Besides the composite ayllu of weavers, silverworkers, carpenters, and potters, there are also listed occupations such as tailor, innkeeper, barber, and painter (*pintor*).

The Caylloma Mine

In 1626 the Gamero brothers discovered gold, copper, silver, and other minerals in the vicinity of Caylloma and Callali in the puna above Lari.[32] This event was to set in motion a major reorientation of the economy of the region, away from the provisioning of the Potosi mine and the transport of wine inland from Arequipa. The immediate impact of these developments was to shift the economic focus from the middle Colca Valley to the puna and to diminish the number of peninsular Spanish who came to live in the valley (Manrique 1985:143; Flores Galindo 1977:26). Lari, Yanque and Cavana lost their position of predominance as attention was diverted to the new mining centers above the valley. The town of Caylloma was founded halfway between the mine of the same name and the *trapiches* at Cucho, a puna outlier of Lari and probably a way station along the road to Cuzco. Caylloma became the capital of a new province (*corregimiento*) of the same name in 1631, replacing the corregimiento of Collaguas. The influx of Spaniards led to the creation of two Cayllomas: one for the Spanish and one for the Indians, each with its own church and curate. In providing the enormous quantities of labor demanded by the mines, Lari, among Collaguas settlements, contributed disproportionately. In a census for 1688, more than half of its tributary population was working in the mines. In comparison, neither Yanque nor Cavana had a village subpopulation working in the mines (Cook 1982: table 2.8, p. 25).

The mining boom financed a wave of construction of large, impressive churches in the *mestizo* style beginning in 1691 with the *templo* at Sibayo and lasting until the first decades of the nineteenth century (Tord 1983).[33] These beautiful churches, which have delighted architectural historians since their discovery in the 1970s, replaced earlier edifices constructed during the Toledan reducciones, including the one at Lari mentioned in the 1604 Visita (fol. 116v). Lari's Templo de la Purisima Concepcion, built by the priest Juan Bautista Ramos in 1758 (Valdivia 1847:122), is the largest of the post–mining boom churches in the Colca Valley, grander indeed than most of the colonial churches in Arequipa. Murals over the portal and a host of other significant architectural features embellish this magnificent structure, 83 meters long and 26 meters wide.[34] Legend has it that the Mamanis, a local family, donated the petrified lava (*silar*) to build the church from a deposit they controlled in the puna.

The Tupac Amaru rebellion of the 1780s and the transfer of the Caja Real to Arequipa from Caylloma, reducing the capital available for obtaining mercury from Huancavelica, eventually led to the demise of the mining economy.[35] By the end of the colonial period, more than two thousand silver mines at Caylloma, among them some of the richest in Peru, were abandoned. New political institutions only partially filled the power vacuum in the valley at the end of colonial rule. The Province of Caylloma was created by a decree of June 21, 1825, following independence, and seventeen of the largest townships, including Lari, were made districts. When the colony fell, only two national institutions extended into the countryside, the army and the church. The army was never visible in the Colca Valley, but the church was, and it filled the power vacuum after independence by assuming the distribution of medical services and maintenance of civil records necessary for tribute assessment. The church's civil role is illustrated by a communication from the Bishop of Arequipa to parish priests in the valley in January, 1845, twenty years after the culmination of the independence movement, exhorting them to remove all references during public events to the king, the imperior, or his armies and to substitute "the Republic" (Manrique 1985:180). At the village level, priests coalesced with the governor and justice of the peace (*juez de paz*) to dominate politically the *alcaldes de indios*.[36] While ayllus had declined considerably by the beginning of the nineteenth century, dual moiety organization remained strong throughout the period. Moieties had separate alcaldes de indios and maintained separate herds of sheep to provide for the expenses of the resident priest throughout the nineteenth century.[37] By the end of the nineteenth century, though, alcaldes de indios had become virtual dependents of ecclesiastical and political authorities (Manrique 1985:177).

The Wool Trade and the Ascendency of Chivay

The disarticulation of the southern highlands following the decline of the mining economy turned around in the late nineteenth century in response to a surge in the world demand for wool and fiber and developments in transportation and communication. England was industrializing its textile production and traditional suppliers on the Continent could not keep up with the demand. Manufacturers turned first to Australia and later to the new Latin American nations, including Peru. In the southern Peruvian highlands, sheep's wool first began to be exported, followed by alpaca and llama fiber.

In 1870, a railroad between Arequipa and the port of Mollendo on the coast was finished and in 1876 the line was extended from Arequipa to Juliaca in the Department of Puno. The Arequipa-Juliaca stretch included a stop at Sumbay in the Pampa de Cañagua. Travelers to and from Arequipa and the Colca Valley could descend or ascend the train at Sumbay, providing a much more efficient and quick rail link for a major part of the trip. The railway connection soon eclipsed the Majes-Caylloma-Cuzco and the Puno-Moquegua route from the highlands to the coast that peasants had followed since time immemorial. This route is the one that the Shippee-Johnson expedition followed in the early 1930s, taking two and a half days to reach Chivay from Arequipa using a combination of rail and mule train. By taking the train to Sumbay, then mounting a mule train to Chivay, they were able to cut about two days off of the trip. From Chivay it took another day to arrive at Yanque, following a tortuous zigzagging path along the south side of the river. Lari was another "short day's ride" from Yanque. Leaving the Colca Valley, the expedition needed another three days to travel 20 kilometers across to the tributary Andagua Valley by means of a 5,600-meter pass, because it was impossible to follow the Andagua River downstream.

The ascendency of Chivay in the early 1930s as the communication and transportation hub of the Colca Valley sprang from its geographical location that enabled it to best Caylloma in taking advantage of the wool trade. Herders from the puna above the valley descended during the year to trade highland products for the grains produced in the valley, and Chivay was on their route. The bridge built by the Inka to connect it with Coporaque gave Chivay access to the north side of the Colca Valley and to distant wool producing zones as important as Paucartambo and Apurímac. Wool buying agents of the large Arequipa wool houses settled in Chivay to service the new and growing trade. The Rickets house alone had seven wool buyers serving Chivay and Caylloma (Burga and Reategui 1981:174–75). Chivay first attempted to use its new muscle to attain the status of provincial capital in 1919 but was repulsed by a veto of President Leguía. It was eventually granted that status in 1932.

Until the early 1940s, wool purchased in Chivay was carried by mule train and llama caravan to the Sumbay railway station or directly to Arequipa (Shippee 1934:111). In the 1940s, a road was built, with the infamous Conscripción Vial, between Arequipa and Chivay. This harrowing, corduroy track across the puna, under good conditions, allowed one to reach the Colca Valley in twelve hours. In 1949, a dry season road, passing through Lari, was built through the efforts of Cesar Lazarte, the subprefect of Chivay, to connect Chivay with Madrigal and transport out minerals from the mine he owned in Madrigal. This represented the first link between Lari and the Chivay-Arequipa road network.

The building of a road network linking Chivay with Arequipa and the rest of the Colca Valley brought prosperity to Chivay. This period (1935–50) is remembered by Chivaiños as an "epoca de oro" (Manrique 1985:212). Chivay became firmly established with government agencies, a daily market, and an elite that remains to this day, comprised of commercial interests tied to the wool trade and regional retailing and of officials attached to the government agencies.

In the late 1950s, a bus left Arequipa once a week for Chivay. Within the valley, most villages were connected by mule path (*camino de herradura*) and the occasional dry-season road, such as the one from Chivay to the Madrigal Mine. The real impetus to an all-season internal road network is associated with the construction of roads connecting villages with Chivay on the south side of the valley by the Majes Project in 1972 and on the north side by the newly recapitalized Madrigal Mine in 1969. Along the south side of the river, a well-maintained 61 kilometer road connecting Chivay with Cabanaconde, passing through Yanque, Achoma, Maca, and Pinchollo was completed in 1972 with support from the Majes Project (Webber 1988:96). Today, buses ply the Arequipa-Cabanaconde road daily, stopping at each of the villages. From Cabanaconde, the road descends to the Pampa de Majes, meeting the Lima-Arequipa stretch of the Pan-American highway.

On the north side of the river, a road of equal or better quality connected Chivay with the mine at Madrigal. The road passed through Coporaque, Ichupampa, and Lari, stopping at the mine above Madrigal. The road from the Madrigal Mine through Chivay to Sumbay is maintained by the Cia. Minera Madrigal. This road is used for heavy truck transport of mineral to Sumbay, where it is offloaded onto railway cars for transport to Moquegua. A road closure can have serious effects for mine output and whenever the mine is in operation the road is kept in good repair.

The excellent road network has helped in the proliferation of bus, taxi, and truck service. In Lari, one can wait in the plaza and catch one of two taxis passing through the village from the Madrigal Mine to Arequipa. Leaving Lari at around 10:00 A.M., one usually arrives in Arequipa about 7:00 P.M. For the more adventurous, a bus passes through Lari from Madrigal at about 6:30 A.M. and, with luck, arrives in Arequipa in the late afternoon. Trucks pass through the village constantly.

Chapter 3

We Are All Equal: The Ideology and Behavior of Land Tenure and Use

The Colca Valley has never been dominated by the large haciendas so ubiquitous elsewhere in Peru.[1] During the seventeenth century, the lure of gold, silver, and copper deposits discovered by the Gamero brothers in the Caylloma puna distracted cash-laden Arequipa entrepreneurs from investing in the valley. Mining these deposits diverted large quantities of *mita* labor and led to the abandonment of considerable quantities of land and animals. A few pastoral haciendas did form in the puna in the late nineteenth and early twentieth centuries, but the most significant effect of an expanding wool and fiver market in the valley was the emergence of Chivay as the regional center of bulking and transshipment. Outside of Chivay, the wool trade had little impact on Colca Valley villages, and pastoral haciendas in the puna were eventually expropriated during the 1969 agrarian reform. Thus, the agricultural communities of the Colca Valley have never been subjected to the deprivations of an hacendado class. Farmers have not been forced to obtain land from a hacienda through the payment of rent in labor, kind, or cash.

The absence of haciendas helped the Colca Valley to elude the unrest of land invasions and labor union activity that swept the coast and the highlands in the late 1950s and 1960s.[2] The only significant indications of ferment were attempts by social divisions of Yanque to seek legal recognition under special protective legislation. Legal recognition has been a main strategy since the 1940s in defending rural communal lands against incursion by haciendas and private interests. An early attempt in the 1950s by Chalhuanca, a puna herding outpost of Yanque, failed following a negative recommendation by the subprefect (Benavides 1988b:170). Yanque-Hurinsaya in 1965 was the first Colca Valley community to achieve recognition, followed by Yanque-Hanansaya in 1970 (Valderrama and Escalante 1988:49; Benavides 1988b:170).

In other ways, the penetration of market forces in the valley has been curtailed. While the improved road system induced farmers to produce agricultural commodities to market in Arequipa, distance effectively constrained the shift toward cash crops for sale in urban markets. The Arequipa dairy industry is illustrative. The development of an internal market in Peru in the 1940s and 1950s, due to export-led growth and the creation of an industry for import substitution, was felt with dramatic effects in many regions of the highlands, including Arequipa. In 1942, the North American Carnation Milk Company (Leche Gloria S.A.) opened a plant on the west edge of Arequipa to provide a locally manufactured source of evaporated milk. This development had an enormous impact on the Arequipa Valley and the economy of the department (Love 1989). The plant quickly stimulated landowners to shift to the dairy production of fresh milk to supply the plant and eventually came to control the regional market for milk. Highland migrants were drawn to the region in search of work and consumer goods began to move into the petty commodity sector.

While the dairy industry dominated the agrarian economy of Arequipa and its immediate hinterland, it failed to gain a foothold in the Colca Valley. Distance and high transportation costs keep fresh milk from being produced in the valley for delivery to the Leche Gloria plant. With the exception of limited cheese production, focused largely in Achoma and oriented to a local market, fresh milk production is quite low, seasonal, and almost entirely consumed in the home.

Exceptions to the isolation of the Colca Valley communities do come to mind. The first is Cabanaconde, known throughout the southern highlands for a tasty, high-quality variety of large-kerneled maize. At harvest, peasants arrive on trucks and llama caravanners descend with puna products to barter for the "maize Cabanita." Across from Cabanaconde, Tapay farmers specialize in fruit production to trade for the grains and tubers produced in higher altitude villages (Paerregaard 1991). Cabanaconde and Tapay are distinguished from other Colca Valley communities by their specializations. The market circuit for which they produce, however, is rural and peasant in nature, dominated by barter transactions, rather than urban (Gelles 1991: fn. 7).

A significantly different impact is produced by the demand for meat associated with regional mining and irrigation projects and coastal urbanization. It will be discussed in detail in chapter 11. Farmers have responded to this demand by producing large numbers of animals for sale. Some buy calves to fatten on their own or rented pastures, later selling them to local contractors or visiting buyers. Others ascend to the puna to purchase carcasses of alpacas, llamas, and sheep from herders to resell. Despite these recent shifts, a conjunction of factors, to be discussed in later chapters, has prevented the transformation of a small-holder into a large-scale, hacienda-style land tenure pattern.

Access to Land

The most common form of access to land in Lari is inheritance, followed by purchase, sharecropping, and, to a much lesser extent, renting and acquisition of land as collateral for a loan (*anticresis*).[3] Agricultural plots are the basis of a land market in which prices are regulated by supply and demand and there are no restrictions on sale to outsiders (*forasteros*). Careful consideration of a parcel's altitude, productivity, crop history, water source, physical state, and distance from the village enter into price setting, Sales are registered before the local juez de paz but are considered "imperfect" until a final registration by a land judge (*juez de tierras*) in Chivay (Benavides 1990:3). Prices are set by a land appraiser (*perito, catador*) in each village. Local registration may be witnessed by local irrigation officials. Owners declare landholdings annually and are taxed accordingly.[4]

As can be seen from table 2, most fields (78 percent) are farmed directly by their owners. The most popular form of indirect access is sharecropping, which owes its appeal to the lack of a cash outlay by the landowner and the sharing of risk between the owner and sharecropper. Sharecropping contracts do not last for long periods of time because of laws that transfer ownership of a field to the sharecropper after five years in the arrangement. Anticresis and rent are rather insignificant means of access. While renting has definite advantages—one does not have to pay taxes on the land and can select parcels of optimum size and location to ensure access to water—lack of cash in circulation keeps it from being more common.

Land Measures

Three measures of land area are in use today in Lari. The first is *topo,* an indigenous Andean land measure employed in the Visita of Lari-Hurinsaya of 1604 and used, at least through the mid-nineteenth century, as an all-purpose measure. Topo is a relative rather than an absolute measure, referring to the amount of land a team of men wielding a footplow (*chakitaclla*) could prepare in one day. As late as 1966, topo served as the measure for the sale of communal land (AMuL, LA: June 1, 1966). While its use has declined as the chakitaclla has been almost totally replaced by the oxen and plow, topo continues as an occasional measure for land transactions and work assignments during corvée labor projects.

The conceptual basis of topo is retained in another common measure, *yuntada,* the amount of land a team of oxen (*yunta*) can plow in a day. Yuntada is the measure of choice for most agricultural purposes, particularly water allocation. Yuntada, like topo, is a relative dimension. The amount of land a team of oxen or group of men wielding chakitacllas can plow in a day varies by plot shape, slope, soil type (dense, clayey as opposed to friable, sandy soils), and distance from the village.

The metric system offers a third, absolute, measure of land area. The preciseness of meters and hectares contributes to its appeal for many purposes, such as laying out houseplots, but the lack of measuring devices, particularly measuring tapes, keeps it from being more widely used. In irrigation matters, relative measures are preferred. Two fields may measure the same in area under the metric system but have quite different water absorption rates and capacities because of field characteristics. Relative measures allow proportional allocations of water and labor to be negotiated and adjusted to fit individual cases. The process of adjustments for field capacity is made during water distribution and will be described in the next chapter.

An insight into the relation between yuntada and hectare can be drawn from table 3. One set of data comes from a cadastral survey conducted in 1978 in which the area in hectares of each plot in the village was calculated using aerial photographs and planimeter techniques.[5] A second is a set of fields surveyed during the 1983–84 research measured in yuntadas. The table compares the two measures for the same plot where a plot appeared in both the cadastral survey and the land use survey. For each value of yuntada, the average area in hectares from the cadastral survey is listed.

TABLE 2. Land Tenure Arrangements, Lari, 1983–84

Land Tenure	*N*	%
Owner, used directly	338	77.9
Owner, sharecropped	36	8.3
Owner, anticresis	2	0.5
Owner, rented out	4	0.9
Nonowner, sharecropped	46	10.6
Nonowner, anticresis	8	1.8
Total	434	100.0

Source: Land use survey.

While there is a linear relationship between hectares and yuntadas, it is very weak ($R^2 = 0.22$). The order of magnitude from the smallest to the largest field expressed in hectares is 1:9, for fields expressed in yuntadas, 1:33. Almost half of the fields (139, 47 percent) are said to measure between 0.3 and 1 yuntada but are about the same size, about a third of a hectare. This is suspiciously close to the statements heard throughout the Colca Valley of the approximate size of a topo (approximately 3,496 sq. m.) and a yuntada (about 3,000 to 3,300 sq. m.), suggesting a clustering of informants using this relative measure. The next order of magnitude, from approximately one-half to two-thirds of a hectare, includes 46 percent ($N = 134$) of the fields and suggests a cluster from 1.5 to 4 yuntadas). The remaining 20 fields, 7 percent of the total, are said to measure from 5 to 10 yuntadas.

Several aspects of these data merit comment. The tendency to round the size of fields expressed in yuntadas to the closest decile implies a lack of knowledge of the size of a field. Second, the yuntada is a relatively new measure, associated with the introduction of the oxen and plow. Farmers may be aware in a general sense of how much land a team of oxen can plow in a day. But there is no "normal" field to which this measure can be applied in the village. Wide, narrow (back to front), sloping bench terraces represent

TABLE 3. Comparative Measures for Identical Fields

Yuntadas	Mean Hectares	*N*
0.3	0.31	21
0.5	0.26	27
0.8	0.36	2
1.0	0.35	89
1.5	0.63	16
2.0	0.59	65
2.5	0.44	5
3.0	0.65	28
3.1	0.48	1
3.5	0.11	1
4.0	0.64	18
5.0	1.03	6
6.0	0.99	3
7.0	1.20	3
8.0	0.41	2
8.1	1.14	1
8.5	1.23	1
9.0	2.79	2
10.0	1.66	2
Total *N*		293

very different plowing situations than fields on flat alluvial terraces (pampas). Field idiosyncrasies (dense soils, irregular shape, distance) can increase or decrease plowing time significantly. Lastly, since about half the fields are about one topo in size, we may be observing the retention of a common field size adjusted over time to the vagaries of inheritance, labor availability, irrigation procedures, water distribution practice and the like.

Measures of Stratification and Inequality

Land distribution patterns for the Colca Valley are summarized in table 4, drawn from the 1978 cadastral survey. These data indicate a small-holder (*minifundio*) land tenure pattern. Ninety-three percent of the farms are under five hectares in size and together represent 68 percent of the total land area. The majority of these (61.4 percent) are farms between one and five hectares in size. Several factors account for land atomization. Increasing population combined with bilateral inheritance results in successive subdivision of land at the death of an owner. Agricultural risk forces owners to diversify their holdings across many microclimates, The difficulties of supplying and scheduling labor under such circumstances limits the total size that a family can farm. Development of medium to large holdings in the 20 to 49.9 hectare category is limited to 1 percent of farms, constituting close to 10 percent of the total land area. The lack of holdings 50 hectares and over in size is consistent with the absence of large-scale, hacienda-style operations. While land inequality in not acute, Colca Valley farmers share a common poverty produced by numerous small-scale holdings.

In table 5, comparable data on farm size distribution for Lari are presented. Land tenure reflects the small-holder pattern that obtains at the regional level. Approximately 80 percent of the farms are 3.5 hectares or under

TABLE 4. Farm Size, Caylloma Province, 1978

Farm Size (Has.)	*N*	% of Farms	Total Land Area (Has.)	% of Total Land Area
0–1.0	1,000	31.5	515	7.9
1.0–4.9	1,950	61.4	3,900	60.0
5.0–9.9	145	4.6	955	14.7
10.0–19.9	50	1.6	500	7.7
20.0–49.9	30	0.9	630	9.7
Total	3,175	100.0	6,500	100.0

Source: CIPA 1981: 15, table 6, based on the 1978 Cadastral Survey.

but represent only 38 percent of the land area. Of the remainder, the majority (17.7 percent of the total) are between 3.51 and 11 hectares. Only six farms (1.6 percent) are over 11 hectares, but these constitute 12.4 percent of the total land area. A figure of 13.8 percent of the households in the category of near-landless (i.e., less than 0.25 hectares) is noteworthy in comparison with a figure of 14 percent in this category of the households sampled in a survey in Cajamarca, a region affected by hacienda penetration (Deere and de Janvry 1981:345). While Lari possesses the attributes of a classic minifundio economy, near-landless and land-rich groupings indicate unequal access to land.

Annual declarations made by property owners for purposes of taxation (*auto-evaluos*) represent another source of information on land distribution. Data from a sample of 159 property owners for the year ending 1983 are presented in figure 3 in the form of a histogram, with a normal distribution superimposed on it. These figures should be treated with caution. Property owners may underestimate land holdings in order to minimize taxes; they may also be unfamiliar with their area expressed in hectares. Given these caveats, the data again reflect a small-holder land tenure pattern with a mean of 2.2 hectares (SD 2.9). Seven property owners (4.4 percent) were landless and 4 (2.5 percent) had holdings over 10 hectares in size.

Another possible source of inequality in farm size is demographic differentiation. As households begin, grow, and mature over the course of their life cycles, changes in land holding reflect fluctuations in the demand for land associated with each stage (Chayanov 1966). A young household forms and expands, acquiring land to meet its growing needs. Later, as children mature and leave the household, pressures decline and land holdings may contract. The demographic cycle may thus contribute to inequality in farm size. Data to evaluate this association are presented in table 6.

Increased labor strength tends to conform to the domestic cycle. The majority of the households in the sample fell in the category of young fami-

TABLE 5. Farm Size, Lari, 1978

Farm Size (Has.)	*N*	% of Farms	Total Land Area (Has.)	% of Total Land Area
0–0.25	53	13.8	8.5	1.1
0.26–3.5	257	66.9	300.0	37.3
3.51–11.0	68	17.7	395.7	49.2
> 11.0	6	1.6	99.8	12.4
Total	384	100.0	804.0	100.0

Source: 1978 Cadastral Survey. Farm size is based on the total size of the plots declared by an owner.

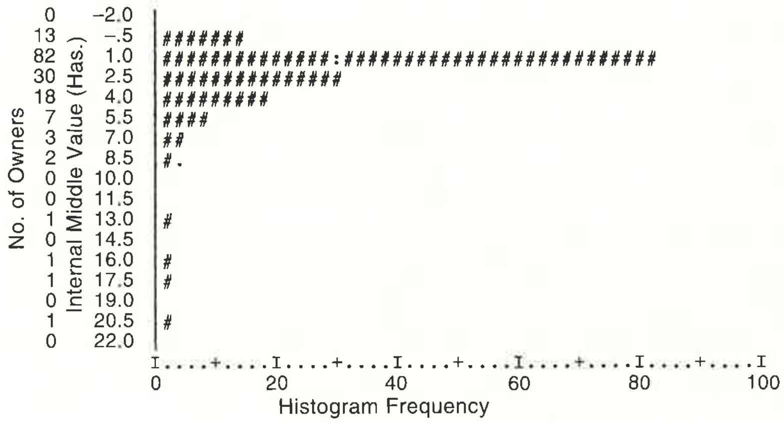

Fig. 3. Land ownership, Lari, 1983.
(From tax returns [auto-evaluos] for 1983.)

lies, in the labor-strength range of 2.0–2.9. The next two largest numbers of households fell, in decreasing order, in the next two categories of increasing labor strength, 3.0–3.9 and 4.0– 5.9. The point at which total land under cultivation expands to meet the highest consumption requirements of the household is 4.0–5.9 and above. While cell sizes are small, there is a predicted Chayanovian association between farm size and labor strength. The majority of large farms, between 11.01 and 20.0 hectares, are in the labor strength categories of 3.0–3.9 and 4.0–5.9. With the exception of the category in which labor strength falls below 2.0, middle size farms (3.51–11.0 hectares) are distributed across the labor strength categories.

The majority of the small farms are in the labor strength category of 2.0–2.9, that is, young households. There are some patterns inconsistent with the Chayanov model. In the large labor strength category (above 6.00), no family was in the two largest farm size categories. In the smallest labor strength category, one individual held a farm more that 20 hectares in size and in fact was the largest landholder in the village. These data suggest that demographic differentiation does explain a substantial amount of land inequality among Lareño farmers but also indicate that some land accumulation is accounted for by other factors.

TABLE 6. Distribution of Households According to Labor Strength by Farm Size

Farm Size (Has.)	Labor Strength					Total
	0–2.0	2.0–2.9	3.0–3.9	4.0–5.9	> 6	
0–0.25	—	—	—	—	—	—
0.26–3.5	3 (13.6%)	10 (45.5%)	6 (27.3%)	3 (13.6%)	—	22 (100.0%)
3.51–11.0	—	7 (43.8%)	3 (18.8%)	4 (25.0%)	2 (12.8%)	16 (100.0%)
11.1–20.0	—	—	1 (50.0%)	1 (50.0%)	—	2 (100.0%)
> 20.0	1 100.0%	—	—	—	—	1 (100.0%)
Total	4 (9.8%)	17 (41.5%)	10 (24.4%)	8 (19.5%)	2 (4.9%)	41 (100.0%)

Source: 1978 Cadastral Survey; 1983–84 land use survey.
Notes: Totals for percentages are rounded to 100.0. The average rate of exchange during the research was 3,060 soles/U.S. $1. Labor strength was calculated with the following index (see Thomas 1973).

0.0–3	years of age	= 0.0
3.1–5		= 0.1
5.1–8		= 0.3
8.1–12		= 0.5
12.1–17		= 0.8
17.1–59		= 1.0
59.1–65		= 0.8
65.1–75		= 0.5
over 75		= 0.3

Social Differentiation

In table 7, indicators of social differentiation are presented for a sample of Lari household heads. If one takes 3.5 hectares of land, considered sufficient elsewhere in the Peruvian highlands to produce subsistence requirements (Deere and de Janvry 1981:351), 58 percent of the sample had access to less than this figure. Only 11.5 percent of the sample had farms that exceeded 10 hectares in size. While these data are static and do not follow the process of social differentiation over an individual's life cycle, they do show an association between unequal land distribution and unequal distribution of other means of production. The frequency of the ownership of the oxen essential for field preparation increases with access to land. The main vehicle through which market forces have penetrated the village is, as will be discussed in detail in chapter 11, the demand for meat produced by mines, the Majes irrigation project, and coastal cities. Cattle and sheep, indicators of response to this demand, increase in numbers with increasing access to land.

TABLE 7. Social Differentiation, Lari

Farm Size (Has.)	Distribution of Households %	Mean Amount of Land Owned (Has.)	Mean No. of Houses Owned	Frequency of Oxen Ownership %	Mean No. of Cattle Owned	Mean No. of Sheep Owned	Mean Value of Total Assets
0–1.0 (N = 5)	19.2	0.79	1.0	40	1.4	5.8	1,553,000
1.01–3.5 (N = 10)	38.5	1.82	1.4	50	3.5	19.7	3,201,825
3.51–10.0 (N = 8)	30.8	5.23	1.4	100	6.6	23.8	4,482,718
> 10.0 (N = 3)	11.5	16.49	1.3	67	6.0	7.6	5,466,916
Total (N = 26)	100.0	4.4	1.3	69	4.3	16.9	3,599,951

Source: Derived from land use survey and tax returns for 1983.

Note: Farm size is defined by the total amount of land controlled by a household. Asset values were calculated using an index, as follows, derived from informant's estimates of typical selling prices:

0.35 hectare of land	500,000 soles
House	1,000,000
Cow, bull, steer	150,000
Calf	75,000
Sheep	12,000
Lamb	6,000
Llama, adult	25,000
Llama, infant	12,000
Alpaca, adult	50,000
Alpaca, infant	25,000

Finally, the mean value of total assets is highly unequal among the four groups. The mean value of total assets of wealthy farmers is 22 percent higher than that of middle holders (3.51–10.0 hectares). Middle holders, in turn, have mean assets almost three times that of the near landless.

Class Perception

When queried about the structure of their society, Lareños state forcefully that there are no significant differences among them: "we are all equal." This perception extends to most spheres of local life. No one individual or group is said to be able to exert power over another for extended lengths of time. Public and private discourse on matters of land and water lack reference to terms such as *mistis, gamonales, pequeños propietarios,* or *terratenientes,* indicative elsewhere in the Andean highlands of land-based class divisions

and approbation. Nor does one encounter indications of envy (*envidia*) manifest through witchcraft accusations.

Villagers do make a distinction, based on land ownership, between large landholders, *mayoristas,* and small landholders, *menoristas*. These distinctions operate only within the sphere of water management and are limited to the assignment of work during corvée labor projects (*faenas*), the levying of fines, and the imposition of limits on water during droughts. Their use in the assessment of fines and limits on water will be addressed in later chapters. In the organization of a corvée labor project for the construction or repair of a waterwork such as a canal or reservoir, irrigation officials make a list of individuals who own land above a cutoff point in the area irrigated by the water work. For example, during a faena organized in early 1984 to line a major canal with cement, five yuntadas of land were set as the upper limit for small holders. Twenty individuals held more than this amount in the area watered by the canal and were required to work the first seven days of the project. Thereafter, small holders worked one day each until the project was completed. During other corvées, work assignments may differ. If the project is relatively small, mayoristas may provide all the labor. Or the mayorista-menorista distinction may be dropped and a simple formula of one day of work for each unit of land employed. A review of cases of corvées suggests two rules underlying the practice: every one must work at least one day and mayoristas work an average of one day for each unit of land, be it topo or yuntada. Mayoristas are also expected to serve as foreman (*capitán*) of the crews (*cuadrillas*) organized during corvées.

The distinction between mayorista and menorista rarely enters into discourse outside of the contexts of water management. While mayoristas do have more land than most farmers, this is not perceived as necessarily bringing them any more power. Nor are mayoristas said to act in concert to expand their power in the village. Villagers see nothing inherently wrong with amassing large numbers of fields beyond the minimum necessary for subsistence. The increased work assignments and other burdens of mayorista status add to the constraints, such as risk-reducing field diversification, labor and oxen availability, and water allocation, that make it difficult to amass large amounts of land.

Land Distribution and Stratification: Summary

Land distribution in Lari has the attributes of a classic minifundio pattern of small holdings with tendencies to inequality. In its overall features it is similar to other Colca Valley communities (IPA 1981:13–15; Instituto Nacional de Planificacíon 1983:14; Valderrama and Escalante 1988:37–43). While some land accumulation can be attributed to demographic differentiation, not all can and evidence exists for an association between unequal land distribution and unequal distribution of other means of production.

Lareños do not perceive their social structure as marred by gross differences of power and prestige. Their perception accords in many respects with observed behavior. Haciendas do not dominate the regional political economy by barring villagers from access to land. All households have access to at least a small parcel on which to subsist and, as we will see, communal water management principles are tilted in the direction of ensuring that the land-poor can derive a subsistence minimum. While large landholders are categorized as mayoristas, they do not constitute a clearly recognizable class. The alternative—the accumulation of power through short-term coalitions put together in the political arenas of the village—will be discussed in a later chapter. Indicators of class polarization common elsewhere in the Peruvian highlands (Indian-mestizo ethnic tension, land invasions, rural labor union activity, and hacienda-community friction) are weak or nonexistent in Lari. Haciendas never gained a foothold in the Colca Valley proper, as elsewhere in the highlands, and only recently has a link with the Arequipa road network afforded easy access to the village.

Land Use

In turning from land distribution to land use, we take up first the range of land use types encountered in the village. Agricultural plots, abandoned fields, and noncultivatable land are scattered throughout the cultivated area in a belt between the Colca River bottom at 3,200 meters and the current upper limit of agriculture, at approximately 3,600 meters (fig. 4). Above this belt, land extends from the upper slopes to the puna above the village. While this land is unsuitable for agriculture because of altitude, slope, or lack of water, it does provide natural pastures appropriate for grazing in many areas.

Within the agricultural belt, abandoned fields and noncultivable land are referred to as *tierra eriaza*. The bulk of these fields are bench terraces that were cultivated in the past but have since been abandoned. In Lari's agricultural belt, 478 hectares belong to this category (table 8). Another form of tierra eriaza is land rendered uncultivable by acute slope, lack of topsoil, lack of water, or water in excess. Two common types of this form of tierra eriaza are the edges of lakes or reservoirs (*cochas*) and outcroppings (*moros*). Tierra

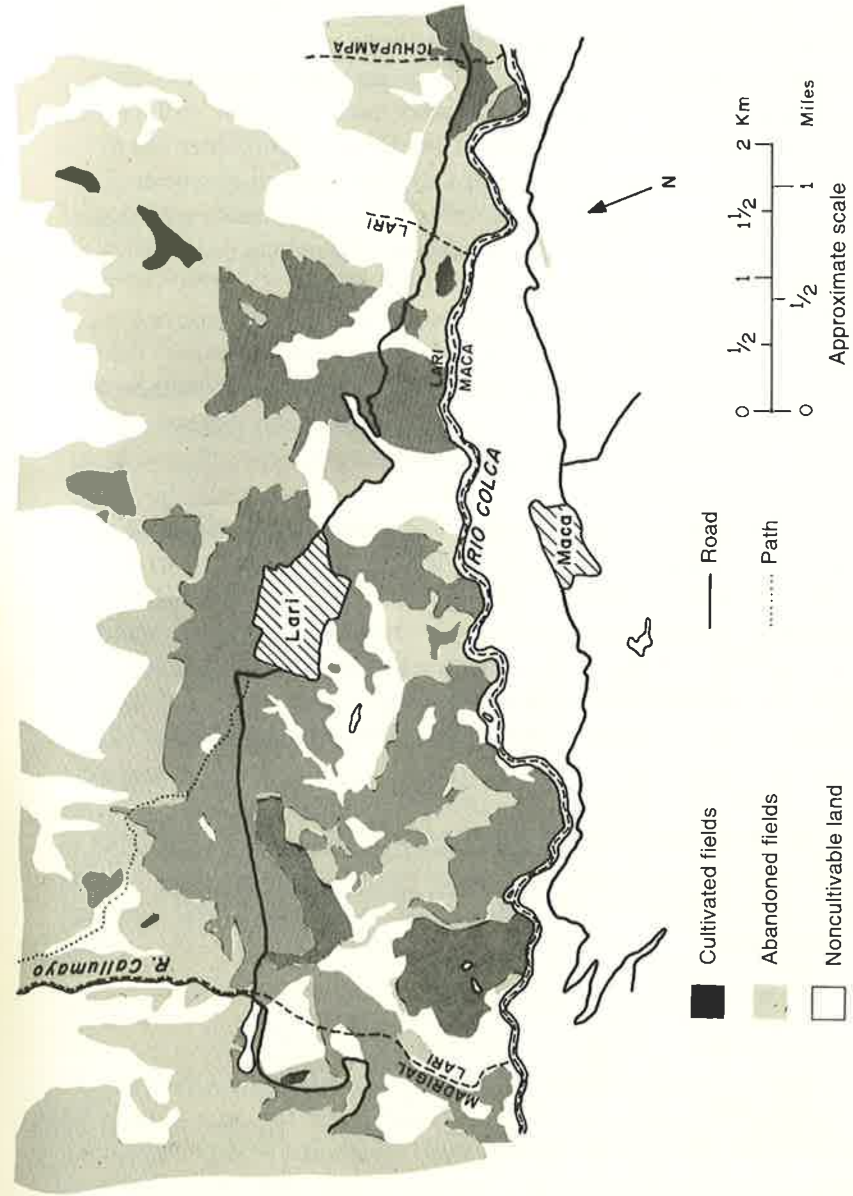

Fig. 4. Agricultural land use in Lari

eriaza is not irrigated and is communally controlled and open to residents of the village for grazing and the collection of herbs and firewood.

Agricultural fields (*chacras*) are cultivated with the staple crops of maize, barley, broad beans (*habas*), quinoa, potatoes, wheat, and a host of lesser cultigens. While cultivated plots can be located anywhere that soil of adequate depth and quality, sufficient water, and suitable altitude are available, water is by far the limiting factor and virtually all fields are irrigated. After a period of cultivation and indications of declining yields, fields are left to fallow (Que. *puruma;* Sp. *terreno en descanso*).

A *canchon* is an irrigated, fenced, agricultural plot adjacent to a houseplot. It may be used either to corral animals at night or to intensively cultivate early (*mishka*) crops of broad beans and barley. Over time, animals corralled in canchones deposit dung and urine producing extremely rich soil. Productivity is generally higher in canchones than in chacras, but canchones, located in pampas, are frost ridden.

An *alfalfar* is a fenced and irrigated plot used for the cultivation of the forage crop alfalfa. Alfalfa meadows differ from chacras in their use but resemble canchones in having walls to retain grazing animals. Distance is not a consideration and alfalfa meadows may be located anywhere within the altitudinal limits for agriculture. Alfalfa is tolerant of conditions that would inhibit the production of maize. The extensive root system and mode of growth of alfalfa allow the plant to recoup quickly from a frost and to draw on moisture at great depth to withstand drought. Thus, alfalfa can survive on the flats where frost is an ever present risk.

TABLE 8. Land Area Represented by Major Land Use Types

Land Use Type	Has.	%	Has.	%
Agricultural belt				
Cultivable land				
Fallow	111	13.8		
Cultivated fields	422	52.4		
Canchones	48	6.0		
Alfalfa meadows	224	27.8		
Subtotal	805	100.0	805	7.9
Abandoned fields			478	4.7
Noncultivable land			295	2.9
Natural pastures			8,556	84.4
Total			10,134	99.9

Sources: Figures for cultivable land were derived from the 1978 Cadastral Survey. Figures for abandoned fields and noncultivable land, from Denevan 1988b:22 table 1, which contains a discussion of sources, methodology, and estimates of error. The pasture land figure was calculated from tax records (*auto-evalúos*) for 1983 in the Cabildo archives of Lari. Percentages may not add to 100 due to rounding.

TABLE 9. Agro-Pastoral Land Use

Type	Use	Tenure[a]	Location
Chacra	Cultivated field	Private	Dispersed[b]
Canchon	Cultivation corral animals	Private	Adjacent to houses
Galpon	Houseplot	Private	In village
Huerta	Kitchen garden	Private	Adjacent to houses
Puruma	Field in fallow	Communal, divisible	Dispersed
Tierra eriaza	Grazing/collecting	Communal, indivisible	Dispersed

[a]For a definition of land tenure form described in the chart, see Guillet 1981.
[b]Altitudes for dispersed locations range approximately 3,200–3,600 meters.

Huertas are intensively cultivated kitchen gardens, located within canchones adjacent to houses. They are used for the cultivation of herbs and vegetables and for experimentation with new crops and techniques. Kitchen gardens are placed within a canchon where insolation is greatest and spillover from water faucets occurs. The system of piped water created for domestic purposes affords opportunities for irrigating kitchen gardens illicitly. Abandoned houses with standing walls (*galpones*) also provide sites for huertas and are especially preferred for the cultivation of eucalyptus trees. Land use in Lari belies the assumption, often made, that irrigated maize agriculture is a continuous regime: about 4 in every 10 hectares of cultivable land was in fallow or in alfalfa. The figure of 224 hectares in alfalfa is significant in light of its virtual absence from the village in the 1950s. It has been introduced into the traditional fallow period since that time and will be discussed in detail in a later chapter. Characteristics of land use types are summarized in table 9.

Conclusion

The penetration of market forces in Lari has been largely felt in the demand for meat. Because of constraints such as increased work assignments for mayoristas, bilateral inheritance, risk-reducing field diversification, labor and oxen availability, and water allocation practices to be discussed in later chapters, a large-scale land tenure pattern has not emerged. While villagers share a common poverty produced by numerous small holdings, the presence of near-landless and land-rich groupings indicates differentiation. Demographic differentiation does explain some of the land inequality, but land accumulation is also accounted for by other factors. Unequal land distribution is associated with unequal distribution of other means of production.

What is anomalous, given these indicators of differentiation, is the lack of the perception by villagers of socioeconomic inequality. Their perception accords rather well with observed behavior. Distinctions between large landholders, mayoristas, and small landholders, menoristas, do exist but they operate solely within the domain of water management. As we will see, communal water management principles are tilted in the direction of ensuring that the land-poor can derive a subsistence minimum. While large landholders are categorized as mayoristas, they do not constitute a clearly recognizable class.

The key to understanding the paradox lies in access to water. In areas of high rainfall, land accumulation is associated with the purchase of labor and the capitalization of production; in arid and semiarid regions such as the Colca Valley, water is of supreme importance in capitalizing land. A major constraint on the expansion of the "internal" land frontier of Lari is the water necessary to bring into cultivation the 478 hectares of cultivable, but abandoned, land and to fully cultivate the land to which farmers already have access. Understanding this constraint requires addressing the communal management of water and the role of the state, to which I now turn.

Chapter 4

The Irrigation Cluster

One can admire the great works of the Indians in the irrigation canals carved or dug out of and hanging on the precipices and slopes, those shear surfaces on which not even a bird could find a perch. Necessity taught them a perfect hydraulic system.

—Echeverría y Morales [1804] 1952:81

The most important limiting factor in land use in the Colca Valley is the availability of water. As the cold Humboldt current courses off the Peruvian coast, it condenses almost all of the humidity out of the western air currents before they can reach land. The effect in southwestern Peru is to produce a dry coastal desert, a northward extension of the Atacama, the world's driest desert. In the upper valleys that rise up from the coast, such as the Colca, rainfall is so slight and irregular that, without supplementary water, agriculture is extremely difficult. The occasional rain-fed plot of the upper slopes is almost an afterthought, used by its owner to grow forage (*kachu*) for his animals.

Irrigation systems with complex rules for water rights and distribution have evolved to transport ground and surface water to agricultural fields and natural pastures. In this chapter I focus on two aspects of the Lari system: the physical infrastructure for the transport of water from its source to users and the social mechanisms for the distribution of water to users. Allocative principles of distribution, and other aspects of the communal management of water, will be the subject of later chapters.

Precipitation and Irrigation

The longest series of annual rainfall data for the Colca Valley comes from a weather station at Yanque that began measurements in 1951. A mean rainfall figure of 422.7 millimeters places the valley within the generally accepted range (150–250 mm. to 250–500 mm.) of semiarid ecosystems.[1] In these systems, while rainfall agriculture is possible it is highly unreliable. Minimal precipitation levels for unirrigated maize have been reported at between 500 and 1,000 millimeters in Peru and Bolivia (Knapp 1984).

Annual rainfall is also highly seasonal. A belt of tropical rains migrates annually from north to south, reaching its southernmost point in February. Precipitation is also affected by heating, which is related closely to solar position, and local convection. These forces translate in the Colca Valley into a dry season from June to August when the rain belt is north of the equator and solar angle at noon is at a minimum (McCamant 1986:5). The rainy season begins slowly in August, picking up during September and October, and increases dramatically during November. The height of the season is between January and March, after which rains decline sharply. Almost all of the annual rainfall comes in the five months from November through March (ONERN 1973: 2: Annex, 44). Available rainfall data (fig. 5) indicate year-to-year unpredictability with occasional stretches of years of extremely low rainfall.

The effect of the migrating rain belt becomes less important, and solar position more important, at higher altitudes. In general, there is a tendency for precipitation to increase as altitude increases on the dry western slope of the Peruvian Andes.[2] Areas above 3,800 meters may receive light snow and hail rather than rain during cold spells. The rather high precipitation in these highlands contributes significantly to the water available for irrigation in the valley.

While the most obvious function of irrigation in the Colca Valley is to augment low seasonal precipitation, it can also serve as a means of manipulating the timing, predictability, and quality of water available for agriculture (Winterhalder 1991). Predictability—the statistical certainty of the quantity of rainfall given the month of the year—is of special importance. If, for the whole year, knowing the month or season allowed one to state with certainty the quantity of rainfall, then precipitation would be completely predictable. Predictability, in turn, can be measured by constancy and contingency. Constancy refers to the evenness of the phenomenon at each time interval in the period of interest. If the same amount of rain falls in each month of the year for all years reported, precipitation would be maximally predictable due to complete constancy. Contingency is a measure of the regularity of seasonal pattern. Predictability would be maximal due to contingency if the quantity of rainfall were different in each month of the year, but in a pattern that was precisely the same every year. Predictability is thus an aggregate measure of regularity arising from the combined effects of constancy and contingency;

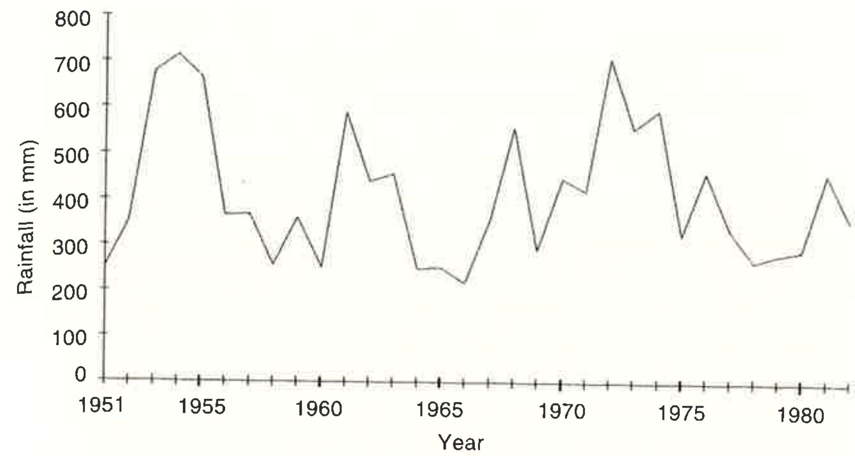

Fig. 5. Yanque rainfall, 1951–82

it is measured on a scale of 0 to 1 as a sum of varying amounts of constancy and contingency.

A rather low figure of 0.35 for predictability in Yanque indicates a highly irregular distribution of rainfall from year to year and accords with farmers' assessment of it as a major risk factor in agriculture (table 10). A figure of 0.10 for constancy and 0.25 for contingency implies that the limited regularity of monthly precipitation is due largely to the repetition of a highly seasonal pattern. These measures suggest that irrigation can have an important function by reducing irregularity in the monthly distribution of rainfall.

Another key variable is the onset and conclusion of the rainy season. Onset refers to the first month of the rainy season in which a majority of years recorded have rainfall greater than 64 millimeters; conclusion refers to the last month of the rainy season in which a majority of years recorded have rainfall greater than 64 millimeters.[3] The relatively short rainy season from January to March contrasts with the thermal season, favorable to agriculture, of a full twelve months (Winterhalder 1991:28, fig. 14). With such abundant water above the Colca Valley, it is no surprise that farmers have made efforts to move it a short distance down the slopes to their fields where it augments the quantity and duration of the restricted rains under more favorable thermal conditions.

Irrigation can also be used to manipulate the quality of water used for agriculture. It is often used, for example, to flush and reclaim saline soils. But saline soils do not present a problem in Lari, because snow and glacier melts that feed the irrigation system are very pure, the rocks through which irrigation water flows do not contain excessive amounts of soluble salts, and the lengths of canals from sources of surface water to fields are relatively short (Jon Sandor, pers. com.).

These data on precipitation suggest several important functions of irrigation in the Colca Valley. It taps abundant sources of water in high elevation areas to augment the low quantity of available moisture in the valley, reduces the highly irregular distribution of rainfall from year to year, and provides water before the normal rainy season to complement a much longer thermal season. Irrigation may also mitigate the damage from frost of the low mean annual minimum temperatures of the valley.

Water Transport

Hydrology

The most important sources for water for irrigation in Lari are melt from permanent and seasonally renewed snow packs, rainfall, and, most importantly, snowfall. These surface water sources feed streams and marshy lakes or seeps (*bofedales*) in the puna that are tapped by open canals. Canals bring water down to the cultivated slopes where it enters into a complex system of branch and feeder canals. Precipitation and runoff add to canal flow along the way. Of lesser importance in terms of irrigated area are natural springs.

Three main canals, Callumayo, Chaico, and Surimana, descend from the puna, eventually emptying into the Colca River. Along the way, offtakes (*tomas*) divert water into feeder canals to irrigate contiguous collections of

TABLE 10. Yanque Precipitation

Average Annual Precipitation (mm.)	422.7
Maximum Recorded Annual Precipitation (mm.)	715.7
Minimum Recorded Annual Precipitation (mm.)	217.4
Predictability of Monthly Precipitation	0.35
Constancy of Monthly Precipitation	0.10
Contingency of Monthly Precipitation	0.25
Onset of the Rainy Season	January
Conclusion of the Rainy Season	March

Source: Derived from Winterhalder 1991: table 4.

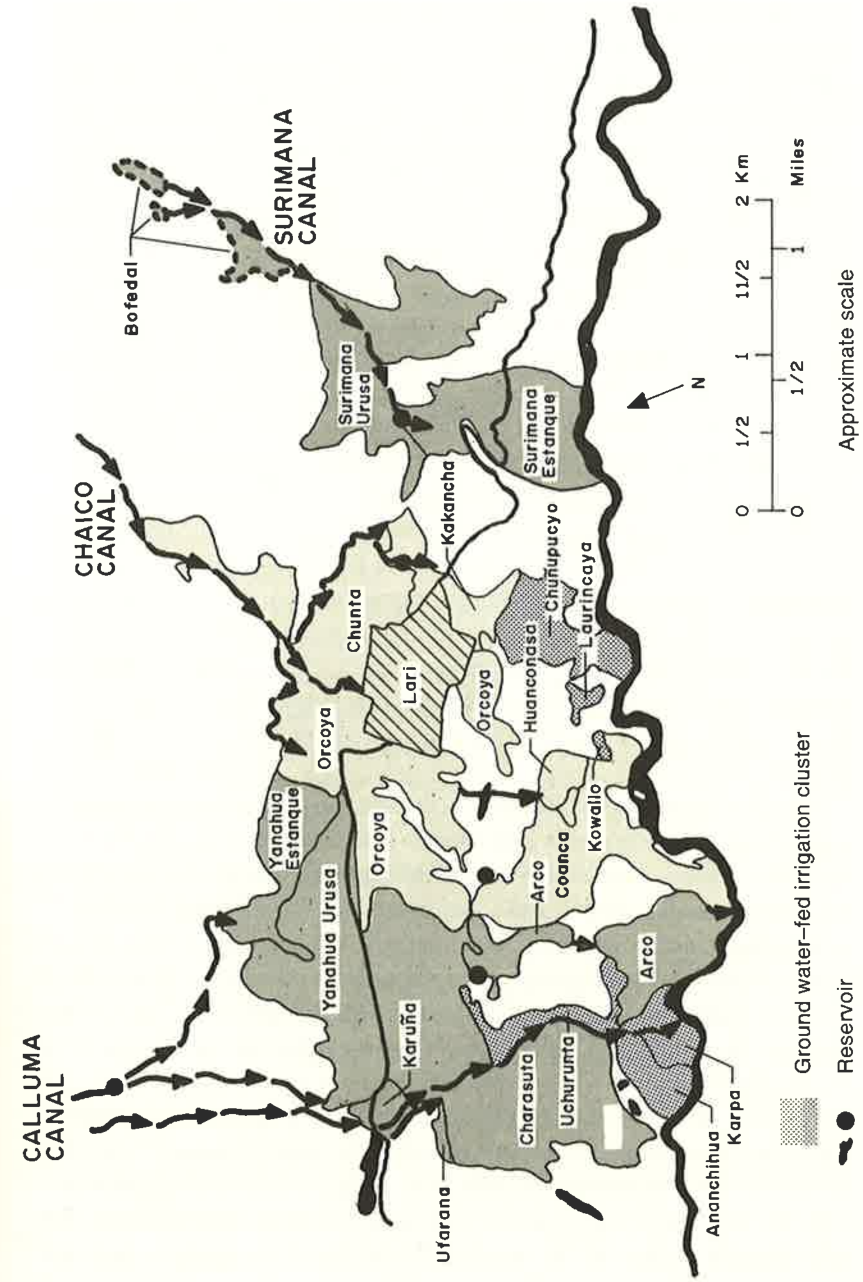

Fig. 6. Lari irrigation system

fields, nodes in the water distribution network (fig. 6). Offtakes are rather simple mud (*ch'ampa*) or stone diversions to the main flow. Both flexible and easily built or removed, they can be quickly adjusted to change the direction of water flow.

Water moves from a main canal to the irrigator in two ways: it may be transported directly to the field through feeder canals, or it may be stored overnight in a reservoir (Que. *qocha;* Sp. *estanque*) for distribution to fields the following day. Reservoirs are usually located above the fields they irrigate, often on marginal, otherwise unusable land or in low marshy areas. Much of the land in Lari includes inactive landslide topography and in some areas reservoirs and marshy areas have been created by constructing dams around landslide depressions. Other natural landscape features such as volcanic dikes have been utilized to direct surface water movement through agricultural terraces constructed between parallel ridges of andesitic dikes oriented perpendicularly to mountain slopes.[4]

Irrigation systems on the Peruvian coast depend on controlling and diverting large volumes of water that descend from the highlands to the sea. Storage is relatively unimportant in these systems, but in Lari it plays a key role. Reservoirs allow water to be collected at night for distribution during the day, while the same canal irrigates other plots directly. By storing water, pressure can be increased, and the task can be done during the day when it can be better observed, speeding up the process of water distribution.[5]

Canal irrigation has a difficult task: it must complement low and irregular rainfall and supplement high water losses from evapotranspiration by crops and natural plants, evaporation from water surfaces, and infiltration into the soil.[6] Main canals, branch canals, and reservoirs are not lined with stones, as in more refined examples of Inka hydraulic engineering designed to cope with the problems of filtration and evaporation (Sherbondy 1982:40–41; Poma de Ayala [1584–1614] 1980:11,066). On the other hand, stone-lined drainage canals (*colcha*) and spillways were engineered into many of the original terraces.

The hydrology of Lari's irrigation system is quite similar in most respects to that of other Colca Valley villages.[7] The valley is a catchment basin for the snow melts of the peaks above it. Unlike river-based irrigation systems, such as those of the Peruvian coast, intercommunity conflicts over upstream-downstream access are not common. There are conflicts, however, over control of the sources in the upper zones.[8]

Spatial Organization

Once water leaves a main canal and enters the cultivated area, offtakes divert it to clusters of contiguous fields. These irrigation clusters can also be referred to as tomas. In what follows, I will use toma in this sense rather than to refer to the physical offtake from a canal. Tomas are named and represent nodes in the water distribution network of one of the three major canals or fields irrigated by an independent source of groundwater such as a spring. There is a total of nineteen tomas (table 11). Within a toma, smaller sets of contiguous fields are also distinguished by name, as are, occasionally, individual plots within them. The location of a field can thus be specified by reference to the names of its toma, its zone, and infrequently by an idiosyncratic name.

Tomas vary with respect to soil type, slope, exposure, and water availability. Some are blessed with abundant water, often enough to share with less fortunate ones. Chuñuhuayco, Laurincaya, and Nucuña, located on the lower slopes and watered by the Chuñupucyo spring, are highly valued. On the other hand, Orcoya is continually plagued with difficulties in meeting the needs of its users. The term *urusa* (Que.) is often appended to the name of a toma that draws water during the day from a main canal; estanque (Sp.) is appended to a toma name when water stored in a reservoir is used for irrigation. The Yanahua canal thus flows to Yanahua Urusa during the day and at night fills the Yanahua reservoir to irrigate Yanahua Estanque the next day.

The Chaico Canal Network

Chaico canal, the mother canal (*yarqha madre*), is considered the most important in the village, providing water for 716 plots, the largest of the tomas. Its origins lie 4,670 meters above the village in the bofedal of the same name. Chaico is the longest of the three main canals, 8.5 kilometers in length from its origins to the point it enters the cultivated area. Nonetheless, it is rather short by comparison with those feeding other Colca Valley communities, such as the Warangante (17 km.) and Misme (12 km.) canals of Yanque (Valderrama and Escalante 1988:63–64). In comparison with those on the coast, Colca Valley canals are rather short (Denevan 1986b:545).

TABLE 11. Irrigation Divisions and Plot Characteristics in Lari, 1978

Irrigation Division	Total Area Has.	Mean Size	No. of Fields	% of Total	No. of Users
Calluma canal					
Yanahua Urusa	46.36	0.48	96	5.3	68
Yanahua Estanque	67.75	0.40	171	9.5	109
Karuña	7.95	0.42	19	1.1	16
Charasuta	69.71	0.44	157	8.7	91
Arco	45.69	0.44	104	5.8	78
Utarana	33.05	0.45	74	4.1	55
Subtotal	270.51	0.44	621		
Chaico canal					
Chunta	57.56	0.36	159	8.8	98
Coanca	56.70	0.33	174	9.6	105
Kakancha	27.66	0.32	87	4.8	52
Orcoya	116.66	0.44	267	14.8	158
Huanconasa	9.45	0.33	29	1.6	41
Subtotal	268.03	0.37	716		
Surimana canal					
Surimana Urusa	118.25	0.71	166	9.2	92
Surimana Estanque	66.01	0.49	136	7.5	74
Subtotal	184.26	0.61	302		
Groundwater-fed tomas with no regina					
Añanchihua	15.38	0.32	48	2.7	36
Uchurunta	5.18	0.52	10	0.6	9
Karpa	17.98	0.37	49	2.7	37
Subtotal	38.54	0.36	107		
Groundwater-fed tomas with no regidor					
Laurincaya	9.33	1.33	7	0.4	12
Kowallo	11.46	0.34	34	1.9	30
Chuñupucyo	36.21	2.01	18	1.0	14
Subtotal	57.00	0.97	59		
Total	818.34	0.45	1,805	100.0	

Source: 1978 Cadastral Survey.

On entering the cultivated slopes, the Chaico canal separates into three branches. One supplies water to Chunta, a pampa immediately behind the village, and from there flows east to fill the Kakancha reservoir. Another branch irrigates Orcoya, adjacent to Chunta. Chunta and Orcoya share the canal during the day. A third branch, known as Puririwaq, fills the stone-lined tank that provides potable water to houses in the village through an underground network of pipes. Puririwaq also feeds open, stone-lined canals that flow through the middle of each street. They appear to be part of the original plan of the Lari reduccion and are used today for washing clothes and irrigating kitchen gardens.

At night, water from Puririwaq canal flows through the village to fill the Coanca and Huanconasa reservoirs. These reservoirs supply water for day-time irrigation. Water from the Coanca reservoir is combined with flow from several small springs that emerge near the Azullema Mayo zone in the mornings for irrigation. When the reservoir empties, irrigators rely on springwater for the rest of the day.

The Callumayo Canal Network

On the west side of the village, the Cauta ravine delivers water from small seeps fed by the snowmelt of Apacheta mountain. In 1959–60, a canal was constructed to the ravine from Ticllacocha Lake (4,743 m.), which is fed by snowmelt from Quehuisha mountain. The canal provides supplemental water during seeding when water demand is greatest. From its origins to the point at which it enters the cultivated area, the canal is 3,450 meters in length.

The first and uppermost offtake of Cauta delivers water to the Yanahua canal. During the day it irrigates Yanahua Urusa and a cluster called Karuña. At night, it is stored in the Yanahua reservoir for the irrigation of Yanahua Estanque. A second, lower offtake delivers water two days a week to fields in the neighboring community of Madrigal.[9]

On its lower course, the water flowing through the Cauta quebrada (now called Callumayo) during the day irrigates Charasuta, a large collection of fields subdivided into eight zones. At night, the water is stored in the Charasuta reservoir and used the next day to irrigate Arco, a low, warm zone with good soils. A small section, called Utarana, also obtains water during the day from Callumayo.

The Surimana Canal Network

The Surimana network northeast of the village draws water from three seeps, Ullana (3,813 m.), Challwapucyo (3,700 m.), and Japulli, just below Ullana. The distance from the union of the canals connecting the three seeps to the cultivated area is 350 meters. During Monday through Friday, these seeps provide the water to irrigate Surimana Urusa, a high alluvial terrace and fan. On Saturday and Sunday, water from Ullana and Japulli irrigates the natural pastures of the bofedales of the same name. At night, water from each of the three seeps fills the Mallcacocha reservoir. It irrigates the terraced fields of Surimana Estanque and the upper part of Kakancha the next day. Japulli in the recent past provided sufficient water to fill its own reservoir. A decline in the flow forced its abandonment.

Spring-Fed Irrigation Clusters

In several areas, sufficient groundwater, in the form of springs, exists to irrigate small contiguous sections of plots. Springs are common in the lower alluvial terraces underlain with fine sand and silt deposits and susceptible to landslides. In some cases (Ananchihua, Pomacra) small spring-fed ponds are fitted with sluice gates and used as reservoirs. Irrigation in Ananchihua is on a first-come, first-served, basis with the exception of alfalfa, which can only be irrigated prior to staple crops or when there is no need to irrigate food crops. In other cases (Karpa, Laurincaya, Kowallo, Chuñupucyo), springs irrigate fields directly.

Water Flow

Each of the three main canal systems varies considerably in the amount of water it can provide its users. Part of this variation is due to the volume of the water entering the agricultural area (table 12). Soil characteristics represent another source of variation. The Surimana system fares the worst of the three in this regard; sandy soils with poor water retention contribute to its low water availability. Irrigation clusters vary greatly in the amount of water to which each has access within a canal system. The Orcoya toma in the Chaico canal network is persistently plagued with insufficient water to supply its large number of fields.

Interestingly, the Colca River itself is not exploited as a source of water for irrigation. The lift from the level of the river to the communities is several hundred feet in most locations. The water is virtually impossible to tap using traditional technology, and putting motor driven pumps to service would be extremely costly. The Colca River has been dammed upstream in an ambitious project to irrigate land in the Majes and Siguas valleys on the coast. Some communities on the south bank of the river have tapped into the large pipe along the way (Hurley 1978; Valderrama and Escalante 1986:184).

Water Distribution

A second aspect of the irrigation system in Lari is the social arrangements made to distribute water to users. Water distribution in the offtakes of Chaico, Calluma, and Surimana is the responsibility of water distributors (*regidores*) who distribute water during weekly meetings (*reginas*). In the spring-fed tomas, which control their own water, no regina will be held; instead, the regidor goes from house to house to make arrangements. In the smallest spring-fed tomas, such as Kowallo and Chuñupucyo, water is distributed on a first-come, first-served basis and no regidor is named.

Water is distributed according to a cyclical unit of time called a *mita*, which ideally lasts 90 days and is associated with the major seeding (*hatun tarpuy*). Prior to the mita, farmers often make an early seeding of staples, usually of broad beans, to mature when foodstocks are low. Demand for water at this time is low and water is available for the taking. Alfalfa can also be irrigated at this time.

The first application of water, to prepare the field for seed germination is the *kellua*,[10] followed by a second application (*humareo*) after plants have sprouted, prior to weeding and mounding (*aporque*). The *palta* is an extra irrigation to maintain plant growth.

In practice, the mita can last longer than 90 days. Some offtakes are quite large and water flow is insufficient to irrigate all of the plots during a 90 day period, so a mita can stretch out to as many as 120 days. The length of time between the first and the second irrigations is crucial. If the rainy season is

TABLE 12. Physical Measures of Volume

Canal	Total Hectares Irrigated	1981 Liters per Second	Liters per Hectare	1988 Liters per Second	Liters per Hectare
Callumayo	270.51	70	0.25	111	0.41
Chaico	268.03	60	0.22	101	0.37
Surimana	184.26	15	0.08	—	—

Sources: For the 1981 data; CIPA 1981. The 1988 data were provided by Herman Swen and represent an average of measures taken during the months of November and December.

early, the harvest will usually be normal. If it is normal or late, then having a second irrigation in time will make the difference between an adequate and a failed harvest. As the mita is extended, crop production becomes increasingly risky. Many crops are extremely water sensitive, particularly during the early stages of growth, and a tardy delivery of water can be disastrous.

The beginning of the irrigation season and the mita is signaled by the cleaning of Chaico canal and the Malcacocha reservoir during the month of August. Harvested fields are irrigated during field preparation prior to seeding (*barbecho*) and early crops in June and July. These tasks are not considered part of the mita and there are no restrictions on water use before and after it. The season lasts until the rains fall in earnest in January. If rains come early, then the palta, and possibly humareo, will be eliminated.

A second use of mita is to refer to one's allocation of water. For example, a farmer will occasionally complain that he has to wait too long for his mita to irrigate his field. Turn (*turno*) is a gloss for this usage of mita; it may also refer to the location of one's field in the spatial sequence of the irrigation of a toma.

Spatial Sequence

Spatial sequence is an important aspect of water distribution.[11] In order to understand it, one must know something about terraces and endwalls. A significant architectural feature of bench terraces is endwalls that enclose vertical groups of terraces. Endwalls are usually continuous and when seen from afar appear to divide terraces into vertical strips that run up and down the slopes. In one sense, landholdings are dispersed throughout the territory of Lari in a pattern common to Andean communities. On inspection, however, terraces are held as vertical strips, one under the other, to facilitate a top-down pattern of irrigation. Within an irrigation cluster, one's holdings coincide with vertical groups of terraces. Attempts are made to keep them intact (on sale or inheritance) to accord with water distribution practice. Generally, a landowner will own several terraces within a vertical section bounded by endwalls.

The first terraces to be irrigated at the beginning of a mita are those located in the vertical section highest and closest to the offtake. Water enters the uppermost terrace of a section, usually at a corner but occasionally in the middle of a terrace. The next lower terrace is then irrigated with the overflow until the lowest terrace is irrigated. Depending on the width of the terrace, from one to four scratch canals (*melga*) will be temporarily cut into the terrace surface. They help to distribute water evenly over the surface of the terrace and on to the face from which it falls to the base of the next terrace.

After one vertical strip is irrigated, the sequence starts again at the top of the next vertical strip, until all of the terraces are irrigated. The first set of terraces located closest to the offtake is called the head (*cabecera*) and the last is called the tail (*cúlata*). Irrigation is said to proceed thus from head to tail.[12]

The location of fields within a toma is a very important indicator of the relative quantity of water that will be available for their irrigation. Those closest to the head will be irrigated first in the mita sequence, those located in the tail, irrigated last. This becomes very significant when an irrigation cluster has insufficient water and must stretch out the mita beyond an ideal 90-day cycle. An extended wait for water to reach the tail may cause an owner to water too late to assure seed germination or to maintain optimum plant growth.[13] Owners with fields in such locations in tomas plagued with water problems are known to forego cultivation or change to a less water sensitive crop.

Huanconasa is a relatively small irrigation cluster of 9.5 hectares of land divided among twenty-seven individuals. Their twenty-nine holdings average a third of a hectare in size. Because of its small size, Huanconasa is not divided into zones. As can be seen in figure 7, these holdings consist of several terraces, separated by endwalls. Irrigation starts at the northwest corner of the toma and proceeds down one vertical strip and up the next until the southwest corner is reached, at which point the next cycle starts again.

The amount of water available to irrigate a plot depends, then, on its location in a toma. The sequence of water distribution can result in fields located near the tail end experiencing problems in obtaining sufficient water for irrigation.

Crop Irrigation Sequence

During the mita, water is distributed in a specific sequence by crop. Prior to the mita, alfalfa and early crops intended to be consumed fresh are irrigated. The mita begins with the starting-up of water (*levantamiento de agua*) and the irrigation of the staples (*sembrios*) in the following order: maize, broad beans, wheat, and barley. An individual may only obtain water if, when his or her land comes up in the spatial sequence, it is cultivated in the particular crop specified in the stage of the mita in question. The crop irrigation sequence accommodates the length of the growth period of each crop. Early

early, the harvest will usually be normal. If it is normal or late, then having a second irrigation in time will make the difference between an adequate and a failed harvest. As the mita is extended, crop production becomes increasingly risky. Many crops are extremely water sensitive, particularly during the early stages of growth, and a tardy delivery of water can be disastrous.

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The location of fields within a toma is a very important indicator of the relative quantity of water that will be available for their irrigation. Those closest to the head will be irrigated first in the mita sequence, those located in the tail, irrigated last. This becomes very significant when an irrigation cluster has insufficient water and must stretch out the mita beyond an ideal 90-day cycle. An extended wait for water to reach the tail may cause an owner to water too late to assure seed germination or to maintain optimum plant growth.[13] Owners with fields in such locations in tomas plagued with water problems are known to forego cultivation or change to a less water sensitive crop.

Huanconasa is a relatively small irrigation cluster of 9.5 hectares of land divided among twenty-seven individuals. Their twenty-nine holdings average a third of a hectare in size. Because of its small size, Huanconasa is not divided into zones. As can be seen in figure 7, these holdings consist of several terraces, separated by endwalls. Irrigation starts at the northwest corner of the toma and proceeds down one vertical strip and up the next until the southwest corner is reached, at which point the next cycle starts again.

The amount of water available to irrigate a plot depends, then, on its location in a toma. The sequence of water distribution can result in fields located near the tail end experiencing problems in obtaining sufficient water for irrigation.

Crop Irrigation Sequence

During the mita, water is distributed in a specific sequence by crop. Prior to the mita, alfalfa and early crops intended to be consumed fresh are irrigated. The mita begins with the starting-up of water (*levantamiento de agua*) and the irrigation of the staples (*sembrios*) in the following order: maize, broad beans, wheat, and barley. An individual may only obtain water if, when his or her land comes up in the spatial sequence, it is cultivated in the particular crop specified in the stage of the mita in question. The crop irrigation sequence accommodates the length of the growth period of each crop. Early

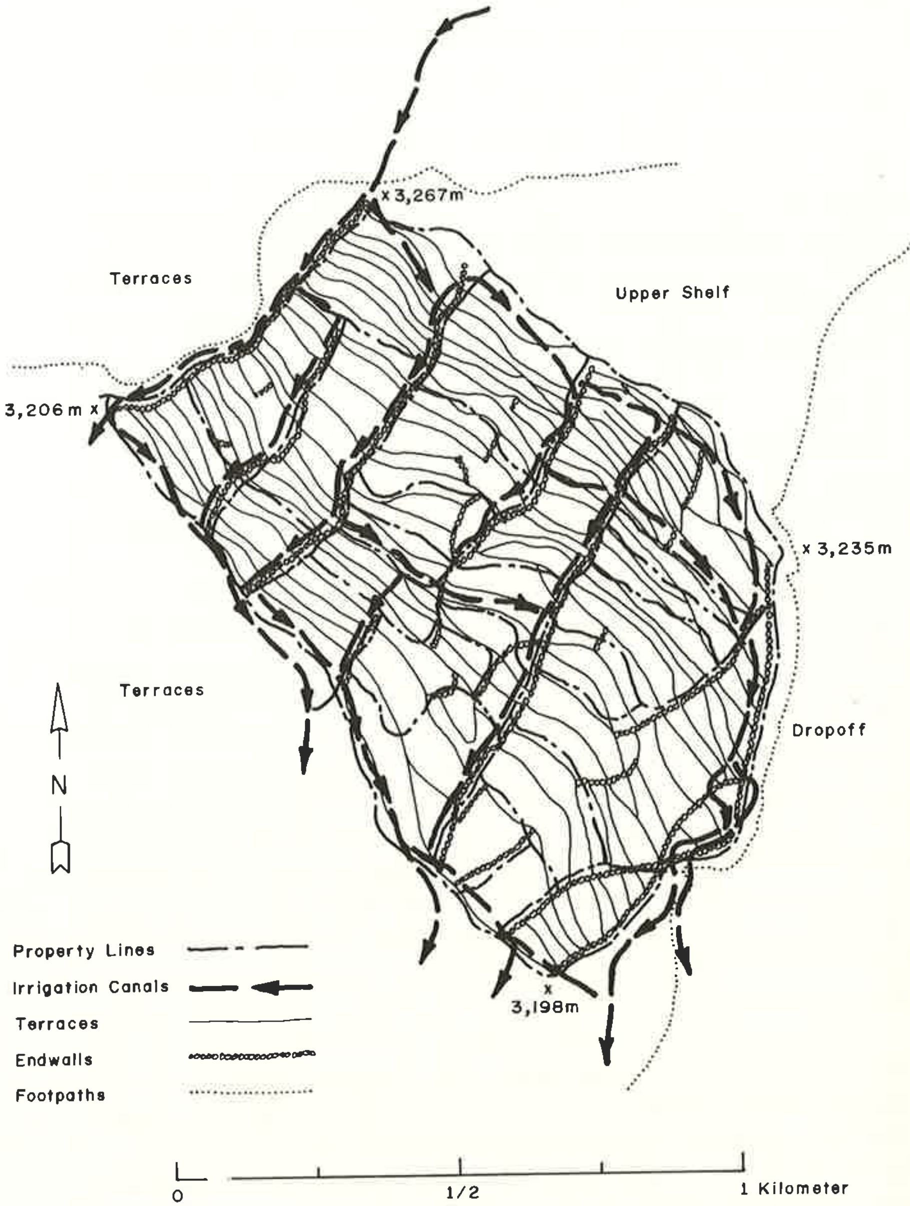


Fig. 7. Huanconasa irrigation cluster

crops consumed fresh have short growing seasons in comparison with maize, broad beans, wheat, and barley, which are harvested in their dry state. Irrigation by crop is followed in other Colca Valley villages (Benavides 1983a).

Distributing irrigation water by crop works in concert with several factors to discourage farmers from seeding all of their land in one crop. First, high altitude agriculture exposes the producer to a host of endemic risks, particularly frosts and drought, and to a lesser extent crop disease and pests. Browman, for example, estimates that some part of high altitude crops are lost to frosts or droughts every third year on the average (Browman 1987:13). Keeping all of one's holdings in a single irrigation cluster increases risk exposure. Farmers diversify by using varieties of cultivars adapted to micro-environments and spreading holdings across a number of irrigation clusters. Farmers in a survey of land use conducted during the research owned fields in an average of five irrigation clusters (N = 48; std. dev. 2.52). Second, keeping one's holdings in numerous small fields rather than a few large fields facilitates diversification across irrigation clusters. It is also a response to labor and time constraints. Seeding all of one's plots in a single crop such as barley would force one to irrigate in each of the phases of irrigation (first, second, and third irrigations) at approximately the same time. Third, within fields, farmers diversify by groups of cultigens and by intercropping. Quinoa, for example, is intercropped with barley, maize, and broad beans. Cultivating several crops in several locations combines risk-reduction through crop and field diversification with optimal use of household labor.

Crop production is largely oriented to home consumption and for exchange with pastoralists of the upper zones. It is very difficult to cultivate crops for sale in urban markets such as Arequipa because of the difficulty in obtaining water. Thus, one is constrained by the nature of water distribution from entering into specialized market cultivation. As we will see later, since the Spanish Conquest there have been adoptions of new crops and the deletions of older crops in the crop irrigation sequence. By and large, however, the system remains oriented toward local consumption.

Reginas and the Role of the Regidor

The regidor's role is to distribute water to individuals in accordance with principles of crop sequence and location. Beginning closest to the offtake, the regidor distributes water in the customary spatial sequence to farmers who have fields ready to be seeded or seeded to the cultigen specified in the crop rotation sequence. After the crop is irrigated, the sequence starts over again at the head with the next crop.

Reginas start quietly with people standing in clusters usually within a radius of about 40 to 50 feet. During the regina, claimants present their petition to the regidor, who then discusses their merits. As the regidor begins to make his decisions, the ambience heats up and shouting may ensue. The circle begins to shrink and the regidor may find himself surrounded by anxious and often hostile petitioners.

As he proceeds to distribute water, the regidor checks to see if a landowner is present who is entitled to a share. If so, he assigns him or her a specific quantity at a time during the period before the next regina.[14] All clusters that obtain water directly from a main canal use time as a measure of quantity, as do some clusters which draw from a reservoir. A typical assignment would be 5 hours of water to irrigate one yuntada of land. When time is the measure used, reference is occasionally made to *agua de chilleca,* daytime water that flows from approximately 7:00 A.M. to 4:00 P.M. and *agua de punku* (door, entryway), nighttime water from approximately 5:00 P.M. to 4:00 A.M.[15] In irrigation clusters that draw water from reservoirs, such as Surimana Estanque and Yanahua Estanque, the unit of distribution is the tank: one person, for example, will receive half a tank of water, another a tank and a half.

The regidor's dilemma is that there is almost always a greater demand for water than there is water available. It is not uncommon in larger irrigation clusters, such as Orcoya, to have three claimants for every one water share present at a regina. Sorting out real from spurious claims is an unenviable job. Some petitions are clearly unwarranted, as when one wants to irrigate a crop out of sequence, is behind others in the spatial sequence, or has been penalized for a transgression. Others are justified and the regidor must ferret them out. Farmers do know, approximately, when their turn will come and how much water they should get. But there is no certainty. There are a host of factors that can affect the timing and the quantity of the water one gets.

One of the responsibilities of the regidor is to keep a register (*padrón*) of the fields, their area, owner, and location in the toma. The padrón is supposed to serve as a guide in the distribution of water. Not every regidor can read or write well enough, though, to keep a padrón, and what usually suffices is a spiral bound notebook (*cuadernillo*) in which the regidor writes the list of assigned irrigators for each regina. It may contain a simple list of landowners and an estimate of their size of their land. Often no padrón is kept at all.

In one sense, it probably works to the system's advantage that strict, formulaic water distribution procedures are not followed. Such a system, based on a rotation with fixed hours in the day assigned to each irrigator and noted in a register, is found in the Spanish villages of Murcia and Orihuela (Maas and Anderson 1978). Demountable diversion dams (*paradas*), slow and raise water so it can be delivered to farms along the way. The rotation (*tanda*) begins with the lowering of the first check at 6:00 in the morning of the first day. After a fixed interval, the check is raised, the next downstream check is lowered, and the second branch is irrigated. The problems endemic to this system of transport and distribution stem from topographic irregularities, such as variation in elevation, and variation in drainage along the course of the canal. Changes in the area of land served by a check are very difficult to make, requiring changes in the official register. As a result, informal procedures are developed that may acquire prescriptive justification from longstanding acceptance (Maas and Anderson 1978:66–77).

Rather than keeping to a fixed register that must be constantly modified through informal procedures, the water distribution process in Lari is flexible. Reginas are held in locations, often a rise or hill, that overlook the fields watered by the offtake. Farmers can see instantly which fields have been irrigated because they are dark and stand out clearly against the background of light-colored dry fields. One can determine if the spatial sequence is being followed from head to tail, if someone's field has been irrigated out of turn, or if someone who was advanced water at the last regina failed to irrigate.

Negotiated Shares

The ability to quickly obtain irrefutable information on the status of fields would appear to facilitate efficient water distribution by crop and spatial sequence. Several factors conspire to make the process of water distribution problematic and subject to negotiation.

It is often unclear exactly how much water is necessary to irrigate one's field. The amount depends only in part on the area of the field in question, for fields of the same area can vary greatly in the quantity of water they need. Fields with volcanic ash or sandy soils can be irrigated quickly, while dense, clayey soils take much longer. It will take longer for water to arrive at a field located on a slight rise relative to others, and the water may arrive with lower pressure. Cold or overcast days reduce evaporation, allowing irrigation to proceed more rapidly than hot sunny days. Astute farmers use these factors in negotiating with the water distributor for the amount of water they feel they need.

The Orcoya toma, the largest in irrigable area and number of fields, is especially problematic in this regard. Because of its size, it is subdivided into three subsections: Altu Yarca, Pampa Yarca, and Puririwaq. Landowners from each subsection will often stand off to the side during the meeting and work out a sequence among themselves, presenting it to the regidor for ratification.

While the head-tail sequence works well in relatively small irrigation clusters where movements from start to finish do not take excessively long, in large ones the spatial sequence may have to be modified. Orcoya has dealt with this problem by the creation of three "tracks." But slowness in moving along the spatial sequence raises the anxieties of users and forces adjustments. Landowners in Lloclla, at the tail end of the spatial sequence in Kakancha, forced an agreement in October, 1983, that one person would be picked from the head of the list and one from the tail (the very last one in the tail, moving up). Other adjustments known to occur are for the regidor to initiate two separate irrigations, one starting at the head (cabecera) and the other lower down. Or, sensing that this is slowing irrigation by decreasing canal water pressure, a regidor can increase canal pressure and speed up the irrigation by irrigating one, rather than two, sets of fields. A snowfall in the puna can augment the flow for a few days or a rain in the valley can reduce the demands for irrigation.[16]

Irrigation by crop is tied to an idealized sequence of early crops and alfalfa followed by the main crops of maize, broad beans, wheat, and barley. This sequence is modified within irrigation clusters to fit the agronomic characteristics of the fields in question. For example, in tomas dominated by terraced fields, such as Charasuta and Surimana, maize is the preferred crop and barley is rarely grown. Rather than having a special turn for barley, it is irrigated, together with the occasional potato field, in the turn for alfalfa.

Traditional measures of land, the yuntada and the topo, are very difficult to apply in the context of water distribution. Though villagers would like to use the more precise metric measures, they lack measuring devices. As a result, the apportioning of water based on land area is quite contentious, with the owner often inflating his field area to ensure sufficient water while the one next in line tries to downplay it.

Conclusion

The system that transports water from sources high above the village to augment the low available moisture in the valley is remarkably efficient considering the high water losses encountered through evaporation, evapotranspiration by crops and natural vegetation, and soil infiltration. Beginning the mita in August provides water before the normal rainy season to complement the much longer thermal season.

Nighttime storage of water in reservoirs and bench terraces with deep soils and controlled runoff contributes to the efficiency of the system. Efficiency is also enhanced by a well-engineered spatial division of clusters of land that share a water source, as well as distribution procedures adjusted to the source and the microenvironment. A highly segmented division of water distribution does not mean, however, that water is evenly or justly distributed. Irrigation clusters vary widely in the amount of water entering them. The best have access to their own water from springs; the worst must meet the needs of a large number of farmers with unpredictable surface water. Mechanisms for sharing water between water-rich and water-poor clusters are an important dimension of communal water management and will be discussed in a later chapter.

Within irrigation clusters, the position of a field can also affect its access to water. Those closer to the water source are better situated than those at the distal end of the feeder canal. This may lead to land abandonment at the distal end or a shift to less water-intensive crops. Reconciling the differences in water access between well and poorly located fields is one of the many roles of the water distributor. Indeed, the water distributor is a very important element of the efficacy of the irrigation cluster. In lieu of a heavily centralized, formulaic system of water distribution, with adjustments made by informal, off-to-the side agreements, water distribution within irrigation clusters is flexible, able to adjust quickly to changes in landownership, field expansion or contraction, and cropping pattern.

Chapter 5

Crop Choice and Soil Management

If it weren't for the frost and the scarcity of water, we would be fine.
—Lari farmer

The counterpart of the autonomous irrigation cluster is the independent household unit of production. Farmers reject the notion that communal guidelines affect their use of a plot and counter that they are free to cultivate or fallow, choose the crops they wish to cultivate, and follow any pattern of crop or field rotation they desire. In this sense, land use corresponds to the model of private control described for continuous agriculture (Guillet 1981). This chapter looks closely at the degree of independence inherent in household production decisions. Farmers have been cultivating these flats and pampas for at least five hundred years and the accumulated stock of knowledge is reflected in remarkably sustained productivity and environmental regeneration over this period. Neither the household nor the irrigation cluster, however, is entirely free of communal control, and so this chapter will set the stage for an analysis of the communal management of water in later chapters.

Agricultural Production

About 805 hectares of cultivable land are in agricultural use in a belt between the Colca River bottom, at 3,200 meters, and the current upper limit of agriculture, at approximately 3,600 meters. This land is divided into small fields farmed by their owners, dispersed across the belt in a common form of risk-reducing diversification. Production decisions concerning the use of these fields are made by the heads of the households that own them. Agricultural production includes the results of routinized procedures and conscious, rulebased procedures. The former are standardized sequences of stereotypic, familiar activities carried out over the course of the year that guide the farmer through the stages of agricultural production. While routinized procedures may appear to the observer to be rule-driven, to the farmer they involve no evaluation or deliberation—they are simply done. They are "scripts," preattentive plans analogous to scripts in plays that tell actors what to do (Schank and Abelson 1977). Rule-based procedures, in contrast, are consciously selected alternative courses of action oriented to short- and long-term production goals.

The distinction between these two procedures can be illustrated by a slight modification of the well-known "restaurant script" used in cognitive science to illustrate Schank and Abelson's notion of scripts (Quinn and Holland 1987:19). This script guides the customer through the sequence of actions—entering the restaurant, taking a seat, ordering the meal, paying, and leaving a tip—in the routine of having a meal in a restaurant. During the enactment of the script, however, when the menu arrives, the customer selects an appetizer, entrée, dessert, and drink by carefully evaluating selections with respect to considerations such as cost, individual taste (a cheese rather than a pastry for dessert), and complement (a white rather than a red wine for a fish entrée). On entering an unfamiliar ethnic restaurant, the overall script may be the same, but on being confronted with a strange and exotic menu one may ask assistance from a waiter for suggested appropriate choices or culinary rules for combining dishes, textures, and flavors.

The farmer, like the customer in a restaurant, moves through a sequence of actions with a beginning (field preparation) and an end (harvest), taking some actions reflexively (e.g., plowing under crop refuse) and others after careful consideration, such as the choice of a crop and associated soil amendments for a field, based on soil type, altitude, slope, and availability of water. In the latter case, soil modification is one of the tools in the farmer's kit, along with water management, varietal selection, and sequence scheduling, used selectively to optimize the production of a crop or crops in a field. Fertilization and fallow, for example, are used to achieve crop production goals rather than to improve soil fertility or texture, manage soil erosion, or reduce the buildup of soil pathogens. Such changes in soil characteristics may derive directly or indirectly from pragmatic measures to optimize crop production, but they are not goals independent of crop production.

This should not be taken to mean that soils are manipulated in an ad hoc or unconsidered manner. Farmers work from a rich native knowledge of soil properties and types. Lareños group soils into about eight major classes based primarily on texture followed by performance characteristics and color.[1] Figure 8 presents a sample tree produced by sorting tasks as performed by one informant (Furbee 1989). The properties or features that the informant used in deciding on grouping criteria are also presented, and the soil groups

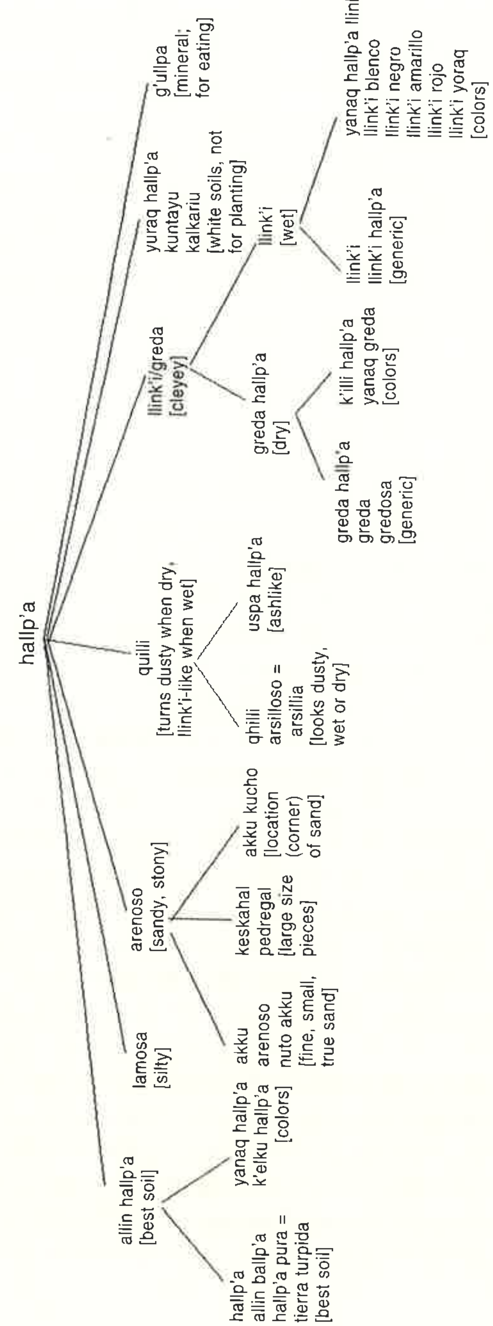


Fig. 8. A sample taxonomic tree of Lari soil classification. (After Furbee 1989.)

range left to right from the best to the worst in terms of agricultural productivity. Farmers recognize that soil properties can be modified within limits. While knowledge is greatest for those soils encountered in one's fields, all farmers possess a generalized knowledge of the local range of village soils.

Rule-based decisions in crop production involving soil modification include short-term production decisions that are oriented to the next harvest, multiyear long-term crop and plot rotation strategies, and routinized soil management procedures. After discussing these types of decisions, the chapter will conclude with a consideration of the role of native soil management in producing the generally excellent soils found in Lari and elsewhere in the Colca Valley.

Short-Term Management Decisions: Abandon, Fallow, or Cultivate

The initial production decision involving soils—whether to cultivate, abandon, or fallow a field—is taken at the beginning of the agricultural cycle. Abandonment and fallow benefit soil by allowing it to regain fertility and reduce the buildup of pathogens. Fallow has also been shown experimentally to protect soil from runoff and erosion (Felipe-Morales et al. 1979).

Abandonment is a complete withdrawal of the field from any form of use, a radical step that would not willingly be chosen. In almost all cases, abandoned fields are located in a 56-hectare area that was walled off by the community and removed from use following two massive landslides in 1978. In that year, the alluvial terrace on which the village sits was undermined by the rising waters of the Colca River. The episodes left the alluvial terrace in a very unstable condition with the risk that irrigation of adjacent fields would further undermine it, in all likelihood leading to a landslide that would jeopardize the village proper. Prohibition was a dramatic, but necessary, step to prevent further land loss.[2] Historically, landslides occur throughout the Colca Valley and elsewhere in Peru during the rainy season and result in land abandonment.[3]

About 4 in every 10 hectares of cultivable land were in fallow or in alfalfa. Alfalfa has been introduced since the 1960s into the traditional fallow period and will be discussed in a later chapter. The decision to fallow may be taken as part of a long-term production strategy (crop and field rotation) or as a result of a constraint on short-term use. We will discuss fallow in relation to crop and field rotation below, focusing now on the short-term.

The most important cause of short-term fallow is insufficient moisture. Spring-fed fields have the most secure sources of sufficient and dependable water for irrigation and are rarely fallow for lack of water. Irrigation clusters fed by precipitation and snowmelt, on the other hand, have much more precarious and variable sources of water. In a canal-fed toma, one may have to wait 90 to 105 days to irrigate a second time after the initial seeding of maize. In a spring-fed toma one can irrigate optimally, every 30 to 45 days.

The variation across canal-fed and spring-fed irrigation clusters is significant in terms of the availability of water. An additional consideration is the possibility that the community will impose limits on the water available to individual farmers in a water-scarce toma. This happens frequently during years of drought and can force a farmer to fallow a field unwillingly.

As we have seen, the location of a field in a toma directly influences the sequence of water distribution and indirectly the timing and quantity of water the field will get. Location thus becomes very important when a toma has insufficient water and must stretch out the mita in order to accommodate all users. An extended wait for water may cause an owner to water too late to ensure seed germination or to maintain optimum plant growth. Owners with fields near the tail in a toma plagued with water problems may forego cultivation or change to a less water-sensitive crop because of the insufficient supply of water.

Insufficient moisture due to low levels of surface water, communal limits on the water made available in a toma, and poor field location within a toma can conspire to force a farmer to fallow all or a part of a field.

Other factors can also lead to fallow. Farmers with many fields may find themselves with insufficient labor to farm them, forcing them to cut back. Lack of sufficient dung to apply to fields can have the same effect. Farmers who possess only a limited number of fields, on the other hand, may be forced to cultivate without fertilizer, the prospect of poor yields notwithstanding.

In sum, while farmers ideally cultivate all the fields to which they have access, they may be forced to fallow all or part of a field because of insufficiencies of water, labor, or manure. Mechanisms such as sharecropping can alleviate the problem of variations in land distribution, and reciprocal exchanges of labor, oxen, and dung between households are common means of meeting these demands, though even these mechanisms may be insufficient.

Short-Term Management Decisions: Crop Choice

If a field is to be fallowed, the farmer has the choice of forgoing cultivation or seeding alfalfa. Generally, the benefits of seeding a fallowed field to alfalfa (forage or soil improvement) outweigh the costs (seed and labor). In this cash-poor economy, however, the cost of seed can be a significant constraint. This explains, at least partially, why about one out of every four noncultivated fields are fallowed and not seeded in alfalfa.[4]

If the field is to be cultivated, the farmer considers whether to grow a crop for home consumption (and possibly exchange), or forage to feed one's animals.[5] Crops grown for subsistence include maize, barley, potatoes, and broad beans. Maize is consumed as a fermented beer (Que. *chicha*), toasted kernels (Que. *cancha*), hominy (Que. *mote*), and as corn on the cob (Que. *choclo*). Barley is parched, ground into a mush (Que. *mashka*), put in soups, and used for chicha. Broad beans are consumed fresh, or dried, in hominy. Of lesser importance are *quinoa,* wheat, oats, the indigenous tubers *oca, papa lisa,* and *año* (known collectively as Que. *chawa*); also of lesser importance are vegetables such as onions, lettuce, peas, and chard. Alfalfa, and slowly maturing barley and oats, are used for forage.

Frost Risk

Crop choice is a much more complex decision than whether to cultivate, abandon, or fallow a field. Frost risk, water availability, labor requirements, distance, and soil type, all of which interact in subtle ways, must be considered. One of the most serious constraints on crop production is frost risk, associated with the low mean minimum temperature of the Colca Valley of –6.7° (ONERN 1973: 1:55–56). While all fields are at risk, fields situated at lower elevations are better off because of a relation between altitude and mean minimum temperature in the equatorial Andes (Knapp 1984:66–67).

Absolute minimum temperatures reflect conditions during those cloudless nights most favorable to frost. Cold air tends to pool on flats and valley bottoms, lowering the temperature in comparison with the slopes.[6] In Lari, depressions caused by landslides and subsequent slumping produce basins that are closed artificially (Que. *poqro;* Sp. *hoyo*) and extremely susceptible to frost. Surface characteristics also known to affect temperature near the ground at night include: undulation and hollows, narrow ditches with heat retaining side walls, standing water, physical properties of soils, and soil color (Knapp 1984:74).

Crops vary in their susceptibility to frost. Maize, onions, lettuce, peas, and chard are particularly susceptible. Broad beans and barley are more frost-resistant, followed by quinoa and alfalfa. Farmers are aware of the varying susceptibility of these crops to frost and the subtle and complex interactions of altitude, field-surface characteristics, and topography in determining the frost risk of fields. They continually point out special frost-resistant microclimates such as low, protected quebradas and bench terraces planted with the edible-fruited tuna (*Opuntia ficusindica*), as well as onions, broad beans, maize to be consumed fresh, and squash.

Water

In this semiarid environment, farmers are very much aware of variation in water demand by crop. Crops with high water requirements include alfalfa, chawa (oca, papa lisa, and año), potatoes, onions, and, to a lesser extent, maize. Crops with the lowest water requirements, valued for their drought resistance, are quinoa and barley. Farmers estimate the quantity of water that will be necessary for field preparation and crop growth and base their crop choice on this estimate. Their concern is not with optimum but with predictable crop production in line with subsistence needs. Thus, while alfalfa requires a relatively large amount of water to achieve maximum yield, long roots enable it to survive droughts and recover from frost damage, helping to explain its popularity. Quinoa, a native cultigen that does well in long dry spells and resists frosts, is interplanted with barley and broad beans despite the tedious and time consuming process of preparation.

Labor Availability

Household heads count on the labor of their household in meeting agricultural tasks. This labor is usually sufficient except during peak periods of the agricultural cycle such as field preparation and harvest. On these occasions labor is scarce, forcing farmers to resort to reciprocal labor and, if cash is available, the hire of workers. All farmers face peak periods at approximately the same time, however, and demands for labor and oxen can exceed supply. Labor requirements of specific crops thus enter into crop choice decisions.

Distance

The distance from house to field is an important element in crop choice. There may be as much as a forty-five-minute walk to a field. If a farmer has fields scattered throughout the village, much time may be spent just getting to and from them. There will be an incentive to seed distant fields with crops needing modest amounts of labor.

Soil

A farmer's knowledge of soils extends to key agronomic characteristics, including seed germination, water retention, and fertility. Most soils are identified by terms that indicate differences in texture: in Quechua, sandy, *akku;* clayey, *llink'i;* and intermediate, *allin hallp'a;* and in Spanish, sandy, *arenoso;* gravelly, *cascoso;* loamy, *lomoso;* clayey, *arcilloso, gredoso;* and rocky, *pedregoso*. These terms become reference points in discussions of the effect of differences in texture on germination rates, water retention, and fertility. For example, allin hallpá, an intermediate textured soil, is used to exemplify the most fertile soil, while akku is said in Quechua to be *tullu*, "like a bone" and "lazy" or "languid" (also Sp. *flaco*). Germination rate is also perceived to vary with texture in that loose akku soils facilitate quick germination in contrast with heavy llink'i, soils. Rapid germination rates are important in short growing seasons such as those of the Colca Valley. Villagers in nearby Madrigal point out that the growing season begins earlier in Lari because akku soils predominate.[7]

The water retentive qualities of locally recognized soil types are known and of obvious importance in this water scarce region. Poor water retaining soils need more frequent irrigation. High water retaining soils, on the other hand, do present risks during the rainy season for crops susceptible to root rot, such as barley or peas.

The soils of a field are, therefore, monitored closely in the process of crop choice. Poor water retaining soils are selected for drought resistant crops such as barley. Clayey soils are said to be good for barley and vegetables, but not potatoes. Sandy or gravelly soils are bad for all crops with the exception of alfalfa and potatoes. Once crops are chosen for a field, soil type partially determines field management.

Short-Term Management Decisions: Simplifying Crop Choice

The range of crops that can grow in Lari and the variables that enter into their selection are indeed numerous and their interactions complex. In order to simplify what would otherwise be an unmanageable decision problem, farmers narrow the range of choices by using rules of thumb that, because

of the force of some aspects of a field, can eliminate others from consideration. This process of human decision making was first described by Tversky (1972) and applied to agricultural decision making by Gladwin (1980).

1. *Fallow*. Alfalfa is automatically chosen for seeding in a fallowed field. Alfalfa is a hardy, drought-resistant forage plant with long roots that conserve moisture during dry periods and allow the plant to recover quickly following a frost. It is said to grow well in sandy, infertile soils and in locations not suitable for maize. Farmers now cultivate alfalfa during what would have been a fallow period in maize cultivation. Water remains a concern since a minimal amount of water is essential for alfalfa, but alfalfa's frost resistance and low labor requirements remove frost risk, crop and field rotation, labor availability, distance, and soil type from consideration.

2. *Flats and Closed Basins*. Cold air pools on the surface of flats (pampas) and closed basins (poqros) rendering them extremely frost ridden. This fact overrides consideration of other field characteristics such as soil type, particularly those that would suggest the cultivation of maize, which is highly susceptible to frost. While an unusually protected flat or closed basin may reduce frost risk sufficiently to allow maize cultivation, in general, these locations are seeded with the more frost resistant broad beans, barley, or alfalfa.

3. *Terraces*. Due to the effect of cold-air pooling, slopes tend to be warmer than flats and closed basins. Slopes are terraced and thus enhanced by the retention of heat in the stone endwalls and faces of terraces. A terraced field will remove from consideration aspects that would select for frost-resistant crops such as barley and broad beans. The frost-reducing nature of terrace slopes is of greater importance to farmers than other benefits of terracing such as improvements in water retention, increase in soil depth, and defense against soil erosion. Alfalfa, on the other hand, will not be removed from consideration, because of its importance in field rotation.

The rules of thumb for frost-resistant crops in flats and frost-susceptible crops in terraces produce an association of maize with terraces and barley with unterraced fields as shown in table 13.

4. *Snowcap*. At the beginning of the cycle, farmers inspect the snowcap of the mountain above Lari that feeds the toma in which their field is located, thereby determining the amount of snowmelt that will feed their toma during the coming season and the possibility, if the cap is small, of limitations that will be placed on the amount of water each farmer in the toma can use. These limitations are set in a villagewide association of irrigators with the purpose

of ensuring that each irrigator will have access to a minimum amount of water.[8]

Crop choice is by far the most important and complex production decision made by a farmer. One must weigh a host of agronomic factors, realistically estimate household subsistence needs for the coming year, and try to predict the vagaries of the market and the amount of water available during the coming dry season. Rules of thumb are essential in reducing the complexities of the decision.

Long-Term Management Decisions: Crop and Field Rotation

Alongside short-term production decisions oriented to the successful conclusion of an agricultural season are long-term considerations of maintaining sustained yields from year to year. Two important dimensions are the maintenance of soil fertility over time and the control of soil pathogens that build up in conjunction with continued production of the same crop. Crop and field rotation are important long-term production strategies in this regard. One finds two basic sequences: one for fields used for maizales; the other for fields on which maize is not cultivated. In the former case, maize is cultivated for a period of from 3 to 10 years, depending on soil quality and fertilization, until yields begin to decline. Then the field reverts to fallow and alfalfa for approximately 7 years. The field is then "broken" (Sp. *rompe*) for return to food crop production and potatoes are cultivated for 1 to 2 years, after which one begins the cycle anew with maize. On fields not used for maize cultivation, one rotates barley, wheat, and broad beans, followed by a period of fallow and alfalfa, followed by potatoes, at which point the cycle begins again.

TABLE 13. Crop Association with Terraced and Unterraced Plots

	Terrace		Pampa	
Crop	*N*	%	*N*	%
Alfalfa	70	34.0	60	27.8
Potato	4	1.9	3	1.4
Maize	99	48.1	36	16.7
Broad Beans	15	7.3	22	10.2
Barley	14	6.8	88	40.7
Wheat	4	1.9	7	3.2

Source: Based on results of the land use survey administered to 54 household heads.
$p < .05$

Such a crop rotation pattern assumes that a household has sufficient fields to allow ideal crop rotation practices, on one hand, and sufficient numbers of fields seeded each year with staple crops of maize, broad beans, potatoes, and barley, on the other. Ideally, each household should have access to one field per household member, which allows optimum crop rotation and staple production. If there is less than one field per household member, then the household is forced to depart from optimal crop rotation practices. For example, a field that may be somewhat marginal will be used, on a more or less permanent basis, for barley or, if extremely marginal, alfalfa. In these circumstances, the household may decide to rotate crops or intercrop within fields rather than rotate crops across fields. A field with sandy soils not appropriate for maize will nevertheless be used for maize if there are not enough maizales.

These patterns are determined by the need to provision the household. Estimates for consumption of staples are one sack each of barley, maize, and potatoes and one and a half sacks of broad beans per person per year.[9] Some variation in these needs occurs, of course, due to food preferences. In addition, market concerns and forage needs also influence production. For example, if a farmer has animals, then he or she will be concerned with obtaining forage leading to alfalfa cultivation. If not, he or she may still seed alfalfa in order to rent out the plot for forage.

Crop Choice and Soil Management Practices

After a crop has been chosen, the farmer turns to devising a strategy to tailor its production to the characteristics of the field in question. Soil characteristics are considered more directly in this process and measures will usually be taken to modify them.

Manure

All crops, with the exception of alfalfa and broad beans, are fertilized with the dung that collects in corrals (Sp. *abono de corral*) adjoining houses. Dung is dug, loaded into sacks, transported by mule or burro to the site, and spread in piles across the field surface just before plowing. Some corrals also receive deposits of llama dung added annually during trading expeditions to Lari by caravans from the upper pastoral zones.[10]

Dung is known to be an important source of fertilizer and fuel in the Andes (Winterhalder, Larsen, and Thomas 1974). The results of chemical analysis of dung collected in the neighboring Colca Valley village of Coporaque confirm this (table 14). All soil nutrients important for plant growth are present. Percentage composition of each of the nutrients falls near the average reported for dung on U.S.A. farms and samples collected in Nuñoa. Sheep and llama dung are particularly rich in nitrogen, in comparison with that from cows, horses, and swine (Sandor 1987). Another important component of manure is the ash collected from hearths, harvested and burned crop refuse, the burning of weeds during field preparation, and the periodic burning of vegetation on the face and endwalls of terraces to keep field mice and birds out of fields. Hearth ash, accumulating from the burning of dung for fuel and other household refuse, is piled up periodically in a corner of the corral and mixed with dung before transport to the field. While ash is said to "lighten" heavy, clayey (llink'i) soils, it "burns" a soil known as *calcha hallp'a*.[11] As indicated, ash is an important source of all the essential soil nutrients, particularly phosphorus and potassium, in the form of burned barley stalks.[12]

Applications rates, measured in kilograms per square meter, for a sample of nine Lari fields that received dung ranged from 0.1 to 1.2, with a mean of 0.46. These figures are consistent with McCamant (1986:68), who reports dung application rates for maize in Coporaque to range from 0.06 to 2.3, with a mean of 0.43. McCamant's figures are lower than those for Coporaque of 1.0 (Treacy 1989:285), for typical rates on U.S. farms of 1.4–2.1, and for potato fields of 1.8 (approximate dry weight basis) in Nuñoa, an agropastoral village in the Peruvian Department of Puno (Winterhalder, Larsen, and Thomas 1974). Application of nutrient-rich dung at a rate of 1.0 would

TABLE 14. Partial Elemental Composition of Manure and Ash Samples, Coporaque

Type	N	P	K	Ca	Mg	S	Na	Fe	Mn	Zn	Cu	B
Llama dung	16.7	2.87	12.2	21.4	3.85	3.50	1.16	2.3	238	58	29	33
Sheep dung	15.8	5.60	14.9	28.6	6.59	1.87	1.10	15.4	366	101	41	33
Mixed dung[a]	14.1	4.20	15.7	13.2	3.40	2.70	1.24	2.7	146	77	15	24
Hearth ash[b]	1.8	25.50	33.1	115.1	22.30	7.10	0.51	12.7	874	331	90	93
Freshly burned barley stalks[c]	15.0	11.1	48.6	36.70	5.80	6.80	0.24	3.7	169	79	16	44

Source: For the sheep and llama dung samples, Sandor 1986; for the mixed dung and ash samples, Treacy 1989:14.
Note: All measurements given in grams per kilogram except Mn, Zn, Cu, and B, which are given in milligrams.
[a]Mixed dung, probably sheep, burro, and horse, collected from a pile on a maize terrace.
[b]Mixed household refuse ash collected from a pile upon a maize terrace.

have a clear impact on the maintenance of soil fertility. Annual inputs into soil of the three main fertilizer elements would be about 160–70 kilograms of nitrogen, 30–55 kilograms of phosphorus, and 120–50 kilograms of potassium per hectare, well within the range of fertilizer application rates used in corn production in the United States (Sandor 1987). Somewhat lower dung application rates in Lari may explain slightly higher levels of nitrogen and phosphorus encountered in Coporaque's soils.

The main criterion for dung application is the choice of crop: Maize, potatoes, vegetables, and high-yielding two-rowed barley (*Hordeum distichum L.*), known locally as cebada cervecera, receive dung; common barley (*Hordeum vulgare*) and broad beans do not.[13] Broad beans respond to dung (and chemical fertilizer) with excessive leaf growth rather than increased yields. A secondary criterion is soil type. "Lazy" or "languid" soils (Que. tullu; Sp. flaco), which need dung to produce a crop, will usually get an application, while extremely fertile fields may not. Nor do all crops receive it. Since alfalfa does well in poor soils and since its production is oriented to minimal rather than maximal yields, it will not get an application.

Chemical Fertilizer

Small amounts of chemical fertilizer are applied in about one out of every three cultivated fields.[14] Ammonium phosphate is broadcast during the seeding of maize, peas, and potatoes. Maize and potatoes are later sidedressed with urea.[15] Urea is also applied to onions, garlic, vegetables, maize, and potatoes. The use of chemical fertilizer depends, of course, on the availability of cash. Crops destined for market are much more likely to receive dung and chemical fertilizer. The adoption of chemical fertilizer is of recent origin, related to the extension of the road network, the introduction of cash crops, and the expansion of the services of the Ministry of Agriculture.

Soil Management Scripts

Aside from consciously selected soil modification strategies taken in conjunction with short- and long-term production decisions, there is another category of soil management behavior: routinized practices that affect soil quality, including terrace maintenance, minimal planting techniques, postharvest grazing of animals on fields, and barbecho.

Agricultural terraces of the Colca Valley increase topsoil thickness through the filling in of soil behind terrace walls. Measured increases range from about 0.3–1.3 meters, with estimates of as much as 2–3 meters in some terraces (Sandor 1986:245). Terraces also reduce erosive runoff and enhance water conservation by reducing slope angle and length. Ratios between terraced and original slopes, expressed in percentage, are 13:30, <2:20, 7:22 and 14:22 (Sandor 1986:245). These benefits are jeopardized by heavy rains from December to March that weaken terrace faces and endwalls, causing landslides, mudslides, and flooding, and washing away terraces on the valley bottom. Terrace maintenance is thus an important dimension of soil management and conservation.[16]

Many contemporary agricultural techniques originated in the Andes prior to the sixteenth-century conquest while others were introduced by the Spanish during the colonial period. An important aspect of these techniques is their minimal disruption of fields. The scratch plow, of Mediterranean origin, has now fully replaced the Andean foot plow (chakitaclla) in Lari.[17]It is a shallow draft plow that, unlike the later moldboard plow, does not turn over sod or produce an impacted plowpan. Animals are used for transport rather than wheeled containers, thus minimizing the trampling effect.[18]Crops are not seeded in furrows, but potato and maize plants are mounded at their base creating a favorable microclimate for water retention and temperature.

After harvest, animals are turned onto fields and allowed to graze on the stubble, adding dung. June and July, after animals have finished grazing, are the months of the barbecho: fields are irrigated, left for a few days, and, before they are entirely dry, they are plowed and the soil is turned over. Barbecho breaks down the compacted soil, removing the clods (Que. *toqra*) that impede germination, and fosters the growth of weeds that can be removed prior to seeding by plowing under or burning.

These procedures are a very important element of soil management, yet they are not consciously chosen but are instead a routinized, taken-for-granted part of agricultural production. Some, such as the use of a scratch plow, are not perceived as having any beneficial effect on soil quality; others, such as the grazing of animals on stubble, are understood as having an effect, but are motivated by other considerations, such as the demand for forage.

Agronomic Characteristics of Lari Soils and Crop Production

The outcome of the effect of soil management practices applied to natural soils in the Colca Valley setting can be seen in the agronomic characteristics of Lari soils presented in tables 15 and 16.[19] Laboratory analysis showed most topsoils to be relatively thick, organic matter-rich, Mollisols. This is true for natural as well as thicker, terraced topsoils. Loams or sandy loams predominate among topsoils. Soil structure and bulk density indicate good soil tilth, favorable permeability and aeration, high available water capacity, and a good porosity. Soils appear generally fertile in terms of nitrogen and phosphorous, with levels of organic matter comparable to Mollisols of the U.S. Midwest. The pH range is optimal for nutrient availability for the crops grown.

Texture varies across fields, helping to explain, in part, the emphasis on texture in Lari soil classification. The three most common native soil classes—akku (sandy soil), allin hallp'a ("good" soil) and llink'i (clayey soil)—agree closely with U.S. soil classification and laboratory analysis. Akku soils are sandy loams or loamy sands with a low clay percentage (about 8–10 percent). Llink'i topsoils are loams averaging 23 percent clay and subsurface samples are usually clay loams or clay with about 40 percent clay. Allin hallp'a soils have intermediate textures of loams or sandy loams. Using the U.S. soil taxonomy (Soil Survey Staff 1975), akku soils fall into sandy or coarse-loamy classes, llink'i into fine-loamy or fine classes, and allin hallp'a into intermediate coarse-loamy or fine-loamy classes (Sandor 1989).

In general, the data on soils from Lari confirm laboratory analyses of soils from the neighboring village of Coporaque (Sandor 1987). Levels of nitrogen and phosphorus are somewhat lower than those reported in Coporaque. This may indicate lower levels of dung and ash applied in Lari, different soil sampling methodology, or other factors.

Productive soils in Lari are also indicated by crop yields obtained for a sample of twenty fields. Yields of 3.5 metric tons per hectare were obtained for maize (N = 4). Average yields for barley were 2.9 metric tons per hectare (N = 13). These yields are substantially higher than those reported by the agricultural ministry and Coporaque farmers (1.2 tn. per ha.) or the average U.S. yields for 1974 (barley 1.7 tn. per ha.) (Janick et al. 1974; Sandor 1987). Yields in the United States have almost doubled in the period since 1974 (Jon Sandor, pers. com.) and farmers' estimates of yields are subject to exaggeration on some occasions and underestimation on others. Nonetheless, they do indicate rather high yields by regional and U.S. standards.

Agricultural Production and Sustainable Agriculture

There is a rich knowledge in Lari of the distribution and properties of local soils and their role in crop production.[20] To what extent can this knowledge account for the excellent soil structure, good soil fertility, and high and sustained crop yields in Lari? To address this question, one must first acknowledge that the Colca Valley in many cases possesses young soils well endowed with basic plant nutrients, in particular potassium.[21] Cold temperatures and a semiarid climate also help account for the maintenance of soil quality. For example, while the amount of dung that is applied to fields in Lari and Cuyo, on the eastern slopes of the Andes in Puno Department, is roughly similar, there is a much higher level of organic matter in Cuyo Cuyo's soils. This is accounted for by higher altitude and greater amounts of rainfall in Cuyo Cuyo (Jon Sandor, pers. com.).

Despite favorable parent material and provident environmental variables, it is clear from the abundant record of man-land interactions in montane environments that even the best soils can be mismanaged. It seems obvious, then, that native soil management plays an important role in the excellent state of soils in Lari and elsewhere in the Colca Valley. First, manuring with dung and ash contributes significantly to soil nutrients, particularly nitrogen

TABLE 15. Soil Chemical Properties for Intensively Sampled Agricultural Fields in Lari, Grouped by Quechua Soil Classification

Soil Type	pH	Organic C	Total N	NO_3-N	Total P	Available P
			0–15 Centimeter Depth			
Akku	7.1 (0.4)	7.2 (2.8)	0.61 (0.25)	9 (6)	686 (71)	9 (4)
Allin hallp'a	7.2 (0.3)	13.5 (2.1)	1.18 (0.15)	12 (7)	578 (100)	7 (6)
Llink'i	6.5 (0.5)	13.7 (2.7)	1.21 (0.23)	8 (7)	625 (205)	12 (9)
$LSD_{0.05}$	0.3	1.6	0.14	4	87	4
			40–50 Centimeter Depth			
Akku	7.4 (0.2)	3.0 (0.8)	0.20 (0.10)	8 (6)	661 (81)	5 (5)
Allin hallp'a	7.2 (0.2)	4.5 (0.4)	0.46 (0.05)	6 (1)	582 (114)	3 (0)
Llink'i	7.1 (0.5)	8.7 (0.9)	0.76 (0.06)	6 (2)	581 (225)	5 (3)
$LSD_{0.05}$	0.4	0.9	0.09	5	188	4

Source: Sandor 1989; 42 table 4.

Notes: Measurements for C and N are given in grams per kilogram; those for NO_3N and P given in milligrams. Data are given as means, with standard deviations in parentheses. Sample size for each group is 20 at 0–15 centimeter depth and 6 at 40–50 centimeter depth. $LSD_{0.05}$ = least significant difference at the 0.05 level.

and phosphorus. Corrals attached to house sites in the early colonial settlements were a feature of the colonial reduccion settlement of Lari and indicate the agro-pastoral orientation of its economy from at least that period. Levels of phosphorus in several abandoned terraced soils in neighboring Coporaque, radiocarbon-dated at about 1,400–1,700 years before the present, are unusually high (Sandor 1987). Phosphorus and nitrogen levels in Lari soils are lower than those reported for Coporaque, although higher in comparison with those encountered elsewhere in the highland Andes. It is not clear, as yet, whether lower levels in Lari are due to lower levels of dung and ash applied to fields or other management or edaphic factors. Nonetheless, mixed agro-pastoralism has been essential in providing access to the manure that has maintained soil fertility .

Second, excellent soil structure, indicated by good tilth, permeability, aeration, water retention, and porosity, is related directly to routinized soil management practices, in particular, minimal disturbance tillage, barbecho, and postharvest grazing (Sandor 1989), carried out on generally well-maintained agricultural terraces of pre-Colombian origins. Minimum tillage, known also as no-till and conservation tillage, maintains and, in some cases, improves soil tilth and texture.

TABLE 16. Soil Physical Properties for Intensively Sampled Agricultural Fields in Lari, Grouped by Quechua Soil Classification

	Particle Size Distribution (mm.)				
Soil Type	Sand (2–0.05)	Silt (0.05–0.002)	Clay (<0.002)	Water retention 1.5 MPa	Bulk density
			0–15 Centimeter depth		
Akku	76 (8)	16 (3)	8 (2)	0.07 (0.02)	1.32 (0.11)
Allin hallp'a	54 (8)	30 (2)	16 (3)	0.12 (0.02)	1.25 (0.06)
Llink'i	44 (7)	33 (2)	23 (6)	0.14 (0.02)	1.43 (0.09)
$LSD_{0.05}$	5	2	3	0.01	0.06
			40–50 Centimeter Depth		
Akku	78 (9)	12 (3)	10 (4)	0.07 (0.02)	
Allin hallp'a	53 (4)	28 (2)	19 (2)	0.12 (0.01)	
Llink'i	24 (13)	35 (5)	41 (5)	0.20 (0.01)	
$LSD_{0.05}$	12	4	5	0.02	

Source: Sandor 1989: 43 table 5.

Notes: Data for particle distribution are given in percentages; those for water retention, in kilograms per kilogram; and those for bulk density, in grams per cubic centimeter. Data are given as means, with standard deviations in parentheses. Sample size for each group is 20 at 0–15 centimeter depth and 6 at 40–50 centimeter depth. $LSD_{0.05}$ = least significant difference at the 0.05 level.

Lastly, it is significant that about four out of every ten hectares of cultivable land are either in fallow and uncultivated or in fallow and cultivated in alfalfa, in contrast with a stated ideal by farmers that all fields should be cultivated in face of the demands of growing households.[22] These low-intensity uses rest the soil, protect fields from runoff and erosion, and maintain fertility through the addition of dung from grazing animals and the nitrogen-fixing effect of alfalfa. The paradox is that while farmers, if permitted, would farm all fields, forced low-intensity use plays an important role in soil management.

Water Availability and Cropping Strategies

One reason for low-intensity, less-than-ideal land use is that insufficiency of labor, fertilizer, or water may force household heads to fallow otherwise cultivable fields. Lack of sufficient fields to practice crop and field rotation will also force crop-rotation strategies to be broken. Access to water clearly has an impact on many elements of household production decisions. Poor field location or insufficient water flow to an irrigation cluster influence the decision to cultivate or fallow, and, for those fields to be cultivated, estimates of water availability based on rules of thumb such as the extent of the snow pack influence crop choice.

Another reason for low-intensity use stems from the effect of communal controls on resources. In order to address this issue, we must shift our focus away from the irrigation cluster and the household and toward the communal sphere of water management.

Chapter 6

Irrigation and the State: Water Management under the Inka, Colony, and Republic

> In districts where the quantity of water for irrigation was small, they divided it proportionately (as they did with everything they shared out), so that there should be no dispute among the Indians about obtaining it. This was only done in years of scanty rainfall when the need was greatest. The water was measured, and as it was known from experience how long it took to irrigate a *fanega* of land, each Indian was accordingly granted the number of hours supply he needed for the amount of land he had, with plenty to spare. Water was taken by turns, according to the order of the plots of land, one after another. No preference was given to the rich or nobles, or to favorites or relatives of the curaca, or to the curaca himself, or to royal officials or governors. Anyone who neglected to irrigate his land at the proper time received an ignominious punishment.
>
> —Garcilaso de la Vega [1609] 1966: 248

Having arrived at this point in our journey, one could reasonably conclude that at the heart of irrigation in Lari is the distribution of water shares by a regidor to the owners of a cluster of fields that share the same source.

If I have done my work well, I would also have impressed the reader with the adaptability of this process: its ability to adjust quickly to topographic irregularities, changes in land ownership, cropping patterns, and fluctuating water flow. From the farmer's perspective, one simply shows up at the right time at the regina in question, shouts hard and often to stake a claim to a water share, and makes sure to irrigate on the day and at the hour assigned. I was given this perspective in irrigation when I first moved into the village. During a casual conversation with my new neighbors, they mentioned, almost as an afterthought, that when I needed to irrigate the walled garden attached to my house, I should show up at the Orcoya regina and I would be assigned a day and time to irrigate.

Though true, this account is incomplete. Undergirding the irrigation cluster is a wider, communal sphere of water management. This sphere is responsible for the maintenance of the infrastructure of canals and reservoirs, the complex coordination and scheduling of the flow of water through the system, the creation and enforcement of sanctions, and actions taken to respond to a crisis mode of water scarcity. This chapter concerns the history of communal water management in highland Peru. Many of the mechanisms, we will find, have their origins in Inka irrigation administration.[1] The nature of communal water management is taken up in the next chapter.

Irrigation Administration during the Inka State

In the incorporation of conquered peoples such as the Collaguas into the Inka state, the ayllu played a key role in resource management. Fields and water to irrigate them were assigned Indians by virtue of their membership in an ayllu and could be passed on to one's heirs (Sherbondy 1987:132). The ayllu, in turn, was believed to have originally received these rights from its founders. The territory allotted an ayllu bore a close relationship to the area fed by a water source, be it lake, river, or underground stream. State authorities, *saywa checta suyuyoc* (Poma de Ayala [1583–1615] 1980:1:325), were responsible for delimiting and marking ayllu territories and used piles of stone and sacred stones, sculpted to represent canals and springs and the distribution of water rights (Sherbondy 1987:144).

Ayllu social organization was coterminous with the groups assigned to construct, maintain, and use the irrigation system. The ayllu, a fundamental division of the Andean world, thus functioned as a local unit as well as a community of irrigators. Ayllus, in turn, were incorporated into dual spatial and social (saya) and quadripartite (suyu) divisions.

The application of dual organization to terrestrial space led to the divisions of irrigation systems into upper and lower sections, often defined by a natural topographical marker such as a river. The Inkaic Cuzco Valley was paradigmatic. There the Huatanay River divided land between mountain and valley and left and right, with Hana, the right side, higher in sociopolitical rank than Hurin, the left side. Hanan and Hurin had separate irrigation systems and water officials that monitored boundaries. Hanan Cuzco and Hurin Cuzco were further divided in half into Chinchaysuyu/Antisuyu and Collasuyu/Cuntisuyu, respectively, creating a quadripartition. A set of lines (ceques) radiating from a center in the city of Cuzco marked off wedge-shaped divisions embodying irrigation subdivisions with their own source of water. These subdivisions, in turn, were associated with social groupings

ranked according to tripartite principles and may have served as a basis for the recruitment of labor. While seemingly complex, rigid, and reflecting on-the-ground divisions informed by a cognitive model of spatial organization, the resulting system was quite flexible, able to adjust to topographic and other environmental constraints.

While the ayllu controlled a delimited land areas, source(s) of water, and population, the process of water distribution was the responsibility of water distributors (*qillkiwa*) named during the month of November at the onset of the irrigation season (Poma de Ayala [1583–1615] 1980:3:1058).[2] They were charged with ensuring an equitable distribution of water, in order to counter the power of wealthy individuals, the señores, to take water from the poor. Guaman Poma takes pains to point out that water distributors, not curacas, were responsible for water distribution and remained in the office for a year, in contrast to curacas who inherited their position and kept it until death.

Curacas were of four ranks, depending on the number of male taxpayers over whom they had charge, ranging from chiefs of one hundred men to ten thousand men. The position of curaca was hereditary and subject to imperial approval. While the decimal system that resulted is said by many chroniclers to have been a rigid one, in practice, due to constant shifts and reclassification of families and ayllus, it was adapted to circumstance. A man would be made the leader of an ayllu and given the rank of curaca called for by the approximate number of taxpayers the ayllu contained. The Collaguas curacas, like those elsewhere, had preferential access to rescues, including land and animals (Deustua 1978: Cock 1976–77).

By their ability to withhold water, water distributors held check over the curacas who otherwise would be able to obtain water to irrigate the large quantity of land to which they had access. Guaman Poma's account gives credence to a decentralized system of water distribution in the form of local, autonomous nodes.

According to another Inkan chronicler, Garcilaso de la Vega, "no preference was given to the rich or nobles, or to favorites or relatives of the curaca, or to the curaca himself, or to royal officials or governors" and punishments were assessed for failure to irrigate land at the proper time (Garcilaso de la Vega [1609–17]1966:1.248). Irrigation was by turns, "according to the order of the plots of land, one after another" with water distributed corresponding to "the number of hours supply he needed for the amount of land he had" (Garcilaso de la Vega [1609–17]1966:1:248). A document from 1659 concerning the irrigation in the Cuzco Valley describes a mita of water distribution that normally ends in November or December. If water continues to be needed, turns are repeated in the same order as before (Sherbondy 1982:108). In the Cuzco Valley under the Inka, high fields were generally irrigated first, followed by fields downslope; this sequence could be modified to fit the topography or microclimates of an area (Sherbondy 1987:143).

The Inka state provided a temporal framework for local authorities to distribute irrigation water by the creation of an official irrigation and agricultural calendar. This calendar scheduled public rituals and offerings made in connection with beliefs about the forces associated with agriculture and water. Each of the major stages in the agricultural calender was marked in this way. Thus, while each field was unique in its soils, altitude, exposure and other edaphic variables, which dictated the timing of the agricultural tasks performed on it, the ritual calendar provided a structure within which farmers and local villages could schedule these tasks.

Tasks associated with the irrigation and cultivation of maize were central to the Inka agro-ritual calendar. The six major stages in maize agriculture were as follows: (1) the cleaning and repair of water transport systems in preparation for the initiation of the agricultural cycle; (2) the first round of irrigation, loosening the soil, and preparing it for seeding; (3) the onset of the first light rains; (4) the second round of irrigation ensuring the continued growth of the sprouted maize plants, also a time for the late planting of maize and other crops ; (5) the onset of heavy rains when no irrigation was needed; and (6) the end of the heavy rains and the beginning of the maturation period of crops (Sherbondy 1982:103–16).

Rituals appealing to the spiritual forces that controlled water and temperature initiated and accompanied each of these stages. Water was of special concern during the first, drier half of the agricultural cycle. Offerings were made during the cleaning of canals and reservoirs to plead for a plentiful water supply and for the continuity of the irrigation system. The date for the first seeding of maize was August 17, the antizenith of the sun, one of the two periods of the year when this occurs. The earth was thought to open at this time and become receptive to seed and irrigation water. A public ritual during which the inka and coya (king and queen) personally plowed and planted maize kernels in a sacred field (Sausero) celebrated the opening of the agricultural season. Other rituals included the Situa, coinciding with the first light rains in Cuzco in September, and Uma Raymi in November when the mummy of Inka Roca, the ancestor associated with water, was carried through Cuzco to the accompaniment of ritual cries for rain. Severe drought triggered an extracalendrical ritual, the Ytu Raymi. The first half of the agricultural year came to an end with the December solstice and was marked by Capac Raymi, a major state ritual that initiated a period of joy and celebration.

The centrality of maize in the official agro-ritual calender reflects the intense efforts made to adapt this heat-loving plant with a Mesoamerican hearth to the cold, hostile, short-growing season of the Andean highlands. The growing season of maize is longer than the highland rainy season of December to April.[3] Irrigation is thus essential to extend the growing season (Mitchell 1976). If maize is seeded at the beginning of the rainy season in December, however, it risks being damaged by June frosts before it matures. Advancing the seeding of maize, with the assistance of artificial irrigation, to August and September, the dry season, lessens this risk. It also allows the irrigation of maize during its initial growth stage to enable it to better withstand the violent onslaughts of rain during the rainy season that blow the plant over, "lodging" it. The importance of seeding maize at the right time—not too early to risk the frost killing of seedlings or mature plants—was the motive for the attention given by the Inka to the agro-ritual calender (Sherbondy 1979:ix).

Inka Irrigation Administration and the Collaguas

We may never know the manner in which the Inka reorganized the Collaguas polity and assigned land and water sources to ayllus. While the collection of Visitas is superb for reconstructing Collaguas land patterns, they tell us next to nothing about irrigation. Excepting the Ulloa Mogollón Relacion of 1586, we lack early descriptions of the Colca Valley that match the quality of detail in Polo de Ondegardo's account of the ceque system ([1571] 1917), copied by Bernabé Cobo ([1653] 1956) and drawn on extensively by Zuidema and Sherbondy to reconstruct the social and hydraulic organization of Inkaic Cuzco. Thus, the elegance, hierarchy, and symmetry of Inkaic Cuzco irrigation organization one would expect to find replicated in the Colca Valley, known to be an unusually clear example of Inkan planning (Zuidema 1964; Rostoworowski de Diez Canseco 1983:121–23), may escape us.

Given what we know of the hydraulic organization of Inkaic Cuzco and the extant archaeological and ethnohistorical record, we can surmise the outlines of a scenario for the Colca Valley. The capital of the Inkan province of Collaguas was Coporaque, on the north side of the valley, the site of a palace covered with sheets of copper and a bridge to connect the town with Chivay on the opposite bank of the river. It would have been a likely residence of the administrative ayllus with access to the best lands, the lands of the Inka, and corresponding irrigation sources.[4] If the Colca Valley had access to deposits of guano, they may well have been used in whole or in part on the land of the Inka in Coporaque, which would explain the high amounts of phosphorus, a nutrient that tends to become fixed and remain in the soil for long periods of time (Sandor 1987). We would also expect that dual, quadripartite, and tripartite principles would have fulfilled a similar function in the reorganization of the Colca Valley. Inkan planners were faced, of course, with modifying the principles to fit the environmental setting of the Colca Valley–the sources of water, topography, and the location of cultivable land.

The association between land and water source is indicated by the division of land into named groups of fields that share the same water source, a very old practice in Lari. In table 17, contemporary irrigation clusters are compared with toponyms extracted from the 1604 Visita of Lari-Hurinsaya. Sixteen of the nineteen irrigation clusters in use today (84 percent) were recognized by name in 1604. The three not listed—Chuñupucyo, Kowallo, and Uchurunta—are small groups of spring-fed fields on the unstable, landslide-prone lower slopes. Springs have a history in Lari, and elsewhere in the Colca Valley, of drying up and reemerging, and the three spring-fed tomas may represent land irrigated by springs that have emerged since 1604.

If we look at the zones within contemporary irrigation clusters, we find that the majority of them in the Calluma and Chaico canal systems were in use in 1604. Only about half of the Surimana zones are listed in the Visita, reflecting the fact that the Visita lists Indians who belong to Lari-Hurinsaya moiety, while the Surimana canal network is located within the Hanansaya spatial division. The figures do indicate that Indians who belonged to the moiety of Hurinsaya controlled fields in Hanansaya. Moiety land divisions were not thus restricted to members of the moiety in question.

While the majority of the toponyms in the 1604 Visita have been identified and are still in use, there are many that are unidentified. Unidentified toponyms may represent land that has since been abandoned or turned to another use. This is the case with Humaro, a large section of land on the eastern side of the village, which will be discussed in some detail in a later chapter. Many unidentified toponyms may be idiosyncratic field names.

Evidence from the Visita of Lari-Hurinsaya suggests a great deal of continuity in land use from 1604 to the present. At both points of time, land was organized spatially by irrigation cluster. These findings corroborate those of Treacy (1989:252–59) in neighboring Coporaque.

TABLE 17. Continuity in the Spatial Organization of Irrigation, 1604–1984

Irrigation Divisions in Use in 1984	In Use in 1604?	No. of Zones in Use in 1984	No. of Zones in Use in 1604	Continuity (%)
Calluma canal				
Arco	Yes	1	0	
Charasuta	Yes	8	8	
Karuna	Yes	1	1	
Utarana	Yes	0	0	
Yanahua Estanque	Yes	6	5	
Yanahua Urusa	Yes	9	8	
Subtotal		25	22	88.0
Chaico canal				
Chunta	Yes	9	8	
Coanca	Yes	7	6	
Huanconasa	Yes	0	0	
Kakancha	Yes	3	2	
Orcoya	Yes	15	12	
Subtotal		34	28	82.4
Surimana canal				
Surimana Estanque	Yes	9	4	
Surimana Urusa	Yes	14	8	
Subtotal		23	12	52.2
Spring-fed land				
Anachihua	Yes	4	1	
Chuñupucyo	No	1	1	
Karpa	Yes	1	1	
Kowallo	No	2	1	
Laurincaya	Yes	0	0	
Uchurunta	No	1	1	
Subtotal		9	5	55.56
Total		91	67	73.6

Source: Visita of Lari-Hurinsaya of 1604, entry for the *pueblo* of Lari.

Note: A toma name often occurs as a zone within the toma. Toma names are not counted as zone names in these instances.

Irrigation Administration during the Colony

Spanish colonial policy attempted to maintain basic parameters of Inka irrigation practice with as few changes as possible. The main concern was the control and regulation of land and labor rather than water. Spaniards, like the Inka, had institutions of rotation (turno) in water distribution and water distributors (Glick 1970). The Spaniards also introduced litigation and codification of water rights as a solution to conflicts over water (Lynch 1988:77). Two distinct systems of water tenure then in existence in Spain were applied to water use in the colony. The first was a tradition of state ownership of water that could be granted as *merced* or alienable right to landowners (Lynch 1988:77). In this system, Spaniards considered themselves owners of water shares and were accustomed to sell water shares independently of fields (Sherbondy 1987:143). It was in use in various regions of Spain as, for example, Alicante, Elche, and other southern huertas of Valencia (Glick 1970:12–13). The concept of alienable water rights differed significantly from Inka water practice which attached water rights to fields and not to the persons who had rights to the fields (Sherbondy 1987:143). The second form of water tenure was to consider water rights as inalienable from a field. This was the practice in other areas of Spain such as the northern huertas of Valencia (Glick 1970:12–13). This tradition is apparently behind the Spaniard's acceptance of the transfer of water rights with the fields Indians inherited (Sherbondy 1987:132).[5]

The dual moiety and quadripartite divisions were dismembered (at least in Cuzco), but in other respects the lower levels of the Inka system, the irrigation cluster, ayllu and ceque divisions were retained (Sherbondy 1991). According to a document from 1659, Spanish administrators respected the Inkan agricultural calender, maintaining the priority of the irrigation of maize from June 25 and prohibiting the irrigation of any other crop until the maize was finished (Sherbondy 1979:ix). Catholic priests, however, attempted to repress the Inka state ritual calendar and replace it with the Catholic feast-day calendar adapted to the agrarian cycle of the temperate zones of the Northern hemisphere. Nonetheless, while the Inkan ritual accompaniments to the agricultural calendar were dropped at the state level, Indians practiced indigenous agrarian rituals locally and covertly, under the guise of a convenient Catholic feast day.

One colonial policy that had ramifications in irrigation management was the creation of a new local government structure, the Indian Town Council (Cabildo de Indios), as part of a package of reforms carried out by Viceroy Toledo in the 1570s. Two mayor (*alcaldes*), one *principal* and the other *comun,* were established for villages of more than eighty families, reflecting the perseverance of dual social organization. Four aldermen (*regidores*) were also named and, together with the mayors, carried staffs (*varas*) as symbols of authority. Other officials included an *aguacil, mayordomo, procurador, mayordomo de hospital,* and an *escribano.* Officials were elected by the *comun de indios* each January 1 (Varallanos 1946:48)

The introduction by the Crown of a local government structure modeled on that of peninsular Spain seriously affected Inkan provincial political organization. In particular, by establishing a range of elected political offices, it dealt a severe blow to curacas, whose power was inherited. There were no special authorities established for water management to replace the qillkiwa, nor guidelines for water distribution.

The accommodation that emerged in the Colca Valley to these changes did maintain some degree of continuity. In Lari, the *alcalde principal* and *alcalde comun* assumed the responsibilities of curacas principales of Lari-Hanansaya and Lari-Hurinsaya, respectively. Regidores took on the role of water distributors and their numbers increased, presumably to match the qillkiwa they replaced. Today there are sixteen.[6] It was a solution beset with problems, however, since by bringing water distributors under the authority of alcaldes, their autonomy was weakened, although it did tend to strengthen the dual hydrological-social organization.

The Spanish Conquest and subsequent reorganization of local government spread throughout the highlands. While the colonial state retreated from interfering directly in the local irrigation, it indirectly attached local independence by imposing an alien government structure in which water distributors were incorporated under the authority of alcaldes. Water distributors continued to distribute water within their clusters, but they became subject to the influence and control of alcaldes.

Irrigation Administration during the Republic

Ayllus as corporate land and water managing units were weakened significantly by Spanish colonial administrative practices. They were used as census units for the last time in a 1787 census of the Colca Valley (Cook 1982: 29, table 2.11) and by the beginning of the nineteenth century, ayllu organization had declined considerably in importance (Manrique 1985). Dual moiety organization, on the other hand, remained strong through the nineteenth century. In 1868, for example, Lari had two mayors, one each for Hurinsaya and Hanansaysa (AAA, LLI 1868).

The passage of the Municipality Law (*Ley Orgánica de Municipalidades*) in 1892, modeled after the French Municipal Code of 1873, further reinforced the trend initiated by the Toledan reforms to embed irrigation management in a local government order. A new structure of municipal government was established, designed to provide sufficient power and autonomy to carry out the normal functions of local government. One elected mayor, a town council, and other minor officials constituted the new government body. It was a lethal blow to the political autonomy enjoyed by the dual moieties prior to the Municipality Law. Under the Municipality Law, irrigation management was assigned to the new authorities. By this step, the independence that water distributors had held during the Inka period was also dealt a final blow.

The implementation of the law has had a checkered history (Austin 1964). In practice, whenever local governments experienced difficulties in carrying out assigned functions, they have tended to transfer them to the central government or to special authorities, rather than strengthen their own institutions. In large urban areas, irrigation management was turned over to a government agency or corporation, such as the Water Tribunal (*Juzgado de Aguas*) established in the city of Arequipa in 1901 (Gelles 1990:253). In rural areas, traditional water distributors continued to distribute water but came under the authority of municipal officials.

The most serious challenge to their autonomy occurred in 1920 when President Leguía abolished municipal elections. Mayors and town council members were appointed thereafter by members of the prefectural hierarchy.[7] Numerous studies have shown how the concentration of power at the provincial level, especially from 1920 to 1963 when subprefects name mayors and town council members, was used to support regional interest groups, in particular, large landowners (see, for example, Burga 1976, and Fioravanti 1974).

During this period, the subprefect in Chivay acted as the local agent of the state in irrigation matters, issuing guidelines for water and land use, collecting fines, and resolving conflicts over water.[8] The settlement of a water dispute in Lari in the early 1960s illustrates the subprefect's role in this regard. The dispute involved a landowner who had excavated a reservoir on his land and was storing water for his own use. The mayor, acting on behalf of the village, issued a formal *denuncia,* delivered to the subprefect in Chivay accusing the landowner of the illegal construction of a reservoir. The subprefect brought the landowner and the mayor to his office and mediated the dispute. The village ultimately purchased the land and the improvement from the landowner.

Unlike valleys elsewhere in the Peruvian highlands, villagers in the Colca Valley were fortunate in not having to contend with an hacendado presence. The regional elite in Chivay, made up of wool merchants and officials of government agencies, did not rely on the resources of the agro-pastoral villages of the valley for their livelihood. Thus, with some exceptions, water disputes taken to the subprefect in Chivay for resolution had a more objective hearing than would have been the case elsewhere in highland Peru.[9]

In December of 1963, President Belaúnde reinstituted the right to elect local authorities and the first elections were held. This step returned a measure of autonomy to local communities, removing the direct influence associated with the prefectural hierarchy.

The Contemporary System of Irrigation Management in Lari

As Lari moved into the second half of the twentieth century, problems endemic to the system of irrigation management became increasingly manifest. Power was concentrated at the regional level in the subprefect and at the local level in the hands of a mayoral appointee, José Neyra. Neyra presided over Lari for about thirty years and controlled all facets of the irrigation system, naming and removing water distributors and influencing the distribution of water. This led to serious failings in the system. While water distributors were responsible ultimately to the users in an irrigation cluster, they could be removed at the whim of the mayor. By currying favor with the mayor, abusive regidores remained in office against the wishes of irrigators. There were no mechanisms by which villagers could have the mayor removed.

Water distributors abused their office by favoring relatives and kin and ignoring the spatial and crop sequence of water distribution. No written list was kept and water distributors merely pointed at individuals to indicate shares. Lacking checks on their performance, water distributors could withhold water for their own use, give shares to relatives, and curry favor with the mayor by giving him a share.

Against this background, increasing population created pressures for agricultural expansion and intensification, dependent in turn on augmenting the water supply. At the heart of the crisis was a paradox: while households were growing in number and in size, much cultivable land was abandoned. Unlike many other areas of the Peruvian highlands, where cultivable land was at a premium, there were many patches of abandoned terraces in the village. The main problem was insufficient water for irrigation.

Representatives of the National Office of Agrarian Reform (ONRA) and the Ministry of Agriculture began to visit the Colca Valley in the late 1950s and a water administrator (*Administrador de Aguas*) was hired for the province of Caylloma. Part of their labor was to help resolve the irrigation problems of rural communities. Lari, plagued with water dispute and shortfalls, was ripe for any reordering of its system that promised an increase in water availability.[10] In 1959, Ministry of Agriculture officials visited Lari and organized a villagewide irrigation association in response to recurring conflicts over water.[11]

Special-purpose irrigation associations are known to have existed elsewhere in the Colca Valley as early as 1940. This is the date of initial entry in a *Libro de la Junta de Regantes* in Cabanaconde. It lists a set of irrigation officials, including a *juez de aguas* (water judge) The *Libro* makes reference to the formation of an irrigation association (*comunidad de regantes*) in 1942, a body called for under the provisions of the Water Code (*Codigo de Aguas*) of 1902. It cannot be determined from the *Libro* if these were endogenous developments or initiated with outside guidance and suggestion (Paul Gelles, pers. com.).

The founding of the Lari irrigation association, consisting of president, three subadministrators (presumably one each for the Chaico, Callumayu, and Surimana subsystems), and water distributors from the irrigation clusters, marked a turning point in the village. It transfered responsibility for irrigation from the municipality to a special-purpose association with a governing board of elected officers. By establishing links, albeit weak during the early years, between the new irrigation association and the Ministry of Agriculture, a vertical channel, bypassing a prefectural hierarchy vulnerable to political meddling, was opened. The codification of norms of irrigation practice in the *Reglamiento del Sistema de Riego* (table 18) formalized customary principles of resource management and helped to settle water disputes on a timely basis by specifying penalties and procedures for their resolution.

The irrigation association did not represent a complete break with the municipality and the two administrative bodies often act in concert. The municipality has allocated funds to provide part of the costs of new irrigation infrastructure (AMuL, LA:Apr. 1, 1966), purchased land from villagers for the construction of reservoirs (AMuL LA:Apr. 23, 1968), and rented land or given parcels of abandoned land to individuals as compensation for their donation of land or services to cover costs for the construction and maintenance of irrigation infrastructure (AMuL, LA:June 15, 1974; Mar. 16, 1973).

For its part, the irrigation association has an important function with respect to land transfers. Municipal authorities act as agents of the state in legitimating land transfers. Since the transfer of land does not *de jure* automatically transfer water rights, purchasers often ask for regidores to be present to witness the recording of the transfer in the Cabildo office (AMuL LA:June 6, 1974). The role of irrigation officials in legitimating the transfer of traditional, if unrecorded and informal, water rights *pari passu* with land transfers attests to their power in situations when a mayor's decree would have sufficed in the past.

This organization persisted until the early 1970s when, following the institution of a provincial office of the Ministry of Agriculture in Chivay to implement the reforms of the Velasco government (including a new water law, the *Ley General de Aguas* 17752), it was reorganized. This will be the subject of the next chapter.

Conclusion

Basic parameters of household production have remained remarkably stable in Lari from the sixteenth century to the present. The Lareño farmer would recognize in the production strategies of his counterpart of the sixteenth century a familiar pattern of keeping land scattered across the slopes in small parcels to grow food for household consumption. There are some important differences: Old World cultigens (barley, broad beans, wheat, and alfalfa) and animals (sheep, horses, goats, and swine) have largely but not entirely

TABLE 18. Irrigation Association Regulations, 1963

1. Penalties for theft of water: 50 soles and twenty-four hours of incarceration for the first offense; 100 soles for the second offense, and appearance before the subprefect in Chivay for a third offense. Fines will vary depending on the amount of land held.
2. Fines for not using water after solicitation: 10 to 20 soles, depending on the quantity of land.
3. Irrigators will use water by turns and depending on the foodcrop. Priority will be given for requirements of seeding.
4. Regidors will allocate water only for those plots known to the village. In the case of a new user who is poor and who does not have sufficient fields for his or her family's sustenance, one can obtain rights to irrigate a maximum of two yuntadas by petitioning and paying 10 soles.
5. Plots in the pueblo will be irrigated on Sundays, and on other days a portion will be allotted for domestic use (*aguas del pueblo*).
6. Meetings of the board will be held every fifteen days and as needed.
7. Fines will be used for the repair and maintenance of offtakes, reservoirs, and sluice gates.
8. Members of the board will be fined for 10 soles for failure to attend a board meeting. After excessive absences one will be expelled.

Source: LA, SA: Oct. 6, 1963.

replaced the indigenous quinoa and llamas and alpacas on the cultivated slopes. By and large, however, production strategies are very similar.

Moreover, both farmers would have recognized the chore of getting up at the break of dawn to assemble on a hilltop to petition a water distributor for a share of water. This aspect of the water distribution process, has been, and probably always will be, a fixture of agriculture in Lari, no matter what the water distributor may be called. Indeed, for most farmers, it is *the* irrigation system and many are not aware, nor particularly care about, what goes on outside of the four or five irrigation clusters in which they have land. Their most pressing concern is that on those days when their turn comes they can go to a regina, ask for, and get a sufficient water allotment.

Nor are farmers probably aware of the struggle over autonomy that has characterized the history of irrigation management from the Inka period to the present. Under the Inka, autonomy was ensured by rotating the position of water distributor and making it independent of the wider political system and the influence of curacas. Colonial reorganization weakened the power of the curacas and attacked the autonomy of water distributors by forcing them to assume positions in new local government structures under the authority of mayors.

The creation of a prefectural hierarchy in the twentieth century linked local water management directly with the state. At the regional level, the subprefect emerged as the arbitrator of last resort over water disputes within and between communities. During periods when local elections were suspended and mayors were appointed, the power of the subprefect over local affairs assumed almost unchallenged dimensions. It allowed mayors to abuse the water distribution system, overriding the authority of water distributors.

These weaknesses were not significant during the colonial and early republican periods because population had fallen dramatically, reducing pressure on resources. It is only since the late nineteenth century that rapid population increase has stressed the water delivery system, bringing its weaknesses to the fore (see chap. 11). The organization of a special-purpose irrigation association in 1959, strengthened by the 1969 Water Law, facilitated long overdue improvements to the physical infrastructure, increasing the amount of water made available. Technological assistance and outside funds began to move to irrigation producing a small-scale irrigation revolution.

Chapter 7

Communal Water Management

Irrigation in Lari can be viewed from one perspective as an acephalous network of groups of irrigators who distribute water to fields sharing a common source of ground or surface water.[1] From another perspective, farmers follow a set of unwritten principles in managing their water sources, principles that give unity to their system but cannot be elicited from informants by posing the question, "What are the principles?" because they are not neatly arranged as a systematic collection of precepts periodically reviewed and drawn on consciously as precedents. They are *costumbre* (custom).

In this chapter we attempt to bring these diffuse principles into focus and discover their underlying order. This will involve clarifying the understandings underlying the allocation of water to offtakes and reservoirs, the organization and ends of corvée labor, and the scheduling of irrigation in space and time. We will also attempt to locate the origins of resource management principles in the historical frames of the last chapter: some can be traced to Inka practice, while others are post-Conquest introductions from the Colonial and Republican periods. Lastly, we will attempt to understand the logic of communal water management in relation to household production goals.

The 1969 Water Law

With the expansion of the state into the Colca Valley in the late 1950s, communal water management became increasingly subordinate to national water law. It took a dramatic turn on July 24, 1969, when the reigning Water Code (Codigo de Aguas) of 1902 was replaced by the Water Law of 1969 (Decree No. 17752, Ley General de Aguas) enacted by the government of General Juan Velasco Alvarado. The 1969 Water Law was one of several major reform initiatives of the Velasco government heavily influenced by norms of social justice. Modified slightly in 1981, the law is still in effect.[2]

The declaration in article 1 of the inalienability of water and its ownership by the state sets the tone for Peruvian water law.[3] Private ownership of water or water rights is expressly prohibited. An appropriate state agency grants permission for all uses of water, other than for domestic purposes (art. 4f). Permission to use water is regulated, in turn, by a system of priorities. Permissible uses of water include, in order of priority, from high to low: domestic needs, animal husbandry, agriculture, hydroelectric power, industry and mining, and other uses (art. 27). Priorities are also established for agricultural uses, including, again from high to low: irrigation of cultivable land with existing irrigation systems, irrigation of specific crops with surplus water, improvement of soils, and all-purpose irrigation (art. 42).[4] A clause allows land brought into use through the expansion of irrigation systems to be transferred to private ownership for housing and agrarian reform.

Permission for agricultural use of water is granted by crop. To receive permission, one must inscribe in a register (padrón), maintain the irrigation infrastructure of one's fields in good repair, and pay the tariffs and fees levied by the water authority (art. 49). Once granted, a right to use water may not become part of a title of landownership (art. 37).

For administrative purposes, the law divides regions into irrigation districts (*distritos de riego*) each with an elected administrative body (*junta de usuarios*). Irrigation districts are administered by the Water and Irrigation Agency (*Dirección General de Aguas e Irrigación*) of the Ministry of Agriculture and Fisheries. District administrative bodies and representatives of the Water and Irrigation Agency jointly formulate an annual or biennial cultivation and irrigation plan (art. 44).

Irrigation districts are subdivided, in turn, into sectors (*sectores*) with their own irrigation commissions (*comisiones de regantes*) (art. 136). These local-level irrigation associations derive funds for administrative expenses, technical studies, and capital improvements from tariffs collected from irrigators, based on the volume of water used (art.12).

One of the most important provisions of the law is for an emergency water regime brought about by drought, flooding, or pollution. Water authorities are empowered in these circumstances to dictate strict procedures to protect, control, and distribute water for collective benefit (art. 17). Emergency water regimes for reasons of scarcity (*estado de emergencia por escasez*) are treated in articles 45 through 48. Once a state of crisis is determined, cultivation and irrigation plans must shift to crops of the widest possible benefit, the most efficient structuring of water distribution, and the most appropriate fields for the preferred crops (art. 45). Article 48 authorizes water authorities to establish special water distribution systems including mitas, *quiebras*, and turns.[5]

In the early 1970s the Ministry of Agriculture set up an office in Chivay

to implement the agrarian reforms of the Velasco government. The improvement of water management was high on its agenda. Since there were no haciendas in the Colca Valley to expropriate or agrarian syndicate activity to monitor, the office could direct its undistracted attention to improving water management and implementing the new Water Law. The office moved quickly, naming an administrator and assembling a staff, including a hydraulic engineer (*ingeniero de aguas*) and water judge (*juez de aguas*) to oversee the newly created irrigation district of the Colca Valley. By the middle 1970s, eighteen comisiones de regantes, corresponding closely to existing village irrigation systems, had been established. Each commission has a president who exercises oversight and represents it in contacts with the Ministry of Agriculture. Other members of the board include a secretary, treasurer, fiscal, two vocals and a complement of regidores. Board members are elected, serve for two years and can be removed by a majority vote. In Lari, the board meets once every one or two weeks during the irrigation cycle. Each irrigation association sends an elected representative to the district administrative body.

By becoming a member of a village irrigation commission, then, one gains under the Water Law the legal status to request water for irrigation. Water is granted to the farmer under the general conditions specified in the Water Law and in the specific conditions established by the regional office of the Ministry of Agriculture and the local irrigation commissions. Only under these conditions can one gain *de jure* access to water for irrigation in the Colca Valley. They have their origins in the Hispanic tradition of regarding water as property of the state to be granted to landowners as a merced or alienable right (Lynch 1988:77). This is not to say that the state in this way determines fully the access and use of water in the region in question; as we will see below, *de facto* rights to water differ significantly in some cases from state directives.

The Ministry of Agriculture moved forcefully to implement a system of priorities for the permissible use of water, focusing its effort on regulations concerning abandoned land (tierra eriaza) and fallowed land (terreno en descanso). Abandoned land has no permissible water rights but, if cultivable, may be extended water at the discretion of the Ministry of Agriculture. Fields in fallow up to three years plus one day can receive water if the owner pays a fine and reinscribes the field in the register (padrón de regantes). Fields in fallow more than three years and one day revert to abandoned land and lose all rights to water. In order to recover rights, one must go to the Ministry of Agriculture office in Chivay, show title, give the reasons for abandonment, and pay a fine to the local irrigation commission.[6]

The Village Irrigation Association and Principles of Water Management

The village irrigation association established in the late 1950s by the state and strengthened by the 1969 Water Law provides a special-purpose vehicle for the management of ground and surface water in Lari. It operates on the basis of traditional water management principles, provisions of the Water Law, and ad hoc rulings by the Ministry of Agriculture.

The Autonomy of the Irrigation Cluster

boundary

The first, and most important, principle is the autonomy of the irrigation cluster, the building block of the system. Once water enters an irrigation cluster it comes under the control of the landowners in question, irrespective of whether the source is groundwater (a local spring) or surface water (an offtake of a main canal). On its entry into an irrigation cluster, landowners defend their right to use water in any way they see fit.

The autonomy of the irrigation cluster has its origins in Inka water management. Fields and water to irrigate them were assigned to members of an ayllu and these assignments were allowed to be passed on to one's heirs (Sherbondy 1987:132). Checks were established to defend the independence of the water distributor against attempts by the wealthy to bend water distribution to their will. By attaching water rights to land rights, members of an irrigation cluster consider themselves individual owners of the fields they possess but joint owners of the ground or surface water to irrigate them. As joint owners of water they determine the most efficacious method of distributing it: a regidor where competiting claims and complex scheduling is involved or a first-come, first-served basis when the scale is much lower. When purchasers of land ask regidores to witness sales, they are in effect requesting acceptance of the transfer of water rights to them.

The autonomy of the irrigation cluster conflicts directly with the national Water Law in two important ways. First, the Water Law places ultimate responsibility for water management in the hands of designated representatives of the state. Second, it expressly prohibits water rights from being attached to land rights. These conflicts are more apparent than real, however, because ministry officials at the local level realize the efficiency of the irrigation cluster in water distribution and refrain from becoming directly involved in day-to-day water management. Where the ministry does enter into the affairs of the regina, albeit indirectly, is under those circumstances—such as the imposition of limits on water during droughts—when irrigators cede autonomy to the village irrigation association. Otherwise, higher level irrigation authorities approach the regina only if asked, most commonly to coordinate the sharing of water between offtakes and to help quell disputes that a water distributor is unable to handle.

Priority in the Allocation of Water

The principle of the autonomy of the irrigation cluster can also be seen in the priorities established in communal management to the allocation of water. Water for agriculture is assigned the highest priority, followed by pastoral and domestic use. These priorities often conflict with those of other decision-making parties, including the irrigation cluster, the state, and the municipality. The extent to which water is under the control of the irrigation cluster is the determining factor.

Conflicts between the irrigation cluster and other levels over the use of water are illustrated by the domestic water supply of the village. Water for domestic use is transported via a branch of the Orcoya canal to a cement-lined reservoir behind the village and delivered through underground pipes to spigots in the patios behind each house. This branch also feeds, once or twice a week, stone-lined canals in the village that provide for domestic use (washing laundry and cooking implements, processing food) and the irrigation of kitchen gardens. Everyone living in the village benefits from access to this water. Since the reservoir is fed by the Orcoya offtake from the main Chaico canal, Orcoya irrigators control the water. Inasmuch as Orcoya has difficulties with scarce water even in good years, landowners are reluctant to allow domestic use to assume higher priority over irrigation. Municipal officials appear before the Orcoya regina rather than the irrigation association to plead with irrigators to keep the reservoir full to lessen the danger of a fire during dry spells. Orcoya thus exercises *de facto* control over the use of the surface water entering it; notwithstanding the assignment under article 27 of the Water Law of the highest priority to domestic use of water, followed by animal husbandry and agriculture.

Until it is diverted by an offtake to an irrigation cluster, water comes under the *de facto* control of the community in its descent from the high altitude snowfields, lakes, and bofedales. Conflicting claims for agricultural versus pastoral use of this water illustrate this. High altitude herders customarily diverted this water to irrigate pastures to improve the quality of natural grasses. As demands on water multiplied in the 1950s, farmers began to complain of the loss of water from irrigating upper pastures.[7] The irrigation association responded by entering into negotiations with owners of herding ranches to eliminate or reduce the practice.[8] The Ministry of Agriculture strengthened the irrigation association's hand by citing provisions of the 1969 Water Law establishing the priority of agricultural over pastoral use.[9] In these cases, estancia owners negotiated with the irrigation association, but rather than individual irrigation clusters, such as Orcoya, where the complaints were loudest, because the water in question was diverted prior to entering an offtake.

Principles of Water Allocation: Under Normal and Abnormal Conditions

Under normal conditions farmers are given water sufficient to cover the requirements of their fields, a proportional allocation principle with Inka antecedents (Garcilaso de la Vega [1609] 1966:1:248). When water scarcity threatens, this principle is modified and actions are taken to ensure that each household has access to a subsistence minimum. These procedures are taken in conjunction with legislation enabling the Ministry of Agriculture to regulate land use and water allocation during droughts. Many Colca Valley village irrigation systems use moiety divisions as spatial principles of water distribution (Guillet 1991a). The ministry has attempted to rationalize these systems by introducing a system for irrigating one adjacent field after another. The introduced system is known by various names: *mita, mita global* and *riego canto a canto* in Coporaque, *mita* in Lari, and *de canto* in Cabanaconde (Guillet 1991a). The Ministry of Agriculture initially attempts to introduce continuous irrigation as an emergency water regime; if successful, it moves to institute it as the sole system of irrigation. It has been unable, however, to expand it as the dominant system in those villages where water is distributed along moiety lines, for the following two reasons. In some villages, one moiety benefits disproportionately and its members are able to resist dismantling the system. In Cabanaconde, on the other hand, villagers resist because they feel moiety competition motivates regidores to advance quickly through the irrigation cycle (Gelles 1991). In Lari, continuous irrigation uninfluenced by moiety principles was already in effect prior to the formation of a village irrigation association and contact with the Ministry of Agriculture.

A second prong of emergency water regimes is the reduction of demand on water by limiting the amount of land a household can cultivate, restricting the water available to households for irrigation, or eliminating the irrigation

of alfalfa in favor of subsistence crops. In Lari, the ministry has been able to reduce demand on water by limiting the quantity of water a landowner can receive in an irrigation cluster. During the 1983–84 drought the maximum was set initially at an amount sufficient to irrigate two yuntadas of land; later it was reduced to one yuntada when shortfalls in the Chaico offtake assumed crisis proportions.

The successful imposition of limits on water during droughts exemplifies the meshing of a social welfare principle in resource management with provisions for emergency water regimes contained in the 1969 Water Law. Article 45 empowers the state to institute radical measures including limits on water during droughts. They bring to mind checks on water distribution under the Inka to ensure that the land-rich could not obtain water at the expense of the land-poor (Poma de Ayala [1584–1614] 1980:3:1058). While they have been bitterly fought by land-rich farmers, limits have been invoked during all of the drought years since 1970.

The effect of limits is to force large landholders to fallow land in irrigation clusters where their fields are concentrated because the amount of land one can cultivate is constrained by the maximum that can be watered. If land is left uncultivated for a long period of time, it risks being categorized as abandoned land, making it extremely difficult to obtain water. Limits on water during droughts contribute to the tendency, noted in chapter 2, toward diversification of landholdings across irrigation clusters, weakening tendencies to land concentration and stratification.

Irrigate by Crop and Time Sequence → (?)

Water is allocated to irrigation clusters on the understanding that it will be distributed by crop in a general sequence of maize, broad beans, barley, and potatoes. Even in irrigation clusters fed by groundwater, independent of a canal system, alfalfa must still come after staple crops (sembrios). Oral history suggests that water was distributed before 1945 without any stipulation as to crop or stage in the mita. In the years following, it began to be informally organized on an irrigation-by-crop basis. The sequence can be adjusted within an irrigation cluster since microclimates, topography and soils may conspire to select for some crops and not others.

Irrigation by crop in Lari is the norm and not a special measure taken in response to drought as in other regions of the world. For example, farmers in the Spanish town of Murcia impose a special regimen during droughts (*regimen extraordinario de estiaje*) in which water is distributed according to land use and crop and special procedures are instituted. Water for domestic use and public health gets first priority, followed by water for crops. Among the preferred crops, priority is given to those that are high water users (tomatoes, string beans, peppers, and onions), followed by those that require it less frequently (maize, alfalfa, potatoes, and citrus) (Maas and Anderson 1978:77).

Irrigation by crop helps to coordinate and schedule water distribution. It ensures that water is delivered at the optimum time for moisture uptake by the plant. Placing maize at the beginning of the crop irrigation sequence guarantees that it receives the water necessary for its long growing season. As we have seen, the importance of seeding maize at the right time—neither so early as to risk the frost killing of seedlings nor so late as to endanger almost mature plants—was the motive for its centrality in the Inka agro-ritual calendar (Sherbondy 1979:ix).

Compliance with a Common Calendar

Water management activities are carefully scheduled in compliance with a common calendar. The irrigation association sets dates for the beginning of the irrigation cycle and coordinates the transition from crop to crop. The cleaning and repair of the Chaico canal and the Maucacocha reservoir in early August initiate the agricultural cycle by putting the water transport system in order and triggering the water ritual complex. Two *mayordomos,* one each from Hanansaya and Hurinsaya, make separate ritual offerings (*pagos*) to appease the spirits who control water and to ensure a productive agricultural year. It is essential for two cargo holders to make pagos in order for ritual equilibrium. If only one is present, the other must make a "double offering" (*double pago*).[10] The notion of symmetrical balance extends to other spheres of village life and will be discussed in more detail in a later chapter dealing with social organization.

The feast of the Virgin de la Asuncion follows soon thereafter, on August 15, corresponding closely in time to the ritual first seeding of maize in the Inka calendar on August 17, the antizenith of the sun. In Lari, ritual seeding of maize occurs during a movable fiesta, the Camile, held in 1983 on October 12 and 13.

The irrigation season formally begins with the initiation of the mita (levantamiento de agua) in each irrigation cluster. Dates are set separately for each offtake and staggered, beginning in mid-to-late August and running until the middle of September. Offtakes in the Callumayo system are irrigated first, beginning with the uppermost, Yanahua Urusa and Yanahua Estanque, followed by the successively lower Charasuta, Arco, Coanca, Uchurunta, and Karpa. Aninchihua, with its own source of water, comes next and then offtakes of the Chaico system—Chunta, Kakancha, and Huanconasa. The last offtakes in the sequence are Surimana Estanque and Surimana Urusa.

The sequence begins with the lower and more protected fields on the west side of the village where seeds germinate quicker and plants grow faster. Staggering dates spreads labor requirements out during a peak period of labor demand for field preparation and seeding. A similar rationale motivates the distribution of reginas throughout the week to keep difficulties to a minimum for farmers who have fields in several locations.[11] The same sequence governs the harvest scheduled by the municipality rather than the irrigation association, which, by this time, has ceased activities. Again dates are staggered and follow the earlier sequence. Harvest begins with the lowest offtakes on the west side (Arco, Jacupa, Ananchihua, and Karpa) and moves east ending with Surimana Estanque and Surimana Urusa. The feast-day of San Antonio on June 13, heavily imbued with symbolic references to the horse used to transport the harvest to the homestead, brings the agricultural cycle to an end.

Table 19 compares the mita and harvest sequence with the order in which water distributors give reports during meetings of the irrigation association.[12] The two are quite similar, suggesting a common theme of movement from west to east, beginning with the Callumayo canal system, followed by Chaico and the ground water fed field clusters of Ananchihua and Karpa and ending with Surimana. Within the west-east movement, uppermost fields are irrigated first followed by lower fields in the irrigation clusters within the canal systems.

A common ordering in the mita, harvest, and reporting sequence suggests vestiges of a radial organization of space along the lines of the Inkan ceque system. Each canal system may have been a discrete resource set managed by an ayllu with rotation from west to the east consistent with the agronomic characteristics of each canal system and a semicircular progression through space and time.[13] The one exception, the precedence of the Orcoya regidor in the reporting sequence, may be a survival of the principle of a higher rank ayllu vis-à-vis a lower rank ayllu.

Maintain Progress during the Mita and Facilitate the Sharing of Water, If Necessary

While the irrigation association schedules the mita, the regidor is responsible for transitions within the irrigation cluster in the irrigation-by-crop sequence.

The time necessary to irrigate one crop varies greatly among tomas. For example, a majority of the fields in irrigation clusters will be in maize. The time spent in the maize irrigation stage of the irrigation-by-crop sequence will be more protracted than those irrigation clusters situated on the surface of exposed alluvial terraces usually seeded in barley. Other factors that can cause a toma to move quickly or lag behind in proceeding through the mita include the availability of water, topography, the number of fields and irrigators, and the nature of its soils.

The rapid and steady movement of each irrigation cluster through the mita is essential to agricultural productivity. Plants are very sensitive to moisture and irrigation must be applied at the right time to maintain plant growth and ensure maturity. Delaying seeding or a second irrigation can stunt growth, lowering yields or causing a crop to fail. Many factors can conspire to retard irrigation and the timely movement from one crop to the next.

Communal water management plays an important role in controlling fluctuations in water flow among the irrigation clusters. During time set aside for reports in weekly meetings of the irrigation association, regidores announce, one after another, the crops currently under irrigation, the number of fields remaining, difficulties they are experiencing, and the anticipated transition to the next crop. The phrase "we are not progressing" (*no estamos progresando*) indicates an irrigation cluster is having difficulties in moving quickly through the crop and spatial sequence and usually touches off appeals for water sharing. Water can be easily shunted to another toma by a simple opening of a sluice gate or diversion. Some tomas may have abundant water

TABLE 19. Irrigation Scheduling

Mita and Harvest Sequence	Reporting Sequence
Yanahua Urusa	Orcoya
Yanahua Estanque	Yanahua
Charasuta	Yanahua Estanque
Arco	Charasuta
Karuna	Arco
Coanca	Coanca
Karpa	Uchurunta
Ananchihua	Karpa
Orcoya	Aninchihua
Chunta	Chunta
Lloclla	Lloclla
Huanconasa	Huanconasa
Surimana Urusa	Surimana Urusa
Surimana Estanque	Surimana Estanque

and be in a position to donate some to others. Water sharing is not automatic, however, and unless requested, excess water runs into the river below. If a regidor has the confidence of the irrigators in his toma, he may accede to a formal request. Ultimately, a water distributor acts with the consent of irrigators and has no independent power to donate water. Nor can irrigation clusters be coerced by higher levels of water management into sharing water.

At one level, sharing water is an expression of an easily understandable mutual survival ethic, but personal interests may also enter in as motivations. Most farmers have fields in more than one toma and there is a possibility that one will have a field in a water-poor cluster experiencing difficulty and also have a field in a water-surplus cluster in a position to help out. Farmers also know that the vagaries of water flow are such that a toma with a water surplus one week can be water-poor the next.

Maintain Irrigation Infrastructure in Good Repair

Upkeep of the physical infrastructure of irrigation, the canals, reservoirs, sluice gates, and offtakes is crucial to efficient water transport in this semiarid environment. These systems become clogged with silt and refuse and must be cleaned annually and refurbished or improved periodically. Maintenance operations are underway throughout the year, ranging from the repair of a terrace spillway to a complete overhaul and lining of a major canal from its source in the puna. Projects such as the cleaning of the Maucacocha reservoir and the Chaico canal are complex logistical operations requiring scheduling and coordination with water ritual, the organization of corvée labor, and the provision of food, drink, and entertainment.

Households that possess fields in the area watered by the canal or reservoir must send an adult male to the corvées. Women and children are not considered replacements for an adult male. Since the Chaico canal provides water for the domestic supply of the village and irrigation for over seven hundred fields, every household must participate in its cleaning. The Maucacocha reservoir services a much more limited population and only households that use the water are required to participate in the reservoir's refurbishment.

The basic unit of corvée labor organization is the crew (*cuadrilla*), headed by a foreman (*capitán*). Irrigation officials recruit crews according to traditional dual and tripartite lines of social organization.[14] As recently as 1968, a major corvée would have two sets of cuadrillas, one for each moiety of Hanansaya and Hurinsaya. Each set consisted of three crews of about thirty men and a foreman. The first ten men of Hurinsaya worked the first day, another ten men the second day, and the remainder of the crew on the third day. The foreman works each day. The next crew then took over in the same order followed by the last crew. The Hanansaya crews followed. This project took eighteen days (AMul, LA: Mar. 28, 1968).

Although moiety organization of crews in corvée labor projects has declined in recent years, tripartite organization remains common. Generally, three cuadrillas will be organized, with one working a set period of time, followed by the next, and then the last, at which point the cycle repeats until the work is completed. The size of crews and the length of time each works vary according to the complexity of the project and other considerations such as the land area held by a household. During the 1960s, villagers built a canal linking the Ticclacocha lake with the Callumayo canal network. Three crews were organized from among those who would benefit from the water. The first consisted of large landholders (mayoristas) who worked the first three days; the second, middle holders (posedores medios) who worked two days, followed by small holders who worked one day. This basic sequence continued without stop until the labor was finished. During 1983–84, villagers worked to line the Chaico canal with cement provided by government agencies. A cuadrilla of fifty large holders worked five days, followed by a cuadrilla of fifty small holders who worked one day.

The Maucacocha reservoir cleaning, held on August 30, is smaller in scale, lasting only three days, and is not organized along moiety lines. The lower canals are cleaned on the first day, the middle and upper canals on the second day, and the reservoir the third day. Each crew is assigned a length of canal, usually 500 meters, or a section of the reservoir on which to work and a competitive spirit prevails. Work is accompanied by musicians paid for by the mayordomo of the fiesta.

The unspoken social contract rests on reciprocity (*ayni*) in the exchange of access to water for participation in communal obligations, the importance of which is contributing labor to the corvées held annually to clean reservoirs and canals. So integral is the faena to communal life that it remains the one event organized along the ancient dual and tripartite lines which, in so many other ways, have disappeared.

Conflict Resolution and Fines

Sanctions, particularly fines, are regularly employed to ensure compliance with management principles. Infractions fall into three broad categories, involving users, irrigation officials, or members of adjoining communities.

(See table 20.) The most common infraction committed by irrigators is the failure to appear for a corvée. This is considered a dereliction of one's communal obligations and a serious offense. The second most common is a generic category of unauthorized irrigation. Illicitly diverting a canal to one's plot or irrigating a field or a kitchen garden at night are examples. "General infraction" also includes, in large, water theft. Failing to irrigate after water has been granted is another frequently cited offense that deprives another of water. Wastage, irrigating a disallowed crop, abandoned land, or an estancia without permission, while less common, do suggest a sensitivity to water conservation. Meetings are also used to establish codes of conduct for users and irrigation officials. Water distributors complain frequently of users offending them by ignoring their rulings and issuing threats or verbal abuse. The board and other water distributors usually take a strong stance on this and assess punishments. Collective-choice arrangements

2) The second category of infractions includes those committed by irrigation officials: water distributors and members of the governing board. Of these, the most common is missing a general meeting or a regina. Any incidence of favoritism can lead to an infraction, such as deviation from a traditional sequence of water distribution within a sector, favoring a relative or compadre, or failing to carry out the accords of the general meeting.

3) The last category, while numerically insignificant, indicates the special treatment of irrigators from Madrigal. This is an attempt to solve a problem of "free-riders": individuals who benefit from goods provided by others without paying their due share of the production costs (Hardin 1982). The problem stems from the lack of participation by Madrigaleños who own land and draw water in Lari in irrigation corvées (faenas) held to repair and improve irrigation infrastructure. Participation in faenas is considered a basic requirement for access to water. Special fines are one solution; another is a percentage assessment on the sale of land that is levied by the Ministry of Agriculture and returned to Lari to cover improvements to reservoirs and canals. These measures do not always work and the problem of free-riders remains a contentious issue in the village.

As can be seen in table 21, monetary fines constitute the most common punishment for infractions. Fines for minor infractions—water theft (*robo de agua*), irrigating a crop out of turn (*turno prohibido*), obstructing the flow of water (*quitar el agua*), and failure to maintain one's personal canal—range from 1,000 to 20,000 soles, with proceeds going to the treasury of the irrigation association. Cultivating abandoned land is a more serious matter and, as we have seen, leads to the intervention of the Ministry of Agriculture.

Regidores are responsible for collecting fines, keeping records, and delivering receipts to the irrigation association. Since most regidores have little formal education or are illiterate, accurate record keeping presents a serious problem. Charges are frequently brought against irrigation officials, often unjustly and politically motivated, of misuse of monies collected from fines.

Failure to pay a fine led in 8 percent of the cases to an additional penalty in the form of a loss of a turn or the withdrawal of rights in one or all sectors during the irrigation season. Loss of a turn is not uncommon elsewhere in the Andean highlands as a sanction against irrigators who fail to appear during faenas held to repair irrigation infrastructure (Sherbondy 1987:132).

In three cases, perpetuators were jailed: one for water theft and two for verbal abuse of an irrigation official. Two of the five instances of the abuse of an irrigation official led to jail, indicating the sensitivity of irrigation

TABLE 20. Infractions by Type in Meetings of Irrigation Association

Type of Infraction	*N*	%
Infractions involving users		
Failure to appear for corvée labor	33	27.0
Theft of water	19	15.6
General infraction	16	13.1
Failure to use allocated water	9	7.4
Water waste	6	4.9
User offends official	6	4.9
Irrigation of a nonallowed crop	4	3.3
Irrigation of an estancia without permission	3	2.5
Irrigation of abandoned land	2	1.6
Failure to appear at a regina	1	0.8
Failure to pay assessment	1	0.8
Other	1	0.8
Infractions involving irrigation officials		
Water distributor misses general meeting	5	4.1
Junta member misses general meeting	1	0.8
Failure to deliver receipts	1	0.8
Alter water distribution sequence	1	0.8
Water distributor favors kinsman	1	0.8
Water distributor offends user	1	0.8
Water distributor misses regina	2	1.6
Water distributor fails to carry out accords	1	0.8
Infractions involving members of other areas		
Infraction involving user from Madrigal	7	5.7
Infraction involving user from grazing zone	1	0.8
Total	122	100.0

Source: AMul, LA.

officials and the willingness of municipal officials to cooperate in providing use of jail facilities.

Assess Costs on the Basis of Land Area and Water Use

Land area determines the volume of water use and provides the basis for the assessment of tariffs and fees. Data on land holding and water use are kept in two locations. One is in a register, the padrón de regantes, on file in the office of the Ministry of Agriculture in Chivay. This register, which is updated periodically, lists the land area and water needs by irrigator in each of the irrigation commissions in the Colca Valley. It is used to assess tariffs to pay for the administrative expenses, technical studies, and capital improvements of water management. In addition, regidores are expected to keep a padrón de regantes for their respective tomas in order to assess work assignments during corvées, limitations on water during droughts, and fines. A mayorista is given stiffer work assignments in corvée labor projects than a menorista and is expected to serve as foreman (capitán) of work teams and mayordomo of fiestas. Land area is also used to assess fines and to determine those subject to limits on water during droughts. The amount of fine one pays for not attending the cleaning of a canal is based on the amount of land owned. This leads users to underestimate their landholdings when they are levied a fine but to overestimate their land when they ask for irrigation water.

Communal Water Management Principles and Household Production Goals

Communal water management is an obvious adjunct to household production in ensuring the flow of water to irrigation clusters, thereby providing the

TABLE 21. Resolution of Cases Brought before the Irrigation Association

Sanction	*N*	%	Valid %
Fine	80	65.6	70.8
Fine and cutoff	10	8.2	8.8
Lose water for cycle	7	5.7	6.2
Lose turn	6	4.9	5.3
Jail	3	2.5	2.7
Other	7	5.7	6.2
Missing data	9	7.4	0
Total	122	100.0	100.0

Source: Libro de Actas, Comite de Regantes moisture necessary to render land and labor productive. It also constrains household production in less obvious ways. Distributing water by crop delimits the range of cultigens that a household may grow. With few exceptions, irrigable crops are staples destined for home consumption rather than market sale. The exceptions are alfalfa, grown for animal feed, and a hybrid barley (*cebada de la cerveceria*) produced in a contractual arrangement for sale to a brewery in Arequipa. Irrigation by crop and the delimitation of a range of irrigable crops combine to maintain the subsistence orientation of the economy and constrain the adoption of cosmopolitan crops oriented to urban tastes or destined for market. This is not to say that farmers resist market production. On the contrary, villagers often monitor wholesale prices in Arequipa to select a crop to seed in excess of household consumption needs in the hope of producing a marketable surplus. Nor should it be taken to imply that new crops cannot be incorporated into the system. As we shall see in a later chapter, alfalfa has been successfully introduced in recent years into the irrigation-by-crop sequence.

Within the limits of irrigation by crop, farmers can exercise a great deal of independence in selecting crops according to consumption requirements, tastes, marketing considerations, labor availability, and land holdings. The intensively irrigated agriculture of Lari contrasts, in this regard, with sectorial fallowing, a widespread extensive agricultural regime of the Andean slopes (Guillet 1981). In sectorial fallowing, cultivable land is divided into two or more named sectors that are planted for a series of years and then left fallow for a series of years. Crop rotation is another feature. Generally, potatoes are followed by indigenous tubers and cereals, including the introduced barley. Community members have access to fallowed and cultivated sectors at the end of harvest for grazing their animals. Sectorial fallowing is marked by the coordination of the activities of participants and the following of rules regarding planting, harvesting, rotation of crops, and grazing. The community exerts direct control over production in sectorial fallowed fields.

In accepting compliance with a common agricultural calendar "stacked" to optimize maize production, farmers trade off lower yields for other cultigens that would benefit from more optimal irrigation. Barley, for example, is of rather low priority, irrigated last in the crop sequence. While it is less sensitive to the considerations that govern maize production, with a shorter growing season and better ability to withstand frost, barley yields could be improved considerably by optimizing its irrigation scheduling.

Nor do communal water management principles restrict access to water. No qualifications of birth or residence, for example, govern access to water

other than that one is cultivating land in the irrigation cluster in question. Madrigaleños hold land and obtain water in Lari legitimately, as do a few Lari villagers in Achoma, across the Colca River. The only requirement is that one fulfill communal obligations of participating in irrigation corvées. Failure to do so leads to problems with "free-riders" and special measures such as those taken against Madrigal villagers.

The short-term goals of household production oriented to the immediate harvest contrast with the longer time horizon of the communal management of water. Within the communal management sphere, the physical infrastructure of irrigation is maintained and improved with a view to sustaining the viability of the household. Limits placed on the irrigation of abandoned land ensure that available water is not stretched beyond its limits. Farmers accept corvée labor requirements, limits on water, and the constraints of irrigation by crop because they see them as necessary adjuncts to household production.

Conclusion

Several of the principles of communal water management—the autonomy of the irrigation cluster, a common agro-ritual calendar centered on maize, proportional water allocation, and irrigation by crop and spatial sequence—have pre-Columbian origins. Others, such as the prohibition of the irrigation of abandoned land and limitations on water during droughts, derive from the 1969 Water Law. These principles are oriented primarily to the economic survival of households in this difficult and fragile environment. Water distribution is limited during droughts to ensure that households are guaranteed a subsistence minimum. Priorities for water allocation reflect the importance of agriculture over pastoralism and domestic use. While this reverses the priorities established in the 1969 Water Law, it ensures water for irrigation to produce the staple crops, the most important component of subsistence diets. On the other hand, incorporating alfalfa into the irrigation-by-crop sequence allows the maintenance of pastoralism, an important buffer in the economy.

These principles retard the accumulation of land, market entry, and the emergence of stratification. Of particular importance, in this regard, are limits on water imposed during droughts. Landowners who own large quantities of land in one irrigation cluster are severely affected by a limit on water imposed within the cluster. To circumvent limits, one could scatter holdings across the offtakes, and, in fact, diversification is a common form of risk reduction. By increasing the complexity of scheduling tasks, however, diversification brings other difficulties in its wake—appearing at reginas to claim water, irrigating several quite distant fields, coordinating water to fields on different days, arranging for traction and transport animals, and so on. Even with hired labor it is difficult to coordinate all of the activities in space. Specialization in one crop intensifies the problem because it means that all tasks—irrigation, field preparation, seeding, weeding, and harvest—fall at the same time. The supply of labor, as well as draft and transport animals is finite and peak periods affect rich and poor alike.

One could conclude from the foregoing that the system has little capacity for change. This is not so. In later chapters we will explore short-term adjustments to drought and long-term accommodations to a new crop.

Chapter 8

The Social Organization of Agro-Pastoralism

Agro-pastoralism produces a dialectic with conflicting tendencies that are resolved in the sphere of social organization. Cultivating a multitude of small, individually owned and intensively irrigated and terraced plots and organizing the complex, conflicting labor schedule of field and pasture create a disposition toward flexible, atomistic forms of social organization. Pressures toward corporate forms of social organization are produced, on the other hand, by scattered natural pastures in the puna managed as undivided family estates over the generations. In this chapter we will explore how these conflicting pressures lead to different forms of social organization and how they are integrated.

In Lari, as elsewhere in the highland Andes, the basic unit of production and consumption is the household, a coresidential group that eats and resides together ideally in a compound (*hogar*) which includes a house, patio, and corral (*canchon*). The economic viability of a household also depends on access to the fields and animals necessary for agro-pastoral production. Often, the ideal is unreachable and various compromises have to be made. For example, if households cannot manage to live independently, they may share a house divided with walls or simply string dividers to provide contexts of privacy. If these divisions are associated with separate eating arrangements, I consider them separate households, following local perceptions of domestic functions. Using this definition, a census conducted as part of the 1983–84 research shows the village population of 945 breaking down into 229 households, with an average size of 4.12 members (std. dev. 2.09) distributed as indicated in table 22.

Laslett's typology of household types (1972:28–34), a convenient, standardized vehicle for analyzing household structure, is used in table 23 to categorize households in the nucleated village and dispersed puna segments of the population. As can be seen, simple family households predominate in both the village and the puna and, of these, married couples with children are the most common. Over two-thirds of the households in Lari are able to meet the ideal of independent living. Extended family households, particularly those which include an elderly parent, represent a less desirable solution to living arrangements. Conflicts are said to be more common in these households. Puna and village differ little in the incidence of simple and extended family households.

Stem families most often incorporate an offspring's family, reflecting the hardships of setting up a new household. Postmarital residence is ideally neolocal, but practicalities keep many young families in the house of the parents of one of the partners.

The category of solitary household merits comment. The number of individuals living alone in the puna and the village is small and often composed of older, usually widowed, individuals. The nucleated village settlement helps the elderly to realize the ideal of independent living by making it easy for sons and daughters to visit and seeing to it that their parents' needs are met. Not all of the aged are treated in this way and some complain of abandonment by a son or daughter. The dispersed household clusters of the puna do not afford the same convenience. The arduousness of foot travel in the puna and the distance from the lower village and other population centers make visits difficult. The solitary elderly of the puna lack the social contacts of their counterparts in the village.

Inheritance

Much of the difficulty in establishing a new and independent household lies in accumulating the capital needed for agro-pastoral production (fields and animals) and the domestic items needed to set up independent living. All new

TABLE 22. Household Size Distribution, Lari, Nucleated Village

Size	*N*	%
1	29	12.7
2	34	14.8
3	27	11.8
4	42	18.3
5	35	15.3
6	28	12.2
7	18	7.9
8	14	6.1
9	3	.9
Total	229	100.0

Source: Lari household census.

households rely heavily on inheritance and godparents (*padrinos*) play an important role by seeing to it that parents fulfill their obligations and by contributing goods in their own right to the newly wed.

Goods that are brought in separately to a marriage and owned separately are distributed separately to one's heirs. Women inherit from their mothers and men from their fathers, in a form of parallel inheritance. Land brought into the marriage is cultivated by both husband and wife and they share

TABLE 23. Structure of Lari Households

	Village		Puna	
Household Type	*N*	%	*N*	%
Solitaries				
Subtotal	29	12.7	8	12.9
No family				
Coresident relatives	1		0	
Subtotal	1	0.4	0	
Simple family households				
Married couples alone	21		15	
Married couples with children	112		26	
Solitary parent with children	20		2	
Subtotal	153	66.8	43	69.4
Extended-family households				
Extended upward	11		5	
Extended downward	3		0	
Extended laterally	3		2	
Combinations	6		1	
Subtotal	23	10.0	8	12.9
Multiple-family households				
Stem families				
Secondary unit down	14		2	
Secondary unit up	1		0	
Frereches	2		0	
Subtotal	17	7.4	2	3.2
Indeterminate				
Subtotal	6	2.6	1	1.6
Total	229	100.0	62	100.0

Source: Lari household census.

equally in its produce, but it is distributed along parallel lines. Goods acquired by a couple during marriage constitute joint patrimony that is distributed equally among heirs.

Partial distribution of inheritance (*reparticion*) to the bride and groom occurs eight days after the marriage. Godparents act as intermediaries at this time, prodding each set of parents to contribute sufficient land from their inheritance to allow the bride and groom to start off their married lives. Ideally, there should be a mix of productive assets: a maize terrace, an alfalfa meadow, a male and female of each domestic animal to produce offspring, and a site to build a house. Godparents attempt to negotiate equal amounts from each set of parents and to mediate when antagonisms develop between sets of parents over the goods they will contribute. If the bride and groom move elsewhere to live, then the lands which they have received are worked by the parents and the harvest is shared between the parents and the newly married couple.

Parents of the groom select the *padrinos mayores,* who are responsible for the costs of the fiesta and the provision of a white wedding dress for the bride and suit for the groom. The *padrinos menores* or *secundos,* selected by the parents of the bride, are obligated to purchase the rings and the collars (*cadenas*) worn by the bride and groom during the religious ceremony.[1] Godparents are also expected to contribute household items, since land and animals are the responsibility of the parents.

Godparents often ask their godchildren to let them also serve as godparents (*padrinos de bautismo*) for the couple's first child, often long before the child is born. The request is commonly granted and considered an informal payment or compensation for serving as padrinos de matrimonio. In this manner, godparents can recover all the funds that were spent in the marriage ceremony, since godchildren (*ahijados*) are obligated to help their godparents out in field labor. Padrinos mayores usually become the padrinos for the birth of a male child and padrinos secundos the padrinos for the birth of a female child.

The bulk of the inheritance is distributed at death. An attempt is made to realize equal shares. A house, which cannot be divided up equally among heirs, will be given to one heir and others will be compensated with land. It is not uncommon for parents to reward well-behaved children with a greater share than a child who has been a problem. If the children are too young to assume responsibility at the distribution, then the oldest male child takes over. If one spouse dies, the other continues to control the inheritance. In the event that a couple dies without children, the immediate families inherit or

the land is donated to the church, a practice encouraged by priests who stress the necessity to support the coffers of the church and the opportunity to win spiritual reward.

One of the recurring problems in partible inheritance, particularly in small holder economies such as Lari's, is that shares of land may be too small to be economically viable. Having too much land in one irrigation cluster often means, as we have seen, that some fields may not be granted water. Heirs exchange parcels among themselves to assemble optimally sized and distributed holdings, thus affording cultivation possibilities for a mix of crops and microclimates.

The main exception to divided inheritance is herding ranches (estancias) in the puna. They are retained in one piece and are managed collectively (see chap. 9).

Descent: Kinship Terminology

In Lari, the family encompasses larger social groups that can have several possible bases for organization. Kinship terminology provides a universal means for organizing the social universe that is created through descent and marriage relationships into recognizable categories for social interaction. Kinship terminology in Lari combines Quechua and Spanish terms. Their use is not random, however, as can be seen in the terms reserved for relations of descent (Figs. 9 and 10).[2] Only Quechua terms are used for members of one's own generation, Spanish and Quechua for ascending generations, and Spanish for descending generations. In contrast to a relative consensus surrounding terminology for close relatives, there is a blurring and a lack of consistency with respect to distant relatives who are linked through grandparents in one's own generation. Lareños get very confused in referring to these relatives and prefer to use Spanish terms. They are aware of the discrepancy and suggest that in Cuzco, where "real Quechua" (*Quechua legitima*) is spoken, one will find Quechua terms for these distant relatives.[3]

In abstract discussions of kinship terminology, informants are most comfortable in using Spanish terms to refer to generation as the main grouping criterion. One informant's statement—"We are all grandparents, aunts and uncles, nephews, and grandsons."—would readily be accepted by Lareños grown tired of responding to an anthropologist's persistent probing of the minutiae of kinship terminology.

The generational grouping criteria is invoked when an informant encounters difficulty in supplying a term for a distant relative. The speaker will

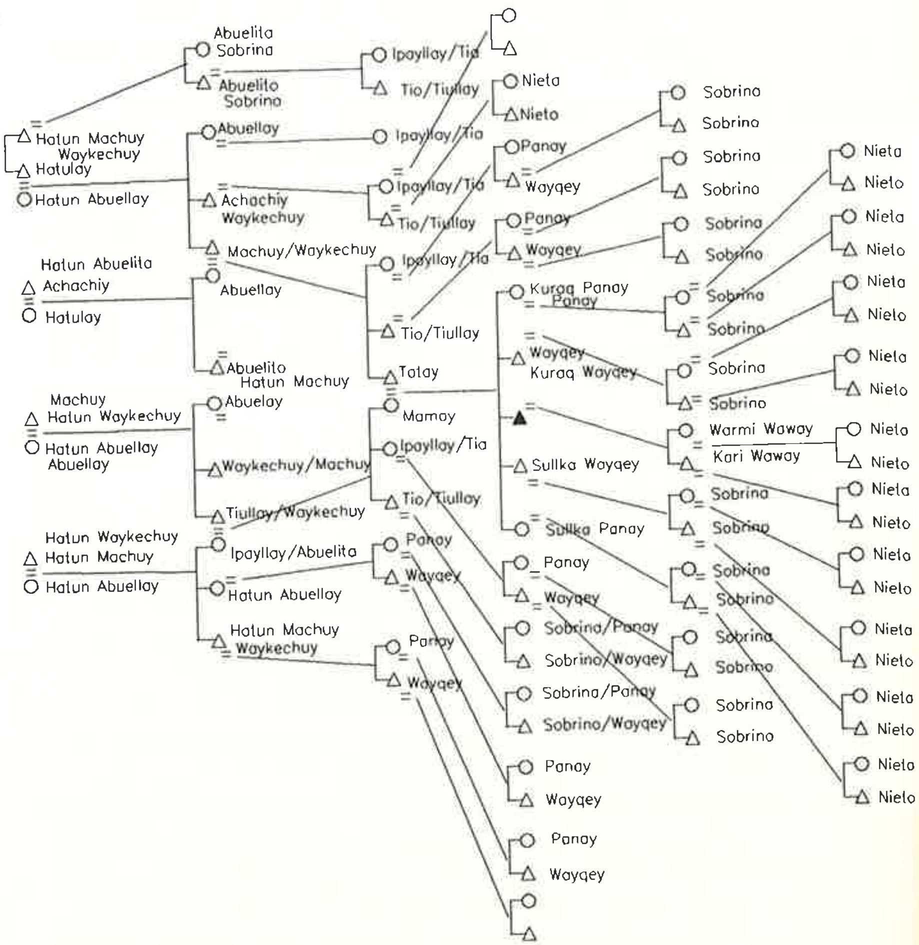


Fig. 9. Descent terminology, male ego

attempt to find an existing relative in that position in order to respond to the inquiry. If there is not a living relative in that position, then often the informant cannot supply a term. If the informant cannot readily locate the individual among his or her immediate relatives, he or she will attempt to situate the relative with respect to generation using the Spanish term. In general, men have a weaker sense of kin terminology than women.

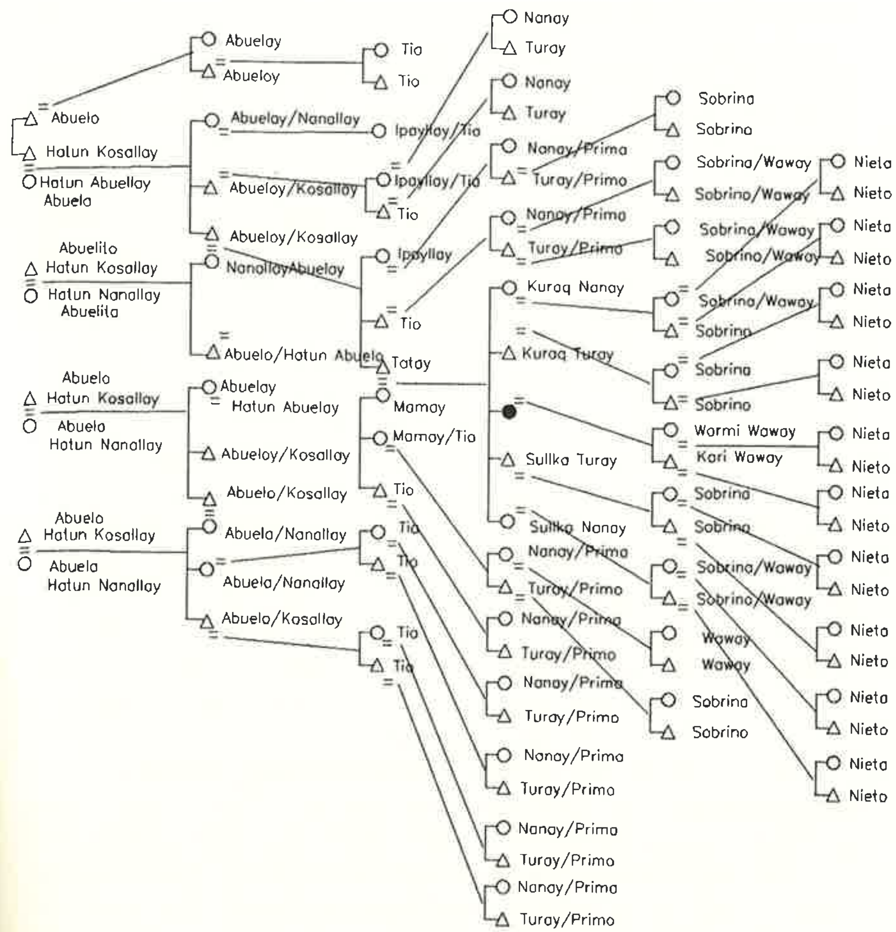


Fig. 10. Descent terminology, female ego

Several common Andean patterns can be found in the descent terminology employed in Lari. Sibling terms vary depending on the sex of the speaker and are further distinguished with respect to birth order. Sibling terms are generally extended to include individuals of the same generation as oneself who are descended from the siblings of one's father and mother or from the siblings of one's paternal grandfather or maternal grandmother, thus indicating a bifurcate merging principle.

Descent: Ayllu and Familia

Visitors to Lari are often surprised to find children addressing adults in the street as *tio* (uncle) or *tia* (aunt) and adults responding with *sobrino* (nephew) or *sobrina* (niece). If they stay in Lari long enough they will eventually come to be addressed in this way and, if culturally sensitive, will respond in an appropriate manner. In a small, close-knit community such as Lari, virtually everyone will sooner or later come to be related to everyone else, if not through consanguineous or affinal ties then through fictive kinship. Close, primary relations are so pervasive that "communal" sentiments are expressed through terms of kinship in public encounters in the street.

On important private ritual occasions that indicate changes in the life cycle, such as the first haircutting and the taking of a spouse, only a portion of one's relatives will participate.[4] On these occasions, wider social categories beyond the nuclear family are determined, ordered, and assigned specific duties and responsibilities. Learning the terms assigned to kinspeople will only partially help to explain the rationale for this ordering. The facile response to the question of who participates on these occasions, readily provided to the inquiring Spanish speaker, is one's "relatives" (*parientes*). When pressed, the more inclusive ayllu or *familia* is provided.

In Lari, the term *ayllu* refers to a bilaterally organized and ego-centered kindred consisting of individuals who can trace descent to a group of grandparents (*abuelos*). So defined, ayllu bounds a rather unwieldly, amorphous collection of people not all of whom may be on equally intimate terms with ego. In reference to marriage, however, villagers distinguish ayllu, in the sense of intimate family, from *karu ayllu* (or Sp. *familia lejana*), distant family. Members of a karu ayllu trace descent to common grandparent and grandparent's siblings; members of an ayllu restrict group membership to a pair of grandparents. Offspring of the siblings of one's grandparents belong to one's karu ayllu and marriage with them is permissible while marriage is prohibited with one whose common relative is closer than the grandparent's siblings. This prohibition is not to be taken lightly, for such marriages bring approbation on the couple, making it difficult to find *compadres*, and are said to produce sickly children.

Ayllu, therefore, has a more restricted frame of reference in Lari than in other highland Andean communities. In Cuzco it takes on a territorial connotation—the community or its constituent units, such as hamlets or estancias (see Poole 1984). In Lari, it is first and foremost a social category defined in terms of descent. Moreover, by separating categories of ayllu who can marry and those who cannot, ayllu assumes a form quite close to those recorded for regions of Ayacucho (Isbell 1978; Flannery, Marcus, and Reynolds 1989:30). The Lari ayllu does not control either territory or corporate resources.

The term *familia* represents a somewhat different frame of reference for wider social groups and it is here that we encounter corporate control. Familia, in this sense, refers to patronymic groups. Close track is kept of their vicissitudes, and Lareños can readily cite the geographical origins and subsequent history of a family. They are quick to point out, for example, the two sets of Quispes in the village and to recite their origins and time of arrival in the village. The importance of male, as opposed to female, surnames reflects the position of the male role in the political and economic domain (Webster 1972:29). A relatively few patronymics, of which the majority are autochthonous, group together a large number of households, while other surnames may be represented by only one or two. One surname group does not dominate village society, in contrast with Albó and Mamani's (1980) contention that alliances within the same surname group occur more in traditional Andean communities. Moreover, the residence of a patronymic group may change over time. In the sixteenth century, the Mamani family was concentrated in the puna, what is today the estancia of Llorqueta; today, the Mamanis are spread throughout the nucleated village.

Pasture management helps to clarify the pressures behind the familia as social group. As we will see in the next chapter, family herding ranches, unlike other possessions, are not divided up through inheritance but pass intact to sons and daughters who manage them collectively. The pasture land is understood to be part of the patrimony of the family and access to it is available to all who share the family patronymic.

This form of joint management of a resource produces strong pressures to cooperate and to think collectively. It reinforces the ties of family that might be weakened through bilateral inheritance and counteracts the looseness of ayllu social bonds. Without family management, the individualistic tendencies of both small holding and the affinal kin classes that operate in labor exchanges would exert strong pressures. The concept of ayllu becomes an ideology for expressing family solidarity.

Alliance: Kinship Terminology

Marriage creates a special relationship between spouses; the husband becomes *qosay* to the wife; she becomes *warmiy* to the husband. These terms can also be extended to include the spouse's siblings: husband's brother is also qosay and wife's sister, warmiy.

Focal terms for the construction of affinal kin groups are *qachun* and *qatay*. These terms are used in different ways to finely distinguish degrees of relationship. Qachun at its most basic is a son's wife; qatay, a daughter's husband. In the presence of bilingual speakers qatay becomes the Spanish *yerno*, son-in-law, and qachun becomes *nuera*, daughter-in-law. Qachun and qatay are only used by parents-in-law in addressing or talking about their sons- or daughters-in-law.

Masiy is used in combination with qachun and qatay to indicate the relationship between wives of brothers, qachunmasiy, and husbands of sisters, qataymasiy. The relationship has its counterpart in Spanish: *concuñadas* and *concuñados*. The extension of sibling terms is a further signal of this relationship: *nanay*, my sister, is used among qachunmasiy; *wayqey*, my brother, is used among qataymasiy. Qachunmasiy and qataymasiy do not include parents-in-law; they are restricted to wives of brothers and husbands of sisters.

There has to be at least a pair of siblings on both sides for the qachunmasiy and qataymasiy relationship to hold, because, as one informant put it, "if there is only one brother, and he is the one who has the wife, then she doesn't have anyone to call qachunmasiy. For this reason, the minimum (in a qachunmasiy relationship) is two, but if there are more than two then they are qachun- or qataymasiy depending on the number of brothers and sisters."[5]

The Spanish term *suegro* (father-in-law) and *suegra* (mother-in-law), and their Quechuized form, *sokray*, are used to refer to a spouse's parents. The solidarity that sets of suegros feel is expressed by the Quechua term *illasiy*, with *qhari illasiy* used between suegros and *warmi illasiy* between suegras. Warmi illasiy is also a son's wife's mother. Illasiy is slowly being replaced by the Spanish compadres and *consuegros*. *Consuegro*, or parent-in-law with respect to the parent of one's son or daughter-in-law, is a particularly apt Spanish gloss of the duality of the masiy relationship, albeit one used by only the more educated informants.

Generational differences are important axes for the conceptualization of affinal kin classes. Suegros are senior members of the kin class created through marriage, perceived as senior to qachunmasiy and qataymasiy and not included within the junior terms of reference. Qachunmasiy and qataymasiy are peripheral terms with respect to the class created by son's wife and daughter's husband.

Affinal Kin Classes

Mayer's (1980) analysis of the principles behind the constitution of affinal kin classes in Tangor, a highland community in the Department of Pasco, is relevant to the situation in Lari. It rests on the key concepts of masiy and *yanantin*. Yanantin refers to things that are equal but complementary. This is confirmed by informants in Lari who illustrate yanantin by reference to sexual complementarity: the boy and girl who become sweethearts (*novios*) and the female dove (*embra*) who meets her mate (*macho*).[6] Masiy, on the other hand, is a relationship between two things that are equal and same. The qataymasiy relationship is exemplified metaphorically by a pair of yoked oxen (yunta), while qachunmasiy is exemplified by *q'onchamasiy*—the two holes in the adobe hearth on to which cooking pots are set.[7]

The choice of yunta and q'oncha as metaphors for qataymasiy and qachunmasiy aptly rests on sharing of work, be it agricultural for men or domestic for women, and symbolizes another dimension of affinal kin classes: a reciprocity that binds the relationship and reinforces obligations in the sphere of labor exchanges (ayni). In the irrigated agricultural economy of Lari, peak periods of labor demand fall at regular intervals in the agricultural cycle. In order to meet these demands, reciprocal labor exchanges are sought. Since the labor force is finite, affinal kin ties are quite useful in gaining a competitive edge to recruit reciprocal labor.

Marriage creates a system of affinal kin classes that rests on symmetry, duality, reciprocity, and solidarity, as well as duties and obligations in the sphere of production. These ties are symbolically enacted and maintained in the ritual of marriage. Affinal kin classes also reflect the outcome of descent-based marriage rules that produce groups of wife givers and wife takers. One's qachunmasiy and qataymasiy tend to come from a set of marriageable partners defined with reference to a descent rule.

Households, Terms of Reference, Descent, and Alliance: A Summary

Social organization in Lari rests heavily on the ideal, reached in most cases, of creating and maintaining an independent family household. Beyond the household, one strives to develop and sustain a personal network of kinspeople, fictive kinspeople, friends, and neighbors. Reciprocal obligations of ayni are extremely useful in this regard. A fluid and far-flung social network is advantageous in meeting the requirements of a spatially disperse and complicated temporal calendar of labor recruitment. This ego-centered, bilateral kin group is kept track of through terms of reference that, in their emphasis on generation and the extension of sibling terms to members of ego's generation, share much with those recorded elsewhere for the Andes. By drawing on an ancient tradition of affinal kin classes (masiy) and undergirding them with metaphors of symmetry, duality, reciprocity, and ritual obligations, one improves the chances for recruiting reciprocal labor during peak periods of the agro-pastoral cycle.

While descent defines the parameters of the amorphous kindred known as the ayllu, a marriage rule effectively restricts it to a group of nonmarrigeables that contrasts to a wider group, karu ayllu, of marriageables. Ayllus have lost their Inkan corporate descent group and collective resource management character. Family control of high-altitude pastures, however, is a vestige of such earlier forms of corporate control and management.

Chapter 9

Pastoralism in an Irrigated Agricultural Economy

A second focus of the economy of Lari, aside from irrigated agriculture, is pastoralism. Animal production takes two forms. Approximately 8,550 hectares, or 90 percent of the usable land of the village, consists of natural pastures unsuitable for agriculture because of slope, altitude, or lack of water for irrigation. The bulk of this land is located high above the village in the puna. Natural pastures in the puna support a dense population of llamas, alpacas, and sheep. Sheep, cattle, goats, burros, and horses are also herded in conjunction with farming on the bench terraces and flats of the valley. These two forms of pastoralism will be the focus of this chapter.

Pastoralism in Lari-Collaguas

The Colca Valley is known from at least the Collaguas period to have a productive pastoral economy based on the herding of alpacas and llamas. According to Ulloa Mogollón, residents of the puna possessed their own herds and traded animal products for maize and quinua from valley farmers. The puna and the valley were thus integrated through the exchange nexus in the barter of products between the two zones. Herd ownership gave pastoralists a degree of independence.[1]

The 1604 Visita of Lari-Hurinsaya expands on Ulloa Mogollon's observation. First, ayllus listed in puna settlements headed by curacas and curacas principales had large numbers of animals in their household inventories, thus indicating a specialization in herding. The presence of ayllu officials in these listings also suggests that the seat of the ayllu was in the puna and not in the lower valley. These ayllus had outliers in valley settlements, which gave them access to agricultural land. This is indicated by the inclusion of the name of an ayllu in the enumeration of a valley settlement, as, for example, the Ayllu Pastores de la Challacinqa (the herding ayllu from Challacinqa) listed in the Lari valley reduccion.

Ayllus with seats in valley settlements, on the other hand, did not declare animals in their household inventories and were clearly specialized in agriculture. These same ayllus also had outliers in the puna, which gave them access to natural pastures. Ayllu Curaca Collana, whose seat and residence of its curaca principal was the valley reduccion of Lari, had an outlier in the puna settlement of Caylloma. This suggests that agricultural ayllus sent Indians to manage animals and pastures in the puna. The Visita thus confirms the integration of the puna and the valley through production—puna herders' control of valley agricultural land and, conversely, valley farmers' control of natural pastures in the puna—and through exchange.

By the early nineteenth century, ayllus no longer functioned as corporate landholding units. Control over natural pastures in the puna shifted to the lineage-like family groups discussed in chapter 8.

Pastoralism in the Puna

Puna Ecology

Natural pastures are located above approximately 3,600 meters on the slopes rising up to the summits of the snow-capped peaks of Misme and Quewisha and behind on the high, undulating puna that stretches to the outskirts of Caylloma. Despite its proximity to the ameliorating climate of Lake Titicaca, Caylloma is the most frostridden and coldest of the three major puna regions, which include Puno and Chuquibamba (Tapia Nuñez and Flores Ochoa 1984). The only feature moderating the extreme cold is a discontinuous topography broken up by volcanic action.

Total rainfall in the puna is higher than in the valley because of more frequent snow and hail. Moisture in the puna is sufficient in most years to permit year-round access to pasture. Seasonal variation in moisture accounts in large degree for seasonally varied flora. An important rainy season plant is the frost-resistant perennial *chilliwa* (*Festuca dolichophylla*), which flourishes during the rainy season but remains palatable to animals during drought. It thrives in bofedales where it is grazed by a wide range of animals. Alpacas prefer its small, leafy parts; sheep, llamas, and horses like its stalk. Aside from forage, chilliwa finds applications in rope making and roof thatching. The tenderness and nutritive quality of the short-stemmed *llapa*, another rainy season plant, attract alpacas. Other species worthy of mention include *cebadilla* (Sp. *trebol, Bromus catharticus*), *pilli* (*Hypochoeris taraxacoides*), and *totorilla* (*Scirpus rigidus*) (Gómez Rodríguez 1985:13).

Ubiquitous among the dry season species is *tola* (*Parasthrephis quadrangulare*). While poor in nutritive quality, tola is drought- and frost-resistant and provides an important source of forage during the dry season. Others include *jano cara* (species unknown), consumed by alpacas and llamas, and *turpa* (species unknown), preferred by sheep. Overgrazing in streambeds and protected slopes has resulted in the proliferation of toxic plants, such as *paco paco* (species unknown) and *garbancillo* (*Astragalus garbancillo*).

The Organization of Puna Pastoralism

Puna pastoralists live in ranching complexes (estancias) that consist of a cluster of one or more circular stone-walled huts with conical roofs of thatch, and stone corrals surrounded by natural pastures. Piles of stones (*mojones*) mark recognized boundaries between estancias. One or more domestic units may reside in an estancia. An *astaña* is a distant natural pasture of an estancia. It is usually provided with a small hut (*cabaña*) that serves as a temporary residence while herding. As pastures become available, herders rotate animals during the dry season (May to October) between the estancia and astañas.[2]

Herders rise and eat an early meal (*almuerzo*) at around 7:00 A.M., remove the animals from their corrals and leave the estancia for the pastures around 8:00 A.M. They return with the animals for a second meal (*cena*) at around 6:00 P.M. Corralling is necessary to keep predation to a minimum and to guard against the ever-present risk of theft (*abigeato*). Herding itself is not physically demanding and women and children can manage it with ease. Alpacas and llamas walk themselves in and out of their corrals and herd movements can be directed by controlling the movement of the dominant animal. Wandering animals can be returned with the aid of dogs and slingshots (*honda*).[3]

Estancias vary greatly in size, ranging from Chuqui, a minute patch of 10 hectares of abandoned terraces behind the village, to Llorqueta, an enormous 2,300 hectare ranch in the puna at around 4,590 meters in altitude. Casaverde estimates that Caylloma estancias average 20 square kilometers in size and can sustain 465 alpacas and llamas; these figures are probably accurate for the puna above Lari (Casaverde 1977:174).

Family Herding Corporations

Most estancias are controlled and managed by lineage-like family groups that are united by a common patronymic. Responsibility for the management of family pastures rests with the *cabecilla* (leader), a respected family member chosen for his or her knowledge of good herding practice and pasture characteristics. While one may hold a senior position in the family descent line, which may confer respect and some authority, it is experience and competence that lead to one's selection as cabecilla.

The cabecilla allocates parcels of pasture to family members, based on an evaluation of carrying capacity and a sense of fairness. If pasture lands are extensive, the cabecilla will carve off sections and allocate pastures to family members in each section. In unusually large estancias, up to three cabecillas may be appointed. Carrying capacity, evaluated annually, depends on pasture area, quality, and snowpack. Abundant rain the previous year leaves a heavy snowpack to feed the bofedales that supply the high quality forage for animal growth and reproduction, particularly the chilliwa and llapa on which alpacas thrive. Alpacas are preferred over sheep and llamas because their wool brings very high prices. The most prized estancias are well supplied with the bofedales that produce large herds of alpacas. Droughts reduce the snowpack and lower the estimate of carrying capacity for the coming year, forcing herders to reduce their herds through sale.

Family pasture shares call for equal numbers of animals. Family members who keep more animals than others are looked down upon. If the family decides to contract an outside herder, allowance must also be made for his personal animals. Under no conditions is a hired herder allowed to keep more than half of the total number of animals on an estancia.

While possession of a patronymic entitles one to a share in family pastures and while shares are often sold and traded within the family, shares have no legal status. Family herding groups are *de facto* rather than *de jure* corporate groups. [4] Legal ownership is vested in the cabecilla, who registers an estancia in his or her name, declares the holdings in the annual self-assessment (auto-evaluo), and pays taxes accordingly. This practice is an adaptation to Peruvian legal, land registration, and taxation procedures, which contain no provisions to accommodate the structure of family herding groups. While the cabecilla as legal owner can sell an estancia, to do so would violate the trust of family members. Were family herding groups to receive legal corporate status and accommodation under Peruvian law to their peculiar nature, individual pasture shares could be recognized and defended.

Families strive to have both a high-altitude and a low-altitude estancia. This lets them move animals and herders from higher to lower altitude pastures during the rainy season when cold makes living difficult and snow covers pastures. The upper puna is a hostile environment, with the very real

risks of death from the cold of the rainy season and cattle rustlers. The unpleasantness of herding makes labor difficult to recruit. Strategies for solving the problem are summarized in table 24.

The Durand Family Pastures

The Durand family controls four estancias—Chaico, Umalaque, and Chullucani, together totalling about 600 hectares, and Mamacancha, about 200 hectares. Chaico (4,553 m.) is used during the dry season. During the cold rainy season, herders and animals descend to Umalaque and Chullucani (4,140 m.). The estancias are registered in the name of the cabecilla, Aniceto Durand, the most senior of the oldest generation of Durand brothers. He willingly accepted the position of cabecilla because he was aging and increasingly unable to perform hard agricultural chores. Durand spends most of his time alone in the estancia, although he has a house in Lari where his wife lives. Until 1984, he was accompanied by a contracted herder to help in the herding chores. The family became dissatisfied with the arrangement and decided to send one member of the family each month to the estancia on a rotating basis.

Pasture is allocated to each individual who carries the Durand surname as indicated in figure 11. While Maria Durand Quico can claim access to Durand family pastures, it is denied to her children who have the paternal surname, Benavides. The children will instead have access to pastures held by the Benavides family.

Household Strategies in the Integration of Puna and Valley

To what extent do households integrate both puna pastoralism and valley farming into their production and exchange strategies? First, most households residing in the puna tend to specialize in herding and do not have agricultural fields that they cultivate directly. Similiarly, many village households neither belong to family surname groups with access to puna pastures nor count themselves among those who have gained control of communal pastures (*botaderos*) on the slopes behind the village (Guillet 1991b). Households that follow such specialized strategies must perforce use the exchange nexus to obtain complementary products.

Households do find ways to manage direct or indirect production in both ecological zones. Perhaps the most common is for members of a family herding group to reside in the village and keep animals on family pastures.

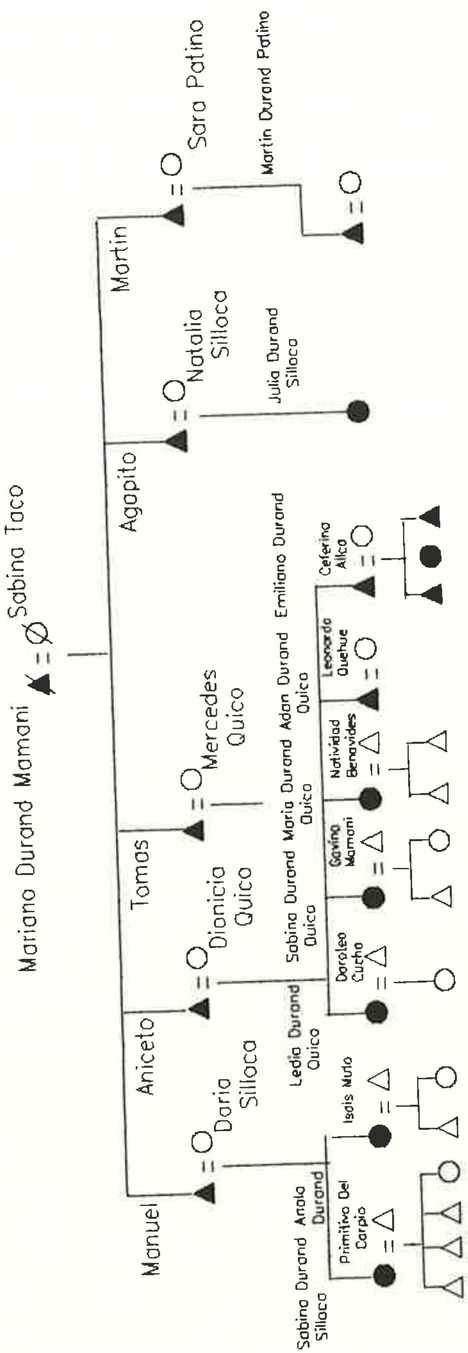


Fig. 11. The Durand family pastures. Shaded symbols indicate pasture shares.

Evidence suggests that patronymic groups once specialized in puna herding are moving to the village to take up mixed herding and agriculture: several patronymics representing families living in Lari are said to have arrived from distant herding outposts. The Mamanis resident today in the Hurinsaya section of the village are said to be associated with Llorqueta, the ceremonial center of Hurinsaya in the puna above the village. The patronymics Taco, Arhuire, Italaque, and Condori are linked with Pillone (controlled by Hanansaya); and Huancarane is linked with Suririwi (controlled by Hurinsaya). Both are distantly located in the puna. Perhaps the most important reason for the shift is that the presence of a school in the village, so important for social mobility, has attracted puna herders to take up residence there.

Households living in the puna and cultivating fields in the village are less common. Agricultural production is much more labor intensive and specialized than herding. Herding tasks are less demanding than the complicated schedule of showing up at reginas to claim water, field preparation, seeding, weeding, and harvest. It is very difficult to manage these tasks directly from the puna. Indirect arrangements do afford some possibilities. In comparison, a village household can more easily use one of the methods of organizing herding tasks listed in table 24.

TABLE 24. Herding Arrangements in the Puna

* The owner contracts a herder to reside on the estancia. His compensation includes living quarters, food, and the right to pasture his own animals on the estancia (up to 50 percent of the total number of animals kept on the estancia). According to estancia owners, contract herders pay more attention to their own than to the animals of the estancia.
* The owner resides in the estancia and herds his own animals. The lightness of herding, in comparison with farming, may appeal to an older man with kin in the village who can provision him.
* The owner resides in the estancia and contracts one or more additional herders.
* The owner contracts a resident herder who is paid on a cash basis before and after harvest. He receives a payment-in-kind during harvest.
* The owner contracts a resident herder. The owner and the herder split all newborn animals, two for the owner and two for the herder.
* Family members select a cabecilla to reside at and manage the estancia.
* Family members take turns living in the estancia.

Ritual Unification of Puna and Valley

Ritual provides another perspective on the integration of puna and valley and reveals much about cultural notions of ownership and cognitive models of culture. Above Lari, one finds estancias said to be "owned" by villages elsewhere in the valley and the puna. Challpo, Ch'alla, Hanaqcancha, and Pampuyo estancias "belong" to Tapay, Hornillo to Yanque, and Utawanta to Caylloma. These estancias are found alongside (*colindante*) those of Lari.[5] Similarly, Lari is said to control, or to have once controlled, the estancias of Suririwi and Chachas Altas above Tapay and Pillones above Yanque. This local concept of ownership bears no resemblance to legal notions. Title to the estancias in question is held by an individual, not by a community. The individual can be either an independent landowner or a cabecilla representing a family corporation. What villagers have in mind by "ownership" is the place of origin of the owner. Thus, if the legal owner of a puna estancia hails from Tapay, then the estancia is "owned" by or belongs to Tapay.

Underlying these notions of estancia "ownership" is a cognitive structure of spatial organization (fig. 12). One axis is the division of space into Hansansaya and Hurinsaya associated with the course of the mother canal (*yarqha madre*). The division follows an imaginary line running alongside the canal from its origins in the puna, through the village, bisecting the church and plaza, and ending in the cemetery.

When it enters the village, the imaginary line separates the community into two halves. Facing the church, Hanansaya is on the right of this line and Hurinsaya the left. Hanansaya's position on the right is consistent with its dominant place in village social organization. The interior of the church is also divided along moiety lines by an imaginary line running down the middle. Each half has its own atrium and collection of wooden and painted images of saints, but those on the Hanansaya side are said to be the more powerful.[6] The main focus of Hanansaya and Hurinsaya is the irrigated terrace agriculture of the valley. Duplicate segments, however, are found in the cold, upper puna, the location of the pastoral side of the village economy.

The division of the puna by moiety is also indicated by separate ceremonial centers, the hamlets of Llorqueta for Hurinsaya and Visuyu for Hanansaya. Small, simple chapels (*capillas*) were built in each of these locations in the mid-nineteenth century. They house the images of the saints brought out in public procession on September 1, the feast of the Immaculate Conception, and in late June during the celebration of Saint Anthony in Hanansaya and Saint Rosa in Hurinsaya. Moiety feasts in the puna have only one cargo

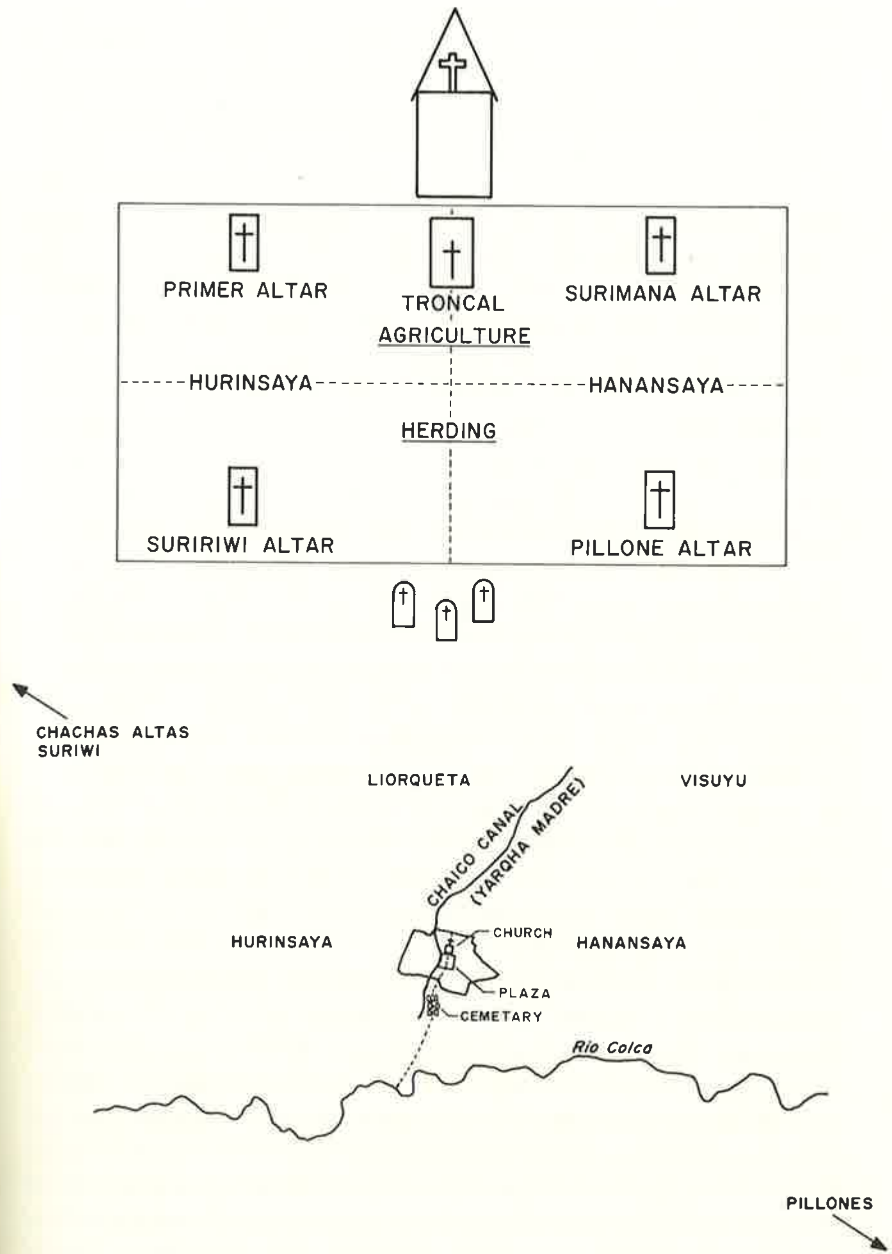


Fig. 12. Lari spatial organization and ritual quadripartition

holder, while feasts in the village usually have two, one each from Hanansaya and Hurinsaya. A cemetery serving both puna moieties is located in Visuyo, the ceremonial center of Hanansaya, the dominant right moiety.

One can observe this structure during two ritual complexes: feasts of the Virgin de la Asunta on August 15 and the Virgin de la Concebida, the Reyes, and the Niño Jesus on January 12. These two feasts are distinguished from others in the village ritual calendar by the constructions of *altares*—poles from which hang plates, flags, dolls, cooking utensils, paintings, and images of saints. Five altars are mounted, one on each corner of the plaza, and the largest and most important, the *troncal,* in front of the church.[7] The troncal is considered essential to maintain a sense of equilibrium.

The plaza is symbolically divided along two axes, thus creating a quadripartite spatial organization. One axis is the dual division of Hanansaya and Hurinsaya with Hanansaya on the east side of the plaza and Hurinsaya on the west side. The other is between the agricultural and pastoral zones, with agriculture on the north side and pastoralism on the south.

There are traditionally seven cargos associated with the two fiestas in which altars are mounted. Two cargo holders from the village, from Hanansaya and Hurinsaya, host the fiesta, set up the troncal, and provide the musicians. Another cargo holder is responsible for the mass and procession. Responsibility for setting up (*armar*) the four altars is given to *altareros,* cargo holders who represent the social groups associated with the quadripartite spatial divisions. On the Hanansaya side, a Surimana altar is set up on the northern corner and a Pillone altar on the southern corner. Surimana refers to the Hanansaya moiety and land watered by the Surimana irrigation system. Pillone was once a political annex of Lari in the distant puna above the village of Yanque until it became incorporated into the newly created district of San Antonio de Chuco.

On Hurinsaya's side of the plaza, a *primer* (first) altar is mounted on the northern corner and hosted by a cargo holder from the village. The altar on Hurinsaya's southern corner is associated with one of its pastoral outposts and has been hosted from time to time by cargo holders from the estancias of Carahuire, as well as Suriríwi and Chachas Altas above Tapay. According to the oldest villagers, Chachas Altas hosted the altar at the beginning of this century. When Lari lost "ownership" of Chachas Altas, sponsorship of the altar shifted to Suririwi, an estancia fed by the snowcap of Suririwi mountain under the jurisdiction of Chachas.[8] Suriwiri continued to supply a cargo holder for the altar until approximately thirty to forty years ago, at which time Lari "lost control" because of "a lack of vigilance." Estancias above Lari do not provide cargo holders for the altars. Instead, they have their own separate moiety feasts on September 1; these take place in Llorqueta for Hurinsaya and in Visuyo for Hanansaya.

This quadripartite division of social space in Lari existed until approximately fifteen years ago, when it was submerged into a dual division. The reasons for the breakdown were the Suririwi's failure to provide a cargo holder for its altar and the incorporation of Pillone into the newly created district of San Antonio de Chuco. This division symbolized, on the one hand, the dynamic and tension-ridden cleavage of Hurinsaya and Hanansaya and, on the other, the essential ecological division of herding and agriculture.[9] The two altars on the southern corners allotted to cargo holders from distant estancias allowed them to articulate symbolically the connection between the agricultural village and the pastoral outlier and Lari's "ownership" of them. The fiesta begins with the Hanansaya and Hurinsaya cargo holders assembling on their respective side of the village with their dancers, ayllu followers, and the band. The procession starts from the cemetery and first visits the house of the governor to invite him to drink and ask his permission to hold the fiesta. It then moves to their moiety altar, where they pray and dance for some time. They then go to the houses of the mayor and the justice of the peace for more dancing and drinking. They end the day's procession in front of the troncal at the church, which delineates the line dividing the two moieties. At night, they return to the homes of the cargo holders, where they drink and dance until the morning. They depart early to the moiety altar, dancing a special dance known as the *witite,* parade around the plaza, and wind through the village.[10] After a rest until midday, they repeat the procession.

This fiesta is also an occasion for the appearance of the *comisarios,* indigenous political authorities. For each moiety there are three comisarios: two representing the agricultural community—the *hatun comisario* (also *hatun varayoc*) and the *aguacil*—and a *campo* representing the puna. The campo is subordinate to the aguacil, who is in turn subordinate to the hatun varayoc. Each carries a vara as a symbol of the authority of his office.

To summarize, estancias above Lari controlled by other villages and estancias in distant areas of the puna controlled by Lari are a survival of the precolonial pattern in which valley ayllus maintain natural pastures in the puna. In these cases, herders in puna estancias trace their allegiance to an agricultural village in the Colca Valley. Relations are maintained by sponsorship of altars during the two fiesta complexes and the exchange of marriage partners.

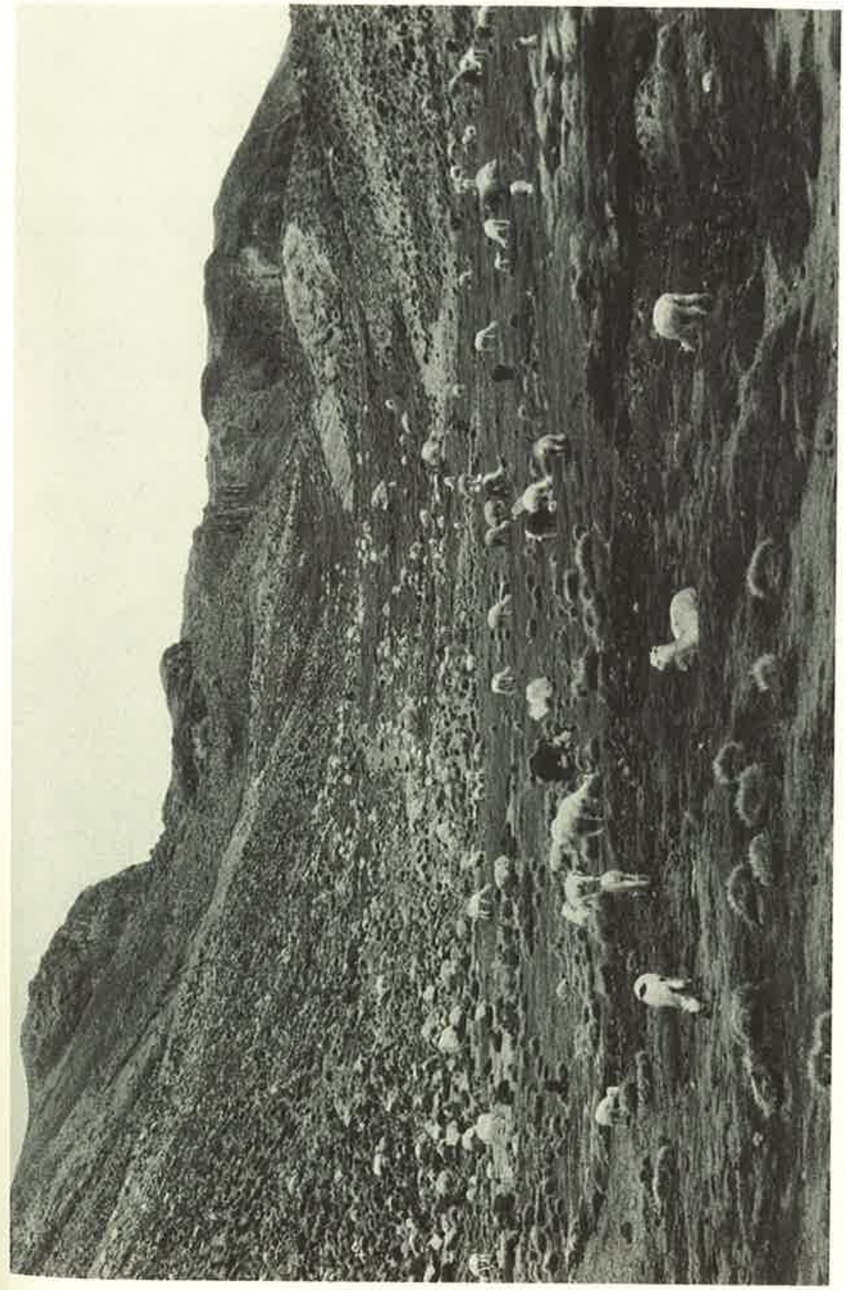
Animal Production in the Valley

Animal production is an important complement to agriculture in the village; approximately 85 percent of the households own animals. Sheep and cattle are kept in the valley and to a lesser extent in the puna; llamas and alpacas stay in the puna. Information on the size and composition of sample household herds is presented in table 25. While households on the average had 14.3 sheep and 3.9 cattle, most households owned neither llamas (64 percent) nor alpacas (59 percent). Those households that did own these animals kept large herds, distorting the overall average.

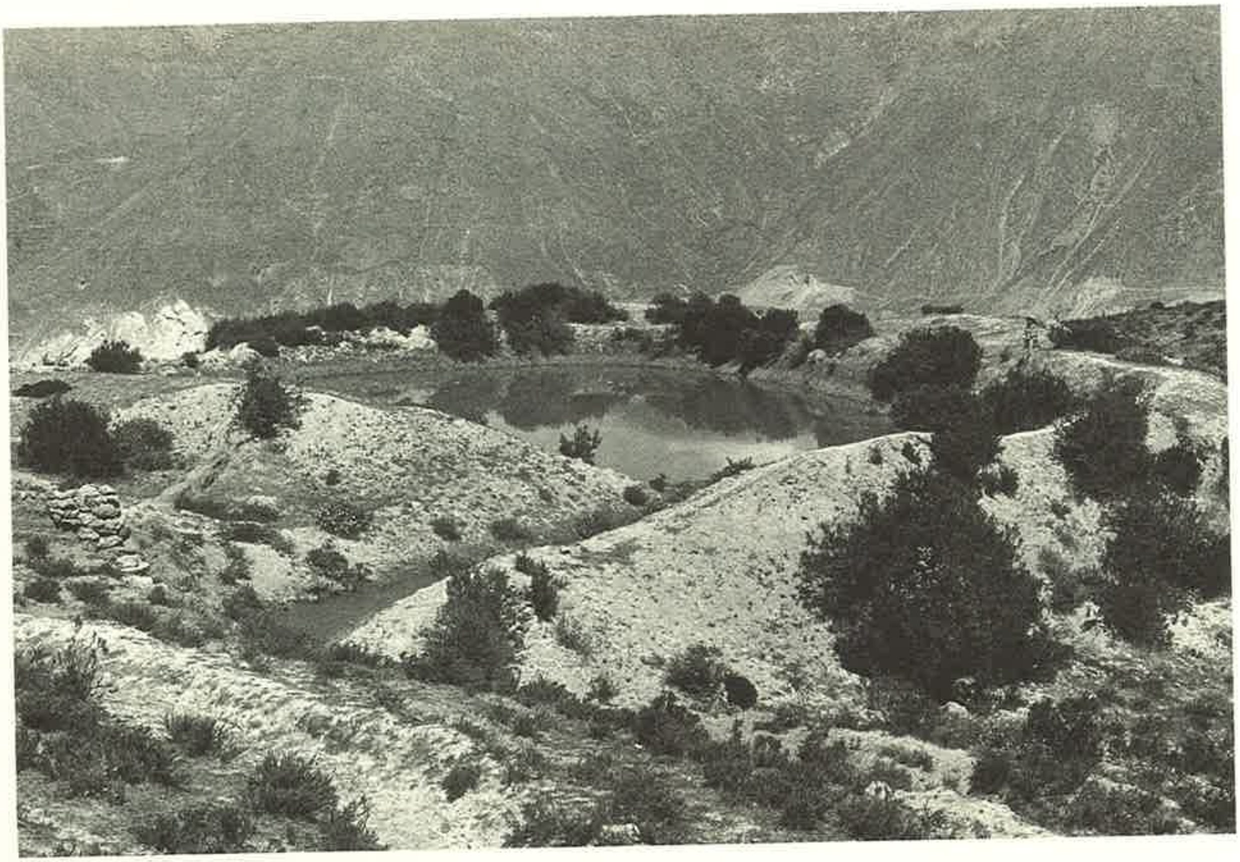
Most houses in Lari have an adjoining corral to which animals return at night. Table 26 presents figures calculated from a nighttime count in 1984 of animals in corrals. These data must be used with some qualifications. Not every household has a corral, nor is every corral used for animals; some are used to grow early crops and vegetables. Animals are also commonly grazed jointly. Thus, these figures do not necessarily represent independent household herds, but rather herds that may contain animals from more than one household. They do, on the other hand, represent an accurate count of the total population of grazing animals in the village and the size of joint herds.

The national agropastoral census returns for Lari for 1972 (ONEC 1974) provide data on 293 economic units. Results for the total animal population in Lari are presented in table 27. The animal population reported in this census is significantly greater than that of the corral census and extrapolation from the land use survey. The larger mean number of alpacas and llamas is probably a result of the inclusion of puna residents. While peasants tend to underreport not overreport animals to census takers to escape taxation, villagers do say that there were more animals in the past than at present.

Three breeds of sheep provide meat and wool for home use. *Serrano* (also known as *criollo*) sheep are the hardy descendents of the merinos and churruas introduced by the Spanish in the sixteenth century. This mixed breed is the only one to survive on the tough grasses of the puna (Orlove 1977b:209). While serrano sheep have relatively little wool, it is fine and easy to spin. The difference in pasture quality between the puna and the valley has a great effect on animal production: carcasses of serranos raised in the puna range in size from 6 to 10 kilograms, while valley-raised serranos can weigh as much as 20 kilograms. *Merinos* were reintroduced into the southern Peruvian highlands in the late nineteenth or early twentieth century in response to the increasing demand for raw material for the newly mechanizing textile industry (Orlove 1977b:209). Merino sheep are said to need



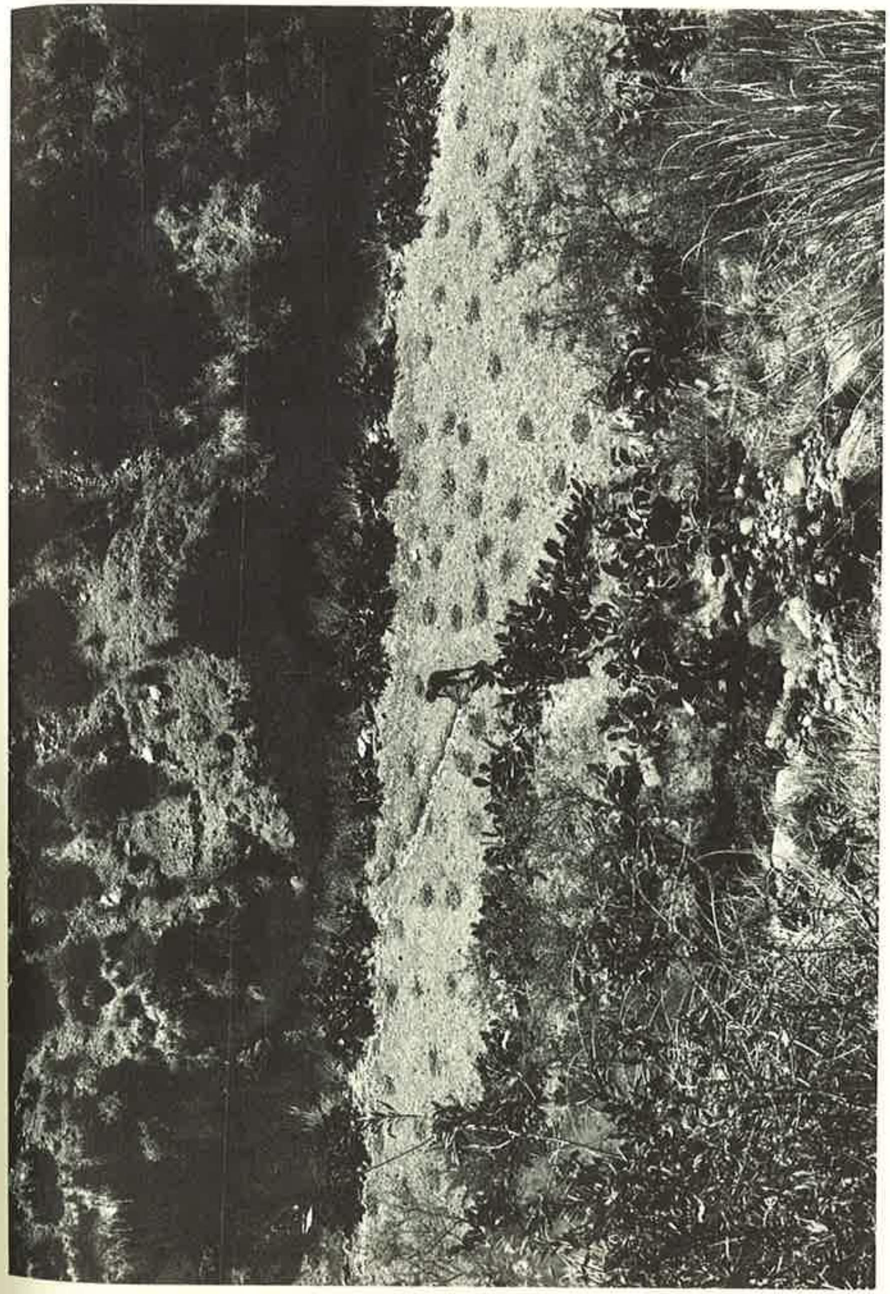
A Puna bofedal


The Yanahua reservoir

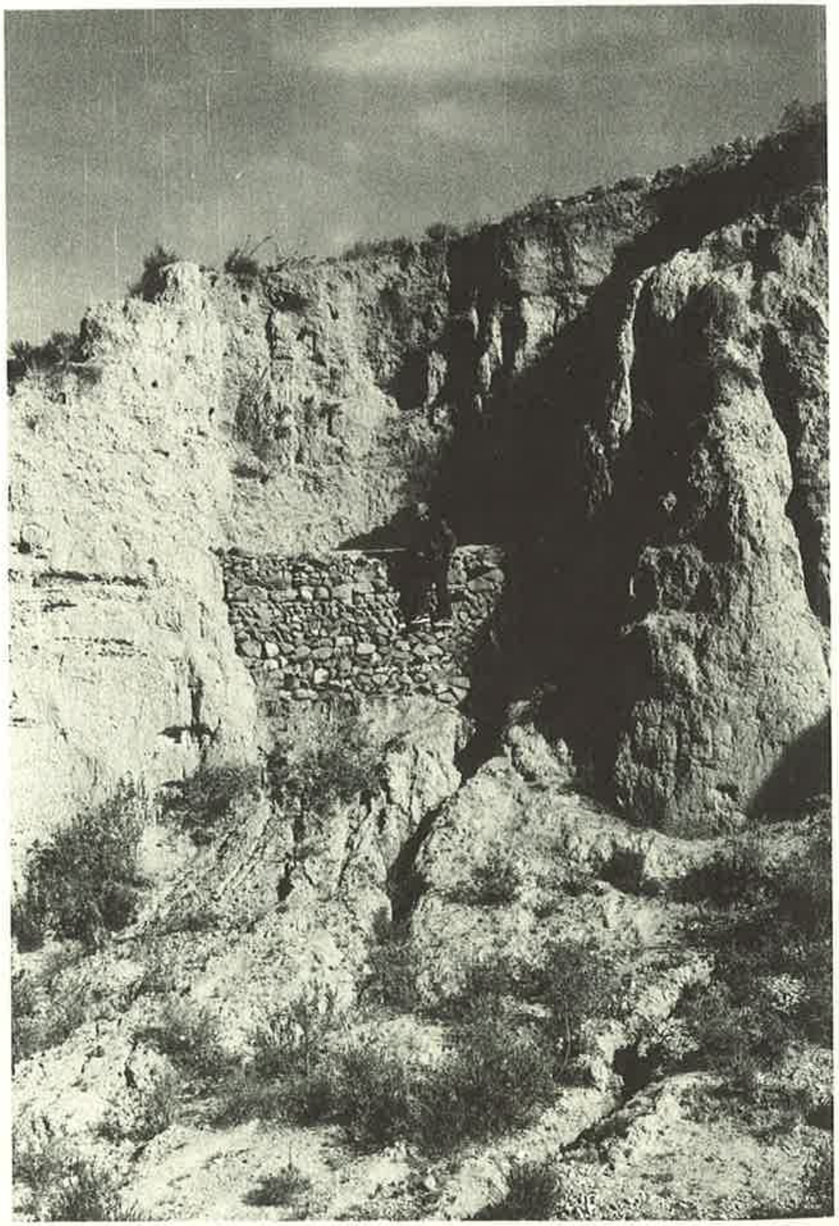

Ananchihua and Karpa tomas

Rebuilding terraces and canals

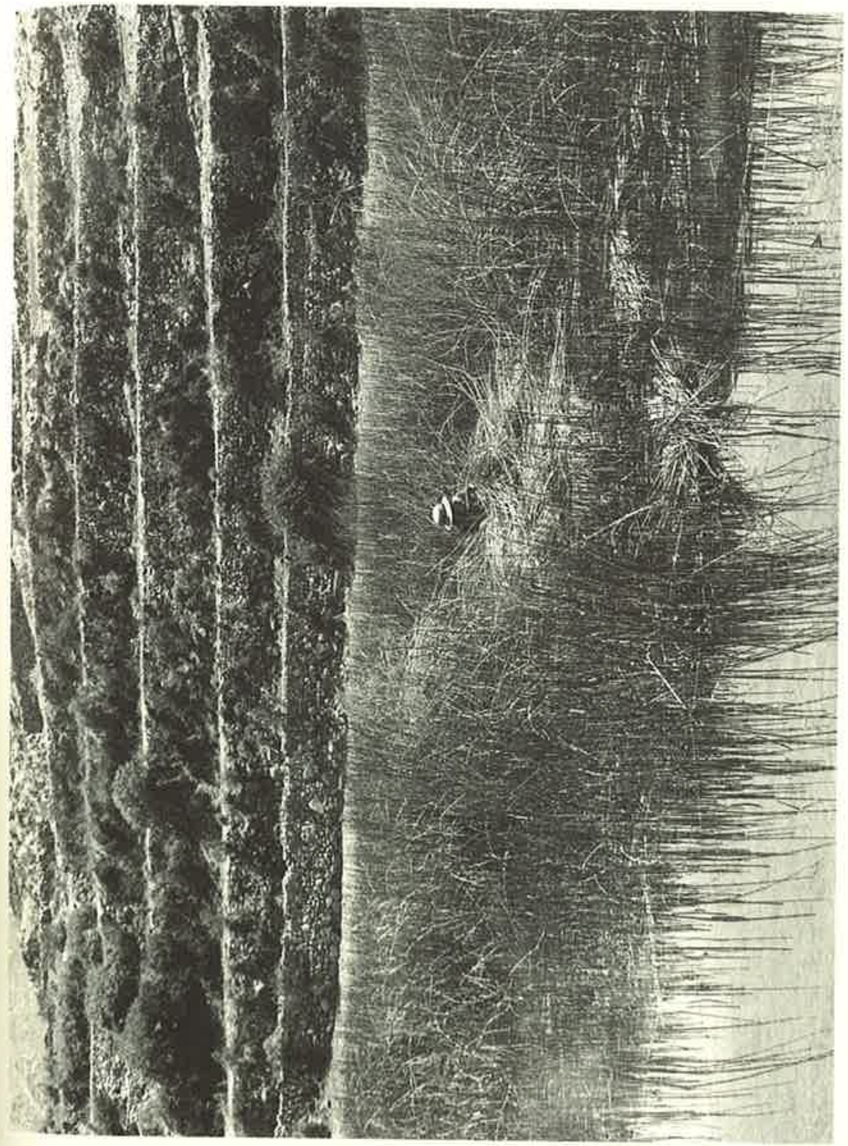
Field preparation with the scratch-plow and oxen



Manuring and cutting a diversion canal in preparation for irrigation



A small maize terrace. The greatest constraint to agricultural production is lack of moisture. If access to water can be obtained, farmers will go to great lengths to create the other conditions for agriculture.



Rights to cut forage from reservoirs are an important benefit of community membership during the dry season.

Ritual and agrarian symbols mark the end of a successful harvest.

alfalfa to prosper and are more susceptible than serrano sheep to diseases, particularly foot rot and eye infection (Orlove 1977b:210).[11] Black-faced (*cara negra*) sheep are the largest and most prized. Their price can reach 100,000 soles per animal; by comparison, prices for serranos range between 20,000 and 30,000 soles.

Cattle have a variety of uses. Oxen are yoked to provide traction for plows. Cows do provide milk for home consumption, but overall milk production is quite low. According to the 1972 census of Lari, while 363 of 851 cattle censused were milk cows, only 14 had been milked the day before the census was administered, producing only 21 liters of milk (ONEC 1974: 507, table 12). During the rainy season, milk production increases and there are sufficient quantities to make cheese for sale locally and in Chivay. Most

TABLE 25. Composition of Sample Household Herds, Lari, 1984

	Mean	Median	Maximum	SD
Cattle	3.9	3	10	2.7
Sheep	14.3	6	80	19.1
Llamas	6.8	0	120	21.6
Alpacas	10.7	0	105	21.3

Source: Land use survey.

TABLE 26. Animal Population, Lari, 1984

	Total Count	Mean Animals per Herd
Sheep	1,055	6.9
Cattle	661	4.4
Goats	18	0.1

Source: Nighttime corral count.

TABLE 27. Animal Population, Lari, 1972

	% of Total Households Who Own Animals	No. of Animals	Mean
Sheep	36.9	3,850	35.7
Alpacas	38.9	4,905	43.0
Llamas	30.7	2,917	32.4
Cattle	63.8	851	4.6
Goats	2.3	32	4.6

Source: Derived from ONEC 1974: 507, table 12, and 519, table 14.

cattle are produced for sale to middlemen, who transport them to the Madrigal and Caylloma mines and to coastal cities.

Four breeds of cattle are recognized: *serrano,* a highland breed; *criollo,* a coastal breed; *cholo,* a cross between serrano and criollo; and *suizo,* of recent introduction and available for purchase in Arequipa. Serrano cattle are well adapted to the rigors of the highlands; they find all local grasses palatable, need little forage, and adjust to low temperatures. They are moderately sized animals with well-developed horns and large tails. Criollo and suizo cattle require more than just natural grasses; they are said to need supplemental feeding, preferably with alfalfa, or failing that, maize stalks and barley straw (*chala*). Lari villagers estimate that their total cattle population is 70 percent serrano, 25 percent cholo, and 5 percent criollo and suizo.

Goats play a rather minor role in animal husbandry even though they have many advantages over sheep. They consume a much wider variety of grasses and weeds, can reach places inaccessible to sheep, and, overall, adapt better to seasonal forage deficiencies. These advantages would seem to outweigh their reputation for being difficult to herd and damaging to crops. In actuality, market forces are lowering demand for the goat fat (*cebo*) used in the domestic manufacture of candles and the skins used in making containers and drumheads. Inexpensive wick kerosene lamps and manufactured candles have replaced homemade candles. Goatskin containers were once used to transport smuggled wine and alcohol from the coastal valleys to the highlands; but they have now been replaced by steel drums carried by trucks.

Communal Pastures

Communal pastures (*botaderos*) are found in several locations in Lari (Guillet 1991b). Some lie in a belt (*franja*) on the slopes behind the village, above the upper limit of cultivated terraces (at about 3,600 m.). This degraded, sloping land provides bunch grasses for grazing during the rainy season. Communal pastures were once much more extensive but have shrunk due to a process of privatization to be discussed in chapter 11. Village cultivators use botaderos, while puna herders rely on their own private pastures. Animals grazed in botaderos include, in decreasing order of importance, sheep, cattle, donkeys, horses, and goats.

The upper common pastures are part of Lari's communal property, which extends to the crest of the mountains above the village. They are accessible by a network of footpaths that connect the village with puna estancias on the other side of the mountains. The closest common pasture is a twenty-minute climb; the most distant takes about an hour.

Common fields are also found on flats (pampas) on alluvial terraces, atop rocky outcrops, alongside marshy reservoirs, and in terraces that have been abandoned for lack of water. In these cases, excessive slope, insufficient topsoil, or the absence of water make agriculture impossible but sufficient natural grasses exist to allow grazing.

Communal lands are ideally open to all villagers. Any Lareño can pasture animals on the land and collect firewood, medicinal and culinary herbs, water reeds, and construction materials such as stone. Such land is considered abandoned land (tierra eriaza) under communal control and cannot be sold or transferred to private ownership. In the Colca Valley, district councils manage communal pastures and levy fees for their use.

Common Fields: Harvested Chacras

Another form of common fields, no longer common because of the introduction of alfalfa in recent years, were harvested chacras. During the agricultural season fields were under private control. At the end of harvest, private ownership rights were relinquished and fields were opened to communal grazing on the stubble. No other rights—collection of building materials, herbs, turf, or firewood—were recognized. As each irrigation cluster was harvested, it became open to grazing; in effect, irrigation clusters became communal grazing areas. In order for this to occur, irrigation clusters were enclosed by walls or fences, but nothing within them restricted the movement of animals.

The shifts from cultivation to fallow and from private to communal control were structured by the mita sequence. As pointed out in chapter 7, the harvesting sequence is heavily influenced by the mita schedule set by the irrigation association, even though the harvest is actually scheduled by the municipality. Thus, low offtakes on the west side of the village, such as Karpa and Ananchihua, were irrigated first, harvested first, and came open to communal grazing first. Water thus played a largely unrecognized role in the structure and organization of agro-pastoralism.

Llama caravans descending to the village from the puna are closely integrated into valley agriculture. Llamas provide an important service by transporting harvested crops from the field to the house. The municipality facilitates this by allowing them to forage on communal pastures in return for a fee (*yerbaje, yaryagua*) paid in woolen ropes (*sogas*), textiles, or cash. For example, in May 1976, the municipality charged one soga or 15 soles for every ten llamas grazed on communal pastures; and it authorized eight days of pasture for each arriving caravan (AMuL, LA: May 10, 1976).[12]

Llama caravans also complemented agricultural production by bringing otherwise inaccessible products to exchange for maize and barley (Casaverde 1977). From the moist, high inner valleys come the fresh and freeze-dried (*chuño*) potatoes and other indigenous tubers, so important in highland diets, and from the puna come the hides, fiber, woven goods, dried and fresh meats. As the villagers become more urban in their tastes, consuming increasing quantities of rice, sugar, and noodles, caravanners found themselves detouring to puna markets to sell or exchange their products in order to obtain more marketable foodstuffs to barter with villagers.

Herd Movements in the Annual Agro-pastoral Cycle

Village herd movements are coordinated closely with the agricultural cycle. Animals must be taken off fields that will be irrigated, plowed, and seeded in July and August, but they can be left on fields in fallow. Communal pastures accept animals at this time, but until the rains begin about December, the forage is poor. Water reeds growing along the edges and in the shallows of unlined communal reservoirs are extremely important forages during this period. Animals are brought there to graze, and water reeds are cut and carried back to the village for corral feeding.

Once the rains begin, barley is seeded, later to be cut and stored as a supplemental feed. Natural grasses begin to grow in earnest at this time in communal pastures. This brings relief for stock owners since the muddy corrals increase the danger of disease. While alfalfa growth is brisk, animals left on it for several hours risk death from bloat. Herd owners increasingly look to upper communal pastures and estancias during January to May as a location for forage. As the harvests begin in June and July, maize and barley stalks (chala) are stored for later use as emergency feed and a supplement for oxen during plowing. At the end of harvest, animals are turned out to graze on the stubble of harvested fields.

The Integration of Agriculture and Pastoralism: A Summary

Pastoralism interacts in complex, multifaceted ways with agriculture in Lari. The first aspect of this interaction is the complementarity of puna pastoralists

and valley farmers. Studies of the energetics of Andean agriculture and pastoralism have shown that "pure" pastoralism is unable to produce sufficient calories to sustain life, even with optimal combinations of land, labor, and capital (Thomas 1973). Thomas calculates the energy-efficiency ratio for the herding of Andean camelids and sheep in Nuñoa, in the puna of the Department of Puno, at 1.6 to 1. This is an extremely low caloric return and helps to explain why "pure" Andean pastoralists are rare (Webster 1973).

The Caylloma puna is even more cold and stressful than Puno. Hence Caylloma herders are more motivated to enter into production and exchange strategies with agriculturalists to supplement their low caloric returns. One strategy is to obtain access to land in the village and produce food directly or indirectly through some sort of arrangement with another household there. One estancia owner, for example, kept around forty-five alpacas, eighty llamas, and thirty sheep in his puna estancia. He has always owned land in the village and used to descend each year to cultivate his fields, assigning his herding chores to family members. In the mid-1980s he was getting on in years and preferred to negotiate an arrangement with a resident villager to carry out the heavy tasks of cultivation. Another strategy of pastoralists is to supply valley farmers with puna products in exchange for valley foodstuffs. Caylloma herders exchange with coastal farmers in Siguas, Camana, and Majes, with Colca Valley farmers, and with potato farmers from Puno, Cuzco, and Apurimac (Comisión 1985:11ff.).

One should not assume from energetics ratios that puna herders are completely dependent on village farmers. The most important recent development affecting the puna economy has been its incorporation into the international wool market. Increases in world demand for alpaca wool have raised prices to such levels that estancias with bofedales to support alpacas can become quite profitable, particularly if a herder selectively breeds for white alpacas, whose dyeable fiber brings the highest price (Comisión 1985).

Valley farmers, on the other hand, need puna products. Agriculture at the altitude of Lari is laden with risk. Part of it, of course, is the bane of small-scale farmers throughout the world who suffer disproportionately from crop disease, pests, and theft. But high-altitude agriculture is particularly prone to frost and droughts in this semiarid region (see chap. 12). While herd animals suffer from predation (by puma, fox, and condors), straying, exposure, lightning, theft, lack of adequate pasture of sufficient quality, and disease, these risks are much lower than the impact of frost and drought on valley agriculture. For villagers, then, herding offers a relatively low-risk supplement to farming and a buffer to the nutritional stress caused by crop failure (Thomas 1973). The widespread strategies we have reviewed in this chapter for keeping animals in the puna allow Lari farmers direct access to animal products.

The second aspect of agro-pastoralism is the interaction of pastoralism and agriculture within the valley. Animals graze on fallowed and harvested fields during the day and deposit dung in corrals that will subsequently be collected and applied to fields. Dung provides essential nutrients and organic matter and plays a key role in the high overall quality of Lari soils and crop yields. Intensively cultivated early crops and vegetables are also grown in the enriched soils of corrals after animals have been quartered there for several seasons. Animals are also incorporated in other ways into valley agriculture: following the Spanish Conquest, oxen have been used for plowing, and, because Lari has never adopted the use of the wheel in agriculture, the use of llamas, horses, and mules for transport has always been of great importance in this region.

Chapter 10

Vecinos and Forasteros, Networks and Coalitions: The Politics of Water in Lari

Our discussion of water management in Lari has emphasized a functional complementarity between the irrigation cluster and the sphere of communal water management. Communal water management is an obvious adjunct to household production in ensuring that water flow to irrigation clusters is maintained, thereby providing the water necessary to render land and labor productive. Through scheduling irrigation in time and space, maintaining the infrastructure of canals and reservoirs, codifying and enforcing water allocation principles, prioritizing water rights with respect to types of land, and limiting water during droughts, the communal sphere unifies an otherwise acephalous network of irrigation clusters.

While this relationship has deep roots in regional history, one should be wary of assuming a "seamless" model of process. Resource management systems respond to endogenous and exogenous perturbations associated with the environment and their human managers. One source of disorder comes from competition over the scarce and valued resources managed by these systems. Such competition is a potential source of conflict in all communal resource management systems. This appears to be the case with water management in arid and semiarid environments. Without water, land is virtually useless. For the near landless, access to water equals survival, so much so that water theft is an undesirable, but often unavoidable, consequence. For the land-rich, water makes material the otherwise unrealizable returns on investment in land. Water is of such importance in the arid and semiarid environments on the western escarpment of the Andes that it overshadows land as a goal of political activity, in marked contrast with the struggle for land in the highland regions that have sufficient moisture to permit rainfall agriculture.

The character of water politics in Lari is our concern in this chapter: What form does political behavior take with respect to water? Are there checks in the form of monitoring and enforcement to keep such behavior within bounds? How effective are these checks?

The Arenas of Water Politics

The Irrigation Cluster

If asked how politics influences irrigation, most farmers would cite *abusos* (abuses) committed by irrigation officials. They would recall a regina when they were unable to get a water share because the regidor passed them over to keep it for himself or to reward a *conocido* (friend, relative, or compadre member of his personal network). Abuso in this context encapsulates notions of fair play and the corruption of power. Regidores commit abuses when they bend the rules to favor someone else, distributing water out of turn or ignoring the crop or spatial sequence.

The vulnerability of the regidor to charges of favoritism stems from a structural weakness in the water distribution process. While longstanding principles of irrigation-by-crop and spatial sequence guide the regidor in distributing water shares, they are necessarily ambiguous and flexible. As we have seen, rigid, inflexible water distribution procedures would require constant modification to adjust to the fluctuating water flow, shifts in household cropping choices, and rapid changes in spatial and crop sequences that are endemic to the system. By keeping the process flexible, but informed by broad spatial and temporal principles, water distribution procedures achieve a fragile, but necessary, balance between anarchy and rigidity.

While flexibility contributes to the efficiency of water distribution, it creates both a difficult situation for the regidor and the potential for abuse. Regidores receive no compensation for their service and, as a result, are tempted to bend the rules to make the job worthwhile.[1] The only legitimate reward is the prestige gained from having served well or an occasional formal recognition in the presentation of certificates of appreciation (LA, CR: Dec. 31, 1980) or a banquet (*parrillada*) in their honor (LA, CR: Mar. 9, 1983).

The position of regidor is similar in some ways to that of the chairman of an academic department in a North American university. Both positions are at the lower level of an administrative hierarchy in which support for their decisions from higher levels (irrigation association president or college dean) cannot always be relied on. Financial rewards that compensate for the drudgery of the office are either nonexistent or minuscule. Succession thus relies heavily on a presumed sense of "responsibility" and "obligation" among the senior members of the group, be they irrigators or professors. Rotation in office is characteristic, not because it divides a prestigious or remunerative prize among numerous aspirants, but because it shortens the time spent in what is a thankless, onerous, but necessary, task. In lieu of legitimate material rewards to attract qualified individuals, perks for oneself or for one's friends, colleagues, or clients become important. The reality of the reward structure exposes officeholders to rumor, envy, and jealously. Legitimacy in the eyes of the users they serve is linked to fair and just distribution of goods and services, be they water shares or annual raises.

In spite of these constraints, the ability of the water distribution process to work as well as it does derives from an ingeniously simple mechanism. Reginas are held on rises above the fields, close to the water source. During a meeting, farmers can look out over the fields and readily identify recently irrigated fields by their darkened, moisture-laden state. This allows one to immediately see fields that have been irrigated, the crops they carry, the fields that come next in the spatial sequence, and, most importantly, the fields that have been irrigated illicitly. The availability of instant information on the status of irrigated and nonirrigated fields allows water distribution to be easily monitored. For the same reasons, it is a powerful check on the susceptibility of regidores to influence. Furthermore, because the information is free and because the number of participants in a regina is small, the costs of reaching agreement and of monitoring and enforcement are extremely low.

The Communal Water Management Sphere

While the politics of the irrigation cluster can be reduced to influence brought to bear on the water distribution decisions of the regidor, which can be easily monitored, the politics of the communal management sphere takes a different form for management decisions in the village irrigation association are arrived at through a tedious process of consensus in which individuals argue positions in intense, face-to-face public encounters. The participants in these encounters—irrigators, regidores, members of the governing board, and representatives of the state—are more numerous and more diverse than in the regina. Decision-making costs—the time spent in arriving at a consensus, obstacles to the collection of information on past management decisions and the impact of future management decisions, and the difficulties of enforcing decisions—are much greater in the communal management sphere.

Of particular importance is the necessity to incorporate the 1969 Water Law and ad hoc rulings of the Ministry of Agriculture into management decisions. Traditional principles—notions of social justice, irrigation-by-crop, spatial sequence, and knowledge of the ritual and beliefs attached to the local pantheon of water spirits—are common knowledge within the irrigation community. However, bureaucratic procedures and the Water Law, which is a complex, legalistic document written in Spanish, are not commonly known. Transating water legislation into Quechua (the principal highland language) would not make it more widely understood, for Quechua is not a written language and although orthographies do exist, dissemination in that language would nonetheless require reading and writing skills that most Quechua-speaking farmers do not possess. Debates surrounding the Water Law and the rulings of the Ministry of Agriculture thus tend to favor educated, Spanish-speaking farmers over monolingual, uneducated, Quechua-speaking farmers, who are wary of the manipulation of legal loopholes and procedures by the more educated and acculturated.

The Ministry of Agriculture

The Ministry of Agriculture is the third arena of local water politics. Ministry officials, including the water judge (juez de aguas), director of the irrigation division, and the hydraulic engineer, make many important administrative decisions and rulings on matters such as the reclamation of abandoned land and emergency water regimes. These decisions directly and indirectly influence water access and land use by individuals and communities. They are usually made by individuals in a private, bureaucratic context after formal procedures bring the matters to their desks.

Staff in the Ministry of Agriculture and other government agencies reside in Chivay, a rather isolated provincial capital that is in many ways more of a village than a town. Most of the families of government staff members live in Arequipa, to which staff often return on weekends. Opportunities for social interaction in Chivay are limited to one of the two restaurants on the plaza, where most take meals, a couple of bars, the market, and scattered retail establishments. Professional government staff quickly come to interact with and constitute part of the Chivay elite, thus opening the possibility that other members of the Chivay elite influence resource management decisions.

Political Actors: Vecinos and Forasteros

In turning from the arenas to the actors of hydraulic politics, we consider the distinction between *vecinos* (neighbors), who are born inside Lari, and *forasteros* (strangers), who are born outside Lari.[2] Forasteros are important in water politics because they exert a disproportionate influence on the economic and political life of the village, winning high political office and acquiring wealth over rather short time spans. They are usually literate and Spanish-speaking and bring with them useful experience outside the village and personal networks with connections to regional elites. Most importantly, their lack of knowledge of and respect for local resource management traditions enables them to discover and seize opportunities for self-aggrandizement that are closed to vecinos, who are constrained by respect for social welfare and a long-term history of relatively successful resource management. The ability of forasteros to move unencumbered through the economic and political space of the village identifies them as classic political entrepreneurs.[3]

Unlike vecinos, forasteros arrive in Lari lacking established social ties. While this would seem to put them at a disadvantage, it frees them from debts and obligations built up over time. Forasteros have no local hard-gained reputation to defend, no family line to maintain, and no network of kin or compadres to support. A forastero can thus focus on assembling a personal network geared to maneuvering in the political and economic realms. Word quickly gets around, for example, that one is willing to pay the costs of serving as a godparent for a marrying couple or a newborn child. By acting in such a manner, a forastero can quickly create a network of compadres obligated to return past favors. The forastero's existing network, already full of contacts in the villages and towns left behind, thus expands to incorporate strategically selected local members.

The wider experiences and better preparation of forasteros bring them decided advantages over vecinos in debating water law in the arenas of the irrigation association and the Ministry of Agriculture. The greatest constraint on forasteros is the vecinos' mistrust. Thus, before taking contentious stands on issues, forasteros move slowly at first in order to establish confidence.

Political Actors: The Regional Elite?

One of the themes of the political economy of the Peruvian highlands is the ability of regional elites, operating in the provincial capital, to manipulate state institutions and agencies—the Guardia Civil, courts, urban administrative hierarchy, and government ministries—to their advantage. This theme is often used to develop theories that argue that the highlands, while not directly linked with state power as the coast is, are indirectly linked through local and regional elites. Because all of these instruments of state power are present in Chivay, the question arises concerning the extent to which regional elites, working formally through the court system or informally through their ties to government officials, constitute political actors bent on manipulating the Water Law to their advantage in Lari and elsewhere in Colca Valley villages.

The Chivay elite, with an economic base in commercial capital tied to the animal fiber trade and retailing rather than agricultural production, has little general interest in the disposition of water disputes in Colca Valley communities. As in other Colca Valley villages, water to support Chivay's agricultural economy comes from a rather independent set of surface water sources that originate above the town. One cannot overemphasize the fact that irrigation systems in the valley do not draw water from a common source, in this case the Colca River, thus avoiding upstream-downstream problems and the possible domination of an elite in Chivay, well-connected with key government agencies. Nor is it feasible for local village elites to coalesce into a regionwide class of powerful landowners; because they are physically isolated one from another, the ability of village elites to act beyond the limits of their village is relatively weak. For these reasons, the possibility of regional elites operating as political actors in local water politics is kept at bay.

This is not to say that, under certain circumstances, individual members of the Chivay elite can become directly interested in local water affairs. Some residents of Chivay possess fields in the neighboring villages of Yanque and Coporaque and have been able to influence ministry decisions concerning water in their favor (Benavides 1983a; Valderrama and Escalante 1988; Treacy 1989). No one residing in Chivay, however, owns land in Lari. The village is simply too far from the provincial capital for Chivainos to maintain cultivated fields there. The Chivay elite thus has little direct interest in the politics of water in Lari.

The most important opportunity for the intervention of regional elites in water management in Lari, and elsewhere in the Colca Valley, is through actions they can take on the behalf of members of their personal network living in villages outside Chivay. Here again we encounter the fact that wider experience, bilingualism, and education gives forasteros greater opportunity to cultivate ties with the Chivay elite than vecinos. The activation of links in personal networks that extend to Chivay is a further illustration of the personalistic, coalitional character of local water politics rather than the elite, class-based, interest-group politics more characteristic of other regions of highland Peru.

A Forastero Career

When villagers discuss the phenomenon of forastero political entrepreneurs, they often cite the example of Pedro Ruiz, a schoolteacher who arrived in Lari in the late 1950s during a period when there was a resident priest.[4] When the church rectory burned around 1958, Ruiz took the priest into his home and cared for him for several years. One of the priest's responsibilities was the management of church *cofradria* fields. These fields originated in land set aside for the upkeep of the church during the reduccion resettlements in the colonial period and were augmented over time by donations of the faithful. Cofradia lands are given to individuals who agree to serve as host (mayordomo) for an annual celebration to honor one of the saints kept as sculpted images in the church. The host cultivates the cofradria fields and pays for the expenses of the feast (his cargo) with the harvest. Following the feast, the fields return to the church to await reassignment for the next year.[5]

The priest rented the cofradia lands to Ruiz, who cultivated the fields as a commercial enterprise, growing alfalfa to fatten the cattle much in demand by buyers for local mines and coastal cities. Ruiz neither cultivated the traditional staple crops of cofradria lands nor hosted the fiesta required of a mayordomo. Ruiz increased his influence in the village by complying with requests to serve as godparent at weddings and baptisms. The network of obligated compadres he assembled in this fashion provided him with labor for cultivating the rented cofradria fields. Ruiz's compadres irrigated his fields on Sunday morning, the day set aside by tradition for the irrigation of cofradria fields, and were allowed by him to irrigate their own fields the rest of the day.

These abuses came to a head in 1966. One of the first actions of a newly elected president of the irrigation association in that year was the filing of a criminal proceeding in Chivay on behalf of the village against Ruiz. When word filtered down that the schoolteacher had well-placed friends in Chivay, the president, sensing his cause was lost, failed to appear in court to pursue the case.

Ruiz eventually became ill and moved to Arequipa where he died. Before he left Lari, however, he gave the fields to another schoolteacher, who, at the end of his assignment, transferred the fields to three individuals in return for personal favors. They rented the fields, in turn, to another set of individuals. During the 1970s, the fields in question were the subject of litigation by the Catholic Church to return them to its control.

The example of Ruiz illustrates several common themes in forastero political careers. First, he used his powers of persuasion and the respect garnered from his position of schoolteacher to consummate an under-the-table arrangement with the priest to gain access to the cofradria fields. Ruiz then used the institution of *compadrazgo* to assemble a network of compadres and called on them to return favors by working on his cofradria fields. Giving them access to irrigation water compensated them for the approbation of the villagers. He felt no compulsion to host the saint's-day fiestas as required of a mayordomo. Lastly, when push came to shove, he was able to use his ties in Chivay to thwart attempts by the village to stop his abuse of power.

Political Actors: Coalitions and Evangelical Protestants

The phenomenon of forastero political careers illustrates another dimension of water politics: the ease of converting personal networks into the patron-client and leader-follower relations essential to establishing and maintaining a political following. Fictive kinship and friendship ties are extremely important in this regard, offering close, solidary, long-lasting ties that one can use to exert influence on others. Ties are sustained through numerous public and private ritual occasions on which ceremonial exchanges create debts and obligations.

In the creation of political alliances from personal networks, descent ties (ayllu and karu ayllu) rarely form a basis for coalescence, because, with one exception, they are not associated with territory or corporate control of resources. A shallow genealogical depth and lack of corporate ownership of resources keep the ayllu from emerging as a political force. The sole exception—the control by patronymic groups of high altitude pastures—offers a limited basis for alliance in certain restricted contexts of the irrigation of high altitude pastures.

Much more important in recent years for the assembling of short-term coalitions in the political arenas of the village are the opportunities provided by the founding of two Evangelical Protestant congregations in the late 1950s and early 1960s. The origins of the Evangelical movement can be traced to the arrival of Seventh-Day Adventist missionaries in the Lake Titicaca region of the Department of Puno in 1909. They were quite successful in quickly building a network of schools and centers of worship, due in large measure to their willingness to teach children in Spanish in a region

where pressure from haciendas kept the indigenous population from attending school. By offering a package of education, health, and religion, the Seventh-Day Adventists appealed to the more progressive groups in rural communities (Collins 1988:52–53; Lewellen 1978:127, 138).

Emboldened by their success, Adventists and other fundamentalist Protestant missionaries pushed beyond the Lake Titicaca region into more remote areas of the highlands. Large numbers of migrants from the altiplano regions of the Puno and Cusco departments were flooding coastal cities such as Arequipa, Moquegua, and Tacna in search of work. Llama caravans also regularly plied altiplano-coast routes, visiting communities on the western slopes of the Cordillera. These caravans descend annually to Colca Valley villages from the high puna of Caylloma, Yauri, Espinar, and Castilla to barter for agricultural products. While in the village they stay at night in the corrals of favored trading partners (conocidos) and forage during the day in his fields or in communal grazing land.[6] Many of these visitors and migrants from the altiplano were recent Protestant converts and constituted the vanguard of missionary activities.

In 1958, an Evangelist church was founded in Lari by a North-American dentist-missionary who arrived one day in a camper van fully equipped as a dentist's office.[7] Four years later the Seventh-Day Adventist Church was founded by an immigrant who came from Espinar in the altiplano of the Department of Cuzco.[8] These sects met with immediate and increasing success. The most important, the Seventh-Day Adventists, grew from 80 adults and children in 1984 to about 250 in 1987, a quarter of the village population.[9]

The emergence of Evangelical Protestants illustrates well the opportunities and limitations of coalitions in water politics. Strong solidarity obligates Protestant regidores and village officials to favor, whenever possible, their counterparts in distribution and management decisions. It also provides a basis for the formation of coalitions to elect Evangelicals to positions on the board of the village irrigation association. They are limited, on the other hand, by the consensual nature of decision making, elections as means of succession to office, and mechanisms for removing elected officials. Until and unless Evangelicals constitute a majority, the same highly visible solidarity that brought them into office can also work in reverse to remove them from office, as we will see in chapter 11. Their efforts to move beyond short-term coalitions to dominate water management and other political arenas of the village remain stymied.

Conclusion

The tenor of water politics owes much to bilateral forms of social organization that have replaced corporate descent group resource management, a tradition of public face-to-face consensual decision making, and election as a means of succession to office instituted by the state. Within these constraints, politicking becomes a process of influence and assembling short-term coalitions for electoral ends.

One indication of a breakdown in personalistic, coalitionist politics would be the emergence of elite, class-based interest groups. This has yet to happen. The environmental, market, and social welfare constraints discussed in earlier chapters retard the emergence of land-based stratification. Physically isolated one from another, village elites are relatively weak in terms of their ability to act beyond the limits of their village. As we have seen, no regionwide class of powerful landowners has been able to exert its influence disproportionately on the implementation of the Water Law.

Chapter 11

Long-Term Response to Scarce Water: The Adoption of Alfalfa

Resource management systems, in order to be effective, must be able to respond to change. Farmers modify cropping patterns in response to shifts in consumption and higher yielding crops. Climate is never constant, shifting over the short, medium, and long term. Communal water management systems must have the flexibility to adjust their subsystems of water transport, allocation, and distribution accordingly. Excessively rigid resource management principles may present stumbling blocks and have to be modified. Indeed, given the accumulating evidence for environmental degradation, the extent to which sustainable resource management principles are retained or modified during agrarian change is an important question. Change in the principles of managing scarce and valuable resources always occurs within a political context that can hinder or facilitate individual innovation.

These rather abstract concerns translate into real issues. In agro-pastoral regimes, does population pressure result in a willingness to allow animal numbers to increase, with subsequent overgrazing, in order to increase the availability of manure for the intensification of agriculture? When faced with pressures for market production, does communal resource management allow capital to be accumulated by sale or transfer of some (or all) resources in order to finance new enterprises or educate children? How do communities maintain control over resources in the face of pressures to individualize production?

These and other questions will be addressed in this chapter by analyzing the introduction of alfalfa into the economy of Lari. The cultivation of this crop directly challenged many of the long-standing principles on which water management rested. The accommodation that emerged maintained the integrity of the system while allowing for agro-pastoral intensification.

Alfalfa In Peru

Alfalfa (*Medicago sativa L.*) was brought to Lima from Spain in 1535, introduced into the lower valleys of southwestern Peru by Spanish colonists soon thereafter and fully diffused there by the early seventeenth century.[1] Alfalfa is now the principal forage plant on the western slopes of the Cordillera, from the coast to an altitude of 3,700 meters (Weberbauer 1945:617). In the Arequipa countryside (*campiña*), where an alfalfa meadow can produce up to five crops of alfalfa hay a year, it is the bulwark of the dairy industry.[2]

Alfalfa first became important in the highlands during the colonial period as a crop to feed the mules and horses engaged in the Cuzco-Potosí trade that could not adjust to native grasses and weeds (Gade 1975:167). It was intensively cultivated in the Arequipa Valley in conjunction with the provision of mule trains for the trade with Charcas. By the mid-nineteenth century, 78 percent of the Arequipa campiña was in alfalfa.[3] Widespread diffusion of alfalfa in the highlands awaited the evolution of a long-lived, hollow-stemmed, cold-resistant variety, probably in the nineteenth century (Swanson 1956:1). This development allowed alfalfa to attain its potential as a semiperennial; until then, it had to be cut and dried before being killed by frosts.

Alfalfa in Lari

Alfalfa is not listed in the Visita of Lari-Hurinsaya of 1604. A late eighteenth-century account describes the cultivation of small quantities for local use in the nearby Siguas Valley, but it is missing from the list of the crops grown in Caylloma (Alvarez y Jiménez [1790–93] 1946: 66). A source from about the same time period (Echeverría y Morales [1804] 1952) lists alfalfa growing in Maca and Ichupampa but lacks information for Lari. A mid-nineteenth-century account lists maize, potatoes, and broad beans, but not alfalfa, for Lari (Valdivia 1847:122); in other respects, this source repeats the description of Echeverría y Morales. In 1878, alfalfa was seeded in a walled garden on the church grounds, traditionally a site for agricultural experimentation (AAA, LLI 1878). In Stiglich's *Diccionario geográfico del Perú* (1922:263) from the early twentieth century, broad beans, quinoa, barley, and wheat are said to be cultivated in the upper fields, and maize, potatoes, and oca in the lower fields, but, again, no alfalfa is listed for Lari.[4] The evidence from these accounts suggests that alfalfa was grown on an occasional, probably experimental basis, beginning in the nineteenth century. Presumably because of the lack of a variety adapted to high altitude, alfalfa was an inconsequential element of village agriculture throughout this period.

But this situation was to change with the large-scale adoption of alfalfa that began in the 1950s.[5] Responses to a question concerning the year farmers

first began to cultivate alfalfa are presented in table 28. Data are aggregated by ten year periods, from the 1940s through the 1970s. The earliest date is 1947. These data suggest that the process of adoption began in the 1950s and slowly picked up momentum, particularly in the 1970s. When the archaeologist Max Neira entered the Colca Valley in 1957–58 to conduct his survey of Collaguas sites and ceramics, he saw no alfalfa (Max Neira, pers. com.); nor does the anthropologist Juan Gomez remember encountering alfalfa on his initial trip to the valley in 1963 (Juan Gomez, pers. com.).

According to oral history, alfalfa was first grown in intensively cultivated kitchen gardens (huertas) that adjoined houses. Protected huertas with access to piped water are traditionally used for experimentation with new crops and techniques. Abandoned houses with standing walls (galpones) are also used for alfalfa for much the same reasons.[6]

The shift to the cultivation of alfalfa in fenced and irrigated meadows (alfalfares) occurred first with farmers who had large amounts of land but limited labor. For them, alfalfa was a crop that could be grown with little effort. The schoolteacher who gained control of church cofradia fields used them to grow alfalfa. Alfalfa cultivation eventually spread as villagers found from their kitchen garden trials that alfalfa would grow well and discovered others growing it successfully on bench terraces and on pampas. Many say that the alienation of the communal pastures was a primary cause.

Data from the 1978 Cadastral Survey show the pattern of alfalfa cultivation by the end of the wave of adoption (table 29). About one out of every four fields was in alfalfa, with the crop occupying over a quarter of the total cultivated area. Alfalfa fields were somewhat larger than the mean size for other fields.

General Aspects of Alfalfa Cultivation

Alfalfa is a hardy, drought-resistant cultigen with long roots that conserve moisture during dry periods and allow the plant to recover quickly following

TABLE 28. Initial Year of Alfalfa Cultivation

Year	*N*	%
1940–49	1	2.5
1950–59	9	23.1
1960–69	12	30.8
1970–79	17	43.6
Total	39	100.0

Note: The figure for 1980–83 is 5.

a frost. Three varieties are cultivated from seed purchased in Arequipa: Blanca, Morada, and Yaragua, the most frost-resistant and widespread.[7] Alfalfa provides eight to ten years of production before reseeding becomes necessary to restore vigor. Alfalfa allows from four to five periods of cutting or foraging per year, the same as the Arequipa Valley. During the rainy season, alfalfa is cut and dried and stored for supplemental feeding to cattle, particularly, oxen, during the dry season.

Aside from its drought and frost resistance, alfalfa has several other advantages. Its grows well on poor soils and in locations not suitable for maize. For example, fields on the southeast side of the village, watered by the Surimana canal system, have sandy soils with low water retention. The only crop to grow in these fields, even without fertilization, is alfalfa. Many farmers now cultivate alfalfa during the traditional fallow period that follows several years of maize cultivation. The growth of alfalfa in fallow fields gives animals access to a much higher quality of forage than the natural grasses that would have grown there or the crop stubble. Agricultural production following the return of the field to cultivation may be higher, too, due to the soil-improving qualities of alfalfa.

Perhaps the most significant advantage of alfalfa is its low labor requirements. Alfalfa requires the least labor of all the crops cultivated in the Colca Valley (ONERN 1973: 2:125, table 2). It is particularly gainful in comparison with maize, requiring less than one-third the labor (table 30). Alfalfa can be sown during the rainy season without having to plow first. The only other labor necessary is occasional irrigation and cutting, drying, and storing if used for supplemental feed. Maize, on the other hand, must be plowed, cultivated, and carefully harvested. Because of its low labor requirements, alfalfa is favored by labor-scarce households even for fields otherwise suitable for maize.

TABLE 29. Alfalfa Cultivation in 1978

	No. of Fields	%	Total Area (Has.)	%	Mean Size (Has.)
Alfalfa	399	22.1	223.8	27.3	0.56
Other crops	1,406	77.9	594.5	72.7	0.42
Total	1,805	100.0	818.3	100.0	0.45

Source: 1978 Cadastral Survey.

Reasons for the Cultivation of Alfalfa

Drought

Lari farmers attribute the shift to alfalfa to water scarcity and declining rainfall. They are not alone in suggesting such a trend. Antúñez de Mayolo (1981) has argued that it is part of a general pattern of increasing aridization in the Central Andes. Substantiating such a trend with the available data is difficult. The longest series of rainfall data in the Colca Valley comes from a weather station at Yanque that began measurements in 1951 (fig. 5). These data reflect a pattern of extreme irregularity and periods of very low rainfall, including 1956–60, 1964–69, and 1975–82. Average annual rainfall for the entire 32-year period (1951–82) was 418.4 millimeters. Regression analysis reveals a slight decrease of 3.27 millimeters per year over the period but is not, however, statistically significant ($t = -1.166$). A longer, 48-year series from Chuquibambilla in the Province of Cotabambas (1931–79; data missing from 1932) also fails to substantiate a long-term trend of decreasing rainfall and, in fact, reflects a slight increase (1.94 mm. per year, $t = 1.299$) over the period in question.[8]

If available data do not substantiate Lareños' claims of a decline in rainfall, they do show that rainfall is low on the average, very irregular, and subject to periodic droughts. Each of these factors is a major constraint on agriculture and pastoralism and would in itself produce competition over scarce resources such as pasture.

TABLE 30. Labor Expenditure Estimates for Alfalfa and Maize, One Topo-sized Fields, Coporaque

	Plow	Seed	Irrigate	Cultivate	Harvest
Alfalfa					
Laborers	0	6	2	0	5[a]
Days	0	1	2[b]	0	1
Total laborers	0	6	4	0	5
Total laborer days: 15					
Maize					
Laborers	4	7	2	6	6
Days	2	1	4[c]	2	2
Total laborers	8	6	8	12	12
Total laborer days: 47					

Source: Treacy 1989: 444, app. 11.
[a]Labor figures are for one yearly cutting of dried alfalfa.
[b]Irrigation may only take two to four hours.
[c]Irrigation may only take two to four hours.

Population Pressure

A possibly more compelling reason behind increasing demands for forage and pasture is population growth. Population figures for the district of Lari, broken down by the nucleated village and dispersed puna segments, are provided in table 31.[9] Since the first national count of 1876, the district population grew slowly but consistently until 1972, when it began a slight decline. In general, these figures suggest a rather stable population.

Given the impact of lowered death rates, associated with improved health practices and medical care, on natural increase in the Colca Valley, such relative stability is anomalous (Cook 1982:87). This is certainly the case in Lari. An analysis of births and deaths for the period 1950–83, recorded in the Lari civil registers, shows that births exceeded deaths for each of the years in question, with the exception of 1977. The rate of natural increase for the period, 1.97, is high and consistent with lowered death rates and an expectation of population growth. One demographic force ameliorating the effect of natural increase is out-migration. In order to clarify its extent, genealogical informants were asked to supply information on the date and destination of family members born in Lari who left the village. The frequency of outmigration, by year, in the sample of fifty-three four-generation genealogies, is presented in figure 13. The first instance of out-migration in the genealogies occurs in 1925. From that date until 1970, the numbers of outmigrants grow slightly but remain low. In 1970, the incidence jumps dramatically. Throughout the 1970s and early 1980s, individuals and entire households leave the village in significant numbers, helping to lessen new population growth due to natural increase and the related demand on resources.

What were the factors at the outset of the 1970s that contributed to the surge in out-migration? One development of obvious importance was the road network linking the village with Arequipa. The first dry-season road between Chivay and Madrigal was completed in 1949 and bus service between Chivay and Arequipa began in the late 1950s. But the link was intermittent at best until the completion in 1969 of the all-purpose road connecting the Madrigal Mine with Chivay and the Arequipa road network. The ensuing bus service between Madrigal and Arequipa passed through Lari offering a quick and relatively inexpensive trip to the departmental capital and points beyond. About 1970, a road was also constructed in the puna to Caylloma from Chivay and bus service came soon thereafter, facilitating out-migration. Indeed, the province of Caylloma experienced a net population loss of out-

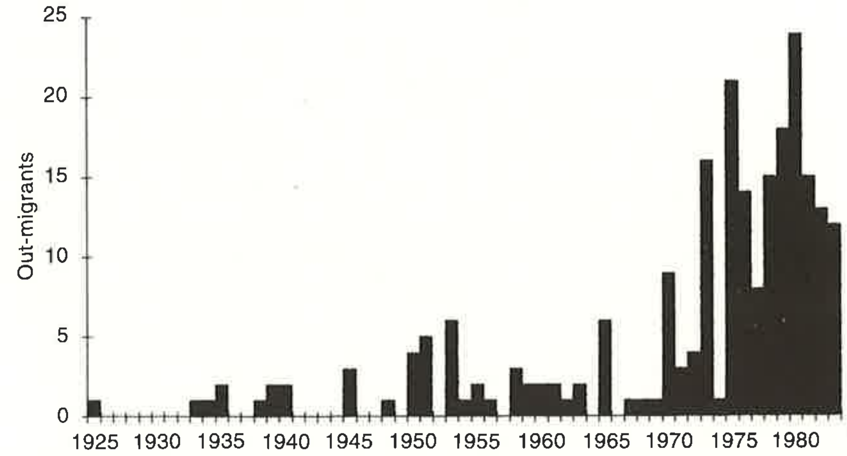


Fig. 13. Frequency of out-migration, by year

migrants (4,810) over in-migrants (3,609) of 1,201 from 1976 to 1981 (Instituto Nacional de Estadística 1987: 54, table 8).

Population growth, then, only partially explains the increase in demand for forage and pasture that lies behind the adoption of alfalfa. While the potential for natural increase has been high since the 1950s, out-migration, particularly after 1970, has kept it in check, helping to maintain a rather stable district population for the last forty years.

The Demand for Meat

A more compelling reason for the cultivation of alfalfa has been the demand for meat and forage to feed the cattle to produce the meat. The initial demand

TABLE 31. Population of the District of Lari, 1876–1984

	Village		Puna		
	Total	Households	Total	Households	Total
1876	533	—	237	—	770
1940	789	194	225	56	1,014
1961	820	224	249	55	1,069
1972	989	276	250	75	1,239
1981	1,028	—	128	—	1,156
1984	945	229	204	62	1,149

Source: For 1876, 1940, 1961, 1981, national censuses. Household numbers were not available for the 1876 and 1981 censuses. For 1984, census conducted during fieldwork.

came from the Majes Project. Work on the physical infrastructure began in 1971 and was completed in 1982.[10] It included the construction of canals and tunnels from the main intake at Tuti to a tunnel below the Cabanaconde road, an airstrip, and an expatriate "village" outside Achoma, across from Lari, in 1974. Existing roads and bridges were also improved and a new road constructed linking Cabanaconde with Huambo and the Pan-American Highway. The Majes Project employed a large number of workers, calculated at its peak in 1977 to have been 5,000 (Hurley 1978:181).[11] The demand for meat to feed workers housed in camps at Callali, Chivay, Achoma, and Huambo soon soared. A slaughterhouse was built in Achoma, next to the expatriate village, in the late 1970s and seventy cattle per week were butchered during the peak of the project (Webber 1988:96).

As the Majes Project was drawing to a close, long-dormant mines at Madrigal and Caylloma were started up and recapitalized, recreating the need to feed a large labor force.[12] At its peak in 1979, the Madrigal Mine employed 760 people, but by 1983 the work force had declined to a total of 539. In 1985, the mine was purchased from Homestake by a Peruvian consortium; a year later it was declared in bankruptcy and most of the mine workers were dismissed. In January 1987, under a reorganization scheme, the mine returned to production on a much smaller scale. The mine's problem is its high level capitalization pitted against low prices for the minerals it produces.

Local demand for meat from the mines and the Majes Project is supplemented by the demands from outside the region to supply the growing populations of coastal cities such as Arequipa, Moquegua, and Lima. These cities have grown enormously since 1960 and much of their population has acquired cosmopolitan tastes for meat. While the meat supply is tightly regulated, most of the distribution occurs through a network of informal markets linked to sources such as the Colca Valley. In Lari, buyers regularly arrive from as far away as Lima to purchase fattened cattle.

The expansion of alfalfa, the forage of choice for cattle and fine merino and black-faced sheep, has proceeded apace with growth in the demand for meat. Farmers have been converting fields to alfalfa meadows to fatten their own cattle for eventual sale or to rent to Lari and Madrigal mine workers who purchase calves with their wages to fatten for eventual sale. Herders also rent alfalfa fields to pasture animals that are normally kept on high altitude pastures. In 1977, fines were set for the theft of alfalfa from fields, thus indicating the extent of the increased demand.

While the majority of fields are converted to alfalfa meadows to obtain forage during a fallow period or for small-scale cattle fattening, some villag-

ers specialize exclusively in alfalfa production. One landowner, for example, lives solely on rental income from five yuntadas of land in one irrigation cluster, with rents ranging from 100,000 to 200,000 soles per year.[13] Specialization appeals to landholders with large amounts of land but little labor and to older farmers who find field-crop production physically demanding. It does lead, however, to virtually complete dependence on cash transactions to obtain needed commodities. While alfalfa resists frost and drought relatively well, particularly in comparison with maize, it involves risks. Since most surplus food is kept for barter with llama caravanners and little food produced locally is sold locally, it may be difficult for landowners specializing in alfalfa to purchase food from local suppliers. Moreover, as alfalfa cultivation expands, with more and more farmers renting alfalfa meadows, supply overtakes demand. Some farmers have been lured into seeding all of their fields in alfalfa only to find no one who will rent the fields for forage. This is a nightmare for producers who cannot consume a crop as a fallback strategy when market conditions turn down. Several farmers were caught in this position when the Madrigal Mine closed abruptly in 1987, removing the most important local buyer of cattle.

Alfalfa meadows are rented for as long as it takes for the forage to be consumed. Meadows are rented by the yuntada and the topo. In late October 1983, one topo went for 15,000 soles and lasted the owner, a herder from an estancia above Lari, six days. Rates for a yuntada the same year were about 20,000 soles. These rates applied to landowners from the village and for compadres and kinsmen of the owner. Renters from Madrigal, on the other hand, paid prices ranging from 30,000 to 40,000 soles, beacuse of special levies on Lareños who rent to people from Madrigal. This measure controls the free-rider problem of individuals who use water but do not participate in irrigation faenas. Rental contracts for an alfalfa field stipulate that 50 percent is due on the signing of the contract and the remainder within five days.

Causes and Effects of Alfalfa Cultivation: The Privatization of Communal Lands

In the late 1960s, at about the same time that alfalfa started to be adopted on a large scale, the use of various forms of communal land in Lari changed dramatically. In some instances, the shifts took the form of classic enclosures, comparable to those reported by Mayer (1979) for villages in the Cañete Valley: large, open common fields were divided into individual parcels, fenced, and transferred to individual owners. In other instances, private users of common lands prohibited communal access. The system of communal grazing on the stubble of harvested fields was dismantled entirely. And in still other cases, pressures to privatization were successfully resisted. These radical changes in land use both caused and were affected by the shift to alfalfa.

The Parcelization of Communal Lands

In the last twenty to thirty years, an area of tierra eriaza on the western edge of the village used in the past as a communal grazing field has been slowly converted to household plots and corrals (canchones). The earliest reference to these transfers is in June 1966 in the minutes of the Cabildo, and there are indications that the practice had been going on for some time. Most of the transactions took place during the years 1970–74, as part of the actions of the Velasco reform government. In 1972, the area was divided into numbered houseplots and declared an "urbanizacion," using the subdivision model of urban land of Arequipa and other cities. In the last reference to the transactions, on September 26, 1981, there appears a statement that no more communal land remained in or outside Lari.

Many of the recipients of the plots were originally from the high provinces of the departments of Cuzco and Puno. From these areas, llama caravans annually descend into the Colca Valley to trade highland products for barley and maize. Favored trading partnerships were established with local villagers and, when land became available, the visitors were in a position to buy into the village.

During the same period (1970–81), communal land located on an alluvial terrace some distance from the village was sold for conversion to fields and alfalfa meadows. In many ways, these transactions complemented the conversion into houseplots of land adjacent to the village. For some of the new owners, the fields supplied part of their subsistence needs and supplemented other land purchased from individuals or obtained through indirect means, such as sharecropping. The Ministry of Agriculture granted permission to distribute the land but only allowed owners to irrigate the holdings with surplus water, if available (*si hay de sobra*). The irrigation of kitchen gardens in these fields has been prohibited without specific permission of the Ministry of Agriculture.

The Privatization of Botaderos

Communal pastures (botaderos) in the belt (franja) on the slopes behind the village have always had an ambiguous status. While they were perceived as communal property, transfers to private use have occurred over time and for a variety of reasons. Some transactions are legitimate, based on an open and consensual decision by the community, often recorded in the district council minutes. Others are illegitimate, deriving from a village authority's sale of communal property to an individual.[14]

Private use rights, however, were not absolute. Village officials would request traditional rights to pasture village animals each year for a twenty- to thirty-day period, a request usually granted by the "owners." An entry in the council minutes for 1977 states, for example, that animals are allowed onto the communal pastures of Umaro-Pampa, Chipta, Uruquipa, Huayllincuña, Cuchuruma, Tomallihua, Morro de Uchuruta, and others, beginning on September 15.

In mixed communal-private use botaderos, many "owners" have exerted private rights to the land, prohibiting villagers from grazing their animals and collecting herbs and firewood. By and large, the community has not contested this move in what would seem to be a conflict-laden competition over scarce pasture. This has only occurred in the case of some botaderos; other botaderos and other forms of communally controlled open areas, such as cochas and tierra eriaza, have resisted the trend to privatization and remain open to all villagers.

Communal Grazing on the Stubble of Harvested Fields

As the pace of alfalfa cultivation picked up, it led to pressures on the system of communal grazing on the stubble of harvested fields. By the early 1980s, it had been completely dismantled. Households graze their animals only on their own harvested fields; the stock of other villagers is kept off. This transformation is closely linked to the introduction of alfalfa. In the pampas, it was necessary to construct walls to fence in animals, to keep them from damaging adjacent fields cultivated with foodstuffs. No longer is there a fixed village harvest period, since alfalfa can be grazed at any time; nor are there open communal pastures at the end of harvest. It was also necessary to restrict animals' movements on bench terraces used for alfalfa by an adobe wall (*tapial*) on top of the vertical endwalls separating terrace sections.

In sum, the parcelization of communal lands, the dismantling of the system of communal grazing on the stubble of harvested fields, and the privatization of botaderos contributed greatly to the increased demand for forage.

Incorporation of Alfalfa into the System of Water Allocation and Distribution

While the land, labor, and seed requirements of alfalfa did not present insurmountable difficulties to its adoption, water was problematic. First, alfalfa was not one of the crops included in the traditional irrigation-by-crop-sequence. If maize was to continue to retain this priority, then alfalfa, rather than the calendar, would have to accommodate it. Second, as a forage rather than a food crop, alfalfa challenged the principle of the priority of agriculture over pastoral uses of water and the subsistence orientation of the economy. No crop destined for animal consumption had ever before been incorporated into the system of irrigation by crop. Third, alfalfa increased the demand for water. As a semiperennial it requires water year-round, adding up to a total annual water demand greater than for the other crops (table 32). Moreover, alfalfa is cultivated in fields otherwise in fallow. Since fallowed fields are unirrigated, their conversion to alfalfa, requiring irrigation, increased overall water demand significantly.

Despite the difficulties imposed on water demand and water distribution, alfalfa's benefits were such that it was eventually accommodated. When alfalfa was first adopted, it was allocated water during the mita with the staple food crops. This was acceptable because the numbers of fields with alfalfa were few and presented no problems. Later, as the numbers of adoptions increased, particularly when the municipality received an enabling decree to sell fields in Chillema Pampa and the upper slopes of Chunta, owners of alfalfa fields asked for and received a regular allotment of water. An allocation of water for alfalfa is now given during the irrigation of early crops as well as prior to and at the end of the mita.[15] Alfalfa did not disrupt the central position of maize because it could be seeded in the rainy season, in December and January, on fallowed and recently harvested barley fields, at a time when there are no demands for the irrigation of food crops. Once the irrigation turns for food crops stop, alfalfa can be irrigated.[16]

The incorporation of alfalfa into the irrigation system has not been without flaws. We will see in the next chapter that debate over alfalfa's position

in the irrigation-by-crop sequence continues. The extent of alfalfa cultivation is such that farmers exert pressure to irrigate alfalfa during the regular mita.

Conclusion

The incorporation of alfalfa into Lari's agriculture began on an experimental basis in the 1950s by land-rich farmers looking for a crop that could be grown with little labor. Although farmers perceive the subsequent introduction of alfalfa to be a response to declining rainfall, it stems largely from demand for meat by the Majes Project, the mines, and coastal cities and the loss of communal land that provided natural grasses and crop stubble for forage. Cultivating alfalfa to feed one's animals solved the problem of secure, high-quality forage. Cultivating alfalfa to rent out to others for cattle-fattening became a rather risk-free alternative, as long as the market for cattle remained strong. By the late 1970s, alfalfa cultivation had become firmly established in the economy of the village.

In the beginning, when the scale of alfalfa cultivation was small, alfalfa meadows were irrigated along with foodcrops. As the momentum picked up and the number of alfalfa fields increased, villagers began to demand a regular allocation of irrigation water. The response was to incorporate alfalfa into the irrigation-by-crop system by assigning it a place after early crops had been irrigated, prior to the initiation of the mita.

This accommodation retained both the integrity of irrigation-by-crop and the centrality of maize in the crop and calendrical sequence. Adapting alfalfa to the existing calendar rather than changing the calendar to meet the needs of alfalfa was made easier by the fact that it can be seeded during the rainy season (January through March) and following the harvests (June through August) when there is no demand for water for irrigation. Eventually, alfalfa did come to be irrigated during the mita, competing with foodcrops, and the

TABLE 32. Annual Water Demand By Crop

Crop	Cubic Meters per Hectare
Alfalfa	55,832
Potatoes	26,202–16,402
Maize	23,827–15,050
Onions	21,849–17,448
Barley	18,323–10,372
Vegetables	18,238–11,816
Wheat	18,034–11,187

Source: ONERN 1973: 1:325, table 25-RH.

priority of agricultural over pastoral uses of water was accordingly modified. This shift reflected the value of alfalfa as an appropriate intensification of land and labor. A long tradition of cultivating clover, which started before the Conquest (Lizarraga [1605] 1916:163), and of cultivating alfalfa in the Arequipa campiña, which started in the early colonial period, must have made farmers aware of the soil-improving qualities of these nitrogen-fixing plants.

The introduction of alfalfa also produced shifts in the integration of agriculture and pastoralism, similar to those that are known to have occurred elsewhere. The system of communal grazing on the stubble of harvested fields was dismantled in a process of "enclosure" that is analogous to British common fields. Private control of fields is now fully entrenched in the economy. Yet, as we have seen in chapter 4, there is no evidence for massive erosion and decline in soil fertility, key indicators of land degradation. Soil quality may, indeed, have been enhanced by the nitrogen-fixing qualities of alfalfa.

The introduction of alfalfa has not led to the widespread monocropping and land consolidation often associated with market forces, as ensued in the campiña of Arequipa with the expansion of the dairy industry (Love 1989). These tendencies were held in check in Lari for three reasons. First, for the majority of farmers alfalfa has been a means for placing animal husbandry on a more secure basis rather than for expanding it. Certainly, some farmers have responded to market incentives by cultivating alfalfa to fatten their own cattle or to rent out their fields to others. But, while alfalfa cultivation per se is relatively risk-free, the enterprise of cattle fattening runs the risks of animal disease and downturns in the demand for cattle. The majority of farmers avoid these risks by restricting alfalfa cultivation to land taken out of maize production and normally left fallow. The village remains heavily oriented toward subsistence, with households producing their own maize, broad beans, and barley for local consumption.

Second, distance from Arequipa keeps fresh milk from being produced in the Colca Valley for delivery to the Leche Gloria plant in Arequipa. With the exception of limited cheese production, focused largely in Achoma and oriented to a local market, fresh milk production is quite low, seasonal, and almost entirely consumed in the home (Webber 1988).

Most important, while the shift to alfalfa has entailed major adjustments in water allocation and distribution, irrigation authorities have been very careful to safeguard the subsistence orientation of their agro-pastoral production. They are aware that a complete shift to alfalfa, as has occurred in the campiña of Arequipa, would reduce the ability of villagers to grow food for home consumption and force them to depend on other sources of income, of which there are very few in the region. Water is allocated to alfalfa during periods when demand for water for foodstuffs is low.

Farmers in Lari adopted alfalfa and made the transformations in their agro-pastoral system in an incremental way, monitoring the results as the process proceeded. While communal control over botaderos has weakened, reducing access to what were once extensive natural pastures, this has not become a critical issue, precisely because alfalfa offers, in both its fresh and dried forms, a much more secure and higher quality source of forage. Thus, we find the emergence, anomalous by Andean standards, of private forms of tenure concomitant with increased and more secure access to productive resources.

Chapter 12

We Are Not Progressing: Portrait of a Drought

Droughts are a frequent occurrence in the southern Peruvian highlands, where some part of the harvest is lost to frosts or droughts every third year on the average (Browman 1987:13). In the late 1970s and early 1980s, the southern Peruvian highlands were affected by a serious drought, arguably more extensive than those of 1942–44, 1956–57, and 1964–66. In one particularly bad year (1982–83), crop production was estimated to have fallen by 60 to 70 percent (Browman 1987:7–8). According to Caviedes (1982, 1984), unusually wet years in arid northern and central Peru, caused by El Niño, are often coupled with below-average precipitation in the southern highlands and altiplano of Peru and in the altiplano of Bolivia. The pattern was particularly evident in El Niño of 1982–84 and the simultaneous drought in the southern highlands.

When preparations for the 1983–84 agricultural cycle began, farmers were well aware that five out of the last six years had had below-average precipitation. They had been stung the year before when large amounts of rain in October led them to bring all of their fields into production, seeding many with potatoes that require high moisture. When next to nothing fell in January, usually a good rainfall month, crop growth slowed and many fields eventually failed to produce, particularly those in potatoes.[1] With these losses in mind, the mita began amidst much apprehension and anxiety. For the ethnographer, the situation presented an unusual opportunity to observe how the system of communal water management responded to stress.

In this chapter, I hope to convey some of the rush of events during the tumultuous 1983–84 irrigation cycle. I present it as a linear narrative pieced together from a variety of sources, much of it from observation and from minutes of meetings of the irrigation association and reginas during this period. My attempt is to convey the rush against time encapsulated in a phrase heard with dismaying frequency: "we are not progressing."

The 1983–84 Irrigation Cycle

Preliminaries to the 1983–84 cycle begin on July 8, 1983, with the convening of a meeting of the irrigation association to elect new officials. The hydraulic engineer from the Ministry of Agriculture arrives to oversee the activities and lend advice. Assembled villagers take advantage of the occasion to vent numerous complaints about outgoing officeholders. One goes so far as to suggest that the next president be a forastero, perhaps from Caylloma, with no ties to local people. This rather radical sentiment, given the reputation of forasteros, is indicative of the attitudes toward the previous leadership. These convictions notwithstanding, the election proceeds and a new board is chosen. The Evangelical and Adventist congregations join together in a coalition to elect a Protestant president and board majority.

The first meeting of the reconstituted association is held a month later on August 14. There is a heavy agenda. Regidores have informally worked out a schedule of reginas and announce it to the assembly (table 33). They also report on the progress of the fields of newly seeded alfalfa. These *majuelo* fields, like early crops of broad beans, are irrigated once or twice before the initiation of the mita. Farmers are rushing to complete two rounds of alfalfa irrigation prior to the beginning of the mita and already some irrigation clusters are reporting difficulty. In the first of what will become a litany, the Uchurunta regidor reports ominously that he lacks enough water to go around and asks other tomas to divert some his way. Uchurunta gets its water from the groundwater-fed Pomacra reservoir. While the reservoir has been upgraded in recent years with a sluice gate and cement lining, insufficient water indicates a low water table and problems to come. The meeting ends with a call for the naming of regidores for Yanahua Urusa, Karuña and Ananchihua.

Much of the general meeting four days later on August 18 is devoted to planning the annual refurbishment of the Chaico canal, naming foremen, organizing work crews, setting a schedule of fines for no-shows, and assigning work quotas. All this is eventually worked out and the cleaning is scheduled to begin the following Monday and end on Friday. Two mayordomos, one each for Hanansaya and Hurinsaya, have stepped forward to sponsor the canal cleaning fiesta. This brings much relief after the awkward, but necessary *doble pago* of recent years when just one person volunteered.[2] Once again, in the affirmation of a long-rooted custom, musicians who perform during the fiesta are exempted from the canal cleaning labor. Lari is proud of its musicians, who are in demand throughout the valley for their talents and stamina.

Once the Chaico corvée and fiesta are organized, attention turns to housekeeping chores associated with the levantamiento de agua. The president names the regidores that have come forward for Yanahua Urusa, Karuña, and Ananchihua. Fines will be levied against owners of puna estancias who divert water to irrigate their pastures. This establishes, anew, communal control over water and the priority of agricultural over pastoral use. The Orcoya regidor agrees to supply the village with water every fifteen days from the Puririwaq canal to irrigate kitchen gardens. Provisions of the Water Law prohibiting the irrigation of abandoned land are restated. Finally, dates are announced for the beginning of the mita (table 34).

By the next general meeting on September 18, the mita has begun in all of the tomas, with the exception of Chunta, and the Chaico canal and Mallcacocha reservoir renovated. The meeting begins with reports from the tomas. The Surimana Urusa regidor announces that there will be one irrigation for four days followed by two. The regidor from Surimana Estanque thanks the assembly for the help it gave during the cleaning of Mallcacocha reservoir and acknowledges the contribution of a sluice gate by the mayordomo of the fiesta. He makes the first of what will be several requests for contributions toward the purchase of cement to install it.

TABLE 33. Regina Schedule 1983–84

Sector	Regina
Ananchihua	None
Arco	Wednesday and Sunday 4:00 P.M.
Charasuta	Wednesday and Sunday 4:30 P.M.
Chunta	Thursday 6:00 A.M. (concurrent with Kakancha)
Chuñupucyo	None
Coanca	Wednesday 6:00 A.M.
Huanconasa	Wednesday and Sunday 6:00 A.M.
Kakancha	Thursday 6:00 A.M. (concurrent with Chunta)
Karpa	None
Karuna	None
Kowallo	None
Laurincaya	None
Orcoya	Thursday and Sunday 6:00 A.M.
Surimana Estanque	Tuesday 6:00 A.M. (concurrent)
Surimana Urusa	Tuesday 6:00 A.M. (concurrent)
Uchurunta	None
Utarana	None

Following the report by the regidores, the president takes the floor to chastise several regidores for failing to deliver the fines collected during the cleaning of Chaico canal and the Mallcacocha reservoir. He then discusses the performance of the treasurer of the irrigation association from the previous year and publicly requests that he deliver the accounts. This is the first indication of friction between the president, elected by the Protestant coalition, and the ex-treasurer, a forastero who gained his considerable wealth by marrying a land-rich Lareña. The dispute will erupt on various occasions throughout the year.

By the October 1 meeting, serious shortfalls in water have started to affect several irrigation clusters and much of the time is devoted to arranging water sharing. Even though the mita has formally begun, early crops remain to be irrigated in many tomas. Usually, they are not a problem because they are small fields and can be worked in during the mita. The difficulty is Orcoya, the largest and most important toma. Because Orcoya is adjacent to the village, in a location that allows fields to be easily monitored, it has many mishka fields of wheat and broad beans. Theft of early crops is a recurring problem because they mature during a period when there is a serious food deficit. In extending irrigation of early crops to October 10, the regidor puts Orcoya behind in the mita, a delay that will grow more serious as the cycle proceeds. The president asks if any tomas are in a position to help Orcoya and the Kakancha regidor steps forward to donate three nights. Since Kakancha draws its water from the same major canal as Orcoya, it is a simple matter of shunting water. Other tomas are in a similar plight and sharing is arranged; Yanahua Urusa will divert some water to Utarana, and Yanahua Estanque and Chunta will help Arco.

TABLE 34. Dates of the Beginning of the Mita, 1983

Sector	Date
Yanahua Urusa	August 25
Yanahua Estanque	August 25
Karuna	September 1
Utarana	September 1
Orcoya	September 1
Jacupa	September 8
Arco	September 8
Uchuruta	September 8
Surimana	September 10
Coanca	September 10
Chunta	September 25
Karpa	September 15
Kewa	September 15

The Surimana Estanque regidor repeats his appeal for cement to finish the installation of the sluice gate of the Mallcacocha reservoir. In its lower fields with sandy soils, low in water retention, much alfalfa is under cultivation. Permission is needed to allow alfalfa to be irrigated immediately after finishing with the first seeding of barley. The regidor's request to allow Surimana Estanque to irrigate alfalfa during the mita is granted.

On the other side of the village, in Charasuta, there are serious problems. Water from the Cauta flume flows to the Charasuta reservoir at night and is used during the day to irrigate a large area of low terraces with good soils, prime land for maize cultivation. During the day water flows through the flume to irrigate Arco, an area of low terraces with good soils. The area has been plagued from time immemorial with insufficient water, a problem caused in large degree by two small, inefficient reservoirs beset with filtration problems. Construction on a large, improved reservoir began in 1967 and was finished in 1973.

The sources of the water that flows through the Cauta flume are controlled by Lari, although the reservoir sits within the territory of Madrigal. During the construction of the reservoir, an arrangement was negotiated with Madrigal to allow farmers with fields within the irrigable area of the reservoir to have access to water. They contributed labor to the construction of the reservoir. According to the rather fragile accord, water from the flume is divided at 5:00 P.M. each evening. One branch flows to the Punco reservoir in Madrigal until 4:00 A.M., the other to the Charasuta reservoir in Lari until 7:00 A.M. Both branches are closed during the day when the water flows to irrigate Arco.

Accusations are being heaped on Madrigaleños of obstructing the flow to Charasuta around midnight and diverting it to their own fields. After two or three hours of irrigation they are said to remove the mud diversion (ch'ampa) and allow the water to flow back to the Charasuta reservoir. As a result, the Charasuta reservoir has not been filling. (This became a problem almost as soon as the reservoir was constructed and often meant that all of the irrigators had to travel as a group to Chivay to plead their case before the subprefect until village irrigation associations were strong enough to negotiate among themselves and until the Ministry of Agriculture had established a permanent presence in the Valley.[3]) Resolving the conflict requires a higher level of authority and a special meeting is scheduled for the following Wednesday. The meeting is held at the Charasuta reservoir on October 7, with authorities of the respective irrigation associations and users present. Irrigation authorities present agree to levy a fine of 10,000 soles against offenders from either Lari or Madrigal, with repeat infractions punished by a cutoff of water. Irrigators are asked to show up promptly at the assigned time to begin irrigating in the morning and to remember to return water to the reservoir in the afternoon. The presidents agree that if they discover a transgression they will make sure that the other party knows about it.

During the next regular meeting of the irrigation association on October 10, users voice complaints of regidores favoring kinsmen and others in distributing water. The ex-treasurer, speaking in his capacity as an irrigator from Orcoya, accuses the regidor of giving water to kinsmen and members of his Adventist congregation to seed barley when early crops of broad beans remain to be irrigated. A similar complaint is lodged against the regidor of Yanahua Urusa. These accusations strike a resounding chord and the assembly agrees to levy a fine on regidores who fail to enforce the rulings of the irrigation association, followed by a cutoff if they persist.

The situation in Charasuta still has not been resolved and reports are about of nighttime water theft by Madrigaleños. This moves the president to post a guard to monitor (*rondar*) the offtake at night. The meeting ends with the assessing of fines for a variety of infractions.

The next general meeting on October 15 is held at night. The *fiscal* takes charge of the meeting in the president's absence, with the mayor intervening on occasion. This is a contentious meeting marked by disorder and shouting; the president, sensing the mood, may have judiciously decided to be absent. A lot of conferring takes place in small groups off to the side, often an indication that a meeting has broken down. In light of the absence of the president, the mayor plays an important role in keeping order. Participants pay close attention to his opinions to see how the debate turns.

Regidores come in for some strong criticism for favoring their kinsmen and friends and failing to showup at meetings of the irrigation association, sending their wives in their stead. The body agrees to a 1,000-sol fine on regidores for failing to attend a meeting, escalating to a cutoff of water if they persist. The meeting then turns to the reports from the tomas.

In Orcoya, the zones of Orcoya, Puririwaq, Pampa Yarqha, and Altu Yarqha are being irrigated. The first irrigation of the mita should have begun long before but fifteen farmers still have mishka and alfalfa fields to irrigate. The rest cannot wait any longer and the regidor announces that he will begin distributing water for the second irrigation of barley. He accuses irrigators of not appearing at the regina to claim their share, forcing him to chase them down in the village or leave a message with a neighbor when it is their turn to irrigate. Frequently, neighbors do not relay the message and use the water

to irrigate their own plot. When the legitimate irrigator misses his turn, he then goes and complains to the regidor. The regidor announces that from this week on, he will attend to no one outside of the regina. If a person fails to appear at a meeting, he will be passed over and his water share given to the next person.

In Yanahua Urusa, users are finishing alfalfa and will soon begin the mita with barley. The only ones who have not irrigated alfalfa are those who missed a regina when their turn came and those who suffered cutoffs for failing to pay fines. Discussion then turns to a person who was granted water to irrigate a field in a zone known as Lekempa. He instead used the water to irrigate a field in Utarana. He then went informally to the regidor to ask for water to irrigate his field in Utarana. The regidor checked with the president and allowed the man to irrigate the field on Sunday. When this message was relayed to him, he mistakenly irrigated on Friday, keeping users in the lower part of Utarana from their assigned water.

This incident leads the president of the association to decree that no water assignments made outside of reginas would be honored. Nor would any side agreements between a regidor and the president granting water be binding. All assignments had to be made publicly, in a regina. The president, in effect, took the position stated by the Orcoya regidor and implements it as a general principle.

The discussion turns to the problems of Charasuta and Arco, which draw their water from the Callumayo flume. Despite the October 7 meeting between irrigation officials of Lari and Madrigal and the posting of a guard at night, Madrigal irrigators continue to divert water during the night to irrigate their own fields. Moreover, the volume of water through the Callumayo flume is quite low. As a result, seventeen users have yet to irrigate to moisten fields for maize seeding, and many zones, Jacupa, Arco, and Chillema, are dry. The Charasuta regidor asks the regidor of Yanahua Estanque to donate at least three days of water, but he demurs, preferring to consult with the users. The situation is of such urgency that the mayor is asked, and agrees, to schedule a *Cabildo Abierto* (village meeting) for Monday next, during which Yanahua Estanque will be asked formally to help Charasuta. No one shows up for the meeting on Monday; it is reset for Wednesday morning and again no one shows up. It is finally held late Wednesday night.

In Arco, maize has been finished and water is beginning to be distributed for alfalfa. This is another instance of alfalfa being irrigated during the mita. Arco has only a few alfalfa fields but they are an important replacement for the fallow period of the maize terraces for which the toma is known. Several users do not appear at the regina when their turn comes to ask for water. Others appear and are granted a share but fail to use it, allowing water to spill over onto the road. The board decrees a fine, followed by a cutoff of water in the toma in question, for these infractions.

The next subject to come up concerns the Coanca reservoir filled at night by the Puririwaq canal, which flows through the village tantalizingly close to kitchen gardens filled with onions. According to a previous agreement, one could take an hour of water from the Puririwaq canal to irrigate onions after appearing at the Coanca regina to notify users. So many villagers are illicitly irrigating onion fields at night that the reservoir is kept from filling. The board takes action to stop the practice, levying fines, arranging for a nighttime rotating watch, and laying plans for the installation of a locking sluice gate.

The remainder of the reports contain few surprises. Alfalfa and early crops are slowly being finished in Uchurunta and barley will be started soon. Chunta, in the second irrigation of alfalfa and early crops, is helping Orcoya on Tuesday and Wednesday with a few hours of water. Lloclla is irrigating mishkas and alfalfa and soon will begin barley. Huanconasa is irrigating mishkas and alfalfa.

Surimana Urusa, on the other hand, is in a severe crisis. In one zone (Haychulla), fourteen farmers have been unable to irrigate to prepare fields for the seeding of maize and broad beans; in another (Kashwa), seven. The regidor asks for help in monitoring wastage and in locating poorly maintained feeder canals that are losing water. He also asks for donations from other tomas of water to speed up the mita so they can begin barley and alfalfa. There is a serious risk of frost damage and a subsequent loss of harvest. Surimana Estanque is still finishing maize and broad beans and has not yet started alfalfa.

The Orcoya Regina

Farmers seeking water begin to assemble on the hillock where the Orcoya regina is held around 7:00 A.M. By the time the regidor opens the meeting, about thirty-five are present, a substantial number considering that only about one in three will end up getting one of the eleven shares distributed for the next three days. The regidor begins by informing those present of the decisions taken in the general meeting on Saturday last. He points out that regidores will no longer go from house to house notifying individuals whose turn it is to irrigate. If one fails to appear at the regina when one's turn comes, then it will be lost. Nor can users send others to present their claims for water.

The regidor then proceeds with the distribution of water for alfalfa, maize, broad beans, and early crops. Orcoya is a large and complex toma and is subdivided into three sections: Pampa-Yarqha (pampa canal), Puririwaq, and Altu-Yarqha (upper canal). Looking out across the fields, he draws up a list of those whose fields are seeded with the crops in question and are next in the spatial sequence. He makes note of those who are petitioning for water but who have empty fields (*en seca*); they would use water to moisten fields (barbecho) to seed barley. Since water has already been allotted for the barbecho and seeding, they would be subject to a fine for irrigating out of turn if they were allotted a water share and used it for this purpose.

An exception is made for three farmers to irrigate dry land to prepare for barley cultivation. These are the only fields these particular households have to feed themselves and they were away from the village when water was being distributed for barbecho and seeding. The regidor refuses the requests of others who have lots of land in different tomas and failed to request water on time. This exception illustrates the discretion and flexibility of the regidor which rests on an intimate understanding of the microecology of the toma, the nature and distribution of fields, and the structure and economic characteristics of the households who hold land there. It also illustrates the principles of collective survival and fairness.

During the next general meeting, held two days later on October 17, a host of complaints are raised about farmers irrigating out of turn, and the authorities agree to deny them water for the second irrigation. Others are taking cows to drink water from canals adjacent to someone else's fields and causing damage. Owners are directed to give their cattle water only from a canal adjacent to their own fields. If cattle take water from a distant canal and damage it, their owner will be responsible for the repairs.

In a decision that will prove contentious, limits are placed on the allocation of water for barley. They range from one to two days of water, depending on the size of one's fields. Regidores are instructed to make a list (padrón) containing the number and area of seeded and unseeded barley fields for each user in their toma. The decision implements provisions of the Water Law empowering irrigation authorities to impose strict measures during a drought to protect, control, and distribute water for the overall benefit of the community. The rationale for the limits is that they will ensure a minimum amount of water for subsistence cultivation for the largest number of households.

The meeting ends with a discussion of the problem with residents of Madrigal who rent alfalfa fields from Lareños. These farmers do not attend the faenas held to maintain the irrigation infrastructure yet claim water for their fields. Lari landowners who rent alfalfa fields to individuals from Madrigal are assessed 1,000 soles payable to the irrigation association.

Increasingly serious shortages in water prompt an extraordinary meeting of the irrigation association on October 19. Pressure is mounting to irrigate barley in tomas still finishing alfalfa. In order for this to proceed, the irrigation association must agree to a modification of the traditional crop irrigation sequence. The president mounts a spirited defense of the traditional crop sequence and prevails.

The meeting then turns to the reports from the tomas. The Orcoya regidor's announcement that he will begin to distribute water for barley on Sunday once again raises the issue of limits on water. Although local officials are backed by provisions of the Water Law, clearly the measure will not be automatically accepted and will be debated. Several landowners in Orcoya need to irrigate very large fields of barley and complain about the limits.

The president mounts a vigorous defense of limits arguing that the small holders should have sufficient water for subsistence needs. He is joined by a respected landholder who asks whether large landowners should get all of the water they need at the expense of the small holders, some of whom would have to go without, or should limits be instituted. They are opposed by a forastero ex-treasurer of the irrigation association who mounts a two-pronged rebuttal. First, if a field came "with its own water" then the owner should be given sufficient water to irrigate the field. This is a subtle argument drawing on the tradition that water rights attach to fields and transfer on sale or inheritance. He points out that in the recent sale of abandoned land to the winners of a lottery authorized by the Ministry of Agriculture, new owners were also allotted water, albeit of low priority. Mistrust and references to a poorly understood Water Law keep him from getting support for a position that, in many ways, was quite defensible. Sensing a losing position, the landowner shifts to a second front. In an appeal to sentiments of social welfare, he argues that he needs the water to support a large family with many children. This is a weaker argument since many farmers are in the same situation with even less land to feed their families.

Failing in his drive to drop the limits altogether, he next focuses on the implementation of the measures. He argues that such procedures should affect all landowners equally, large and small, by proportionate reductions in the water allocated to their holdings. Thus, if one normally took three

hours to irrigate one's field, it would be reduced to two hours. If one needs three days to irrigate five fields, then it would be reduced to two days. This again is a disingenuous position. While it has a ring of "equity," it will hurt small holders disproportionately since any reduction in water to a farmer with just one, or a few, small field(s) introduces a real threat of crop failure, all the more serious since it may be the only food source for feeding one's family. Cutting back on the water for a farmer with many larger fields would reduce the potential for a marketable surplus but not jeopardize the subsistence base. Farmers are quick to draw the implications and eventually side with the president. A limit on the number of days of water allocated for one field is set. During the debate there are no references to terms indicative of class divisions, such as mayoristas, gamonales, pequeños propietarios, or terratenientes, nor does it touch on the propriety of unequal land distribution.

In Charasuta, fifteen maize and twenty barley fields remain to be irrigated. So little water flows at night that the reservoir empties by 11:00 A.M. The Callumayo flume is divided upstream to feed Charasuta/Arco and the Yanahua Urusa and Yanahua Estanque tomas. The volume of the flow is regulated by a formal agreement between the two sets of irrigation clusters. The Charasuta regidor charges that landowners in Yanahua are obstructing the flow to Charasuta to increase the volume to their own fields. The irrigation association assesses a special fine for Yanahua irrigators who obstruct the flow and anyone discovered irrigating during the period water is supposed to flow to Charasuta.

The first irrigation of barley and the second irrigation of alfalfa is underway in Karuna. In Coanca, the irrigation of alfalfa has just begun. The Coanca regidor complains that users are not monitoring the flow from the reservoir, allowing an excessive amount onto their fields, failing to cut scratch canals across the surface, and walking off to leave the field to soak. Water quickly floods the field and overflows onto unattended lower fields or onto the road below. The board agrees this is a serious matter and allows the regidor to fine the individuals involved. In Arco, the second irrigation of maize has been finished, a little alfalfa remains, and within five or six days, the second irrigation of barley will begin. In Ananchihua, sembrios and alfalfa have been terminated. In response to a complaint about the diversion of water at night from the reservoir to private fields, keeping it from filling, the board names two guards to monitor the reservoir at night to ensure the sluice gate remains closed.

In Chunta, the only farmers who have not irrigated either failed to appear at the regina at the proper time or owe fines. The president agrees to come to the next regina to allocate water to those who did not show up before. If they do not show up at this regina, then they will move on to barley.

Only alfalfa remains to be irrigated in Lloclla; on Thursday, they will start barley. While there are no problems in Huanconasa, Surimana is seriously behind schedule and its regidor asks for help from Orcoya and Chunta. The respective regidors agree to help Surimana once they finish with barley. During the meeting, a formal accusation (*denuncia*) is entered into the minutes for the failure of the Orcoya regidor to deliver an accounting of fines collected during the last irrigation cycle.

On October 30, the forastero who argued the minority, losing position over limits on water during the October 19 debate in the irrigation association meeting takes up his cause in the Orcoya regina. The meeting quickly degenerates into a shouting match between him and the regidor. The forastero now tries a new tack, arguing that Orcoya should implement the limits by cutting water to some of a landowner's fields but allowing those fields that are irrigated to receive all of the water they need. Thus, if one has four fields, only three would be irrigated but irrigated in full. This would substantially weaken the mode of implementation agreed to during the October 19 meeting. The regidor counters by pointing out the disproportionate benefit this would bring large landholders while putting the small holder at risk. Irrigators side with the regidor and arrive at a consensus to limit owners of two yuntadas of land to one of the two days of water they would normally receive, and those with one yuntada, one-half-day.

Another issue then arises. The owner of a herding ranch in the puna has been illicitly irrigating pastures with water from the Chaico canal, reducing the flow to the lower fields of Orcoya. This practice was expressly prohibited by the irrigation association in August in a restatement of the priority of agricultural over pastoral uses of water. The regidor outlines several steps he will take. First, he will write and deliver a memorandum prohibiting him from irrigating. If he persists he will receive a stiff fine; if he continues, the Banco de la Nacion will be asked to embargo his property. These actions suggest the capacity of a toma to act autonomously, independent of the irrigation association.

Later that day a Cabildo Abierto is called by the mayor to announce a grant to Lari by the Development Corporation of Arequipa of 20 million soles for the lining of the Chaico canal. It is announced that funds will be paid out as the work progresses and the first payment of 1.8 million soles has been received.

The irrigation association next meets on October 31. Familiar issues

from earlier meetings again surface. The Huanconasa regidor agrees to provide five days of water to Coanca, beginning on November 5. Reports of users failing to seed after having irrigated lead the board to decree that those users will not be given another turn in their respective tomas. While this has no effect on the unseeded field, it stops the kellua of other fields that may have been seeded. Those who have seeded barley when they were given water for broad beans will now have to wait until the end of the mita to receive water again. The Orcoya water distributor describes his efforts to stop the estancia owner from illicitly irrigating his pastures and the board declares that he will lose a turn in each of the irrigation clusters in which he has water. This is a considerable vote of support for Orcoya and actively enforces the efforts of the water distributor there to stop the practice.

No end seems in sight to the ongoing problems in Charasuta. Problems continue after the earlier meeting of October 7 between the officials of the respective irrigation associations of Madrigal and Lari and the posting of a guard to monitor the canal at night. The Ministry of Agriculture will be asked to intervene. There are also reports that the flow of water into Chunta, Kakancha, Orcoya, and Coanca tomas has diminished. The president agrees to arrange a meeting with the regidores concerned about measuring the flow. It is held on November 7 with the presence of the water judge from Chivay and the presidents of the irrigation associations of Madrigal and Lari.

The irrigation association on November 11 once again takes up limits in conjunction with its scheduling of the transition to barley on November 17. Questions concern special considerations for household composition. A consensus emerges that while limits for families with older children are justified, families with young children and infants should receive extra water. The debate highlights a sensitivity to social welfare and an implicit understanding of the effect of the consumer-to-worker ratio on resource use (Chayanov 1966). The president concurs but reminds the assembly of the need to have it ratified by the Ministry of Agriculture, the "maximal authority" (*autoridad maxima*), for it to go into effect.

The meeting of the irrigation association on November 31 is long but orderly due to the presence of the mayor. All but three of the regidores are present. Coanca and Orcoya are experiencing great difficulties. The Orcoya regidor announces he is alternating three days of irrigation in the upper fields with three days in the lower fields to equalize access, rather than following the normal sequence of starting at the offtake and proceeding down to the lower fields. The board makes several rulings affecting Orcoya. In an attempt to clear up the confusion in Orcoya about limits on water for barley, the board decrees one day maximum for mayoristas and establishes an hourly measure of water volume for minoristas. The association confirms the cutoff of water in Acaya and Mazano as punishment for the estancia owner who has been illicitly irrigating pastures with Orcoya's water. Irrigators who have been given water but who have not seeded will be denied any further water. If one requests water to seed maize and broad beans but does not seed, he will be issued an ultimatum to seed or lose water rights. Lastly, if a farmer has been given water for a certain date but does not irrigate on that date, he will be denied further water. It is noteworthy that by now, late in the season, cutoff of water has replaced the fines used earlier as punishment for transgressions.

There are a couple of problems in the Yanahua Urusa toma. A woman who was angry with the regidor for cutting off her water for failure to pay a fine allowed water to flow onto the street, wasting water for the next in line to irrigate. The board instructed the regidor to increase her fine. Complaints were also raised against the regidor for attempting to join Chillema Pampa (in lower zones) with Allumayo (in the upper zones), violating a tradition of joining Chillema Pampa with Chillema Kucho and, after they are irrigated, irrigating Allumayo. The board rules that the traditional sequence will be respected because Allumayu is a protected quebrada and can wait a little longer for water. Those in Allumayu who still have not irrigated early crops will be given a special turn.

The Utarana regidor has taken some steps to speed up irrigation by distributing water for the seeding of maize and broad beans and a small number of alfalfa meadows. The board works out an arrangement to augment Utarana's water pressure to irrigate more quickly. Branch canals of the Cauta flume, one to Karuna toma and the other to Madrigal, will be closed off, increasing the flow to Utarana. This will halve the time required to irrigate the land in question. The result will be two days of irrigation for Mazano, two days for Karuna, and two days for Madrigal. This emergency measure was first suggested years ago during a drought by a president of the irrigation association. It requires negotiation and coordination, however, and a meeting between the hydraulic engineer from Chivay and the presidents of the irrigation associations of Lari and Madrigal is scheduled.

In a welcome relief from the litany of troubles, the Karuna regidor reports no problems in his sector. Broad beans are being irrigated on schedule. Nor are there problems reported by the Karpa regidor. In Charasuta, eight farmers still have to irrigate early crops and maize. Once they are finished, broad beans will begin. Since there are few fields with broad beans, they will be irrigated on an alternating basis with alfalfa.

Coanca's sandy and rocky soils, combined with the recent high temperatures that have kept moisture retention to a minimum, are cited by the regidor for the difficulties it is encountering, particularly now with the irrigation of early crops in flower at a sensitive time. The regidor asks for assistance. Huanconasa is finishing the irrigation of barley and alfalfa and its regidor offers fifteen days of water to aid other tomas. The president congratulates him for this donation and assigns five days to Coanca and ten to Orcoya. The Orcoya supplement will be used to irrigate kitchen gardens and early crops in canchones at night.

Farmers assemble on December 2 at the work site to begin lining the Chaico canal. Work is under the supervision of a specialist (*maestro*) and a person in charge of the foreman and crews. During the past week, twenty-three people worked on the canal, lining 33 meters with cement and another 40 with stone.

During a general meeting of the irrigation association on December 3, reports from the tomas reflect the severity of the situation ninety days after the mita began in many tomas. Orcoya has not finished its mita and many fields have received no water at all. People who do not have barley in any of the zones will be given preference. Chunta agrees to help out with a day's worth of water to Orcoya. There are problems in Utarana and Karuna; the president will visit them on December 5.

The plight of Orcoya consumes the agenda of irrigation association meetings on December 24 and January 8. Kakancha, Huanconasa, and Coanca tomas coordinate the sharing of their water with Orcoya. Chunta is also having difficulties and Kakancha agrees to help out as soon as it has finished its own mita.

Rain and snow fall heavily during the second week of January. Reginas are called off and work stops on the Chaico canal project. For all intents and purposes, organized water distribution for the current agricultural cycle has come to a halt. Irrigation matters are far from over, however. On February 17, a Cabildo Abierto, with the presence of the hydraulic engineer from the Ministry of Agriculture, is held to address some problems caused by the recent election of the secretary to mayor and the election of the president to *sindico de gastos* of the municipality. While the new mayor resigned his position with the irrigation association, the president wants to remain in his position. The issue of whether one could hold posts simultaneously in municipal government and the irrigation association is discussed. The president states that he was assured by authorities in Chivay that one could hold more than one office at the same time if willing and able. The subsequent debate turns not on his legal right to hold two offices but his performance in the irrigation association. He is heavily criticized in this regard for having failed to enforce directives of the board and other abnormalities. The debate expands to include the performance of the Orcoya regidor, who is accused of favoritism, allowing his kinsmen and fellow Protestants to irrigate out of turn in Urbanizacion Canto, an area of abandoned land parcelled out and sold to villagers for houseplots during the 1970s. They were allotted water for irrigation, but only after all other fields in the toma were irrigated. This debate occurs in the context of a coordinated sweep of the recent municipal elections by Protestants. The individuals who are being criticized are Protestants and the debate approximates one of Catholic versus Protestant.

As the discussion winds down, a consensus emerges, supported by the hydraulic engineer, to elect a completely new governing board. The new board that emerges from the election is younger, and with one exception, Catholic in composition. Most are small and medium property holders. The board is installed on March 3 following an accounting of the financial records and public works associated with the outgoing board. During the next two months, the major canals are closed and cleaned and work resumes on the lining of the Chaico canal.

Discussion

The 1983–84 agricultural season that began apprehensively in the third week of August and ended the second week of January with the onset of the rains was another year of hardship. Diminished surface and groundwater reserves from years past combined with low precipitation to wreak havoc with water distribution and invoke painful measures of drought management. The most frequently applied of these measures was water sharing, which began immediately on August 14 and continued unabated throughout the mita until the rains began. Canals were joined and spatial sequences modified through the efforts of the irrigation association. These measures are accepted as necessary and reasonable. The decision to impose limits on water on October 17 affected irrigators directly and was much more contentious.

It also brought into focus, as crises tend to do, the political side of water allocation and distribution. The quixotic struggle of the forastero to resist limits first took place before the irrigation association, where his education and experience would be expected to be advantageous. Even though there was a clear legal precedent for invoking modified water distribution procedures under the emergency water regime provisions of the Water Law, the fact and manner of their implementation were heavily debated and only resolved by a consensus decision of the collectivity present. Losing the debate at this level, the forastero turned to the reginas of the irrigation clusters in which he would be affected by the limits.

This material also clarifies certain aspects of the nature of power at the core of irrigation. According to the Peruvian Constitution and the 1969 Water law, the state is *de jure* the "maximal authority" governing the use of water. Even though Ministry of Agriculture, as agent of the state, empowers local irrigation officials to impose limits on water, their ultimate implementation depended on the outcome of heated debate in the irrigation association and in the irrigation clusters that constituted the nodes of the system. The major battles of the 1983–84 irrigation cycle were over the implementation of limits on water called for under these provisions. It is noteworthy that other Colca Valley irrigation associations have rejected similar measures outright (Guillet 1991a). They were successfully implemented in Lari because they fit well with local notions of social justice and survived the attacks of individuals and coalitions aligned against them.

The issue of the distribution of the water flowing through the Cauta ravine illustrates the hierarchical nature of conflict resolution. The highest offtake of the flume feeds the Yanahua tomas. Another offtake downstream takes water to a canal that feeds a section of fields in Madrigal and Charasuta. The Charasuta regidor was powerless to keep Madrigal farmers from irrigating illicitly at night. He brought the matter to the board of the irrigation association. The president of the association arranged a meeting with his counterpart, the president of the irrigation association of Madrigal. Failing that, the president set up a guard at night to monitor the flow. As a last resort, the irrigation association acting on the behalf of the Charasuta toma requested the assistance of the water judge of the Ministry of Agriculture in Chivay in coming to the village to remeasure the diversions and negotiate a solution to the problem.

We also see in the chronicle of these events the still uneasy accommodation with alfalfa. Villagers never really complain about the disturbances it creates, but they are there. While early crops remain to be irrigated at the opening of the mita, they can usually be worked in because of their small size. Alfalfa is another matter. In many tomas, such as Surimana, with large areas of alfalfa, the beginning of the mita is delayed until they can be irrigated. In some of these (Orcoya) the irrigation-by-crop sequence of the mita is modified to accommodate alfalfa. Many tomas irrigate alfalfa after the first seeding of barley and maize and this requires special permission. In general, solutions are found to enable alfalfa to be worked into the sequence. The phenomenon of renting alfalfa meadows is recognized and fees from landowners who rent to people from Madrigal are assessed.

Chapter 13

Conclusion

I begin this chapter by summarizing the emergence and resolution in Lari of a common problem in Andean society and culture—the conflict of autonomy and control—in the domain of water management. Can one generalize from the Lari case to the wider population of irrigation systems in highland Peru? Answering this question leads into a discussion of the agronomic functions of irrigation and the relation of irrigation to human organization in the Andean highlands. We will perforce return to history to help sort out the stable and enduring from the variable and malleable dimensions of Andean irrigation organization. I will argue, in this regard, that the irrigation cluster is a building block of Andean irrigation organization, while the form that irrigation organization and water authority take above the irrigation cluster is an outcome of the interaction of locality and state. This sheds light on another paradox of Andean ethnology, an ideology of egalitarian resource distribution alongside evidence for socieconomic differentiation. The manner of its reconciliation in Lari begs comparison with other Andean highland communities.

Autonomy and Control in Andean Water Management

Farmers in Lari express a strong ideal of autonomy in their production decisions, in stating that one should and does have the freedom to cultivate, fallow, or abandon fields, to choose crops to cultivate, and to rotate fields and crops as one sees fit. This sentiment is consistent with a pervasive ideology of private property, the form in which most land is held. It is also heard in conjunction with the use of the water controlled by landowners in an irrigation cluster, namely, that owners should be able to distribute water as they see fit, be it for domestic, agricultural, or pastoral uses or to share with a water-poor irrigation cluster. The informal institutions of regina and regidor set up to distribute water within a cluster of fields sharing the same water source are, in their view, the simplest methods for owners of water to partition a bulky resource.

The articulated ideal of autonomy in household production, and its extension to the irrigation cluster, contrasts in interesting ways with the acceptance of direct controls on household production in the sectorial fallowing regimes of the tuber production zones elsewhere in the Andes. In these regimes, cultivable land is divided into two or more named sectors that are planted for a series of years and then left to fallow. Crop rotation of tubers followed by cereals is another feature. During the fallow period, land is used for the grazing of animals. Land is held in usufruct rather than privately, and the community directly affects production decisions by specifying allowable fallow and cropping choices for land divisions (Guillet 1981; Orlove and Godoy 1986). Communal control directly dictates key production decisions of field and crop rotation, thereby weakening household autonomy.

While Lari farmers resist the *idea* of direct communal constraints on the use of their privately held land and water, as obtain in sectorial fallowing, they nonetheless accept the indirect controls implicit in the communal water management principles of irrigation-by-crop, mita scheduling, and limits on water during droughts.[1] Their acceptance is predicated on a shrewd, if perhaps unconscious, evaluation of the costs and benefits of such indirect controls. On the cost side, water management principles make it difficult, though not impossible, to experiment with new crops, specialize in one crop, farm all of one's land, or reclaim abandoned land. But the long-term returns are substantial. Excellent soil structure, good soil fertility, and high and sustained crop yields attest to the success of a land-use system that has been in place for at least the 450 years since the Spanish Conquest. Indeed, the logic and track record of a water management system that has stood them in good stead through years of adequate rainfall and years of drought are hard to assail.

The acceptance by farmers of indirect controls on production through communal water management illustrates their willingness to trade off immediate gains for longer-term economic security and environmental sustainability. It highlights an aspect of peasant production often hidden in studies that emphasize short time horizons, extending from field preparation to harvest, marked by an in-between "dead" period when, freed from agricultural labors, peasants could migrate elsewhere to engage in wage labor.

The Agronomic Functions of Irrigation

Our understanding of the agronomic functions of irrigation in the Andean highlands has benefited in recent years from research on climate, in particular, the importance of variation in precipitation, temperature, and the onset of thermal and rainy seasons in the three geoecological zones of the Peruvian Andes: the eastern escarpment, inter-Andean valleys, and western escarpment.[2] Annual precipitation is highest in the eastern escarpment, decreases to between 400 and 800 millimeters in the inter-Andean valleys, and drops to a range of 200 to 400 millimeters in the valleys that descend the western slopes of the Cordillera. The rainy season, which lasts five to six months in the eastern escarpment, decreases to three or four months as one passes from the high slopes of the eastern escarpment across the Altiplano to the high slopes of the western escarpment.

The Lari materials and studies of other Colca Valley irrigation systems suggest a general model for communities on the slopes of the western escarpment: irrigation taps abundant water sources in high elevation areas to augment the low quantity of available moisture in the valley, reduces the highly irregular distribution of rainfall from year to year, and provides water before the normal rainy season to complement a much longer thermal season, favorable to agriculture, of a full 12 months. In addition, soils dampened by irrigation lower the high frost risk caused by low annual minimum temperatures.[3]

Mitchell's (1976, 1991) analysis of the role of irrigation in the village of Quinoa in the Ayacucho Valley may be taken as paradigmatic for systems of the inter-Andean valleys. In the upper of two agricultural zones exploited by the community, irrigation is used to extend the growing season to bracket the thermal season of crops, particularly maize. It is also used to help plants establish strong root systems to withstand the potential damage caused by soil saturation during periods of heavy rainfall. While the rainy season overlaps the growth period of crops in the lower zone, precipitation is inadequate and irrigation supplements available moisture. At this altitude, irrigation is not necessary to extend the growing period.[4]

Extending the growing season in both the inter-Andean valleys and the western escarpment is especially important for maize, a crop with ceremonial significance, which can be easily preserved, stored, and transported. Maize has a long growing season, well beyond the limits of the rainy season in the highlands. Moreover, if maize is seeded at the beginning of the rainy season in December, it risks being damaged in June by frosts before it matures. With the assistance of artificial irrigation, the seeding of maize can be advanced to August and September during the dry season, thus lessening this risk.

The opposite environmental extreme to the western escarpment is the eastern escarpment where rainfall increases substantially due to rising air masses from the adjacent humid Amazon basin. In its higher portions, according to Winterhalder, a thermal season of eight to twelve months amply brackets a rainy season of four to six months. Absolute amounts of precipitation are also significantly greater than in the altiplano or the western escarpment. These patterns suggest that irrigation would be less important for modifying the timing, quantity, and quality of water for agriculture, extending the growing season, or augmenting available moisture. Rather, one would expect to find landscape modifications and water control systems designed to drain water. Recent discoveries of a host of indigenous drainage technologies to cultivate fertile but water-logged soils confirm this expectation.[5] The functioning drained-field system in Colquepata in the intermediate altitudes of the Paucartambo highlands of Southern Peru is representative (Zimmerer 1991). Colquepata cultivators drain swales to grow potatoes and other cultivars. Runoff is controlled and moisture reduced to agriculturally appropriate levels by orienting lateral and mother canals to drain fields into gullies and rivulets.

The Organization of Irrigation

Sorting out the agro-ecological functions of irrigation tells us very little, however, about the patterns irrigation organization takes in the Andean highlands. Indeed, the relation between irrigation and human organization is one of the most debated, and seemingly intractable, issues in the literature. What emerges from the Lari materials is the ubiquity of the toma or irrigation cluster—a group of fields, their owners, and a shared ground or surface water source(s)—as the basic building block of irrigation organization. For most farmers, the dynamic of each of the tomas in which they own land is their most important concern. On those days when their turn comes, they want to be able to go to a regina and petition for and obtain a water share sufficient to moisten their field. They anxiously monitor the status of the water sources that feed their toma and the timeliness and adequacy of water delivery. Such matters are the stuff of life; all other irrigation affairs pale in comparison. The ability to see instantly which fields have been irrigated allows one to determine if the spatial sequence, from head to tail, is being followed, if someone's field has been irrigated out of turn, or if someone who was advanced water at the last regina failed to irrigate. This is a feature without which the flexible, negotiated method of water distribution within the toma would fail.

The ethnographic literature suggests that small clusters of fields, landowners, and water sources are ubiquitous and constitute the basic building blocks of irrigation organization throughout the Andean highlands.[6] While ethnohistoric research on early irrigation organization is in its infancy, the present use as field locations in the Visita of Lari-Hurinsaya of 1604 as toma names suggests that, at least for Lari, the contemporary organization of irrigation clusters extends back to that point in time.

For some Andean communities, the irrigation cluster is the highest level of organization and is coterminous with the community. This is the case with the Rio Tigre systems of the Vilcanota valley (Bolin 1991). In other instances, villages control numerous irrigation clusters, some or all of which are integrated into a network. In still others, a collection of largely independent irrigation clusters constitutes the irrigation system. The Colca Valley village of Tapay, for example, has thirty-two independent irrigation clusters, each of which has access to its own source of water, maintains its own hydraulic infrastructure, distributes its water, and manages conflicts within the group (Paerregaard 1991 and pers. com.). The only water officials are regidores, and irrigation clusters are not incorporated into moiety, village, or higher levels of organization. There is no need for a hierarchical or centralized system, or the power associated with such a system, since there is no upstream-downstream problem, no main canal to maintain, and no intercluster disputes to resolve. Indeed, Tapay has rejected attempts by the Ministry of Agriculture to form a villagewide irrigation association integrated into a regional network.[7]

Acephalous collections of irrigation clusters, such as those of Tapay, disperse authority rather than unify it and lack constituted authority. While rare, such systems have been found elsewhere.[8] In most highland irrigation systems, however, irrigation clusters are integrated into some form of higher-level, special-purpose or multipurpose organization. A common function of communal water management in these instances is the recruitment and coordination of corvées to maintain irrigation infrastructure. Participation in faenas, the ubiquitous Andean form of corvée labor, is ensured by linking it to water access and expressing it in the idiom of ayni, the key symbol of balanced reciprocity that undergirds virtually every domain of Andean culture. It makes no difference whether irrigation corvées are organized by a special-purpose water management association or a multipurpose urban administrative organization, as long as three conditions are met: a social contract among irrigators of water for work, scheduling accommodated to a local calendar of water rituals, and adherence to beliefs in the necessity of sacrifices to appease the spirits that control the source of water. Coercive institutions and authoritarian central power are unnecessary for irrigation corvées that are legitimated in this way; when this legitimacy breaks down, formal sanctions such as fines and other institutional solutions become necessary to solve the free-rider problem.

Other conditions leading to higher-level organization of irrigation clusters include the need, particularly in long and complex canal systems, for a centralized repository of topographical and environmental knowledge to guide system maintenance (Bunker and Seligman 1991); the resolution of upstream-downstream conflicts between irrigation clusters, and the coordination of water sharing in networked irrigation clusters. The importance of water-sharing during droughts is illustrated vividly by the chronicle of events during the 1983–84 drought in Lari.

Irrigation Organization and Property Rights

The property dimensions of irrigation organization have attracted consideration in recent years. This attention began with Leach's (1961) study of Pul Eliya, in which he noted the influence property relations had on social organization. The theme has been taken up by Coward in his work on Asian irrigation (1986, 1990). He has suggested that in many local irrigation systems the activities of water users in creating and maintaining their irrigation facilities establishes property relationships that become an important basis for collective action.

The Lari case illustrates well the relationship between hydrology, property rights and irrigation organization. Streams and marshy lakes in the puna fed by snowmelt, rainfall, and snowfall are tapped by open canals and the water is brought down to the cultivated slopes. Precipitation and runoff add to canal flow along the way. Until it enters the system of branch and feeder canals, water comes under communal control. The ability of the village irrigation association to determine whether this water can be used to irrigate natural pastures prior to its entry in the agricultural zone reflects this concept of property.

Once it is diverted by an offtake, landowners in the irrigation cluster assume ownership of the water, as do landowners in an irrigation cluster that draws water from an independent groundwater source. The ideal of irrigation cluster autonomy is founded on this property concept and is illustrated by Orcoya landowners' ability to decide whether water from its offtake could be dispersed for domestic, rather than agricultural, purposes.

As joint owners, members of an irrigation cluster transfer water to individuals in the form of a water share, expressed as a unit of time or water volume. This is done through the agency of the regidor acting on behalf of the landowners and is illustrated by the presence of regidores during the recording of land transfers.

While a water share is a property right in one sense, it is not transferable like other objects of property such as houses, cattle, and land. There are no formal markets for selling or trading shares such as one finds in some Spanish systems and in the Western United States or informal trading of water shares as one finds, for example, in Pakistan.[9] One can speak thus of three levels of property rights: the communal level in the control of the sources of surface water in the puna and the physical infrastructure to transport it to the lower zones; the irrigation cluster, once water enters it by diversion from a main canal, or in the control of groundwater within the irrigation cluster; and the farmer, once granted a water share.

At the two higher levels, water property rights establish social groups that share in the responsibility for water allocation and infrastructure maintenance. Maintenance of the canal and terrace infrastructure at the lowest level falls to the landowner. Members of an irrigation cluster assume responsibility for the maintenance of the infrastructure of the toma, while the upkeep of main canals from their sources in the puna above to the point where offtakes divert the water to individual tomas falls to the community.

Rights to water that attach to land are not absolute. While the Ministry of Agriculture empowers local irrigation officials to limit water during droughts, the implementation of limits depended on the outcome of heated debate in the irrigation association and in the irrigation clusters. Ultimately, members of an irrigation cluster decide to withhold water from a landowner's field. In effect, the state suggests an emergency water regime to the irrigation association, which, once it is accepted there, passes on to irrigation clusters. Irrigation clusters, not higher-level authorities, possess *de facto* power to grant or withhold the water they control. Unified authority in the irrigation association, thus, does not necessarily lead to unified power. The successful imposition of limits on water expressed not a display of state power but a fit with existing notions of social welfare and justice.

The origins of this tripartite division of property rights can be traced, as we have seen, to the Inkan policy of the allotment to an ayllu of a territory fed by a water source, be it lake, river, or underground stream. Ayllu social organization was coterminous with the groups assigned to construct, maintain, and use the irrigation system that drew on this water. While post-Conquest changes weakened ayllu resource control in most areas, notions of communal "ownership" of water remain as vestiges of ayllu control.

While the ayllu controlled a delimited territory, water source(s), and population, water distribution was the responsibility of water distributors. The similarities in the roles of the Inkan qillkiwa and Lari regidores are striking: both are named at the onset of the irrigation season, rotate in office, and exercise autonomous power to distribute water. The relationship between the Inkan qillkiwa and the spatial organization of irrigation remains to be elucidated, but one could reasonably surmise that Inkan water distributors were appointed for naturally occurring irrigation clusters and carried out their tasks much as they do today in Lari.

Material from communities elsewhere in the Andean highlands suggests that similar patterns of water property rights obtain there as well. At the lowest level, individual households receive allocations of water from an irrigation cluster and assume responsibility for maintaining the immediate canals that feed their fields. Above the household, one commonly encounters a social group with a long-standing claim to "own" a source of water, be it a glacier field, lake, snowpack, river, or spring (see, for example, Bolin 1990). This claim may stem from Inkan ayllu territorial allotments or post-contact creation of an irrigation system, such as the town of Miquiyauyo's construction of a canal network to tap the Mantaro River around 1858 (Adams 1959:126). These claims are usually respected if the source feeds an independent, discrete, territorial unit with legal recognition as an urban administrative unit such as a *municipio* or formally recognized peasant community; in effect, the unit is coterminous with the irrigation cluster. In these cases, canal and reservoir construction and maintenance, water allocation and distribution, and conflict resolution are usually managed collectively through consensual decision making at the village or interhamlet level.[10] Large command areas and multiple water sources and irrigation clusters increase the size, scale, and complexity.

History suggests that the fragmentation of ayllu control, the emergence of haciendas and the implementation of agrarian reforms have dismembered traditional water property rights in many cases. Two examples should suffice. The first is the Rio Tigre system of the Vilcanota Valley which draws water from a glacier field to irrigate a series of lower villages (Bolin 1990). Each village is responsible for maintaining the section of the canal that irrigates the land within its borders and for organizing the distribution of water to irrigators from the main intake of each village; villages correspond to irrigation clusters. The highest villages, Tintinco and Paucarpata, are closest to the source and consider themselves "owners of the water" a claim that traditionally gave them some bargaining power to deal with lower villages, particularly Cusipata, the district capital. Conflicts over water distribution during the dry season led to the intervention of extracommunal authorities such as the governor or the district judge. In the 1970s and 1980s new canals were constructed with the assistance of national and international development agencies. While the new canal infrastructure expanded the irrigable land area and increased the beneficiaries, it considerably weakened the power of Tintinco and Paucarpata, upsetting traditional relationships. Conflicts now arising over inequitable distribution of benefits negatively affect the cooperation of water users along the entire canal system (Bolin 1990).

In the District of Huanoquite in the Department of Cuzco, two long and topographically complex canals drawing water from the Qewar and Qolla Wayku rivers irrigate land belonging to a number of villages (Bunker and Seligman 1991). Prior to the Conquest, ayllus united under a centralized authority controlled the drainage and coordinated the recruitment of labor needed to maintain it. As ayllu control fragmented following the Conquest, haciendas expanded to incorporate the better lands and monopolize water distribution. Despite the agrarian reform of the 1970s, much property remains in private hands. The lack of a centralized authority today impedes corvée labor recruitment and leads to the loss of the topographic knowledge and skills necessary to maintain the system; as a result, canals deteriorate.

Colca Valley villages are fortunate in that large-scale hacienda-style landholdings are not a factor in the local political economy and agrarian reform has not been an issue. While ayllu control did fragment during the colonial and early republican periods, there is as yet no historical evidence that traditional water property rights differed significantly from those encountered today.

Institutional Forms of Irrigation Organization

The institutional form taken by unified irrigation clusters, on the other hand, is heavily influenced by the interaction of locality and the state, as we saw in chapter 6.[11] During Inka hegemony, ayllus controlled land and water, but independent water judges distributed water. Spanish colonial administrators assigned water distribution to local, multipurpose urban administrative units and attempted to commoditize water in line with Spanish notions of water use. Eurocentric water management policies continued after independence in municipal legislation of French origin and national constitutions and water laws codifying state ownership of water.

The enactment by decree of the 1969 Water Law marked the first serious attempt by the state to intervene in highland water management. This law laid out an extensive agenda for state intervention at the local level: transferring the ownership of water to the state, creating a state-chartered irrigation organizational hierarchy linking local irrigation associations with the region; establishing a system of water taxation; and providing for direct state participation in key communal resource management decisions, including water allocation. Of particular significance, historically, were the provisions to create new, and strengthen existing, local government-chartered irrigation associations and link them to a hierarchy of canal and regional levels of water management. It regained for local water management some of the autonomy lost since the Spanish Conquest.

The state has been only partially successful, at best, in imposing its agenda of reforms on highland communities. Some have adopted it wholeheartedly, others in piecemeal fashion, and still others have rejected it out of hand. The Colca Valley is illustrative. At one extreme stand communities such as Lari that reorganized an existing state-chartered irrigation association, allowing for a significant degree of government participation in water management. At the other extreme, Tapay has rejected out of hand ministry attempts to organize a formal irrigation system (Paerregaard 1991). Somewhere in between stand villages like Yanque, marked by a weak state-chartered irrigation association alongside a strong traditional, heavily "Inkaic" irrigation organization with a nested hierarchy of irrigation clusters incorporated into moiety and supramoiety levels (Valderrama and Escalante 1988). Similar variation in response within valleys can be found elsewhere, such as the Vilcanota Valley (Bolin 1991).

Why has the state been unable or unwilling to impose its water management reforms? Structural-determinist theories so prevalent in the Peruvian literature, which place the locus of power at the state level, fall short in explaining this variation. Their failure is due not to an absence of the instruments of state power since the courts, government ministries, *guardia civil*, and urban administrative hierarchy are all omnipresent in the highlands and have usually served state interests well. Nor do variants of these theories suffice that argue that the highlands, while not directly linked with state power, as, for example, the coast, are indirectly linked through local and regional elites. Unquestionably, elites working formally through the court system or informally through their ties to government bureaucrats have in many cases bent the Water Law to their advantage.[12] But there are just as striking examples of the use of state institutions by irrigator communities to successfully modify the terms of the implementation of the Water Law. Some irrigator communities use the court system to take legal action against state intervention; others use the courts to take action against regional elites who want to thwart state intervention.[13] If these measures do not work, there is always the threat of mass mobilization, which has stood peasants in good stead as a political resource since the wave of land invasions and syndicate activity hit the country in the 1960s.

The path of quiet resistance, the "Weapon of the Weak" as James Scott (1985) calls it, is perhaps the more successful, if less visible, weapon: attacking the legitimacy of public meetings with ministry officials by failing to show up, refusing to enlist in government mandated registers of irrigators and pay taxes, ignoring laws that they dislike or working out a *modus operandi* with sympathetic traditional officials, and taking a generally passive stance that often works quite well to dissuade government agents from touching the system.[14]

Irrigator communities, then, have a range of "onstage" and "offstage" weapons to offset state power, some of which, paradoxically, were created by the state to implement agrarian reforms. As a result, the state is forced to negotiate with, rather than dictate to, highland communities in the implementation of water policy.

The form state participation in local water management has taken in Lari suggests one possible mode of interaction. Day-to-day water distribution decisions remain in the irrigation cluster, while the communal level enters in to coordinate water sharing between irrigation clusters, resolve intra- and inter-community conflicts over water, and organize the maintenance and expansion of irrigation infrastructure that it controls. The state intervenes only at the communal level to facilitate conflict resolution, particularly between communities, and to attempt to enforce provisions of the Water Law and ad hoc rulings of the Ministry of Agriculture concerning water use. The state has been successful in enforcing water access provisions, particularly limitations on water during droughts, because they fit traditional notions of communal water management principles and withstand political attacks against them in the irrigation association and irrigation clusters.

The regional level of the state-imposed hierarchy of irrigation organization is weak and ephemeral in comparison with the irrigation association and the irrigation clusters. One obvious reason for this is the lack of a hydrological or property basis for regional irrigation organization. Colca Valley villages draw water from high-altitude sources in the puna or from springs on the lower slopes. The independence of irrigation systems makes regionwide integration difficult. If villages were situated on a flat, wide, alluvial plain of the Colca River and each drew water from it, then a hydrological and property basis for a regionwide irrigation association would be much more compelling.

Understanding the modes of state-locality interaction requires insight into the motives of each actor. The Peruvian state has a rather explicit agenda in this sense—to "rationalize" irrigation by introducing presumed managerial efficiencies. There is no such uniform "rationality" among the highland irrigator communities in their interactions with the state. One reason, of course, is that variation in Andean irrigation and drainage is as great as any area of the world: water flow patterns, physical irrigation infrastructure, and the sociopolitical organization of irrigation differ greatly from village to village, even within the same drain age basin. But one can understand something of these multiple "rationalities" by returning to the customary property relationships of water. The logic of existing property relationships in local irrigation systems informs irrigator's negotiations with the state and its expressed policy of state ownership of water.

Not surprisingly, state intervention has succeeded where customary property relationships and their organizational counterparts have been left in place. Ministry officials have shown a degree of leniency in imposing state-ownership of water on highland communities with established customary property relationships; they have not stepped in, for example, in Lari to abrogate the power of irrigation clusters to determine water use. Nor have they sought to impose their legal rights to modify irrigation regimes. Fortunately, the state appears not to have sought to co-opt through its bureaucratic apparatus local management functions as it has done elsewhere with disastrous results (Merrey 1987; Lees 1974a, 1974b). Whether this is a conscious, pragmatic acknowledgement of the efficacy of traditional property rights in water management or an indicator of the weakness of state power is unclear. Looking at it from a historical perspective, *de facto* legitimization of traditional property relationships and *de jure* legitimization of their organizational forms shifts power to irrigators, reversing a trend since the Spanish Conquest toward centralization of power in the lower levels of the urban administrative hierarchy noted in chapter 6.

One should not lose sight of another important fact. While the social character of highland irrigation systems is heavily influenced by local hydrology and the property relationships that have arisen to manage it, the intervention of the state in local irrigation matters forces irrigators to respond as a collectivity and transforms them into a political community in ways in which day-to-day water management does not. The very tools that the state provides to implement its policies afford one of the means through which irrigators are able to counter heavy-handed and poorly conceived expressions of state power.

Egalitarian Ideology and Socioeconomic Differentiation

Variability encountered in the stratification of highland Andean communities dependent on irrigation suggests a reconsideration of the time-honored association of irrigation and stratification (Hunt and Hunt 1976:396). A theme in studies of these communities is an ideology of egalitarian resource distribution alongside socioeconomic differentiation; the manner of its resolution is a key to understanding the emergence of stratification (Montoya 1980; Montoya, Silveira and Lindoso 1979; Fuenzalida et al. 1982). As we have seen in Lari, an ideological cornerstone of communal resource management is egalitarian resource distribution encapsulated in the maxim "we are all equal." While this sentiment describes rather well a minifundio land distribution pattern of small holdings and shared poverty, similar in overall terms to other Colca Valley communities, it does not account for the evidence of socioeconomic differentiation. Demographic differentiation does explain some of the land inequality, but land accumulation is also accounted for by other factors. Unequal land distribution is associated with unequal distribution of other means of production. Lareños, however, deny that mayoristas act as a class vis-à-vis menoristas, and indicators of class polarization common to the Peruvian highlands—Indian-mestizo ethnic tension, land invasions, rural labor union activity, and hacienda-community friction—are weak or nonexistent in the village. Consistent with their ideology, villagers accept differential landholding and water demand, understanding it as an expression of the need to expand land under cultivation to feed growing households, a more subtle acquisitiveness, or a result of the exhortations of fellow Evangelicals. Similarly, they see a slackening of these pressures as the household ages, matures, and sheds members.

The Lareños' denial of what more dispassionate observers would take as indications of at least incipient class formation raises the question of whether an ideology of egalitarian resource distribution masks existing class differences and furthers class interests. I do not think it does so and I believe the reason lies in the nature of communal water management. While land and labor are available and land can be accumulated, the main constraint on the capitalization of land is water. Normally, this would present no problem given a customary linkage of water rights with land. Risk-reducing field diversification, however, makes it difficult to assemble large blocks of land. More important, communal water management imposes limits on water during droughts and assigns corvée labor and fines according to land area as proxy for water demand. The acquisition of new land, moreover, does not automatically convey water access. The inability to capitalize land by acquiring water is the greatest obstacle to the emergence of land-based stratification. The differences between large and small holders are thus restricted to the sphere of communal water management and do not extend to other spheres of village life.

Clearly, the state has played an important role in the ability of communal water management to retard the emergence of stratification. It has provided a legal and institutional apparatus for implementing limits on water and restricting the expansion of irrigated land. Without the state's entry, large, wealthy landholders would more likely be able to coalesce into powerful interest groups in villages and enhance their access to water, and ability to expand, at the expense of small holders. The state's role is insufficient, however, to guarantee egalitarian water distribution and social welfare measures. When one looks at hydraulic politics elsewhere in the Colca Valley, one finds complex, highly contested arenas with greatly varying outcomes. Village elites constantly manipulate and challenge traditional principles of egalitarian distribution and are often able to subvert them.

Colca Valley villages also assign differential costs for access to water on the basis of landholdings. In Yanque, the total land area held by an individual in a *barrio*, one of the four divisions of the community, is used to distinguish small (minorista), medium (mediano) and large (mayorista) landholders. In Tiracalle barrio of Yanque Hanansaya, for example, small holders own up to six topos, medium six to ten topos, and large over ten topos. Villagers with over five topos of land are also expected to serve as regidor. Labor for irrigation corvées is also apportioned on the basis of land area, with one day of work for every two topos of land. Labor obligations can be satisfied by paying a cash sum equal to the wages of a day laborer, providing a day laborer to work in one's place or appearing on the day and place with a son (Valderrama and Escalante 1988).

Yanqueños argue, as do Lareños, that mayoristas should contribute more labor to irrigation faenas because of their greater use of water for irrigation. Outside of corvées, a mayorista is considered a landholder with more than ten topos of land. Categorizing individuals as mayoristas is avoided, however, because it is a term of approbation, generally associated with mestizo.[15] The distinction is restricted to communal labor assignments, and villagers do not perceive mayoristas acting, in any way, as a cohesive interest group in local affairs.

User fees proportionate to land area and water demand reconcile the paradox of egalitarian consciousness and differential access to land and water in Lari and other Colca Valley communities; conversely, their absence opens the social structure to class tensions. Two well-documented, but contrasting, cases of irrigation-dependent communities on the western slope of the Andes further illustrate this point.

Puquio, a district capital in the Department of Ayacucho, is rigidly divided between indios and vecinos, an acculturated grouping originating in the arrival in the late nineteenth century of Spanish miners and criollo cattle merchants.[16] Between 1915 and 1925, the community shifted to the cultivation of alfalfa for the fattening of cattle destined for the urban markets of the coast. Vecinos possessed the capital to take advantage of the new opportunities. A large-scale land tenure pattern did not emerge, however, for much the same reasons as in Lari: cattle fattening created a need for alfalfa and not land, the highly sloped terrain was unfavorable for extensive grazing, and a weakly developed market network lacked the capacity and institutions for large-scale commercial enterprises.

In the rush to intensify the use of water to cultivate alfalfa, vecinos took advantage of a traditional ideology of egalitarianism: "everyone has land" (*todos tienen tierra*) and "water belongs to everyone and is for everyone" (*el agua sea de todos y para todos*), using it to maximize their use of water, minimize their contribution to corvée labor, and obscure their growing wealth. Where communities, therefore, are unable to restrict access to water through user fees proportionate to water demand or draw on other mechanisms such as state power for limiting access to water, the contradictions of egalitarian resource distribution ideology and emerging socioeconomic differentiation will be resolved in favor of the latter.

A more optimistic outcome attended developments in Huayopampa, a community in the Department of Lima.[17] Prior to 1960s, users contributed labor and cash equally to the needs of communal water management, irrespective of the quantity of water they used. Irrigation water was allotted on an equal basis; there was no distinction made as to the amount of land one held. Every *comunero* was required to participate in faenas and to contribute with equal sums of money for the construction and maintenance of dams, canals, and reservoirs. This obviously benefited those with more land.

In the early 1960s, as the community shifted to market-oriented fruit production with hired labor, socioeconomic differentiation began to emerge. Huayopampa is quite accessible to Lima, and villagers had been migrating there as early as the 1940s and 1950s. By the mid-1960s, migrants began to return to the village in substantial numbers. In confronting the situation of rising socioeconomic differentiation, returning migrants argued that the use of water should be proportionate with participation in faenas and monetary contributions. While there was much opposition from the wealthy farmers, the communal assembly eventually adopted a principle in 1974 that water users would henceforth contribute in money or in labor in a form proportionate to the hours of irrigation. This principle was soon extended to other communal projects such as the purchase of a bus. Thus, while socioeconomic differentiation has not decreased since 1966, it has been kept in check by adjustments in the costs of access to water. Egalitarian principles remain strong.

The paradox of an ideology of egalitarian resource distribution alongside socioeconomic differentiation continues to provoke tensions in Andean highland communities. The manner of its resolution in the communal management of land, pastures, water, firewood, and other resources will tell us much about the shape and depth stratification takes. We can no longer view these and other questions such as the conflict between autonomy and control as entirely confined to the locality and the region. The state has historically had an important role in their framing and, as it expands increasingly into resource management spheres, we will be asked to reconsider the nature of linkages between the state and the locality, their efficacy and impact on the autonomy of existing local resource management systems, and the features of regional systems that inhibit or facilitate them.

Notes

Chapter 1

1. Fendatarios are peasants who enter into a contractual relationship with an *hacendado* or landowner, in which they exchange labor for a subsistence plot of land and a minimal wage.

2. See Salomon 1982 for a perceptive discussion of the theme of cultural unity in Andean ethnology.

3. Andean sectorial fallowing regimes have been described in Guillet 1978 and 1981 and in Orlove and Godoy 1986. Campbell and Godoy (1986) compare Andean and medieval English common field regimes.

4. For a review of the issues and the protagonists in the debate see Brush and Guillet 1985:28–29.

5. The earliest reference to enclosure in the nineteenth century is Matos Mar et al. 1958:41. Contemporary references include Mayer (1979) for the Mantaro Valley. Scholars with fieldwork experience elsewhere in the Andean highlands have recently observed enclosure of sectorial fallowed fields in the communities in which they have been working (Catherine Allen, Keith Jamtgaard, Constance McCorkle, pers. com.). Additional material on the intensification of sectorial-fallowed lands can be found in Bourliaud et al. 1988.

6. For a summary of the literature on household production in the Andean economy see Brush and Guillet 1985.

7. This is no longer the case. Since the early 1980s the Colca Valley has become the focus of extensive ethnographic, ethnohistoric, and archaeological inquiry. References to this work will be made where appropriate in the text.

8. See Pease 1977 for the original description and partial publication of the documents discovered in a cupboard of the church in Yanque. The archive has recently been inventoried by Benavides (1988a) and transferred to the Archivo Arzobispal de Arequipa. This archive of materials has helped to make the Colca Valley one of the most thoroughly documented colonial societies in the New World.

9. Johnson 1930: figs. 23 and 26.

10. The clearest statement of the Asiatic Mode of Production is found in "Formen," a section of the manuscript known as the *Grundrisse* ([1857–58]1973): "The self-sustaining unity of manufacturing and agriculture" within the village commune that thus "contains all the conditions for reproduction and surplus production within itself" (70, 83, 91).

11. See, for example, Leach 1961; Mitchell 1976; Hunt and Hunt 1976; and Millón 1962.

12. See Orlove and Guillet 1985 for a discussion of unity and diversity in the Andes and Himalayas.

13. Recent analyses have examined the association of irrigation with water tenure (Fonseca 1983), social organization (Mitchell 1977; Valderrama and Escalante 1988) and political control (Gelles 1991).

Chapter 2

1. Means used a photograph from the expedition as the dust cover for his book, *Fall of the Inca Empire*, in 1932.

2. See Shippee 1932, 1934 for a description of the Shippee-Johnson expedition.

3. Sources used for the reconstruction of the physical geography of Lari and the Colca Valley include Denevan, Treacy, and Sandor 1986; Sandor 1987, 1989; ONERN 1973. Geomorphic and land use patterns have been interpreted using LANDSAT imagery in Craig 1985.

4. This is surface A4 in the alluvial terrace classification (Sandor 1989:12).

5. General information on Colca Valley vegetation can be found in ONERN 1973. A representative floristic inventory has been completed for the village of Coporaque (Treacy 1988).

6. The *relación* of Juan de Ulloa Mogollón, carried out in 1586 at the request of Virrey Fernando de Torres y Portugal, remains one of the most informative sources about Collagua economy and society and the impact of Inkan reorganization. It reports that the absence of trees in the higher agricultural communities of the Colca Valley forced them to be imported from long distances, including Arequipa and the lower Colca Valley below Tapay (Ulloa Mogollón [1586] 1965: 331–32).

7. Poma de Ayala [1584–1614] 1980: 147 [147], 270 [272], 293 [295], 324 [326]. The system of numbering is that used in the edition of John Murra and Rolena Adorno: the first number refers to a page in the Paris facsimile edition; the second, in square brackets, to the corresponding page in the original manuscript.

8. We can surmise their structure and content from an example of a volcano cult among Arequipa Indians, recorded in the *Cronica Agustiana* of Calancha and analyzed by Cabrera Valdes (1924:33—34). A few days before the eruption of the Ubinas volcano in 1600, a deity in the form of a deformed snake with a human head called Pichinique appeared to the shamans of the nearby Indian villages. Pichinique said that in a few days they would be the victims of a disaster such as never had been seen before. The Indians had brought this curse on themselves by turning away from Pichinique and no longer making sacrifices to him. Instead, they had become baptized as Christians. Pichinique's words were heeded. They went to Guaina Putina and offered sacrifices of alpacas, birds, and chicha in the form to which the demon was accustomed.

In his analysis of the myth, Cabrera Valdes suggests that the deity was the emissary of the volcano Ubinas, an object of veneration. He holds the view that volcano cults were localized, associated with a particular volcano, rather than mass cults devoted to the worship of volcanos.

9. The divergence of the Cavana from the Collagua people has been discussed by Zuidema 1964 and Manrique 1985:28ff. See Gelles 1990 for a description of contemporary differences.

10. For descriptions of the conquest of the Collaguas by Inka Mayta Capac, see Garcilaso de la Vega ([1609–1617] 1966: 1: 153) and Cobo ([1653] 1979:119).

11. These writers often cite a passage in Ulloa Mogollón: "They governed themselves according to a system put in place by the Inka, under which a cacique from each ayllu and parcialidad was named. There were three ayllus, Collana, Pasana, and Cayao; each ayllu had three hundred Indians and a principal whom they obeyed, and these three principales obeyed a cacique principal, who was above everyone. The cacique principal had authority and power over all the other principales, who were most obedient to everything that he commanded, in matters of war as in matters of justice and punishment of crimes. The cacique was imposed by the Inka and succeeded by his sons, and lacking sons by his brothers, although the legitimate brother of the cacique was preferred in inheritance over his son, even though he was legitimate." ([1586] 1965:330, my translation).

12. Such strong indications of Inkan cultural motifs are unusual in that in other traits, such as architecture and ceramics, the Inkan presence in the Colca Valley was not strong (Denevan 1986a:19).

13. I have drawn on the following sources for the reconstruction of the early colonial history of the Colca Valley: Cook 1982; Davies 1984; Cock 1976–77, 1978; Pease 1977; Málaga Medina 1974, 1975, 1977; Lohmann Villena 1957; Galdós Rodriguez 1984, 1987; Manrique 1985; Takahashi 1986.

14. The encomienda was a grant of Indians for a fixed period to an individual (*encomendero*) who, in return for protection and instruction in the Catholic faith, could levy tribute on them in the form of goods or currency and, until 1549, labor services (Davies 1984:14–15).

15. The account of the division is found in the Visita General de Francisco de Toledo (Toledo 1975). In early documents, Lari-Collaguas is also referred to as Recollaguas, and the moieties of Hanansaya and Hurinsaya as *parcialidades*.

16. Davies (1984:119) suggests, however, that the Crown did occasionally choose excellent corregidores such as Licenciado Juan Polo de Ondegardo.

17. Analyses of the Colca Valley reducciones can be found in Lohmann Villena 1957:596, table 7; and Málaga Medina 1977. Architectural aspects of the settlements are discussed in Instituto Nacional de Cultura 1985.

18. See Galdós Rodriguez 1987:110ff for analysis.

19. In a review of Collagua settlement patterns, Cock (1976–1977: 115–16) calls it "salpicado de territoros."

20. The *Visita General* of Toledo was conducted under unusually high standards and is an important source of information on the economy of Collaguas during the 1570s. It details the population of an encomienda with a breakdown by tributaries, old and infirm, boys under eighteen, and women and lists tribute items and their value in currency. See Málaga Medina 1974, 1975; Manrique 1985:86–98.

21. Tribute in kind was often sold. A register of the auctions of goods collected as tribute payments from Arequipa encomiendas, including those of the Collaguas, is

available in the Archivo Historico of Arequipa, entitled "Registro de almoneda de los tributos de yndios vacos q'pertenecen a S.M. 1555."

22. See, for example, Protocol D° de Aguilar (1575) p. 210 in the Municipal Archives of Arequipa, for the record of a sale by Alonso Picardo of 105 sets of ropa de cumbi and 25 sets of ropa de abasca tribute goods. Additional material on weaving in Lari can be found in Ulloa de Mogollón ([1586] 1965); and Manrique 1985:102.

23. Ganado de la tierra was introduced as a tribute item by at least the 1570s. Maize, wheat, and chickens followed, in much smaller proportions. The lack of variety in tribute in kind suggests a lack of access to a wide range of ecological zones.

24. Collaguas Indians helped in the reconstruction of the city after a massive earthquake in 1582. Planned and unplanned movements to Arequipa, a high rate of mortality among Indians in the city, and a prehispanic pattern of landholding in Arequipa by Collaguas Indians produced a highly flexible and mobile Indian labor force there (Takahashi 1986).

25. Chimba was organized in three different ways: (1) by repartimiento, of which there were five, including two of Lari Indians—the Repartimiento of Retamoso, with 2 caciques, a population of 639, and 159 tributaries, and the Repartimiento of Picado, with 2 caciques, a population of 805 and 181 tributaries; (2) as a pueblo with a civil administration, a status it received in 1576 by a declaration of the Viceroy of Toledo; and (3) a prehispanic political organization (Takahashi 1986).

26. Leaves of the Visita of Lari-Hurinsaya are numbered on the recto side. A number followed by a *v*, indicates the verso of a numbered leaf.

27. For example, Punco, which today is a natural pasture, was used for the cultivation of maize (fol.103v, 90, 85, 74, 65, 59, 41, 39). Older informants agree that with good rains, maize could have been cultivated here. One very old informant remembers the cultivation of this zone as a child. In other cases, such as Tiracanchi, where terraced maize and quinoa fields were located, today a natural pasture, informants are much more doubtful about cultivation possibilities, although some do not completely discard the possibility.

28. As Cardich (1985) has pointed out, a very small increase or decrease in mean annual temperature can have a significant effect on vegetation zones in the Andes.

29. Treacy (1989:86) interprets *lucri* as an Aymara word for terrace, citing Brundage (1967:351) and Donkin (1979:20, n. 25).

30. Annual redistribution may have been the practice in lands that followed a crop and plot rotation sequence as in middle altitude, tuber zone, lands (Guillet 1981). Inasmuch as the use of irrigated terrace lands was not controlled by the community and fields were not regularly rotated as in a sectoral fallowing system, there was less occasion for the redistribution of use rights.

31. "Toledo ordered communities to designate parcels of potato and maize lands as *chacras de comunidad*, whose yields were to feed the poorest inhabitants. In good years, a village was to sell part of the crop and put the proceeds in its *caja de comunidad*, or community treasury. In times of dearth, the community's crop would be distributed directly to the poor and the savings in the caja would provide for food purchases to tide the people over until the next harvest" (Larson 1988:68–69).

32. For material on the Caylloma mine, see Manrique 1985:113–228; Málaga Medina 1977; Flores Galindo 1977; and Barriga 1952: 1:113–18.

33. In the Colca Valley, *templo* refers to a church building and *iglesia* to the gathering of the faithful. These terms come from old Catholic liturgy (Benavides 1983a:28).

34. See Tord 1983:97–108 and Instituto Nacional de Cultura 1985:14–16 for descriptions and photographs of the church.

35. The mining crisis does not seem to have been caused, at least in the Colca Valley, by a demographic crisis, since at this time the population of the valley was increasing (Manrique 1985:132ff.).

36. In 1847, there were twenty-three justices of the peace and nineteen *sindicos procuradores* in the province. The only schools were outside the valley proper, in Siguas, Pitay, Tintin, and Callali (Guía de Forasteros 1847).

37. Hurinsaya and Hanansaya moieties each had an alcalde de indios in 1868 (AAA, LLI 1868). "The only income of the church is the alms voluntarily spent by the faithful in a few festivities and the profit produced by two herds of approximately thirty and forty sheep. The town is divided into two sections called Anansaya and Urinsaya each of which names a herder annually who is responsible for its respective herd" (AAA, LLI 1885). Separate herds of sheep maintained by each moiety are noted as late as 1901 (AAA, LLI 1901).

Chapter 3

1. The agrarian history of the Colca Valley region has been reconstructed from accounts by Málaga Medina 1975; Davies 1984; Gomez Rodriguez 1977; and Manrique 1985.

2. No reports of mobilization in the Colca Valley occur in a comprehensive analysis of 837 notices of peasant activity appearing in major newspaper and periodical sources during the period 1956–64 (Guzman and Vargas 1981).

3. In anticresis, one transfers land to another as collateral to secure a sum of money for a set period of time. The lender has use rights to the land until the loan is repaid. According to Benavides (1983a:42), this method is used by out-migrant landowners to gather funds for traveling expenses that they expect to pay with savings on their return.

4. In some Colca Valley villages, the justice of the peace, in conjunction with the governor, issues certificates of landownership (Hurley 1978:135ff.). A land judge took up office in Chivay as part of the reforms of the Velasco government in 1969–70.

5. The Colca Valley is one of the few highland Peruvian valleys for which cadastral records exist. The cadastral survey was conducted by the Ministry of Agriculture in 1978 and produced maps at a scale of 1:5,000 with 25-meter contours, showing individual fields and canals. For each field, a data sheet contains the name of the owner, irrigation cluster, field size, area of field in cultivation, and principal crops. Field size was calculated using a planimeter. I do not know the planimeter measurement error. My impression from working with these data is that measures of field size and area in cultivation are sufficiently valid and reliable to be used for the purposes in this study. I have less confidence in using the data to indicate cropping patterns, given problems with absentee ownership and anticipatory inheritance. Whenever possible, therefore, I use the results of a land use survey I conducted during the

study, together with other data such as tax records, in speculating about household production patterns.

Chapter 4

1. I have relied extensively on Winterhalder's (1991) discussion of precipitation and its hypothesized relationship to irrigation in highland Peru. Climatic patterns of the western escarpment of the Andes are treated in Knapp 1984. For material on rainfall patterns in the Colca Valley, see McCamant 1986; ONERN 1973; Denevan, Treacy, and Sandor 1986; and Treacy 1989. Arid ecosystems are classified by mean annual precipitation and productivity in Moran 1979.

2. Winterhalder's plotting of altitude against precipitation on data from twenty weather stations from the western escarpment shows a striking fit with a polynomial regression model (average annual precipitation = constant x altitude^2) producing a Pearson correlation coefficient of $R^2 = 0.97$ and an explained variance of $R^2 = 0.94$ (Winterhalder 1991: table 7).

3. For the rationale behind the figure of 64 millimeters, see Winterhalder 1991: nn. 6–7.

4. The reservoirs of Pomacra, Lekempa, and Ananchihua appear to have been constructed on this basis (Jon Sandor, pers. com.). See Sandor 1989 for a discussion of geomorphology and land use in Lari.

5. Valderrama and Escalante (1986:187) suggest that storage averts the problem of water freezing in open canals because of low nighttime temperatures, thus slowing or stopping flow.

6. See Waugh and Treacy (1986) for a discussion of the role of these factors in contributing to water loss in the neighboring village of Coporaque.

7. For Yanque, see Valderrama and Escalante 1989; for Coporaque, see Treacy 1989, 1991, and Waugh and Treacy 1986; for Cabanaconde, see Gelles 1990; for Tapay, see Paerregaard 1991.

8. See Benavides (1983a:36–38) on conflicts between Coporaque, Yanque, and Chivay. We will analyze in a later chapter disputes between Lari and Madrigal and Ichupampa.

9. Legend has it that Madrigal gained access to this water many years ago when people from the village helped one year in the sponsoring of the fiesta of the Virgin de la Concebida on December 8.

10. It also referred to as irrigating "dry" (*riego en seco*).

11. Some of the material in this section first appeared in Guillet 1987a.

12.The sequence appears to be reversed in Yanque, with irrigation beginning in the lower altitudes (Valderrama and Escalante 1986:187).

13. One solution is to replant with barley or wheat.

14. In some tomas, one can be absent and still be assigned a water share. This usually forces the regidor to find the landowner to notify him of his share and is a bone of contention to regidores, as we will see in a later chapter.

15. When water began to flow through two canals in Huarochiri that received day water, it signaled the start of the day. When it began to flow to the Taillapo canal that received water at night, it signaled the end of the day (Espinoza Soriano 1971:164).

16. The sequence in Orcoya always begins with Rosasani at 3,723 meters because its deep, terraced soils retain humidity for a long time, more than 90 days for broad beans and up to 105 days for maize.

Chapter 5

1. See Furbee 1989 for a detailed discussion of native soil classification in Lari. Her findings parallel those of McCamant (1986) for soils in neighboring Coporaque.

2. For a record of land use modifications taken in conjunction with the landslide see AMuL, La: Nov. 17, 1981.

3. Older landslide areas, once stabilized, may provide preferential land for terracing since they have loose soils and gentler slopes.

4. In the discussion that follows, we assume that the decision maker is resident in the community and charged with provisioning a household, the situation in which virtually all residents find themselves. We are not interested, for example, in fallow that stems from absentee ownership strategies. Thus, some of the approximately four of every ten cultivable fields in fallow or alfalfa may be accounted for by these and other forms of indirect tenure.

5. Barley and maize surpluses are bartered for hides, dried meat, *cochayuyo* (algae collected from highland lakes and the coast), and woven rope and storage bags brought by the llama caravans that descend annually around harvest time. Hybrid barley produced with seed provided by an Arequipa brewery is sold to the brewery, and potatoes and onions are sold in regional markets. Farmers do not grow crops solely for barter or sale, however. They do select crops for certain fields that they hope will produce a surplus. Even then, they expect to consume the harvest in the event that the surplus is not forthcoming. This is the case even with *cebada cervecera,* a hybrid barley.

6. As one informant put it, "cold air falls down the slopes to rest on the pampa."

7. Additional material on the organization of the knowledge of native soil terms in Lari can be found in Furbee 1989. The agronomic importance of using texture as a soil classificatory measure is discussed in Sandor 1989.

8. "During the August canal-cleaning period in Coporaque, teams of villagers ascend to the edge of snow-covered Cerro Misme to calculate snow levels and thus irrigation potential" (Denevan, Treacy, and Sandor 1986:50). The size of the snowcap is also used by Yanqueños to estimate crop plans (Valderrama and Escalante 1988:68). Farmers in the Chili Basin of Arequipa observe variations in the snow line of the Charcani, El Misti, and Pichu Pichu peaks to estimate stream flow during low moisture periods (Holmes 1986:122).

9. A sack (*costal*) of shelled maize weighs 35–40 kilos, a sack of barley, 50 kilos, and a sack of broad beans, 60 kilos.

10. These caravans descend annually to Colca Valley villages from the high puna of Caylloma, Yauri, Espinar, and Castilla to barter for agricultural products. While in the village, they stay at night in the corrals of favored trading partners (*conocidos*) and forage during the day in his fields or in communal grazing land. Their stays usually last no more than three or four days. A survey of caravans that visited Lari from October 1983 to May 1984 found an average of 22.8 animals per caravan (n = 12).

In the past, llamas also descended during the harvest to help in the transport of grain to the village. Large corrals attached to the rear of houses were part of the original design of the urban reduccion settlements of the Colca Valley in the sixteenth century, indicating that animal husbandry was an important part of the village economy, then, as now.

11. According to U.S. soil classification, calcha hallp'a is Typic Haplustoll, coarse-loamy, mixed, isomesic. A sample was taken in Lari from a colluvial surface at an elevation of 3,280 meters (Sandor 1989).

12. See Knapp 1984:172ff. for manure-soil interactions in the western Andean escarpment.

13. Similar patterns are reported by McCamant (1986) for Coporaque: maize and potatoes are fertilized consistently; barley rarely. Broad beans were fertilized in 32 percent (six of nineteen) of fields surveyed. See Gade 1975 for a description of barley varieties and cultivation in the Vilcanota Valley that applies generally to the Colca Valley. If dung is in good supply, common barley will get an application.

14. Six out of eighteen fields received chemical fertilizer in the 1987 soil management survey.

15. Urea application presents an interesting parallel with guano side-dressing during the precontact period (Julien 1985).

16. Terrace maintenance is discussed in more detail in Guillet 1987a:411–12.

17. See Gade and Rios 1972 on the chakitaclla and Schjellerup 1987 on the Andean scratch plow. Informants state that their fathers used the chakitaclla on the slopes where now only oxen and plow are used. This shift necessitated the widening of terraces.

18. Horses, mules, and burros, however, have harder hooves than the soft-hooved llama and alpaca and thus do trample more.

19. The dual sampling devised by Jon Sandor to study agricultural soils in Lari was based on the need to sample broadly enough to describe the total range of soils, but also to sample intensively in some representative areas to adequately characterize the composition and variability of important soils and the distribution of soils within farmers' fields. To describe the range of soils, soil was excavated by auger near the middle of each of the twenty-four fields visited during the soil management survey. In most cases, the soil could be dug to the 1.25 meters maximum depth attainable with the auger. A small soil sample from the agriculturally important 0–15 centimeter depth was also collected from each site for laboratory analysis. Later in the fieldwork, following preliminary results of an ethnoscience investigation of native soil classification by Louanna Furbee and a reconnaissance survey by Sandor to assess the prevalence of major soil types, soils in the three major soil classes (akku, llink'i, hallp'a) were intensively sampled as follows. Two samplings of each of the three soil types were conducted in widely distributed fields selected from the extensive samples. Ten 0–15 centimeter samples per site, spaced 5 meters apart in two transects 20 meters apart, were taken. To also systematically sample the subsoil, auger borings were made at transect points 1, 3, and 5 to a depth of 1.25 meters. Samples were collected from the 40–50 centimeter depth at these points and another sample was taken at 125 centimeter depth from transect point three, making a total of fourteen samples per site. For a detailed description of the methods employed and results, see Sandor 1989. For a description of the ethnoscience methods employed in the construction of a folk expert system model of native soil classification, see Furbee 1989.

20. Farmers' awareness of the distribution of soils appears to be highest for the range encountered locally, in the village. Broad knowledge of soil distributions within the middle Colca Valley is apparent. There is less evidence that they are aware of intrafield variation in soil types. Based on casual inquiries, farmers do not appear to have a folk theory of soil formation, but more focused interviewing may alter this impression. They are aware of the origins of recent soil movements, (e.g., mudslides and erosion). Further information on soil knowledge can be found in Furbee 1989.

21. John Treacy first pointed this out to me. I have also benefited from discussions on the geomorphology and natural soils of Lari with Jon Sandor.

22. Removed from consideration here are the 56 hectares of land taken out of production by the community because of landslide threat.

Chapter 6

1.This chapter is an expanded revised version of Guillet 1989. The section on Inka irrigation systems owes much to work of Sherbondy (1979, 1982, 1987, 1991).

2.Qillkiwa appears in Poma de Ayala's manuscript as *cilquiua*. The updated spelling is that of Ludeña de la Vega (1982:86).

3. As Sherbondy points out (1979:ix), while there are varieties of maize that can be cultivated in short growing seasons, preferred varieties have a growth period longer than the duration of the rains. In my experience, short varieties of maize and other crops are often reseeded when the first seeding fails for some reason.

4. In Inkaic Cuzco, panacas, royal administrative ayllus, had access to the most important lands and irrigation sources. There are no reports that the panaca was found outside the valley of Cuzco, however (Sherbondy 1987:119, 148). Lands of the Inka were one of three categories of land into which territory was divided, the others being Land of the Sun and Land of the Community.

5. For contemporary examples of the two systems of water tenure in Spain, see Maas and Anderson 1978. Scholars have attributed the differences to environmental and cultural factors (Glick 1970:13, 149–242; Brunhes 1902).

6. In Yanque and Cabanaconde, water judges are also called regidores or *yaku alcaldes* (water mayors) and still carry varas (Valderrama and Escalante 1988:58; Gelles 1990).

7. Under the Constitution of 1933, the country was divided into departments, provinces, and districts. The urban settlement of each of these divisions is administered under the provisions of municipal law. The constitution also established a corresponding hierarchy of appointed officials, with the central government represented at the departmental level by the prefect, the province by the subprefect, the district by the governor or lieutenant governor, depending on its size. Each official reports to an immediate superior and all are ultimately responsible to the president through the Ministry of Government.

8. See the reference in September 1959 to a memorandum issued by the subprefect delineating rules for the irrigation of reclaimed fields (LA, SA: Sept. 15, 1959). In an entry from 1963, fines collected for water code infractions are directed to be

sent to the subprefect (LA, SA: Oct. 6, 1963). Benavides's transcription of the account of a battle by a participant in 1972 between Yanque and Coporaque over water rights mentions that irrigators had been going to Arequipa to seek redress because there was no office of the Ministry of Agriculture in Chivay (Benavides 1983a:114).

9. The known exceptions are the villages of Coporaque and Yanque, where landowners lived in or had close contacts with neighboring Chivay. Cabanaconde is a somewhat different exception in that there was an early entry of the state into irrigation affairs and the municipality undertook to organize a water tribunal (juzgado de aguas) in 1940. Gelles shows that in these years strong forastero families exercised a great deal of influence in water management (Gelles 1990).

10. In Pampacolca in September of 1966, a system of irrigation by turns was instituted with the assistance of the Ofician Nacional de la Reforma Agraria (ONRA), the prefect, and the direccion de aguas. This action weakened the power of large landowners who had monopolized irrigation water since the construction of the first reservoirs in the mid-nineteenth century (Rodriquez Amezquita 1961).

11. Entries in the *Libro de Actas del Subadministrador de Aguas de Regadio*, an important source for the history of the village irrigation association, begin on August 25, 1959.

Chapter 7

1. This simplifies the picture somewhat in that some offtakes of major canals are augmented with water from nearby springs.

2. For reviews of the Peruvian legislation concerning water, see Andaluz and Valdez 1987:41–62; Centro de Apoyo y Promoción al Desarrollo Agrario 1990:3–9. Lynch (1988) provides a critical history of the emergence of a state bureaucratic water management apparatus.

3. The Water Code of 1902 allowed private ownership of water. In the 1933 Constitution, private ownership of public ground and surface water was prohibited except for "rights legitimately acquired." The 1969 Water Law was ratified by the rewritten 1979 Constitution (Centro de Apoyo y Promoción al Desarrollo Agrario 1990:3–4).

4. Art. 42: "Podrán otorgarse usos de aguas para agricultura en el siguiente orden: a) el riego de tierras agrícolas con sistemas de regadio existente; b) el riego de determinados cultivos con aguas exedentes en tierras agrícolas con sistemas de regadio existente; c) mejorar suelos; y d) irrigación."

5. A quiebra refers to the closure of an upper offtake of a river or a canal so that water can be drawn from lower offtakes. A mita in the sense referred to here is continuous irrigation of adjacent fields.

6. These provisions would appear to inhibit long-term fallowing, a regenerative practice of traditional agriculture. In practice, they are usually ignored by regidores who distribute water to landowners returning fields to cultivation after short periods of fallow. Owners of fields fallowed longer than three years make their case for restitution of water rights in the regina rather than take it up with the Ministry of Agriculture, often a long and inconclusive process. Farmers see these provisions of the law as unjust and lacking in understanding of the need for periodic fallow.

7. See Palacios Ríos 1977 for an analysis of water tenure among herders who irrigate pastures.

8. In October 1962, a fine was levied by the irrigation association against the irrigation of pastures in the puna (LA, SA: Oct. 25, 1962).

9. A meeting was held in Ullana, one of the seeps that feeds the irrigation of Surimana, on December 5, 1979: "With the presence of Carlos Cruz (director of the Irrigation Division, Ministry of Agriculture, Chivay), a determination of the use of the water from Japulli and Ullana was made as follows: (1) The waters that originate from three springs in Ullana estancia can be used for two days per week, on Thursday and Sunday, to irrigate the estancia's pastures. Water will be available from 5:00 A.M. Thursday to 5:00 A.M. of the following day, twenty-four hours in total. The same holds for Sunday. The owners of Ullana and Japulli estancias agree to this. It is further stated that failure to abide by this agreement will result in punishment called for by article 17 which was explained to those present" (AMuL, CR: Dec. 5, 1979, my translation).

Another meeting in Ullana was held in May of the next year, again with Carlos Cruz present: "In view of the serious drought of recent years, and in order to make a good distribution of water, given that V. V. has been using thirty-six hours of water: (1) The owners of Ullana are granted use of the water for a day and a half, from 5:00 A.M. Saturday to 5:00 P.M. the next day during the mita and three days a week, from 5:00 A.M. Friday to 5:00 A.M. Monday, or seventy-two hours, during periods when water is not being distributed [during the mita]. Any infraction will result in sanctions called for by Decreto Ley 17752. (2) In case of any infractions, vigilantes will immediately notify the Irrigator's Commission. (3) The Irrigation Director prohibits estancia owners from constructing new irrigation canals" (AMuL, CR: May 12, 1979, my translation).

10. For comparative data on canal-cleaning rituals see Isbell 1978:138–65 and Urton 1981:68.

11. It does not entirely solve the problem. Farmers who have numerous plots may have to monitor several reginas during the week, irrigate fields, and do other tasks. If a farmer is scheduled to be first to irrigate during the day from a reservoir, he must show up at 5:00 P.M. the previous day to fill it up. If two farmers are scheduled to irrigate the next day, they often cooperate; one will divert the canal to fill the reservoir the day before and the other will release water from the reservoir in the morning of the next day. It can be an hour's walk from one end of the village to another.

The rather tenuous solutions to the problem illustrate one dimension of the costs of dispersed fields. Field dispersion is a common means to reduce subsistence risk, shortfalls of harvest induced by unpredictable factors in the environment (Winterhalder 1990; McCloskey 1976). Its costs can be onerous, particularly in mountain environments where fields may be separated by an hour's walk over very difficult terrain.

12. The reporting order, in this case from a meeting held on October 15, 1983, is repeated with little variation in every meeting.

13. Treacy contends that a system of continuous water distribution put into place in Coporaque during droughts was pro bably Inkaic in origin (Treacy 1989:174–81). His argument is based on an east-to-west rotation of irrigation and

planting and the physical layout of the irrigation system, with canals emanating from central points and a close association of house sites with canal, suggesting a correspondence with ceque organization: "The arrangement of the alleged ceques in Coporaque may have involved sight lines from reservoirs (nodes) to settlements on *qhopos* (hills) near canals, allowing an observer to note which canal was in use on any day. Most importantly, the heart of the organizational principles of ceque lines is discernable in the Coporaque system, especially in terms of establishing a locus of responsibility (irrigation administration from reservoirs), and assigning irrigation use periods according to a semi-circular march through canals in space and time" (Treacy 1989:181).

14. On the relation of social organization to labor organization in irrigation corvées, see Isbell 1978; Sherbondy 1987:136; Tello and Miranda 1923.

Chapter 8

1. Padrinos must be respected Lareños, economically able to assume the costs involved. The padrinos accept the responsibility to monitor the behavior of their godchildren and have license to discipline them in the place of a parent, even physically if a transgression is serious.

2. Quechua kinship terms are given in the possessive form of address, e.g., "my sister" rather than "sister."

3. For comparable material on kin terms and social organization, see Bolton and Mayer 1977.

4. The sole exception is at death, when one enjoys, posthumously, the ritual recognition of the greatest number of relatives. Paerregaard (1987) provides an analysis of death ritual in nearby Tapay.

5. "Porque si un hermano solo, es el que tiene su esposa, entonces ella no tendra a quien decir qachunmasiy. Por eso, es lo minimo que sean dos, pero si hay mas de dos entonces tambien son qachun o qatay masi segun el numero de hermanos y hermanas."

6. "Yanantin es una pareja, uno con otro, por ejemplo, se dice yanantin cuando una paloma encuentra su macho. Entonces esa pareja es yanantin."

7. Duties and obligations of qachun and qatay are also symbolized during wedding ritual. Of special importance on these occasions is a category of female consanguines of the husband, including mother, grandmother, sisters, aunts, and cousins referred to as *qachun pusoq*. This category unites all of the relatives of the same sex across generations who provide ritual service to the relatives of the opposite sex. During the wedding ceremony, they bring the new wife, their new qachun, to the groom's house. There, on the second day of the wedding cycle, the bride is made to dance with two of the qachun pusoc of the groom, who hold the girl as if she were learning to walk as an infant for the first time—"Acareciandola de dos en dos como se fuese una criatura." A cot (*litera*) is then prepared on which the couple is forced to lie. The cot is then put on the shoulders of the groom's kinsmen and they are carried into the street in the direction of the padrino mayores house. The cot is purposely made weak and often the couple break it and fall to the ground, much to the amusement and jokes of the marriage cortege. This ritual is called the *paseo en litera*. These rituals, which take place in the groom's house, are eliminated if he is a *forastero* lacking parents in Lari.

Chapter 9

1. "The commerce and profits that they have are from alpacas and llamas (*ganado de la tierra*), wool and meat, that the Indians bring from the highlands, where the animals are raised, to the Indians of the valley and trade for maize and quinua" (Ulloa Mogollón [1586] 1965:332, my translation).

2. Additional information on transhumance among Caylloma herders is available in Inamura (1986) and Comisión (1985:18–19).

3. See Comisión (1987:19) for additional information on herding practices.

4. Family herding groups are corporate groups according to Appell's (1983:304) definition of corporate group as "a group of individuals . . . associated for a particular purpose," in which "the economic benefits and obligations of this association can be construed as belonging to the whole group corporately, not to its individual members. But in contrast with a corporation there is a specific group of individuals involved."

5. Challpo and Pampuyo are estancias located in the puna above Lari. They are listed as *caserios* of Tapay in the 1940 census, indicating that they were under the political control of that district. Challpo is also listed as an estancia under Lari in the same census. Challpo is likely the original location of a major ayllu. This is indicated by reference to it as Challpo-Capilla. Capillas are chapels established when the indigenous population began to return to the puna following the reduccion settlements (Cook 1982). They were often located on top of sacred places (*huacas*) associated mythically with the origins of ayllus. It is clear that in the 1940s Pampuyo and Challpo were considered as appendages of the district of Tapay. Politically, puna residents belong to the district of Lari. See Inamura 1986 for an extensive discussion of the political aspects of Caylloma estancias.

6. When an earthquake destroyed the twin belltowers flanking the entranceway in the late nineteenth century, Hanansaya's was rebuilt first, reflecting its greater importance. Following the temporary movement of the cemetery in 1978 after the landslide, it was lengthened and returned to its original location, "in line with the church."

7. The origins can probably be traced to the altar behind which hangs the cross and the crucified Jesus, key symbols of Catholic ritual.

8. The estancia is fed by the waters of the mountain of the same name. Suririwi is located within the jurisdiction of Chachas and may have held a capilla.

9. In having duplicate divisions in the upper puna, Lari approximates the situation described by Platt (1975), among the Machas of Bolivia, in which community segments (major ayllus, minor ayllus, and minimal ayllus) are based on the cold puna but have duplicate segments in the warm, maize-growing valley. The order is reversed in Lari, where the main point of orientation has been the valley and the extensions of valley populations in the upper herding zone depend politically and ritually on the valley. It is likely that the incidence of malaria and Chagas disease in the valleys of

Bolivia is a reason for the lesser importance of the valleys to the Machas. See Guillet 1987a.

10. See Bernal Málaga 1983 for material on Colca Valley folk dances.

11. During the rainy season, only small sheep and alpacas graze on alfalfa early in the morning when there is dew and heat. Large sheep and cattle run the risk of bloat (*aventarse*). Herders wait until the wind dries out the alfalfa, around 10:00 A.M. to 12:00 P.M. Until then they can either keep the animals in their corrals or bring them to higher, drier places to graze. But cattle do not graze well on the dry season grasses in the heights.

12. In Cabanaconde, in the late 1970s, one sol per year per head of sheep and between twenty and forty soles per year for cows, horses, donkeys, and mules were assessed (Hurley 1978:147ff.).

Chapter 10

1. This may not have always been the case. Older informants recall regidores being given extra parcels of land in the past. In Coporaque, regidores receive a gratuity of one *inti* (seven U.S. cents in 1986) for every topo they irrigate (Treacy 1989:325).

2. Commenting on this distinction among Colca Valley villagers, Benavides (1990:7), states: "The inhabitants of the valley identify themselves with their community (*pueblo*), making a distinction between 'offspring of the community' (*hijos del pueblo*), that is to say, residents, the son-in-law of the community (*yernos del pueblo*), or strangers married with a woman native to the community, and the 'foreigners' (*forasteros*) without any marriage bond with the community. A few peasants call themselves with pride 'original Indians' (*indios originarios*), implying that those who are not 'original' are foreigners or mestizo immigrants from other provinces" (my translation).

3. The town of Cabanaconde has a long and full history of the intrusion of forasteros into the local polity and economy that is recounted by Gelles (1990:250). He stresses the importance of literacy as a qualification for higher office.

4. Pedro Ruiz is a pseudonym. The political career of Ruiz parallels that of other forasteros in the Colca Valley, such as Antonio Fuentes in Cabanaconde (see Gelles 1990:255ff.).

5. Cofradria fields are distinguished from *chacras de la iglesia* (or *curas*), which are rented out to pay for the expenses of the church.

6. See Casaverde 1977 on the social relations between caravanners and agriculturalists.

7. The dentist-missionary may have been one of the "two American missionary paramedics settled in Yanque, which at the time had no medical dispensary and provided much-needed assistance together with some protestant indoctrination" (Benavides 1983a:25).

8. Three well-respected vecinos of Lari were also instrumental in the founding of the Seventh-Day Adventist congregation. Members are ranked according to their economic status (rich, moderate, and poor) and tithe accordingly. Each year the local congregation elects a new elder. The local congregation is administered by the Arequipa office. Adventists stress education: to be elected president of the Arequipa church one must have finished secondary school; to be elected president of the Peruvian church, one must be a university graduate.

9. This substantial increase can be attributed to a life-style attractive to many and a record of material improvement of many of the households who belong to the congregation. The church also provides for its own. Arequipa and overseas churches donate clothes to poor congregations such as the one in Lari. These donations were quite important during the drought of 1983–84. The Evangelist congregation in 1984 of fifteen adults and children was much reduced, in contrast, by a mass defection to the ranks of the Adventists.

Chapter 11

1. On the initial introduction of alfalfa in Peru, see Cobo [1653] 1956: 1:410; de León Porocarrero [1620?] 1958:50.

2. While alfalfa was a new cultigen, the concept of fertilization with a forage legume was known to Arequipa Indians who had a tradition of cultivating clover (*trebol*) (Lizarraga [1605] 1916:163).

3. The figure of 78 percent is taken from Love (1989:157). Markham visited Arequipa during the mid-nineteenth century and had this to say: "There is a great deal of maize grown in the valley and guano is extensively used as manure; but the wealth of the campiña is chiefly derived from its mules, which monopolize the carrying trade from the coast to Arequipa, and from Arequipa to the interior. A quantity of *lucerne* or alfalfa is raised for their sustenance, and the *arrieros* or muleteers are a wealthy class of men, generally possessing a chacra or farm of their own, besides considerable sums in ready money" (Markham 1862:77).

4. This information is interesting on several accounts. It suggests a pattern of the "vertical" distribution of crops, with frost-resistant ones cultivated in the higher, colder altitudes and the more susceptible one confined to the lower fields. Stiglich's claim that Lari is remarkable for its kitchen gardens with fruit trees and flowers and a rather warm (*algo calido*) climate would warm the heart, if not cut the chill, of anybody who has spent a night in Lari! Second, it presents a much wider range of cultivated crops than do earlier accounts. While crop substitution has occurred, pre-Spanish cultigens (maize, quinoa, potatoes, and oca) remain important.

5. Some of the material that follows is adapted from Guillet 1991b.

6. Abandoned houses with standing walls become quite fertile places for kitchen gardens over time because people relieve themselves there.

7. See Webber 1988 and Treacy 1989:271 for material on alfalfa cultivation in Achoma and Coporaque.

8. I wish to thank Bruce Winterhalder for providing me with these data.

9. Differences in the figures from the 1981 national census and 1984 census conducted during the fieldwork are revealing. The fieldwork census was carried out under carefully controlled conditions (Guillet 1985b). Almost identical figures for the district totals suggest a rather high degree of validity for the national census count. The total district population is categorized differently by population segment: the national census enumerated a higher percentage of the district population (89 percent) resident in the village than the fieldwork census (82 percent). The national census

count of 1981 of the puna population is half that of the previous census (1972). Without knowing the procedures followed by the census takers, explaining the discrepancy is difficult. I have confidence in the census conducted during the fieldwork and feel it is a more valid reflection of relative contributions of the village and puna population segments than the national census.

10. For background on the Majes Project in the Colca Valley, see Hurley 1978.

11. Tunnels were bored from the two ends simultaneously with laser beams used for alignment. This enabled tunnels to be kept to within 5 millimeters of their planned course (Hurley 1978:180). Despite the application of sophisticated technology and the use of tunnel shift crews more than twice the size of a crew employed in similar work in Europe, unions resisted any attempt to cut back on laborers (Hurley 1978:180).

12. Information on the history of the Madrigal Mine comes from Benavides (1983a, 1983b) and from informants. The Madrigal Mine extracts metallic ores, copper, lead, and zinc; the Caylloma mine, silver and gold. The Madrigal Mine was discovered (or, more likely, rediscovered) in 1943 by the subprefect of Chivay, a former employee of the Caylloma silver mine, Cesar Lazarte. Lazarte worked the mine as a small-scale operation, carrying the mineral out on mule-back to Chivay and from there to Arequipa. The enterprise never employed more than forty-five men, women and children at one time. In 1949, through the efforts of Lazarte, a dry season road from Chivay to Madrigal, passing through Lari, was built under government auspices. On Lazarte's death in 1963, the Casa Mauricio Hochschild firm in Arequipa registered rights to Madrigal Mine in its name, operating the mine for a time, until selling the rights to Andes Orientales, a Peruvian prospecting firm. In 1969, Homestake, the U.S. mining company of San Francisco, bought the rights with a Japanese loan, repayable in mineral, and began large-scale development. These developments included the improvement of the Sumbay-Chivay and Chivay-Madrigal links of the Arequipa road network connecting Madrigal. Difficult negotiations with villagers in Madrigal ensued, marked by violence in some cases, to purchase land for an expanding mining camp, a road from the village to the mining camp, and a tailings deposit (*cancha de relave*). Local villagers were employed for surface and tunnel work. The company made considerable efforts to maintain good relations with the local population, pointing out the benefits of the road, better communications, and the opportunities for wage labor.

During its heyday, the mine was considered well run and known for the measures, such as ventilation and medical care, that it took to avoid accidents and prevent silicosis. Nonetheless, it is reported that after six or seven years, workers catch silicosis, an incurable lung disease. They are then assigned to light work or retire to their homes. All workers and their families had access to the mine's hospital and all of its services: obstetric, medical, optical, and dental. Children were permitted to attend the primary and secondary schools at the mine.

13. Rents vary depending on whether the renter resides in Lari or Madrigal.

14. An example of a legitimate private use of the upper communal pastures is Chipta, a mountain that rises up immediately behind Lari. Chipta is clearly perceived as part of the village's heritage. Yet when Lareños discuss family pastures, Chipta is said to be "owned" by the Mamanis. The Mamanis' claim to ownership rests on a legend concerning the family's contribution of volcanic rock (silar) to the construction of the church in Lari in 1758 (Valdivia 1847:122). Silar comes from deposits near Caylloma in the puna above Lari. In view of the Mamanis' generosity, the village assigned the family rights to use Chipta mountain in perpetuity, albeit with the restrictions of communal access. The practice of granting communal land to individuals in thanks for their generosity or exemplary effort on behalf of the common good is not unusual.

15. In a meeting of the irrigation association, for example, "On October 18, alfalfares will no longer be irrigated, and irrigation will move into the seeding" (LA, CR: Oct. 15, 1982).

16. "The irrigation system in all of the sectors is under control (*bajo ordenanza*) only until the last irrigation turn is finished. Once the food crops are suspended, only alfalfa will be irrigated" (LA, CR: Mar. 3, 1983).

Chapter 12

1. See Treacy 1989:57–59 and figure 6.

2. When only one mayordomo volunteers to sponsor the fiesta, he must make two ritual offerings, one for the moiety he represents, and another for the moiety lacking a mayordomo. This is referred to as a *doble pago* and is necessary in order to maintain equilibrium.

3. See LA, SA: Nov. 19, 1969, Nov. 21, 1969, Nov. 27, 1969, Sept. 2, 1971, and Nov.17, 1973.

Chapter 13

1. Fonseca (1983) was the first to recognize the possibility that communal controls over land use could obtain indirectly through communal water management.

2. In the material that follows, I draw extensively on Winterhalder 1991.

3. Discussions of the hydrology of the Colca Valley village of Coporaque are useful in this regard (Treacy 1989; Waugh and Treacy 1986). Material can also be found in ethnographic studies of irrigation in other Colca Valley villages: Paerregaard 1991; Gelles 1990; and Valderrama and Escalante 1988. Irrigation systems elsewhere on the western escarpment have been studied by Holmes 1986; Echeandia 1981; Montoya, Silveira, and Lindoso 1979; Fonseca 1983; and Gelles 1984.

4. See also: Bunker and Seligmann 1991; Seligmann 1986; and Bolin 1991.

5. These discoveries are, as yet, restricted largely to archaeological remains of abandoned systems (Erickson 1988; Denevan, Matthewson and Knapp 1987). Zimmerer (1991) and Flores Ochoa (1987) provide two recent ethnographic accounts.

6. See Echeandia 1981 (San Pedro de Casta); Fonseca 1983 (Cañete Valley); Mitchell 1976 (Ayacucho); Gelles 1990, Paerregaard 1991, Valderrrama and Escalante 1988 (Colca Valley); Bunker and Seligman 1987, 1991; Seligmann 1986 (Huanoquite); Adams 1959 (Mantaro Valley); and Bolin 1990, 1991 (Vilcanota Valley).

7. Another example of an acephalous water management system is the drained-field system of Qolquepata on the eastern escarpment (Zimmerer 1991). Household or reciprocal labor is sufficient for construction and maintenance of the fields, conflicts

involving others are few, and the system requires no centralized scheduling or coordination.

8. According to Hunt, "the total recorded number of systems with no constituted authority is no more than fourteen" (1988:345). See Netting 1974 for an ethnographic example.

9. See Maas and Anderson 1978 for material on Spain and the United States and Renfro and Sparling 1983 (cited in Coward 1986:496) for Pakistan.

10. Many highland communities control their own source of water and operate bounded independent irrigation systems. Miquiyauyo (Adams 1959: 126–27) and San Pedro de Casta (Echeandia 1981) are representative.

11. The interaction of local irrigation associations and the state has been discussed extensively in the literature. Eva and Robert Hunt (1976:133) employ the term "centralization" to refer to the articulation of local water management functions with a state-supported and legitimated irrigation hierarchy. An unarticulated local system would, in their view, be decentralized and autonomous. The degree to which local water management is linked to, or independent of, the state is characterized by Kelly with the concepts "articulation and autonomy" (1983:883).

12. For example, Bunker and Seligmann (1991) document the history in Huanoquite of successful attempts by local elites and hacendados to contest water claims in the courts and ministry offices.

13. One example is the successful legal struggle over many years by the Colca Valley community of Cabanaconde to keep wealthy forastero families from access to water to irrigate illicitly obtained land (Gelles 1990:260).

14. Overt and covert resistance to government intervention is a theme of studies by Paerregaard (1991) and Bolin (1991).

15. In Yanque, "the quantity of topos each *campesino* possesses is recorded (in the padrón de regantes) and assumes importance during irrigation faenas. Participation in faenas is assigned according to the quantity of land each domestic unit possesses. While the community annually sets the fine (for no-shows) and the work schedule, it is customary to require from each worker a day of work for every two topos of land he possesses. In these circumstances, it is recalled who are 'minoristas' and who are 'medianos'; the term mayorista is generally associated with mestizo and is used as an accusation among campesinos, which does not exclude campesinos from the 'mayorista' category" (Valderrama and Escalante 1988:37, my translation).

16. Puquio has been the subject of extended fictional and ethnographic treatment. The Peruvian novelist and ethnographer José Maria Arguedas used Puquio as the subject of a novel *Yawar Fiesta* in 1941 and later conducted focused ethnographic research there (Arguedas 1941, 1956, 1968). The material on which I draw comes from Montoya, Silveria, and Lindoso 1979 and Montoya 1980.

17. The history of the peasant community of San Agustín-Huayopampa and its shift to market-oriented tree crop production was the theme of a classic study in 1968 (Fuenzalida et al. 1968). A second edition published in 1982 contained a revision of the original updated through 1980.

Glossary

The words and phrases listed are appropriatly identified by language: S is Spanish, Q is Quechua.

Acequia (S) - Irrigation canal. *See* Yarqha.

Anchaca (Q) - Bench terrace.

Bofedal (Q) - Seep.

Cabecilla (S) - Foreman of a work crew (*cuadrilla*). Head of a family pasture corporation.

Cabecera (S) - Head. The uppermost point of a *toma*, closest to the offtake (*see* Culata).

Capitán (S) - Foreman of the work crews organized during corvées held to maintain irrigation infrastructure.

Ch'ampa (Q) - A stone or clump of sod or earth used to close a canal.

Chulluchiy (Q)- *See* Remojar la tierra.

Comisión de regantes (S) - Irrigator committee. Village-level administrative body created by the 1969 Water Law.

Compuerta (S) - Sluice gate to control the flow of water into a reservoir.

Corte de agua (S) - Action taken to cut off access to water.

Cuadrilla (S) - Work crew. Labor organization used in construction and maintenance of irrigation infrastructure such as canals and reservoirs.

Culata (S) - Tail. The lowest point in a toma, the last to get water. The distal end of a canal. *See* Cabecera.

Escarbo de acequia (S) - Canal cleaning.

Estanque (S) - Reservoir. Traditional reservoirs are excavated depressions into which water flows from a canal at night to be used for irrigation during the day. *See* Cocha.

Faena (S) - Traditional pan-Andean form of corvée labor.

Filtración (S) - Water that overflows saturated upper terraced fields and may be used for the irrigation of lower fields.

Fuente de agua (S) - A source of ground or surface water; e.g., spring or lake.

Hoya (S) - Spring fed sunken field that can support agriculture without irrigation, but is frost ridden.

Humareo (S) - Second irrigation after seeding. *See* Kellua.

Juez de aguas (S) - Water judge. Official of the Ministry of Agriculture in Chivay.

Kachu (Q) - Forage, usually produced from a rain-fed plot.

Kalcha (Q) - Drainage canal engineered into the face of a terrace to direct overflow onto the next terrace.

Kellua (Q) - First application of water to prepare field for seed germination.

Killa (Q) - Scratch canal cut with a shovel to spread water onto a plot while irrigating. Synomym is Melga (S).
Levantamiento de agua (S) - Initiation of the irrigation cycle.
Majuelo (S) - Newly seeded alfalfa that is allowed to be seeded once or twice during the regular seeding period.
Manantial (S) - Spring.
Mayorista (S) - Large landholder, with more than 5 hectares in one toma.
Melga (S) - *See* Killa.
Menorista (S) - Small holder.
Mita (Q) - A irrigation cycle of ninety days. *See* Turno.
Okho (Q) - Seep. Underground springs rise to surface and can be channeled for irrigation.
Ordenar agua (S) - Distribution of water by a regidor.
Padrón de regantes (S) - (1) Register of landholders kept by the Ministery of Agriculture. (2) List kept by regidor of the order of irrigation.
Pauca (Q) - Water overflowing a terrace used to irrigate a lower terrace.
Pozo (S) - Well; simple collection tank.
Palta (Q) - Third irrigation after Kellua and Humareo to maintain plant growth.
Pukio (Q) - Spring or seep.
Quadrilla (S) - One of four work teams used in corvée labor.
Qocha (Q) - Lake, reservoir, or depression that becomes a lake during the rainy season.
Ración (S) - Allotment of water to an individual. A synomym is *dotacion*.
Refacción (S) - The resurfacing of a reservoir.
Regidor (S) - Water distributor. Cabildo official during colonial period.
Regina (S) - Water distribution meeting attended by a regidor and the claimants to water shares.
Remojar la tierra (S) - Soak prior to seeding. Synomym is Chulluchiy (Q).
Repartir agua (S) - Water distribution.
Repartidor de agua (S) - Name given regidor following the implementation of the 1969 Water Law. Rarely used.
Riego en seco (S) - Initial irrigation of a dry field in preparation for seeding.
Rondar durante la noche (S) - To monitor the flow of water into a reservoir during the night to ensure it fills for the next day. T he responsibility of those whose turn it is to irrigate the next day.
Rueda (S) - A round of irrigation. Usually used with reference to alfalfa.
Sembrío (S) - The initial period in the agricultural cycle when water is allocated for seeding.
Surco (S) - Furrow.
Tapar el agua (S) - Close canal (in order to fill tank).
Tierra eriaza (S) - Abandoned land that lacks access to water.
Toma (S) - (1) A source of water for irrigation such as an offtake from a canal or a spring. (2) Collection of fields irrigated from the same ground or surface water source(s).
Topo (Q) - Indigenous measure of land area.
Turno (S) - A ninety day irrigation turn. Also referred to as mita.

Urusa (Q) - Water is drawn directly from a canal during the day. Yanahua Urusa and Surimana Urusa sectors operate this way, as opposed to Yanahua Estanque.
Usario (S) - Irrigation user.
Usario moroso (S) - User who does not attend regina.
Yarqha (Q) - Irrigation canal. Synomym is Acequia.
Yarqha madre (Q, S) - The "mother" canal of Lari whose origins are in the Chaico seep above the village.
Yuntada (S) - (1) The area of land that a team of oxen (*yunta*) is able to plow during one day. (2) A unit of measure used in allocating water.

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