ORGANIZATION AND GROWTH AMONG EARLY COMPLEX SOCIETIES IN CENTRAL PACIFIC PANAMA

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This research explores the development of organizational variation among early complex societies in Central Pacific Panama. Beginning around the onset of the Late Ceramic II period (AD 700-1522) strongly hierarchal societies emerged in multiple parts of this macroregion, such as the Río Parita valley, and continued to develop until the sixteenth century. Social power within these societies was drawn from a wide range of different activities, but there is strong evidence to suggest that such power was drawn from the same general suite of activities in different regions, and at different points in time. Despite these similarities, however, there were other parts of Central Panama, such as the Río Tonosí valley, where early complex societies also evolved, but that did not develop the strong levels of social hierarchy or engage in the same sorts of aggrandizing behavior that is documented in other regions. These societies interacted with and shared many important sociocultural characteristics with those that were more hierarchical, but for some reason seem do not seem to have developed systems of strong hierarchical organization.

This research set out to explore the factors that led to such variation by conducting a systematic, full-coverage regional-scale survey of the Río Tonosí valley, so as to compare the settlement and demographic patterns that played out in this region to those of the Río Parita valley, where regional survey has already been carried out. These results suggest that, despite exhibiting many strong similarities in demographic and social organization between AD 200 and 500, the trajectories of these two regions began to diverge sometime between AD 500 and 1000. This divergence seems to have been sparked by differential levels of regional demographic growth, coupled with differential levels of environmental risk that existed in these regions. These differences prompted early complex societies to

organize their interaction in substantially different ways across the landscape, facilitating different sorts of activities and forms of social behavior, ultimately leading to the organizational variation that can be observed in the Late Ceramic II period.

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1.0 INEQUALITY AND VARIABILITY AMONG EARLY COMPLEX SOCIETIES

In recent decades one major objective of early complex society research has been to understand the immense amount of variability that exists in the way early complex societies developed. Particularly important to this endeavor has been an attempt to understand the highly variable role played by social inequality, and the forces that came to shape inequality in such a variety of different ways. Why was it, for instance, that some societies came to be organized according to very strong hierarchical principles, while others exhibit little in the way social differentiation? Moreover, why among those in which inequalities emerged did factors such as economic control, specialization, ritual, and warfare play such highly variable roles? Archaeologists have approached these questions from a number of different vantage points, resulting in a diverse range of models aimed at understanding the various forms of behavior and sets of activities through which early inequalities came to develop.

One popular approach to this issue has been to distinguish between corporate and network modes of hierarchical organization (Blanton *et al*. 1996). Whereas network modes are based on exclusive social relationships, competition, and the conspicuous accumulation of wealth and prestige (e.g. Clark and Blake 1994; Junker 1999; Renfrew and Cherry, eds. 1986), corporate modes are based on more inclusive relationships, management, and a general sense of cohesion within social groups. Since its inception this model has been used to evaluate hierarchical variability across a wide range of world regions where early complex societies developed, including the U.S. southwest (Earle 2001a; Feinman 2000; Feinman *et al*. 2000), Mesoamerica (Blanton *et al*. 1996), and the Mississippi River Valley (Trubitt 2000). It has even been applied to the study of modern nation states (Feinman 2010a).

Adopting a somewhat different approach, Earle (1997) has compared the variable extent to which resource control, warfare, and ideology were used as early sources of social power in three separate world regions. Among the Bronze Age societies of Thy (Denmark), Earle (1997) argues, such power was drawn largely from ideological control; in the Upper Mantaro valley (Peru) during the Late Intermediate Period it was more firmly rooted in military affairs; and for the pre-contact societies that developed in Hawai'i it was the control of key economic resources that seems to have been most important. Earle's attention to these specific factors is echoed throughout much of the anthropological literature, which has also emphasized the role of ideology, (Aldenderfer 1993; DeMarrais *et al*. 1996; Earle 2001b), warfare (Carneiro 1990, 1998; Redmond 1994a, 1994b), and resource control (Earle 2001a; Gilman 2001; Welch 1996) in supporting early forms of social power (see Mann 1986).

In addition to these and other models which have sought to explain the qualitatively different forms of hierarchy that developed among early complex societies (e.g. Beck 2003; Renfrew 1974; Scarborough and Burnside 2010), others have taken aim at studying less hierarchical forms of social organization. Heterarchy, for instance, has been used to explain the relatively non-hierarchical character of early complex societies in the U.S. southwest (Rautman 1998) and Bronze Age Thailand (O'Reilly 2003), and to study other complex systems of organization that were not overtly hierarchical (see Ehrenreich *et al*., eds. 1995; cf. Johnson 1982:396-404). An increasing number of studies are also beginning to emphasize the role of communal ritual in spurring certain aspects of complex society development; irrespectively, it seems, of strong hierarchical principles. Such ritual is argued to have been the impetus for craft specialization among some small-scale societies (Spielmann 2002), and to have alleviated problems of scalar stress in the Titicaca Basin during the Middle Formative period, leading to the growth of large village communities (Bandy 2004; see Johnson 1982:405-406).

However one characterizes it, archaeological research has by now revealed a great deal of variation in the way early complex societies developed. One need not scan the globe, however, for such variation to be manifest; within the limits of what is often referred to as the Intermediate Area (e.g. Drennan 1996; Lange, ed. 1992; see Lange 1992:4, Figure 1; cf. Hoopes 2005) a great deal of variation

can be clearly observed. In the Alto Magdalena of Colombia, for instance, ritual and ideology were the primary basis for social power during the Regional Classic period (Drennan 1995a, 2000), whereas in the western llanos of Venezuela it was more firmly connected to warfare and agricultural production (Redmond *et al*. 1994; Spencer and Redmond 1992, 1998). There is little evidence to suggest that craft specialization was particularly important in either of these two regions, though it was an important element underlying inequality in the Valle de Samacá, in the Muisca Territory of Colombia (Boada 2007a).

But despite the relatively small part of the world that the Intermediate Area represents, the geographic scope across which variability can be observed could be narrowed even further. As one homes in on increasingly smaller scales, one begins to approach areas within which societies would not only have had regular contact with one another, but that would have shared important sociocultural roots and traditions. These areas represent particularly interesting contexts within which to study the variable pathways of early complex society development. Within these contexts such variation is not simply the consequence of different historical trajectories, but of divergent evolution sparked by specific forces of social change (e.g. Flannery and Marcus, eds. 1983; Linares and Ranere, eds. 1980). To identify these forces not only contributes to our understanding of how early complex societies developed within these specific sociocultural zones, but to our broader understanding of how they developed in such a variety of different ways around the world.

Though there are many zones across the Intermediate Area within which considerable variation came to develop, that of Central Panama presents a particularly interesting context for research. This zone falls within the limits of what has come to be known as the Gran Coclé Semiotic Tradition, one of three sociocultural "interaction spheres" that existed in Panama during the last 1500 years of prehispanic occupation (see Cooke and Sánchez 2004:9). This tradition was based on the shared use of many abstract and figurative icons which appeared on a wide range of material goods, including gold work, polychrome ceramics, and various ornaments made from stone, bone, ivory, and resin (see Cooke *et al*. 2000; Mayo 2006; Roosevelt 1979). Though relatively widespread by AD 700 (Sánchez and Cooke 2000), broad cultural similarities appear to have developed well before this period of time.

In addition to these similarities, however, the archaeological record of Central Panama exhibits many important differences in the way early complex societies developed, particularly with respect to the evolution of inequality. This variation is most apparent during what is known as the Late Ceramic II period (AD 700-1522), which marks the height of prehispanic sociopolitical development in this macroregion.

1.1 INEQUALITY AND VARIABILITY IN CENTRAL PACIFIC PANAMA

For many years much of what was known about the early complex societies of Central Panama was based largely on the rich and vivid descriptions that were left by the Spanish in ethnohistoric accounts (e.g. Andagoya 1865; Jopling, ed. 1994; Las Casas 1986). These accounts document the existence of relatively large and powerful chiefdoms (Figure 1.1), organized on the basis of strongly hierarchical principles and engaged in a seemingly wide range of specialized activities. *Quevís* (or chiefs) occupied the top tier of the social hierarchy, followed by *sacos*, *çabras*, commoners, and then *pacos* (or slaves) (Helms 1979:12-14; Lothrop 1937:22-24). While such distinctions would imply relatively rigid social divisions, some have argued that these categories may not accurately reflect the nature of indigenous social organization during the sixteenth century (Sauer 1966:239).

Nonetheless, ethnohistoric sources leave little doubt that very strong levels of inequality existed within many Central Panamanian chiefdoms. One oft-cited expression of such inequality was documented at the funeral of Chief Parita (Cooke *et al.* 2003:120; Flannery and Marcus 2012:221-222; Haller 2008a:3), whose funerary treatment has been described as follows:

> Parita had been laid out for burial in his finest array. On his head was a great basin of gold like a casque, around his neck were four or five necklaces of gold, his arms and legs were cased in tubes of gold, his chest and shoulders were covered with plates and medals of gold, [and] around his waist was a golden belt from which hung bells of the

> same metal. In short he appeared to wear a golden coat of mail. At his feet lay the body of a woman and at his head a second, both adorned with many fine ornaments of gold. The two other chiefs [who were captives from neighboring territories] were wrapped in the same manner and embellished with golden jewelry only less elegant than that of Parita (Lothrop 1937:46).

Such lavish treatment, of course, was not afforded to everyone. Though high-ranking social positions were often ascribed at birth (see Helms 1979:23-28), warfare was an important avenue of social mobility and source of chiefly authority (Helms 1979:13, 31-37; Linares 1977:74; Oviedo 1959:28-29), and is said to have been conducted for purposes of territorial expansion and resource control (Linares 1977:73-74; see Helms 1979:33, 1994:57). Interregional exchange was also important to chiefly power, as it helped fuel the political economy and the ideology on which that power relied (Helms 1979). Such exchange seems to have involved a wide variety of goods, including maize, fish, salt, blankets, hammocks, and gold (Cooke *et al*. 2003:114) Though craft specialization and resource control are also documented in ethnohistoric texts (Helms 1979:14-15, 57; 1994), Helms (1979) argues that exchange, warfare, and, above all else, ideology were the mainstays of social power among Panama's sixteenth-century chiefdoms.

Despite the very strong level of inequality that existed during the sixteenth century, such inequality was nothing new to the indigenous societies of Central Panama. Comparable levels of inequality appear to have emerged some 700 years beforehand, at the onset the Late Ceramic II Period (ca. AD 700).

1.1.1 The Río Grande and Río Coclé Valleys

The very lavish graves recovered from Sitio Conte (Figure 1.2; see Briggs 1989; Lothrop 1937) have long been recognized as a prehispanic manifestation of the social power that existed among the sixteenth-century chiefdoms (e.g. Drennan 1995b:323; Flannery and Marcus 2012:219-222; Linares 1977:72). Not

only were these graves stocked with the most elaborate funerary assemblages anywhere in Central Panama, but so too do they stand out as being some of the most elaborate graves among early complex societies from around the world (Drennan *et al*. 2010). A cluster analysis of these grave assemblages exhibits a very marked hierarchical structure (Briggs 1989), much like those of other early complex societies where strong social hierarchies are known to have developed (e.g. Peebles and Kus 1977).

The contents of these graves provide a telling indication of just how strong inequalities were in this region (e.g. Drennan *et al*. 2010), and of the various spheres of activity in which those inequalities were rooted. The most elaborate grave (Burial 11), for instance, contained a total 23 adult individuals, mostly males, one of whom is believed to have been the principal figure for which the others were likely sacrificed. This individual was centrally located among the other bodies (see Hearne and Sharer, eds. 1992:9; Lothrop 1937:50, Figure 31), and was associated with many of the graves more notable gold offerings (Drennan *et al*. 2010:47-48). In total these offerings included 3,496 beads; 233 ear rods; 87 bells; 31 medallions or pendants; 17 chisels; 13 plaques; 10 cuffs, wristlets, or anklets; and 6 nose ornaments. Additional offerings (i.e. those not made of gold) included at least 152 polychrome and 159 monochrome ceramic vessels, 1,548 stone projectile points, 168 stone celts, 4 agate pendants, 68 bone points, 100 shark teeth, 321 canine teeth, 176 rabbit teeth, and as many as 205 stingray spines (Briggs 1989:199-203; cf. Drennan *et al*. 2010:47). Though this was the most elaborate grave assemblage recovered from Sitio Conte, many others were also very lavishly stocked (see Briggs 1989). So too were burials at the nearby site of El Caño (Figure 1.2), where recent excavations have recovered grave assemblages that were very comparable to those of Sitio Conte (see Williams 2012), and which seem to correspond to this same period of time (Mayo and Mayo 2013).

Such a relatively large stockpile of finely crafted items (see Hearne and Sharer, eds. 1992) suggests that some form of craft specialization or exchange was associated with elite behavior, but there is currently little that can be said about the organization of these activities in the Río Grande and Río Coclé valleys. Mineralogical analyses have revealed that at least some of the gold ornaments recovered from these graves were originally produced in Central Panama (Harrison and Beaubien 2010; Williams

2012:80), but others were likely imported from far more distant regions (see Cooke *et* al. 2003; Lothrop 1937). These assemblages also suggest that some form of warfare or violence may have helped underwrite social inequality in this area, given the notable quantities of gold armor, various forms of weaponry, and additional bodies that were often interred with elites which are thought to have been sacrificed victims (see Briggs 1989; Lothrop 1937; Williams 2012). This notion is also consistent with the fact that high-status burials were almost exclusively adult males (Briggs 1989:72-75; Cooke *et al*. 2003:124), and with what archaeologists have identified as defensive architecture in the northern reaches of this region (Mayo *et al*. 2007).

Finally, while the extravagance of these graves would suggest that they were meant to serve as conspicuous expressions of status seen by relatively large groups of people, so too does the formal ritual architecture that was constructed at each site. Lines of basalt stone columns and "altars" were common to the layout of both Sitio Conte and El Caño, and the latter exhibits additional construction features, including cobble-paved pathways and small earthen mounds (Figure 1.3; see Lothrop 1937:39-43; Mayo and Mayo 2013; Mayo *et* al. 2010; Mayo *et al*. 2007; Mojica *et al.* 2007). Some stone columns depict 'decapitated' individuals with their hands bound behind their back (see Mayo *et al*. 2010), which again attests to the importance of warfare or violence as an element of social power.

As the data from Sitio Conte and El Caño exhibit, many of the key activities that helped underwrite social power among sixteenth-century chiefdoms in Central Panama appear to have established their roots relatively deep in prehistory. For instance, as in the ethnohistoric period, very strong levels of inequality developed between AD 700 and 900, which seem to have been rooted in some form of warfare or violence, craft specialization and exchange, and elaborate expressions of status that included lavish funerary rituals. Although such organization did not persist uninterrupted in the Río Grande and Río Coclé valleys throughout the remainder of the Late Ceramic II period (see Menzies and Haller 2012a), the evidence from Sitio Conte and El Caño, in conjunction with ethnohistoric data, suggest that there were certain types of activities and forms of behavior that were fundamental to social power among early complex societies in Central Panama. This idea is reaffirmed when examining the

archaeological record of other regions, namely that of the Río Parita valley, some 50 km further south (Figure 1.2).

1.1.2 The Río Parita Valley

Given the disproportionately high frequency of high-status burials at Sitio Conte and El Caño (most of which were, again, those of adult male individuals, and thus clearly not representative of any local or regional population), some have argued that these sites may have served as a sort of macroregional necropolis at which elites from multiple regions would have been buried (Briggs 1989:64, 130; see Cooke *et al*. 2003:126). Even if this had been the case, however, that these sites were located in the Río Grande and Río Coclé valleys suggests that this region may have been a particularly import seat of power in Central Panama from AD 700 to 900. But such power, it seems, was relatively short-lived. In what some have argued marks an episode of chiefly cycling within Central Panama (Menzies and Haller 2012a), it was around AD 900, as population levels dropped and social inequalities began to wane in the Río Grande and Río Coclé valleys, that social inequality in the Río Parita valley began to reach new heights. From AD 900 to 1300 household artifact assemblages from the central-place community of El Hatillo (Figure 1.2) exhibit greater levels of differentiation than had ever existed before (Locascio 2010; Menzies 2009), as does the mortuary record of this same local community (Bull 1965; Ladd 1964; see Haller 2008a).

Household artifact assemblages suggest that status inequalities at El Hatillo first began to emerge sometime between AD 550 and 700 (Menzies 2009). Although these inequalities were relatively modest, it was during this time that some households began to gain access to a fancier and more diverse array of ceramic goods than other members of their community. Such differential access was even greater, however, during the subsequent 200 years of occupation (AD 700-900), as some households began to engage more frequently in the production of shell ornaments and polished stone axes (Menzies 2009). The spatial distribution of tools and production debris suggests that these households were often associated with elite families, and in some cases were clearly one in the same (Menzies 2009; Menzies

and Haller 2012b). Though the level of productive differentiation was minimal, this evidence nonetheless suggests that status disparities had by this time begun to sink their roots into additional spheres of activity. Interregional exchange also seems to have been important in this regard, given that the raw material from which axes were produced was not locally available within the region, and that elite households appear to have had greater access to non-local ceramic goods (Locascio 2010:49-50, 63; Menzies 2009:84-85).

From AD 900 to 1100 some high-status households began to create relatively well-defined activity areas used for the preparation and serving of food (Menzies 2009:114). These areas may have been used for feasting events held by local elites, which household midden deposits suggest had begun by AD 1100 (Locascio 2010:40). These events were more common, however, over the course of the next 200 years (Locascio 2010), as were other status-related activities. From AD 1100 to 1300 elites were once again more actively engaged in craft production and non-local exchange, and at relatively greater intensities than they had been before (Menzies 2009). As in previous periods these activities seem to have focused on the importation and finishing of polished stone axes, along with some form of woodworking that may have been exclusive to elite household contexts (Menzies 2009:158; Menzies and Haller 2012b).

Taken together these activities gave way to greater social inequalities than had ever existed at El Hatillo prior to AD 900. In addition to maintaining access to a fancier and more diverse array of ceramic goods than other households, elite families had by this time also gained greater access to personal items such as polished bone ornaments and beads (Menzies 2009). They also seem to have had a better diet than other members of their community, which was characterized by greater quantities of deer meat and higher quality cuts of meat overall (Menzies 2009).

It was also around AD 900 that small earthen burial mounds began being constructed at El Hatillo, used for the interment of elite individuals. A total of 13 mounds were ultimately constructed within this local community, and by AD 1300 they had come to delimit a formal plaza area within which ceremonies were presumably held (Figure 1.4). Though detailed inventories are lacking for many of the

graves that were excavated (due to looting and amateur excavations; see Haller 2008a:93-95), those which exist document the presence of relatively elaborate funerary assemblages. Mound 2, for instance, contained the remains of three adult males, who were associated with a total of two metal ornaments; 1,102 shell beads and 29 shell ornaments; 7 jadeite beads; 29 beads and ornaments made of bone; seven animal teeth; two quartz crystals and one dark, unidentified stone; along with some 100 monochrome and polychrome ceramic vessels (Bull 1965:36-38; see Menzies and Haller 2012a:457). Approximately 30 well-crafted gold ornaments were recovered from another grave within these mounds (Biese 1967; see Bray 1992:44-45; Cooke 2004:277; Haller 2008a:101), while yet another appears to have included a gold helmet (Roosevelt 1979:81), an item which at Sitio Conte was reserved for high-ranking individuals (Briggs 1989:138). Ultimately, although these funerary assemblages were not as elaborate as those from Sitio Conte or El Caño, they were significantly more elaborate than those of other Late Ceramic II burials at El Hatillo (see Menzies 2009:140-141), and are to date the most elaborate anywhere in Central Panama outside of the Río Grande and Río Coclé valleys.

In addition to the status disparities that are evident in the mortuary data from El Hatillo, these data also point to other activities that may have been associated with elite behavior. In addition to the gold helmet that was mentioned above, a finely carved spear thrower made of manatee bone (see Cooke 2004:277-278), multiple gold pendants depicting “warrior” iconography (Bray 1992:45), and two necklaces made from human incisors were also recovered from the burial mounds. One necklace contained a total of 737 teeth, drawn from a minimum of at least 184 individuals (Haller 2008a:107-109). These data thus suggest that some form of warfare or violence may also have helped underwrite social inequality in the Río Parita valley. Such an idea is consistent with the fact that elite graves at El Hatillo, like those Sitio Conte, were predominantly, if not exclusively, those of adult males (Haller 2008a:93).

Both household and mortuary data thus indicate that strong social inequalities developed in the Río Parita valley during the Late Ceramic II period (AD 700-1522). Though seemingly weaker than those that developed in Río Grande and Río Coclé valleys, these inequalities were nonetheless sufficient so as to afford elite households finer things, better diets, and more lavish funerals than other members of their

community. These households were also able to procure the resources that were necessary for hosting feasts, and to devote relatively more time to the production and exchange of status-reinforcing objects, including ornaments, polychrome ceramics, and polished stone axes. Despite participating more frequently in such activities, though, there is no indication that elites held control over these or any other economic resource; both household and regional-scale data suggest that everyone had sufficient access to the resources that they needed (Haller 2008a; Menzies 2009). Instead, social power in the Río Parita valley seems to have been largely rooted in ideology (Locascio 2010; Menzies 2009), along with a range of activities through which that ideology would have been reinforced, such as feasting, warfare, and funerary rituals (e.g. Helms 1979; see Earle 2001b).

1.1.3 A Tradition of Aggrandizement in Central Pacific Panama

While the current evidence suggests that there were some important differences in the way social inequalities were organized among the Late Ceramic II societies of the Río Parita valley, the Río Grande and Río Coclé valleys, and the ethnohistoric chiefdoms of the sixteenth century, this evidence also alludes to some important, overarching similarities. To begin with, it is clear that inequality in each of these contexts was expressed through rather ostentatious displays of status upon the death of elite individuals. In such displays these individuals were accompanied by relatively elaborate funerary assemblages, no doubt so as to impress the relatively large number of people that would seemingly have been in attendance. Such an attendance is evident in the architectural layout of these Late Ceramic II cemeteries, which each included a plaza, pathway, or some other formal demarcation of space that could accommodate relatively large groups.

There also exists within each of these contexts some indication that warfare or violence was an activity associated with elite behavior. In each context some elites were buried with gold-plated armor, and among those of the Late Ceramic II period, at least, some form of weaponry as well. Moreover, while there is evidence to suggest that elites at Sitio Conte and El Caño were interred with sacrificed victims,

much like those that were to accompany Chief Parita, elites at El Hatillo appear to have made jewelry from those they captured or killed in battle. Taken together this evidence accords well with the fact that, during both the ethnohistoric and Late Ceramic II period, elite status seems to have been reserved largely for adult male individuals.

Finally, craft production and exchange seem to have been additional activities that were associated with elite behavior in each of these contexts, at least insofar as these activities were vital to the very conspicuous expressions of status that elites often displayed. In the Río Parita valley it seems that these activities were not directly controlled by elite individuals, but were simply carried out with greater intensity by high-status households (Menzies and Haller 2012b; see Ames 1995; Janusek 1999). Through these activities elites acquired goods (such as ornaments and polychrome ceramics) that provided the visible expression of their elevated status, which would have helped reinforce status disparities and the ideology that was used to sustain them. This ideology, archaeologists suggest, was the primary basis for social power in the region (Locascio 2010; Menzies 2009).

Though different in some important respects, this scenario is somewhat similar to Helms' (1979) model of social power among sixteenth-century chiefdoms. While the emphasis that she places on long-distance exchange and esoteric knowledge is not necessarily matched in the archaeological record of the Río Parita valley (or other Late Ceramic II period contexts within Central Panama; see Cooke and Ranere 1992:285), this model nonetheless suggests that ideology was the primary basis for social power during the ethnohistoric period. Activities such as craft production, exchange, and warfare were also important elements, but only insofar as they helped reinforce the ideological system on which social power was based (Helms 1979).

Thus, though ideology is an important component to any form of social power (DeMarrais *et al*. 1996; Earle 2001b), it is argued to have played a particularly important role in the development of inequality among early complex societies in Central Panama (Helms 1979; Locascio 2010; Menzies 2009). Here this source of social power, however, was wielded rather differently than in other parts of the Intermediate Area, where ideology was also used to underwrite early forms of inequality. In contrast to

the Alto Magdalena, for instance, where religion and ideology were more or less the exclusive basis for social differentiation during the Regional Classic period (AD 1-900; see Drennan 2000; Drennan and Peterson 2006), elites in Central Panama clearly tapped into additional spheres of activity, including craft production, exchange, and some form of warfare or violence. This suite of activities, in conjunction with the very conspicuous expressions of status on the part of elite individuals, is consistent with a form of inequality that was rooted in aggrandizing behavior, or what some might refer to as a 'network' (Blanton *et al*. 1996) or 'individualizing' (Renfrew 1974) mode of social hierarchy. Such a form of inequality is similar to that which emerged in the Valley of Oaxaca between 1150 and 500 BC (Marcus and Flannery 1996), and in the Philippines between the tenth and sixteenth centuries AD (Junker 1999). As in Central Panama inequality in these regions was rooted in a wide of range of activities that are often associated with aggrandizing behavior, including public ritual, craft production, exchange, feasting, and warfare.

The archaeological and ethnohistoric records of Central Panama thus suggest that a 'tradition of aggrandizement' emerged within this macroregion during the Late Ceramic II period, and persisted well into the sixteenth century. This tradition was characterized by specific elements of social power that were common to different regions and to different periods of time. While the fact that such a tradition came to emerge is, in and of itself, very interesting, what is even more interesting is the fact that it did not emerge everywhere. Many other regions exist in Central Panama where early complex societies developed, but that, despite sharing certain sociocultural characteristics, seem to lack the very features of organization that link the case studies discussed thus far. Archaeological evidence suggests that the Río Tonosí valley represents one such region (Figure 1.2).

1.1.4 The Río Tonosí Valley

Like in other regions of Central Panama between AD 200 and 500, human burials from the sites of El Indio and El Cafetal in the Río Tonosí valley (Figure 1.2) exhibit no strong evidence for social inequality (Briggs 1989; see Cooke 1984:289-290; Cooke and Ranere 1992:284; Menzies 2009:47-51). Evidence for

such inequality, however, is also very weak over the course of the next 500 years (AD 500-1000), during which time status disparities were beginning to emerge in multiple areas of the macroregion. In addition to the inequalities that were developing in the Río Parita valley, along with those which existed in the Río Grande and Río Cocclé valleys between AD 700 and 900, funerary evidence suggests that modest levels of inequality were also emerging at Cerro Juan Díaz (in the Río La Villa valley) and at Playa Venado between AD 550 and 700 (Figure 1.2; Hoopes 2005:23; see Cooke *et al*. 2003:117-118; Lothrop 1954:229).

Such evidence makes it all the more interesting that similar developments were not occurring in the Río Tonosí valley. Though Briggs (1989) identifies some important differences between the graves of this period (AD 500-1000) and those of the preceding 300 years—including an overall increase in the number of sumptuary goods, and in the level of social differentiation in general (1989:62; see Cooke 1984:289-290)—he nonetheless concludes that these burials, like those pre-dating AD 500, represent an egalitarian form of social organization (Briggs 1989:153). One of the most well-furnished burials from this period was recovered from El Indio (Grave 42), and contained only 11 monochrome and polychrome ceramic vessels, three shell pendants, three *tumbaga* pendants, along with an unknown number of unworked shells and animal bones (Briggs 1989:178); another grave from La Cañaza (Grave 3) yielded over 600 shell beads, but otherwise contained only three shell pendants and two monochrome ceramic vessels (Briggs 1989:179). Interestingly, grave assemblages do not seem to have changed much over the course of the next 500 years (AD 1000-1522).

Beginning around AD 1000, as small earthen burial mounds were being constructed at El Hatillo and inequalities in the community began to proliferate, so too were small earthen burial mounds being constructed throughout the south of the Azuero Peninsula. Though these mounds were constructed in various numbers and at various locations across the southern Azuero, nowhere were they more numerous than at Guaniquito Abjao, in the Río Tonosí valley (Figure 1.2). In contrast to the mounds that were constructed at El Hatillo, however, those that were built throughout the southern Azuero do not appear to have been used for the ostentatious display of status on the part of elite individuals. Of the two

mounds that were excavated at Guaniquito Abajo, for instance, the most elaborate grave assemblage (recovered from Mound 5) contained only one gold bead and one gold pendant, two greenstone pendants, one unworked nodule of jade and another of quartz, one incised bone, one fossilized shark tooth, and only 36 monochrome and polychrome ceramic vessels, many of which Ichon (1980) refers to as having been of "poor quality" (1980:402). Thus, not only does this grave assemblage represent a much lower level of material investment than those at Sitio Conte, El Caño, or even El Hatillo, but is one that is perhaps more reminiscent of earlier graves in the Tonosí region—graves which are routinely taken to represent egalitarian organization (Briggs 1989; Cooke 1984:289-290; Cooke and Ranere 1992:284).

Also lacking from these graves, and from the rest of Ichon's (1980) excavations at Guaniquito Abajo (see 1980:394, Figure 129), was any conspicuous evidence of violence or warfare, such as armor, weaponry, or other types of 'militaristic' paraphernalia. The craftsmanship of the funerary goods does not suggest that they were produced by particularly skilled or specialized labor (e.g. Ichon 1980:402), and while some items would likely have been imported from other areas (see Ichon 1980), there is no indication that such exchange was particularly intense, or that it extended beyond the limits of Central Panama.

Although Mounds 5 and 6 are unfortunately the only two mounds that have been excavated of the 17 identified at Guaniquito Abajo, the excavation of additional mounds throughout the southern Azuero has produced very similar results. The only notable object to have been recovered from the pair of mounds that were constructed at La Bernardina, for instance, was but a single red, zoomorphic bowl (Ichon 1980:407, 451), and mounds excavated at the site of Chara yielded no material goods at all (Ichon 1980:386; see Figure 1.2). Additional graves throughout the region, or those not interred in small earthen mounds, also failed to produce any evidence for social inequality, including three urn burials that were recovered from within ten meters of the mounds at Guaniquito Abjao (see Ichon 1980:384-388).

Ultimately, then, it seems the most conspicuous thing that differentiates the graves at Guaniquito Abajo from others in the Río Tonosí valley is the fact that they occur within small earthen mounds. But while these mounds, like those constructed at El Hatillo and El Caño, may well have required the

coordination of supra-household labor, they nonetheless represent a relatively small labor investment (e.g. Drennan *et al*. 2010), and are themselves not indicative of strong social control. While this does not preclude the possibility that these mounds were meant to distinguish in some way the individuals that were interred within them, Ichon (1980) argues that this was not the case; as he states, "these burials should be interpreted in the same way as the deposits of pottery, as dedicatory offerings" to the mounds themselves (1980:405).

Even if the individuals interred within the mounds at Guaniquito Abajo did hold some level of elevated status, it is clear that they were not afforded the very lavish sets of offerings that accompanied elites in the regions discussed above. Moreover, the spatial distribution of these mounds does not suggest that the death of these individuals was cause for any sort of large-scale public celebration. In contrast to the formal plazas and pathways that were constructed at Sitio Conte, El Caño, and El Hatillo, the funerary space at Guaniquito Abajo exhibits no such delineation of space (Figure 1.5).

1.1.5 Summarizing the Observed Variability

The archaeological record of the Río Tonosí valleys thus suggests that early complex societies in this region developed rather differently than in other areas of Central Panama. In contrast to the strong levels of hierarchy that developed in regions such as the Río Grande, Río Coclé, and Río Parita valleys, social inequality in the Río Tonosí valley appears to have been relatively undeveloped. This region also lacks evidence for many of the activities that were associated with social hierarchy in Central Panama, including warfare, craft specialization, and interregional exchange. Despite this association, however, the apparent absence of these activities in the Río Tonosí valley cannot solely be explained by the low levels of inequality that seem to have developed there. Craft specialization can arise irrespective of strong hierarchical principles (Spielmann 2002), and warfare has been documented among numerous groups with only incipient levels of social hierarchy (e.g. Berndt 1964; Podolefsky 1984; Sahlins 1967).

Nonetheless, these aspects of organization do not seem to have developed among early complex societies in the Río Tonosí valley.

Understanding the sorts of variability that can be observed between the developmental trajectories of the Río Tonosí valley and those of other regions in Central Panama represents a major objective of early complex society research. This variability did not arise, however, among widely separated regions in different parts of the world (e.g. Drennan and Peterson 2006; Earle 1997), but rather among societies that were in clear contact with one another and that shared important sociocultural roots and traditions. Such a setting represents a particularly interesting context in which to explore the variable pathways of early complex society development. How was it that such a strong and persistent tradition of aggrandizement came to emerge in many regions of Central Panama, while in others this tradition never seems to have taken hold, despite having been part of the same sociocultural interaction sphere?

In order to address this question a regional-scale survey was conducted of the Río Tonosí valley, so as to document changing patterns of regional demography throughout this trajectory of early complex society development. Specifically, this survey set out to document changes in regional population levels, the scale and structure of human communities, patterns of settlement and resource distribution, and the distribution of craft activities across the regional landscape. It was conducted with the explicit intention of comparing these patterns to those of the Río Parita valley (Haller 2008a, 2008b), where more conspicuous levels of inequality and aggrandizing behavior ultimately came to develop. Unlike other macroregional studies conducted throughout the Intermediate Area, then, which have traditionally focused on processes of chiefly cycling (Menzies and Haller 2012a; Redmond *et al*. 1999), this study takes aim at understanding the process of divergent evolution, and the forces of change that led to that divergence within a single macroregional context (see Linares and Ranere, eds. 1980).

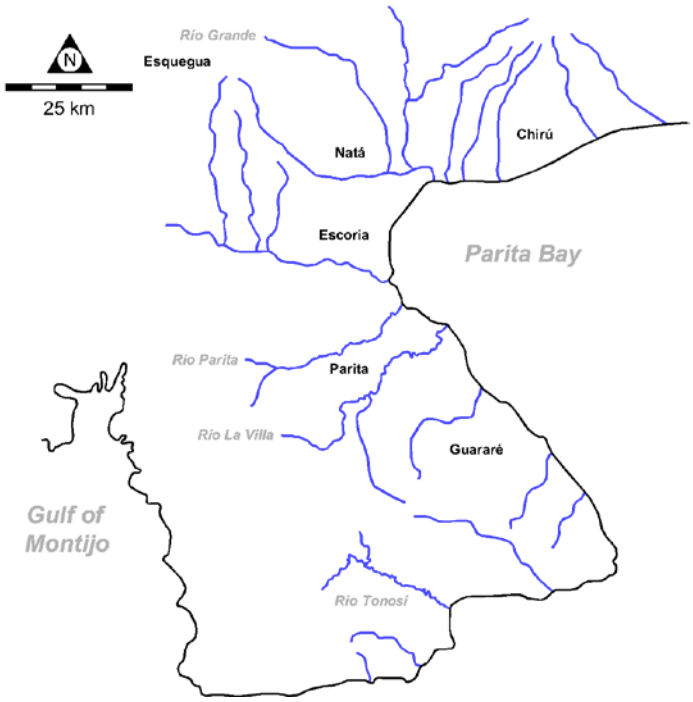


Figure 1.1 Ethnohistorically-documented chiefdoms of Central Pacific Panama (redrawn from Cooke *et al.* 2008:96, Figure 6.1; see Lothrop 1937:5).

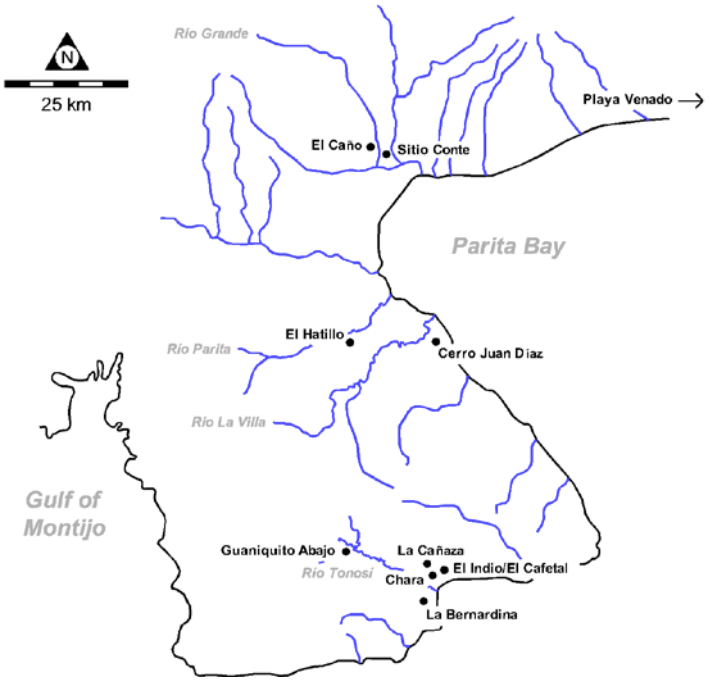


Figure 1.2 Archaeological sites of the Late Ceramic II period in Central Pacific Panama.

Figure 1.3 Ritual architecture at El Caño (from left to right: earthen burial mound, basalt stone columns, and cobble-paved pathway; photos courtesy of Robert D. Drennan).

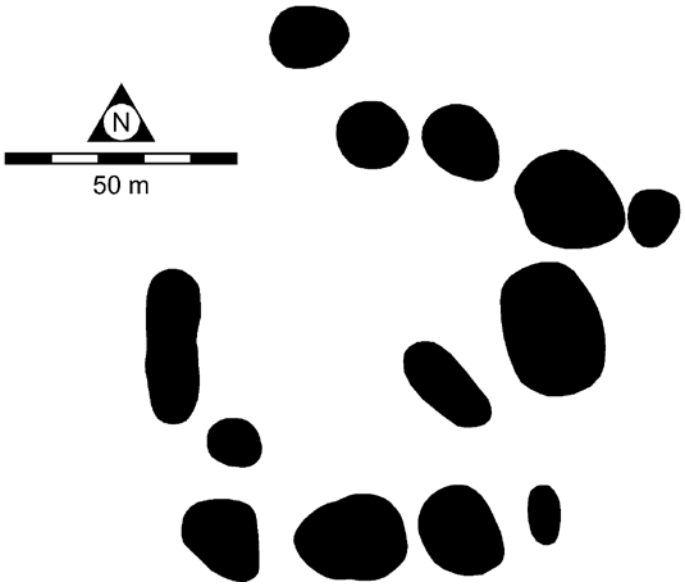


Figure 1.4 Arrangement of earthen burial mounds at El Hatillo (redrawn from Bull 1965:32, Figure 1).

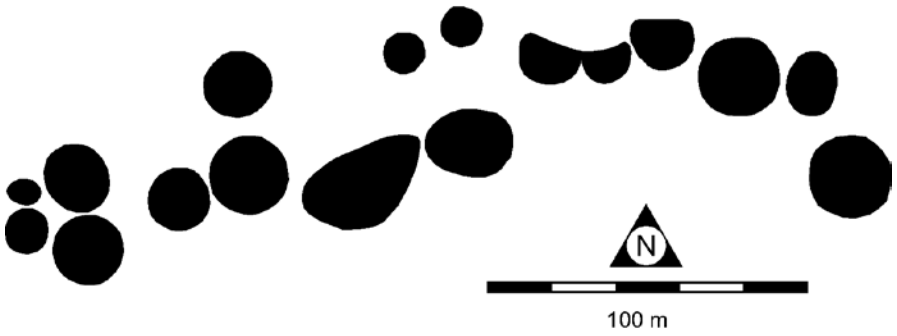


Figure 1.5 Arrangement of earthen burial mounds at Guaniquito Abajo (redrawn from Ichon 1980:394, Figure 129).

2.0 STUDYING REGIONAL DEMOGRAPHY IN THE RÍO TONOSÍ VALLEY

Regional-scale archaeological research has a relatively long history in Central Pacific Panama, which has helped facilitate the macroregional perspective that is adopted in this dissertation (e.g. Balkansky 2006; Kowalewski 2004). Over time such research has become increasingly systematic, moving from the opportunistic sampling of sites (Cooke 1972; Ichon 1980) to the use of more systematic sampling procedures (Weiland 1984), and ultimately to systematic, full-coverage survey (Haller 2008a; Isaza 2007). Though sampling can be an effective method for many types of regional-scale analysis (cf. Fish and Kowalewski, eds. 1990), systematic, full-coverage survey is required to study the sorts of demographic patterns that this research seeks to document (see Chapter 1). As such, a systematic, full-coverage survey was conducted in the Río Tonosí valley, the boundaries for which were based on the results of Ichon's (1980) purposive study of the broader Tonosí region.

2.1 THE SURVEY ZONE AND ITS ENVIRONMENT

The regional survey of the Río Tonosí valley was conducted across an area of 50 contiguous square kilometers in what is now the modern-day district of Tonosí, the largest provincial district in the Los Santos province. Given the research objectives that were outlined in Chapter 1, this survey was designed so as to characterize patterns of prehispanic settlement in the landscape surrounding Guaniquito Abajo, a potential central-place community of the Bijaguales phase (AD 1000—1522; see Ichon 1980:406). By the time survey was complete this zone also came to encompass other settlements that Ichon (1980) had

identified, the earliest of which date to La Cañaza times (AD 500-1000; see Figure 2.1). Consequently, due to its inland location this survey zone did not include many earlier settlements that were documented in the region, the earliest of which date to the Búcaro phase (ca. 200 BC–AD 200); these early settlements were located closer to the coast, and emerged with the widespread adoption of a sedentary lifeway in much of Central Panama.

The survey zone of the Río Tonosí valley centers on the confluence of the Río Guaniquito, the Río Guerra, and the Río Tonosí (Figure 2.1). The natural environment of this zone is characterized as a wet tropical forest (ANAM 2011:49, Mapa 3.1.1; Heckadon-Moreno 2006:31), and receives an average of 2500 mm of annual rainfall (Figure 2.2). Although the Río Tonosi valley, like much of Central Panama, has been heavily deforested over the years, so dense was the forest in this region that it once served as a haven for murderers and other hardened criminals who were "escaping justice or the vengeance of their victims' families" (Heckadon-Moreno 2006:35).

In addition to any impediments resulting from dense forest vegetation, the Río Tonosí valley's position within the Azuero Peninsula also makes it somewhat marginalized from other parts of Central Panama. Not only is this region located at the southern-most point of the Azuero Peninsula, but it is also surrounded by relatively high and steeply-sloping mountains on virtually all sides (Figure 2.3). Travel between the Tonosí region and other parts of Panama is said to have been a dangerous venture even as late as the early 20th century (Heckadon-Moreno 2006), and its relative isolation persists to this day, as encapsulated in the slogan of the modern district capital: "Tonosí: Pueblo Olvidado".

2.1.1 Patterns of Modern Land Use

Despite having once been covered in dense tropical forest, the Tonosí region has experienced substantial deforestation over the years (Heckadon-Moreno 2006). Though such deforestation would have begun sometime during the prehispanic era, it has since intensified as a result of more recent economic activity. During the early part of the 20th century (ca. 1923-1930) the Tonosí Fruit Company, an extension of

United Fruit, was established in the Tonosí region (Heckadon-Moreno 2006), bringing large-scale agriculture into the area. This focus on agriculture, however, was relatively short-lived, as the region quickly shifted to an economy based almost entirely on cattle. From 1950 to 1977 the number of cattle in the region increased by more than 1200% (from roughly 5,000 to over 65,000 head), and today cattle-ranching constitutes the vast majority of the region's total economic activity (Heckadon-Moreno 2006).

This economic focus was particularly apparent within the regional survey zone, where only one or two percent of the landscape was devoted to agricultural activity. Whereas a small proportion of this agriculture entailed growing maize for household consumption, the majority was based on more lucrative cash crops grown for export, particularly rice and *teca*. As the region became increasingly reliant on cattle, patterns of land tenure also changed, resulting in a shift from many small land holdings to a relatively small number of *dueños* who owned the majority of the land (Heckadon-Moreno 2006:118-125). As will be discussed below, these economic practices and patterns of land tenure all had implications for the way survey was conducted in the field.

2.1.2 Local Geography

Though surrounded by some of the highest elevations in all of Central Panama, there is little altitudinal variation within the regional survey zone, which ranges from only 30 to 200 masl. Thus, while there is obviously much more environmental and geographic variation to be found throughout the broader Tonosí region, some important variability nonetheless exists within the survey boundaries. This variability can be broken down into three relatively distinct geographic zones, which include the rivers and their floodplains, the rolling hills that often surround them, and the alluvial spurs that extend from the base of Cerro La Tronosa (the high, steeply sloping hill that abuts the southern edge of the survey zone in Figure 2.3).

2.1.2.1 The Rivers and their Floodplains

Despite their wide channels the rivers of the Tonosí region are only navigable during the rainy season, and even then only in small boats and across very short distances (Heckadon-Moreno 2006). During the dry season these rivers can be easily crossed by foot in many places (Figure 2.4), and do not pose major impediments to interaction between groups living on opposite sides. The courses of these rivers have fluctuated considerably over time, and some sections now run more than 100 m away from where they did only 50 years ago. Though not as expansive as near the coast, where the Río Tonosí can rise to flood homes located multiple kilometers beyond its banks, the floodplains that exist within the survey zone are still relatively large in some areas (Figure 2.5). These areas of the landscape are regularly inundated multiple times a year.

2.1.2.2 The Rolling Hills

Though the floodplains of the Río Guaniquito, Río Guerra, and Río Tonosí constitute a considerable portion of the surveyed landscape, the gently rolling hills that often flank these zones make up an even larger portion. These landscape features are particularly prevalent in the northern half of the survey zone (Figure 2.6), and it is among these hills that the site of Guaniquito Abajo is located (Figure 2.7). While the slopes of these hills vary considerably from one part of the landscape to the next, rarely do they ever exceed 10-15 degrees. In the eastern part of the survey zone these slopes give way to relatively large, flat areas of land, but which are still elevated above the flat, expansive floodplain of the Río Tonosí (Figure 2.8).

2.1.2.3 The Alluvial Spurs

While these large, flat areas of landscape occur to the north of the Río Tonosí, its southern banks are flanked by the alluvial spurs that extend from the base of Cerro La Tronosa (Figure 2.9). These spurs range anywhere from a few hundred meters to over a kilometer long (most extending to the southern edge of the Río Tonosí floodplain), and are all relatively narrow, not usually exceeding 50 to 100 m in

width. These spurs rise, on average, some 5 to 10 m above the floodplain, and are separated by narrow gullies which themselves are not typically more than 50 m wide in most places. As will be seen in the subsequent chapter, these spurs were highly valued settlement locations for much of the prehispanic population of the Río Tonosí valley.

2.2 METHODS OF DATA COLLECTION

The systematic, full-coverage survey of the Río Tonosí valley was based on methods that were initially developed in the Basin of Mexico (Sanders *et al*.1979) and the Valley of Oaxaca (Blanton *et al*. 1982; Kowalewski *et al*. 1989), and that have since been advanced in other parts of the world (Chifeng 2003; Drennan, ed. 1985, 2006). Using these methods it is not the site that serves as the basic unit of data collection, but rather the collection lot. The 'site' has become an increasingly challenged analytical unit in settlement pattern studies (e.g. Drennan *et al*. 2003a; Dunnell 1992; Dunnel and Dancey 1983), and is indeed an inappropriate unit of analysis for some parts of the Intermediate Area, including the Alto Magdalena (Drennan, ed. 2006) and Quijos Region (Cuéllar 2009). In these contexts settlement is distributed so evenly and so continuously across such great distances that the notion of 'site'—as a single, discernable human community or activity area—is virtually meaningless (Peterson and Drennan 2005). By making the collection lot the basic unit of data collection, the existence of 'sites' becomes an issue that can be explored through data analysis, rather than something that is taken for granted in the field.

One important issue that must be considered is the maximum area across which data is collected, or the maximum size of collection lots. In the Río Tonosí valley this maximum was established on the basis of two key factors. One such factor was the regional survey results of the Río Parita valley, where collection lots also served as the basic unit of data collection (see Haller 2008a:27-33), while another had

to do with the specific method of data collection that was employed in the Río Tonosí valley. Due to the dense vegetation that covers much of the Río Tonosí landscape it was clear from the beginning that subsurface testing was going to be an essential mode of data collection in many parts of the region. As with other regional surveys in the Intermediate Area, including those of the Alto Magdalena and Quijos Region, this testing was based on the excavation of small shovel probes. In these regions shovel probes were excavated every 100 m across densely vegetated parts of the landscape, resulting in a maximum area of 1 ha for any given collection (see Cuéllar 2009; Drennan, ed. 1985). Survey results from the Río Parita valley, however, suggest that smaller intervals might be necessary in the context of Central Panama.

As was the case in the Alto Magdalena and the Quijos Region, the maximum area of collection lots in the Río Parita valley was set at 1 ha (Haller 2008a:29). However, in contrast to these regions and the Río Tonosí valley, which are heavily vegetated across large areas, surface visibility in the Río Parita valley was relatively good throughout. This is not surprising given the drier conditions that exist in this particular part of the Azuero Peninsula (see above), not to mention the slightly greater levels of agricultural activity, the fields for which often created excellent surface conditions (see Haller 2008a:26, Figure 2.6). These conditions greatly minimized the need for shovel probes, and virtually all of the collections that were made (about 99% of them) were of artifacts found on the surface (Haller 2008a:31, 2008b). This allowed for a more accurate assessment of the area across which prehispanic garbage was distributed, and thus for the possibility of identifying settlements that were smaller than 1 ha, which existed in significant numbers.

Of the 1246 collection lots that resulted from the Río Parita survey, the average area was about 0.55 ha, and 1004 of them (81%) were smaller than 0.75 ha (Haller 2008b). Although many of these were directly adjacent to other collection lots, and were thus part of larger areas of contiguous settlement, many others occurred individually, and were surrounded by at least 50-100 m of vacant landscape. If comparably sized settlements existed in what are now densely vegetated zones of the Río Tonosí valley, then there would be a risk that many of them would go undetected if only one probe was

excavated for every hectare of habitable land. Given the settlement and demographic dynamics that this survey set out to document, such possibility was deemed highly undesirable.

The maximum area of collection lots in the Río Tonosí valley was thus set at approximately 0.5 ha. In flat, densely vegetated zones of the landscape survey teams, consisting of three or four people each, walked straight-line transects spaced at 75-m intervals, excavating one probe every 75 m along each line, resulting in one probe for every 0.56 ha of habitable land. These straight-line transects were used most often when surveying the flat, expansive floodplains of the rivers (Figure 2.5), along with the very gentle slopes that occur north of the Río Tonosí in the eastern part of the survey zone (Figure 2.8). In other parts of the landscape, however, topography made the use of straight-line transects somewhat impractical. In these areas team members simply followed the natural contours of the landscape (such as along ridgelines or hilltops), excavating a single probe for every half hectare of habitable land. This mode of survey was most common among the rolling hills that exist in the northern part of the survey zone (Figure 2.6), and among the alluvial spurs that extend from the base of Cerro La Tronosa (Figure 2.9).

Like the shovel probes that were excavated in the regional survey of the Alto Magdalena, those in the Río Tonosí valley measured 40 cm x 40 cm (see Drennan, ed. 1985:137; cf. Cuéllar 2009:25; Haller 2008a:31), and in all possible instances were excavated 20 cm into sterile soil. This target depth was often achieved due to the rather shallow archaeological deposits that exist in much of Central Panama, and only in rare instances did probes have to be terminated prior to reaching sterile soil (this happened most frequently among the earthen burial mounds at Guaniquito Abajo, where deposits were much deeper). If no artifacts were encountered within the first 30 cm of excavation, the probe was filled and team members continued along their transects.

Shovel probes were excavated by team members working either individually or in pairs, depending on the nature of the landscape and the types of soils that were encountered. In the loose, loamy soils that characterize the floodplain and other low-lying areas of the landscape, it was possible for a team member to excavate a probe individually in a very efficient manner, each one taking roughly 30 minutes to complete. In many parts of the region, though, soils were much more compact due to the

high content of clay they contained, and shovel probes were more difficult to excavate. In these areas team members typically worked in pairs, and the time required to complete a probe was somewhat more variable.

The high clay content of soils in the Río Tonosí valley also had implications for the way artifacts were recovered from shovel probes. Though it was initially thought that all excavated soil would be screened through ¼" mesh, this mode of artifact recovery was quickly abandoned, as it was impossible in many instances for the clayey soils that were encountered to pass through the screens at all. Consequently, team members carefully and systematically sorted through excavated soil by hand over plastic tarps, collecting any and all artifacts that they encountered in the process.

Ultimately, a total of 1557 shovel probes were excavated across the Río Tonosí valley, 339 of which yielded evidence of prehispanic occupation. Despite the heavy ground cover that was encountered in these areas, though, it was nonetheless possible to make surface collections in many parts of the landscape. In these areas survey teams continued to walk straight-line transects and follow natural, topographic contours, though here transect intervals were decreased to 50 m so as to ensure the identification of very small settlements. When a team member encountered an artifact on the surface he or she would alert the others, and all team members would spend the next five minutes or so roaming around the surrounding half hectare of landscape, collecting any artifacts that they found. Though these collections were, in principle, terminated when a maximum of 40 artifacts were recovered, this maximum was sometimes surpassed (as was to be expected) due to the excitement of overzealous team members.

While surface visibility improved considerably as the dry season went on, vegetation remained dense in many parts of the valley, and it soon became clear that fence lines, cattle paths, and other areas where the vegetation was routinely trampled presented the most promising opportunities to encounter artifacts on the surface. Hillside erosion also enhanced this prospect, particularly along the slopes of the alluvial spurs; though vegetation was often quite dense on their tops, their eroded slopes were prime contexts from which to recover artifacts (Figure 2.10). In some instances this erosion was clearly caused by heavy rains, but far more often it seems to have been the result of intense cattle activity.

In the end, a total of 889 surface collections were made in the Río Tonosí valley, accounting for 72% of all the collection lots. Every collection that was made in the field, be it by shovel probe or surface collection, was assigned a unique lot number. The location of each shovel probe, or the center of each surface collection, was then recorded using a handheld GPS, and the boundaries of the collection lot were drawn onto satellite imagery (printed at a scale of 1:5000). These boundaries were based on physical features that were conspicuous on the landscape and the satellite imagery (such as fences, streams, tree lines, and natural contours), and were drawn so that no lot exceeded approximately 0.5 ha. Basic information about each collection lot was also recorded in the field, including its location, the type of collection made, the nature of the vegetation, and the materials that were collected.

Once materials were collected they were bagged and, at the end of the day, transported to the field house where they were washed and stored until the end of the field season. The collection lots that had been drawn onto satellite imagery were digitized into an electronic map, and the corresponding information that was recorded on lot forms was entered into a spreadsheet. At the end of the field season artifacts were transported to the archaeology labs of the Smithsonian Tropical Research Institute (STRI) in Panama City, where laboratory analyses were carried out. In the end, a total of 1228 collections were made during the course of the regional survey, documenting some 607 ha of prehispanic occupation. These lots were analytical unit for which population estimates were made, the method of which is discussed below.

2.3 THE CHRONOLOGICAL FRAMEWORK

The chronological framework that was used for this study is based on the regional chronology that was developed by Ichon (1980) specifically for the Río Tonosí valley. This framework is divided into four distinct periods of prehispanic occupation, the dates for which have since been adjusted on the basis of more recent research (Cooke and Sánchez 2003; cf. Briggs 1989:21). These four periods span the length

of the Late Ceramic period (ca. 250 BC—AD 1522; Figure 2.13), and thus provide a coarser chronological resolution than the framework that is used in other parts of Central Panama, particularly the regions surrounding Parita Bay. This more precise chronological framework divides the Late Ceramic period into seven periods of prehispanic occupation (Figure 2.13; Cooke and Sánchez 2003:17, Figure 2; Haller 2008a:35, Figure 2.12; Mayo 2006; Sánchez and Cooke 2000:7, Cuadro 1), but could not be applied to the Río Tonosí valley. The proportion of sherds that can be assigned to this chronology is low even in the regions where it was initially developed, and typically does not exceed about 15% of the overall ceramic assemblage (see Isaza 2007:328; Mezies 2014). This proportion would have been even lower in the ceramic assemblage of the Río Tonosí valley, since polychrome ceramics and other diagnostic wares were less abundant in this region. Given the mode of demographic reconstruction that is used in this research (see below), it was important that a relatively high proportion of sherds be assigned to a chronological phase.

Ichon's (1980) chronological scheme for the Río Tonsoí valley was based largely on morphological and decorative characteristics. However, by analyzing sherds that bore such diagnostic features, it was possible to identify additional characteristics (such as paste, temper, and surface conditions) that could be used to assign sherds without morphological or decorative attributes to one of the four phases in this chronological framework. This is consistent with observations made in other regions of Central Panama, where the more precise chronological framework is used. Although morphological and decorative attributes are often required to assign sherds to any one of these seven phases (e.g. Mayo 2006), archaeologists working in these regions have regularly been able to assign a larger proportion of sherds to slightly broader periods of time, on the basis of paste, temper, and surface characteristics (e.g. Isaza 2007:328; Menzies 2009:142). Interestingly, these broader time frames correspond relatively well to the chronological phases of the Río Tonosí valley, suggesting that the morphological and decorative features of the polychrome tradition were changing at a faster rate than the physical characteristics of most ceramics, the latter of which seem to have changed more or less concurrently across much of Central Panama.

Of the 18,339 sherds that were recovered during the regional survey of the Rio Tonosi valley, about 75% of them (or 13,624 sherds) could be assigned to one of the four chronological phases in the region. These sherds were distributed among 1149 collection lots (or 93.6% of the total), meaning that only 6.4% of the collections were made did not contain any chronologically identifiable sherds; these lots amounted to some 5.9% of the total area that was documented, or about 35.9 ha of prehispanic occupation.

2.4 METHODS OF DEMOGRAPHIC ANALYSIS

As was discussed in Chapter 1, this research set out to document changes in regional population levels, the scale and structure of human communities, patterns of settlement and resource distribution, and the distribution of craft activities across the Río Tonosí landscape. The methods that were used to study these patterns are presented in the following pages.

2.4.1 Demographic Reconstruction

Estimating the size of prehistoric populations is a vital part of understanding how ancient complex societies were organized, and how they changed through time. Archaeologists have by now developed numerous ways to arrive at these estimates, many of which account for variability in both the area and density of human occupation across the landscape. Exactly what sorts of evidence archaeologists use to measure these dimensions of human demography, however, can vary widely depending on the part of the world in which one works and the sorts of evidence that remain. In the Intermediate Area, where residential architecture does not typically preserve on the surface, these measurements are commonly based on the distribution (i.e. the spatial extent and the density) of ceramic sherds. This is based on the common assumption that larger groups of people produce larger amounts of garbage, and thus dispose

of that garbage across larger areas and/or at greater densities than do smaller groups. Ceramic sherds are a particularly suitable type of garbage on which to base demographic estimates, given the frequency with which they would have been used by virtually all members of a community, and the fact that they can often be assigned to distinct periods of time.

The area of collection lots provides a reliable estimation of the area of human occupation. The total area that was occupied during any given phase, then, is simply the combined area of all the collection lots that contained sherds associated to that particular phase. Sherd densities were calculated for individual shovel probes, by dividing the total number of sherds that were associated with each phase by the total area of the probe that was excavated (about 0.16 m^2). Because longer periods of occupation would have presumably resulted in greater densities of garbage, sherd densities were then divided by the number of centuries in each phase so as to standardize their values. This leaves the question of how many people might be expected to have produced the density of sherds that was present in each probe, which was empirically evaluated using other datasets from the Intermediate Area.

These datasets come from the intensive, local-scale survey of four separate prehispanic communities, each of which provide the sub-surface density of ceramic sherds for distinct periods of occupation, along with an estimated population that was calculated using an independent demographic proxy (or one that was not based on the absolute density of sub-surface ceramic sherds). These communities include Mesitas, in the Alto Magdalena (González 2007a, 2007b); Barriles, in the Volcán Barú region of western Panama (Palumbo 2009a, 2009b); and Suta, in the Valle de Leiva (Fajardo2011; Henderson and Ostler 2005), and El Venado, in the Valle de Samacá (Boada 2007a, 2007b), both of which are located in the Muisca Territory. Their average sherd densities (measured as sherds/m^2/century) and estimated residential densities are presented in Table 2.1.

As Figure 2.12 illustrates there is a strong and very significant correlation between the residential densities and sub-surface sherd densities of these communities (r = 0.845; p = 0.008). This correlation provides the basis for making demographic estimates in the Río Tonosí valley. Specifically, this method of demographic reconstruction uses the best-fit line that is illustrated in Figure 2.12 as the basis for

assigning residential densities to individual collection lots (which are the analytical units for which population estimates are made). Due to the approximate nature of this correlation, however, it will not be treated as a continuous scale, but rather as a series of 'density categories'. Doing so allows for broad differences in sherd densities to reflect meaningful differences in residential densities, while at the same time guards against using this correlation with greater precision than it deserves. Four density categories were ultimately established, and are presented in Figure 2.13.

While this correlation provides a basis from which to directly assign residential densities to the 339 collection lots for which shovel probes were excavated, there are still the remaining 889 that were made on the basis of surface collections. As mentioned previously, these collections were most often made along eroded slopes or in contexts with only patchy surface visibility, such as pastures with worn fence lines, cattle paths, or shaded areas where cattle would congregate. The exact numbers of sherds from these contexts do not provide a precise indication of the residential densities that produced them, but substantial differences in the amount of sherds recovered do likely reflect meaningful differences in the density of human occupation. For instance, if a surface collection was made in a context with relatively good surface visibility, but produced only one or two ceramic sherds, then it is reasonable to assume that this area was not as densely occupied as an area where 40 or more sherds were recovered (particularly if the latter was made in contexts with poorer surface visibility, as was sometimes the case). Thus, while it would be a mistake to differentiate between surface collections that exhibit only minor differences in the number of sherds recovered, more substantial differences can provide meaningful information.

Given that shovel probes and surface collections are both widely distributed throughout the region (Figure 2.14), and are both well-represented in each the three geographic zones (see above), the quantities of sherds from each mode of collection can thus be taken as an unbiased sample from the population that consists of all the collection lots. This means that the range of variability within each sample should be comparable, despite being measured along different number scales. The batch of sherd frequencies that resulted from surface collections can thus be aligned with that resulting from shovel

probes, so that the median values of the two batches are the same. If these two batches of numbers are comparable, then this should result in each batch having roughly similar minimum and maximum values. As the stem-and-leaf plot in Figure 2.15 illustrates, this is indeed the case. Although the batch of sherds from shovel probe exhibits a slightly greater degree of upward straggle with higher outliers, the main batch of numbers in each sample covers roughly the same range. Transforming the numbers of sherds that resulted from surface collections in this way thus produces two batches of numbers that are, in effect, measured along the same scale, allowing for these sherd counts to be incorporated into the method of demographic reconstruction that was developed using shovel probes.

Although sherd densities may be slightly low for those lots which contained sherds that could not be assigned to a chronological phase, the impact of these sherds is ultimately rather minimal on demographic estimates. This is because the majority of these sherds were concentrated within a relatively small proportion of the collection lots: of the 4715 sherds that could not be assigned to a chronological phase, about 72% of them were recovered from only 15% of the collections lots. This means that there were relatively few lots that had a high frequency of unidentified sherds, and most of these lots still yielded high sherd density values. Rather than assign the unidentified sherds to phases based on the proportional distribution of identified sherds in each lot (see Drennan *et al*. 2003b), then, these sherds were simply excluded from the analysis.

2.4.2 Delimiting Human Communities

While the demographic estimates that were made for the Río Tonosí valley were important for evaluating the scale of regional populations, so too were they important for understanding the scale and structure of human communities. Evaluating patterns of interaction within communities is a vital part of understanding complex society development, as “it is in this matrix of interaction that the forces that produce social change are generated” (Peterson and Drennan 2005:5). The scale and structure of these communities can have serious implications for the way in which interaction is ultimately carried out (e.g.

Fletcher 1995), along with the types of activities around which interaction is organized. Here the scale and structure of human communities is evaluated on the basis of regional settlement data, using a technique developed Peterson and Drennan (2005).

This method of studying human interaction is firmly rooted in distance-interaction principles, or the idea that people who live in close proximity to one another will interact more frequently than those who live farther apart (see Peterson and Drennan 2005:5-6). It also inherently accounts for the notion of social gravity, or the idea that larger settlements (or, to be more specific, the types of functions and activities that occur within them) tend to have stronger integrative effects than do smaller communities. Although distance-interaction principles and those of social gravity are not the only factors that would have influenced patterns of prehistoric interaction, they are nonetheless two important ones that are ubiquitous to virtually all human societies, and thus provide a solid foundation from which to model the scale and structure of human communities in the Río Tonosí valley.

This method depicts the density of human settlement in a region as a topographic surface, across which the elevation, or z-value, corresponds to the density of human occupation in any given part of the landscape. In an unsmoothed surface large, nucleated local communities rise to create tall, sharp peaks that are clearly discernable from smaller, more dispersed forms of settlement; the contours of these peaks often encapsulate multiple collection lots, and can be taken to represent meaningful community boundaries (Peterson and Drennan 2005:7-11). Local interaction, however, is not always structured in such clearly discernable local communities. There are a growing number of regions in the Intermediate Area where settlement was relatively continuous and unvarying across rather large distances (Cuéllar 2009; Drennan, ed. 2006), making the identification of distinct local communities virtually impossible. This method can also detect such continuous and dispersed local interaction structures (Peterson and Drennan 2005:23-27), along with a range of variability that can exist between these two extremes.

Although human communities have traditionally been thought of as purely local phenomena (e.g. Kolb and Snead 1997), the networks of patterned interaction that constitute such communities (cf. Isbell 2000; Marcus 2000) are known to exist at multiple scales (Peterson and Drennan 2005, 2012; O'Gorman

2010; see Chang 1958). Larger networks of interaction, or supra-local communities, can be recognized through a mathematical smoothing of the settlement surface, and delimited through the selection of an appropriate 'demographic' contour, or by the occupational valleys that separate clusters of settlement (Peterson and Drennan 2005:11-15). Increased levels of smoothing have the potential to delimit increasingly larger networks of supra-local interaction, the intensity of which would likely have decreased as one delimits communities of increasingly larger scale.

2.4.3 Assessing Resource Distribution

Given the diverse range of ecosystems that exist in Central Panama, it is not surprising that prehispanic occupants of the macroregion came to exploit a comparably diverse range of subsistence resources. One particularly important resource base was that of the coast and estuary zone, which people had begun to exploit by as early as 4000-5000 BC (Cooke 2001; Cooke and Jiménez 2008a; Cooke *et al*. 2007; Cooke and Ranere 1999). Despite the well-documented importance of such resources in many coastal regions, however, the prehispanic populations that lived within the limits of the Río Tonosí valley survey zone would not likely have relied on them as much, given the distance at which they lived from the coast (at least 15 km). Although some inland settlements have yielded appreciable amounts of marine resources, such as Sitio Sierra in the Río Santa María valley (which is located some 10-15 km from the shore; see Cooke and Jiménez 2008a; Cooke and Ranere 1999), no evidence for the exploitation of such resources was recovered in the Río Tonosí valley.

Of the 1228 collections that were made in the Río Tonosí valley, only three contained evidence of coastal or estuary resources. In each case this came in the form of unmodified *Anadara* remains, a species of shell that was commonly exploited by prehispanic populations in many regions of Central Panama. Each of these three collections, however, was made near a modern house lot, and in two instances it was confirmed by the current residents living there that these remains were the result of modern economic activity. Coastal and estuary resources thus do not seem to have been a particularly

important part of prehispanic subsistence in the Río Tonosí valley. The dearth of such resources is not simply due to the coarse resolution of regional survey, as surveys of this scale have recovered appreciable amounts of marine resources in other regions on Central Panama. In the Río Parita valley, for instance, shell remains were recovered from 247 of the 1210 collection lots (or about 20%) that were documented in the Lower Survey Zone (Haller 2008a:123, 2008b), and Isaza (2007) recovered large amounts of fish and shell remains in the neighboring Río La Villa valley.

Despite the importance of coastal and estuary resources to the prehispanic populations of Central Pacific Panama, agriculture had arguably become the mainstay of prehispanic subsistence by around AD 250. Although agriculture had been based on a diverse array of crops since the very early stages of cultivation (ca. 5000-7000 BC; see Chapter 3), including species such as manioc, squash, sweet potatoes, and beans (Cooke 1998; 2005; Piperno and Pearsall 1998), maize seems to have become the dominant cultigen by the onset of the Late Ceramic period (ca. 250 BC). By this time maize had undergone significant morphological changes that increased its productivity (Cooke *et al*. 2007:578; Piperno 2006:156; Piperno and Pearsall 1998), and bone isotope analysis from multiple sites in Central Panama indicate that, although subsistence continued to revolve around a relatively wide range of both domestic and wild resources, maize consumption increased considerably from ca. 300 BC to AD 500 (Norr 1991, 1995). These data are consistent with the fact that large-kernelled maize is now the most dominant macrobotanical remain recovered from sites across the Panamanian isthmus (Cooke 2005:148).

Given the dearth of marine resources that were recovered during regional survey, agriculture was likely a particularly important subsistence strategy for the occupants of the Río Tonosí survey zone. Evaluating what sorts of access people had to agricultural resources is thus a vital part of understanding early complex society development in this region. One important part of this evaluation is understanding where people lived in relation to soils with different levels of agricultural productivity. The productivity zones used here are those that were initially presented by Ichon (1980:12-14), which seem to correspond relatively well with those from the *Atlas Ambiental de la República de Panamá* (ANAM 2011:35-36). Four

of the seven zones that Ichon (1980) identified occur within the limits of the regional survey (Figure 2.16), and are characterized as follows (1980:12):

Class I soils – these soils occur in the alluvial plains, and are the most productive in the region; they are deep soils consisting of fine clay; they are slightly acidic yet highly productive, with only slight limitation in the types of crops that can be grown

Class II soils – the soils occur in the fluvial terraces, and are moderately productive; they consist of fine clay and are generally cultivable, but with severe limitations in the types of crops that can be grown

Class III soils – these soils are derived from sedimentary rock, and have relatively low productivity; they have a fine clay texture and can only be cultivated when the slope does not exceed 8%, and with severe limitations to the types of crops that be grown

Class IV soils – these soils are derived from igneous volcanic rock, and are not cultivable; they can only be used for forest and pasture

Ultimately, though agriculture in the Río Tonosí valley may have been the primary form of subsistence in this region, it would undoubtedly have been supplemented by additional subsistence activities, such as hunting (Cooke *et al*. 2007; Cooke and Ranere 1989; Cooke *et al*. 2013a) and freshwater fishing (Cooke and Jiménez 2008b; see Cooke 2001; Cooke and Jiménez 2008a; Cooke *et al*. 2007; Cooke and Ranere 1999). Unfortunately, evidence for such activities is often difficult to recover using methods of regional survey (cf. Isaza 2007), and no such evidence was documented in the Río Tonosí valley.

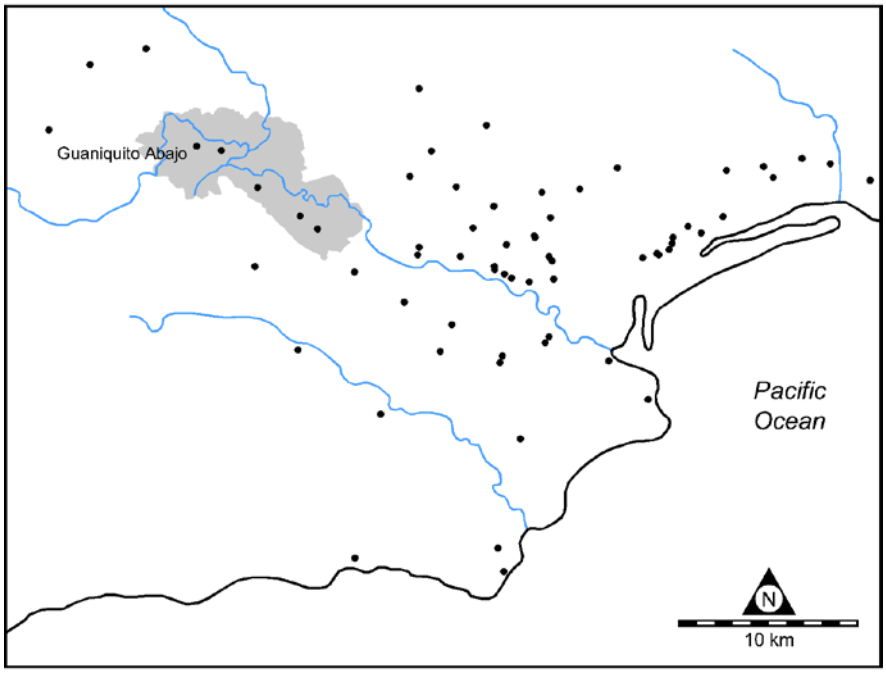


Figure 2.1 Archaeological sites identified by Ichon (1980) in the Tonosí region and the location of the Río Tonosí valley survey zone (shown in grey).

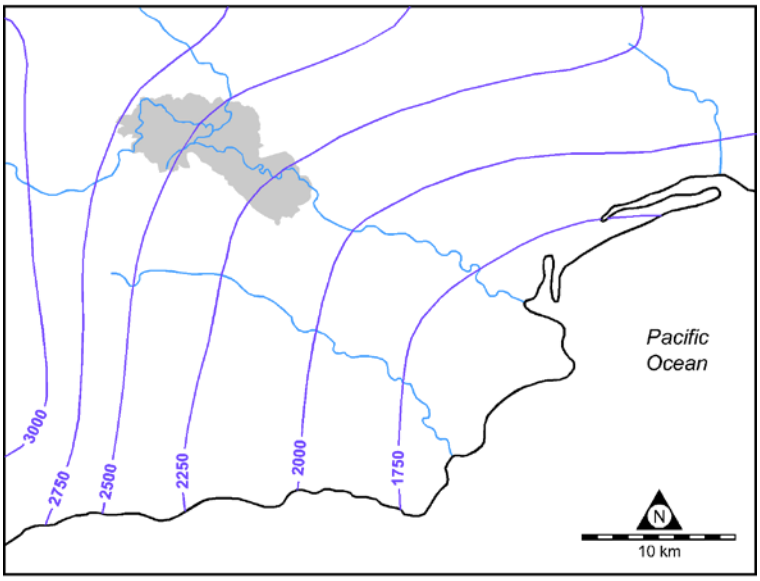


Figure 2.2 Average annual rainfall (in mm) in the Tonosí region (redrawn from Ichon 1980:7).

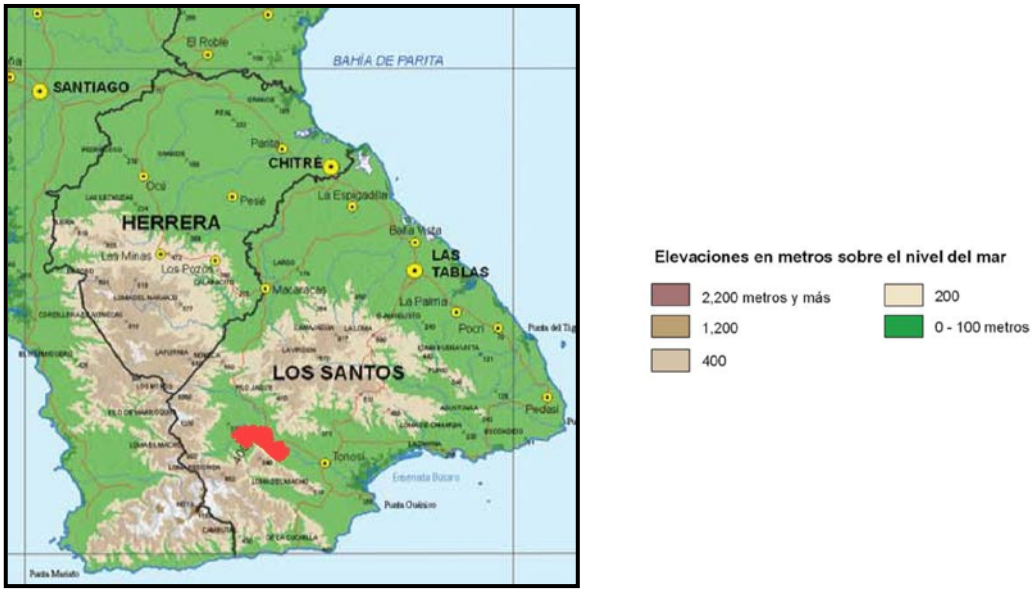


Figure 2.3 Physiographic map of Central Pacific Panama showing the location of the Río Tonosí valley survey zone (in red; base map from ANAM 2011:23, Mapa 1.3.1).

Figure 2.4 River channels of the Río Tonosí (left) and Río Guaniquito (right) during the dry season.

Figure 2.5 Relatively large expanses of floodplain in the regional survey zone.

Figure 2.6 Rolling hills in the northern part of the regional survey zone.

Figure 2.7 Guaniquito Abajo's location amidst the rolling hills in the northern part of the survey zone (Cerro La Tronosa can be seen in the background).

Figure 2.8 Large, relatively flat areas of land that sit above the Río Tonosí floodplain in the eastern part of the regional survey zone.

Figure 2.9 Alluvial spurs which extend from the base of Cerro La Tronosa in the eastern part of the regional survey zone.

Figure 2.10 The eroded slopes of an alluvial spur.

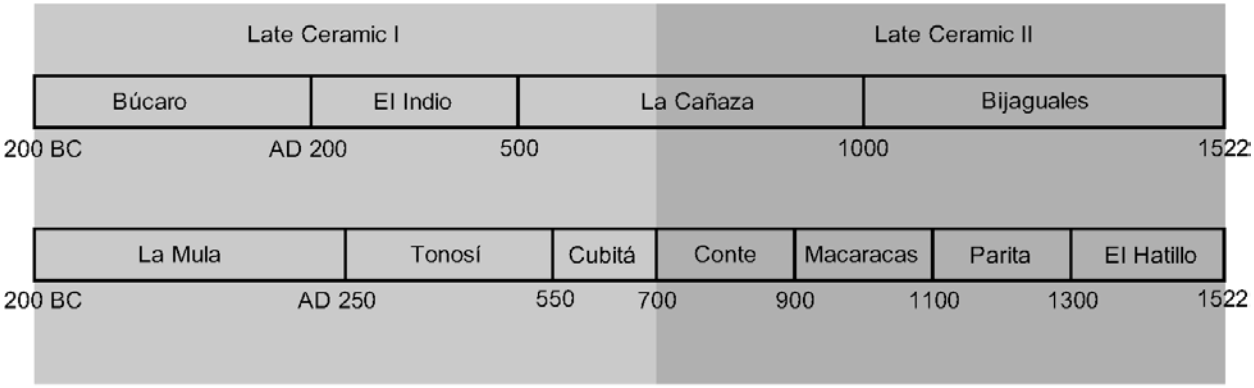


Figure 2.11 Chronological frameworks for the Late Ceramic period (dates for the Río Tonosí valley, on top, are based on Briggs 1989:21 and Cooke and Sánchez 2003; dates for the seven-phase chronology, on bottom, are derived from Haller 2008a:35, Figure 2.12 and Sánchez and Cooke 2000:7, Cuadro 1).

Table 2.1 Average sherd densities and residential densities for four prehispanic communities in the Intermediate Area.

Local Community	Period	Average Sherd Density (sherds/m^2/century)	Average Residential Density (people/ha)
Mesitas	Regional Classic	4.5	7.5
Suta	Early Muisca	39.5	13.0
Suta	Late Muisca	8.9	9.0
Barriles	Early Bugaba	27.9	11.5
Barriles	Late Bugaba	35.0	22.5
El Venado (La Esmeralda Ward)	Early Muisca	90.7	34.6
El Venado (La Esmeralda Ward)	Late Muisca	81.1	19.1
El Venado (Abejas Ward)	Late Muisca	32.3	15.2

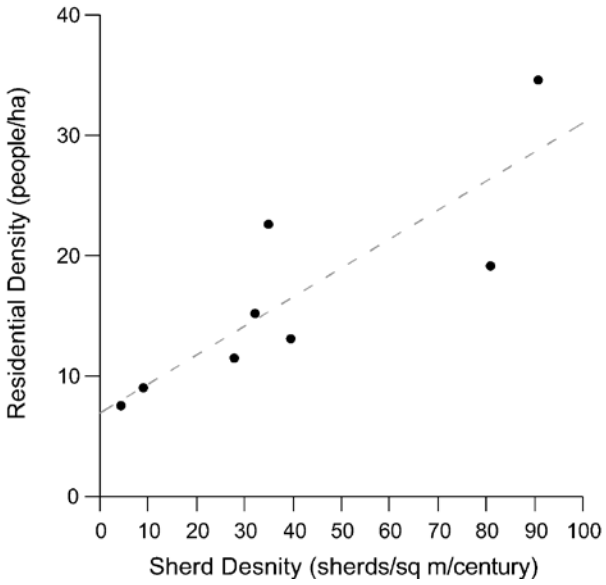
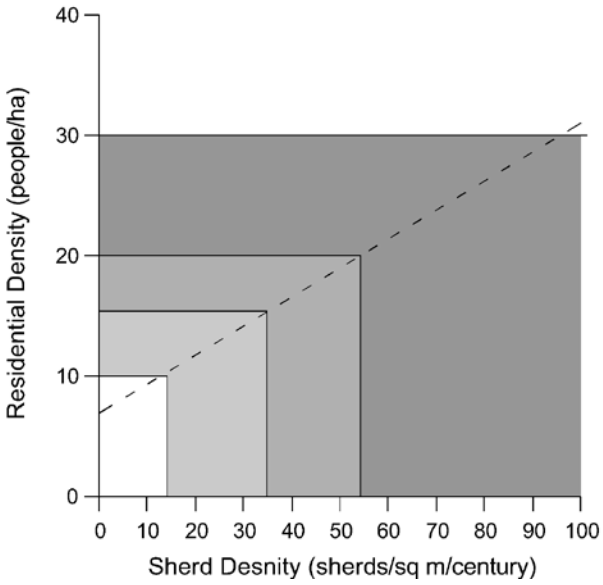


Figure 2.12 Relationship between residential densities and sherd densities at four prehispanic communities in the Intermediate Area.



sherds/m²/century	people/ha
0-14	5-10
15-34	10-15
35-55	15-20
>55	20-30

Figure 2.13 Density categories used to make population estimates in the Río Tonosí valley.

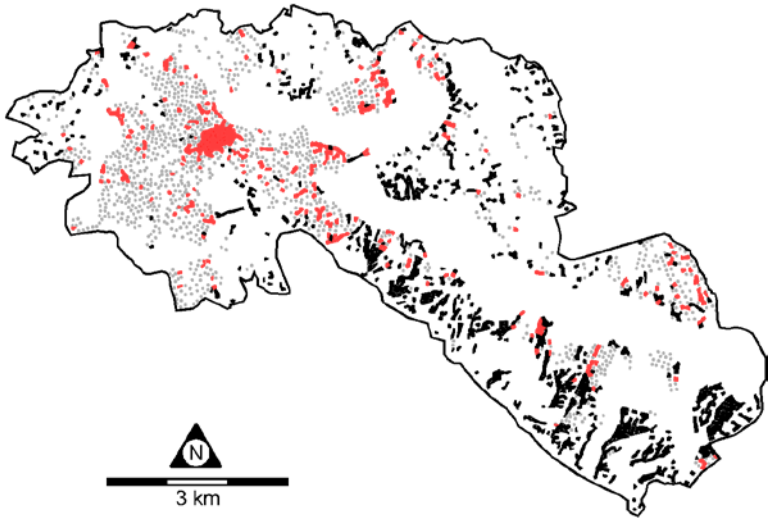


Figure 2.14 Distribution of collection lots made using shovel probes (red) and surface collections (black) in the Río Tonosí valley (shovel probes that did not yield any cultural material are shown as grey dots).

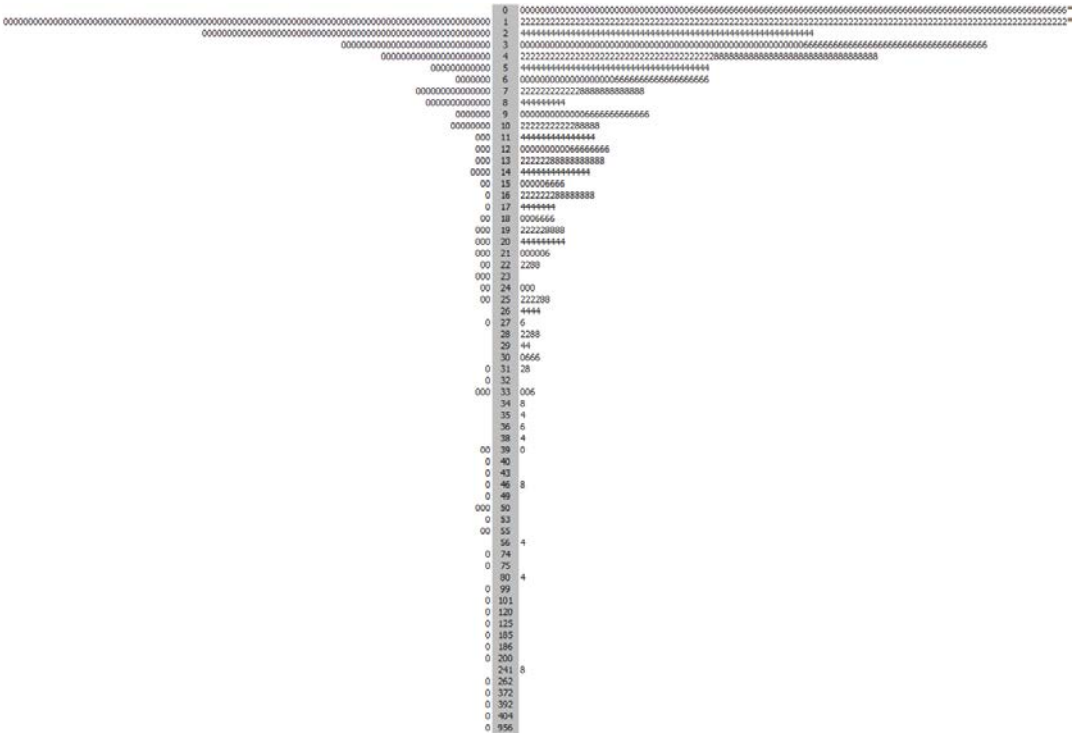


Figure 2.15 Back-to-back stem-and-leaf plot of sherd frequencies from shovel probes (top) and surface collections (bottom; sherds frequencies from surface collections have been transformed so that the median of both batches are the same).

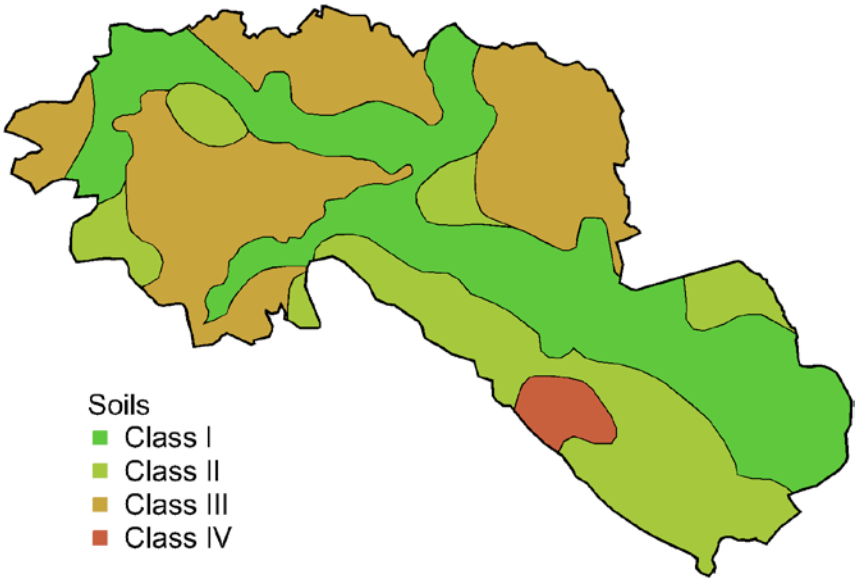


Figure 2.16 Distribution of different soil zones in the Río Tonosí valley.

3.0 EARLY COMPLEX SOCIETY GROWTH IN THE RÍO TONOSÍ VALLEY

The length of prehispanic occupation in the Río Tonosí valley represents but a fraction of the occupational history that exists within the broader Panamanian isthmus. Human occupation first emerged in Panama sometime between 9000 and 7000 BC (Cooke 2005; Cooke *et al*. 2013b), and it was not until at least some 7000 years later that such occupation seems to have spread into southern reaches of the Azuero Peninsula (Ichon 1980). By this time agriculture had already been evolving for many thousands of years, and ceramic technology had existed for well over a millennium (see references below). Yet as significant as these developments were for laying the foundation of early complex society development, it is the last two millennia of prehispanic occupation, known as the Late Ceramic period (250 BC—AD 1522), that is the focus of this research. There is by now a great deal of literature that exists on the hunter-gather lifeways that preceded these Late Ceramic period populations (e.g. Cooke 2005; Cooke *et al*. 2013b; Dickau *et al*. 2013; Haller 2008a:47-53; Pearson 2003; Pearson and Cooke 2007; Ranere 2006; Ranere and Cooke 2003; Ranere and Hansell 1978; Ranere and López 2007), as well as on the rise and spread of early agriculture (Cooke 2005; Dickau *et al*. 2007; Piperno 1994, 1999, 2006, 2007, 2009, 2011; Piperno *et al*. 1985; Piperno *et al*. 2000; Piperno and Holst 1998; Piperno and Jones 2003; Piperno and Pearsall 1998) and the early stages of ceramic technology (Cooke 1995; Iizuka 2013; Ranere and Hansell 1978; Sánzhez 2007). The reader is referred to this literature for more information on these milestones and evolutionary transformations of early Panamanian prehistory (see also Cooke and Ranere 1992; Linares and Ranere, eds. 1980).

It was not until sometime around 250 BC, as a sedentary lifeway began to flourish in many parts of Central Panama (see Haller 2008a; Isaza 2007; Weiland 1984), that human settlement first began to

spread into the Tonosí region. Although no such settlement was documented within the limits of the regional survey, Ichon (1980) identified 12 sites that were occupied during this initial phase of occupation (250 BC to AD 200; see Figure 3.1). These sites seem to have been quite small, typically measuring less than 0.5 ha each (see Ichon 1980:46, Figure 6 and 1980:72, Figure 16), and thus represent nothing more than individual farmsteads or very small hamlets that were widely scattered across the landscape. Their locations exhibit a strong concern for accessing coastal, alluvial, and riverine resources (Figure 3.1), much like in other regions of Central Panama during this same period of time (Haller 2008a; Isaza 2007).

Although some sites continued to exhibit such preferences during the subsequent 300 years (AD 200-500), it was during this time that settlement began to shift further inland (Figure 3.2), as some households began to establish themselves at greater distances from the coast and from the alluvial and riverine resources that had been so desirable during the Búcaro phase. Such an inland shift is also well documented in other regions of Central Panama (Haller 2008a; Isaza 2007), and is likely an indication of an increased reliance on agriculture during this period of time. In some regions, such as the Río Parita valley, this shift may have been due to change and degradation of coastal environments (see Haller 2008a:75), thus resulting in their depopulation. In other regions, however, alternative factors seem to have been involved. In both the Tonosí region and the Río La Villa valley some coastal settlements continued to grow (Ichon 1980; Isaza 2007), suggesting that these environments were still highly suitable for human habitation. A significant number of households nonetheless opted to settle much further inland, some migrating as far as the upper reaches of the Río Tonosí valley, spreading into the limits of the regional survey zone.

3.1 THE EL INDIO PHASE (AD 200-500)

From AD 200 to 500 the regional population of the Río Tonosí valley was relatively small, consisting of no more than about 400 people (Table 3.1). This population was widely distributed across much of the

regional landscape (Figure 3.3), as people opted to live exclusively among individual farmsteads and very small hamlets. Such a dispersed mode of settlement is evident in the density of El Indio-phase sherds that were recovered from collection lots, all but one of which correspond to a residential density of 5-10 people/ha.

Despite this tendency for settlement dispersal, though, there is some clustering apparent at the regional scale. During this time the majority of households lived among the spurs that extended from the base of Cerro La Tronosa, likely so as to have immediate access to the moderately productive (Class II) soils that existed in this particular part of the region (Figure 3.4). Although households would have had easy access to even more productive soils had they lived in the alluvial zone, the frequency with which this zone is inundated would have made it somewhat undesirable for human habitation. Such is evident in the fact that, rather than live on the alluvial soils, the small proportion of households that did not occupy the spurs opted to settle in less productive zones. Some of these households clustered into one of two clearly discernable hamlets that were located in the northern part of the region, and that were conspicuously offset from other areas of habitation. One such hamlet emerged at the site of Guaniquito Abajo, which was home to no roughly 25 people during this period of time.

3.2 THE LA CAÑAZA PHASE (AD 500-1000)

From AD 500 to 1000 the regional population of the Río Tonosí valley underwent substantial demographic growth, as some 2500 people came to occupy the region (Table 3.2; Figure 3.5). While this growth naturally resulted in the founding of many new settlements, a large proportion of the El Indio-phase settlement (or about 80% of it) continued to be occupied during this period of time. These patterns are very consistent with those observed throughout the broader Tonosí region, which also allude to substantial levels of demographic growth and high rates of settlement continuity; the number of sites

that Ichon (1980) documented for this period nearly doubled, and of the 13 sites that existed during the El Indio phase, all of them continued to be occupied during La Cañaza times (Figure 3.6).

During this period households continued to exhibit a strong preference for occupying the moderately productive spurs that extended from the base of Cerro La Tronosa. These spurs were home to roughly 50% of the regional population during the La Cañaza phase, despite making up only 17% of the total regional landscape. Most of the remaining population was scattered throughout the more abundant Class I soils, while a slightly smaller proportion came to occupy the highly productive alluvial zone (Figure 3.7). Although much of this zone is subject to inundation multiple times a year, some areas exist that are slightly more elevated and do not flood as frequently; it was among these slightly elevated patches of land that most households occupying alluvial soils came to establish their residence.

As population levels rose households continued to distribute themselves in a very dispersed fashion across much of the regional landscape. Such dispersal is evident in the relatively continuous nature of occupation that existed in many parts of the region (Figure 3.5), and in the unsmoothed surface of regional settlement (Figure 3.8), which exhibits a broad distribution of numerous, often closely spaced peaks that preclude the delineation of meaningful local communities (see Peterson and Drennan 2005). The one notable exception to this pattern occurs at the site of Guaniquito Abajo, where a single local community is clearly discernable on the landscape. During the La Cañaza phase this community was home to about 150 people, who spread themselves across an area of approximately 14 ha, resulting in a residential density of roughly 10 people/ha.

Though home to a relatively sizeable local population, Guaniquito Abajo was no more densely occupied than most other areas of settlement in the region. Of the roughly 300 ha of total settlement that existed at this time, about 90% of it (or 265 ha) was occupied at a density of 5 to 10 people/ha. The remaining 35 ha were widely scattered across the region, typically occurring in groups of no more than two or three contiguous collection lots in any one location (Figure 3.9). Most of these areas thus amount to nothing more than a few households, and in many cases may simply represent particularly dense concentrations of garbage (such as middens) amidst areas of low-density settlement.

In one area of the landscape, however, a significant number of households seem to have clustered at a somewhat greater density. This cluster of households occurs at the site that Ichon (1980) identified as Montevideo (see Figures 3.6, 3.8 and 3.9), and covers an area of about 7 ha. Within this area lived approximately 90 people, resulting in a residential density of roughly 13 people/ha. This cluster of settlement was thus not much more densely occupied than the large, relatively continuous areas of dispersed occupation that immediately surrounded it, and that preclude the delineation of local community boundaries. Nonetheless, that such a cluster of occupation is even apparent may suggest that there were some activities taking place there that were not occurring in other parts of the region, integrating households into a slightly more compact network of local interaction. Unfortunately, the limited excavations that Ichon (1980) conducted at Montevideo do not provide any indication as to what those activities might have been, nor do the results from regional survey.

Whatever activities may have been taking place at Montevideo, it is possible that they had an effect at an ever larger scale, integrating outlying settlement into a supra-local network of human interaction. As can be seen in Figure 3.10, some households seem to have clustered around the site of Montevideo, potentially having been drawn in by the same forces that were integrating households locally. However, given that the limits of this potential supra-local community would have corresponded closely to those of the alluvial spurs (Figure 3.11), it is unclear as to whether the clustering that is apparent around Montevideo was actually caused by some integrative force, or was simply the result of people's desire to occupy the moderately productive spurs that existed in this part of the region. This possibility can be explored by comparing what the observed population was in the landscape surrounding Montevideo to what one might expect had households been trying to maximize their access to the particular soils on which they lived. If there was indeed some integrative force at work, drawing households into a supra-local community, then the population observed in the landscape immediately surrounding Montevideo should be greater than what can be explained by the amount of Class II soils that were available there.

This issue can be explored by way of a grid-square analysis, using the 1x1 km grid that is illustrated in Figure 3.12. Using this grid an expected population can be calculated for any given square kilometer of landscape, based on (1) the amount of each soil type that is available within it, and (2) the overall population density of each soil zone during any given phase of prehispanic occupation. For instance, in the example grid-square that is shown in Figure 3.12 there exists a total 0.64 km^2 of Class I soil and 0.36 km^2 of Class II soil; the total population density within each of these soil zones during the La Cañaza phase was, respectively, 26 and 109 people/km^2. If households were trying to maximize their access to the particular soils on which they lived, and thus distributing themselves in a relatively even fashion across each respective soil zone, then these population densities should provide a fairly reliable indication of how many people lived within any given square kilometer of each. By multiplying these densities by the amount of each soil type that is present in any given grid square, then, it is possible to calculate an expected population for every square kilometer of the regional landscape. Areas where the observed population is similar to that of the expected value thus represent those areas where households may have been distributing themselves so as to maximize the amount of land that existed between households, given the number of people with whom they had to share them; in those areas where the ratio of observed to expected population was significantly higher, though, other factors would have been at play.

As can be seen in Figure 3.13, there were relatively few areas of the landscape where populations were significantly higher than the distribution of soils would lead one to expect. In fact, there is a fairly strong correlation between the observed and expected population values among the 64 grid squares that were included in this analysis ($r = 0.776$; $p < 0.0005$), suggesting that there was a relatively strong desire on the part of most households to maximize the amount of land that existed between them and their neighbors. Only five grid squares yielded observed to expected population ratios that were more than one standard deviation above the mean, one of which corresponds to the location of Montevideo. Another is located roughly 1 km to the east, yet is separated from Montevideo by virtually vacant landscape; rather than being drawn in by integrative forces at Montevideo, then,

these households may have selected this location due to the highly productive alluvial soils that existed there. This particular location represents one of the few sizeable areas in the alluvial zone that is not prone to regular inundation, and is today one of the few areas of the valley that is subject to large-scale cultivation.

One other such grid-square, however, is located directly southeast of Montevideo, and three others occur occurred directly to the south and west whose observed to expected population ratios were between 0.5 and 1.0 standard deviation above the mean. Ultimately, while these grid squares may suggest that there was some force prompting outlying households to cluster around Montevideo, such a force does not appear to have been particularly strong; most of the grid squares surrounding Montevideo contained observed to expected population ratios that were not particularly unusual (i.e. more than one standard deviation above the mean), and those that are distinguished in Figure 3.13 do not amount to a particularly sizeable area. Although it is possible that additional zones of unusually concentrated settlement extended further east, beyond the limits of the survey zone, such a possibility is unclear at this point.

Ultimately, then, there does not seem to have been any significant level of community integration in the Río Tonosí valley during the La Cañaza phase, at the either the local or supra-local scale. Although households clustered at slightly greater densities both in and around Montevideo, suggesting that there may have been some integrative force at work there which did not exist in other parts of the valley, such a force seems to have been relatively weak. Nowhere in the Río Tonosí valley, in fact, did there exist any substantial degree of settlement nucleation or supra-local integration. While Guaniquito Abajo would have been a likely place for such to occur (given its importance in the subsequent period), this local community was relatively dispersed, and was clearly not drawing in outlying settlement to live in the surrounding landscape, which was some of the least densely occupied land anywhere in the entire valley. Rather than being influenced by social factors, then, settlement decisions in the Río Tonosí valley seem to have been largely motivated by economic concerns. Households exhibited a strong preference for occupying some of the most productive soils in the region,

and beyond that for maximizing the amount of land that was available to them immediately surrounding their houses.

3.3 THE BIJAGUALES PHASE

From AD 1000 to 1522 the regional population of the Río Tonosí valley continued to grow. Though the rate of this growth was slower than it had been during the preceding period, it was nonetheless rather substantial, resulting in a total population of about 3700 people (Figure 3.14; Table 3.3). As population levels rose some 60% of the La Cañaza-phase settlement continued to be occupied, which again exhibits patterns that are similar to those observed throughout the broader Tonosí region. During the Bijaguales phase the number of sites that Ichon (1980) identified increased by roughly 80%, and one-third of them had been occupied during La Cañaza times (Figure 3.15).

During the Bijaguales phase households continued to exhibit a strong preference for occupying the moderately productive alluvial spurs that extended from the base of Cerro La Tronosa. Although the overall proportion of the population that occupied this zone (along with the remaining Class II soils) was less than it had been during the preceding period (Figure 3.16), the population density of this zone nonetheless increased. This pattern suggests that this zone was no less desirable than it had been during the La Cañaza phase, but that there was perhaps not much room for growth to occur here if households were to maintain their preferred, dispersed pattern of residence. Such a preference had the effect of pushing population growth into other, less desirable parts of the region, such as the less productive Class III soils and the regularly inundated alluvial zone, both which experienced substantial growth during this period of time. The only sizeable area among the alluvial spurs that could have sustained more occupation was where Montevideo had once been located, which had been virtually abandoned by the Bijaguales phase. While it is not entirely clear what may have prompted this, or what

may have discouraged more households from living in this particular part of the landscape, it may have had to do with the growing importance of Guaniquito Abajo, as will be discussed below.

That households did in fact wish to maintain their dispersed patterns of residence is evident in the relatively continuous nature of settlement that existed in the spurs and in other parts of the valley (Figure 3.14), and in the unsmoothed surface of Bijaguales-phase settlement (Figure 3.17). Much like that of the preceding period this surface once again depicts a broad distribution of numerous, closely-spaced peaks that preclude the delineation of meaningful local communities. Although Guaniquito Abajo had been the clear exception to this pattern during the La Cañaza phase, this no longer seems to have been the case. Here there existed some 25 ha of contiguous settlement measuring roughly 1 km across at its greatest extent, within which lived approximately 275 people. But this area of occupation is not clearly discernable from the smaller patches of settlement that immediately surrounded it, impeding the delineation of meaningful community boundaries.

As in the preceding period the vast majority of households in the Río Tonosí valley during the Bijaguales phase were residing at relatively low densities. Of the approximately 450 ha of settlement that existed in the region, 90% of it was occupied at a density of 5 to 10 people/ha. Most of the remaining settlement was again widely scattered across much of the region, typically occurring in small groups of no more than a few contiguous collection lots in any one location (Figure 3.18). In three separate instances, however, these denser zones of occupation are seen to cluster on the landscape. One such cluster occurred toward the western edge of the alluvial spurs, at the site that Ichon (1980) identified as Guayabo, while the other emerged roughly 2 km further north, at the site of Barrancón. These two clusters of settlement each consisted of about 75 people, and had residential densities of about 14 and 19 people/ha (respectively).

The third instance of such clustering occurred at the site of Guaniquito Abajo. This cluster of dense occupation was somewhat larger than the other two, consisting of approximately 150 people, and was spread across roughly 7.5 ha of landscape, resulting in a residential density of about 19 people/ha. Interestingly, this cluster of settlement corresponds to the same part of the community where

small earthen burial mounds were being constructed, suggesting that the activities associated with these mounds may have in some been way connected to the more nucleated patterns of interaction that were developing. In examining the growth of Guaniquito Abajo, however, it is clear that this particular part of the community held some significance even prior to the construction of small earthen mounds.

As can be seen in Figure 3.19, it was in the same part of the community where households came to cluster at greater densities and small earthen burial mounds began being constructed during the Bijaguales phase that Guaniquito Abajo was initially founded. This initial area of settlement continued to be occupied during the La Cañaza phase, where slightly denser areas of occupation had begun to emerge. Although these denser areas of occupation were not as contiguous as those at Montevideo, they do nonetheless suggest that this particular part of the community was beginning to distinguish itself in some way. At this point there is unfortunately no indication (neither from Ichon's [1980] excavations or the results of regional survey) as to what sorts of activities may have been associated with this, but it is nonetheless clear that by the Bijaguales phase they had given way to even denser patterns of settlement and to the construction of small earthen burial mounds in this same part of the community.

The relative infrequency with which rituals would have presumably been held at these mounds would suggest that they were not the sole activity around which daily patterns of interaction were organized at Guaniquito Abajo, but they may well have been the basis of organizing interaction at a larger, supra-local scale. However, though such interaction is often structured in the form of a clearly discernable supra-local community, this does not seem to have been the case in the Río Tonosí valley. Although such a community could potentially be identified in the smoothed surface of Bijaguales-phase settlement (Figure 3.20), the overall proportion of the regional population that this community would have incorporated would have been relatively small given the relatively high investment that was made at Guaniquito Abajo in the construction of small earthen mounds. Not only was this site home to the largest number of mounds in the regional survey zone, but so too did it have the most of any site throughout the entire southern Azuero Peninsula (Ichon 1980). Thus, although Guaniquito Abajo would

not likely have been integrating settlements across the entire southern Azuero, its role in organizing supra- local interaction would presumably have extended beyond the limits of what is shown in Figure 3.20.

Although the landscape surrounding Guaniquito Abajo had filled in during the course of the Bijaguales phase, it was still some of the least densely occupied land that existed in the region. Much more of the population settled further east, some of which appears to have clustered around the site of Guayabo. While such clustering suggests that Guayabo, like Montevideo before it, may have exerted some force that was integrating households at a supra-local scale, the results of the grid-square analysis suggest that this this force was very weak. Of the 64 grid squares that were included in this analysis, only four yielded observed to expected population ratios that were more than one standard deviations above the mean (Figure 3.21). Three of these squares correspond to the clusters of dense occupation that occurred at Guaniquito Abajo, Barrancón, and Guayabo, while the fourth corresponds to the same cluster of settlement that had emerged in the eastern reaches of the alluvial zone during the La Cañaza phase (and that seems to have grown during Bijaguales times). Moreover, of the six grid squares whose observed to expected population ratio was between 0.5 and 1.0 standard deviations above the mean, only two occur in the direct vicinity of Guayabo. This pattern thus suggests that the settlement which existed around Guayabo can be explained largely by the amount of Class II soils that were available in this particular part of the region, rather than by any strong integrative force operating from within Guayabo itself. As in the previous phase there is a moderately strong correlation between the observed and expected population of grid squares throughout the entire region (r =0.624; p < 0.0005), suggesting that there was again a relatively strong desire on the part of many households to maximize the amount of land that existed between them and their neighbors.

Though the settlement that was clustered around Guayabo does not seem to have been due to any strong integrative force that existed at this site, it is nonetheless significant that such clustering was now occurring there rather than at Montevideo, which was all but abandoned during the Bijaguales phase (see Figure 3.14). That this clustering of settlement had effectively moved upstream may have had to do

with the growing importance of Guaniquito Abajo, and the desire of some households to live closer to it than had been the case in the previous phase. This desire does not seem to have trumped, however, an even stronger desire on the part of these same households to occupy the moderately productive alluvial spurs. Thus, while the activities that were occurring at Guaniquito Abajo may indeed have been an important factor in structuring patterns of supra-local interaction, they did not result in the formation of a clearly discernable supra-local community. This suggests that the nature of such interaction may have been somewhat different than that which developed among many early complex societies where supra-local communities developed, as will be discussed later on Chapter 5.

While this survey initially set out to document the organization of craft activities across the regional landscape, very little evidence for such activity was ultimately recovered. The only conspicuous evidence for craft production relates to the production of quartz beads. In addition to one complete bead that was recovered from the mounds at Guaniquito Abajo, two blanks were also recovered that represent earlier stages in the production process; one such blank exhibited relatively little alteration, while the other showed evidence of perforation through its core. Rather than being associated with any of the dense clusters of settlement that existed in the region, though, which might suggest that craft production was one activity through which these dense clusters of households were integrated, these blanks were recovered from lots that correspond to individual farmsteads or small hamlets. This suggests that the production of these beads was organized at the household level. In fact, the very limited evidence of craft production itself may be an indication that such activities were not carried out as specialized tasks, or concentrated in any particular area of the region. Such limited evidence is not inherently due to the methods of regional-scale data collection, as comparable methods were capable of documenting even modest levels of craft specialization in the Río Parita (see Haller 2008a; Menzies 2009).

In many ways, then, patterns of settlement and demography in the Río Tonosí valley during the Bijaguales phase represent a continuation of those that had emerged during La Cañaza times. The regional population continued to grow, and many households continued to exhibit a strong preference for occupying the moderately productive Class II soils that extended from the base of Cerro La

Tronosa. Though the relative proportion of the population that occupied these soils was less than it had been in the previous phase, this seems to have been due to the fact that there was not much room for growth to occur there if households were to maintain their dispersed pattern of residence. Such dispersal characterized the vast majority of regional settlement, though in some locations households seem to have clustered at somewhat greater densities. In none of these locations, however, were these dense clusters of households particularly large, the largest being that which emerged at Guaniquito Abajo.

During this time Guaniquito Abajo may have played an important role in structuring patterns of supra-local interaction, drawing many households further upstream along the Río Tonosí and in closer proximity to its location. Such a draw was not strong enough, however, so as to attract households into its immediate vicinity, forming a clearly discernable supra-local community. Instead, people again seem to have located their settlement primarily on the basis of economic concerns. These concerns prompted households to occupy some of the more productive zones that existed in the valley, and to distribute themselves in such a way that maximized the amount of land that was immediately available to them.

3.4 SUMMARZING PATTERNS OF GROWTH IN THE RÍO TONOSÍ VALLEY

From 250 BC to AD 200 settlement patterns in the Tonosí region seem to have been somewhat similar to those observed in other areas of Central Panama, as most settlements came to exhibit a clear preference for occupying coastal and alluvial resource zones. In contrast to areas like the Río Parita and Río Tonosí valleys, though, where larger local communities were beginning to emerge, settlements in the Tonosí region were very small. From AD 200 to 500 these settlements grew slightly, and, as in other regions of Central Panama, began to occupy areas that were further offset from coastal and alluvial resources. This

shift was likely associated with an increased reliance on agriculture, allowing settlements to move further inland, ultimately spreading into limits of the Río Tonosí valley survey zone.

During this time regional population levels in the Río Tonosí valley were relatively low, as households distributed themselves across much of the landscape among individual farmsteads and small hamlets. These settlements exhibited a strong preference for occupying the moderately productive alluvial spurs that extended from the base of Cerro La Tronosa, establishing a pattern that would persist rather strongly throughout the remainder of this regional trajectory. It was also during this time that Guaniquito Abajo was founded, in a location that was relatively far removed from other areas of settlement. This pattern would also persist rather strongly throughout the remainder of this region's developmental trajectory, as the landscape surrounding Gunaiquito Abajo was continuously some of the least densely occupied in region. This may have been due to the relatively unproductive (Class III) soils and the frequently inundated floodplain that existed in the surrounding landscape.

From AD 500 to 1000 the regional population of the Río Tonosí valley experienced substantial demographic growth. As population levels rose households continued to exhibit a strong preference for occupying the moderately productive alluvial spurs, and came to distribute themselves at relatively low residential densities across most of the regional landscape. Such a distribution naturally resulted in very dispersed structures of local interaction, in which households typically lived at least 75-100 m (on average) from their nearest neighbor. So continuous was this dispersal in many parts of the region that it precludes the delineation of distinct local communities. Though Guaniquito Abajo was the lone exception in this regard during the La Cañaza phase, this local community was not particularly nucleated, but was rather a loose aggregation of farmsteads that could all have interacted on a daily basis.

Although there was one notable instance where households seem to have resided at slightly greater residential densities (i.e. at Montevideo), and where households in the surrounding landscape seem to have clustered around it, the integrative forces that seem to have caused this were ultimately relatively week. Rather than being influenced by social factors, then, settlement in the Río Tonosí valley

during the La Cañaza phase seems to have been influenced more by economic concerns. Specifically, these concerns entailed a desire on the part of most households to live in relatively productive environmental zones, and to distribute themselves in such a way that that would have maximized the amount of land that was available to them in the landscape immediately surrounding their houses.

During the last 500 years of prehispanic occupation in the Río Tonosí valley the regional population continued to grow. As population levels rose households continued to concentrate in the moderately productive Class II soils, though by this point many were being pushed into less favorable resource zones, likely so as to maintain their preferred, dispersed pattern of residence. This dispersal once again resulted in relatively large areas of more or less continuous settlement in many parts of the region, most of which occurred at relatively low densities. Though some households came to reside at slightly greater residential densities in a few select locations, none of these dense clusters of households were particularly large, and were in all cases directly abutted larger areas of more dispersed occupation.

The largest instance of such clustering occurred at the site of Guaniquito Abajo, where small earthen burial mounds were being constructed during this same period of time. While the activities that were associated with these mounds seem to have played an important role in structuring patterns of supra-local interaction, prompting settlements to move up the spurs and in closer proximity to Guaniquito Abajo, they did not result in the formation of a clearly discernable supra-local community. Ultimately, then, although integrative forces at Guaniquito Abajo may have led to modest levels of settlement nucleation and influenced patterns of outlying settlement, they were not so strong so as to prompt most households to abandon their economic concerns. Many households continued to occupy some of the most favorable environmental zones that existed in the region, and to distribute themselves in such a way that maximized the amount of land that was available to them in their immediate vicinity.

These patterns of growth provide valuable insight into the nature of early complex society development in the Río Tonosí valley, and into why such relatively low levels of social inequality may have developed in this particular region when compared to other areas of Central Panama. These patterns are most enlightening, however, when compared to those of other regions where more marked

levels of social hierarchy ultimately came to develop. The Río Parita valley represents one such region, whose patterns of growth are discussed in the following chapter. While making the necessary adjustments to account for differences in the way data was collected in the field, this regional dataset will be subject to precisely the same sorts of analyses as that of the Río Tonosí valley.

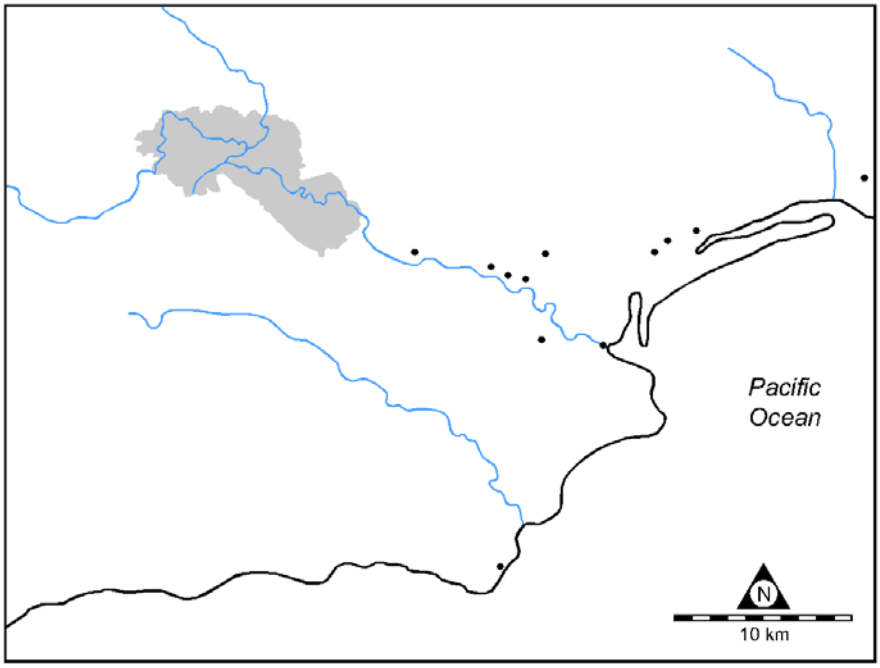


Figure 3.1 Búcaro-phase settlements identified by Ichon (1980) in the Tonosí region (from Ichon 1980:71, Figure 15). The regional survey zone is shown in grey.

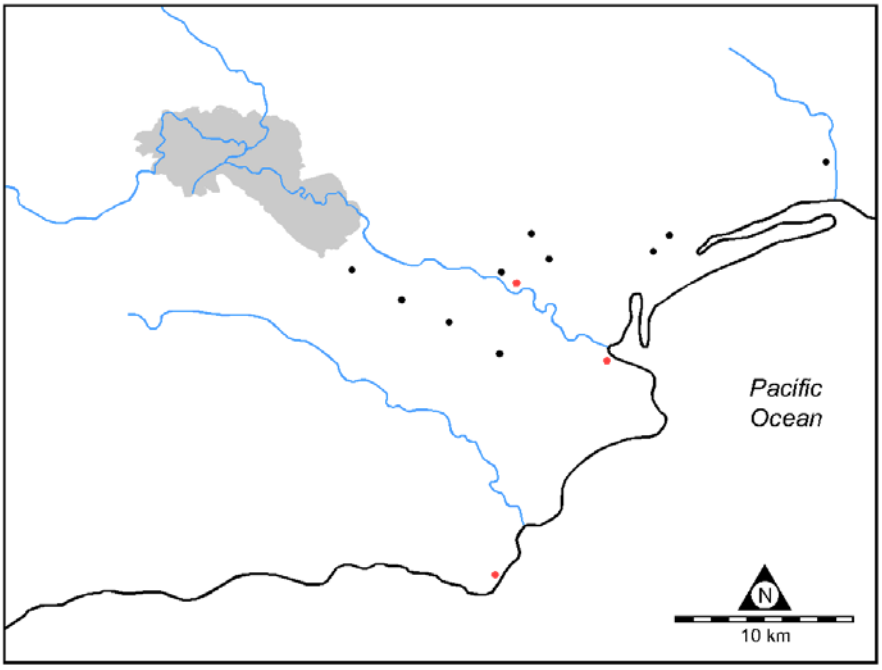


Figure 3.2 El Indio-phase settlements identified by Ichon (1980) in the Tonosí region (from Ichon 1980:194, Figure 61). Sites shown in red are those that were occupied during the previous phase of occupation, and the regional survey zone is shown in grey.

Table 3.1 Regional Demographic Data for the Río Tonosí Valley during the El Indio Phase

Number of collection lots	101
Area of occupation (ha)	52.3
(minimum)	263
Regional population (average)	394
(maximum)	524
Regional population density (people/km²)	7.9

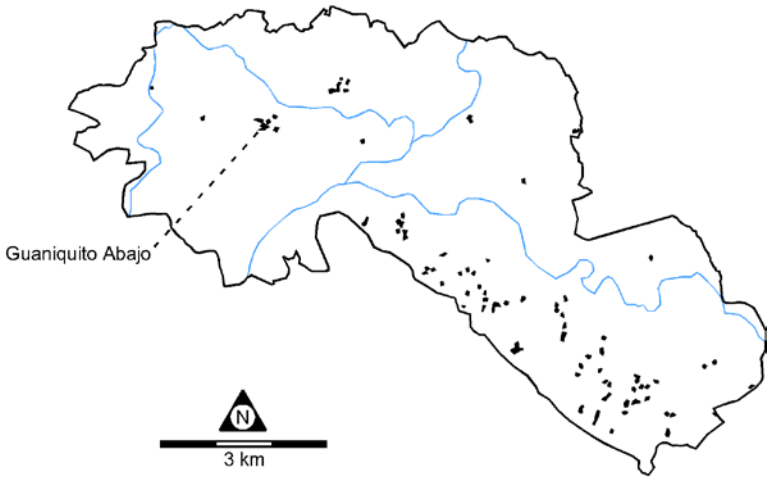


Figure 3.3 Regional settlement patterns in the Río Tonosí valley during the El Indio phase.

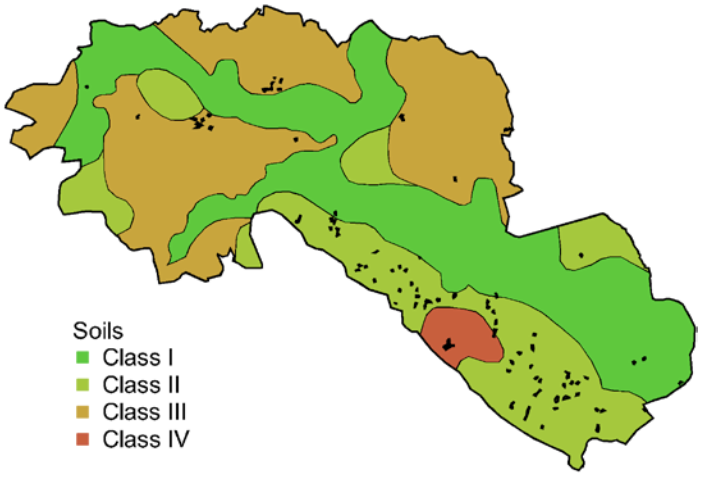


Figure 3.4 Distribution of settlement among different soil zones in the Río Tonosí valley during the El Indio phase.

Table 3.2 Regional Demographic Data for the Río Tonosí Valley during the La Cañaza Phase

Number of collection lots	590
Area of occupation (ha)	298.9
(minimum)	1700
Regional population (average)	2451
(maximum)	3204
Regional population density (people/km²)	49.0
Annual growth rate (% per year)	0.37

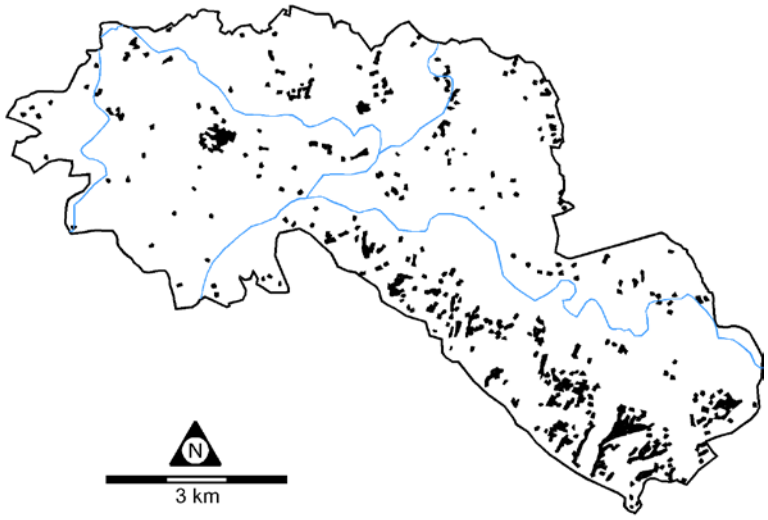


Figure 3.5 Regional settlement patterns in the Río Tonosí valley during the La Cañaza phase.

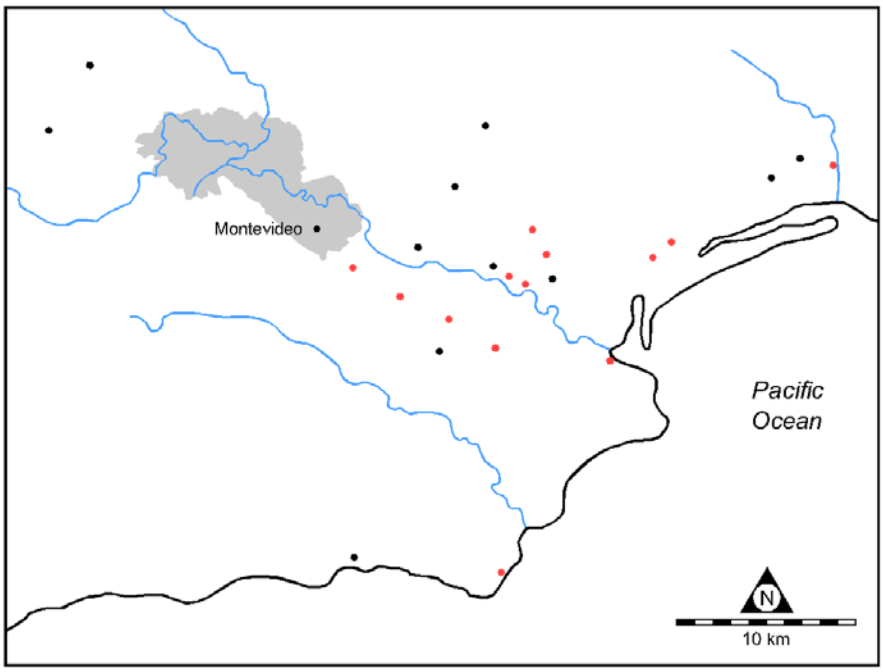


Figure 3.6 La Cañaza-phase settlements identified by Ichon (1980) in the Tonosí region (from Ichon 1980:315, Figure 99). Sites shown in red are those that were occupied during the previous phase of occupation, and the regional survey zone is shown in grey.

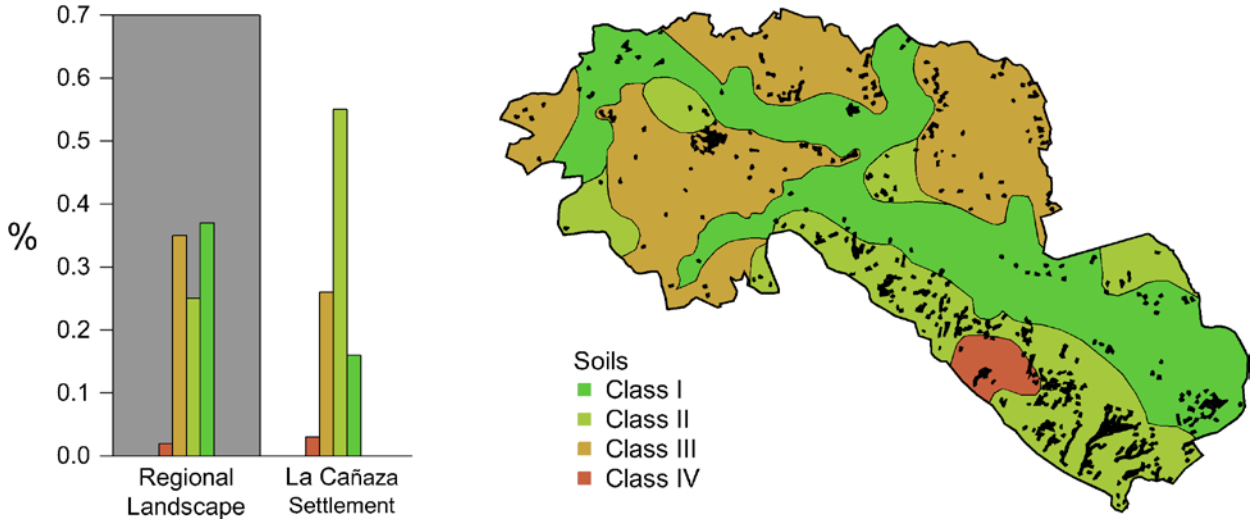


Figure 3.7 Distribution of settlement among different soil zones in the Río Tonosí valley during the La Cañaza phase.

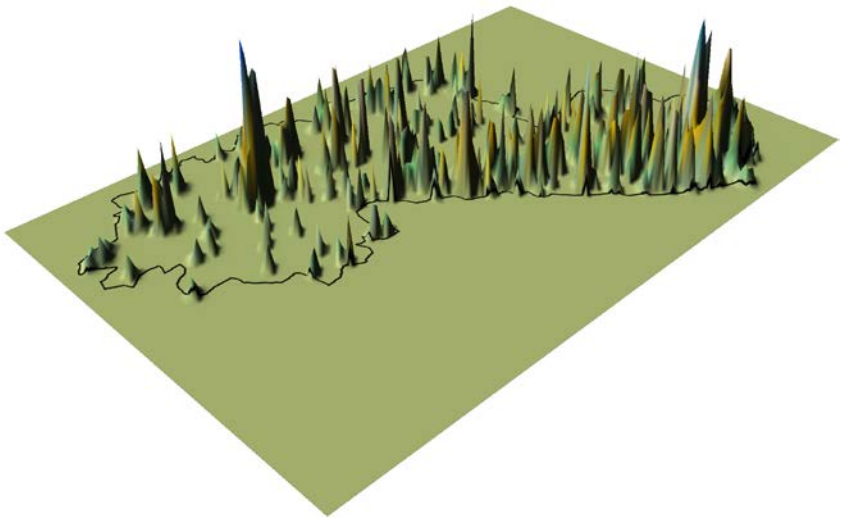


Figure 3.8 Unsmoothed surface of regional settlement in the Río Tonosí valley during the La Cañaza phase.

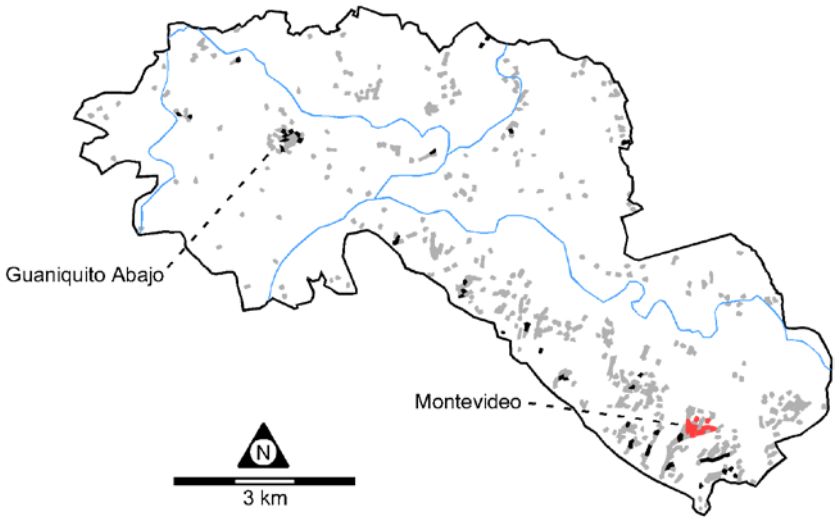


Figure 3.9 Distribution of La Cañaza-phase collection lots with residential densities greater than 5-10 people/ha (hatched in black; areas where these lots clustered together are hatched in red).

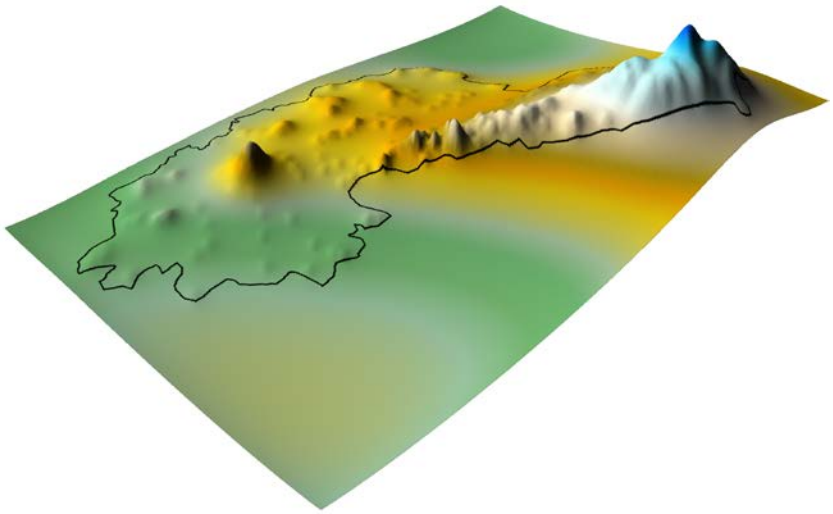


Figure 3.10 Smoothed surface of regional settlement in the Río Tonosí valley during the La Cañaza phase.

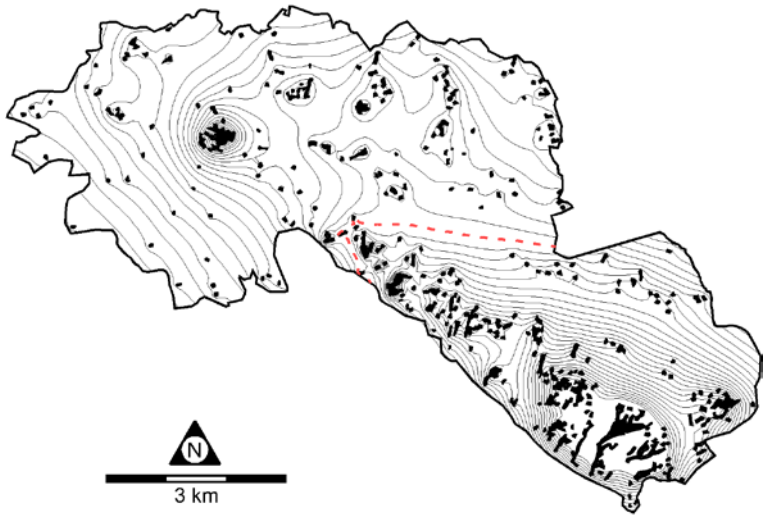


Figure 3.11 Delimitation of a potential supra-local community centered on Montevideo during the La Cañaza phase.

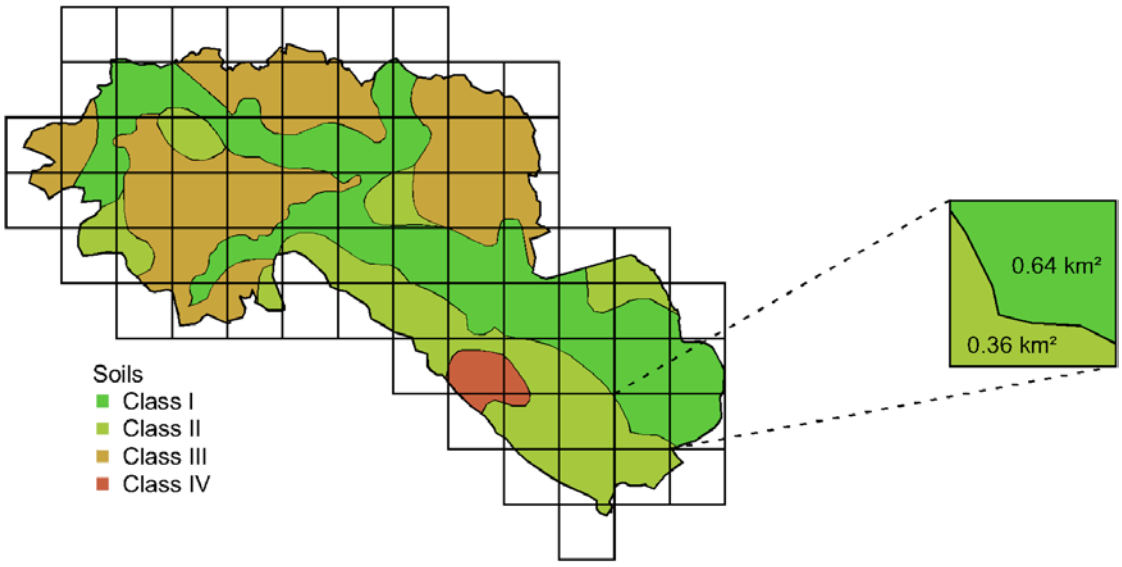


Figure 3.12 Distribution of soils among 1x1 km grid squares in the Río Tonosí valley.

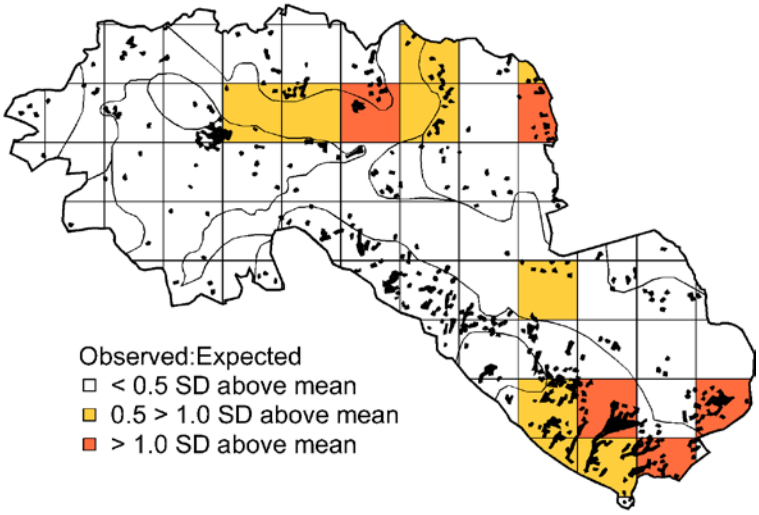


Figure 3.13 Distribution of observed to expected population ratios among 1x1 km grid squares in the Río Tonosí valley during the La Cañaza phase.

Table 3.3 Regional Demographic Data for the Río Tonosí Valley during the Bijaguales Phase

Number of collection lots	894
Area of occupation (ha)	446.3
(minimum)	2581
Regional population (average)	3714
(maximum)	4847
Regional population density (people/km²)	74.3
Annual growth rate (% per year)	0.08

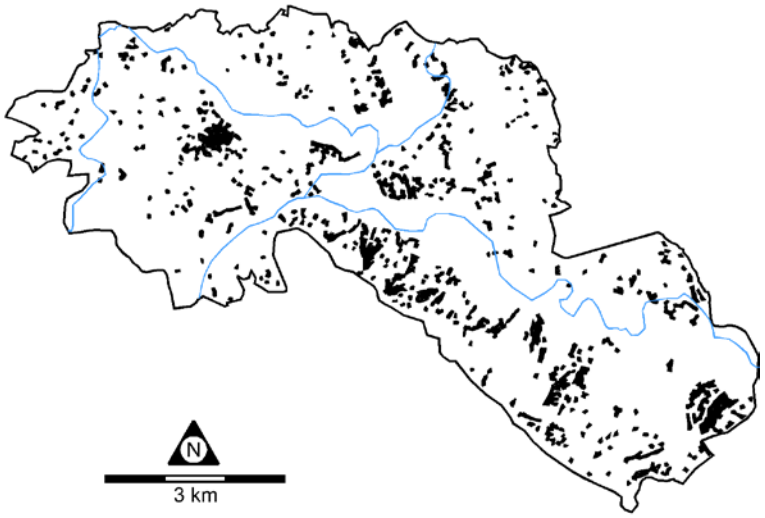


Figure 3.14 Regional settlement patterns in the Río Tonosí valley during the Bijaguales phase.

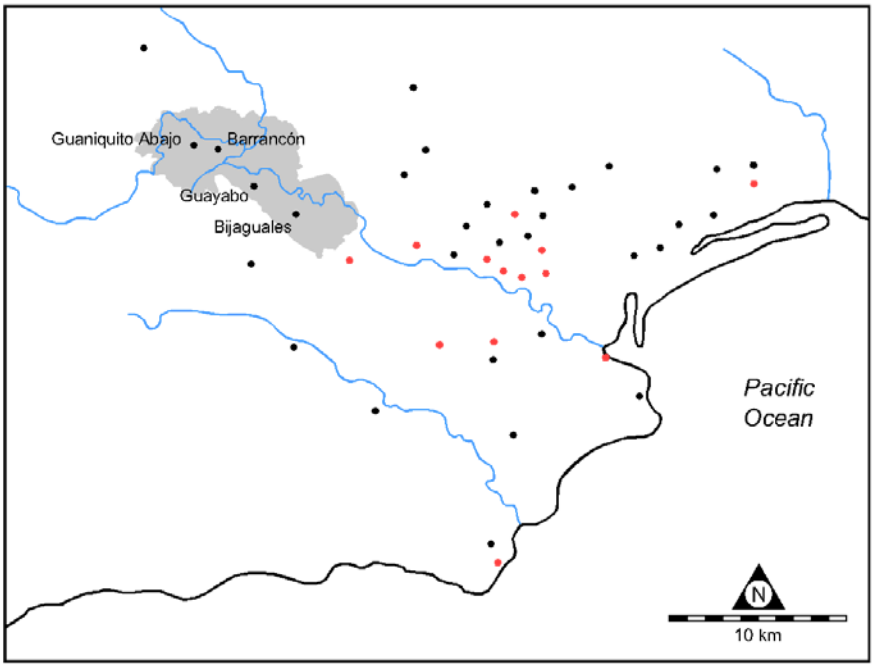


Figure 3.15 Bijaguales-phase settlements identified by Ichon (1980) in the Tonosí region (from Ichon 1980:410, Figure 134). Sites shown in red are those that were occupied during the previous phase of occupation, and the regional survey zone is shown in grey.

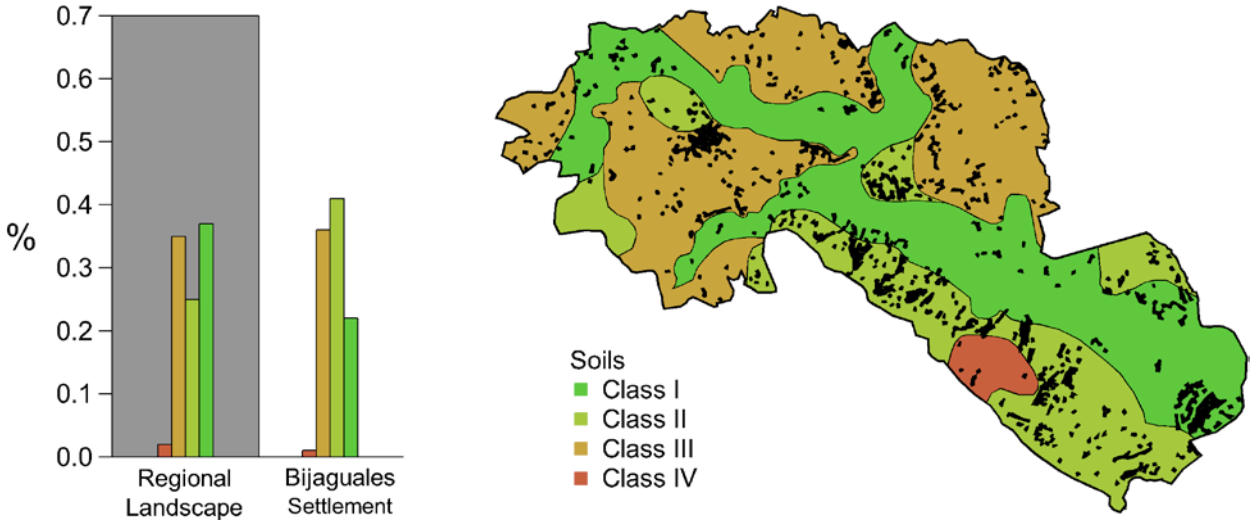


Figure 3.16 Distribution of settlement among different soil zones in the Río Tonosí valley during the Bijaguales phase.

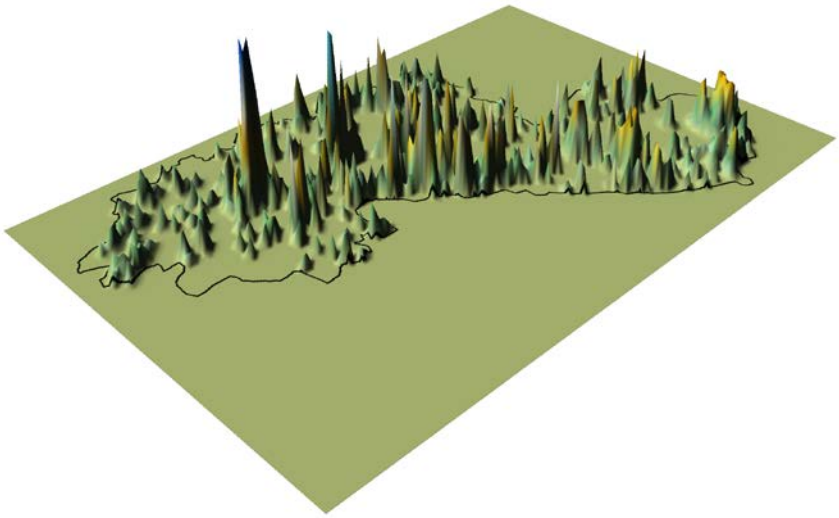


Figure 3.17 Unsmoothed surface of regional settlement in the Río Tonosí valley during the Bijaguales phase.

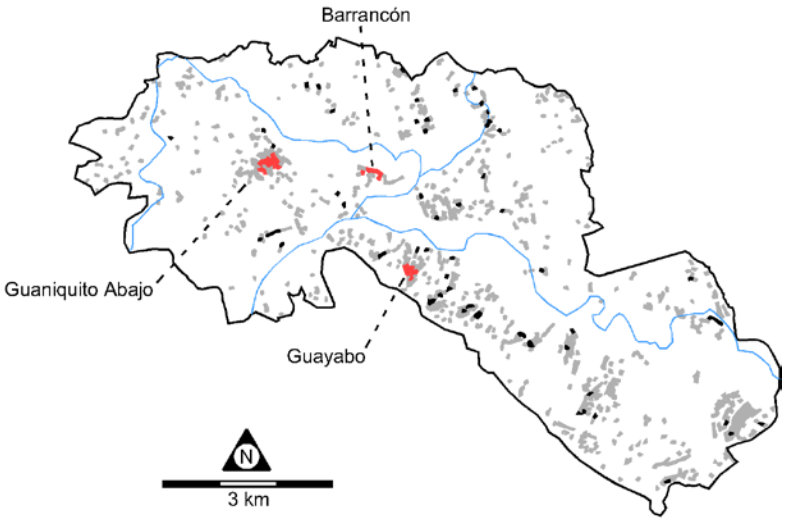


Figure 3.18 Distribution of Bijaguales-phase collection lots with residential densities greater than 5-10 people/ha (hatched in black; areas where these lots clustered together are hatched in red).

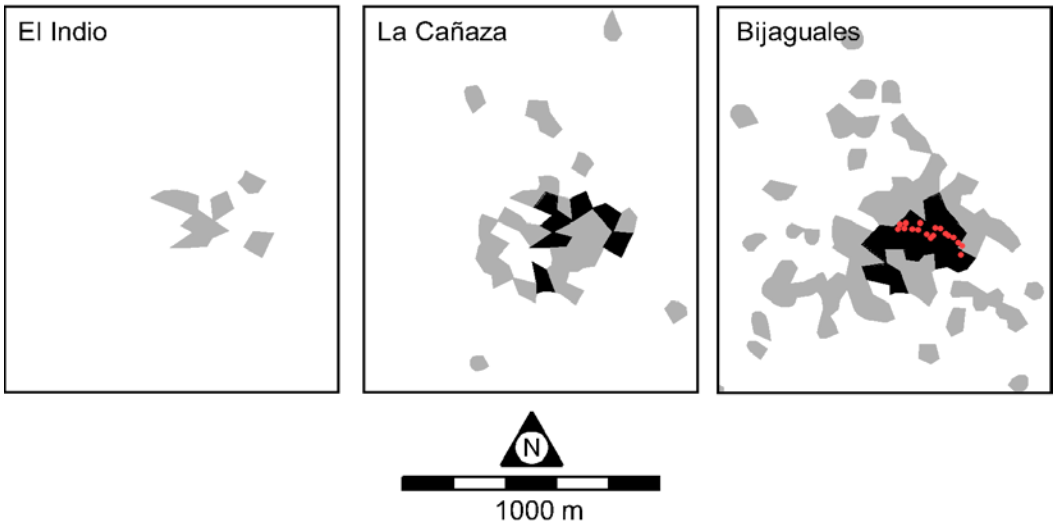


Figure 3.19 Settlement patterns at Guaniquito Abajo throughout its entire history of occupation (collection lots hatched in black are those where residential densities were greater than 5-10 people/ha, and small earthen burial mounds are shown in red).

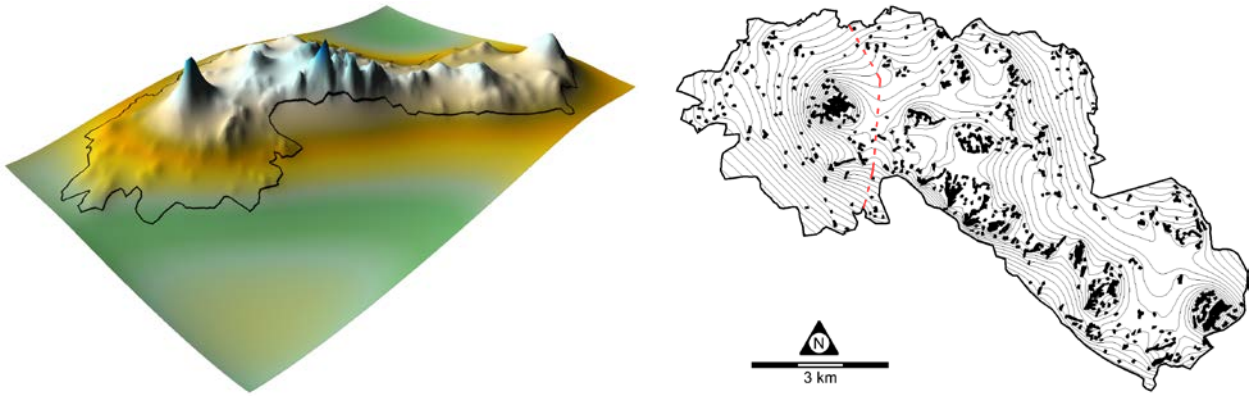


Figure 3.20 Smoothed surface of regional settlement in the Río Tonosí valley during the Bijaguales phase and the delimitation of a potential supra-local community around Guaniquito Abajo.

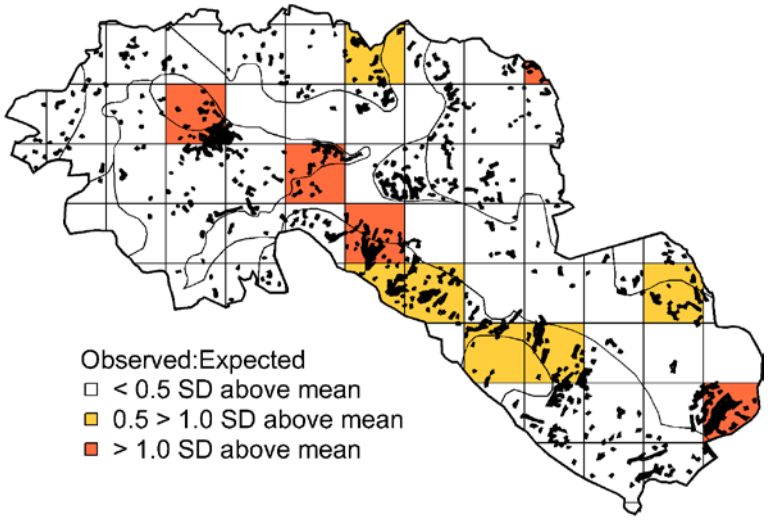


Figure 3.21 Distribution of observed to expected population ratios among 1x1 km grid squares in the Río Tonosí valley during the Bijaguales phase.

4.0 EARLY COMPLEX SOCIETY GROWTH IN THE RÍO PARITA VALLEY

In recent decades the comparative analysis of social organization and change has become increasingly common in complex society research (e.g. Earle 1997; Drennan and Peterson 2006; Smith, ed. 2012). As these comparisons become more firmly rooted in the empirical analysis of archaeological data (rather than the accounts of regional specialists; see Drennan and Peterson 2012:67-71), it becomes increasingly important to consider the means by which those data were collected, and the compatibility of the methods that are used to analyze them (e.g. Drennan and Dai 2010). Methods of data collection and demographic reconstruction were similar for both the Río Tonosi and Río Parita valleys, though there are two important technical differences in the way population estimates were made. One such difference relates to the chronological frameworks that were used in each region (see Chapter 2), and the other to the way in which the area and density of ceramic sherds were converted into absolute population figures.

As discussed in Chapter 2, there is a significant difference in the overall proportion of sherds that can be identified when using the chronological scheme that has been developed in these regions for the Late Ceramic period (ca. 250 BC-AD 1522). Though the seven-phase chronology that has become standard for many parts of Central Panama allows for a greater degree of chronological precision, the overall proportion of sherds that can be assigned to any given phase is, ultimately, rather low. In the Río Parita valley this resulted in a relatively large number of collection lots for which there were no sherds that could be chronologically assigned, and that consequently do not factor into the demographic estimates that were made for this region (see Haller 2008a:35-37). While the impact of these lots on regional population estimates may not be very severe (Haller 2008a:35), they do present an inconsistency with the way in which population estimates were made in the Río Tonosí valley.

This inconsistency can be adjusted for, however, on the basis of a few general assumptions. Of the 279 ha of settlement that were documented in the Lower Survey Zone of the Río Parita valley (see Haller 2008a:21), and for which there existed at least one sherd that could be chronologically assigned, roughly 30% (or 83 ha) contained sherds that dated to the Cubitá phase (AD 550-700). If a similar proportion of settlement for which there was no chronological designation was also occupied during this same period of time, then the total area of Cubitá-phase occupation would have been approximately 200 ha. Using this same logic it is possible to estimate how much of the chronologically unidentified settlement may have corresponded to any given phase of prehispanic occupation, and thus added to the total for which chronological designations were assigned.

Of the 760 collection lots in the Río Parita valley for which there was no chronological designation, 678 (or about 90%) were made as general collections, and thus had relatively low sherd densities that were estimated to be less than 1 sherd/m^2 in the field. Had these lots been subject to the method of demographic reconstruction that was used in the Río Tonosí valley, then, they would likely have been associated with the lowest category of sherd densities (see Figure 2.13). This category corresponds to an average residential density of 7.5 people/ha, which was thus assigned to any chronologically unidentified collection lot that was added to any given phase of prehispanic occupation in the Río Parita valley. Although there is no practical way of determining where these lots may have existed on the landscape, thus making it impossible for them to factor into any sort spatial analyses, they do help make the comparison of regional population densities more reliable.

In addition to issues arising from the different ceramic chronologies that were used in each region, it is also important to evaluate the compatibility of the way in which absolute population estimates were derived from the area and density of ceramic sherds. In other words, what would population estimates for the Río Tonosí valley had been had the area and density of ceramic sherds been converted into absolute population estimates in the same way as the Río Parita valley (see Haller 2008a), or vice versa? To answer this question requires a way of comparing sherd densities from each region that were calculated in the same way (either via shovel probes or systematic surface collections), but this is

not possible on the basis of the regional-scale data. Due to good surface conditions that were encountered in the Río Parita valley only 50 shovel probes were excavated during regional survey (Haller 2008a:31), and only 18 of them yielded any evidence of prehispanic occupation (Haller 2008b). Similarly, due to the poor surface conditions that were encountered in the Río Tonosí valley, no systematic surface collections were made in this region.

But despite the inability to compare sherd densities on the basis of the regional datasets, it is possible to directly compare those from Guaniquito Abajo and El Hatillo. This can be done on the basis of the 368 shovel probes that were excavated at El Hatillo as part of the intensive, local-scale survey (Menzies 2009), and whose spatial distribution provides an adequate representation of sherd densities across the site as a whole. These sherd densities can be compared to those of the 44 shovel probes that were excavated at Guaniquito Abajo during the course of regional survey, where shovel probes were the exclusive form of data collection and are thus also spatially representative.

Before comparing sherd densities, however, it is useful to establish what one might expect if these different ways of converting the area and density of ceramic sherds into absolute population estimates are indeed compatible. Population estimates in the Río Parita valley were based on demographic data from the site of Natá, an important chiefly center in the Coclé region (Figure 1.1) during the sixteenth century. The estimated population of Natá was documented by the Spanish in ethnohistoric texts, and its area was estimated on the basis of archaeological survey. These data suggest that the residential density of Natá was between 4 and 15 people/ha, and demographic estimates in the Río Parita valley are based on the assumption that El Hatillo's residential density was the same during its respective tenure as a central-place community (AD 550-1522; see Haller 2008a:117-121).

The average residential density for El Hatillo is thus estimated to have been about ten people/ha, which is strikingly similar to the average residential density that was estimated for Guaniquito Abajo during this same period of time (see Chapter 3). This would suggest that the average sherd density across these two sites should be similar as well, if the bases for making absolute population estimates in each region were indeed compatible, but this does not seem to be the case. The average sherd density

documented at Guaniquito Abajo was about 337 sherds/m^2/century, while the average at El Hatillo was approximately 2.3 times higher, or about 747 sherds/m^2/century. Given that both of these communities were initially founded sometime between AD 200 and 500 (see Chapter 3; Haller 2008a), and continuously occupied until the sixteenth century, this difference cannot be attributed to different lengths of occupation. Nor is it likely the result of dramatically different rates of ceramic usage, given the close proximity of these two regions and the cultural similarities their populations shared. Instead, this difference suggests that the residential density of El Hatillo was, on average, some 2.3 times greater than that of Guaniquito Abajo, despite the similar values that were obtained from each region's original population estimates. This difference does not just characterize El Hatillo and Guaniquito Abajo, though, but all of the regional settlement in the Río Parita and Río Tonosí valleys.

But while the observed difference in sherd densities between El Hatillo and Guaniquito Abajo suggests that the residential density of the former was roughly 2.3 times greater than that of the latter, it does not indicate whether residential densities in the Río Parita valley should be scaled up in order to account for this difference, or those in the Río Tonosí valley scaled down. For the sole purpose of keeping the relative populations of these regions consistent with the absolute numbers that were discussed in Chapter 3, though, the former option was selected here. The population estimates that are discussed in this chapter are thus based on multiplying the original estimates that were made for the Río Parita valley by a value of 2.3, and adding that to the estimated population that was lost as a result of the low proportion of identified sherds (see above). These new estimates are used for the sole purpose of comparing demographic trends in this region to those of the Río Tonosí valley, and should otherwise not be taken as a substitute for the original estimates that were made (Haller 2008a). The only purpose of these adjustments was to make possible reliable comparative statements about the relative population densities in these two regions.

Ultimately, the purpose of this comparison is to subject the regional settlement data from the Río Parita valley to the same sorts of analyses that were conducted on the Río Tonosí valley dataset. This allows for a more direct comparison of the settlement and demographic trends that occurred in these two

regions, and minimizes the impact of different analytical approaches in conflating potential similarities or differences. In addition to requiring adjustments for regional population estimates, this also resulted in analyzing local and supra-local interaction patterns in different ways than was originally done with Río Parita valley data (see Haller 2008a:39-45). Despite these differences, however, the results that are presented below accord very well with those that were originally produced (Haller 2008a), and reinforce the conclusions that were originally drawn. That such similar conclusions were arrived at using these different types of analyses reaffirms that the patterns observed are indeed the product of the settlement and demographic trends that played out in this region, and not simply the artifact of methodological idiosyncrasies.

4.1 CONTEXTUALIZING THE COMPARISON

While the regional survey of the Río Parita valley consisted of two distinct survey zones separated by some seven or eight km (Haller 2008a:21), it is the larger Lower Survey Zone that is the focus of this comparison. This zone covers an area of 90 contiguous square kilometers, and extends from the coast at its eastern edge to roughly 15 km inland, encompassing the site of El Hatillo. The environment of this zone is characterized as a dry tropical forest, in contrast to the wet tropical forests of the southern Azuero Peninsula (Figure 4.1). This region receives less than half as much annual rainfall as the Río Tonosí valley (or about 1100 mm per year; see Figure 4.2), and experiences slightly higher rates of evapotranspiration (Figure 4.3). The soils of the Río Parita valley also have greater limitations with respect to cultivation than do those of the Río Tonosí valley (Figure 4.4; see Heckadon-Moreno 2006:33), which has implications for comparing patterns of population and resource distribution: though the soils of both regions are divided into four distinct classes of varying productivity (see Chapter 2; Haller 2008a:125-27), they are not directly comparable; any given class of soil in the Río Parita valley may be relatively less productive than its corresponding class in the Río Tonosí valley.

Prehispanic occupation in the Río Parita valley first emerged by at least 5000 BC (Haller 2008a:47-51), and persisted continuously until the sixteenth century. This comparison, however, considers only that which existed until AD 1300. After this time the regional population of the Río Parita valley seems to have diminished substantially, as did the prominence of El Hatillo (Haller 2008a:105-107), though it is unclear whether the decrease of prehispanic remains from this time is actually the result of smaller populations, or decreased rates of polychrome ceramic production and more restricted use (Cooke *et al*. 2003:16; see Haller 2008a:105; cf. Menzies 2009:34). Regardless, given that this comparison is focused on how social power developed in the region, rather than how it devolved, these final 200 years of prehispanic occupation, known as the El Hatillo phase in the regional chronology, are excluded from the current analysis.

So too does this comparison exclude the thousands of years of occupation that preceded the rise of large, sedentary populations in the region, which began to emerge between 200 BC and AD 250 (for more information on this earlier occupation of the region, see Haller 2008a:47-55; Iizuka 2013). During this time the site of La Mula-Sarigua, whose initial occupation was established sometime during the second or third millennium BC (Hansell 1988:199), grew into a relatively large local community, and was in fact one of the largest communities anywhere in Central Panama. Though La Mula-Sarigua was initially estimated to have covered some 58 ha during this time (Hansell 1988:200), and to have been home to approximately 500 to 1000 people (Cooke and Ranere 1992:274-275), this is not consistent with the results of regional survey. These data suggest that La Mula-Sarigua was much more modest in scale, with a population of about 175 people spread across roughly 19 ha of landscape (Haller 2008a:65-67). Rather than a large, nucleated village, then, this community may have represented nothing more than a moderately-sized group of relatively dispersed households, who aggregated at La Mula-Sarigua so as to exploit the rich alluvial, marine, and high-quality lithic resources that this location would have afforded them access to (see Haller 2008a; Hansell 1988).

Even if one is to use these more modest demographic figures, La Mula-Sarigua was still by far the largest local community in the Río Parita valley between 200 BC and AD 250 (Haller 2008a:63-69),

whose regional population is estimated to have been about 630 people during this period of time (Figure 4.5). This demographic prominence, however, would not persist into the subsequent period, and there is little debate surrounding La Mula-Sarigua's fate over the course of the next 300 years.

4.2 THE TONOSÍ PHASE (AD 250-550)

From AD 250 to 550 the regional population of the Río Parita valley dropped to some 75% its previous figure, resulting in a total of about 480 people (Table 4.1; Figure 4.6). Far more dramatic, however, was the depopulation of La Mula-Sarigua (Haller 2008a:71-75; Hansell 1988:200), which diminished to no more than two or three households during this period of time. While this depopulation may have had to do with the degradation and change of the local, coastal environment (Haller 2008a:75), it was also clearly part of a wider regional phenomenon. Despite only a moderate drop in regional population levels, virtually all of the La-Mula-phase settlement in the region (or about 93% of it) was abandoned prior to the start of the Tonosí phase. Such a high rate of settlement abandonment, coupled with only moderate levels of demographic decline, naturally resulted in the founding of many new settlements throughout the region. As in other areas of Central Panama these new settlements were opting for more inland locations (Haller 2008a:71), at greater distances from the coast and the alluvial resources that had been so desirable during the preceding phase. During this time some households may have migrated into the adjacent Río La Villa valley, whose regional population was beginning to grow (Isaza 2007).

As settlement began to shift further inland households came to distribute themselves exclusively among individual farmsteads and very small hamlets that were widely scattered throughout the region (Haller 2008a:71-75). The majority of these settlements were located among the moderately productive Class II soils that existed throughout much of the regional landscape (Figure 4.7), though some households opted to live in somewhat less productive zones. One such group of households emerged at the site of El Hatillo, which at this time consisted of roughly 50-60 people.

Settlement patterns in the Río Parita valley during the Tonosí phase were thus very similar to those observed in the Río Tonosí valley during this same period of time. Regional population levels were relatively low in both regions, and households lived exclusively among farmsteads and small hamlets that were widely scattered across the landscape. The majority of households occupied the moderately productive Class II soils that existed in each region, though some ultimately chose to live in less productive agricultural zones. Whereas one such group of households emerged at Guaniquito Abajo in the Río Tonosí valley, another emerged at El Hatillo in the Río Parita valley, both of which were founded during this period of time.

4.3 THE CUBITÁ AND CONTE PHASES (AD 550-900)

From AD 550 to 700 the regional population of the Río Parita valley underwent a dramatic period of demographic growth (Haller 2008a:79), resulting in a total population of approximately 2520 people (Table 4.2; Figure 4.8). This growth, however, was relatively short-lived, as regional population levels subsequently dropped (albeit only slightly) over the course of the next 200 years (Table 4.2; Figure 4.9; see Haller 2008a:85). These patterns of growth are very similar to those observed in the adjacent Río La Villa valley (Table 4.3), suggesting that whatever factors were influencing demographic trends in the Río Parita valley between AD 550 and 900 were also doing so across a larger area.

While the growth that occurred during the Cubitá phase would, at first glance, appear to have been much faster than that which occurred during the La Cañaza phase in the Río Tonosí valley, this may not necessarily have been the case. For instance, if this growth was averaged out across both the Cubitá and Conte phases, a time frame that is more comparable to the La Cañaza phase in the Río Tonosí valley, then it would result in a rather similar rate of growth (or about 0.47% annually). It is thus possible that regional population growth in the Río Tonosí valley was also by characterized by a relatively rapid growth spurt during the initial stages of the La Cañaza phase, followed by a more stable period that persisted

until AD 1000. Given the chronological precision that exists for this region, though, such a possibility remains unclear.

Regardless of how punctuated or how gradual growth was in the Río Tonosí valley during the La Cañaza phase, it is clear that such growth was more substantial than that which occurred in the Río Parita valley between AD 550 and 900. During this time many households in the Río Parita valley also began to exhibit different preferences with respect to the types of soil on which they lived. Though roughly half of the population came to occupy the moderately productive Class II soils (as was the case in the Río Tonosí valley), this is not particularly surprising given that these soils covered well over half of the regional landscape (Figure 4.10). What is more surprising is the disproportionately large number of people that opted to live among the less productive Class III soils; despite covering less than 10% of the total region, this zone was home to roughly half of the regional population during the Cubitá and Conte phases.

As can be seen in the maps in Figure 4.10, much of the disproportionately high population that lived among Class III soils is attributable to the population of El Hatillo. From AD 550 to 700 this local community grew from a small hamlet of roughly ten households to a relatively large, nucleated village (Haller 2008a:79). In fact, during this time El Hatillo grew at a rate that was even faster than the regional average (about 1.47% annually), culminating in a population of about 460 people. This population was spread across some 19 ha of landscape, resulting in a residential density of about 24 people/ha. Over the course of the next 200 years (AD 700-900) El Hatillo's population declined somewhat (Haller 2008a:87), to around 380 people, but at a rate that was very similar to the observed regional average. As local population levels dropped households distributed themselves across roughly the same total area that they had during the Cubitá phase, resulting in a lower residential density (about 20 people/ha). Most of the Conte-phase population, however, or about 80% of it, lived within a core zone that covered only half of the community's total area, resulting in a somewhat greater residential density (30 people/ha).

During both the Cubitá and Conte phases El Hatillo represented roughly 40-45% of the population that lived among Class III soils, and just under one-fifth of the regional population at large. As

can be seen in the unsmoothed surfaces of Cubita- and Conte-phase settlement (Figure 4.11), it was by far the largest local community anywhere in the valley (Haller 2008a). The integrative forces that facilitated El Hatillo's growth may well have been connected to the modest levels of inequality and craft specialization that were developing around this time, as will be discussed later on in Chapter 5.

Despite being the largest local community in the Río Parita valley, though, El Hatillo was not the only site where households clustered together in relatively large numbers and at relatively high residential densities. During both the Cubitá and Conte phases there existed other nucleated local communities that were clearly discernable on the landscape (Figure 4.12), all of which correspond to "second-order sites" as originally defined by Haller (2008a:79, 87). The populations of these communities ranged from about 45 to 80 people, with residential densities between 20 and 55 people/ha. Combined with El Hatillo they comprised roughly one-third of the regional population, while the remainder was scattered throughout the valley among more dispersed hamlets and farmsteads.

The locations of these nucleated local communities reveal some additional patterns which relate to the distribution of settlement and agricultural soils. During both the Cubitá and Conte phases many of the small, nucleated local communities that existed in the region were located directly adjacent to the Río Parita floodplain (Haller 2008a), likely so as to have direct access to the highly productive alluvial soils that existed in this zone. Such a desire, however, does not seem to have been held by the occupants of El Hatillo. Not only was El Hatillo somewhat more removed from the Río Parita floodplain, but it was located in an area of the landscape where these alluvial soils would have been least abundant; much larger patches of the alluvial zone existed further east, where there seems to have been ample space in the surrounding landscape for a community of this size to exist.

Thus, while gaining access to productive soils may have been an important factor behind the location of some small, nucleated local communities, these patterns provide further evidence to suggest that such concerns were not as important for the occupants of El Hatillo. These households were, in addition, clearly not trying to maximize the amount of land that was available to them immediately adjacent to their houses, nor were many other households that lived in other parts of the region. Such is

apparent in the correlations between the observed and expected populations of grid squares for both the Cubitá and Conte phases, which exhibit only a moderate correlation for both periods (R=0.541; p<0.0005 and R=0.569; p<0.0005; respectively).

During the Cubitá phase a total of 12 grid squares yielded observed to expected population ratios that were more than one standard deviation above the mean. As can be seen in Figure 4.13, many of these grid squares were widely distributed across the region, but some appear to cluster in the vicinity of El Hatillo. An additional three grid squares whose observed to expected population ratios were between 0.5 and 1.0 standard deviation above the mean are also located in close proximity to El Hatillo, suggesting that whatever forces may have been underlying the integration of this large local community may also have been integrating households at a larger, supra-local scale. Such integration is consistent with Haller's (2008a:79) identification of a three-tiered settlement hierarchy (atop which sat the community of El Hatillo), and is apparent when examining the smoothed surface of Cubitá-phase settlement (Figure 4.14), which shows that El Hatillo was at the center of a relatively large supra-local community. The boundaries of this community are clearly discernable on the landscape, and seem to have encompassed virtually all of the occupants that lived within the Río Parita study area (along with others that lived outside of the survey zone). Very similar patterns can be observed for the Conte phase (see Haller 2008a:87), which are illustrated in Figures 4.15 and 4.16.

4.3.1 Summary

Despite there having been strong similarities in the regional demographic patterns of the Río Tonosí and Río Parita valleys from roughly AD 200 to 500, these similarities gave way to rather pronounced differences during the subsequent 400 or 500 years of prehispanic occupation. Although both regions experienced considerable levels of regional population growth, such growth was much more substantial in the Río Tonosí valley. It was also during this time that households in these regions began to exhibit different preferences with respect to the types of soils on which they lived. While roughly half of the

population in each region lived among the moderately productive Class II soils, these soils were far more abundant in the Río Parita valley; they ultimately contained a disproportionately low segment of the regional population, in contrast to the disproportionately high number of households that lived among these soils in the Río Tonosí valley. A notably larger proportion of the Río Parita population opted to live among the less productive Class III soils than in the Río Tonosí valley, despite the fact that these soils made up a much smaller proportion of the regional landscape. These patterns suggest that subsistence concerns did not play as large a role in structuring patterns of human settlement in the Río Parita valley, which is also evident in the results of the grid square analyses. Whereas households in the Río Tonosí valley exhibited a relatively strong desire to maximize the amount of land that was available to them immediately adjacent to their houses, this desire was relatively weaker for many households in the Río Parita valley.

Much of the disproportionately large population that lived among Class III soils in the Río Parita valley was attributable to growth of El Hatillo, which from AD 550 to 700 grew into a relatively large, nucleated local community. While El Hatillo was by far the largest instance of such nucleation in the region, other nucleated local communities also emerged on the landscape. All of these communities were notably denser than the relatively dense cluster of settlement that emerged at Montevideo in the Río Tonosí valley, and comprised a much larger proportion of their respective regional population. While it is not entirely clear what may have integrated the small, nucleated local communities in the Río Parita valley, the integration of El Hatillo was likely associated with the modest levels of inequality and craft specialization that were developing there at this time. These inequalities may have played an important role in integrating the clearly discernable supra-local community that developed around El Hatillo, and that came to encompass virtually all of the region's inhabitants. Although some degree of supra-local integration may also have developed around Montevideo, it was not nearly as prominent as that in the Río Parita valley, suggesting that the integrative forces behind it were considerably weaker than those at El Hatillo.

4.4 THE MACARACAS AND PARITA PHASES (AD 900-1300)

Regional population levels in the Río Parita valley changed very little during the Macaracas phase (AD 900-1100; Haller 2008a:89), and then increased somewhat over the course of the subsequent 200 years (Table 4.4; Figure 4.17). During this time regional population levels rebounded to what they had been during Cubitá times (Haller 2008a:97), after the region's initial period of rapid demographic growth. In contrast to the patterns observed between AD 550 and 900, though, those which played out in the Río Parita valley during the Macaracas and Parita phases were quite different than those in the adjacent Río La Villa valley, which was undergoing notable levels of depopulation during this period of time (Table 4.5).

Over the course of this 400-year period there seems to have been relatively little change in the way people distributed themselves among different soils zones in the Río Parita valley. As can be seen in Figure 4.18 about half of the regional population continued to live among the highly abundant Class II soils, while a disproportionately large amount continued to occupy less productive zones. As was the case in the previous periods, this imbalance was due in part to the local population of El Hatillo, which itself represented roughly 30% of the population that occupied Class III soils.

From AD 900 to 1100 the local population of El Hatillo again experienced a notable decline (Haller 2008a:93), dropping to some 60% of its previous figure, or about 230 people. These people occupied an area of about 11.1 ha, resulting in a residential density of some 21 people/ha. While it is unclear what may have caused this particular stint of depopulation, particularly given that the regional population was not changing during this period of time, its effect was minimal enough that El Hatillo remained the largest local community in the Río Parita valley (Figure 4.19; Haller 2008a:89). As regional population levels rose over the course of the next 200 years (AD 1100-1300), so too did the population of El Hatillo (Haller 2008a:99), which was again growing at a faster rate than the regional average (about 0.22% annually). This growth resulted in a population of roughly 360 people, who were spread across some 14.9 ha of

landscape, resulting in a residential density of about 24 people/ha. As can be seen in Figure 4.20, El Hatillo remained the largest local community in the Río Parita valley (Haller 2008a:99).

During the Macaracas and Parita phases there were again additional areas of the landscape where households came to cluster into clearly discernable, nucleated local communities (Figure 4.21), and these again correspond to second-order sites originally identified by Haller (2008a:89-91, 99). The populations and residential densities of these communities were similar to those of the preceding periods, and many of them were again located in very close proximity to the highly productive soils of the Río Parita floodplain (Haller 2008a). Combined with El Hatillo these nucleated local communities comprised some 25-30% of the regional population, as had been the case during previous periods of occupation.

The results of the grid-square analysis again suggest that many households in the Río Parita valley were not trying to maximize the amount of soils that were immediately available to them in their surrounding landscape. Such is evident in the correlation between the observed and expected populations of grid squares, which again exhibits only a moderate correlation during both the Macaracas and Parita phases (R=0.562; p<0.0005 and R=0.593; p<0.0005; respectively). While these correlation values are not substantially weaker than that observed for the Río Tonosí valley during the Bijaguales phase, the distribution of grid squares with unusually high populations indicates that there were factors influencing patterns of regional settlement that do not appear to have existed in the Río Tonosí valley.

Figure 4.22 shows the distribution of the twelve grid-squares whose observed to expected population ratios were more than one standard deviation above the mean during the Macaracas phase. While some of these squares clustered around El Hatillo during previous phases of occupation, such clustering is even stronger during Macaracas times. The majority of these grid-squares, in fact, are located in close proximity to El Hatillo, along with two others whose observed to expected population ratios were between 0.5 and 1.0 standard deviations above the mean. Such clustering suggests that the integrative forces that El Hatillo exerted were becoming even stronger during the Macaracas phase, drawing outlying settlement in even further to form a more concentrated network of supra-local interaction. This interaction was again structured into a clearly discernable supra-local community (Figure

4.23), which continued to encompass the vast majority of the regional population. As in the preceding periods, El Hatillo was again at the top of a well-integrated, three-tiered settlement hierarchy (Haller 2008a:89). Comparable patterns existed during the Parita phase (Figures 4.24 and 4.25; see Haller 2008a:99-100), before regional population levels began to drop and El Hatillo's prominence began to diminish during the last two centuries of prehispanic occupation (see above).

4.4.1 Summary

The differences that began to emerge between the Río Tonosí and Río Parita valleys between roughly AD 500 and 1000 seem to have persisted into the subsequent four to five centuries of prehispanic occupation. Though regional populations grew in both regions, growth in the Río Tonosí valley was again notably more substantial. Here regional population levels reached new heights, whereas in the Río Parita valley they only rebounded to what they had been during the Cubitá phase. While a similar proportion of the regional population in each valley had by now come to occupy the relatively unproductive Class III soils, in the Río Tonosí valley this seems to have been due to the fact these soils were simply far more abundant, and that there was not much room for growth to occur in the already densely occupied Class II zone (see chapter 3).

The disproportionately large number of people that lived among Class III soils in the Río Parita valley was again largely attributable to El Hatillo, which remained the largest and one of the densest local communities in the region. Although the cluster of settlement that emerged around the mounds at Guaniquito Abajo during the Bijaguales phase was comparably as dense as El Hatillo, it was not nearly as large, and was ultimately more comparable to some of the smaller nucleated local communities that existed in the Río Parita valley. Combined with El Hatillo these nucleated local communities made up a significantly larger proportion of the regional population than did the relatively dense clusters of households that existed in the Río Tonosí valley. These local communities were also clearly discernable on the landscape, in contrast to the dense clusters of occupation that emerged at Guayabo, Barrancón, and

Guaniquito Abajo, all of which were immediately surrounded by relatively large areas of more dispersed settlement, precluding the delineation of meaningful community boundaries.

Though from AD 900 to 1300 El Hatillo's population was no larger than it had been during the Cubitá and Conte phases, its integrative forces were seemingly becoming stronger, as made evident by the fact that supra-local interaction was becoming more consolidated around this central-place community. Such consolidation was undoubtedly connected to the proliferation of elite activities that were occurring at this time. As was discussed in Chapter 1, it was during this time that small earthen burial mounds began being constructed for the lavish interment of elite individuals, and that inequalities became more conspicuous among households artifact assemblages. In addition to the elaborate funerary rituals that were presumably held at the burial mounds, this inequality was also rooted in activities such as craft specialization, interregional exchange, and feasting.

Many of these activities may have had a large role to play in organizing supra-local interaction in the Río Parita valley during the Macaracas and Parita phases, which again took the form of a clearly discernable supra-local community. This structure was quite different than that of supra-local interaction in the Río Tonosí valley, where no such community can be delimited on the landscape. Although the ritual activities that took place at Guaniquito Abajo would likely have been important factors around which supra-local interaction was organized, they did not have a particularly strong pull on outlying settlement. Rather than live in the immediate vicinity of Guaniquito Abajo, most households opted to locate their settlement more on the basis of subsistence concerns, and thus to occupy relatively more productive parts of the landscape.

Figure 4.1 Environmental zones of Central Pacific Panama (the Río Tonosí and Río Parita valley survey zones are shown in blue outline; base map from ANAM 2011:49, Mapa 3.1.1)

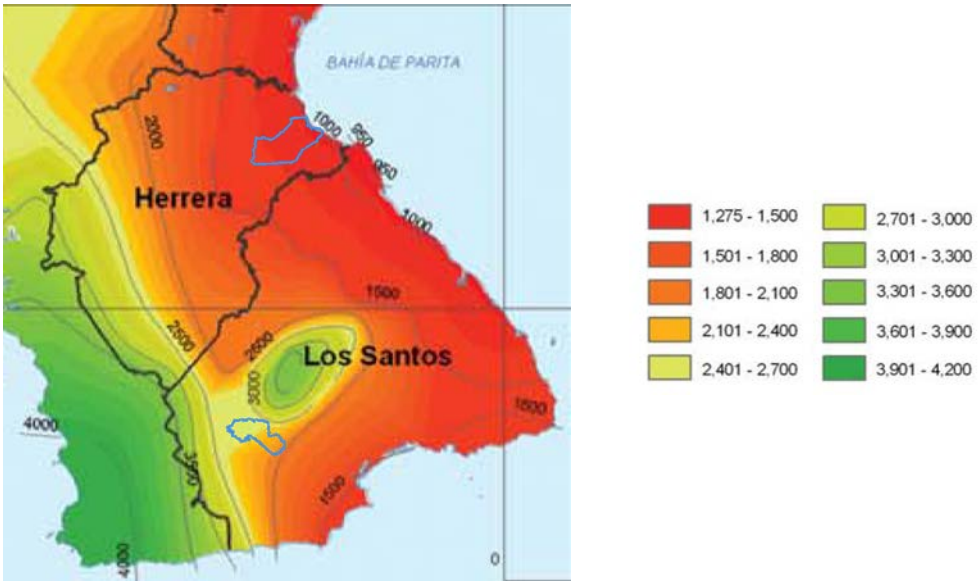


Figure 4.2 Average annual rainfall (in mm) across Central Pacific Panama (the Río Tonosí and Río Parita valley survey zones are shown in blue outline; base map from ANAM 2011:29, Mapa 2.1.2).

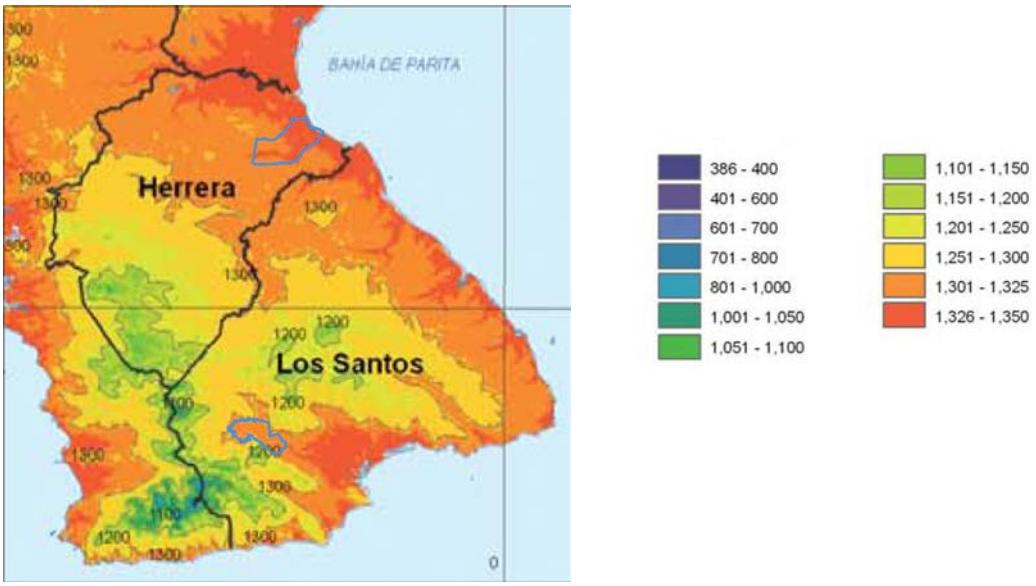


Figure 4.3 Average rates of evapotranspiration across Central Pacific Panama (the Río Tonosí and Río Parita valley survey zones are shown in blue outline; base map from ANAM 2011:31, Mapa 2.1.5).

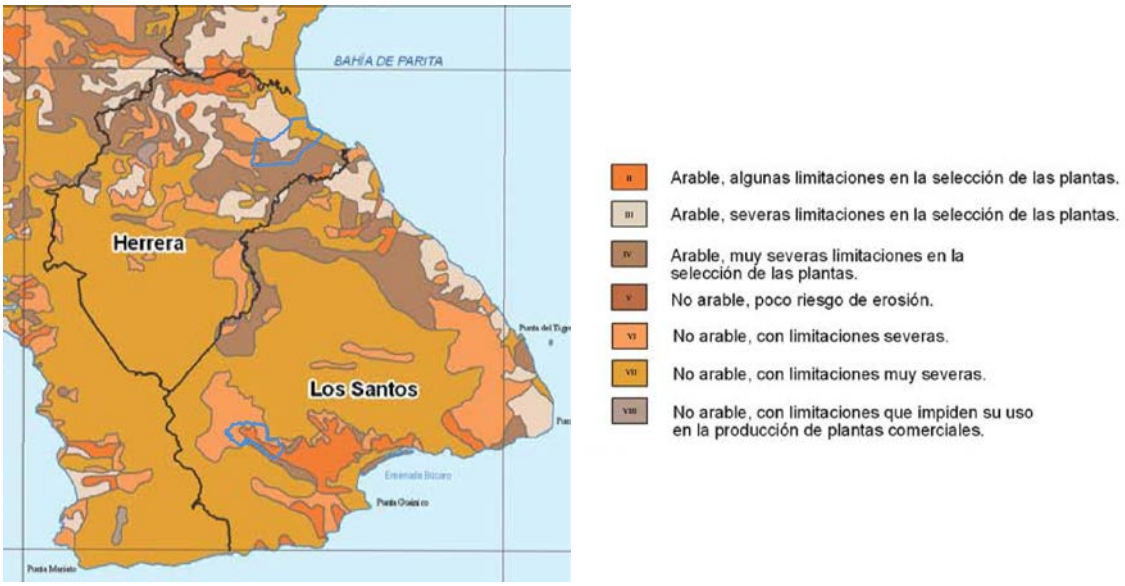


Figure 4.4 Soil quality across Central Pacific Panama (the Río Tonosí and Río Parita valley survey zones are shown in blue outline; base map from ANAM 2011:37, Mapa 2.3.3).

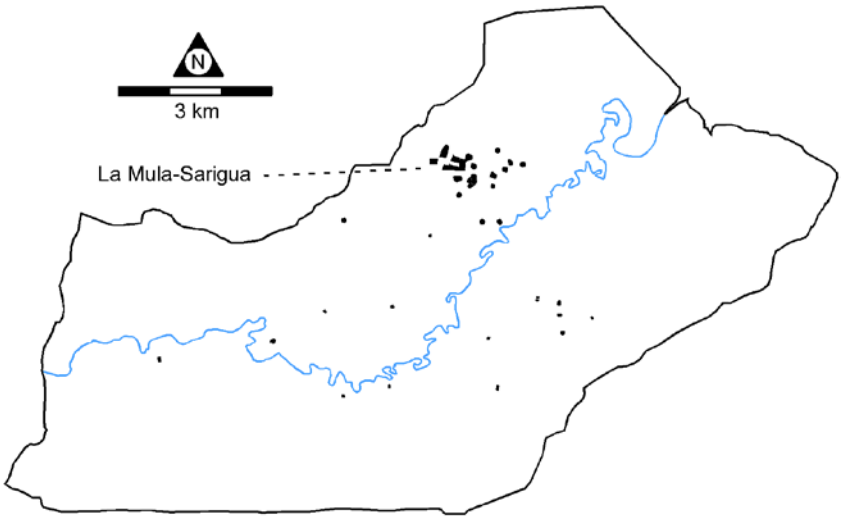


Figure 4.5 Regional settlement patterns in the Río Parita valley during the La Mula phase.

Table 4.1 Adjusted Regional Demographic Data for the Río Parita Valley during the Tonosí Phase

Area of occupation (ha)	61.4
Regional population	482
Regional population density (people/km²)	5.4

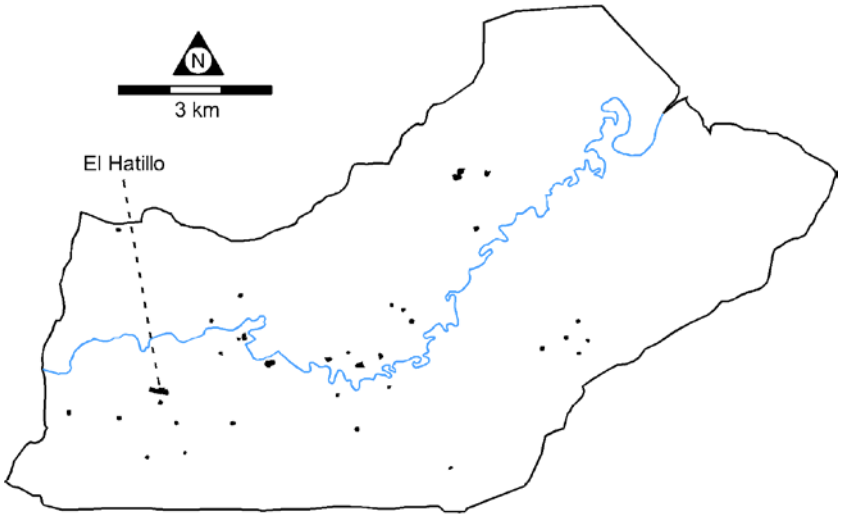


Figure 4.6 Regional settlement patterns in the Río Parita valley during the Tonosí phase.

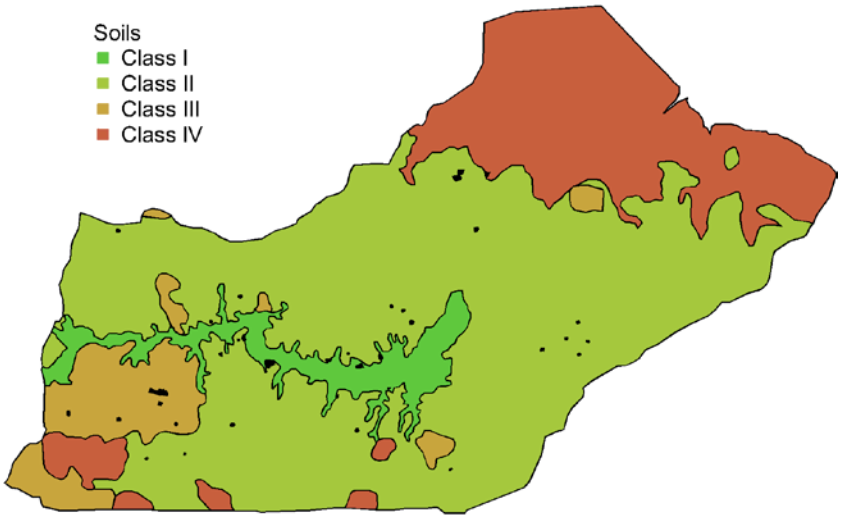


Figure 4.7 Distribution of settlement among different soil zones in the Río Parita valley during the Tonosí phase.

Table 4.2 Adjusted Regional Demographic Data for the Río Parita Valley during the Cubitá and Conte Phases

	Cubitá	Conte
Area of occupation (ha)	198.5	188.0
Regional population	2521	2069
Regional population density (people/km²)	28.0	23.0
Annual growth rate (% per year)	1.10	-0.10

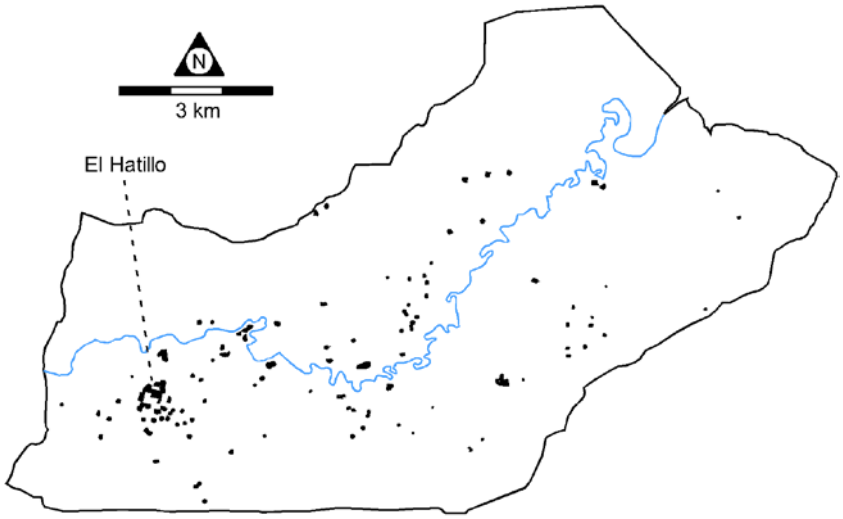


Figure 4.8 Regional settlement patterns in the Río Parita valley during the Cubitá phase.

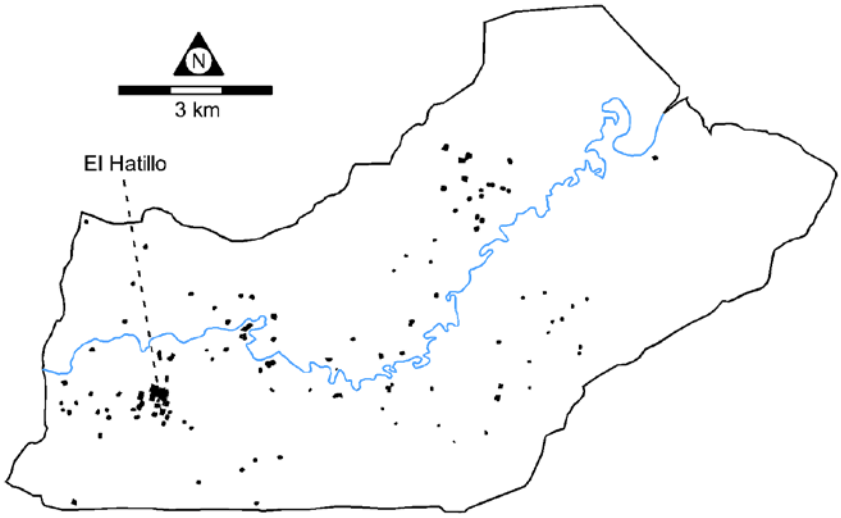


Figure 4.9 Regional settlement patterns in the Río Parita valley during the Conte phase.

Table 4.3 Regional Demographic Data for the Río La Villa Valley during the Cubitá and Conte Phases

	Cubitá	Conte
Regional population	3213	2607
Annual growth rate (% per year)	1.49	-0.10

(population estimates from Isaza 2007:457, Figure 6.71)

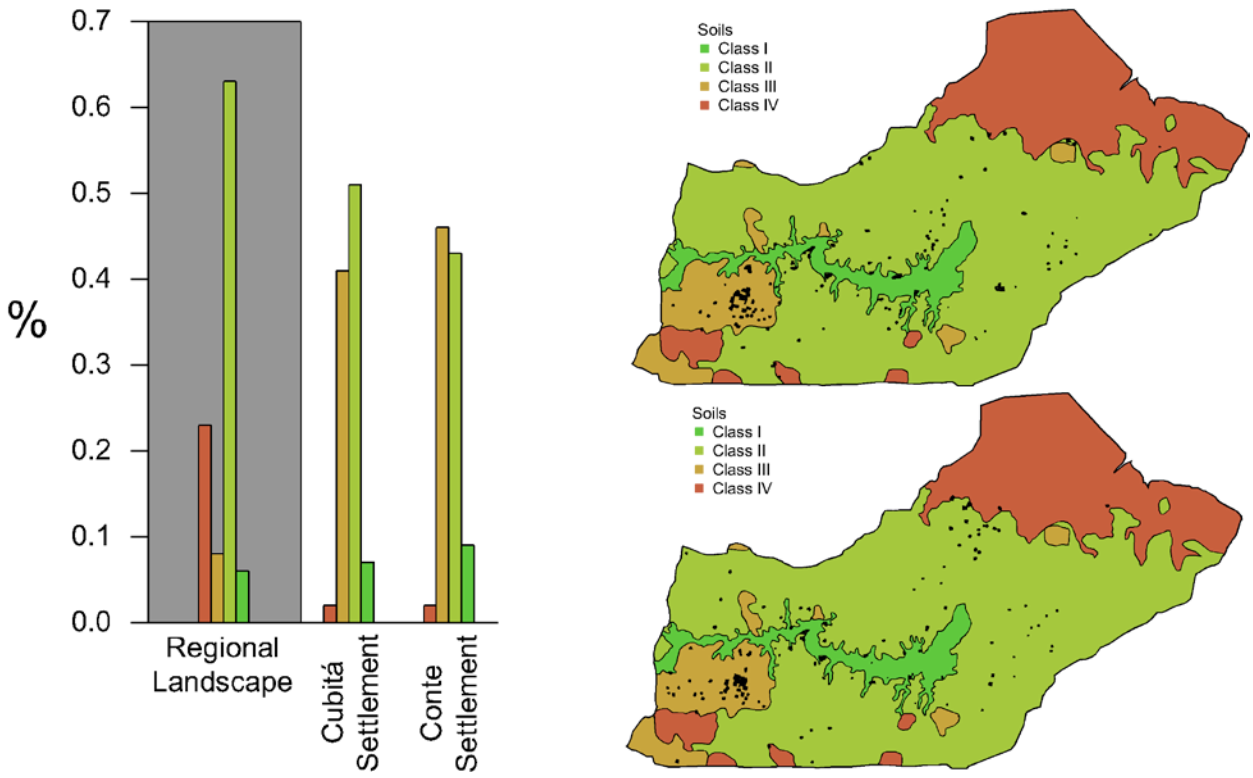


Figure 4.10 Distribution of settlement among different soil zones in the Río Parita valley during the Cubitá (top) and Conte (bottom) phases.

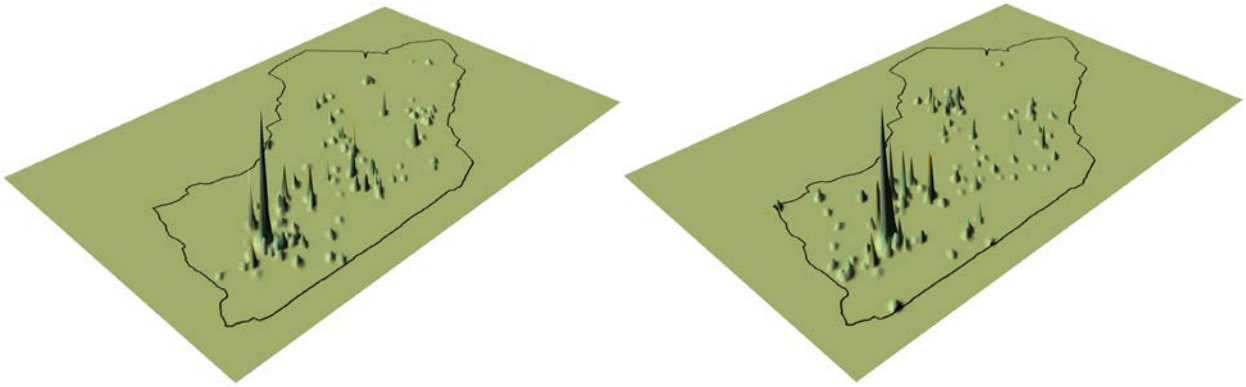


Figure 4.11 Unsmoothed surfaces of regional settlement in the Río Parita valley during the Cubitá (left) and Conte (right) phases.

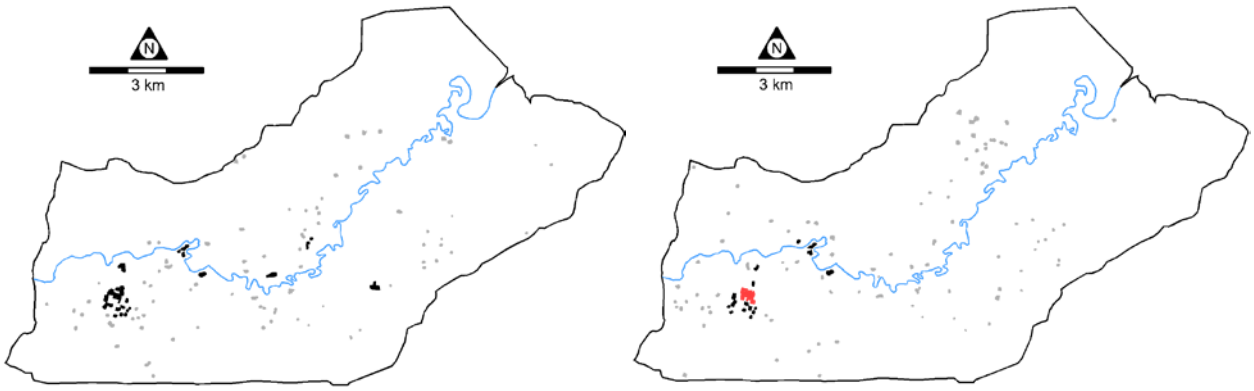


Figure 4.12 Nucleated local communities in the Río Parita valley during the Cubitá (left) and Conte (right) phases (the denser core zone of El Hatillo during Conte phase is hatched in red).

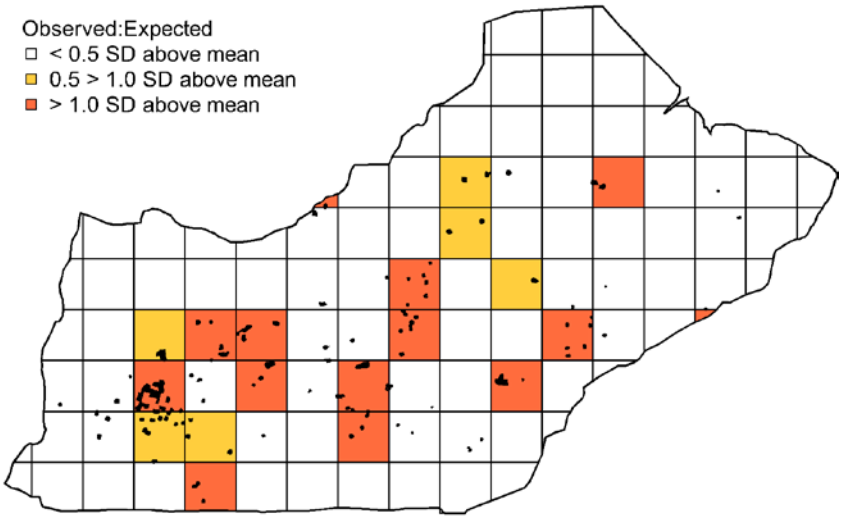


Figure 4.13 Distribution of observed to expected population ratios among 1x1 km grid squares in the Río Parita valley during the Cubitá phase.

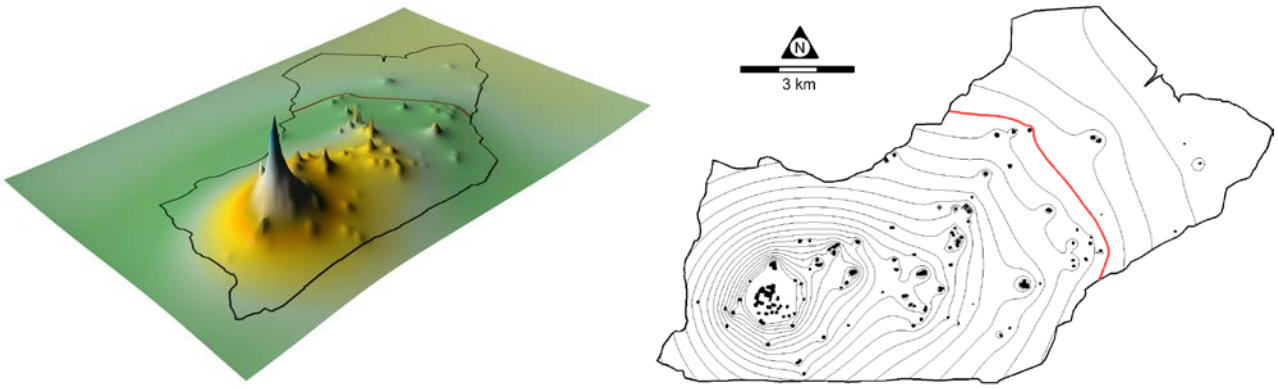


Figure 4.14 Smoothed surface of regional settlement in the Río Parita valley during the Cubitá phase and the delimitation of a supra-local community around El Hatillo.

Figure 4.15 Distribution of observed to expected population ratios among 1x1 km grid squares in the Río Parita valley during the Conte phase.

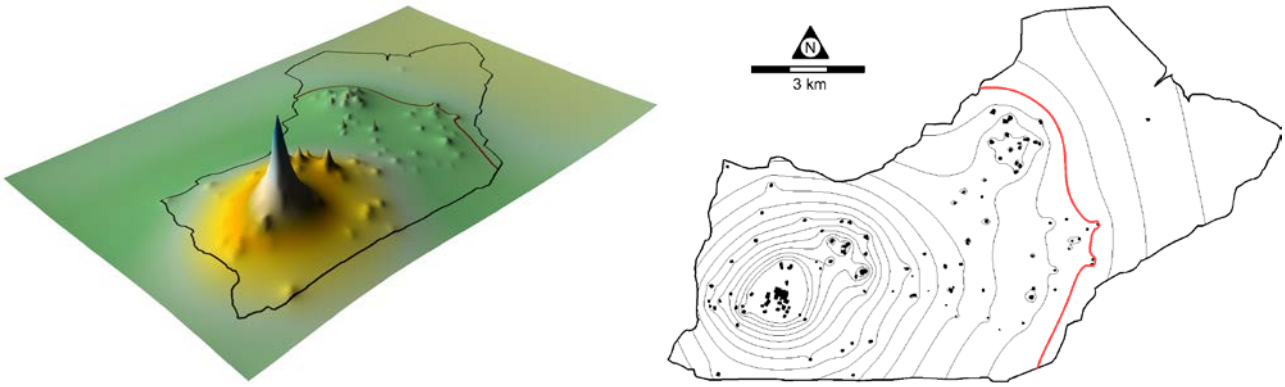


Figure 4.16 Smoothed surface of regional settlement in the Río Parita valley during the Conte phase and the delimitation of a supra-local community around El Hatillo.

Table 4.4 Adjusted Regional Demographic Data for the Río Parita Valley during the Macaracas and Parita Phases

	Macaracas	Parita
Area of occupation (ha)	187.5	223.0
Regional population	2094	2645
Regional population density (people/km²)	23.3	29.4
Annual growth rate (% per year)	0.01	0.12

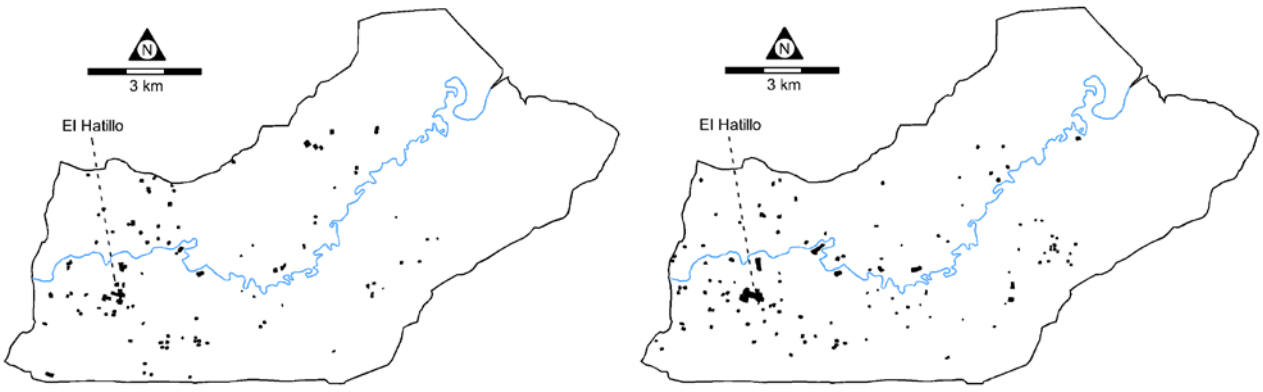


Figure 4.17 Regional settlement patterns in the Río Parita valley during the Macaracas (left) and Parita (right) phases.

Table 4.5 Adjusted Regional Demographic Data for the Río La Villa Valley during the Macaracas and Parita Phases

	Macaracas	Parita
Regional population	2420	1197
Annual growth rate (% per year)	-0.03	-0.35

(population estimates from Isaza 2007:457, Figure 6.71)

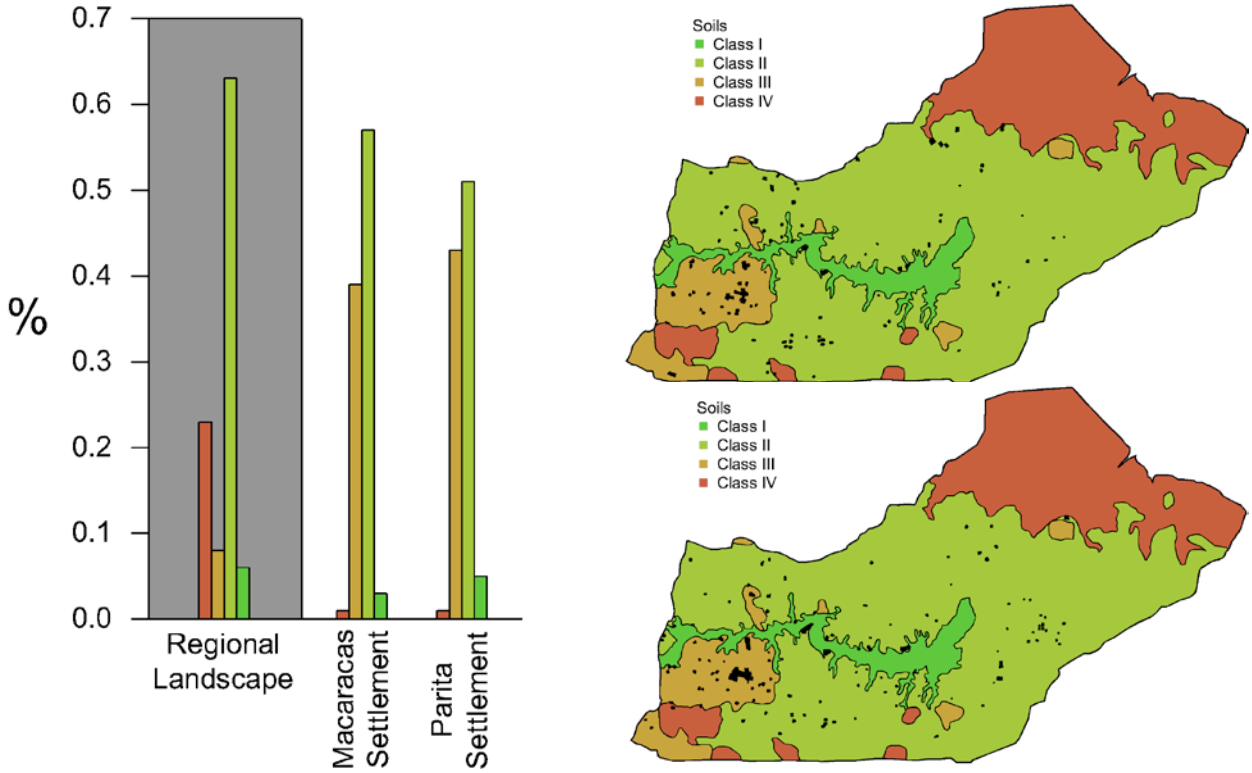


Figure 4.18 Distribution of settlement among different soil zones in the Río Parita valley during the Macaracas (top) and Parita (bottom) phases.

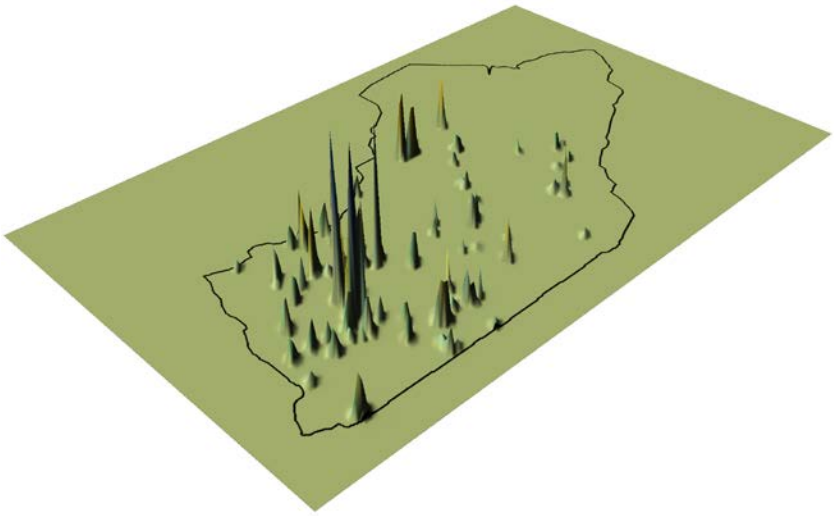


Figure 4.19 Unsmoothed surface of regional settlement in the Río Parita valley during the Macaracas phase.

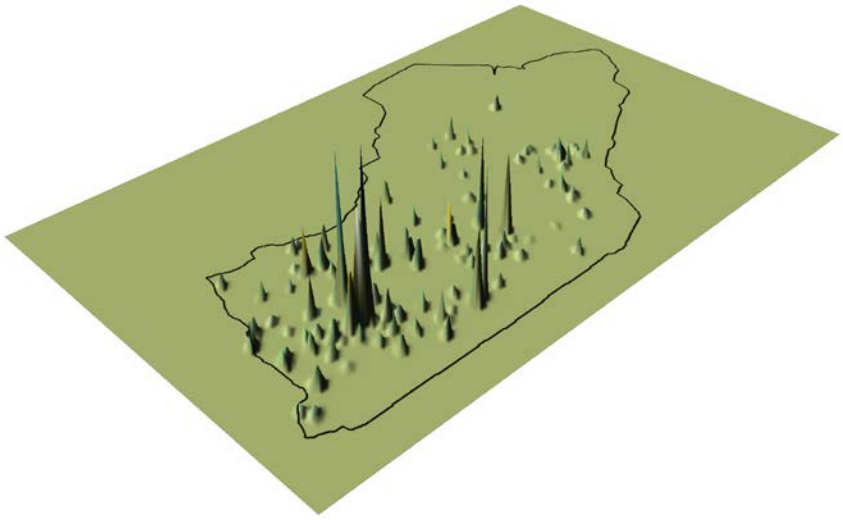


Figure 4.20 Unsmoothed surface of regional settlement in the Río Parita valley during the Parita phase.

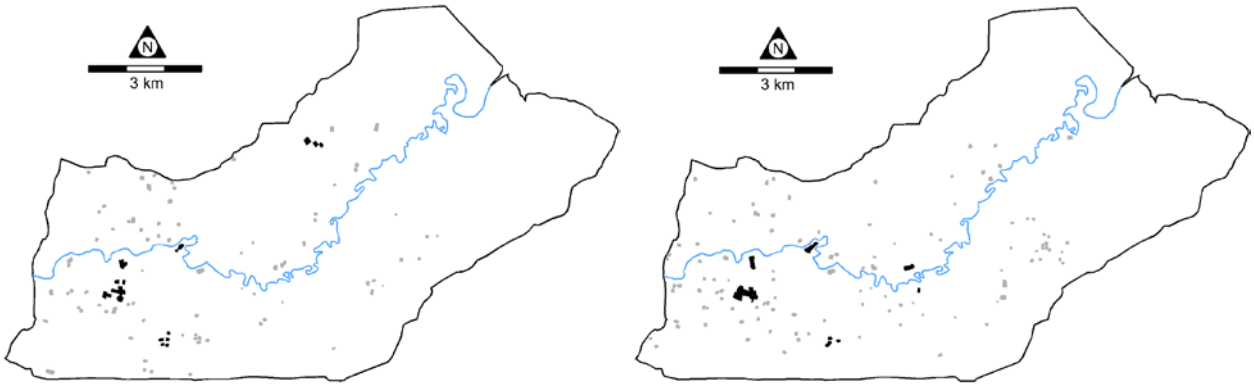


Figure 4.21 Nucleated local communities in the Río Parita valley during the Macaracas and Parita phases.

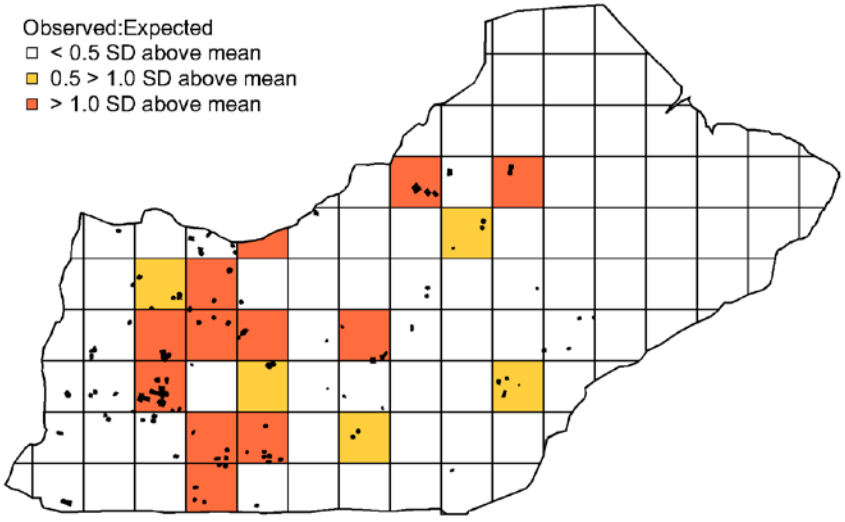


Figure 4.22 Distribution of observed to expected population ratios among 1x1 km grid squares in the Río Parita valley during the Macaracas phase.

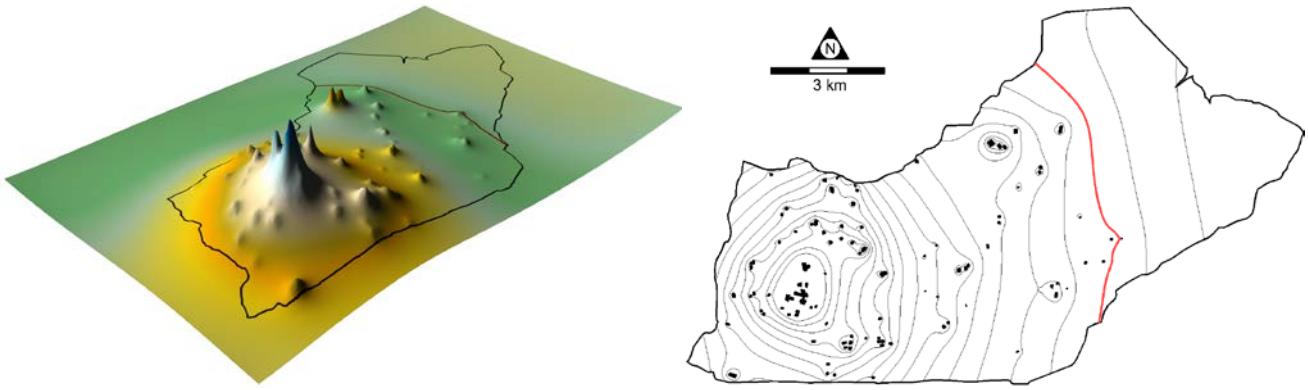


Figure 4.23 Smoothed surface of regional settlement in the Río Parita valley during the Macaracas phase and the delimitation of a supra-local community around El Hatillo.

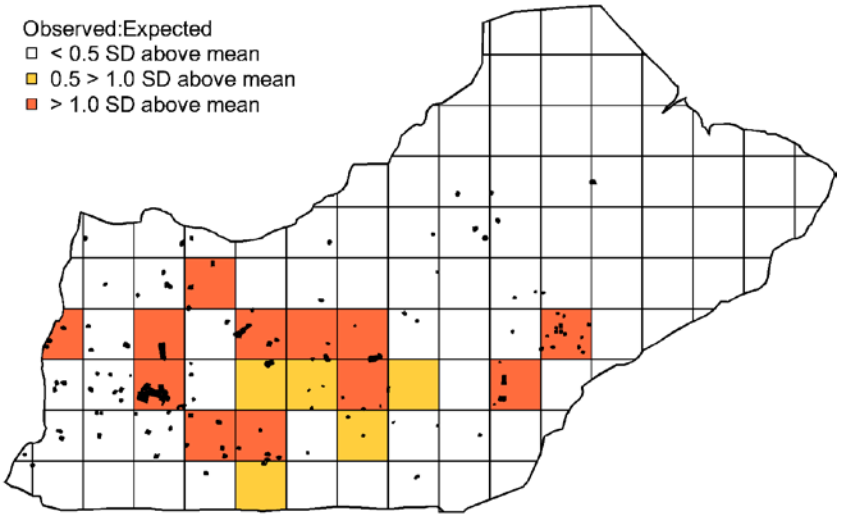


Figure 4.24 Distribution of observed to expected population ratios among 1x1 km grid squares in the Río Parita valley during the Parita phase.

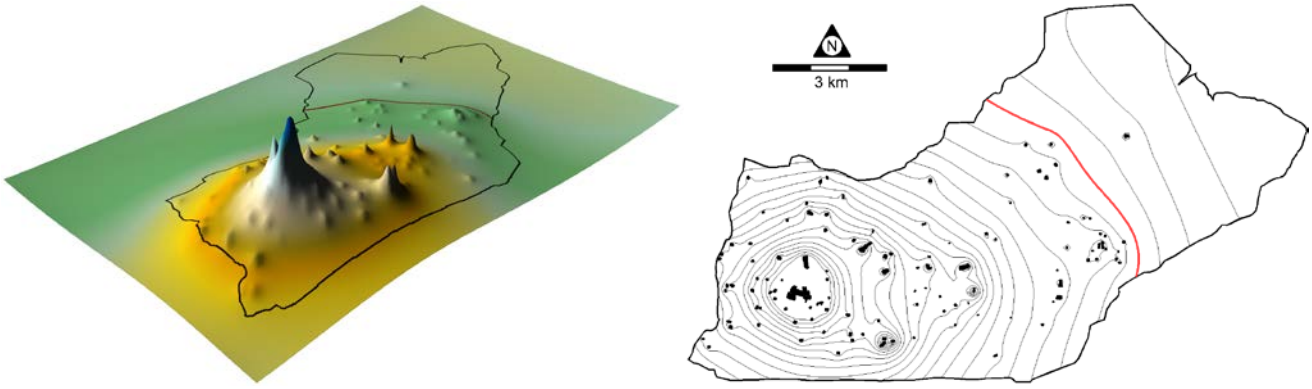


Figure 4.25 Smoothed surface of regional settlement in the Río Parita valley during the Parita phase and the delimitation of a supra-local community around El Hatillo.

5.0 ORGANIZATION AND GROWTH IN THE RÍO TONOSÍ AND RÍO PARITA VALLEYS

Global-scale comparisons of early complex societies have by now revealed a great deal of variation in the way early complex societies developed (e.g. Drennan and Peterson 2006; Peterson and Drennan 2012; Earle 1997). These studies have provided valuable insight into the nature of such variation, and into the factors that led these societies down such variable paths of social development. Further insight can be gained, however, by examining variability at smaller scales of analysis. As that scale homes in on societies that not only interacted, but shared common sociocultural roots and traditions, archaeologists are afforded a unique opportunity to examine more closely the forces that lead to organizational variation. Any variation within such contexts is not simply the consequence of different historical trajectories, but of divergent evolution sparked by specific forces of social change that archaeologists can potentially identify. This dissertation has set out to identify the forces that led to such divergence within the context of Central Pacific Panama, between early complex societies of the Río Parita and Río Tonosí valleys. Although they were part of the same sociocultural interaction sphere known as the Gran Coclé Semiotic Tradition, these regions exhibit considerable variation in the way early complex societies developed, particularly with respect to the level of social inequality that evolved.

This observed variation in hierarchical development is based largely on differences in mortuary data. Although concerns have been raised about inferring inequality from the materials remnants of mortuary practice (e.g. Parker Pearson 1982; Ucko 1969), there is reason to believe that the mortuary variability observed in Central Panama is indeed representative of variation in the level of inequality that developed in different regions. To begin with, as Briggs (1989) has demonstrated with graves from Sitio Conte, status in this context was expressed through an “additive process” (1989:138), whereby the

higher the status of the interred individual, the larger and more diverse the grave assemblage was (cf. Peebles and Kus 1977). Thus, while there may exist many contexts in which aspects of inequality and identity are not reflected in mortuary treatment, the Rio Grande and Río Coclé valleys of the Late Ceramic II period do not appear to have been one of them. If a similar custom was shared among the numerous societies of the Gran Coclé Semiotic Tradition, as the elaborate grave assemblages from others regions would suggest, then levels of social inequality in the Río Tonosí valley were indeed relatively undeveloped.

Moreover, if strong inequalities had developed in the Río Tonosí valley, but were not expressed through conspicuous displays of status, as might be the case among more 'corporate' or 'group-oriented' modes of social hierarchy (Blanton *et al*. 1996; Renfrew 1974), then these inequalities should be apparent in alternative lines of evidence. One common manifestation of inequality in such contexts, for instance, is in the differential distribution of key economic resources. However, as the settlement pattern data from the Río Tonosí valley indicate, no such differential access seems to have developed. There was no concentration of important goods or craft activities anywhere in the region, and there was no apparent control over highly productive resource zones. These data thus suggest that the mortuary data from the Río Tonosí valley is indeed indicative of relatively weak social inequalities, as much of the classic mortuary literature would suggest (Binford 1971; Saxe 1970; cf. Carr 1995; Tainter 1978).

But in addition to the different levels of inequality that seem to have developed between the Río Tonosí and Río Parita valleys, the results of regional survey reveal that there were many other important differences too. By the start of the Late Ceramic II period regional population levels were much higher in the Río Tonosí valley, and human interaction was structured differently as well. In contrast to the compact and bounded local communities that developed in the Río Parita valley, local communities in the Río Tonosí valley were more dispersed and poorly defined. Supra-local interaction was also more clearly defined in the Río Parita valley, and was much more centralized as well, forming a clearly discernable supra-local community. There was also a greater desire on the part of Río Tonosí households to live among more productive agricultural zones, and to maximize the amount of land that was available to

them in the immediately surrounding landscape. Taken together these differences provide greater insight into the nature of the variability that existed between these regions during the Late Ceramic II period, and into how such different forms of social organization ultimately came to arise.

5.1 EXPLAINING THE OBSERVED VARIABILITY

Despite human occupation having a much longer history in the Río Parita valley than in the Río Tonosí valley, this does not seem to have been of much consequence in explaining the organizational differences that arose during the Late Ceramic II period. From roughly AD 200 to 500 patterns of settlement, demography, and social organization were strikingly similar in both of these regions; regional population densities were relatively low, and people scattered themselves widely across the landscape among farmsteads and small hamlets. This period thus marks an effective 'leveling of the playing field' in terms of social development, but sometime after AD 500 the trajectories of these two regions began to diverge. It is thus between AD 500 and 1000 that the factors leading to the organizational differences of the Late Ceramic II period are to be sought.

One important difference that came to emerge during this time was the way that local interaction became structured across the landscape. In the Río Parita valley some households began to nucleate into larger, more compact communities than had ever existed in the region, notably at El Hatillo; in the Río Tonosí valley, however, people distributed themselves much more evenly across the landscape, and at greater distances from their surrounding neighbors. Río Tonosí households were, on average, separated by at least 75 to 100 m, resulting in a relatively dispersed local community structure. Though households at Montevideo settled at a slightly greater density they were nonetheless relatively dispersed, and do not represent a significantly different structure of local interaction than that which existed throughout the rest of the region. Given the distance that existed between households local interaction within such dispersed

structures would have been relatively infrequent, when compared to the more compact local community structure that developed at El Hatillo.

For instance, during the Conte phase (AD 700-900) the community of El Hatillo was home to about 380 people, roughly 80% of which (or 300 people) lived within half of the settlement's overall area. This area amounted to approximately 10 ha of contiguous settlement, which measured roughly 500 m across its maximum dimension (Figure 5.1). The residential density of this core zone would thus have been about 30 people/ha (see Chapter 4), meaning that these 60 or so households were, on average, separated by no more than 40 m from one another, and no household would have had to travel more than 500 m to interact within any other member of this local community.

Inter-household spacing in the Río Tonosí valley, however, was structured rather differently. At an average residential density of 7.5 people/ha (see Chaper 3), there would only have been about 25% as many people (or about 15 households) within the same 10 ha of contiguous settlement, who resided at an average distance of some 75-100 m from their nearest neighbor. Even at the more densely occupied site of Montevideo there would have been just 22 households within this same area, and it would have required a total of 35 ha of settlement (including Montevideo) to encompass the same number of households that lived in the core of El Hatillo. Given the way that settlement was distributed along the alluvial spurs (which were relatively linear landscape features), such an area would have spanned roughly 1.5 km from one end to the other along its maximum dimension (Figure 5.1). Thus, while the distance that existed between adjacent households in the Río Tonosí valley would not have presented a major impediment to frequent interaction between neighbors, such distance would have been compounded amidst a larger group, and thus attenuated interaction within a larger pool of households.

In addition to being more densely occupied than local communities in the Río Tonosí valley, El Hatillo (along with other local communities in the Río Parita valley) was also well-bounded, having been directly abutted on all sides by relatively vacant areas of landscape. This meant that the pool of households with whom one could have interacted on a daily basis would have been the same for

everyone living within the local community. This was not the case, however, for many households in the Río Tonosí valley. Although many households would have been able to maintain daily patterns of interaction with others in their vicinity, these households did not, in some cases at least, belong to a single, clearly defined (or bounded) local community. They instead lived amidst larger areas of more or less continuous settlement, whose extents were sometimes greater than what could reasonably be considered a single a network of local interaction. Thus, two households that could have interacted on a more or less daily basis may not necessarily have been part of the same local interaction network, as the overall pool of households with whom they interacted may have been different. In contrast to a well-bounded community structure, then, local interaction in the Río Tonosí valley may best be characterized as a series of overlapping interaction networks. Guaniquito Abajo represents the clear exception to this otherwise dominant pattern, though from AD 500 to 1000 residential densities here were just as low as they were in other parts of the region, and the local population was relatively small.

The local community structure that developed at El Hatillo would thus have facilitated more frequent and intense patterns of local interaction than any area of settlement in the Río Tonosí valley between AD 500 and 1000. These different structures may have encouraged households to engage in different types of activities and social relationships, and thus could help explain some of the organizational differences that can be observed during the Late Ceramic II period. One such difference relates to the development of craft specialization, which was an important feature of inequality at El Hatillo and was beginning to emerge during this time (see Chapter 1; Menzies 2009).

5.1.1 Local Interaction and Craft Specialization

Craft specialization has historically been a relatively difficult concept to define (see Costin 1991; Hruby and Flad, eds. 2007); it can be carried out within different contexts, at different scales, and with different degrees of intensity. It is this latter axis of variation, however, that is most relevant for purposes here, which can also be described as variation in the degree of productive differentiation (Drennan and

Peterson 2012:78-79). On one end of the spectrum such differentiation can be relatively minimal, so much in fact that the term 'specialization' may not even apply. Such modest productive differentiation seems to have characterized *Spondylus* production among early complex societies of coastal Ecuador (Martín 2010; Masucci 1995), where households engaged in this production so as to bolster their domestic economy. On the other end of the spectrum, however, productive differentiation can be very dramatic, and very fitting of the term craft specialization. This specialization can be carried out in a very intensive manner, under what some might characterize as workshop-like conditions. Such intensive specialization seems to have characterized shell ornament production at Cerro Juan Díaz between AD 550 and 700 (Mayo 2004; Mayo and Cooke 2005), some 20 km east of El Hatillo.

Though craft specialization at El Hatillo was not nearly as intense as that which evolved at Cerro Juan Díaz, it was nonetheless notably more pronounced than anything that developed in the Río Tonosí valley, (where no evidence for craft specialization was recovered), and seems to have entailed some degree of economic interdependence between households. It is such interdependence that the compact and bounded local community structure that developed at El Hatillo may have helped facilitate.

As was discussed in Chapter 1, elites at El Hatillo seem to have been more actively engaged in the production of shell ornaments and polished stone axes than other members of the community during the Conte phase (Menzies 2009). While shell ornaments would not have been an essential item of survival, and may have been produced for export and local elite consumption, stone axes are thought to have been an important subsistence tool used for agricultural clearing, and would thus have been important to most members of the community. Although these items may not have been directly controlled by elite households, the distribution of manufacture debris was largely concentrated around elite household contexts (Menzies 2009:93-96), suggesting that they were nonetheless responsible for producing, or overseeing the production of, the majority of these items.

Moreover, while high-status households may have specialized in stone axe production, they do not seem to have been very actively engaged in the production of other stone tools, as this appears to have been concentrated among low-status households (Menzies 2009:93-94). Like stone axes these

items would have been important for many basic subsistence needs, and thus would have been required by low- and high-status households alike. Low-status households also seem to have been responsible for certain processing activities that entailed the use of cutting and scraping tools, which do not appear in elite household contexts (Menzies 2009:93-94), and may have been the primary ceramic producers well (2009:94).

Domestic artifact assemblages from El Hatillo thus suggest that there was some degree of economic interdependence between elite and commoner households during the Conte phase. This interdependence may have been facilitated by the compact and bounded local community structure that existed at El Hatillo, and the relatively frequent patterns of interaction that such a structure would have enabled. To begin with, if interdependencies are to form between households, then there is an economic advantage of living in close proximity to those with whom one is interdependent, so as to minimize the cost and burden of travel that is required for the exchange of economic goods (e.g. Drennan and Haller 2007:79). Elites at El Hatillo, for instance, would seemingly have been interacting with multiple households so as to acquire stone tools, ceramics, and other basic goods that would have been used on a more or less daily basis, making it advantageous for them to live near those households that were providing them with such goods, and with whom they would have had to interact so frequently.

But in addition to the economic advantage of living in close proximity to those with whom one is interdependent, there are also social advantages as well. Economic interdependence inherently entails placing a part of one's livelihood in the hands of another household, making it advantageous for households that are interdependent to live close to each other; this allows households to keep a close eye on those who are responsible for their well-being, even if only a part of it. Given the distance that existed between households in the Río Tonosí valley, this aspect of interdependence may have been particularly difficult to establish. Such distance would not have allowed for particularly close oversight of potentially interdependent households, thus discouraging strong levels of interdependence from forming.

Whatever may have discouraged strong levels of craft specialization from developing in the Río Tonosí valley, that it was somehow connected to the dispersed structure of local interaction that existed

in this region is supported by data from other early complex society cases. For instance, among the cases whose regional settlement patterns have been compared by Drennan and Peterson (2005, 2006, 2008; Peterson and Drennan 2012), the Alto Magdalena is the only one in which compact local communities, or villages, never seem to have emerged, and where a dispersed structure of local interaction was prevalent across the regional landscape. It is also in this region where craft specialization seems to have been least developed (see Drennan and Peterson 2006, 2008; Drennan *et al*. 2010).

A comparable scenario can be found among the early complex societies of the Quijos Region (Cuéllar 2009), where regional settlement was also relatively dispersed across the entire landscape. There is no evidence that compact village communities ever developed in this region, nor is there evidence for any significant level of craft specialization (Freeman 2011; Knight 2009; see Berrey 2013). Dispersed farmsteads were also a prevalent form of regional settlement among Mississippian societies of the U.S. southeast (e.g. Knight and Steponaitis 1998; Welch 1998), and while some scholars have argued that craft specialization developed among these farmsteads, others suggest that this evidence represents only minor variation in activities, and is in either way plagued by small sample sizes (see Scarry 1996:23-24). Consistent with the patterns that have emerged elsewhere, it is within the larger, more nucleated centers of Moundville and Cahokia where strong levels of craft specialization seem to have developed.

Taken together these data thus seem consistent with the patterns observed in Central Panama: in regions where compact and bounded local communities provided the basic structure for local interaction, significant levels of craft specialization were able to develop, and in regions where local interaction was more continuous and dispersed, such specialization seems to have been discouraged. However, while such dispersal may thus help explain why craft specialization did not develop in the Río Tonosí valley, it does not explain the seemingly undeveloped nature of social inequality. Even in the Alto Magdalena and Quijos Region, where settlement dispersal was particularly prevalent across the entire landscape, strong levels of social inequality did develop. In the Alto Magdalena during the Regional Classic period (AD 1-900) these inequalities seem to have been largely based in ritual activity (Drennan 2000; Drennan and Peterson 2006), while in the Quijos Region both ritual and interregional exchange

may have helped support clearly marked status distinctions. This exchange, however, does not seem to have been based on the movement of economic goods. As Cuéllar (2009) summarizes, "transactions of a non-commercial nature were at the core of Quijos chiefly dynamics, and ...marriage alliances were the driving force behind the systems of regional and interregional interaction of which the Quijos chiefdoms were a part" (2009:171).

Thus, while the dispersed structure of local communities in the Río Tonosí valley does not necessarily explain why no strong level of inequality developed, it does help explain why inequalities did not develop in the same way as other parts of Central Panama, such as the Río Parita valley. The craft specialization on which those inequalities were based seem to have required a different type of interaction than what the dispersed community structure of the Río Tonosí valley encouraged, helping set societies in this region down a different path of social development.

This, of course, does not mean that craft specialization (or inequalities rooted in specialization) is the inevitable outcome of nucleated patterns of local interaction, but simply that such interaction is an important part of the equation if craft specialization is to develop. Though specialization and economic interdependence can themselves be the catalyst for the nucleation process, this does not seem to have been the case in the Río Parita valley. Here households began to nucleate at El Hatillo between AD 550 and 700, and it was not until the subsequent 200 years of occupation (AD 700-900) that craft specialization began to emerge. This leaves open the question as to what caused these households to nucleate in the first place (thus setting the stage for craft specialization and its role in supporting social inequality), along with what may have discouraged households from doing so in the Río Tonosí valley.

5.1.2 Demographic Pressure and Settlement Dispersal

The most likely reason for the dispersed nature of settlement in the Río Tonosí valley was the desire of households to live directly on or adjacent to the plots of land that they farmed. This mode of settlement can be advantageous if (1) there are high labor requirements on individual plots of land, and the

cultivation of that land is organized independently at the household level (Netting 1993), or (2) there is insecurity in land tenure and the need for households to keep a close eye on their fields. Such dispersed, agrarian modes of settlement have been documented ethnographically in a wide range of world regions, including Mexico (Schmieder 1930), Ghana (Hunter 1967), Nigeria (Stone 1992, 1996), and Japan (Smith 1959). It is also argued to have been the motivation behind settlement dispersal among early complex societies in the Tehuacán valley (Drennan and Haller 2007), and among various Late Formative, Classic and Late Postclassic societies of broader Mesoamerica (Drennan 1988). That this was also the motivation behind settlement dispersal in the Río Tonosí valley is plausible given the residential densities that existed in this region, and the amount of land that this would have made available for cultivation between neighboring households.

Given the residential densities that were documented in the Río Tonosí valley, virtually every household in the region would have had at least 0.5-1.0 ha of land (or 0.75 ha on average) available to them in the landscape immediately surrounding their houses. Although it could be useful to estimate just how much of each household's subsistence requirements could have been produced on a plot of this size, such estimates require knowledge of numerous variables (e.g. Krikby 1973) that are not currently available for the Río Tonosí valley. And while yield estimates derived from modern populations in other world regions could help provide a useful point of reference, some even as close as western Panama (Young 1971), these estimates are typically based on swidden agriculture (e.g. Wilk 1991; Young 1971). If households in the Río Tonosí valley were indeed living on the plots of land that they farmed, then such a mode of agriculture would not have been feasible on these individual plots.

Ultimately, even if the land that existed between households in the Río Tonosí valley would not have been enough to sustain those households on an annual basis (as was likely the case), it would nonetheless have provided them with a substantial amount of their subsistence requirements. The remaining requirements could have been met by alternative modes of subsistence, such as hunting, fishing, and farming the alluvial soils that were relatively abundant in the region. In this sense agriculture in the Río Tonosí valley may have thus been characterized by a sort of infield-outfield system, whereby

households intensively cultivated the plots of land on which they lived, and practiced more extensive forms of cultivation in fields located at greater distances from their residence (Sanders 1981:362-363). Households could also have farmed the vacant areas of landscape that separated larger swaths of settlement, such as in the gullies that separated the spurs on which so many people lived.

But why might households in the Río Tonosí valley have been prompted to pursue such an agrarian mode of settlement, resulting in such a dispersed structure of local interaction? One important factor behind this decision may have had to do with the relatively large number of people that were beginning to occupy the region. In the face of rising population levels and diminishing landscape, households may have felt the need to lay claim to their own, individual plots of land. Such a possibility is consistent with the apparent desire of most households to locate their plots on some of the most productive soils that existed in the region, which would have been better suited to sustain such intensive cultivation with little to nor fallow period, and with the high rates of settlement continuity that were observed for both the La Cañaza and Bijaguales phases, which suggests that households were reluctant to give up their plots of land once they had been established.

That this dispersed, agrarian mode of settlement was adopted in response to high regional population levels is also consistent with other archaeological and ethnographic case studies where similar patterns have been documented. As Figure 5.2 illustrates this mode of settlement tends to occur most frequently in regions characterized by relatively high regional population densities. Though such widespread dispersal is not the inevitable outcome of high regional population figures, it is nonetheless under such demographic conditions that such dispersal tends to occur (see Netting 1993:263-265; Stone 1996:101-104).

While many households in the Río Parita valley would have had immediate access to the amount of land that they required, the same cannot be said for those that lived at El Hatillo. Although residential densities here were substantially lower than in other early complex society communities around the world, they were nonetheless high enough that households would not have been able to meet their subsistence requirements, or even derived a substantial portion of those requirements, from the land that

was available between adjacent households. Moreover, as Haller (2008a) has demonstrated, so large was the population of this community that some households may have had to maintain fields that were located at least 3 km away, and this distance would only have increased if the population figures discussed in Chapter 4 are used. Farming practices for residents at El Hatillo would thus have been significantly different than for those that lived in the Río Tonosí valley, entailing different patterns of land use and distribution. These differences may have existed from the very beginning of El Hatillo's occupation, and may actually have been what prompted households to nucleate there in the first place.

5.1.3 Risk, Nucleation, and Inequality

Although occupants of the Río Parita valley may not have been faced with the same sorts of demographic pressures as those of the Río Tonosí valley, this does not mean that they were not presented with subsistence challenges of their own. As was discussed in Chapter 4, the environment of the Río Parita valley is considerably drier than that of the Río Tonosí valley (see Figure 4.1), and is in fact one of the driest areas in all of Panama. Not only does this region receive considerably less rainfall than the Río Tonosí valley (Figures 4.2), but it also experiences slightly higher rates of evapotranspiration (Figure 4.3). The soils of the Río Parita valley also have greater limitations with respect to cultivation than do those of the Río Tonosí valley (Figure 4.4), further increasing the risk of agricultural pursuits.

Although these conditions would have been less favorable for agriculture than those of the Rio Tonosí valley, risk is not simply a matter of general environmental conditions, but of how those conditions change on an inter-annual basis; the greater the degree of inter-annual variability, the greater the degree of uncertainty on the part of households in meeting their subsistence requirements. And though the inter-annual data that is needed to assess such variability is not currently available for either of these two regions, such data do exist for various parts of the Canal zone, and can provide an indication of how variable patterns of rainfall are on a year-to-year basis. By comparing rainfall patterns from the Pacific

side of the Canal zone (where rainfall is least abundant) to those of the Atlantic side (where precipitation rates are much higher; see ANAM 2011:31, Mapa 2.1.4), it is possible to examine potential differences in inter-annual variability between zones that have significantly different levels of average annual precipitation.

Figure 5.3 presents the total annual rainfall for each year of a 24-year period (1908-1931) at the sites of Balboa Heights (on the Pacific side) and Cristobal (on the Atlantic side). As this figure illustrates the site of Cristobal continuously receives substantially more rainfall than does Balboa Heights, and the average annual rainfall at each site across this 24-year period is 3255 mm and 1722 mm, respectively. Although the coefficient of variation across this time period is similar at both sites (0.168 at Cristobal and 0.134 at Balboa Heights), and thus may well have been for the Río Tonosí and Río Parita valleys as well, such variation would have been exacerbated by the lower levels of rainfall that occur in the Río Parita valley. These coefficients are similar to those observed for the Valley of Oaxaca (Table 5.1), where inter-annual variation in rainfall is argued to have posed a significant risk to subsistence pursuits (e.g. Sanders and Webster 1978), though here average levels of precipitation were somewhat lower than the Río Parita valley (about 700 mm per year; Kowalewski *et al.*1989:8).

Though the degree of inter-annual variability at these two sites is similar, there are some interesting differences to be observed when examining the intra-annual variability across this same period of time. Figure 5.4 illustrates the average rainfall for each month over the course of this 24-year period. This figure shows that most of the rain in each zone falls between the months of May and December (i.e. the wet season), with much less occurring between the months of January and April (i.e. the dry season), and the same is true for both the Río Parita and Río Tonosí valleys. However, when examining the monthly coefficients of variation across this 24-year period (Figure 5.5), it is clear that, while both zones exhibit comparable variability during the wet season, Balboa Heights (the direr of the two zones) exhibits somewhat greater variability during the drier months. Thus, during the time of year when conditions would have been harshest, the degree of inter-annual variability may have been somewhat greater in the Río Parita valley than in the Río Tonosí valley, thus increasing the risk of agricultural pursuits.

Ultimately, it is not the point of this discussion to argue that occupants of the Río Parita valley would have been at continual risk of not fulfilling their annual subsistence needs, or that the degree of risk in this region was comparable to that of other regions where risk is known to have played significant factor in influencing early complex society development, such as the U.S. southwest (e.g. Tainter and Tainter, eds. 1992) or highland Mesoamerica (Sanders and Webster 1978). Rather, this discussion is simply to make the point that the level of agricultural risk would likely have been greater in the Río Parita valley than in the Río Tonosí valley, perhaps enough so as spur occupants of the former region to engage in greater levels of risk-minimizing behavior. Such behavior was adopted, for example, by the prehispanic populations of western Hawai'i (Allen 2004), where the average annual rainfall is comparable to that of the Río Parita valley, and where people would have had a comparably diverse range of resources on which they could rely (including agricultural, riverine, and marine resources).

Risk has featured prominently in many discussions of early complex society development (e.g. Sanders and Webster 1978; Tainter and Tainter, eds. 1992), and is argued to have played a major role in spurring social inequalities in many parts of the world (e.g. Halstead and O'Shea 1982; Spencer 1993). One way in which this can happen is through the construction of features such dams and irrigation canals, which are common forms of mitigating risk in many arid environments. The construction and maintenance of these features often require effective means of management, and once completed often restrict access to important subsistence resources, making them easier to control. It is through the need for such management and the resulting restricted access that social inequalities can often emerge. Such is argued to have sparked the onset of inequality in the Tehuacán valley, for instance, during the Early and Late Santa María phases (Spencer 1993), and the construction of such features is said to have accompanied major changes in the sociopolitical organization of early complex societies in the U.S. southwest (Nicholas and Feinman 1989) and southern coastal of Peru (Schreiber and Rojas 2003).

But despite how effective such features can be in buffering against agricultural risk, they are but one of many forms of risk minimization that can be adopted among early complex societies, and there is no evidence that such features were ever constructed in the Río Parita valley. Other common forms of

risk minimization include storage, food sharing, and distributing parcels of farmland across different environmental zones (e.g. Hegmon 1989), each of which would have been viable options in the Río Parita valley. It is these latter two mechanisms of buffering risk, however, which are most relevant for purposes here, as these may have helped spark the nucleation process that occurred at El Hatillo.

Food sharing and exchange occur when a household is deficient in an important subsistence resource, and thus must rely on other members of its social network to meet its subsistence needs. Given that El Hatillo was located on some of the least productive soils in the Río Parita valley, the possibility that some households would have occasionally come up short in their agricultural requirements would likely have been greatest here. To the extent that sharing and exchange were a relatively common occurrence (which is plausible given the environmental conditions of this region), it would make sense for households to live near those members of their social network on whom they regularly relied (or who regularly relied on them). As discussed above, doing so would have minimized the cost of travel between cooperating households.

Though food sharing and exchange often occur between households of the same lineage, they can also occur between those of different kinship groups, and thus contribute to the integration of larger local communities (e.g. Kohler *et al*. 2007). Cooperation in subsistence pursuits can also encourage settlement nucleation (e.g. Kohler and Reed 2011), as can certain patterns of land distribution which discourage households from living directly on or adjacent to the plots of land that they farm. As mentioned above, distributing parcels of farmland throughout different environmental zones can provide yet another means of risk-minimization. This practice has been documented ethnographically among the Hopi of the U.S. southwest (Hegmon 1981), and among the Zapotec of Oaxaca in the early twentieth century. As Flannery (2002:424) summarizes:

> Zapotec families collaborated in clearing land by means of large work groups, [and] then distributed the land among the families who participated. Because the big work gangs moved from place to place, a family who participated could wind up owning parcels of land scattered through several environments. This process not only spread

> risk among many families, it also minimized the chances that a local environmental disaster would damage all of a family's plantings. As Schmieder points out, it also promoted the growth of large, permanent villages; since there was no point in moving one's house to fields that were scattered over so large an area, families continued to live within the larger cooperating group.

Ultimately, a combination of risk-minimizing strategies may thus have contributed to the nucleation process that occurred at El Hatillo between AD 550 and 700 (and at the smaller local villages that were emerging at this time), which could have included food sharing and exchange, cooperation in subsistence activities, and the way in which land may have been distributed among different households (see Drennan and Haller 2007:79). These strategies may have been adopted as a result of the rapid regional population growth that was occurring at this time, which, though not as substantial as that which was occurring in the Río Tonosí valley, nonetheless created a very different demographic context in the region, and may have increased the perception of risk among households (e.g. Tucker *et al*. 2013) in this relatively arid environment.

Though the nucleation process at El Hatillo may have initially been sparked by risk-minimizing behavior, this may not have been the only factor integrating this community throughout its initial period of demographic growth (AD 550-700). It was during this time that social inequalities first emerged at El Hatillo (Menzies 2009), which may also have come to play an important integrative role. These inequalities may have emerged out of the need for management in organizing cooperative subsistence pursuits (Kohler *et al*. 2012), or as a result of the rapidly growing local population, which would have resulted in a greater frequency of inter-household conflict, and thus the need for some households to mediate those conflicts. Providing such mediation may have afforded certain households a higher status within the community (Roseberg 2009; see Sahlins 1958), leading to the modest manifestation of inequality that is apparent at this time (Menzies 2009). That these inequalities emerged as a result of inter-household conflict brought on by El Hatillo's rapid growth is consistent with the fact that it was during this time that El Hatillo's population surpassed an important threshold which multiple scholars

have argued prompts increased levels of scalar stress (ca. 150 people; Kosse 2001; see Feinman 2010b:41, Table 3). It is also consistent with ethnohistoric observations from Central Panama, which document conflict mediation as an important role of chiefly authority (Andagoya 1865:13).

In sum, risk-minimizing behavior may have been a key factor in sparking the nucleation process at El Hatillo. As this community grew inter-household conflicts would have become more frequent, requiring a means of conflict resolution lest this community were to fission (Bandy 2004; Johnson 1982). El Hatillo, however, did not fission, and in fact continued to grow, culminating (by AD 700) in the largest population that this community would ever experience. These new forms of conflict resolution were likely a key factor in facilitating such rapid and substantial growth, and may have given way to the emergence of inequality within the community. As time went on this inequality evolved, and sociopolitical forces may have come to play an increasingly important role in the integration of El Hatillo. Economic interdependence and craft specialization would also have been important in this regard, as would any continued degree of food sharing and cooperation in subsistence activities.

5.1.4 Risk, Inequality, and Supra-Local Interaction

Finally, it may also have been the greater levels of inequality and environmental risk that existed in the Río Parita valley that contributed to the very different structure of supra-local interaction in this region, when compared to that of the Río Tonosí valley. To begin with, supra-local interaction in the Río Parita valley was much more centralized than in the Río Tonosí valley, which was likely a consequence of the sociopolitical functions that took place at El Hatillo. Though it is unclear what specific sorts of activities supra-local interaction may have revolved around early on in this trajectory, ritual activities such as feasting and funerary rituals would likely have been among them during the Late Ceramic II period.

In addition to being more centralized, however, supra-local interaction in the Río Parita valley was also structured into a clearly discernable supra-local community. This may have had to do with the greater levels of environmental risk that existed in this region when compared to the Río Tonosí valley,

where patterns of supra-local interaction were much less clearly defined. In regions where risk can threaten subsistence pursuits it can be advantageous for supra-local populations to clearly delimit their territory on the landscape, so as to lay claim to the land and other resources that exist within its boundaries. Such a clearly discernible supra-local community may also have emerged from the desire to establish buffer zones between neighboring polities, the need for which may have arisen from intense levels of inter-polity warfare (such as that described in ethnohistoric accounts; see Helms 1979). Buffer zones are a common feature in regions characterized by such warfare, including the U.S. southwest (Wilcox and Haas 1994) and the Valley of Oaxaca (Marcus and Flannery 1996). Although more regional survey must be conducted to determine if such zones existed in the context of Central Panama, the observable structure of supra-local interaction in the Río Parita valley certainly allows for this possibility.

Though the sociopolitical influence of the Río Parita chiefdom is thought to have eventually extended well beyond the boundaries of this supra-local community, this community may represent the extents of that influence during the early stages of its development (ca. AD 550-900), and of its 'sociopolitical core' later on in the trajectory. Based on ethnohistoric accounts, defending the resources within this territory, or attempting to acquire those from another, may have been one motivation behind the conspicuous levels of warfare that seem to have developed during the Late Ceramic II period (sheer aggrandizement and maintaining or gaining access to exchange networks being among the others; see Helms 1979).

That no significant level of inequality seems to have developed in the Río Tonosí valley may have contributed to the very un-centralized nature of supra-local interaction in this region. Lacking such inequalities, and the sociopolitical forces that arise from them, this region would have been without one of the most effective known mechanisms for organizing interaction at such a relatively large scale: hierarchical organization. Though hierarchy and political functions are not the only integrative force around which centralized patterns of supra-local interaction can be organized, they nonetheless played a very prominent role in organizing such interaction among most early complex societies around the world (e.g. Peterson and Drennan 2012).

But supra-local interaction was not only un-centralized in the Río Tonosí valley, it was also poorly defined on the landscape. While this may have to do with the relatively small area that was covered by regional survey (meaning that more definable boundaries to such interaction might be found outside the survey zone), it may also have to do with the environmental conditions that existed in this region. If these conditions indeed presented relatively little risk to agricultural pursuits, then this may have mitigated the need to for people to clearly define their territory on the landscape. It may also, however, have had to do with the organization of agricultural production and the relatively self-sufficient nature of households in the region. Because households were essentially defining their territory largely at the household level, this may have precluded the need for doing so at larger scales.

This is consistent with patterns observed in other regions where dispersed, agrarian modes of settlement have been documented, and where the environment poses relatively little risk to agricultural pursuits, such as the Alto Magdalena. Though centralized supra-local communities emerged in this region by at least the Regional Classic period, the boundaries of these communities were relatively permeable and not as clearly defined as those in the other regions (e.g. Drennan and Peterson 2005, 2006; Peterson and Drennan 2012). However, even if there had been a need for occupants of the Río Tonosí valley to delimit their territory from surrounding populations, then the local topography could have done this for them. The mountains and hills that surround this region would have provided natural limits to supra-local interaction in most directions (see Figure 2.3), perhaps precluding the need for people to delimit them clearly in their patterns of settlement.

Given the observed differences in the way supra-local interaction was structured, and the seemingly less important role played by social inequality in integrating supra-local populations, this leaves open the question as to just what the nature of supra-local interaction may have been in the Río Tonosí valley. Rather than serve as a sociopolitical center, as El Hatillo clearly did, Guaniquito Abajo may instead have served more as a burial ground for the interment of lineage heads in the region. In areas such as the Río Tonosí valley, where dispersed patterns of settlement predominate, kinship often serves as the primary means of organizing social relations (see Hunter 1967; Stone 1992, 1993; Wilk 1988:144-146).

Growth tends to occur through fissioning processes originating from the lineage head's household (Hunter 1967; Wilk 1988:144-146), whose importance is often recognized throughout the broader region. Though no lineage heads were able to garner the sorts of power or prestige that could ultimately lead to strong levels of social inequality, they may nonetheless have been revered individuals beyond their respective kinship groups. The deaths of these figures may thus have been cause for periodic rituals attended by multiple lineages, which may have taken place at Guaniquito Abajo.

One other possibility, though, as Ichon (1980:405) has suggested, is that the ceremonies held at Guaniquito Abajo did not revolve around the individuals interred in the mounds. In this sense the nature of rituals held at Guaniquito Abajo may have been more similar to those held by the Kofyar in the Namu District of Nigeria (Stone 1992, 1993, 1996). Here settlement patterns are, as in the Río Tonosí valley, relatively dispersed, with each household occupying the plot of land that it farms. Local interaction between households typically revolves around cooperation in agricultural activities, and periodic work parties known as *mar muos* (or beer farming) are held in the harvest season. These parties are typically hosted by individual households, and serve as a form of repayment for the labor that is provided from other groups.

Given the patterns observed in the Río Tonosí valley, it is possible that patterns of local interaction in this region were also organized around cooperation in agricultural activities, at least for certain times of the year when labor demands on individual plots would have been the highest. And while labor parties such as *mar muos* may have been a part of local interaction, larger harvest rituals may also have been held. Such rituals could have been an opportunity for households to come together and reap the fruits of their labor at the end of the harvest season, strengthening social ties within the supra-local population. Guaniquito Abajo, along with other earthen mound sites in the southern Azuero (see Ichon 1980), may have been the focal points of these large-scale celebrations. Such a notion is consistent with the relatively high frequency of manos and metates that were encountered at Guaniquito Abajo when compared to other settlements, particularly those of the legged variety, which are believed to have been

used for ritual purposes (Haller 2008:147) and were exclusive (within the limits of the regional survey) to the site of Guaniquito Abajo.

Both of these possibilities, however, remain highly tentative. Neither of them helps explain the moderately sized local population that seems to have aggregated around Guaniquito Abajo, which raises some interesting issues, and potential contradictions to the scenarios laid out above. Understanding how these households relate to one another, and to the larger regional population, could provide valuable insight into the nature of Guaniquito Abajo's role, and thus presents a promising avenue for future research.

5.2 DIRECTIONS FOR FUTURE RESEARCH

One important line of evidence that would be useful in this regard is the composition of household artifact assemblages in the Río Tonosí valley. This would allow not only for a better understanding of the types of activities that households engaged in, particularly those related to subsistence and craft production, but also of the nature of inter-household relationships. Guaniquito Abajo would be a particularly promising context for such research, and would provide greater insight into the nature of activities that went on in this community and its role throughout the broader regional context. Such data would also be very useful for the sites of Montevideo and Guayabo, as these data would provide valuable information as to why residential densities seem to have been slightly greater at these locations, and why some outlying settlements seem to have clustered around them. Finally, understanding the nature of artifact assemblages from a sample of the 'normal' farmsteads that characterized most of the regional settlement would also be very useful, as this would allow one to compare the sorts of activities that went on these areas to those that took place in more notable settlement locations (i.e. those mentioned above).

One other valuable line of research would be not only to extend the extents of the current regional survey, but also to conduct such survey around some of the other sites that are scattered throughout the southern Azuero where numerous burial mounds were constructed, such as El Barrabal or La Limona. Such research would provide further insight into how interaction was structured around these notable funerary centers, and allow us to understand if they all seem to have played similar roles within their respective parts of the peninsula.

Regional-scale survey and household excavations oriented toward more coastal settlement would also be fruitful endeavors in the Río Tonosí valley. Not only does this area contain some of the earliest settlements that emerged in the Tonosí region (settlements that predate occupation in the modern survey zone), but here occupation continued throughout the entire sequence of social development. Thus, not only would such research provide greater time depth to our understanding of this regional trajectory, but it would allow us to understand how these more coastal communities were organized in relation to those which existed further inland, in the area surrounding Guaniqutio Abajo.

Finally, in addition to conducting such research in the Río Tonosí valley, our understanding of early complex society development in Central Pacific Panama would be greatly enhanced by similar sorts of research in the Río Grande valley. Regional-scale survey would provide valuable insight into the demographic and settlement patterns of this region, and how it compared to those observed in the Río Parita and Río Tonosí valleys. Given the patterns that have been observed in this dissertation we would expect regional population densities to have been relatively low, and local interaction to have been organized, at least partially, in compact local communities. Household excavations would provide complementary data to the very lavish burials that exist in this region, and insight into whether the strong inequalities that are apparent in these burials also manifest themselves in everyday life. Up to this point these burials have been the focus of attention in this particular region, though additional lines of research have recently been undertaken (e.g. Mayo *et al*. 2007).

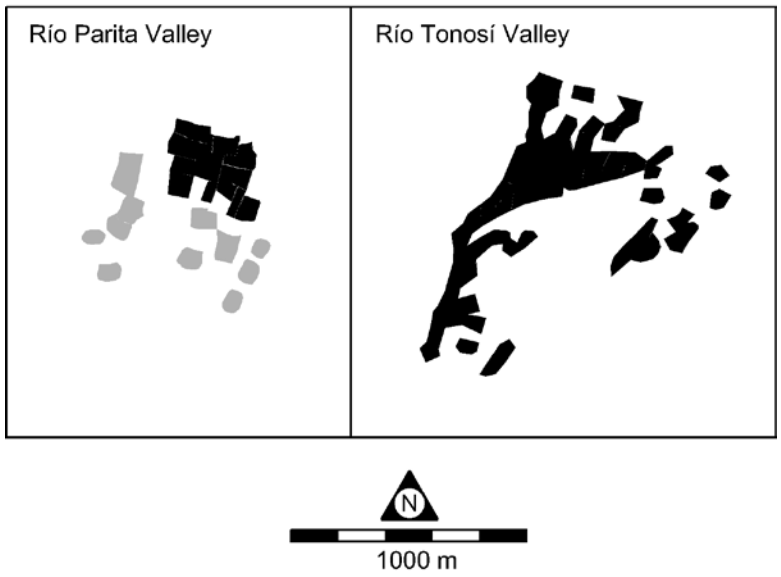


Figure 5.1 Distribution of 300 people in the most densely occupied parts of the landscape in the Río Parita (left) and Río Tonosí (right) valleys between AD 500 and 1000 (on the left: the core zone of El Hatillo during the Conte phase; on the right: Montevideo and surrounding settlement during the La Cañaza phase).

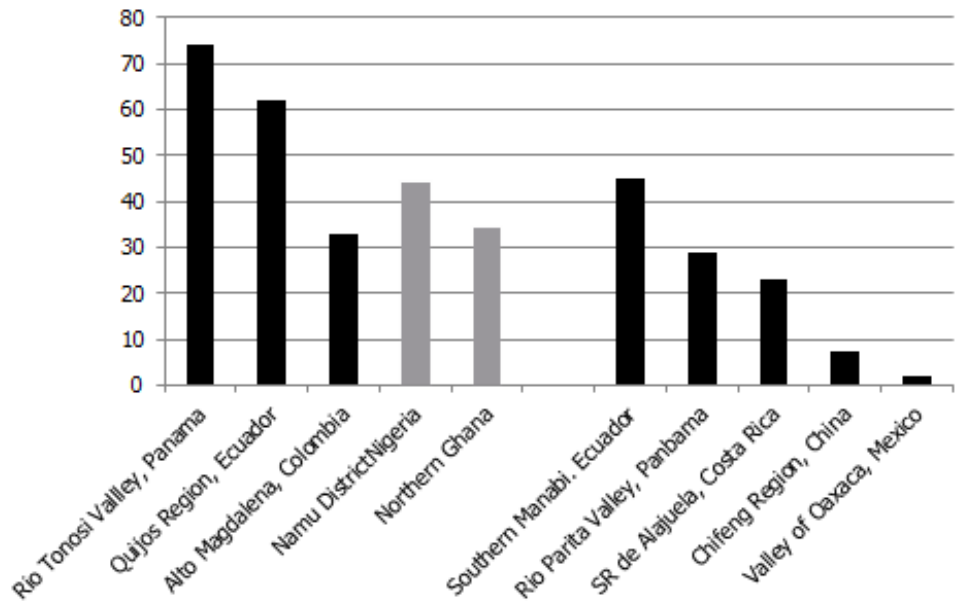


Figure 5.2 Regional population densities (people/km^2) among early complex society (black) and ethnographic (grey) cases. Those cases with dispersed, agrarian modes of settlement are on the left, while those on the right represent a sample of early complex societies with varying degrees of nucleation and dispersal.

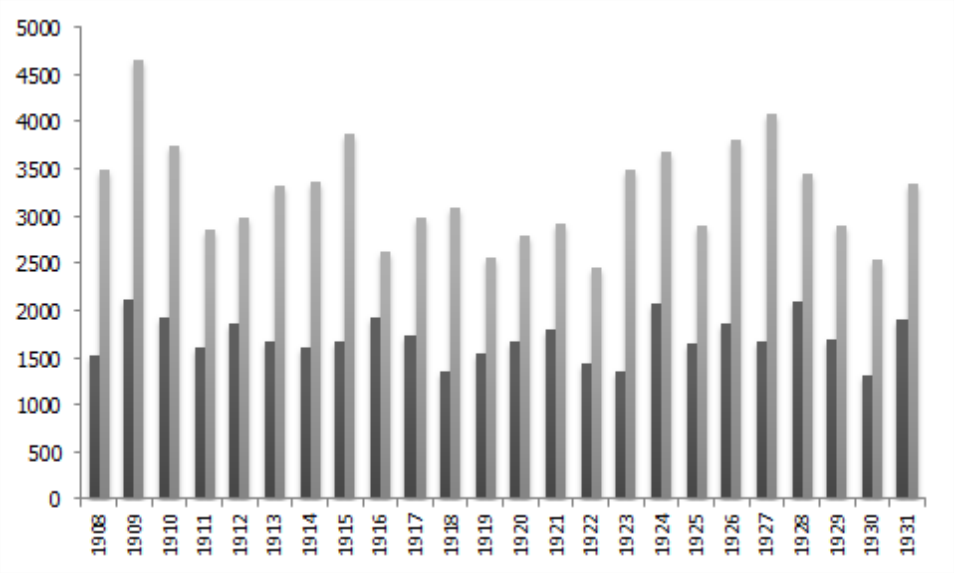


Figure 5.3 Total annual rainfall over a 24-year period at two sites in the Panama Canal zone: Balboa Heights (dark grey) and Cristobal (light grey).

Table 5.1 Mean annual rainfall over multiple-year periods for three separate locations in the Valley of Oaxaca.

	mean	SD	CV
Oaxaca City	597.4	91.9	0.1538333
Tlacolula	529.7	160.7	0.3033793
Tlalixtac de Cabrera	788.6	137	0.1737256

(data from Kowalewski 1980:154)

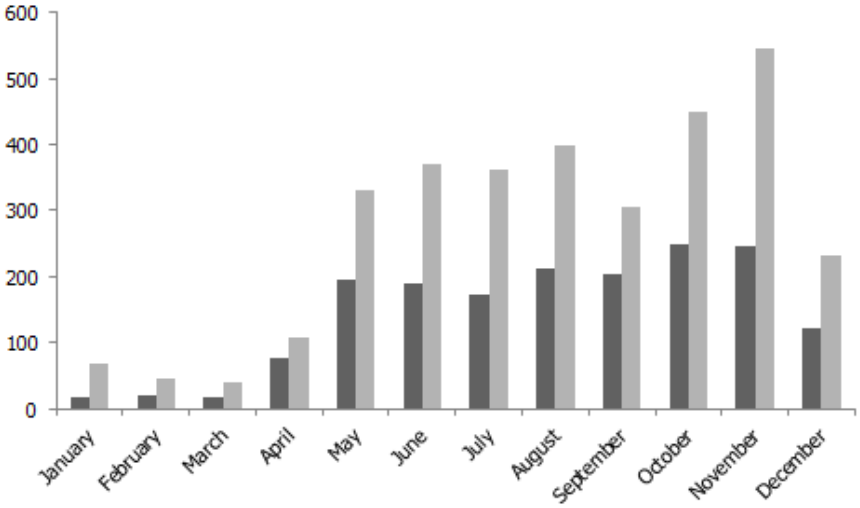


Figure 5.4 Average monthly rainfall over a 24-year period at two sites in the Panama Canal zone: Balboa Heights (dark grey) and Cristobal (light grey).

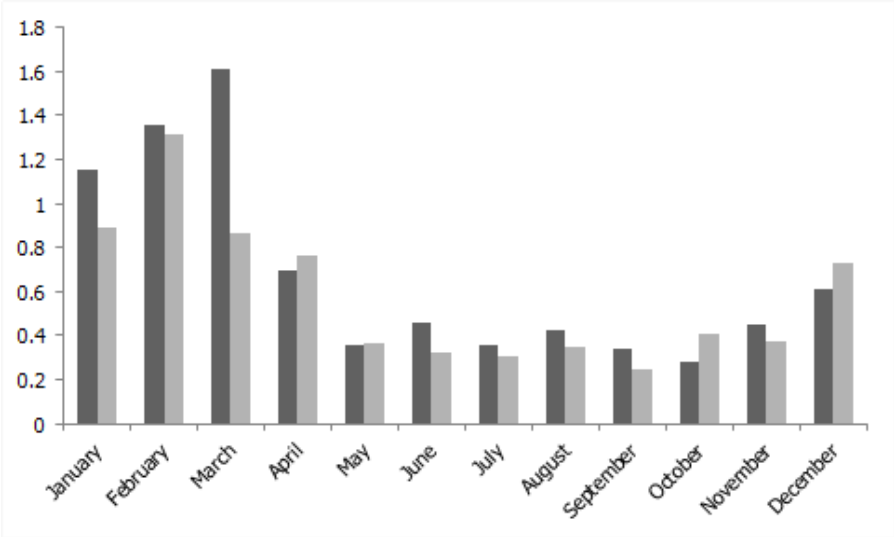


Figure 5.5 Coefficients of variation for the average monthly rainfall over a 24-year period at two sites in the Panama Canal zone: Balboa Heights (dark grey) and Cristobal (light grey).

APPENDIX

ACCESS TO THE ONLINE DATASET

The complete regional dataset for the Río Tonosí valley is available electronically in the Comparative Archaeology Database provided by the Center for Comparative Archaeology at the University of Pittsburgh. This dataset contains both quantitative and spatial information on the individual collection lots that were documented during regional survey, a map of the soil zones that were used in the analyses, along with settlement maps for each phase of prehispanic occupation, which are available in a variety of formats. These data can be downloaded at:

www.cadb.pitt.edu

General questions regarding the database and its contents can be sent to:

cadb@pitt.edu

For specific questions regarding the Río Tonosí valley data, please contact the author directly:

cab10@pitt.edu

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