

LAND USE, SETTLEMENT PATTERNS, AND COLLECTIVE DEFENSE IN THE TITICACA BASIN: THE CONSTITUTION OF DEFENSIVE COMMUNITY

Elizabeth Arkush
University of Pittsburgh
arkush@pitt.edu

INTRODUCTION

This paper starts from the hypothesis that “community” in the Andean highlands in the Late Intermediate Period (LIP) was not only based on kinship and territory, but also on collective defense, including the defense of important common resources. If so, how would the activities of farming and herding have affected the practical organization of defense, and the formation of social communities based in part on common defense? This paper ventures on a preliminary exploration of this question, drawing on the archaeological record of the Peruvian Titicaca Basin. Notwithstanding many basic cultural similarities among LIP Titicaca Basin societies, there are dramatic environmental contrasts across this large region, supporting more-agricultural lifeways in some places and more-pastoral lifeways in others. There are also significant differences across the region in LIP settlement patterns, and in the frequency, size and spacing of defensive hillforts (*pukaras*). These contrasts suggest that the social organization of defense was partly shaped by how grasslands and *bofedales* (wetlands), terraces and farmlands, and the daily and yearly cycles of herding and farming pulled generations of LIP people to move and settle across the landscape.

DEFENSIVE COMMUNITIES IN THE ANDES

Communities exist at different scales, and are created and defined in different ways (see, among many others, Acuto *et al.* 2014; Becker 2017; Canuto and Yeager 2000; Janusek 2002; Reycraft 2005). One of the most important of these logics is common defense (Roscoe 2013), although it arguably gets less attention in archaeology than other mechanisms of community, such as kinship (and fictive kinship), co-residence, economic interdependence, the transmission of knowledge and skills, shared religious practice, or stylistic affiliation. Even archaeologists who study war, though they pay a great deal of attention to the material technology of defense (*e.g.* weapons, fortifications), attend less to what we might call the “social technology of defense”: the constitution and reproduction of communities whose members could be counted on for mutual aid in times of threat. Yet defensive communities must have been very important in times of threat, shaping other realms of social identity and interaction. What were these defensive communities, in the Andes?

One real possibility is that they were *ayllus*. Andean people from the early colonial period into the ethnographic present lived as members of nested systems of kinship and political organization, in which the *ayllu* was the basic social unit above the family. *Ayllus* are often defined as corporate land-holding groups

composed of multiple families, with collective rights to an *ayllu* territory, sharing an *ayllu* name, who perceive themselves to have a common focal ancestor in the distant past (Isbell 1997; Salomon 1991). In the ethnographic present, *ayllu* membership as a practical matter involves a degree of reciprocity, ceremonial participation, and labor on communal resources such as irrigation canals, roads, schools, etc. (Goldstein 2005; Tschopik 1946). However, the role and structure of *ayllus* have clearly changed over time; for instance, native leadership hierarchies of *ayllus* were transformed through their engagement with overarching Inca and colonial administration (e.g. Platt *et al.* 2006; Wernke 2007). I would suggest that, among their other valences, we should think of ancestral *ayllus* or proto-*ayllus* in late pre-Columbian times as defensive communities.

The defensive importance of *ayllus* would have been closely connected to their traditional role as territorial organizations. *Ayllus* collectively controlled pastures, farmlands, and water sources, and guaranteed usufruct rights for their member households (Cobo 1979:213; Izko 1992, Murra 1968; Platt 1987, Rivera 1978; Salomon 1991; Spalding 1984). Pasture lands in particular were almost always communally owned. Land claims were sometimes connected to oral traditions of founding *ayllu* ancestors who had initially occupied or conquered the land (Salomon 1991; Spurling 1984:48). While collective land tenure has been eroded over the years, some aspects of Andean land use are still managed at the *ayllu* level; for instance, the rotational fallow schedule may be managed collectively, and pastures and fallow fields are often communal resources (Guillet 1981; Orlove and Godoy 1986; Tschopik 1946:515). The territorial rights of communities and *ayllus* are nowadays often physically marked by boundary walls, cairns (*mojones* or *linderos*), or other border markers (Erickson 2000). Thus, *ayllu*

land rights have been conceived of as *collective* (at least to some degree), and also *exclusive*. Infringing on the lands of another *ayllu*, most often by grazing animals on their pastures,¹ was considered a legitimate cause for violence; conflicts between *ayllus* over land frontiers erupted repeatedly throughout the colonial era and in recent times (e.g. Arnold and Yapita 1996; Izko 1992). In times of conflict, territorial defense was typically a collective responsibility for *ayllu* members, as it is in so many ethnographic cases of tight-knit communities cross-culturally (Roscoe 2013). Indeed, according to Tristan Platt (1986:235–236; 2009:21), participation in warfare among the Macha of Bolivia is traditionally conceptualized as a form of collective labor responsibility to the *ayllu*, and people use the very same linguistic terms for collective violence as they do for communal labor. In twentieth-century land wars in the Bolivian altiplano discussed by Arnold and Yapita (1996), alliance between *ayllus* was conceptualized as *ayni*, or reciprocal labor service. Both these cases imply a strongly-felt sense of reciprocal duty in the responsibility to fight, whether as a member of an *ayllu* or as a partner in an alliance between *ayllus*.

Did these patterns pertain in the pre-Columbian past? The defensive hillforts (*pukaras*) of the Late Intermediate Period do sometimes seem to be linked with specific territories, especially where productive lands were scarce and widely spaced: for instance, Tarragó (2000) discusses large, distinctly separate communities in northwest Argentina anchored at hilltop *pukaras*, looking down upon their discrete productive territories of water sources and irrigation works, fields, pasturelands, and the smaller scattered residences of group members who tended to these lands. There is also some

¹ In the mid-twentieth-century, Tschopik (1946:539) noted that there were frequent disputes between neighboring communities in the Titicaca Basin over grazing land.

evidence that territorial rights were based on common descent. In the LIP, the landscape was marked with *chullpa* (mortuary tower) cemeteries, mortuary caves, and other visible tombs that typically housed multiple burials, sometimes commingled, and archaeologists have often looked to these mortuary spaces for clues to meaningful communities or *ayllus* (Acuto 2014; Isbell 1997; Nielsen 2008). According to recent studies, these burial groups do indeed reflect descent groups (Baca *et al.* 2012, Velasco 2016, 2018). And in some regions, there is evidence of a relationship between mortuary architecture and territorial defense. For instance, Mantha's study (2009) of LIP architecture in the Upper Marañón of the northern highlands documents a system of defensible settlements and fortified refuge/lookout sites articulated with mortuary architecture, whose placement on the land, in Mantha's view, invoked territorial claims and territorial defense in a nested (segmentary) kin system. The association of defensive walls with tombs has also been noted in many Andean sites of the LIP (*e.g.* Kesseli and Parssinen 2005; Mantha 2009; Moseley 1990; Nielsen 2008, 2009). These significations are highlighted by the Inca destruction of native *chullpas* (Nielsen 2008). In the early Colonial era, *chullpas* in the altiplano sometimes helped to mark corporate land rights; Hyslop (1977:151–152) notes that Lupaca native lords used a *chullpa* as a boundary marker when defining land to support the new church of Chucuito, and Cobo remarks that *chullpas* in the Bolivian altiplano were placed on the family land of the deceased. Hence, the mortuary practices of the LIP can be broadly interpreted to support what Velasco (2016:69) calls the “corporate group model”, in which visible mortuary structures and cemeteries “cultivate an ideology of exclusion predicated on shared descent, resource rights, and political autonomy, intensifying social boundaries between competing kinship groups.”

But perhaps it is not necessary to project contemporary and historic *ayllus* into the LIP past. Without using that problematic word, we can simply acknowledge that defense was a major concern for people of many parts of the highlands in the LIP, as evidenced by unparalleled rates of defensive settlement, fortification, and violent trauma (Arkush and Tung 2013). My argument is that mutual defense was, therefore, probably fundamental to LIP people's understanding of *what a social group was*, whether we wish to call such groups *ayllus* or not. Moreover, the size and shape of those social groups would have been influenced to a great extent by the practical organization of defense. On whom did LIP people rely defensively? This is the question raised here, with an eye particularly to *scale*, both of population and geography. How big a population was in a defensive group? Where did they live—*i.e.*, how local or how regional was the territory of a defensive group?

This is one of these seemingly simple questions that turns out to be quite complicated (see Roscoe 2013). First, defensive groups and networks probably existed at more than one scale simultaneously. Defensive relationships in non-state societies are commonly multiscalar, with the closest and most dependable bonds existing within a settlement or a cluster of settlements, and alliance relationships with other, more physically distant and perhaps more distantly-related groups providing an additional element of protection, advance warning, or at least, neutralized threat (see, for instance, Angelbeck 2016; Meggitt 1997; Rice 2001; Roscoe 1996, 2009). In the Andes, defense may have been facilitated by segmentary and segmentary-like forms of kinship (Arkush 2014). Segmentary organization is especially common among pastoralists and agropastoralists, and it is well attested in the Andes in the ethnographic present, especially the more pastoral south-central Andes (Albarracín 1996, 2003; Izko 1992; Platt 1986, 1987). Speculatively, the

nested or multiscalar quality of *ayllus* noted by some scholars (e.g, Platt 1986) may have to do with past defensive organization, and not just later Inca and colonial administration (see Arkush 2014).

But suppose, for simplicity's sake, we define the *minimal* defensive community in the Titicaca Basin LIP as the builders, users, and defenders of a single hillfort (*pukara*). Then the question becomes: how large was this social group? How far did its members stretch across the landscape in their daily and yearly cycles of movement and residence? At first glance, the answer might have to do with the nature of conflict—how threatening, how frequent, or how predictable it was. In addition, it might have to do with how people were distributed across the land, and what resources (aside from people) needed defending: camelid herds? Agricultural fields? *Bofedales*? Stored crops? How territorial were these conflicts? That is, the social organization of defense (and offense) probably was related in some ways to lifeways and to resource distribution. In the rest of this paper, I examine contrasts in defensive settlement in different parts of the Peruvian Titicaca basin as a preliminary exploration of this question.

TITICACA BASIN SOCIETY IN THE LIP

The Titicaca Basin is a high-altitude intermontane basin framed by the Andean cordilleras, whose central feature is the great Lake Titicaca. In early Colonial times, the region, or “Collao”, as it was called then, was known as the seat of large and powerful Aymara-speaking *señoríos* or ethno-political groups (Figure 1), and these accounts have often been projected back in time to characterize pre-Inca (LIP) society in the altiplano. The best known and best studied portions of the region, both from the ethnohistoric record and from LIP and Late Horizon archaeology, are those inhabited by

Lupacas and the western Collas, covering most of the western side of the lake basin down to the border with Bolivia (Arkush 2011; Bouysse-Cassagne 1975, 1986; Brant in progress; Frye and de la Vega 2005; Hyslop 1976; Julien 1983; Murra 1964, 1968; Spurling 1992; Stanish *et al.* 1997). The two groups shared many similarities, although the Lupaca area relied somewhat more on pastoralism and was noted in sixteenth-century sources for its vast herd wealth (Graffam 1992; Murra 1968). Garci Diez de San Miguel's very informative 1567 *visita* of the Lupaca area portrays a populous group organized in a dual leadership structure under hereditary native lords, corresponding to two ranked moieties (Diez 1964, Murra 1964, 1968). There were seven Lupaca provinces, and each in turn was composed of several *ayllus* belonging to one or the other moiety. In both the Lupaca and Colla areas, society included respectable “Aymaras”, who held land and flocks, and an underclass of Urus, described as poor, landless fishermen (Diez 1964; Toledo 1975 [1583]). The chronicles recount that in pre-Inca times, both Collas and Lupacas were embroiled in incessant wars, especially with each other (Betanzos 1996 [1557]; Cieza 1985 [c. 1553]).

Archaeological research in the Peruvian Titicaca Basin confirms the accounts of warfare in LIP times, while finding less support for large-scale political unification into *señorío* polities, and little evidence for elaborate social hierarchies (Arkush 2011, Frye 1997, Frye and de la Vega 2005, Stanish 2003). LIP people inhabited both defensive and non-defensive sites of a variety of sizes. The biggest population centers are all *pukaras* or hillforts (La Favre 2016:131): densely occupied settlements located on the crests of hills, ridges, and flat mesas, defended by multiple walls on the vulnerable sides (Figure 2). There are also smaller hillfort settlements, and small settlements that are unwallled but defensibly situated on hilltops and ridges. At well-preserved hilltop sites, dozens and sometimes hundreds of

circular houses or house foundations are visible on the surface. The LIP settlement pattern also includes many small non-defensive sites at lower altitudes; they rarely have surface architecture still remaining, and are detectable as surface ceramic scatters. These sites are often distributed fairly close to hillforts and presumably “belonged” to them in some sense. Tombs are found grouped in cemeteries elevated on rocky outcrops, low knolls, ridgelines, and cliffs, sometimes just outside large habitation sites. There is a variety of tomb types dating to this time in the Titicaca Basin, from impressive *chullpas* to small cists marked on the surface with a ring of slabs, and different tomb types are sometimes present in a single cemetery.

LAND AND LAND USE IN THE TITICACA BASIN

In the Titicaca Basin, rainfall is relatively plentiful compared to the Bolivian altiplano further south; both farming and herding are mainstays, and have been since the mid-Holocene. However, there are significant contrasts across this large region in the opportunities the land affords for farming and herding and the relative importance of these activities in late pre-Columbian times. These regional contrasts provide an opportunity to explore how farming, herding, and related settlement patterns may have influenced the social organization of defense and the constitution of LIP communities.

At the transition from the Middle Horizon (MH, c. A.D. 500–1000) into the LIP, there were dramatic changes in land use, probably associated with drought and the risk of crop failure. Middle Horizon populations, like their Formative ancestors, had clustered in large settlements near heavily managed and amended field systems, including raised fields and managed *qochas* (shallow seasonal ponds; both systems relying on complex water management and canalization), lake-edge fields, and large

hill-base terraces (Albarracín 1996; Bandy 2005; Erickson 1993; Flores *et al.* 2012; Graffam 1992; Janusek and Kolata 2004; Stanish 2006). These field systems are located in what relatively low elevations the Titicaca Basin has to offer, typically near Lake Titicaca or other smaller lakes, which have a moderating effect on local temperatures. Chenopods and tubers were the mainstay crops in this high-altitude region (Bruno 2014). In addition, camelid raising was an important component of subsistence; there is extensive evidence of camelid exploitation from Tiwanaku and other MH sites, as well as earlier Formative sites (Browman 1989; Moore 2011; Vallier 2016; Vining 2016). In settlements near the lakeshore, fish exploitation was also significant (Capriles 2014 *et al.*; Moore 2011).

With the collapse of Tiwanaku and the transition to the Late Intermediate Period, intensive forms of cultivation lost ground to more extensive, risk buffering strategies. Settlement patterns in multiple areas document a general shift towards settlement dispersal and higher-altitude locations, often adjacent to hillslope terraces and fields on rolling uplands (La Favre 2016; Stanish *et al.* 1997). Some raised-field systems were apparently abandoned at this time (Janusek and Kolata 2004; Stanish 2003:207–208; but see Graffam 1992), and at least some hillslope terrace systems were built in the LIP (Langlie 2016). Terraces were certainly being *used* at this time: many LIP hillforts are surrounded by substantial terracing. Possibly, the more dispersed settlement patterns may have been connected to field scattering to reduce risk (Goland 1993). The generally higher elevation of settlements also points to more reliance on pastoralism in the mix of strategies, and indeed, ample camelid bone remains are present at LIP sites such as Ayawiri and at Pukara de Khonko (Zovar 2012). Relict corrals and enclosures are sometimes located within or just outside LIP *pukaras*. These shifts in land use may have been a response to drought and a rather volatile

climate (Abbott *et al.* 1997; Thompson *et al.* 1985). They conform in broad strokes with a general reorientation of subsistence in the Andean highlands towards risk mitigation and greater self-sufficiency (Browman 1987; Covey 2008:319).

In the LIP, then, most people in the Titicaca Basin would have been mixed agropastoralists, raising camelids and cultivating crops on rain-fed terraces and open fields on gentle slopes. Of course, as many authors have noted, Andean “mixed agropastoralism” spans a wide range; at one end were primarily farmers who kept a few camelids, grazing them especially on fallow or harvested fields; at the other, primarily pastoralists with large herds exploiting extensive grasslands, but who also cultivated a few fields (Browman 1989). The varied human and environmental landscapes of the Titicaca Basin spanned that range. Although there are vast expanses of flat land, surprisingly little of it is cultivable using traditional techniques (Erickson 2000; Stanish 2006). Cultivation was particularly constrained by altitude, affecting night temperature; by rainfall; and by the availability of suitable slopes for terracing and cultivation. These factors can be mapped in crude fashion by looking at the presence and absence of ancient terraces and enclosed fields across the Titicaca Basin. (While the construction and use of these terraces and fields remains almost wholly un-dated, we can still use them to make general conclusions about what parts of the landscape were *never* cultivated.) Such fields are common at altitudes up to about 4050 masl. Higher altitudes (up to 4150 masl) occasionally also have terraces or enclosed fields, but much more rarely. Those locations are more subject to frost and the soils are thinner, meaning that frost-resistant varieties such as kañawa (*Chenopodium pallidicaule*) and “bitter” potatoes, longer fallow, and manuring may be necessary to ensure output. The most frequently terraced and enclosed

lands—presumably the most preferred lands—are lower-altitude hill-slopes on lake margins, and hill bases or low hill-slopes below about 3950 masl. Slope also affected the choice of land for cultivation. Terraces occur on slopes between about fifteen percent and fifty percent. Rolling hill-base land at a slope of about five percent to fifteen percent, while it is not terraced, is frequently enclosed and cultivated. The same is sometimes true for gently rolling uplands above 3950 masl. Flat land on the plains is now being actively farmed with tractors and disc plows in many parts of the Titicaca Basin, but this land would have been unproductive prior to modern mechanized plowing.² The long fallow required in traditional altiplano farming meant that in any given year, only a fraction of cultivable land was in production—more in the richer lakeside soils, less in the hill-slopes and uplands. In general terms, the extensive cultivation strategies in the LIP pulled populations towards more dispersed settlement patterns.

Pasturage is much more widely distributed in the Titicaca Basin, but it, too, is variable in value. Especially rich pasture is found on the margins of lakes, rivers, and seasonal ponds, and in wetlands fed by springs that seep from the faultlines in hills. Camelids are also pastured on fallow fields, enriching these fields with manure in the process.³ While alpacas are more selective

² In the mid-twentieth century, Tschopik (1947:513) reported that land on the flat plains was the least desirable because of heavy soils, poor drainage, and frost. This is supported by air photos from the 1955 national Peruvian mapping project, which show almost no cultivation on flat plains in the altiplano region at that time (including on relict raised fields).

³ Langlie’s study (2016) of botanical remains from Ayawiri, including from oven contexts where burned dung was probably the source of much of the carbonized plant remains, suggests that camelids were mainly pastured on fallow and harvested fields near the site itself, rather than in the wetland ecozones near the base of this hill and farther afield. This strategy may have helped Ayawiri’s population

about pasturage than llamas and strongly prefer *bofedales*, LIP camelid production was probably practiced more for meat than specialized wool production, meaning that we should not assume LIP herders were restricted to *bofedales*. Anthropogenic modifications to the landscape for pasturing are less visible than terraces, and have barely been studied in the Titicaca Basin. In this paper, greater reliance on pastoralism is assumed in the *absence* of cultivable land.

The limits on farmland posed by altitude and rainfall produce marked contrasts across the Titicaca Basin (Figure 3). On the left, the figure shows *potential* terrace and enclosed-field land in green and yellow, defined as hill flanks and rolling terrain with slope between four percent and fifty-five percent, at altitudes up to 4050 masl. Much of this land was not, in fact, cultivated. The figure on the right shows average total precipitation during the growing season (November to April), with higher rainfall especially favoring cultivation. It is clear that arable land is quite patchily distributed. Some of these regional contrasts are evident in early colonial tax assessments, which document great variation in the products that Andean populations had to provide to Spanish overseers. For instance, in Viceroy Toledo's *tasa* of 1570 (Toledo 1975 [1583]), populations in the far northwest end of the lake basin paid no tax at all in agricultural products (*chuño*)—only in animals and wool cloth (Figure 4). This does not necessarily mean they were “pure” pastoralists, just that they did not produce enough crop surplus to be worth the taxing. Conversely, many populations adjacent to the lakeshore, especially those on the eastern side of Lake Titicaca, owed no tax in livestock.

keep flocks and herders near the protective walls of the pukara, while also fertilizing the local terrace fields that were critical to the community's survival.

THE SAMPLE ZONES

To explore these contrasts, we can examine four sample zones on the Peruvian side of the lake (Figure 3): 1) the southwest basin in the Lupaca heartland, around the important site of Cutimbo; 2) the Lago Umayo/Vilque area west of Puno, near the historic Colla heartland; 3) the lower Huancané River Valley north of Lake Titicaca, also called “Colla” in early documents, but belonging to the eastern, or Umasuyu side; and 4) the western Melgar area around the modern town of Umachiri, which historically was land of the Canas. The zones defined are large blocks twenty kilometers on a side (each covering four hundred square kilometers), large enough to say something about presence and distribution of *pukaras*. The last of these regions has not been the subject of full-coverage archaeological survey, but the others have, a fact which greatly aids in understanding settlement and land use. While these surveys had different methodologies and standards for reporting, the broad-brush patterns are fairly clear. In addition, information from our excavations at Ayawiri (Arkush 2018; Arkush and Paredes 2012a, 2012b) sheds light on the Umayo zone.

These zones contrast a great deal in their agricultural and pastoral potential (Table 1). The Huancané and Umayo zones are both in agriculturally productive areas with expansive systems of terraces and gently sloping hill base fields. In these zones, camelid herding was also surely practiced in the past, as it is today. The Umayo zone has particularly rich pasture areas in the Vilque River Valley and associated *bofedales* on the west of the sample zone and around the margin of Laguna Umayo, which retreats significantly in dry years, especially on the shallow west side. Huancané, with more narrowly incised rivers and few *bofedales*, offers less natural pasture, although a large area of artificial *qochas* would have expanded the possibilities for grazing. Nevertheless, it is noteworthy that in Toledo's

1570 assessment, no livestock were required in tax from the populous Huancané *repartimento* (administrative taxation district). For independent evidence of LIP subsistence in the Umayo zone, we can look to our excavations at the site of Ayawiri. This site is perched on a flat tableland above flights of ancient terraces, with a rich *bofedal* just to the south and west. In excavations in several residential compounds at Ayawiri, both chenopods and camelid bone were plentiful in every compound, and charred tuber flesh was also recovered. Clearly, the inhabitants of Ayawiri had robust access to both crops and camelids.

When we turn to the Cutimbo and Melgar (Umachiri) sample zones, cultivable lands are much more restricted because of altitude and temperature, even though precipitation is more plentiful, especially in Melgar. There are some areas of relict terraces in these zones, but they are very patchy. These are both regions in which rural production today focuses strongly on livestock rather than farming. The Melgar zone in particular has extremely scant cultivable land, but excellent pasturage. In Toledo's assessment of the early 1570s, no crops at all were taxed from the *repartimentos* in the Melgar zone, and the populations were some of the lowest reported in the region (Table 1).

Hence, the four sample zones span a gamut from almost pure pastoralism in Melgar, to the Cutimbo region where pastoralism was dominant, to the Umayo area where cultivation was important as well as herding, to Huancané, where cultivation was probably dominant.

There are also big contrasts in the frequency, size and spacing of *pukaras* in these four zones. Because these are such large areas, the data I draw on here are of variable quality, and sometimes less than ideal. I have scoured each sample zone carefully for identifiable *pukaras* in satellite imagery on Google Earth,

using both current and slightly older images to draw on different high-resolution commercial satellite sources. In the course of my dissertation research in 2000–2002, I also examined air photos from the 1955 project at the Servicio Aerofotográfico Nacional for an area that covered all zones. All *pukaras* mentioned in the published literature are incorporated into these maps. In three cases out of the four (all except Melgar), a portion of the zone has been covered by complete pedestrian survey, and *pukaras* reported in those survey reports or other products are also included in the text below, as is additional data on settlement distribution. Over the years, I have visited and ground checked about a quarter of the sites included in this discussion. This includes sites in all four sample zones; however, I am much more personally familiar with the Umayo and Cutimbo zones than the Huancané or Melgar zones, and can make more confident statements about the former two areas.

Because *pukaras* are hilltop sites and their walls are long linear features, they can be identified with a fair degree of confidence in satellite images and air photos (Figure 5). In addition, other surface architecture is sometimes visible in satellite imagery and on the ground *where pukaras have not been farmed*. Freestanding circular house structures or house foundations can be identified, and often counted. (Houses differ somewhat in construction across these areas, but they are almost always circular and are about the same size, c. 3 to 4.5 meters in diameter.) Houses are clustered in walled compounds or on well-defined terraces, also easy to identify on the surface. Even when a *pukara* has been farmed, these walled domestic compounds are usually visible, for they define the course of later field walls. Other identifiable features include corrals, walled paths, and “empty spaces”.

Here, the LIP archaeology of these sample zones is discussed in turn, moving from south to north, with quantitative measures summarized in Table 2.

1. *The Cutimbo zone* (Figure 6) fell close to the heartland of the historic Lupaca group and was home to several important Lupaca sites, which were initially reported in Hyslop's groundbreaking study (1976). Most notable among them was Cutimbo, which Hyslop postulated was something of an LIP Lupaca political capital, although there were several other Lupaca LIP sites in the same size range. The northeastern portion of the zone was covered by Frye's full-coverage Chucuito-Cutimbo survey of 1994–1995, the results of which are summarized in Frye and de la Vega (2005) and Frye (2005).

Given the low agricultural potential of this zone, it is not surprising that Frye reports a relatively low LIP settlement density. Including fortified sites, there are approximately 0.3 hectares of LIP settlement per square kilometer of land surveyed, and about 0.17 habitation sites per square kilometer of land surveyed, lower than the more agricultural zones of Umayo and Huancané.⁴ *Pukaras* are also comparatively few in number in the study zone: seven separate

pukaras can be identified.⁵ Since there are so few *pukaras*, they are spread quite far apart, at an average of nearly six kilometers from the closest neighbor.

Nevertheless, these *pukaras* are quite large, with a mean walled area of 17 hectares and a maximum of 34 hectares. They had strikingly large populations, as well. At least four sites are large, densely occupied settlements with hundreds of circular domestic structures grouped in large walled compounds. Nuñamarca, in the southern part of the sample zone, has 911 structures clearly visible today, of which nearly all appear in ground-checking to be house (not storage) structures (see Figure 2). They are grouped in approximately 58 walled compounds, located in two discrete occupation sectors on either side of an empty area with no surface architecture. Cutimbo is most famous for its magnificent Late Horizon cut-stone *chullpas*, but it also includes many circular foundations that are almost certainly LIP house structures (Frye and de la Vega 2005:178–180). Frye and de la Vega's careful map of the site shows about 1350 circular structures corresponding well to more recent satellite imagery. In ground-checking, most of these structures appear to be houses rather than storage structures, so the total house census at Cutimbo is probably larger than Nuñamarca, but not by very much. Compounds

⁴ All LIP sites are included, not just *pukaras*. For Frye's entire survey area of approximately two hundred square kilometers, which overlaps, but extends beyond the zone discussed here, LIP settlement density is higher. The figures cited here are for the "agropastoral zone" corresponding most closely to the sample zone, and estimated at approximately one hundred and fifteen square kilometers (see Frye 2005:200, figure 13.1). Frye reports total (summed) site area separately for "habitation sites" and "fortified sites", but it is clear from limited excavation that fortified sites with circular architecture such as Cutimbo were indeed occupied (Frye 2005:203, Frye and de la Vega 2005:178–180). Here, a conservative twenty-five hectares is added to the reported total for "habitation sites" to account for the fortified sites of Chaata and Cutimbo within Frye's survey area.

⁵ *Pukaras* are a little problematic to define in the Cutimbo zone, where they consist mainly of natural flat mesas ringed by cliffs, minimally supplemented by walls. However, the site identifications here fit well with Frye's reported data. In this discussion and in the count of *pukaras*, I do not include several unfortified, naturally defensive mesas with little to no apparent occupation that could have been used as defensive refuges. Among the *pukaras* included here, there are three cases that each consist of a "pair": two closely adjacent but separate walled peaks on the same ridge-line, less than two hundred meters apart. In one pair, these separate areas are connected by an additional wall. I have chosen to "lump," or treat each pair as one *pukara*, on the assumption that they were used by the same defensive community.

at Cutimbo are harder to define, but there are at least 30. Two additional *pukaras* in this study zone that I have not visited, Cerro Ayuncora (Figure 5A) and Chaata, have at least 150 circular structures visible in satellite images, and probably closer to 300 each. From these house counts, we may reasonably estimate that a single *pukara* in this zone, if fully occupied, would have housed from about 400 people, up to perhaps 3000 at the largest centers of Cutimbo and Nuñamarca.⁶

On the other hand, this region also includes some fortified hilltops and mesa-tops that are almost empty of architecture, or sometimes have a few corrals visible in the defended areas. Three of the *pukaras* in the study zone, and several more just outside its edges, appear to be refuges, sites with little or no domestic surface architecture. (This observation corresponds well to Frye and de la Vega's [2005] description of both large, densely occupied fortified sites and empty refuges.) Such refuges could have been used as temporary redoubts to which an otherwise unprotected population could flee, but they also could have protected camelid herds. Indeed, even those *pukaras* with substantial domestic architecture also have large expanses of empty space within the walls, possibly for camelid herds. This means that even in the large occupied *pukaras* of the Cutimbo zone, the number of house structures per hectare of walled area is quite low.

⁶ Our excavations at Ayawiri showed that house structures could be classed into two major types: those with and without a clay oven for cooking. This fact implies that a nuclear family often used more than one house structure (Arkush 2018). Similar results are reported by Frye and de la Vega for *pukaras* in the Lupaqa area (2005:180). Population estimates given here, which should be considered conservative, apply a rule of thumb that the population was between 1.5 and 3 times the number of house structures.

2. *The Umayo sample zone* (Figure 7) was close to the heartland of the Colla ethnic group and housed important Colla sites, most notably Sillustani, which may have been a major LIP political and population center (Brant in progress), and today is an important tourist destination. The northern part of this zone, including just around Laguna Umayo, is intensively cultivated and manipulated: a wholly constructed landscape of terraces and enclosed fields, much of which appears very old and has been continuously maintained up to the present. The southern portion of the zone is higher in elevation, and less of it is cultivable. Portions of this area have been investigated in my previous research (Arkush 2011, 2018), including in a full-coverage survey of an area seventy-nine square kilometers around the important LIP *pukara* of Ayawiri.

The density of LIP settlement in the small Ayawiri full-coverage survey, which does not even include the richest lands in the Umayo zone, is more than twice that of the Cutimbo zone, and there are over three times the number of LIP sites per square kilometer (Table 2). There were simply more people living in this region. *Pukaras* are correspondingly more numerous: there are twenty-three definite *pukaras* and an additional five possible ones.⁷ (That actually underrepresents the density of *pukaras*, since about thirty-five square kilometers of this zone is covered by Laguna Umayo, where no settlement is possible.) In consequence, neighboring *pukaras* are spaced much closer together, at about 1.9 kilometers apart on average. In addition, more of them were occupied: out of eight in the full-coverage Ayawiri survey, all but one had substantial occupation, including both surface

⁷ *Pukaras* can be a little hard to define in the Umayo zone as well, but for a different reason: there are so many thick terrace walls that it is sometimes hard to distinguish them from relic fortification walls in satellite images (e.g. Figure 5D). Because I have been to many of these sites, I believe the numbers are reasonably good.

architecture and dense surface artifacts. In the broader Umayo zone discussed here, only seven of the twenty-three definite *pukaras* appear empty or very low density, the lowest percentage of all the zones.

Where *pukaras* in the Umayo zone have not been extensively farmed, domestic compounds and houses are visible on the surface, and they indicate populations that vary considerably in size, but never quite reached the level of the great centers of the Cutimbo zone. Smaller *pukaras* have forty to fifty house structures on them; a few in the middle have one hundred to two hundred and fifty, and the largest, Ayawiri, has six hundred and sixty house structures. In Brant's careful study (in progress), approximately two hundred and fifty circular house foundations were still detectable on the surface at Sillustani, but many more may have once existed at this heavily altered site. (Storage platforms are also common on *pukaras* in this zone, and probably served to keep tuber crops dry, pointing to the importance of cultivation.) The *pukara* sites are also quite a bit smaller in size than in the Cutimbo zone, averaging only 4.7 hectares, with a maximum of about 12 hectares. There is much less open space within the walls; instead, most of the walled area is taken up with residential compounds and structures. Hence, on average, there are nearly twice as many house structures per hectare of walled area as in the Cutimbo zone. That suggests that there was less need to protect large camelid herds behind *pukara* walls.

3. *The Huancané zone* (Figure 8) also fell within the Colla ethnic group, but on the eastern side of this large region, called Collu Umasuyu in early colonial times. It was a rich agricultural area. The selected sample zone consists of the north-south valley of the Río Huancané and tributary channels, framed by steep hills to the east and west. A large portion of this sample

zone was covered in Charles Stanish's complete pedestrian survey (Stanish *et al.* 2014).

Patterns in Huancané resemble those in Umayo in many respects. Stanish and colleagues (2014) do not report LIP site sizes directly, but from data given in La Favre's appendix (2016), LIP settlement density can be calculated at 0.5 hectare of settlement per square kilometer surveyed: substantially higher than the Cutimbo and Melgar sample zones, though not quite as high as the Umayo zone. These sites are smaller on average than sites in Umayo, so there are actually more LIP habitation sites per square kilometer (0.69, the largest number of any of the zones). The pattern of settlement, then, is of a fairly high overall population dispersed into many relatively small habitation sites.

There are also many *pukaras* in this sample zone, though not quite as many as in Umayo: Sixteen definite *pukaras*, and an additional three probable *pukaras*. Like other habitation sites, *pukaras* in Huancané tend to be quite small, showing both the smallest average walled area and the smallest maximum area of all the sample zones. About thirty-five to forty percent have no, or almost no, surface architecture and appear to be empty refuges. This fits with Stanish and colleagues' report (2014) of a number of *pukaras* with low or no density of occupation. Those that do have well-preserved architecture sometimes have many small, rectangular, tightly agglutinated domestic compounds. Circular domestic structures are present at *pukaras* here, but are not well enough resolved in satellite imagery to count; the descriptions in Stanish and colleagues' report (2014) imply several dozen at *pukaras* such as HU-008 and HU-070. Very little open space is visible at the occupied *pukaras*.

4. *The Melgar zone* (Figure 9), the last of the zones considered here, encompasses the small modern towns of Umachiri, Llalli, and Cupi in the province of Melgar, an area that historically

was occupied by ethnic Cana people (Figure 9). It is a cold, rainy, pastoral area, with very little visible terracing, and less potential for cultivation than any of the other zones. There has been almost no archaeological research done in the sample zone, and no pedestrian survey, so we have no quantitative data about settlement density. It is probably very low.

Pukaras are easy to spot in this region, and they look very different from the other sample zones: they have up to eight or ten concentric walls, sometimes paired with ditches (as in Figure 5B). They are present only in the lower altitudes, near the scant agricultural land in this zone, which implies that *pukara* populations here did rely on cultivation to some extent. There are only eight *pukaras*, and half or more of the *pukaras* appear to have minimal or no domestic architecture (a pattern that continues among *pukaras* that are nearby, but beyond the limits of the sample zone). These *pukaras* are quite large, with an average of 10.4 hectares and a maximum of 21.6 hectares enclosed in the walls,⁸ but a great deal of the walled space is empty. For example, at the steep hill just west of Cupi, where ten concentric walls or wall-ditch barriers enclose 21.6 hectares of land, only seven house foundations could be located in our ground visit. Even “occupied” *pukaras* are much more sparsely occupied than in the Cutimbo sample zone. The largest and most reliable house census is at Pucarapata, which has about two hundred and fifteen house structures clearly identifiable in ground checking, and a handful of storage platforms, huddled in the center of a vast open spread of 18 hectares of walled space. If this *pukara* is taken as representative, it has a house structure density of 12 per hectare of

walled space—much lower than the occupied *pukaras* of the Cutimbo or Umayo zones.

DISCUSSION AND CONCLUSIONS

Certain patterns emerge from these comparisons. As we might expect, there is higher population density (as extrapolated from full-coverage surveys) in the Umayo and the Huancané areas, with their significant agricultural potential, than in the more-pastoral Cutimbo area. Populations in Huancané were dispersed into many relatively small sites, perhaps to accommodate daily routines of farming in the extensive agricultural regimes of the LIP. In Umayo, populations were somewhat more clumped, or nucleated; in Cutimbo, they were low, but much more nucleated. Or, to be precise, habitation sites in Cutimbo are either very small and unfortified, or very large and fortified, perhaps reflecting a palimpsest of occupations composed of periodic (seasonal?) dispersal and aggregation (see also Frye and de la Vega 2005). So, even though pastoralism in the Cutimbo zone supported lower overall populations, it also appears to have facilitated their aggregation into much larger communities—at least, at times.

These general settlement patterns are echoed in *pukaras*. The more-agricultural zones of Umayo and Huancané have denser *pukaras* (more *pukaras*, closer together). More of them appear occupied, but by populations that may not have been very large (except at Ayawiri), and they also enclose smaller areas that are more densely packed with residential architecture. By contrast, in the more-pastoral zones of Cutimbo and Melgar, there are many fewer *pukaras*, spaced farther apart. *Pukaras* in these zones enclose very large areas, with plenty of open, unbuilt space; presumably, they offered protection and sometimes pasture for camelid herds (Hyslop 1976:113). Camelid raiding may have been a major defensive concern in these areas. In Umayo and Huancané, *pukara* walls

⁸ The size pattern of this admittedly small group of *pukaras* is strongly bimodal, with five *pukaras* in the range of two to eight hectares, and three *pukaras* from eighteen to twenty-two hectares.

might also have sheltered herds in times of threat, but those herds must have been smaller.

There are significant implications for defense, alliance relationships, and attack strategies. People in Huancané and, especially, Umayo could have fled more quickly into a nearby *pukara* when needed. It would have been easier for *pukara* inhabitants in Umayo and Huancané to see and signal other *pukara* populations, as well as unfortified settlements, and easier for allied and friendly groups to come to each other's aid quickly. It would probably have been harder for aggressors to move very far across hostile territory on a more densely-occupied and used landscape. On the other hand, each individual *pukara* drew from a smaller geographic "watershed," and especially in Huancané, the populations using them appear to have been rather small. Hence we can envision a more densely-connected web of smaller, more locally-defined defensive communities. By contrast, *pukaras* in Cutimbo and Melgar were relatively isolated centers on an emptier landscape. And because overall population densities were lower, the big *pukaras* in these zones presumably drew from populations that used much larger areas. That is, the "territory" associated with a *pukara* in these zones could have been far more extensive in terms of daily or longer rounds of movement, and perhaps also in terms of who had the ability and the right to seek refuge there. These *pukara* communities could probably rely less usefully on other communities, and had to be more self-reliant when threatened. Because of the relative lack of a population "tripwire" in the surrounding area, communities in these regions could potentially have been more vulnerable to surprise nighttime raids. The defensive strategies taken here are quite interesting. In Melgar, *pukara* populations appear to have been relatively small, but they protected themselves with remarkably impressive fortifications of multiple walls and ditches. In Cutimbo, *pukara*

populations took advantage of high hills and mesas that were naturally difficult to approach, and invested less in fortifications; instead, they aggregated in very large numbers.

Indeed, one of the most interesting points of comparison lies in the size of the human populations that *pukaras* protected, as estimated from house counts. The large inhabited *pukaras* in Cutimbo have astonishingly large numbers of domestic structures. (That is not true for Melgar, where populations would have been the closer to "pure" pastoralism.) And this particular bit of the Lupaca area does not seem to be a fluke; the broader Lupaca lands, especially the pastoral backlands and uplands away from the lakeside, include several other very large *pukaras* with house counts above five hundred such as Tanka Tanka, Llaquepa, and Pukara Juli (Frye 1997, Hyslop 1976). By contrast, in the more agricultural Colla lands to the north, beyond just the Umayo sample zone, there are many other *pukaras* with about one hundred to three hundred and fifty houses, but very few larger than that (Arkush 2011). More tentatively, there may have been differences not just in population size, but population structure, as indicated by compound size and compound house counts. The *pukaras* in the Cutimbo zone have quite large domestic compounds, thirty-five to fifty meters across or even larger, and there may be upwards of twenty house structures per compound. At the best-preserved site in this area, Nuñamarca, the residential compounds that can be clearly demarcated as separate units have house counts ranging from nine to fifty-three, with an average of twenty-three houses per compound. In the Umayo sample zone, at ground-surveyed *pukaras* with good preservation, residential compounds are smaller, around twenty-five meters across, and have much smaller house counts: one to twenty-two houses, with an average of seven to nine houses per compound depending on the *pukara*. (Individual houses are similar in size in these two areas and appear to have been used in

the same ways.) How should we interpret this? Compound groupings presumably reflect understandings of kinship, of who was included within extended family or lineage membership; potentially, they could reflect patterns of polygyny or monogamy. They might also reflect the longevity of compounds, if new houses or house clusters were built as compound families grew over time (see Arkush 2018). We really need much more excavation to distinguish between these alternatives, but it is possible that, in addition to building larger defensive communities, Lupaca people in the pastoral inlands formed or defined larger kin groups.

To conclude, comparisons in the Peruvian Titicaca Basin tentatively support the idea that the size and geographic extent of defensive communities were related to subsistence emphasis (among other factors). Lifeways and land productivity affected overall population density, and the daily and longer-term mobility of populations. Both of these factors affected the number of *pukaras* on the landscape and the geographic catchments these *pukaras* drew from. *Pukaras* in predominantly pastoral regions were fewer and farther between, and potentially drew from populations that used much larger areas; *pukaras* in more agricultural regions were more frequent and served populations who were more local. Defensive strategies may also have responded to the nature of resources that needed protecting. Populations who depended heavily on productive fields and stored crops (heavy, immobile staple wealth) may have had to stay closer to these fixed resources to defend them, potentially leading to more local and dispersed kinds of defensive community. Terrace fields in particular represented significant past labor investments in construction, maintenance, and fertilization. In a climate of threat, these fields may have strongly invested populations in their particular territory, conducing to local forms of defensive community *and* collective land tenure.

Conversely, those people whose wealth lay mainly in flocks could potentially move those animals to strongholds in dangerous times, and nucleate for defense.

The obvious question for future research is whether these tentative patterns are borne out in other regions, including regions beyond the altiplano. For instance, in the Mantaro and Junín area, Parsons and colleagues (1997, 2000, 2013) report a dichotomous LIP settlement pattern, with larger herding sites (with corrals) in the Chinchaycocha area above 3850 masl, and a much more dispersed pattern of small sites (without corrals) in the lower Tarma area below 3850 masl. Perales (2016), in his nearby survey area of the upper Ricran, notes larger and more defensive settlements above 4000 meters with corrals; smaller, more numerous, and generally fewer defensive settlements below 4000 meters. In northwest Argentina, Albeck and colleagues (2018) highlight the contrast between the sparsely-occupied pastoral highlands of the puna de Jujuy, with very few, large, defensive settlements apparently associated with large territories, versus the more numerous and closely spaced *pukaras* of the agriculturally rich Quebrada de Humahuaca. (All these large settlements, even in “herding” zones, were reliant on agriculture to some extent. This is especially clear in the far southern Andean highlands, where aridity placed severe constraints on agriculture: nucleated defensive villages developed only in locations with the potential for reliably productive farming; see Nielsen 2009; Tarragó 2000) Archaeologists of Northwest Argentina (Nielsen 2018; Williams 2018) have recently raised especially interesting questions of seasonal movement from austral winter (dry season) aggregation to summer (wet season) dispersal, illuminated by colonial records describing seasonal movement to higher-altitude refuges and seasonal warfare (Quiroga 2011). Possibly, patterns of *pukara* size and placement in the Titicaca Basin might likewise be related to

practices of seasonal aggregation and dispersal in more pastoral areas, and more permanent residence in more agricultural areas. By and large, we have a good understanding of how specific Andean landscapes of hill-slopes, lakeshores, badlands, and wetlands supported different kinds of productive exploitation, but it remains to be clarified how these landscapes conducted to different scales and shapes of defensive community. The question matters because the social organization of defense would have been fundamental in making late Andean communities, whether in the Titicaca Basin or elsewhere in the Andean highlands.

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Sample zone (each 400 km ²)		Melgar	Cutimbo	Umayo	Huancané
Land within altitude/slope limits for cultivation (as a % of total land)	total	14.7 %	27.4	35.6	42.5
	< 3950 masl	1.8	11	19	22.6
Total precipitation, average across sample zone (mm)	all year	809 mm	752	670	758
	Nov-Apr	718	657	594	636
Tax in head of livestock per tributary, for closest repartimiento, Toledo (1570)		0.176 (Llalli and Umachiri combined, 80 head /455 tributaries)	N/A	0.113 (Hatuncolla, Paucarcolla, and Mañazo combined, 268/2369)	0 (Huancané, 0/753)

Table 1. Environmental contrasts between the sample zones.

Sample zone	Melgar	Cutimbo	Umayo	Huancané
<i>Population and settlement density (LIP only), from full coverage survey</i>				
Source	N/A	Frye and de la Vega 2005 Frye 2005	Arkush and Chávez 2010	Stanish et al. 2014 La Favre 2018*
Surveyed area (km ²)		115 (estimated, "inland agropastoral zone")	79	390
Number of LIP habitation sites (area in ha)		20 (35.85)	48 (57.4)	269 (193.8)
Settlement density (ha/km ²)		0.31	0.726	0.497
Site density (habitations/km ²)		0.17	0.61	0.69
Mean site area (ha)		1.8	1.2	0.72
Pukaras				
Number of pukaras (and possible pukaras)	8	7	23 (5)**	16 (3)
Mean spacing of definite pukaras (nearest neighbor, km)	3.4	5.7	1.9	2.3
Average pukara walled area (ha)	10.4	17.1	4.5	3.32
Max. pukara walled area (ha)	21.6	34.2	11.7	7.45
Min. pukara walled area (ha)	2.1	1.65	1.13	0.44
*Data are for Altiplano II sites, representing peak LIP occupations.				
**Note the raw count of pukaras understates the density in Umayo, because part of this zone is a lake.				

Table 2. Patterns in the size and density of settlements and pukaras in the sample zone.

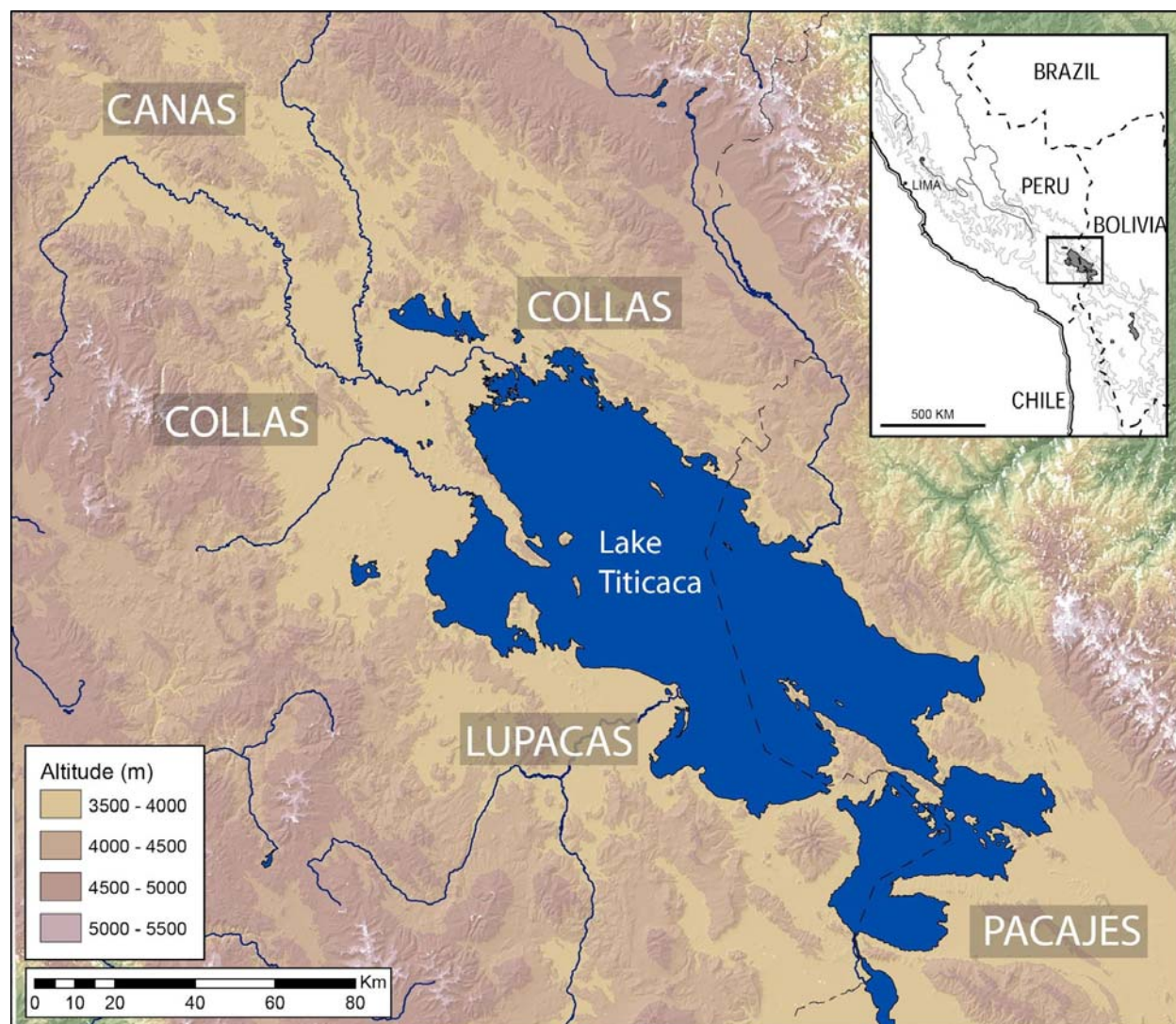


Figure 1. The Titicaca Basin, with major ethnic groups in early colonial times.

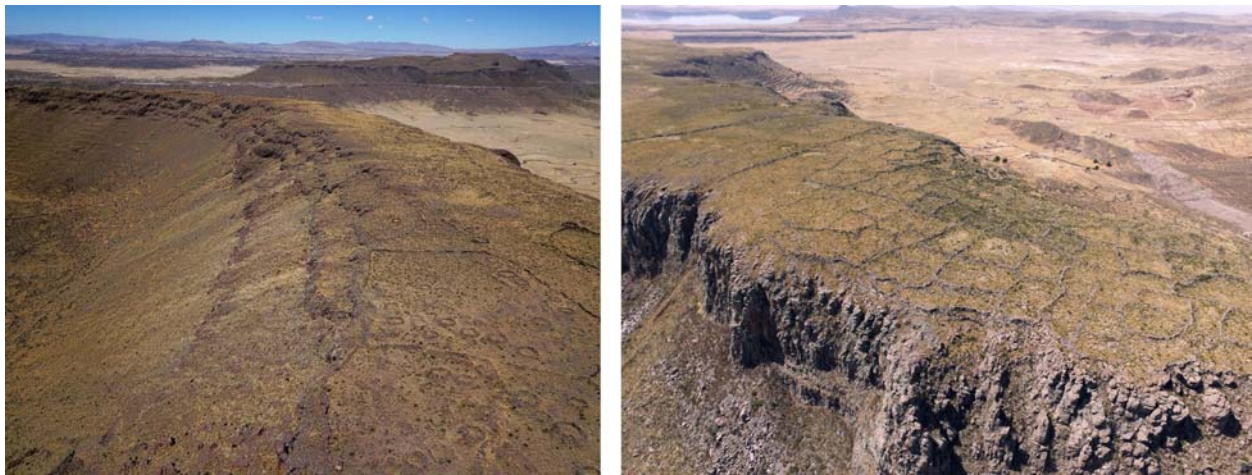


Figure 2. Views of two large pukaras (drone images). Left, Nuñamarca, in the Cutimbo sample zone, with compounds and circular houses visible in the foreground. Right, Ayawiri, in the Umayo sample zone, with compounds visible, and defensive walls at left.

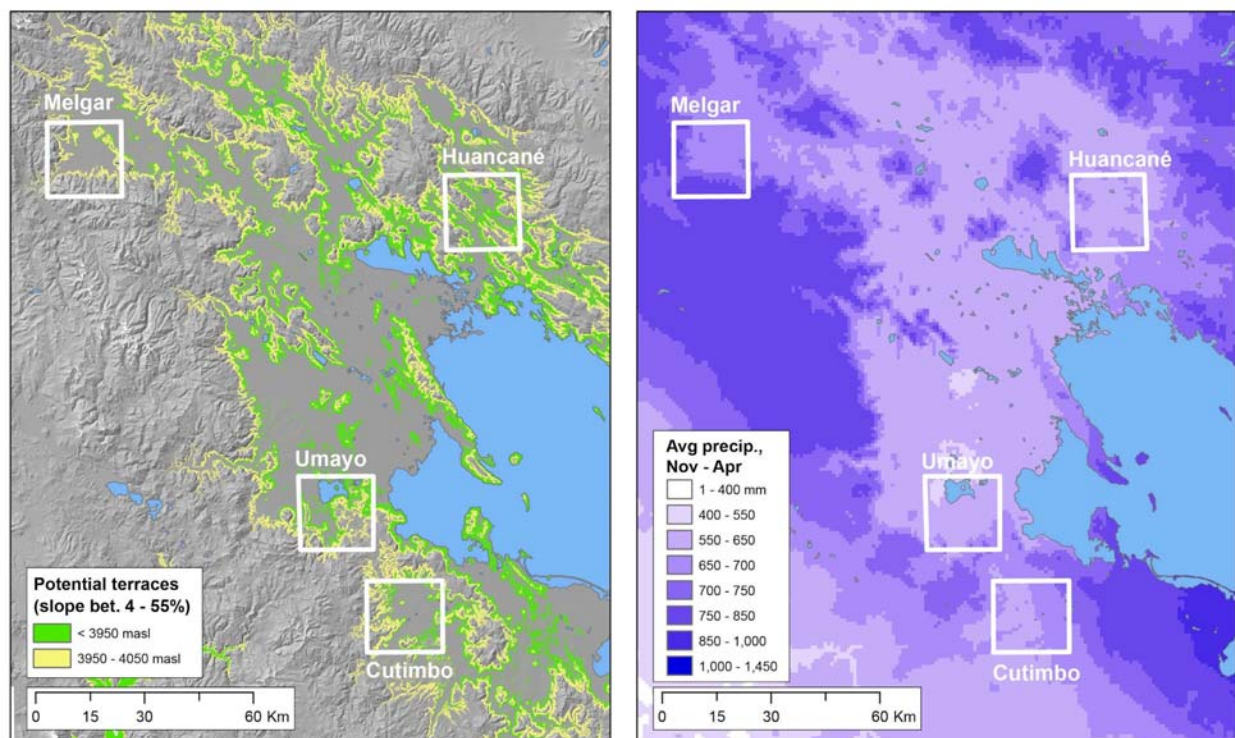


Figure 3. Potential arable and terrace land (left) and average rainy-season precipitation (right) in the Peruvian Titicaca Basin, with the sample zones discussed in this paper overlaid on the map. Slope and elevation data from SRTM; precipitation data from Worldclim 2.0.

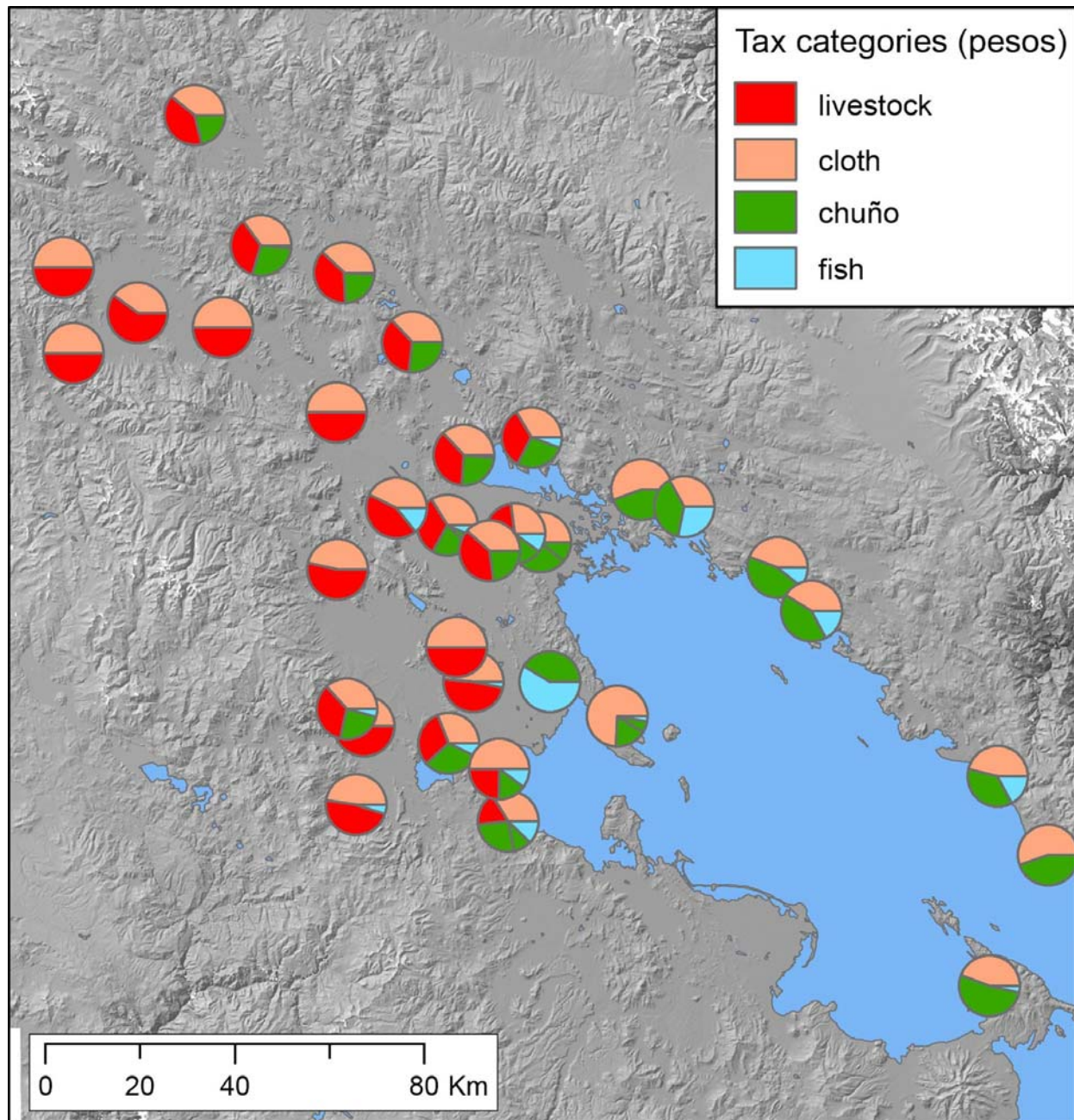


Figure 4. Tax assessments in the 1570 Toledo tasa show regional differences in surplus pastoral and agricultural products. (Maize is not included, because it is more indicative of access to lowland valleys than local production.)



Figure 5. Examples of pukaras in A) the Cutimbo zone; B) the Melgar zone; C) the Huancané zone; D) the Umayo zone. Satellite imagery from Google Earth.

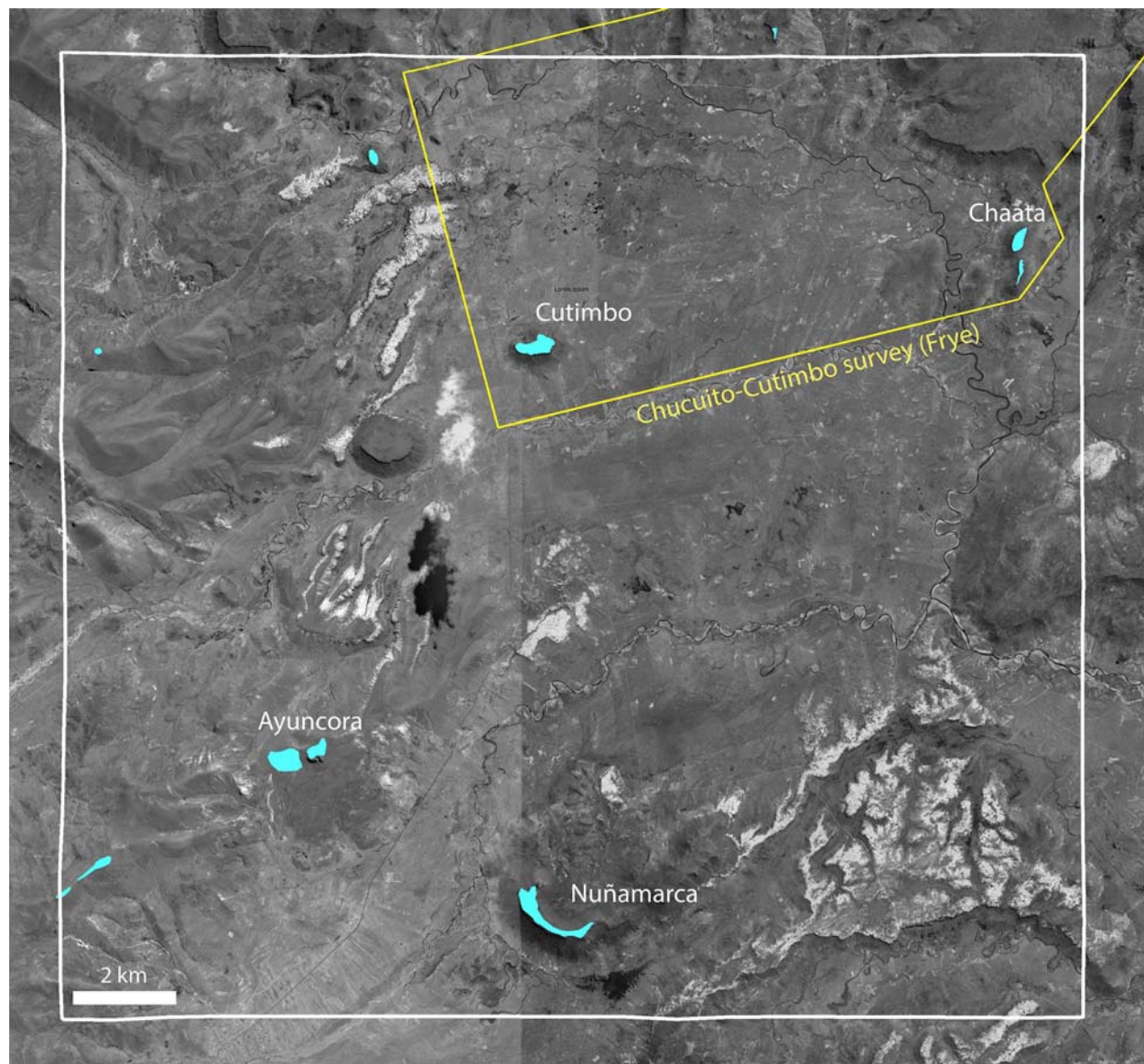


Figure 6. The Cutimbo sample zone, with pukaras shown in light blue.
Satellite imagery from Google Earth.

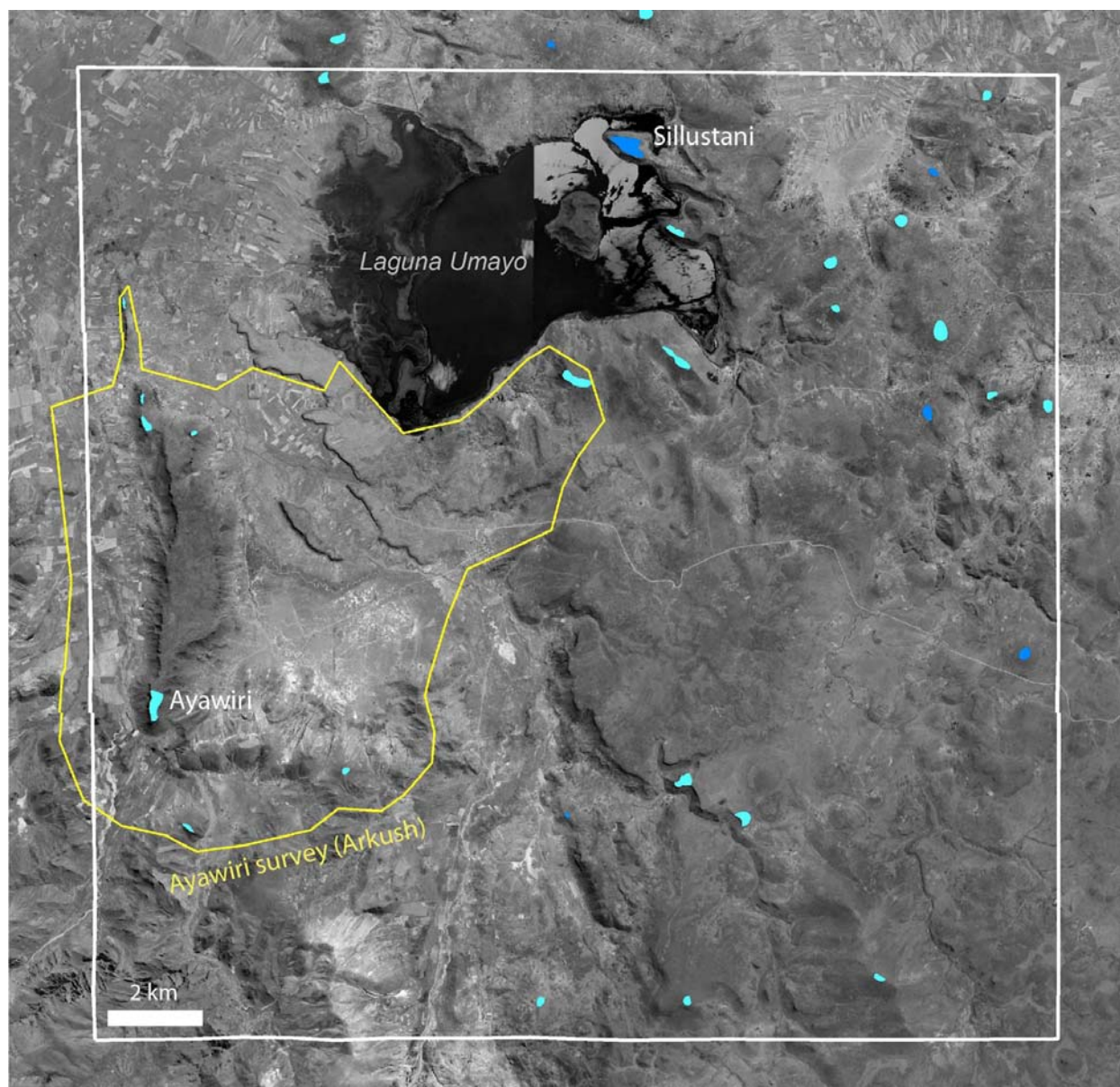


Figure 7. The Umayo sample zone. Pukaras are shown in light blue, and possible pukaras in dark blue. Satellite imagery from Google Earth.

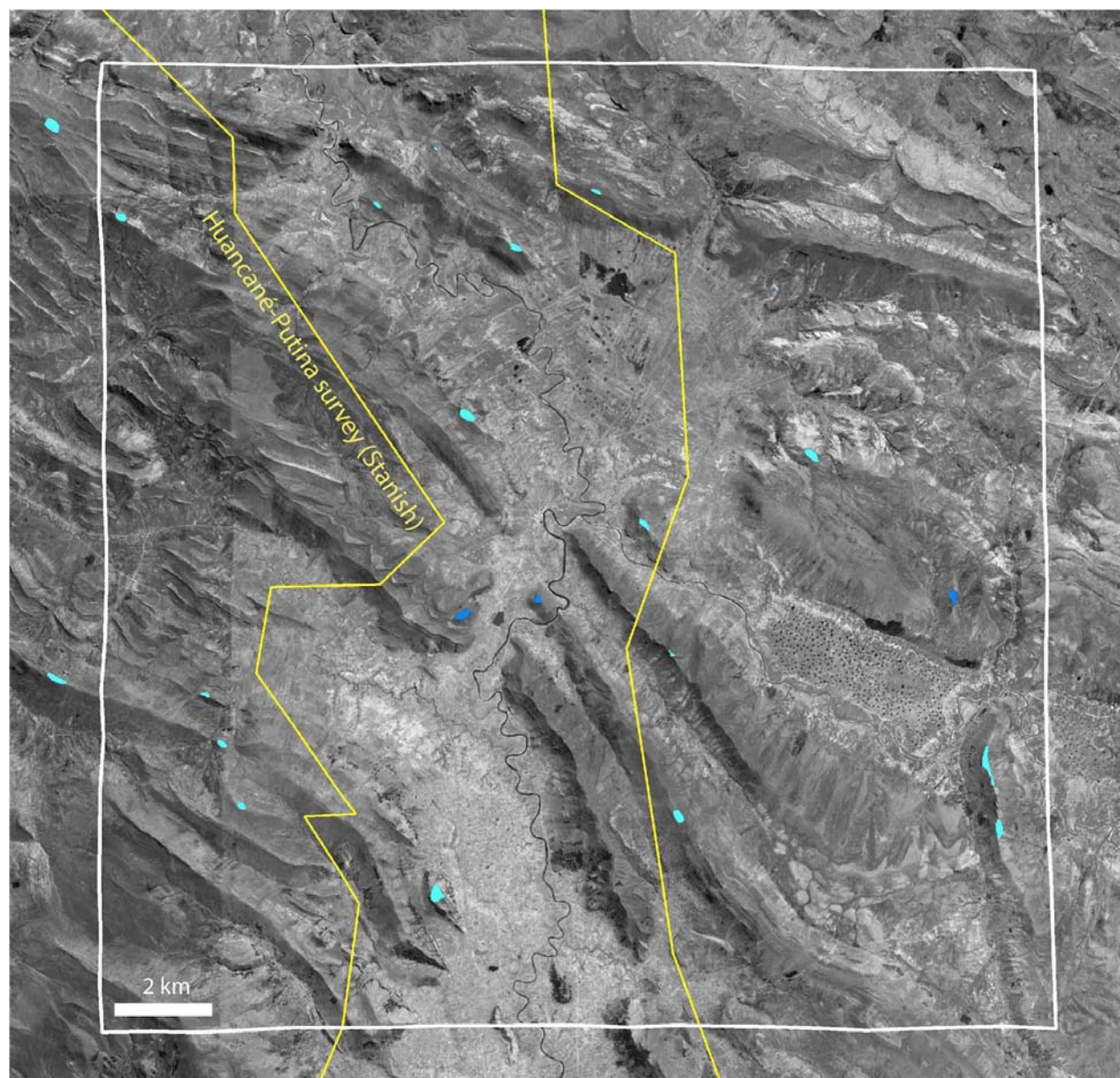


Figure 8. The Huancané sample zone, with pukaras in light blue and possible pukaras in dark blue.

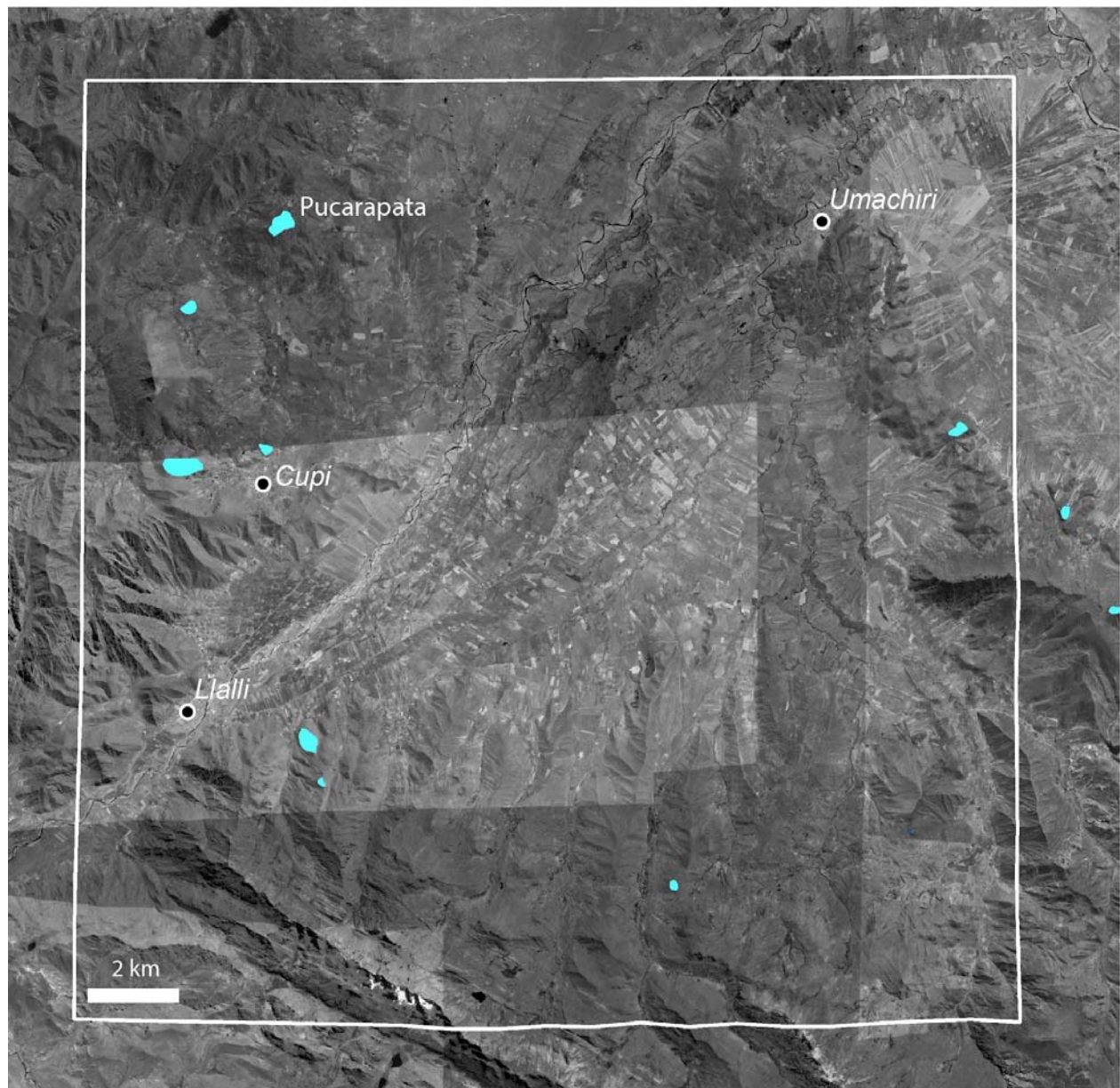


Figure 9. The Melgar sample zone, with pukaras in light blue.

