INTENSIVE AGRICULTURE AND POLITICAL ECONOMY OF THE YAGUACHI CHIEFDOM OF GUAYAS BASIN, COASTAL ECUADOR.

by

Florencio Delgado-Espinoza

BA University of Texas at San Antonio, 1993

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This dissertation was presented

by

Florencio Delgado-Espinoza

It was defended on

September 14, 2001

and approved by

Marc Bermman

Olivier DeMontmollin

Billie DeWalt

Robert D. Drennan
Dissertation Director

Intensive Agriculture and Political Economy in the Yaguachi Chiefdom of the lower Guayas Basin, Coastal Ecuador.

Florencio Delgado-Espinoza, PhD

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This dissertation examines the relationship between intensive agriculture and the development of chiefly societies in the Lower Guayas Basin, coastal Ecuador. The Yaguachi chiefdom arose in the area at least during the Integration Period AD 700-Spanish contact. This social formation built intensive agriculture technology (raised fields) and large earth mounds. Two approaches, top-down and a bottom-up, are contrasted to identify where along a socio-political continuum the organization of the Yaguachi chiefdom lay. The research aimed to reconstruct regional settlement patterns using the spatial distribution of sites and their relationships to raised field zones. Data gathering included methods such as aerial photogrametry and subsurface testing. Excavation was conducted through shovel tests, auger probes and a limited number of excavation units. The surveyed area consisted of 428. 29 km^2, and survey results identified 622 mounds clustered into 16 settlements located along the borders of a large zone of raised fields. These settlements form a three-tiered hierarchy with three main regional centers, sub-centers, agricultural villages and isolated households. Raised fields were found in large tracts. Sites show a strong tendency to cluster, and, for the most part, large centers had large supporting populations. Those centers are located adjacent to raised field zones. Evidence at the core of one of the sites indicates that considerable feasting activities took place. Differences in access to resources among households correspond to their location within the three-tiered hierarchy. Raised field construction required large labor inputs, and they provided

large outputs. Mound building activities, feasting and burial practices indicate strong sense of community in the local population. This evidence leads to the conclusions that local chiefs were engaged in the management of raised field production, and that public mound building and feasting activities served to make this possible.

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Chapter 1

CHIEFDOMS AND INTENSIVE AGRICULTURE

In the recent literature, a correlation between complex forms of chiefly organization and intensive agricultural systems has been observed (Earle 1977, 1978, 1987, Kirch. 1984, 1990, Spencer and Redmond 1992, Spencer et al. 1994, Spriggs 1986, Stemper 1993), but we still do not fully understand how this relationship works. Researchers studying chiefly political economy have focused strongly on analyzing sociopolitical organization and allocation of labor at the broad polity level. Relatively few attempts have been made to study relations of production in the context of agricultural intensification focusing on both households and local communities. It seems to be worth pursuing studies addressing sociopolitical organization at various levels and, as indicated by DeMontmollin (1987), analysis of various components of regional polities, households, household clusters and local communities can be accomplished by regional analysis. Interest in gaining a more specific understanding of the organization of agricultural intensification has prompted the need to register the dynamic at work in a regionally organized polity. Here, the focus rests on the organization of raised field agriculture of the Yaguachi Chiefdom of the lower Guayas Basin of coastal Ecuador.

After early efforts to dismiss monocausal explanations of the emergence and development of social complexity (Earle 1978), scholars have come to agree that there are multiple pathways to political power (Feinman 1995). Earle (1991a) indicates four main aggrandizement strategies used by emerging chiefs to gain power and also by established elites to maintain it: (a) control of staple goods, known also as staple finance, (b) control of production and distribution of wealth goods, also known as a wealth goods economy or wealth finance, (c) organizing warfare and (d) holding control over ideology.

In the case of societies not engaged in agricultural intensification, the development of centralized political power is linked to circumstances other than the control over staple surplus. In Bronze Age Europe, for instance, chiefly power was associated with the development of exchange networks (Renfrew 1974), and in the Caribbean and some northern Andean chiefly societies, political power and the economic advantages of the elite were linked to the pan-regional exchange of wealth goods and extra-regional alliances. Metals, spondylus shells, foreign pottery and obsidian found very distant from their production loci support the claim that regional and long distance exchange was a trademark of north Andean groups (Bray 1995, Cordero 1998, DeBoer 1996, Lumbreras 1982, Marcos 1986, Salazar 1992, Salomon 1980, Vasquez 1999, 2000). Salomon (1980), for instance states, that chiefly societies of the northern highlands of Ecuador based their power during the late pre-contact Period on forming networks of wealth goods distribution that fueled the formation of kin ties.

Further, during most of the southern coastal cultural history from Valdivia times to late Manteño-Huancavilca, Milagro–Quevedo and Puná, local cultures were involved in long distance trade. The rise and persistence of centralized political power most likely rested on control over the organization and maintenance of the long distance networks.

Warfare has also been named as a probable path to leadership and has been very popular for characterizing northern South American societies since Steward and Faron (1959) described them as very warlike societies. Studies of modern communities have led some scholars to argue that the development of some local chiefly formations is tied to warfare (Carneiro 1991, 1998;

Redmond 1994). According to this view, warfare is key for creating and maintaining chiefly political power (Carneiro 1981), and leadership originates from individual and group success in warfare activities. Successful war leaders most likely became the head chiefs, and looser groups became the subjugated population. Based on ethnographic data, Redmond (1994) postulates that leadership in tropical forest chiefly societies rests in balanced success in external warfare and internal politicking.

Ideological control in the region has been linked to long distance trade inasmuch as trading goods usually contain meanings associated with witchcraft and ideological constructions that sanctify chiefly authority (Helms 1993). In the coastal region of Ecuador, ideological themes appeared from the Archaic Vegas occupation, and fully developed by Early Valdivia society. Early social differentiation was perhaps linked to shamanistic activities (Lathrap et al. 1978) whose central themes linked to controlling natural events such as rain (Marcos 1992). Early in Valdivia a charnel house appeared at Real Alto, and during late Valdivia shamanistic activity was linked with early social differentiation (Marcos 1986, Zeidler and Stahl 1998).

Most likely, all these causes played a role in the origin and development of political power and social inequality in the area. Multicausal explanations also agree that some variables are more important than others, as some societies develop with strong elite involvement in craft production and exchange networks, while others develop with elites strongly tied to using surplus gained through intensive agricultural production. Here our main concern is with societies involved in the use of intensive agriculture.

For the most part, studies dealing with societies utilizing intensive agricultural systems such as raised fields have noted the correlation between their use and the rise and persistence of political hierarchy (Ames 1996, Arnold 1995, Blanton et al. 1996, Gilman 1991, Hastorf 1993, Kristiansen 1991, Spencer 1994, Stanish 1994, Steward 1959). Most of these conclude that chiefly leaders gained access to surplus production that was used, in turn, to fund chiefly power. In fact, most of the recent studies of "agricultural chiefdoms" indicate that products of intensified agriculture were used to fund the chief's office (Arnold 1994, Gilman 1981, 1991, Spencer 1992).

Such conclusions note the importance of surplus generation imbedded in the development of complexity. Without claiming causality, it suffices to say that surplus seems to have been a key factor in the development of social complexity (Earle 1997, Patterson 1991). Although current information indicates that elites obtained surplus production generated by the development of intensive agriculture, in some cases with the use of raised field technology (Earle 1978, 1987, Kirch 1984, 1990, Spencer et al. 1994, Spriggs 1988, Stemper 1993), we do not understand the mechanisms by which elites extracted surplus from their subject populations.

Regional perspectives, such as in the Barinas region of Venezuela (Spencer 1994a), have come to the conclusion that surplus from raised field production was extracted by elites. That surplus allowed them to engage in a regional trading network. Likewise, in the middle Guayas Basin, Stemper (1993) concluded that surplus was extracted for use on behalf of the chief's activities. Hawaiian chiefdoms also developed around the same dynamic principle (Earle 1978, Kirch 1990, Springs 1988).

While these research projects' conclusions agree in essence with early ethnohistoric accounts, the mechanism suggested is communal labor organization managed by a chiefly elite through such means as feasting and ritual activities (Hayden 1995). Others see raised fields organized within small household clusters and/or large household units, organizing production outside the political hierarchy. (Netting, 1982, 1990, 1993; Wilk, 1988, 1996) On more theoretical, or even epistemological, grounds a divide has appeared between those claiming that a chiefly elite or any central authority must be linked to the organization of raised field production, advocating a top-down approach, and those arguing for households and small communities' productive autonomy, an approach that is bottom-up. It is in this context that this research addresses the question of how raised field agricultural production was organized. It will deal with the intriguing question of whether a managing elite or autonomous agriculturalists organized raised field production at the Yaguachi polity of the lower Guayas Basin of Costal Ecuador.

The Yaguachi polity was one of the two largest regional polities that flourished in the area prior to and during Spanish contact. It was one of a large number of regional polities (*parcialidades)* that inhabited the entire Guayas Basin and is referred to by early chroniclers as the C*hono nation* (Espinoza Soriano 1988, Moreno Yánez 1988, Muse 1989, Sánchez 1996). Documents written during the early Spanish contact Period point out the existence of a well organized sociopolitical system with a clearly established site hierarchy formed by villages annexed and/or subjected to others (Espinoza Soriano 1988). A glimpse of the Chono's sociopolitical structure was recorded in chronicles and has been reported by Espinoza Soriano in the following passage:

> *A paramount chief and his subjects inhabited the large area of the lower plain…his dependent chiefs provided him tribute required for his subsistence and for his practices of generosity and hospitality; [the tribute] consisted of relatively large quantities of the best quality agricultural goods* [Espinoza Soriano 1988:132; my translation].

Missing from those accounts are the mechanisms by which such tribute extraction took place. This quote is very relevant not just because it provides information (to be tested of course) about chiefs' gaining control over surplus, but also because it indicates that the system was probably organized in a three-tier hierarchy.

It should also be noted that, according to these accounts, chiefs were involved in feasting activities, but although there is a mention of large quantities of fine goods given as part of the tribute, certainly the amount of tribute is imprecise at best.

Archaeologically, the Chono nation was named the Milagro-Quevedo culture by early archaeologists (Estrada 1954, Holm 1981). This "culture" occupied, during the last pre-Hispanic and probably early Hispanic Periods, the entire Guayas Basin (Estrada 1954, 1957b, Evans 1954, Meggers 1966, Stemper 1993, Zevallos Menendez 1995). The small number of archaeological studies conducted so far in the area seems to fit with some of the chronicles' claims. For one thing, many mounded sites known in the area cluster to form the "constellation of chiefly organized polities" mentioned by Espinoza Soriano. Included in the information not discussed by chroniclers are the use of raised field systems and the construction of large earthen-mounded sites, as well as Chono participation in regional and extra regional trading networks (Marcos 1995).

Thus, far, studies in the area close to Guayaquil have identified the settlement pattern formed by a three-tiered hierarchy (Buys and Muse1987). At the highest level, regional centers are considered to be places engendering public and ritual activities. The second tier is formed by what Buys and Muse (1987) calls small centers or sub-centers. These sub-centers would have been central to the management of raised field production and perhaps trade and craft production (Muse

1991). At the bottom of the hierarchy, *aldeas* or small villages or communities are found along with what appear to be isolated special purpose house structures.

Social hierarchy has also been recorded in the area; both early studies that focused on excavated burial materials (Estrada 1954, 1957b, Meggers 1966) and recent ones reconstructing sociopolitical organization in site-oriented research see clear social differences. Burial practices show different treatments of individuals (Meggers 1966, Ubelaker 1981), and craft production seem to be somehow specialized (Suarez 1992, Sutliff 1989).

On the nature of raised field organization Muse (1991: 290), using data gathered at the Peñón del Río site, indicated that "chiefs held no political control over household production or interzonal exchange," instead he seems to be arguing that groups of households were engaged in tasks such as constructing earthen mounds and building, maintaining and managing production on raised field plots. This argument comes from the idea that "chiefs did not control the means of production, but accumulated surplus by means of persuasion" (Muse 1991:289).

The first regional study conducted in the Guayas Basin allowed Stemper (1993) to encounter conclusive evidence that the Daule elite was engaged in agricultural surplus extraction. The surplus, he said, was generated by raised field production. Such surplus, at the same time, allowed chiefs to get involved in craft production and regional exchange networks.

All the studies discussed here fell short in their conclusions because they extrapolated inferences from only one site. Muse, for example, builds a regional model of political economy based upon data from only Peñón del Río. In order to deal with regional political economy, regional information is needed. A different type of investigation was carried out by Mathewson

(1987a) who was interested in understanding the mechanics of raised field technology and the labor investments necessary for their construction.. Mathewson's analysis was regional in scope, but failed to link raised field labor requirements to the sociopolitical organization that such labor requirements may have needed. Instead, he pointed out that no chiefs were needed to generate such works.

Raised fields have been investigated in the area from a cultural ecological standpoint (Denevan 1983). As a result, nine complexes of raised fields were identified in the Guayas Basin area. Those complexes, instead of being culturally significant bounded entities, are in fact arbitrary divisions. In the area pertaining to the Yaguachi chiefdom, Mathewson has identified two raised field systems, Taura and Durán or Peñón del Río. They are separated by an inhabited area, and here it is argued that they could have belonged to a large system bounded by the Babahoyo River. A system of settlements hierarchically organized into three levels and a social organization characterized by inequality are associated with the large Taura raised field complex. The present study, in more specific terms, analyzes the organizational production of the larger Taura raised field complex by the members of the Yaguachi polity that developed in the lower Guayas Basin area prior to Spanish contact.

Two approaches, a bottom-up one and a top down one, will be the end points of the axis of a political continuum along which the production organization of the Taura raised fields could be located. Specifically, based on what is known thus far, the contention is that the management of raised field agriculture of the Yaguachi polity was organized somewhere between the two opposite extremes of a continuum between (1) a top-down strategy with elites managing production, construction, and/or maintenance of raised fields, and (2) a bottom-up organization in which non-elite households managed raised field construction, maintenance and production without elite involvement.

The organization of production will be studied by reconstructing the regional settlement patterns of the Yaguachi polity system encompassing both settlements (archaeological sites) and ancient raised fields. The contention here is that the organization of the whole system reveals the political and economic decisions of the Chono people. Field methodology used included the analysis of aerial photographs by photogrametry, digital examination, and ground survey, including site and raised field mapping, and subsurface survey using both augers and shovel tests. In addition to this, various tests pits and limited excavations were also undertaken.

In addressing the issue of how raised field production was organized, this research hopes to accomplish various general and specific objectives. It seeks to better understand how economic, social and political organizational dynamics played out in complex agricultural chiefdoms such as the Yaguachi. It does so by combining two related research enterprises. In the area under investigation, those studying raised fields have provided large amounts of information regarding the mechanics of raised fields and their technological characteristics, while other studies taking a site-focus perspective were concerned with material culture, pottery, metalwork, etc.

Here, those approaches are combined since it is the contention that they are two interrelated parts of the same system under study. This investigation also contributes to our understanding of the specific history of the study area. And lastly, it combines a series of methodologies that deal with the adverse conditions facing archaeological studies in the lowland tropics. It applies field methods to deal with the lack of ground visibility and heavy post-depositional activity. Equally important this project adds to those few regional studies thus far conducted in the Ecuadorian tropical lowlands.

Chapter 2

THE ORGANIZATION OF INTENSIVE AGRICULTURE

In recent theoretical discussions regarding the management of raised field production, major focus has been placed on understanding what level of social complexity organized it. Possible answers range along a sociopolitical continuum, from a household autonomy to very centralized elite management (Erickson 1993). These views correspond to the opposite ends of the sociopolitical continuum from bottom-up to top down.

The Top-Down Approach to Intensive Agricultural Production

The most extreme view of a top-down approach will see the strongest, more sophisticated and centralized form of power exerting direct control of productive systems. As a result, top-down explanations are strongly associated with state level societies, and it is in this framework that intensive agriculture is most often discussed in the archaeological literature (Adams and Jones 1981, Childe 1954, Puleston 1977, Price 1971). The most important assumption of this approach is that elites obtained surplus production by means of managing the organization and mobilization of large labor power devoted to the construction of hydraulic technology. In regard to raised field production, the most conspicuous feature of a top-down approach is that state bureaucracies managed the construction, maintenance and production of large raised field areas (Kolata 1991b, Palerm 1955, Scarborough 1991, Wittfogel 1956).

The underlying principle put forward by Wittfogel (1956), based on his Marxist thinking, was that irrigation systems in general are large, in other words cover large areas, and in most cases are found in places and times where strong states developed. For this reason, he discounts the possibility that acephalous communities were involved in managing these systems. He also indicated that in arid lands where water constituted a scarce resource, its control by state elites, which later became despotic in nature, triggered the complexity of social systems. These ideas became the core of the hydraulic hypothesis that characterizes the oriental despotism also known as the Asiatic Mode of Production, a view that tacitly undermines the capacity of individual households, or small farmsteads and even local communities to manage intensive technology (Giddens 1984).

Reactions to Wittfogel have produced various kinds of research as well as constant revisions of the hydraulic theory. Most scholars nowadays do not agree with the hydraulic hypothesis as originally proposed. Some disagreements originate from the alleged causal connection between hydraulic technology and state organization (Stanish 1994). Large hydraulic systems are nevertheless often associated with state organizations and thus, their relationship merit scrutiny. Another group denies the hydraulic hypothesis altogether and argues instead that organizational capabilities to manage hydraulic technology are found even within autonomous households and local communities (Erickson 1993). Proponents of the latter idea call for analysis at smaller scales (Netting 1993).

Those that see state organization strongly correlating with intensive agriculture perhaps would not deny the potential that smaller uncentralized organizations have to manage raised field production, but would argue that the correlation that Wittfogel and others advocated cannot be dismissed without scrutiny. They see evidence for strong centralized apparatuses present for raised field management. Kolata (1993), one of the strongest advocates of the top-down approach, at least in regard to his interpretation of Tiwanaku political economy in the Lake Titicaca basin, argued that the complexity and size of raised fields around Lake Titicaca must have required the management of the Tiwanaku state bureaucracy. Further, his argument contends that, although some raised fields were built during earlier Formative times, regional settlements of the Titicaca Basin show that the Tiwanaku florescence strongly correlates with a period of major raised field construction. He also sees a settlement pattern with managerial sites locating in strategic positions to organize labor and distribute surplus.

A twist to this argument is presented by (Stanish 1994), who argues based on regional settlement data from Pampa Koani in Tiwanaku's hinterland, that although the hydraulic hypothesis in its original version is no longer valid, it is a mistake to dismiss it altogether. He instead argues that perhaps direct management as centralized as Kolata sees was not necessary, but the chronological correlation is still highly visible, and state elites were engaged in their production. Admittedly, Stanish is more interested in understanding how Tiwanaku's development placed ever larger demands on commoner populations causing pressure on them to increase production and give state offices higher tribute, rather than focusing on elite management only. Both Kolata (1991) and Stanish (1994) interpret the area's settlement patterns in which specialized sites for the control and or management of the large raised field production are spread along the landscape, strategically spaced in nodal points linking the large Tiwanaku center with smaller local communities.

Turning to Mesoamerica, in many parts of the lowland Maya region, raised fields have been observed in conjunction with other forms of irrigation technology. Scarborough (1993) placed them under the term "water management systems," a group of various strategies lowland inhabitants used to cope with "ecological" constraints, and he further argues that water managed landscapes in the area should not be analyzed in pure economic terms, since even ideological constructs might as well be present underneath their patterning. In Pulltrouser Swamp, Cobweb, Albion Island, Caracol and various places in Petén and bordering Belize, raised fields have been observed and studied, all associated with some sort of "feudal systems" (Adams y Jones 1981, Scarborough 1993, Turner 1974, 1983, Turner and Harrison 1983).

There is a rich set of data for the lowland Maya area, but not much attention has been paid to how centralized was the use of this technology. Some conclusions see household management and others some sort of state management (Adams and Jones 1981, Pohl 1985). Suffice it to say here that interest in the organization of agricultural intensification at a smaller scale of analysis in the lowlands is rather recent (Fedick 1996, Ford and Fedick 1992), although none of these works concern raised field production. Very recently for instance in the Palenque core, a systematic regional analysis was conducted to understand the organization of raised field production among settlements tied to the prime center (Liendo 1999). In that study, the author argues that the system was very centralized around a managerial elite that exerted strong control over the producing population.

Moving to the Basin of Mexico, the complexity of productive systems involving irrigation canals and raised fields in the form of *chinampas* still used today has been addressed only at a large regional scale. Earlier, Wittfogel, Palerm and Carrasco posited that the system worked under the direction of the Basin of Mexico's central authorities, and Price (1971) indicates the existence of strong state involvement in these activities. Even in modern times one view claims that the *ejido* system is highly centralized and perhaps is part of local continuity (Price 1971). Although Wingate (1993) does not state clearly whether he sees strong state managerial elites controlling raised field production in the Basin of Mexico, he implies that the complex engineering of these irrigation systems was under the management of the state apparatus. It is among scholars working in the Basin of Mexico that explanations along the lines of Wittfogel's Hydraulic Hypothesis are still strong (Armillas 1971, Palerm 1955), but analysis of smaller scales have not yet been addressed. However the scale of analysis still remains larger and analysis of local organization of labor for instance has not been carried out thus far.

This brief discussion indicates that for the most part the classic top-down view of raised field production is associated with strong state control. This implies also that large hydraulic systems should appear largely in areas where strongly centralized states arose.

In more theoretical terms, the fact that very large parts of the globe containing hydraulic technology correspond to areas where societal complexity did not attain the level of the state (for the New World see Denevan 2001,1987). Large systems found in the Llanos de Mojos of eastern Bolivia, the Río San Jorge in the Depresión Mamposina of Colombia, the Venezuelan Llanos and the Guayas Basin of coastal Ecuador, to name a few, are associated with complex but non-state societies, contradicting the alleged association between centralized state societies and the use of raised field technology.

Those looking at the systems associated with state societies may automatically ascribe a bottom-up approach to these systems, but, this seems a very simplistic analysis. Furthermore, it arises the same question scholars studying states have tried to deal with for a long time, which is whether a top-down or a bottom-up approach characterizes the organization of raised field production at these less complex societies.

While the traditional top down view is more used to understand state societies, its application to lower levels of societal complexity in essence follows the same principle. The top-down view applied to chiefly societies needs to be rearranged from its original formulation, since what one can consider lack of centralization in a state society may well correspond to centralized managerial authority in complex chiefdoms. The adjustments made to analyze societies placed at a lower sociopolitical level of complexity requires us to get away from the general belief that chiefly elites work only through persuasion rather than force and thus cannot control the means of production. For instance, studies of the New World chiefdoms use the top-down approach to explain the elite's control over the means of distribution of wealth goods. Also chiefly elites have been conceived to be good managers of craft production and the organization of long trade networks (D' Altroy 1985, Earle 1987, 1991a, Feinman 1995, Hirth 1993a).

Studies of European chiefdoms often apply the top-down approach to explain chiefly organization of agricultural production (Gilman 1981, 1991, 1995, Kristiansen 1991). In the study of Hawaiian chiefdoms, Earle (1978) pointed in that direction as well.

No much information on how raised field production was organized within chiefly economies has yet been presented, at least not in the same terms it has been analyzed at the state level. Although some regionally focused analysis see elites and raised fields co-existing, with the exception of Hawaiian chiefdoms, it is not clear yet by exactly what mechanisms the elite got control over surplus obtained from raised field production (Earle 1997).

Almost all studies so far have concluded that indeed surplus extraction existed and that surplus was key in funding elite power (Earle 1977, 1978, Gassón 1998, Spencer 1994a, Spencer 1994b), what remains to be understood is whether population aggregated around central places and let elites take control over managing their labor, or whether it was instead a *laisser faire* system and the non-elite population gave up their surplus to the elite for entirely politico-ideological reasons.

A specific understanding of such organization has not been attained perhaps because of the general contention that what separates chiefdoms from states is that the latter maintain specialized bureaucratic offices that could manage and extract tribute, but the former lacks them and depends more on the ability of the chiefs to persuade followers to give away surplus to fund his or her office (Carneiro 1981).

This argument may be due for debate given present understanding of how at least complex chiefdoms work (Steponaitis 1978). Regardless what one's place is within this debate, on one the hand it can be argued that a chiefdom's lack of necessary mechanisms to collect tribute can be precisely what makes direct management of raised fields in a top-down fashion one of the only ways chiefs could extract surplus from the commoner population. If , on the other hand, one sees elite power in complex regional agricultural chiefdoms on the threshold of maintaining specialized agricultural managerial attitudes, it is admittedly logical to see large raised field production managed from the top-down.

An argument for centralized chiefly activity is the acceptance that chiefly elites often manage craft production, trade networks and ritual activities (Helms 1978). Since production and ritual activity have proven to be intertwined in prehispanic societies to the point that production and ideology overlap, it can be argued that those managing ritual and the ideological domain could well have managed intensive agricultural production too.

Recent studies have focused on understanding chiefly political strategies to both gain and maintain power (Clark and Blake 1994 , Feinman 1995, Hayden 1995). In a top-down approach to raised field production, it seems perfectly feasible that chiefly elite organized labor power through feasting activities (Gassón 1997, Hayden 1995), fitting Kristiansen (1991) ideas of the working dynamic of "group-oriented chiefdoms." In addition, local ethnohistoric evidence on the Yaguachi polity implies a great importance of feasting activities "hosted" by chiefs.

The Bottom-Up Approach to the Organization of Intensification Technology

Some scholars dealing with the intensive agriculture deny all aspects of the "hydraulic hypothesis" and have undertaken research from a different perspective, using a wide range of data. Most of these studies see agricultural systems operating autonomously from any centralized organization (McAnany 1992, Netting 1993, Wilk 1983, 1988b)

Ethnographic studies document hydraulic technology managed by autonomous entities, such as simple small communities of loosely formed villages (Geertz 1972, 1980, Leach 1959, Lansing 1991). Lansing (1991) introduces the religious domain into efforts to understand the organization of hydraulic technology. Based on his analysis of the landscape, he says that the organization of the Balinese irrigation system was based upon a well-organized network of water temples, without centralized authority. Balinese territory is segmented into spaces belonging to particular temples, based on religious beliefs shared by the local population, which gathers several times a year to define the organization of irrigation technology.

Studies of modern peasants have focused on understanding the organization of raised field technology, but since most such studies are performed in areas of clear state influence, this analysis is related to state level societies. Studies of the organization of modern Mexican smallholders (Enge and Witteford 1989) reveal that the management of hydraulic systems such as *chinampas* is organized at the local community level. They indicate that "rural social organization is hierarchical and based on differential access to resources such as water, land, fertilizers, credit, assistance and marketing facilities". Farmers get technical assistance and from the government loans and pay taxes, but producers do not deal directly with the government, but through organizations such as irrigation associations and cooperatives. Such institutions are very hierarchical, based on differential access to water and land.

In the Guayas Basin, ethnographic research conducted around Peñón del Río indicated that the local peasantry is organized into cooperatives, which include some individuals tied by kinship (Alvarez et al.1984). These cooperatives are linked to the central government to obtain technical assistance and land, but each family manages production locally. In the southern Peruvian highlands, Guillet (1992) describes locally managed irrigation systems based on *ayllu* organization through the minka system.

The north coast of Peru saw a sudden state expansion during Chimú and later Inca times. This dry local environment imposed limitations on the amount of water resources, and thus represented the perfect set of conditions for a state to develop in very Wittfogelian fashion. Utilizing ethnohistoric records, (Netherly 1984) instead observed hydraulic technology organized at the local level, with labor requirements and labor organization was in the hands of local *parcialidades*; during both Chimú and Inca times In this area, communal labor parties during the Inca Period, a well-organized system based on kin ties provided local control.

Archaeological studies seeking to demonstrate household autonomy in using hydraulic technology have not provided satisfactory sets of data to support their claim. Instead advocates of this view focus on minor details and problems with the empirical information used by the opposite bottom-up advocates. Graffam (1990, 1992) stands out as providing information that gives support to the bottom-up view of labor organization.

Championing a bottom-up approach to understanding raised fields construction and production in the Titicaca Basin, Erickson (1993) has searched evidence against arguments that see the Tiwanaku state as the managerial entity. He sees contradictions in Kolata's arguments (Kolata 1986, 1991a, 1996) and asserts that (a) raised fields were in place long before Tiwanaku rose, (b) the construction did not end with the fall of Tiwanaku, and (c) the extent of raised fields in the area resulted from the accumulation of construction over a long Period..

Erickson's strongest contribution to the approach comes from his experimental studies in the Huatta area of Peru (Erickson and Candler 1989). Based on this evidence, he proposes that the organization of construction and production of the Titicaca Basin's raised fields were managed at the local level, even at the level of independent households. In his experimental works Erickson found that small local communities such as the Andean *ayllu,* and even independent families inhabiting large households, are able to construct, maintain and manage production in raised field systems without state or "external" involvement, although it can be argued that persuading people to do raised field cultivation, and providing them with seeds and technical support, is no different from a chief "persuading" followers to increase production. His claim that no "external" forces operated there seems far from accurate; when his team persuaded people to use raised fields, they were exerting "external pressures" since becoming involved in such production was most likely associated with access to wealth (more volumetric production to sell), and social prestige. This of course, does not deny Erickson's claims that the organization of raised field production may well lie at the level of small local communities, or large independent households (Erickson 1987)

At this point, though, it seems that one can see either centralization or local autonomy working, depending on what perspective one wants to use. If one wants to understand where in the political continuum the organization of raised field technology lies in a given area, the data used must be clearer than those currently at hand.

Clearly the entire debate has been carried out in the context of state societies, while within chiefdoms; it has been overlooked for the most part. A reason for that, as discussed earlier, relates to the general wisdom that chiefly societies lack the means to engage in large raised field construction. A bottom-up approach for chiefly societies conceives local communities or small farmsteads managing their own production, and organizing and allocating their labor.

Within regionally organized polities constituted into more than two hierarchical levels, a bottom-up perspective argues that the bottom strata of such a hierarchical system organize raised field production. It has been said that one of the most important arenas for leaders seeking to expand political leadership lies in the immediate community organization (Hayden 1995). It has also been argued that labor power used to produce surpluses beyond households becomes controlled, negotiated and alienated in the communal sphere (Friedman and Rowlands 1977, Sahlins 1972). Sahlins (1972) indicates that it is when communal labor is pooled for communal activities that domestic decisions about production and household labor allocation are possible. Organization of labor parties through communal feasting and communal ritual can transform household labor into communal labor.

Advocates of the bottom-up perspective (Ashmore and Wilk 1988, McAnany 1995, Netting 1993) strongly argue in favor of household autonomy. Most of these scholars see this entity as the smallest social unit of production (Netting 1993), where most of decision-making regarding the organization of production and consumption takes place. The main principle that has dominated archaeological thinking dealing with sociopolitical complexity from a household perspective is Chayanov's idea that agricultural households mainly tend to produce to satisfy only their subsistence needs (Chayanov 1966). Only when pressures "external" to the household are exerted, will households produce more than what their members consume (Sahlins 1972). "External" pressures households experience, include climatic changes that cause production shortfalls, and according to some, the rise of political hierarchy.

Ideological constructs are said to play an important role in masking the burden of such "external" pressures in cases such as the rise of political hierarchy with its need for surplus. Within this framework, many archaeologists have pointed out that social hierarchy may have originated through such pressures (Earle 1997, Kristiansen 1991). Along these lines successful chiefs were individuals (perhaps heads of important lineages) that "persuaded" households to increase production. They most likely extracted surplus using ideological constructs, often involving ancestorship claims and the idea of communal welfare (Ames 1995, Gilman 1981, 1991, Hirth 1993b).

In regard to raised fields, a bottom-up perspective for chiefly societies is perfectly comfortable in accepting that individual households, perhaps responding to external pressures, intensified production by themselves. Intensification of production may have caused changes in scheduling and allocation of labor, but production was managed within the household.

Settlement Patterning and Raised Field Production

Some time ago Christaller (1966) showed how the organization of the landscape shows the economic and political relations between settlements. For the most part, archaeologists focusing on the analysis of social phenomena at the regional level advocate such view. Both the so-called processual and post processual archaeologists see human decisions, based on belief systems, economic needs and political activity, shaping the landscape. It is within this framework that this study contends that the patterning of the Yaguachi polity in the lower Guayas Basin reflects decisions taken by its members responding to political reality. A large number of settlement pattern studies have dealt with settlement organization with regard to both agricultural intensification and regional and local sociopolitics (Blanton 1978, DeMontmollin 1988, Drennan 1988 , Hastorf 1993, Killion 1992, Steponaitis 1978, Sanders et al. 1979).

To understand sociopolitical structure, analysis of settlements has included reconstruction of settlement size and structure, and settlement spacing. Studies of site size and structure have examined the degree of centralization of large polities (Johnson 1977, 1978, Steponaitis 1981). Site size and internal structure and overall settlement spatial distribution has allowed the developing of the site hierarchy within regions in a Christaller fashion (Johnson 1980, 1982).

More recent studies have dealt with site distribution in relation to practices of intensive agriculture (Drennan 1988, Killion 1990). Drennan (1988) reviewed a list of factors that promote nucleation and dispersal of households in Mesoamerica; among the various factors reviewed, both political control and labor-intensive agriculture have strong influences on rural settlements locations.

Labor-intensive agriculture demands large labor inputs for construction and maintenance, in addition to planting and harvesting. In the Tuxtlas Mountains Killion (1992) observes that traditional agricultural intensification involving simply reduction of fallow requires larger amounts of labor than non-intensive systems do. Such high labor requirements would have made it more efficient for producers to locate near their plots, thus producing a dispersed pattern. Agricultural intensification among the Kofyar (Stone 1993, 1996), for instance, promotes dispersal as it produces an increase in the time devoted to each individual plot. The Kofyar, a group that live around the hills of the Jos plateau in Central Nigeria, change settlement patterns from dispersed to nucleated in direct relation to agricultural tasks that require high labor requirements (Stone 1991,1992,1996,1998). Stone (1993) argues that settlement spacing relates closely to spatial disposition of labor. Thus considering only optimal use of labor by autonomous households, intensification pulls people to their land and that coincides with the development of ownership rights to the land (Netting, 1982, 1990) .

Nevertheless, the social arena, or as Stone calls it, social factors change this pattern as settlement organization among the Kofyar changes from dispersed to nucleated. The main factor pulling settlements together in this case is the social organization of labor (Stone 1996). Household members produce for their own household needs, and also participate in communal working parties to labor on other people's plots. These labor parties also called *mar muos* involve beer drinking and are hosted by the plot owner.

Through these festivities, local people cope with simultaneous labor demands and bring household labor to a communal arena (Sahlins 1972). The Kofyar remain on their lands, but change settlements for a configuration of dispersed settlements that provide better access to neighboring plots.

From the political standpoint, the main argument is that all things being equal, in politically complex systems, elites would promote nucleation (DeMontmollin 1987). Many studies dealing with settlement patterns associated to politically complex systems conclude that a centrifugal force is exerted by elites to nucleate population around centers (Drennan and Quattrin 1995). Studies dealing with chiefly societies indicate that settlement patterning is greatly influenced by the chiefly elite's interest in promoting settlement nucleation (Drennan 1987a, Earle 1991b, Spencer 1992).

In a political landscape of chiefly competition, political success might have provoked population nucleation. Thus, although regional populations may not show significant increases during early developments of chiefly formations, very localized population may increase dramatically as a product of settlement nucleation (Drennan 1988) Chiefs' desires to concentrate large populations around their domains seem to have promoted population nucleation and the development and growth of communities and villages.

In summary, the patterning of any landscape would have resulted from the work of forces such as the ones discussed above Agricultural intensification could produce a dispersed settlement pattern, as rural households are forced to their land, but supra-household organization might override this tendency. More intensive productive systems tend to produce household clusters dispersed through the landscape, but existing or would be elites strive to concentrate ever-larger populations around centers, producing nucleated villages and forming a well-structured settlement hierarchy.

In the particular case of the Yaguachi chiefdom, both forces were probably operating. Chiefs of the Yaguachi polity did gain surplus from raised fields, according to ethnohistoric records, but the operating mechanisms are not documented. One potential mechanism is direct elite management of raised field production in a top-down fashion. If this mechanism was present, the archaeological settlement pattern would present the following characteristics:

(a) There would be a well-defined settlement hierarchy with specialized functions in different settlements. There would be administrative sites with central place functions, characterized by public architecture consisting of mounds, perhaps surrounding public spaces such as plazas. These sites would most likely contain central storage facilities. Their material culture would include items of public display, used for public activities such as feasting and planting and harvesting ceremonies. These sites would have higher proportions of serving vessels for *chicha* drinking. Elite households would contain more wealth in terms of quantity and quality, especially wealth goods (Smith 1987) correlating to their location within local settlement hierarchy. Variation is expected in secondary centers which, like the one at Peñón del Río are expected to function as storage places and redistribution nodes. Those expected to be located in strategic places, forming distribution nodes close to mayor communication networks. Finally, a large number of non-elite agricultural settlements are expected to be connected to either central places or second tier settlements. These non-elite settlements would have a tendency to cluster and form agricultural communities.

(b) Non-elite households would show little or no variation in the quantity and quality of goods for their own use. This lack of variation would result from the fact that under top down control non-elite households would lack incentives to compete with the other non-elite households to produce more. If surplus production was obtained from communal labor and for apparent communal purposes, individual households would not be eager to engage in competition for gaining wealth.

(c) Nucleated non-elite settlements would locate near large raised field plots, perhaps not far from the specialized managerial elite. Such patterning would result from the elite's need to better manage the organization of labor employed in raised field production, and the need to optimize labor output by reducing traveling distances (Drennan 1988). The chiefly elite's attempt to be more efficient in overseeing raised field construction, maintenance, and production would have produced a tendency for agricultural households to cluster close to raised fields.

(d) Raised field plots would be large, beyond the management capabilities of single households, or even household clusters. Based on various experimental works, it is assumed for the lower Guayas Basin, that individual households would manage an area no larger than 1.2 km^2 (Erickson 1993) .

(e) Burial practices for the common people would be communal, and thus burials are expected to be found in groups. Individual ranking might be distinguished in commoner burial assemblages, but since top-down management is a group-oriented task, individual differentiation will tend to be small.

On the other hand, the ideal settlement patterning of the Yaguachi chiefly formation, if autonomous households and small household clusters managed labor for raised field production by themselves without elite involvement, would have the following configuration:

(f) Site hierarchy may or may not be present, and site functions and site location would be related most with tribute mobilization rather than with labor mobilization. In this pattern the presence of central places is not excluded, but their functions would consist more of managing the distribution of wealth goods than of attracting labor. In this settlement system, large regional centers perhaps would be located near trade routes and areas for strategically maintaining control over regional and long distance trade, close to local river networks. Non-elite agricultural households would be found in a dispersed pattern near or within their raised field plots. This tendency would have been produced by the need to claim property rights over land (Earle 1978, Kristiansen 1991, Gilman 1991), and to optimize labor input, as well as to establish distance from demanding chiefs.

(g) Agricultural households would present high variability among themselves in terms of accumulated wealth, resulting from variation in productive capabilities. If elites did not manage production, but extracted surplus through other means, non-elites would be free to engage in competition for wealth accumulation. As a result, perceivable variation would appear, perhaps correlated with the size of the household's labor pool, in other words, the household's size.

(h) Raised field plots would tend to be small in size and present visible divisions that, ideally would let us recognize the pattern composed by a household and its surrounding raised field plot no bigger than 1.2 km^2.

(i) Even among commoners, burial practices will be individualizing, with some burials having larger quantities of offerings than others.

This research departs from the notion that these two descriptions do not constitute an either-or choice, but rather the end points of a single continuum, somewhere along which the Yaguachi polity can be located.

C h a p t e r 3

NATURAL AND CULTURAL ENVIRONMENTS IN THE GUAYAS BASIN

Natural Environment

The area of this study corresponds to a portion of the Lower Guayas Basin in coastal Ecuador, which is a section of the larger Guayas Basin, found in the central and southwestern Ecuador. This large Basin is formed by the large coastal plain located between the Guayaquil and the Andean Mountain range (Figure 1); on the basis of geomorphology, climate and topography, it has been divided into three minor zones corresponding to (a) the lower western side of the Andean Cordillera from 300 to 600 m above sea level (masl), (b) a second zone in the northern section of the basin from 20 to 300 masl, and (c) a third zone corresponding to the lower alluvial plain, along the southeast of the Guayaquil Estuary, from 0.5 level to 14 masl. (Acosta and Winkell 1983, Domínguez 1985)

The large portion of the lower Guayas Basin bounded by the modern towns of Milagro, Taura, Durán and Yaguachi, corresponds to the area surveyed and reported here (Figure 2).

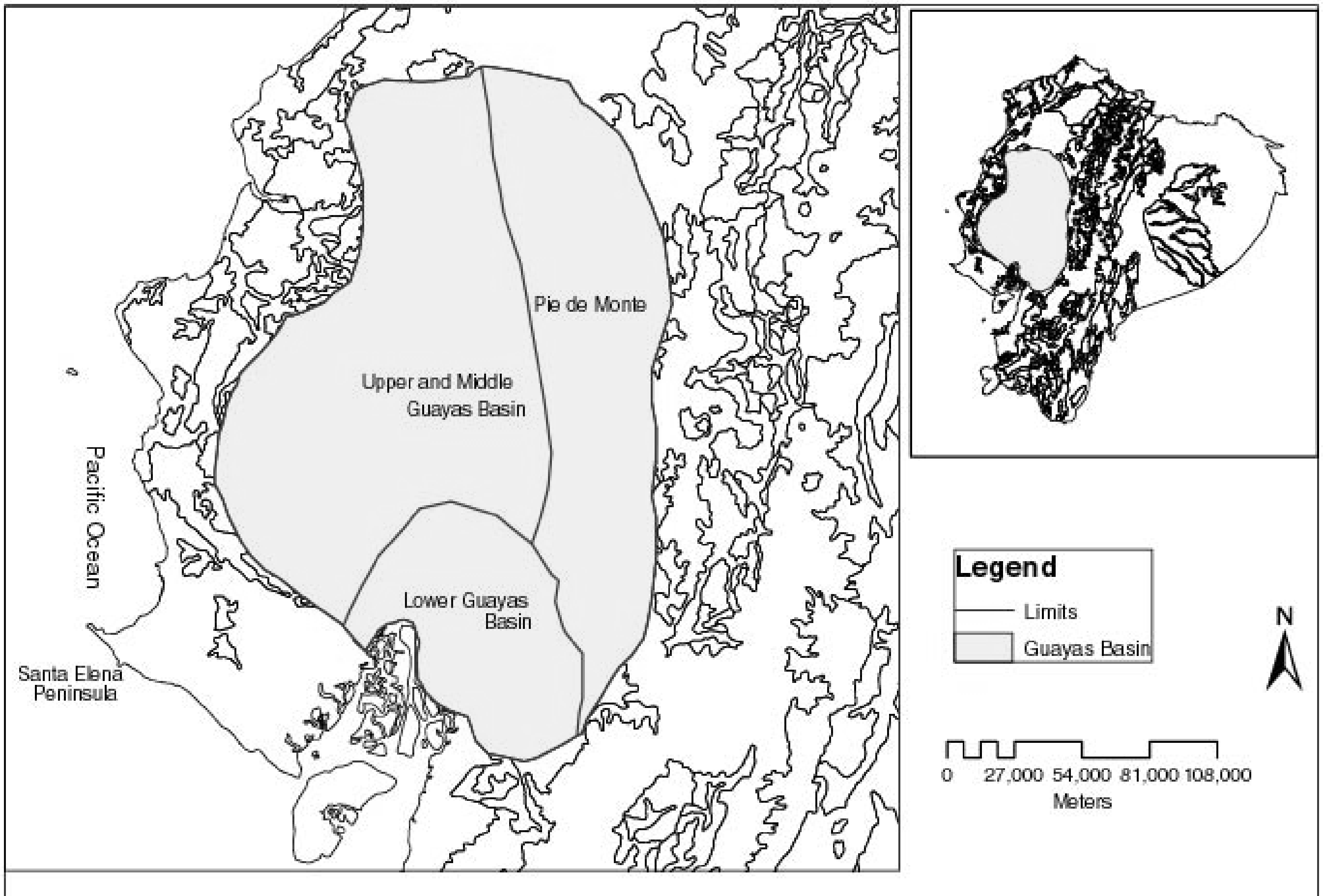

Figure 1. General Map of the Guayas Basin, Coastal Ecuador

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Figure 1 General Map of the Guayas Basin, Ecuador

It corresponds to two different biotopes, one is part of the coastal plain and the other is a small mangrove strip between the coastal plain and the Guayaquil Estuary. (Acosta Solis 1961) Large savannas and pockets of levee-based formations called "*bancos*" form the larger coastal floodplain zone. The smaller strip corresponds largely to mangrove vegetation (Wolf, 1975 [1892]).

The coastal plain is formed by heavy loads of sediment brought down the Guayas River system from the Andean *Pie de Monte*. Heavy deposition occurs in the lower zones, especially in the areas close to the Guayaquil estuary. Nowadays, sediments carried down by the Babahoyo and Daule tributaries produce an impressive sediment build-up in the Guayas River. In the last twenty years local governmental agencies have built infrastructure to avoid flooding in most of the basin's rivers, so now, most sediments form islands in the Guayas River where it meets the Pacific Ocean water at high tide. Geologically, this zone is a recent formation, dating to the end of the tertiary and the beginning of the quaternary epochs. Heavy fluvial activity combined with tertiary uplifted surfaces originated the alluvial plain. Near the Guayaquil Estuary, this uplift contributed to the formation of the Churute-Taura-Durán mountain ranges (West 1977).

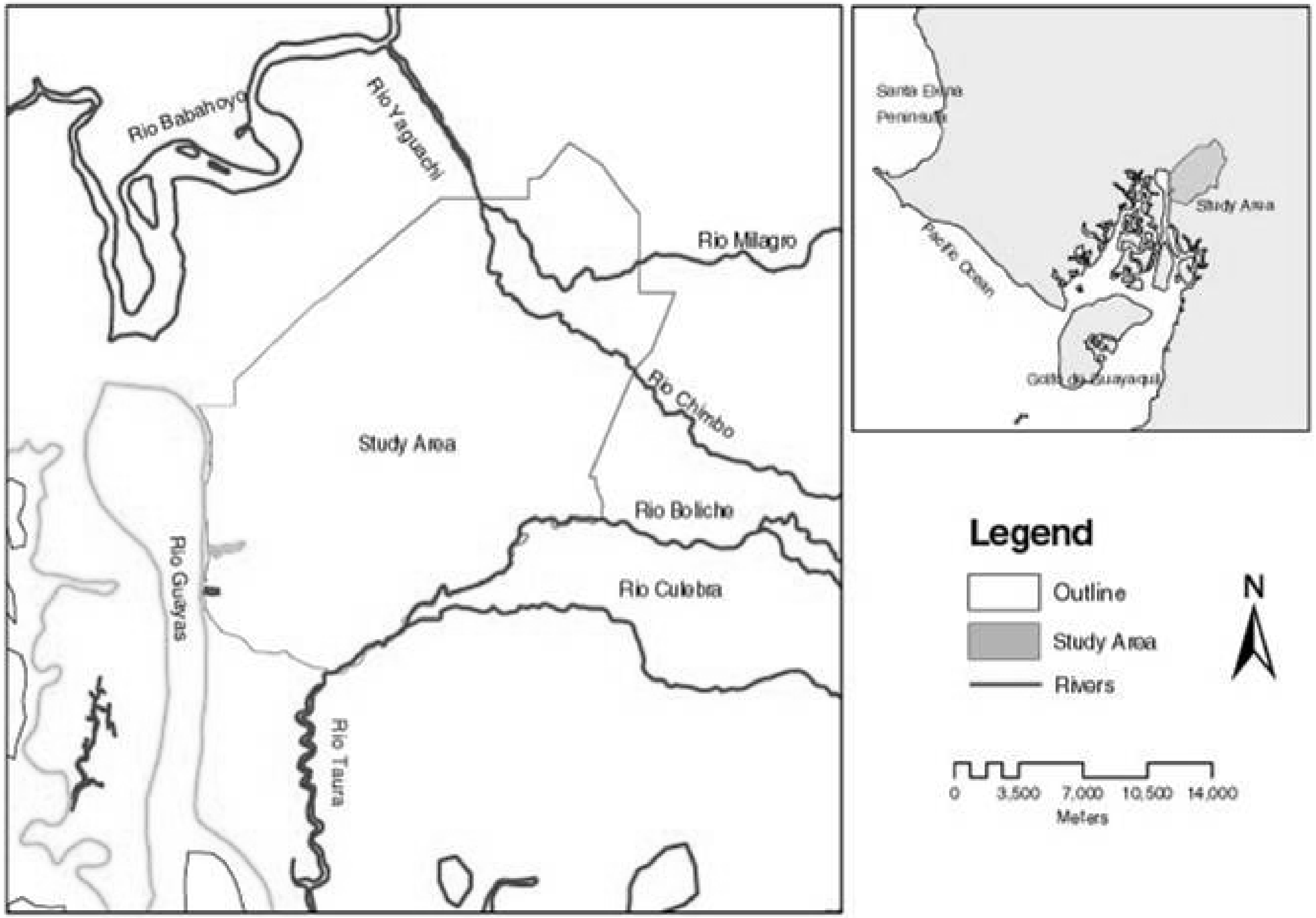


Figure 2 Map of The Surveyed Area within the Guayas Basin

Figure 2 Map of the Surveyed Area in the Lower Guayas Basin

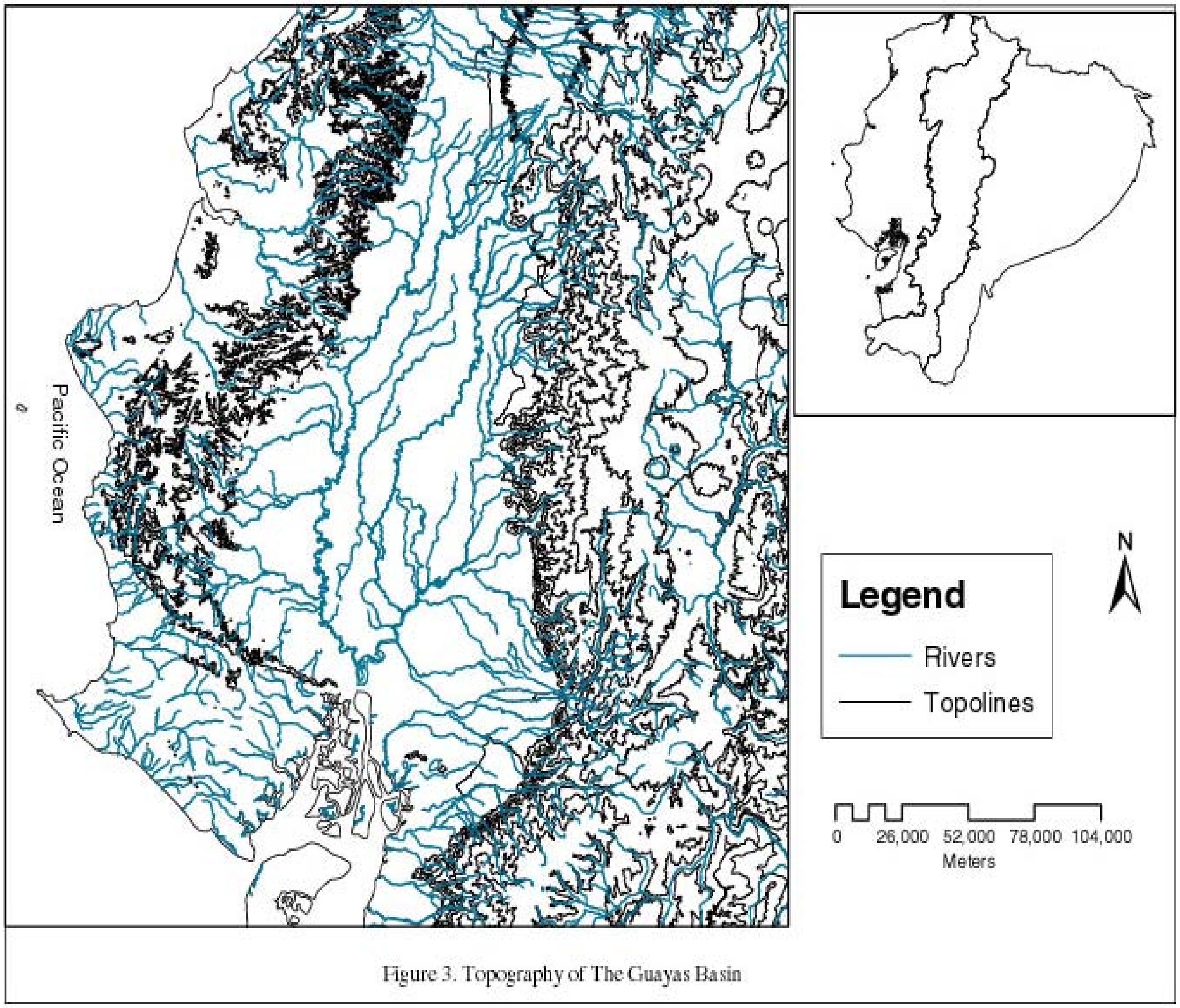


Figure 3 Topography of the Guayas Basin

Heavy depositional rates do not allow sufficient time for pedogenesis resulting in very slow soil formation, but the sediments do bring rich nutrients from the Andean *Pie de Monte* which helps to counter the slow soil development. Every year heavy rains cause flooding of large areas forming of alluvial fans, many meanders and alluvial patches, locally known as *bancos*. These levee areas are the most suited for agriculture in the region since nutrient rich sediments are constantly building up.

Fertility potential

A soil fertility potential taxonomy based on characteristics of humidity, mineral saturation, alkalinity, salinity and physical limitations (Mejia Vallejo 1997) indicates that local soils are vertisols with some limited agricultural potential (Figure 4). In the area there are five soil types: Cg, Cgdv, Cg-L, L-Cdv and LC'dv-Cdv.

All C soil types are limited by low oxygen content, which imposes constraints on photosynthesis p and causes low production. Their high capacity to retain water makes them difficult to drain. At the same time, their porosity causes water close to the surface to evaporate rapidly and form strong structures make the soil difficult to work and accelerate erosion. When flooded, these soils expel O_2 wiping out most aerobic organisms, and, as a result all the anaerobic organisms they host deplete the important chemical components.

L soil types originate from volcanic ash transported from the highlands by the river network. LC soils loamy clay is highly developed. They contain many notable nutrients for plants and abundant clay minerals. Soils of these groups are very favorable for cultivation.

Soils designated with the modifier d have low levels of organic material. High evapo-transpiration prevents water infiltration precluding the formation of clay horizons. These soils if exposed to large amounts of water need drainage; otherwise the water table becomes very high, and water ascends to the ground surface, evaporating very fast. The modifier v (vertisols) includes dark heavy soils with substantial clay content; they expand on contact with water and contract when dry. As a consequence, these soils are very unstable, very plastic when humid and very hard and breakable when dry. Soils with g modifiers lack good drainage and this limits their fertility.

The first of the composite soil types, Cg, corresponds to an area of 74.23 km^2 that represents 17% of the total surveyed area. It consists of very water-saturated clay with few inclusions of sand. Cgc corresponds to an area of 30.26 km^2, or 7% of the total study area; it is also poorly drained clay, and contains sulfuric acid inclusions. Cgdv soils cover 85.57 km^2 and represents 20% of the total study area. It consists also of very humid clay soils. Cg-L soil type corresponds to an area of 171.6 km^2, the largest area covered any soil type, at 40% of the study zone. These soils have drainage deficiencies. LC'dv soils are found only over 2.3 km^2, representing less than 1% of the total area. They consist of dry vertic and calcareous clay. LC'dv-Cdv soils cover an area of 64.7 km^2 representing 15% of the total area. They are composed of dry clayish and vertic soils (Figure 4).

Types Cg, Cgc and Cgdv soils, then, corresponding to 44% of the study area, are heavily saturated with water, which, as previously indicated, reduces their fertility, and potential for agriculture. These soils are very plastic when exposed to water and become very hard and compact when dry. Mejía (1997) recommends that these soils be mechanically drained prior to their use in agriculture. Cg-L soils are a combination of water-saturated soil mixed with component L, which has a relatively good fertility potential. This combination gives them high fertility potential. Although their need for drainage is not as great as in the case of Cg, Cgc, or Cgdv soils, some drainage is necessary nonetheless, to enable the development of this soil's potential fertility. LCdv and LC'dv-Cdv soils do not suffer from water saturation; they are soils with a good agricultural fertility index, and are suitable for agriculture without much artificial drainage.

Table 1 Distribution of Soil Types (Fertility Raking) in the Study Area

Soil Types	Area (km²)	Percentage	Fertility* Ranking
L-Cdv	2.94	1	1
LC'dvCdv	64.37	15	2
Cg-L	171.35	40	3
Cgc	30.25	7	4
Cgdv	85.55	20	5
Cg	74.35	17	6
Total	428.82	100	

- 1= Most Fertile, 6=least fertile

In summary, the fertility potential for local soils is very limited; only 16% of the area is naturally suited for agriculture without need of soil treatment. Another 40 % of the area corresponds to soils suited for agriculture but not without some sort of soil treatment. The remaining 44%, which corresponds to areas with fertility ranking from 4 to 6 is not suited for agriculture without artificial drainage. It is clear from the data that local agricultural producers had to transform unsuited soils into agricultural lands. The main drainage technique applied was the implementation of raised field technology.

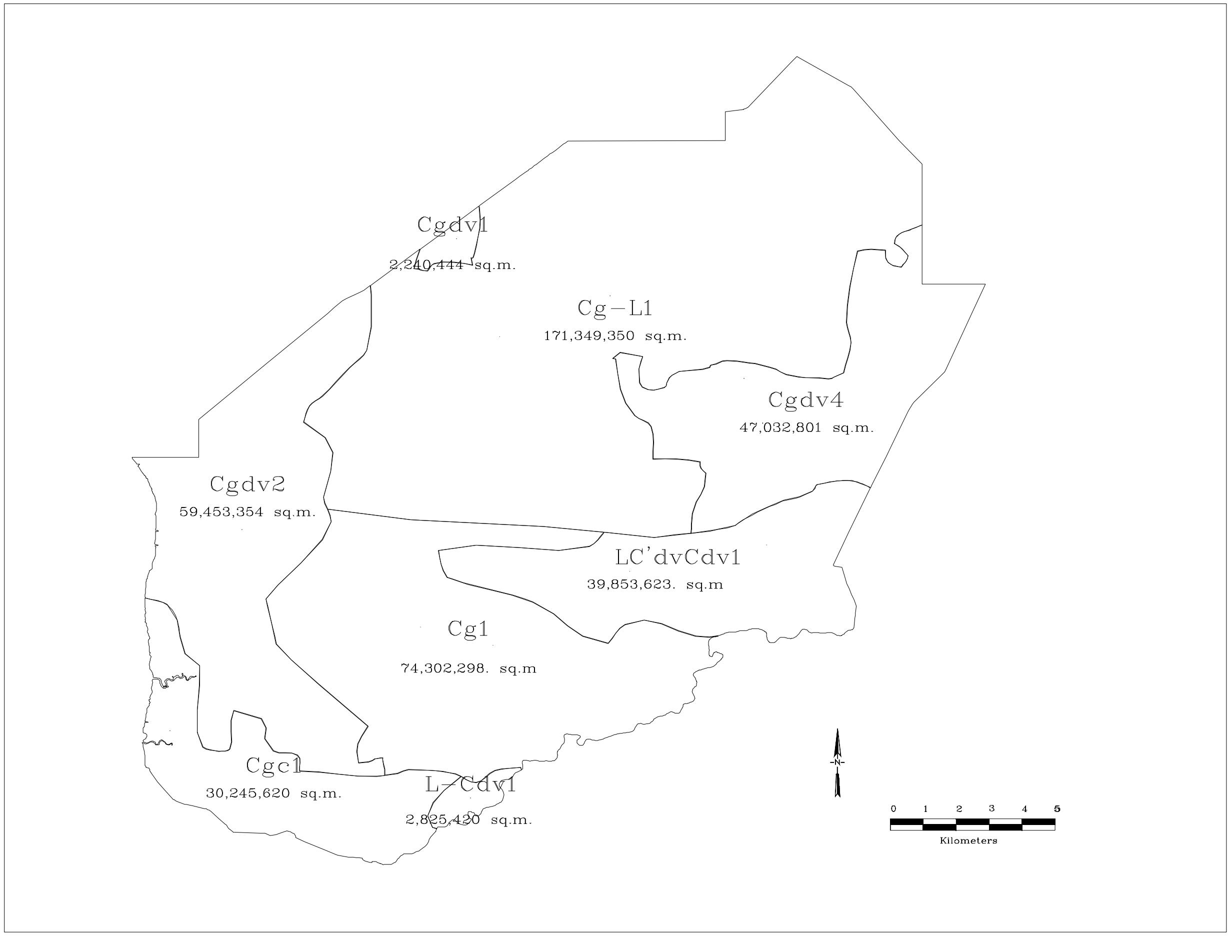


Figure 4 Map of Soil Types of the Study Area

Local Hydrology

The Guayas River system is one of the most important of modern Ecuador. It irrigates the large Guayas Basin, which in turn is considered the most productive region of Ecuador. At the same time, it serves as a fluvial transportation system that connects the Andes Mountains with the Guayaquil Estuary and ultimately with the Pacific Coast. The general consensus in Ecuadorian archaeology is that the Guayas River system connected coastal societies with upper basin, piedmont and highland groups throughout much of pre-Columbian times. Accordingly, this system allowed the formation of a well-organized regional and extra regional trade network (Feldman and Moseley 1983, Jijón y Caamaño 1997, Marcos 1987, Volland 1995).

Rivers and *esteros* found in the study area (Figure 5), include parts of the Chimbo River that runs northeast to southwest. It originates in the central Ecuadorian Andes, meets the Milagro River around the modern town of Yaguachi, and becomes the Yaguachi River that runs north until it reaches the Babahoyo River. The Babahoyo meets the Daule and forms the Guayas River, which in turn becomes the Guayaquil Estuary. During rainy seasons most of these flood and modify the landscape very rapidly. The Boliche River runs also in a southwesterly direction in the southern Basin, meets the Culebra and Bulu-Bulu rivers to form the Taura, a river that ultimately runs into the Río Guayas close to the Jambelí Channel (Wolf 1975 [1892]). The Taura River is usually small during the dry season, but overflows during most of the rainy season and drains the southern part of the basin.

There are many *esteros* as well connected to the rivers, forming communication network. In the northeast of the study area section the Estero Los Chirijos, Estero Bellín and Estero Los Monos are present; they contain water all year round. In addition there other smaller esteros such as the Estero Tímalo and Estero Chobo connected to the larger esteros, and subsequently to the Milagro River. In the center, the Estero Mojahuevos runs east to west reaching the Guayas River a few kilometers from the modern town of Durán. At the south of the study area there are small esteros like the Estero el Guayavo, La Ensenada and La Mona. In the northeast there are the Estero Cantagallo and the Estero Boliche. To the west, the Estero Cantagallo, the Estero Cumbencita and the Estero Boliche transport water from the swampy western plain to the Guayas River. In addition to the hydrological systems already mentioned, there is a swampy area called "tembladera which is under water most of the year" (Wolf 1982). Boundaries of the Tembladera correspond well to the boundaries of the area of the Taura raised field complex.

The hydrological system is very dynamic in the two periods, dry and wet, that shape the area. During the rainy season, it floods large portions of the study area's ground surface. During the frequent El Niño event, most of the area remains under water the entire year.

Climate

The climate of the Guayas Basin like in most parts of Ecuador is influenced by the inter-tropical front or (FIT). This front causes changes in the temperatures of air masses, which provokes heavy rainfall. These temperature changes are produced by the contact near the equator of air masses moving from the two hemispheres (Pourrut 1983). As the FIT moves back and forth from south to north and north to south, paralleling the movement of the sun during April, May, and June, it crosses the equator reaching an approximate location of 10º north latitude. It brings in humid and warm air masses from the southeast, which at the end of May provoke lower temperatures and absence of rain. From July to September, the FIT pulls back to the equator and air conditions remain stable, from October to December, it crosses the equator southwards to about 5º south. These movements provoke scattered rains, and humid warm air masses of maritime origin provoke rain and a noticeable increase of temperature by mid November. From January to March, the FIT pulls back again towards the equator and the area becomes under the influence of warm air masses and high temperatures again, which produce rains. Toward the end of March, temperature and rain have a tendency to decrease. As a result of all this, the climatic regime of the area is characterized by a Period of heavy rains from December to May and a dry and temperate climate from May to December.

In addition to location, climate is influenced by the presence of two Pacific Ocean currents, the warm El Niño and the cold Humboldt. The Humboldt Current runs from south to north carrying cold water that creates the winds on the Pacific Coast that cause colder and drier conditions. Toward the end of the year, the El Niño current runs along the coast of the Pacific Ocean paralleling the continental plain. El Niño's warm temperature causes heavy rain and high temperatures (Glantz 1996).

Temperatures in the area range from the low twenties during the dry season (May to December) to the high twenties and lower thirties during the rainy season (December to May). Readings for a 16-year Period in the Guayas Basin produced an average of 25.12 ºC.

In the climate classification based on vegetation cover, for the Schroeder scheme the study area presents a transition between moist tropical climate and dry tropical water of savanna type of vegetation (Schroeder 1959). In Thortwhite's climate taxonomy, the area corresponds to Dry Megathermic (A'C1a'w), and according to Koldridge's classification, the area's climate corresponds to a Tropical Dry Forest (Cerón 1996).

Highest precipitation occurs from January to April, when 80% of the total yearly rains falls, and lowest precipitation accordingly occurs from May to December. During the rainy season precipitation ranges from 1000 to 2500 mm, and during the dry season it ranges from 100 to 800 mm (Dominguez 1985, Gomez 1992).

On a longer scale, the area is marked by ENSO, the el Niño Southern Oscillation, more than anything else. During El Niño events, the entire lower basin remains under water, and the means of communication of local inhabitants are mostly canoes and *balsas*. In the years of big el Niño most of crops are lost and animals die and the whole system collapses, provoking the evacuation of local habitants and domestic animals. During such events, the plain experiences massive geomorphological changes, resulting in the reshaping of local landscapes. Most rivers change their courses, some esteros disappear, and many others are formed.

In terms of topography, the lower Guayas basin is a uniform plain; elevation ranges from 0.5 to about 12 masl, and as already mentioned, the small uplifted mountain ranges of Taura and the Cerros de Durán are the only disruptions.(Cerón 1996 Veliz, 1998, Villavicencio 1938)". The highest peaks of the Durán mountain range are about 60 masl and the Taura Mountains about 80 masl.meters above sea level.

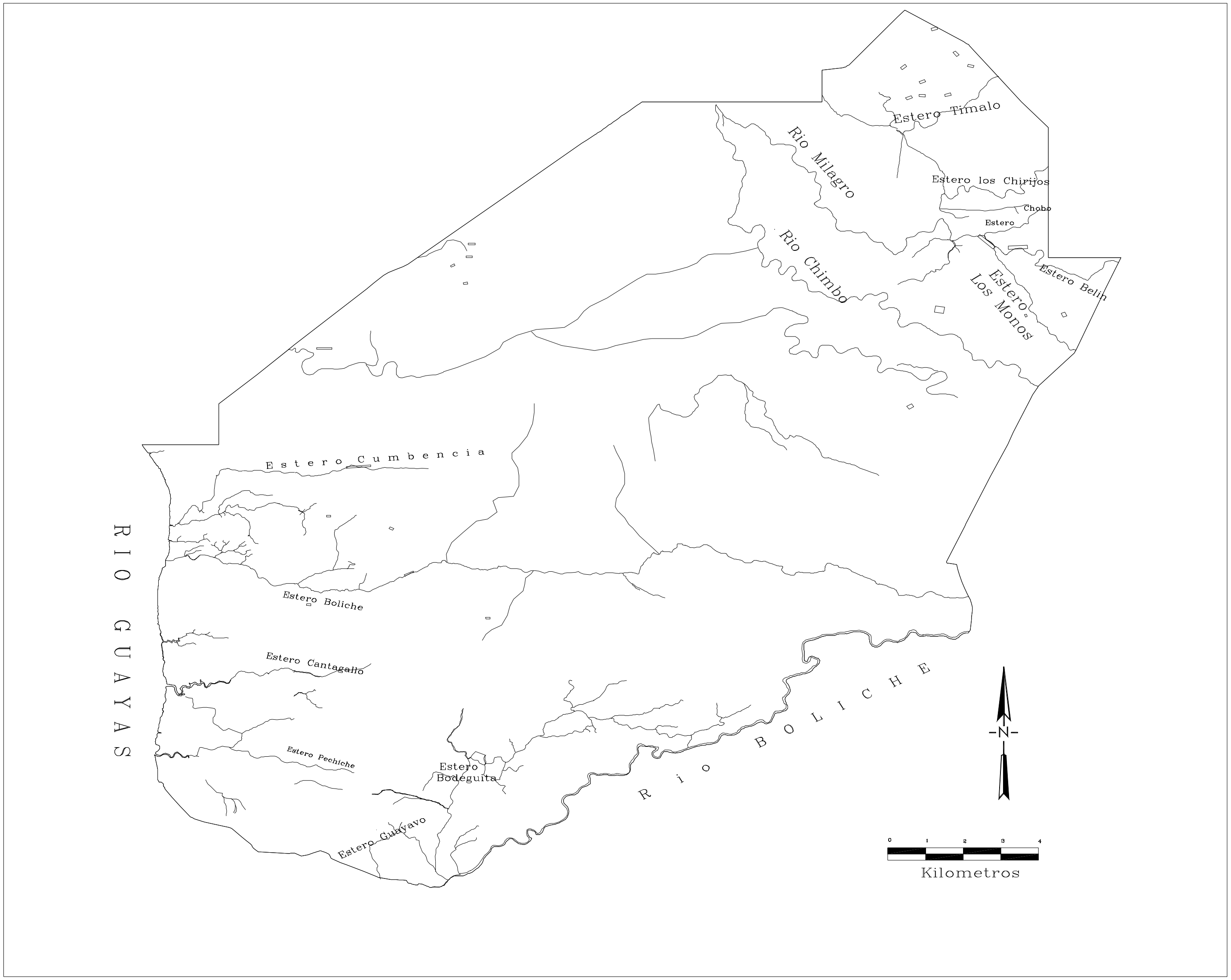


Figure 5 Local River NetworkNatural Resources

Tropical savanna vegetation consisting of tropical bushes, shrubs, middle sized and large trees, covers most of the coastal floodplain. Nowadays the area is the most productive of lowland Ecuador and possesses one of the widest resource varieties of natural species, both native and introduced. In addition, the small strip of mangrove along the Guayas River contains the species *Rizophora mangle* (*mangle colorado*) and *Guadua angustifolia* (*caña guadua* or *caña brava*).

The floodplain contains various types of woods such as bamboo (*Guadua maya)*, and a large variety of tropical fruits including *Annona* sp (*guanabana*), *Inga corincans* (*guaba*), *Herromi baloensis* (*cacao*), *Eugenis ambos* (*pomarosa*), and *Heliocarpus papayensis* (*papaya*). Among the many large trees are *Aviunna nitida* (*mangle*), *Bombax ruiz* (*beldaco*), *Bursera graveolene* (*palo santo*), *Carampa guanensis* (*figueroa*), *Cariocur amigdalala* (*achiotillo*), *Cordia elliodera* (*laurel de Puná*), *Cresentia cuyete* (mate), *Eriteherma smithana* (*porotillo*), *Ficus panamensis* (*matapalo*), *Guaruma ultimafoila* (*guarumo*), *Loxoptery gerum* (*guasango*), *Prossopis herms* (*algarrobo*), and *Terminalia cattoipa* (*almendro*). Very important among trees native to the area are species like *Tryplaris guayaquilensis* (*fernan sanchez*), *Vitex gangateu* (*pechiche*), *Trichila floribunda* (*nigüito*), and *Ochoroma* sp (*balsa*). Since the late nineteenth century changes in the area's land use have taken place; nowadays most of the land is used for banana and sugar cane plantations in addition to other cultigens such as rice and maize. Small portions are devoted growing lowland vegetables such as tomatoes and peppers. In addition, the zone is rich in tropical fruits. Finally, there are old haciendas where the land is used for livestock.

Fauna

The area contains a rich fauna as well. Among the important animals found are howler (*Alouatta palliata*) and capuchin monkeys (*Cebus albifrons),* peccary (t*ayassu tajacu*), *cuzumbos* (*potos flavus*), small felines such as *Felis pardalis* and *jacarrundy* (*Felis yaguaourandi)*. Other smaller animals included the *cuchucho* (*Nasua narica*), raccoon (*Procyon cancrivorus*), squirrels (*Sciurus stramineus*), *raposas* (*Sciurus granatensis*), rabbits, and many species of rats such as the *Proechymis decumanus*. At the junction of the Guayas coastal plain with the Guayaquil Estuary, there are maritime fauna such as many varieties of seashells, crabs, and fish typical of mangrove environments.

A variety of waterfowl like *canclón* living at swampy areas such the lower zones of Laguna de Canclón in Churute and the Taura area, are present. Large flocks of small parrots such as *Brotogeris pyrrhopterus* and *Cardelius siemiradskii* are also found in the area. Other bird species include *tilingos* (*Trylopest* sp), domesticated ducks (*Cairina moschata*), *garzas, gallaretas, marias* and *garrapateros.* In addition there is a variety of hummingbirds, such as *Latrhrotriccus griseipectus* and *Synallaxis tithys* (see Cerón 1996 for a lengthy description).

A considerable variety of large and small reptiles are also found in the area; they range from small lizards, and iguanas (*Iguana iguana* and *Ophryoessoides iridecens*) to larger "lizards" such as caymans. Local rivers and esteros are richly endowed with river fish, turtles, and snakes. Among the snakes the most well known are the *matacaballo* (*Boa* sp), *equis* (*Botrax* sp), *sallama,* and other smaller types.

In summary, the study area contains a very dynamic environment, with climatic conditions severely affected by natural phenomena such as ENSO and the FIT. Those climatic conditions cause very wet and dry seasons, imposing conditions for water saturation of soils during the rainy season and severe drying of soils during the dry season. This dynamic natural setting, as well, houses a very rich set of flora and a variety of terrestrial and aquatic faunal resources.

Cultural Setting

The prehispanic cultural development of coastal Ecuador has been ordered into four chronological Periods: Preceramic, Formative, Regional Development and Integration (Meggers 1966, Moreno Yanez 1997, Porras 1987). Although alternative schemes have been proposed (Ayala Mora 1988), the four period scheme is still the most recognized and utilized for scholars studying Ecuadorian archaeology (Figure 6).

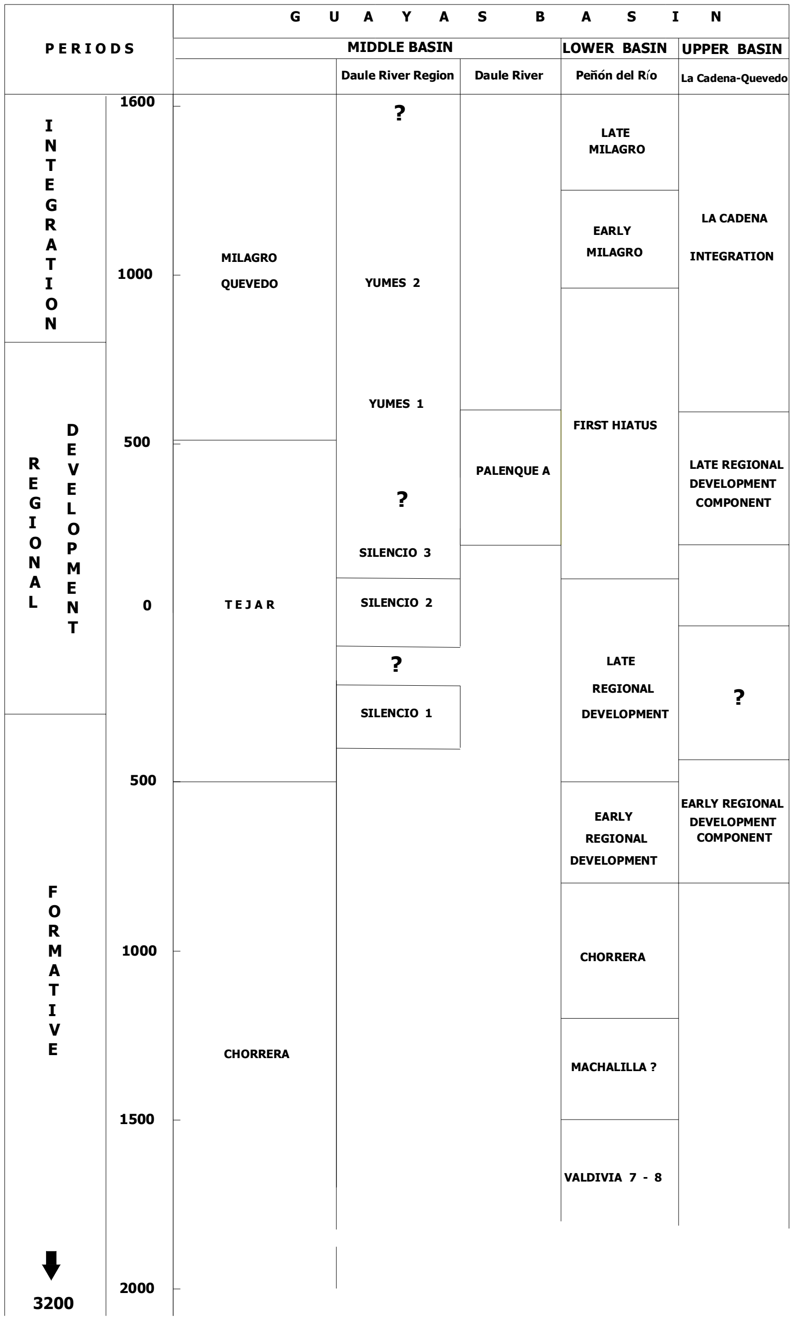
Archaic Period

The scanty archaeological research conducted in the area has not recorded evidence of Archaic (Preceramic) Period occupations. As a result, it is not clear if archaic societies made their way into the lower Guayas Basin. The nearby areas of the Santa Elena Peninsula and the southern El Oro region of Talara contain evidence of archaic occupations (Stothert 1987). The neighboring Puná Island in the Guayaquil Estuary, as well, contained a large Preceramic shell midden (Porras 1980). It can be argued that archaic sites might lie under various meters of levee deposits, and under deciduous mangroves, or even under water in the Guayas River as a result of the last rise of t sea level, but, as of now, there is no evidence of archaic presence in the area.

Formative Period (ca. 3200-300 BC)

The Formative Period in the coast begins around 3200 BC and is marked by the presence of Valdivia society characterized by a sedentary way of life, early use of pottery, domesticates and early village formation (Marcos 1986). Within the lower Guayas Basin, (Parsons 1969) found Valdivia pottery in direct association with ancient raised fields, making him conclude that their use might date to Formative times. González de Merino (1984) also indicates the existence of a Valdivia site around the modern town of Milagro; unfortunately the report contains nothing more than sherd descriptions. Further north Raymond et al. (1980) found in a river-cut profile in the middle Guayas Basin, early and middle Period Valdivia components under 4 m of levee. In the upper Guayas Basin, more recently Valdivia occupations have been reported in the base of multi-occupational mounds in the la Maná location (Guillaume-Gentil 1996, Guillaume-Gentil 1998). Finally, a scanty Late Valdivia occupation has been registered in the Peñón del Río site, although information about it is not published. During Late Formative Period, the Chorrera culture, a society that made high quality pottery, relied heavily on maize agriculture and seems to have maintained a complex political system, developed in the area and in large parts of coastal Ecuador (Estrada 1952, Evans 1957, Meggers 1966).

Chorrera Culture represents a pottery style that expanded through the entire coast. Consequently many scholars see this as a horizon or tradition also known as Chorreroid (Sanchez 1990)). Chorrera culture was first defined in the lower Guayas Basin in the riverbanks of the Babahoyo River near the modern city of Babahoyo, may be representing local development. Evans and Meggers (1957) studied other sites along the Babahoyo River and on that basis defined the ceramic sequence for the Late Formative Period of the Guayas Basin. Porras' excavations in Palenque also uncovered remains of Chorrera pottery (1970) that further documented it local presence. The research in Peñón del Río uncovered domestic features of the Chorrera society (Zedeño 1985). Zedeño's study of domestic assemblages indicates noticeable differences between the highly decorated Chorrera vessels found in museum collections and the domestic pottery found in context. In Peñón del Río during Chorrera the zone is said to have reach its largest occupation (Marcos 1986).



Chronological sequence for the Guayas Basin based on Estrada (1967), Stemper (1993: 31), Porras (1983: 96-97), Muse (1991: 279), and Guillaume-Gentil & Ramirez (1998: 8 and 16).

Figure 6 Chronology of the Guayas Basin Region

Meggers (1966) relates high percentages of obsidian tools associated to Chorrera occupations to contact with Mesoamerica, but this quantity of obsidian at this point in the cultural development of Ecuador seems more likely to indicate close contact with the Andean piedmont and highland groups. This might be considered evidence for the early interaction of multiple elevation zones by North Andean societies in the vertical type of economy postulated for later Periods (Murra 1975a, Salomon 1980, Vasquez 1999).

Regional Development Period (ca 300 BC-AD 800)

The Regional Development Period of the Ecuadorian coast, according to Meggers (1966) is characterized by the shift from small formative societies to ones with regional character, engaged in regional trading, and regional politics. In Meggers' unilineal development system, Formative populations develop into regional polities. Recent data, however, shows that there was nothing more regionally oriented than Chorrera, and the Regional Development Period seems more a fragmentation with various well differentiated pottery assemblages that are taken to indicate the development of various regionally distinct societies.

In the larger Guayas Basin region four (pottery) groups have been found: Tejar-Daule (also known as Silencio in the Daule area), Jambelí (found at the south and connected with the Machala region), fase Guayaquil and Guangala (Acuña, 1995, Aleto 1988, Currie 1989, Evans 1957, Meggers 1966, Parducci and Parducci, 1970, Stemper 1993). Tejar-Daule (Silencio) has been found in the upper Guayas Basin, along the Daule River and Babahoyo River. Fase Guayaquil has been located only north of modern Guayaquil City, while Jambelí is found in the south.

The societies of this period have not been systematically studied yet; for most of them we only know how the pottery looks. Jambelí society is said to be oriented towards marine resources, as most sites are shallow shell middens occurring mostly around the shorelines of the Guayaquil Estuary and El Oro Province (Aleto 1988, Currie 1996, Meggers 1966). Its cultural toolkit includes shell and stone tools and hollow pottery figurines. Negative painting technique was popular in the Jambelí pottery, which resembles many aspects of Guangala style (Meggers 1966).

The Daule-Tejar assemblage contains many of the Chorrera stylistic characteristics in small percentages, but adds other new features such as coarse temper, vessel supports and polypods, and red-on-white painting (Evans 1957). A high frequency of spindle whorls has been observed in sites of the Daule-Tejar phase found along the Babahoyo River. Further, Tejar groups utilized metal objects in small quantities; there are many figurines and tubular flutes, some with anthropomorphic designs (Funes 1970).

The fase Guayaquil has been defined based on the peculiarities of the pottery assemblage excavated in the Sabana Grande; now under a Guayaquil suburb settled over a large plain close to a fossil lagoon. Large constricted vessels characterize the assemblage with red-on-white and negative decoration. The striking feature of the Guayaquil phase is the large proportion of musical instruments and hollow figurines with anthropomorphic and zoomorphic decorations (Parducci and Parducci 1970). The features of the Guayaquil phase resemble those of the Daule–Tejar, Chorrera and Bahía in Manabí. It is puzzling, however that in the systematic survey conducted in Guayaquil and neighboring zones, no sites with such assemblage have yet been reported (Sanchez 1995, Sanchez et al. 1996).

The presence of the Guangala complex has also been reported for the area (Guillaume-Gentil 1995, Ramirez 1996). Guangala pottery has high quality surface treatment, with polychrome painting, expressing the high technological development of the coast. It remains unclear whether

Guangala settled permanently in the area or whether the evidence found is the result of trading activity. Although this society's center is found in the Chongón-Colonche and the Santa Elena Peninsula region (Stothert 1993), its presence in the Guayas Basin is not yet well established.

The Integration Period (ca. AD 800-1600)

The Integration Period is believed to represent a climax of regional integration; at this time regionally developed societies integrate into large confederacies or nations (Meggers 1966). According to Meggers, increase in the development of agricultural systems allowed population expansion that resulted in the formation of urban centers (Marcos 1988, Meggers 1966). In the Guayas Basin, during there Integration Period, appeared the society named Milagro-Quevedo, characterized by mound construction, metal jewelry, and chimney burials (Holm 1981, Meggers 1966, 1957; Marcos 1988, Ubelaker 1981, Zevallos Menéndez 1995). This society populated the entire basin until sometime after Spanish contact. Lathrap (1970) believed that during early Integration Period, Amazonian groups migrated to the lower Guayas Basin and continued with their tradition of mound building and tropical forest subsistence. But recent work indicates that mound construction starts earlier than Milagro-Quevedo (Acuña 1996, Guillaume-Gentil 1996, Ramirez 1996). Stylistic continuity of pottery style between Regional Development, and Milagro-Quevedo in the middle Basin negates Lathrap's proposal, supporting instead the idea of local development of Milagro-Quevedo.

Based on written records and early unsystematic excavations it has long been proposed that Milagro-Quevedo expands in areas east of the Daule River and that Guayaquil and the neighboring area were mostly Huancavilca territory. More sites recently found indicate that the Milagro-Quevedo culture occupied the areas around Guayaquil (Sanchez et al. 1996, and Veliz 1990).

In terms of sociopolitical organization, it has been established that Milagro-Quevedo society attained complex social and political organization. Archaeological evidence and ethnohistoric records establish that Milagro-Quevedo was organized into many chiefly polities (Espinoza Soriano 1987, Moreno Yanez 1988). Social hierarchy within Milagro-Quevedo is manifested in the archaeological record in burial patterns and differential access to exotic resources. Suarez's (1990) study of obsidian production and consumption indicates that although production was performed in the domestic sphere, obsidian was considered an exotic good and thus restricted to use by the elite. Buys and Muse (1987) suggested that spatial organization of settlements near Peñón de Río comprises by a three-tier system with an urban center at the top, sub-centers and small villages and *aldeas*. Based on ethnohistoric information, Moreno (1988) points out that during the Integration Period this zone experienced both regional cohesion and supra-regional organization. He points out that every group would be interdependent with others in a regional interaction system. Regional and long distance trading would have been according to this author, the fuel to run the system. This is what Renfrew (1972) had in mind when he described the peer polity interaction model.

Ethnohistoric Considerations

Early Spanish reports indicate the presence of Milagro-Quevedo society in the area named the Chonos. Spanish Chronicler Fray de Reginaldo de Lisarraga (1560), says about people living in areas near Guayaquil that:

> *Viven en esta ciudad y su distrito dos naciones de indios, unos llamados guancavelicas; gente bien dispuesta y blanca, limpios otros no tan politicos como los guancavelicas …tienen los chonos mala fama en el vicio nefando traen el cabello poco alto [Lisárraga 1560:123]*

> In this city and its district live two nations of Indians, one called Guancavelicas, good looking, white and clean people, and others not like the Guancavelicas… they, The Chonos, have a bad reputation, infamous customs and have short hair [my translation]

Pedro de Alvarado mentions in a brief 1535 description of the area that:

> *[esta] tierra algo mas llana en donde hallamos algunos pueblos pequeños de gente muy salvaje aunque al parecer algo rica donde los hombres y mujeres principales tryan xoyas de oro e de plata e algunas piedras de lo cual se tomo algunas [Lisarraga 1560:125]*
>
> [in this] flatter land we found small towns with very savage people, although apparently rich; men and women had golden and silver jewelry and some stones of which we took some [my translation]

Further, in regard to the resources of the area, Lisarraga mentions that:

> *En ellas hay unos pedazos de tierra alta que son como islas donde los indios tienen sus poblaciones con abundancia de comida y mantenimientos de los que son naturales de sus tierras [Lisarraga1560:132]*
>
> There are pieces of high land that are like islands where the Indians have their towns with abundant food to maintain their people [my translation].

Espinoza Soriano also mentions that during the times of contact the area was inhabited by the Chono nation organized into thirteen "groups" that were later distributed into Spanish *parcialidades*. Among the two most important and populated *parcialidades* were the Daule in the middle Basin, along the Daule River and the Yaguachi in the lower Basin. Ethnohistoric information refers to the Cayche, chiefly family of the Daule chiefdom who controlled large territories, but in this regard no information for the Yaguachi group has been offered. The accounts do describe seven towns making the Yaguachi territory, which were Alonche, Bellín, Chaday, Ñausa Mopenitos, Payo, and Yaguachicono (Xomchuck 1996). Around the areas that still maintain precolonial names, Milagro-Quevedo sites have been located; the ones recorded are Yaguachecono, Bellín, Chaday, Ñausa, and Payo.

Ethnographic Continuity

Since a long time ago, many scholars have argued that the modern ethnic Tsachilla group that nowadays mainly settles the upper Basin is the direct descendants of the ethnohistoric Chonos or the archaeological Milagro-Quevedo (Estrada 1957a, Muse 1989, Zevallos Menéndez 1995). Tsachillas locate at the higher tropical forest close to the *pie de monte* and near the modern town of Santo Domingo where they partially secluded themselves, avoiding contact with western ways of life (Ventura 1995). Politically, they are organized into seven *comunas* that form the Tsachilla nation. Each *comuna* has its own local authorities, which seem to have corresponded to important clans. Each *comuna* holds meetings and decides how local matters are to be handled. The local leaders are part of a large organization that elects the Governor of the Tsachilla nation. Until quite recently, this position was also passed on from generation to generation, from father to son (Delgado 1997, Ventura 1996). For a long time, the governor belonged to the Calazacón clan, an important kin group of the seven *comunas*. Nowadays the governorship belongs to the Aguavil clan, although recently conflict has arisen between members who want elected governors and those that support succession by direct decent. Even if the first model prevails, candidates usually are from the powerful clans. It would be naïve to say that the Tsachilla government system has one to one correspondence with the structure of ancestral Chono-Milagro-Quevedo, but parts of this system could contain the remains of its prehispanic ancestors, and makes a useful analogy if taken with caution.

Chapter 4

SURVEY AND EXCAVATIONS

The South American neotropics impose severe problems for archaeological data recovery. They involve factors such as the lack of preservation and low visibility. As standard strategies used in many regional surveys carried out on surfaces that are more open do not work well in these areas, local archaeologists combine various strategies to cope with low-visibility ground (Zeidler 1995). The entire lower Guayas Basin area is characterized by heavy ground cover due to vegetation overgrowth and heavy fluvial deposition.

The archaeological literature dealing with regional approaches, at the most general level, falls into two camps, those that record 'sites' and those that record aspects of anthropogenically transformed landscapes. These approaches can study the same area and obtain totally different results due to the way in which they record the landscape under study.

Site-based approaches focus their analysis on the concept of archaeological sites, which are considered tangible spaces in which past inhabitants carried out their everyday activities. Many archaeologists, especially those in the camp of landscape archaeology, have indicated that since most of the modern landscape was humanly created and transformed, arbitrary definition of sites does not approximate past realities (Knapp 1996). But even those viewing the landscape as the result of past transformations use some units of analysis to study how past people interacted with their surrounding landscape. A featureless landscape means nothing to any approach.

Indeed, the definition of a site in site-based approaches is troubling since it depends on the presence of significant occupation. In other words, defined sites most likely correspond to dwellings, workshops, temples, shrines, etc., but they will not likely include say, farmlands, as spaces where many subsistence activities took place, but no large number of artifacts were present. Thus, most defined archaeological sites correspond to places where relatively long-term activities took place.

Fieldwork in this instance requires finding sites in the landscape, and thus, methodologies of regional surveys for the most part have been developed to optimize finding sites. Large-scale surveys have been very successful at locating settlements, especially in areas with good ground visibility, where cultural remains are found scattered over modern surface (Adams and Niessen 1972, Blanton 1978, 1990, Sanders et al. 1979). In places like the Susiana Plain and the Basin of Mexico and the Virú Valley, surface surveys have been successfully implemented and field procedures have yield remarkable results for the understanding of early economics, social and political structures.

It comes as no surprise that early studies were performed using surface collection methodologies covering large areas, especially outside the US. Finding sites, however, in areas of low ground visibility has not been that straightforward. Instead archaeologists have been forced to develop sampling techniques involving subsurface testing, such as shovel testing, auger coring and geomorphological, geophysical and chemical analysis to name few (MacManamon, 1981, Shott 1990, Ligthfoot 1986a, 1986b Fish 1990). Of those various methods, shovel testing and auger coring are the most commonly used and are aimed to recover physical remains of human activity, mainly artifacts, building remains, food remains, and so forth.

A successful sampling strategy using shovel testing and coring relies on locating cultural remains like pottery sherds, lithics, bones, etc. The presence of such remains allows archaeologists to find and define sites. There are often several biases associated with this procedure since, for instance, areas such as clean living floors may not be recorded as a site only because no materials are found in shovel or auger coring, while small trash middens most likely yield materials and this makes it most likely that sites with such contexts are easily found. Clear attention to soil changes that indicate the presence of anthropogenic surfaces, can overcome these sorts of biases, and of course, prior knowledge of the general characteristics of local sites helps design methodologies to increase the success of finding sites through this procedure. In places where little is known, however, an array of methods that has proven successful in similar environmental conditions and cultural settings is usually enforced.

Landscape archaeology (Tilley 1994) contrary to the site-based approach, contend that past societies transformed the landscape through their multiple activities, and what we see now is the overlaying of multiple cultural landscapes. Advocates of this approach espouse the concept of built landscape, a culturally dynamic social and natural space (Crumley 1990). Avant guard landscape archaeology approaches, produced mostly in Europe, have been successful at studying features related to ancient cosmology and ritual, but so far, they have poorly addressed questions of regional politics beyond purely theoretical and epistemological discussions. In most of these works, however, data seem not to be important (Tilley 1994).

In the New World, landscape archaeology falls into two basic camps, materialistic and nonmaterialistic in contrast to the European view. The materialistic view clearly developed from a sort of intellectual marriage of cultural geography and archaeology (Crumley 1979, 1987, 1990).

Thus, it looks to tangible facts that allow the understanding of past regional political, economic and social issues. Methodologically, this tradition has been largely influenced by cultural ecology focused on regional resource distribution. Since very early in its development, this approach has relied heavily on tools such as aerial photography analysis, modern satellite imagery, digital photography analysis and GIS technology (Erickson 1995, Miller and Gleason 1994). Recently, anthropological archaeology taking a site-based approach has focused on the study of cultural systems from a regional perspective using spatial techniques largely implemented in geography, and thus differences between the materialistic approach to landscape archaeology and a site-based approach are no longer based on methods, but on the objects the analysis and the questions asked.

The study of ancient raised fields and the way in which they relate to many aspects of past economics, politics and culture has been approached in somewhat different way by projects carried out with site-based research versus landscape archaeology approaches. Site-based studies have concentrated on closely examining archaeological sites, defined as described above. Here, although agricultural systems were important components of the settlement system, they were conceived as passive entities, and prime focus was given to sites. Studies utilizing the landscape approach carried out detailed analysis of the technological aspects of raised fields such as shapes, construction procedures, maintenance procedures, labor requirements, fallow periods, and environmental aspects, but for the most part they failed to link them to their builders, as detailed analyses of sites were for the most part absent.

The present research combines both approaches in an effort to gain a comprehensive understanding of the area's cultural environment. In that regard the area is conceived as a culturally built landscape constituted by (a) arbitrarily defined archaeological settlements, representing those places with cultural material on or under the surface and those with surface modifications such as mounded areas, and (b) other features such as raised fields, reservoirs, etc., as products of human activity not included in the classic definition of archaeological sites. A regional survey with such an approach required a multi-phase field research program that involved (a) large-scale map study and systematic aerial photography and digital imagery analysis, and (b) systematic subsurface survey based on shovel and auger tests.

Aerial Photo, Digitally Enhanced Imagery and Large Scale Contour Map Analysis

Landscape archaeology has developed a series of tools to study ancient agricultural systems (Gelson 1994). Aerial photography provides the most useful low-cost technique to register and define raised fields (Adams et al. 1981, Erickson 1989, 1995, Mathewson 1987a, Denevan et al. 1985; Stanish 1994). Although more efficient technology has been developed in the last decade, high costs and sophisticated methods of analysis prevented their use in small archaeological projects. In this project we examined aerial photographs at a scale of 1:20,000 obtained from the Instituto Geográfico Militar (IGM), and converted into digital form through scanning. These images were enlarged and enhanced with Adobe Photoshop® and AutoCAD 2000® making it possible to reconstruct sizes, and shapes of individual raised fields. A SPOT satellite image obtained through CLIRSEN was also utilized and filtered to aide in the reconstruction of raised field areas. In addition, topographic maps of 1:10,000 scale produced by a local development agency (CEDEGE) were closely examined; these maps registered some of the higher raised fields, as well as lower areas with high potential for ancient raised fields. Through this approach it was possible to map the raised fields, providing evidence of their locations, sizes, and morphological patterns. Further procedures also made it possible to identify some large mounds and mounded settlements. Both raised fields and large mounds identified in this way were represented in an

AutoCAD Map multi-layered drawing. This base map was used as a field guide for survey crews since roads, rivers and cities were also included.

Field Survey

Field survey methodology focused on finding sites, and for that, a conventional set of techniques for a site-based approach were used (Drennan 1996, Orton 2000).

As many archaeologists would have to agree, full coverage surveys are ideal for understanding the cultural processes of regions (Kowalewski 1992). Often, however, we are obliged to sample since neither time nor resources allow full-scale survey. Sampling also offers the option to study in detail small areas in the basis of which with statistical approaches; the population can be characterized (Drennan 1996, Plog 1990). The first inclination of this project was to sample the area dividing it into quadrats, given the extent of the region under study. It soon became clear that it was very difficult to do that and instead a full area coverage survey was more suitable. Perhaps this is one of the few cases when archeologists are imposed by local conditions to renounce sampling the area. After the El Niño event of 1998, large part of the area was re-shaped and some of the markers defined on our maps were no longer present, and sampling required re-working the maps. At that point, instead of focusing on locating such markers we surveyed the entire area bounded by main roads, and rivers. This resulted in a survey of about 429 km^2.

Site discovery, according to (Schiffer 1996) depends on intersection and the probability for that to occur. Intersection refers to whether a given test intersects sites, and the probability refers to the chances that the test contains cultural remains. Schiffer (1996) also states that the abundance, clustering and obtrusiveness of cultural remains affect site discovery. Abundance refers to the quantity of cultural material that occurs in a given area, while clustering refers to how such material is grouped. Obtrusiveness refers to the degree of ground visibility. An area with abundant material, very highly clustered, and high visibility offers the best conditions for surface survey since the probability of finding sites is very high, on the contrary sparse, scattered material in a low visibility area has a low probability of being recorded, thus the difficulty of surveying increases (Zeidler 1995).

When we began fieldwork, the scanty information of Guayas Basin archaeology did not allow us to define the abundance, or the degree of clustering of the cultural material. We did know, however, that the area had a high degree of obtrusiveness. Ground visibility was very poor, due mostly to heavy vegetation cover and the heavy sedimentation the area experiences during the rainy season. It was clear that under such conditions the only field survey that could recover evidence of past settlements was a subsurface program. The strategy of data recovery used in this work combined shovel testing and auger probing, complemented by close inspection of river cuts, road cuts and well walls.

All shovel tests and auger holes containing cultural remains were recorded on a map drawn by the field crew. Each shovel test has a provenience number to identify material recovered. Thus, each shovel test became a unit of analysis that later spatial studies could use. This procedure differs from the usual regional survey. Since surface collection was not possible here the sample consisted of shovel tests, rather than the squares which are generally the units for those working with surface collections.

Schiffer (1996) also pointed out that in a subsurface survey; intensity is one of the main factors affecting the success of site discovery. Survey intensity refers to the spacing of tests in a given area. A survey carried out with high intensity places tests at very short distances from each other, and thus smaller sites have a better chance to be found and overall site discovery probabilities increase as well (Orton 2000). Determining the best spacing of tests that will recover the largest number of sites requires making guesses about the areas of local sites. In more practical terms, the size of the area under study also imposes limits on the distance between tests. Thus both scale and level of resolution play an important role in the spacing of tests. There is a constant trade-off between detail and the size of the region under study.

In this research some compromise of detail was inevitable, especially due to the lack of information on local site sizes and the degree of their clustering. I assumed that that shovel tests and auger probes spaced 100 m apart would recover an adequate sample of the population of sites in the area. Hence the area was divided into a survey grid of 100 x 100m cells. This resulted in surveying 428.89 km² through the excavation of 33,921 shovel tests and 940 auger holes. In addition, shovel tests were excavated in the main plaza of one site (Jerusalén), in order to recover artifacts that allowed defining the character and range of activities that took place there. Limited test and open area excavation was also carried out to recover materials with clear stratigraphic provenience so that temporal control could be attained.

Field Procedures

In the field, teams of two persons walked along each transect separated by 100 meters placing shovel tests, and auger holes. This procedure located possible surface scatters, determined the presence of mounds, and excavated shovel tests. At the beginning of each day, GPS readings were taken at distinctive features on the landscape, such as road crossings or rivers, to use as reference points. This allowed spatial control for locating cultural features and oriented field crews in the local area. At the same time, this allowed us to link GPS readings to the maps. Each shovel test was plotted in an x-y coordinate system based on the distance and angle from the features for which GPS readings were taken. Those tests with evidence of occupation were plotted in a map produced at the field.

Upon finding sites, looters' holes were cleaned to define site stratigraphy and obtain cultural material for chronological identification. In addition, sites were recorded on site forms following the Instituto Nacional de Patrimonio Cultural guidelines. Isolated mounds or mound clusters were drawn in the field and GPS readings were taken. We also recorded distances to key features such as roads, towns and so forth that made it possible to locate them on the map. Measurements of mounds including length width, height and shape, were recorded. Although sketch maps were made of every site in the area, it is important to note that future topographic mapping would provide a better picture of the features that might have escaped the eyes of the survey crew. Shovel tests that were excavated next to specific mounds were associated with them for analysis. In addition, limited excavations were carried out in mounds.

Survey Field Register

Each shovel test and auger hole, and all material collected through cleaning looters' hole and road cuts, etc., was recorded with a provenience number. This number makes it possible to locate exactly where the material contained in each bag came from. On the survey map, positive shovel tests were numbered with the corresponding provenience number. In the field log book, all positive shovel tests were recorded for future cross-checking in the laboratory.

a) Test Excavations

An effort to clean profiles in a partially looted mound (VL-T1), resulted in the excavation of 182 burials. The primary goal was to record the construction history of the mound through a clean profile, but after realizing that it was a burial mound we employed a different strategy. The looted area was about 5.5 x 5.5 m and thus we planned to excavate an area of 6 x 6 m. At the beginning it seemed that most of this area was fill and we would only cut about 50 cm of undisturbed deposit at each side of the looted depression (Figure 40, Appendix A). To maintain control over where the cultural was recovered, the 6 x 6 m was further divided into units of 2 x 2m.

After deciding where to excavate, we placed a datum for the mound to maintain vertical control, and since it was impossible to define cultural stratigraphy, we excavated the mound by arbitrary levels of 20 cm. Each level in each unit was assigned a separate provenience number.

At its center, the mound was entirely looted (Figure 48 , Appendix A). After removing a few cm of fill, we realized that the fill was much less than we thought at first, and we made the decision to keep excavating. Eventually, the burials of 182 individuals were recovered. Of course, burials did cross over the 20 cm level that we had decided to use as a unit. This produced a contradiction between registering material by 20 cm and by burials. A feature number was assigned to each burial or partial burial for registering material. Since features crossed various levels, two or more levels may contain the same feature. Cultural materials associated with the burials were registered with feature number rather than the level. Each feature and level were drawn and photographed and forms for levels and features were filled out. In addition, the process of burial excavation was recorded with a video camera.

Limited excavations were also carried out at three housemounds: VL-T2, VL-T3 and J9 (Figures 38-39, Appendix A). At VL-T2 we excavated two units, one 2 x 2 m and another of 1.5 x 1.5 m. The first one took advantage of an abandoned water well, while the second was located close to a looters' hole. At VL-T3, one unit of 2 x 2 m was excavated, again partially cleaning a looters' hole. Finally, at J9, 8 units of 2 x 2 m were excavated. At J9, the excavation was performed in one of the smallest housemounds associated with the Jerusalén core so as to recover material for identification of the range of activities that took place there.

Excavation in all cases was carried out using the *decappage* system in levels of 20 cm. As in the case of VL-T1, each level corresponded to a provenience number for locating exactly where the material came from. In the case of features such as postholes, ovens, and so forth, a feature number was also given, and each of these features was excavated independently. This was done with the aim of comparing features at different levels of the dwellings.

In addition, other test pits of 1 x 1 m were dug at various sites to obtain classifiable cultural material to place these sites within local chronology. Further tests were excavated in wells, looters' holes, and other surface disruptions. In these cases, their sizes varied, based mostly on the size of the looters' holes and profiles cleaned. In the center of Jerusalén for instance, two looters' holes (Mound 2, and Mound 3) and one latrine hole were cleaned. Material culture remains were transported to the laboratory where they were cleaned, sorted and classified for further laboratory analysis.

Laboratory Procedures

Materials were classified upon arrival at the laboratory; sherds and lithics were cleaned by either washing them or brushing their surfaces. Careful attention was paid to these surfaces in case there was decoration on pottery or attached microremains of textiles in both lithics and pottery. Pottery was classified for chronology and function; lithics were also classified in terms of raw material. Animal bones were cleaned and sent to Peter Stahl at the University of Binghamton for analysis. Soil samples went through the process of flotation and microremains are ready for further analysis.

Chapter 5

SETTLEMENT PATTERNS: TEMPORAL AND SPATIAL DIMENSIONS

Two important dimensions in any regionally focused study are time and space. Reconstructions of regional politics, economics and other social phenomena are based on the definition of vertical (temporal) and horizontal (spatial) units of analysis. Settlements spaced in a region form a system whose patterning, or lack of it, are cultural choices (political, economic, social) and influenced by natural factors. For any spatial analysis to provide useful information requires placing occupations within a set of temporal units, and classifying them into periods of time organized in sequences. This requires knowledge of local and regional chronologies, which, for the most part, have been obtained by classifying pottery based on horizontal and vertical distribution. Spatial patterning, on the other hand, requires determining the spatial location of settlements.

Time and space combined provide archaeologists involved in regional analysis with a series of layers representing different periods. Comparing these layers constitutes the basis of diachronic analysis. For either diachronic or synchronic studies, units of time have to be defined, so in this research pottery classification was carried out prior any further inquiries.

Temporal Dimension: Pottery Classification

Most of the literature on coastal Ecuador is heavily focused on the classification of pottery. In fact, most of what is known of the coast deals with pottery classification. Thus it is surprising that we are far from understanding the local chronologies. Meggers (1966) provided a broad chronology for Ecuador. There has of course been some dissatisfaction with her scheme

(Lathrap et.al 1977, Lathrap 1970, Marcos 1986), but the chronology of the lower Guayas Basin is in fact still a puzzle with very mixed up pieces.

The major problem this research faced was that previous classifications were based on a few unsystematically recovered sherds and diagnostics whose chronological significance is in doubt (Aleto 1988). Even though most agree that the markers used to divide pottery into phases and periods are inadequate, little has been done to fix the problem. For the moment, we work with this division until we can come up with a better one. At the finer level of local phases, there is consensus. The problem is that most of these phases or archaeological cultures span such a large time, that it is hard to study local trajectories in more detail.

Studies at nearby Peñón del Río produced cultural materials ascribed to Formative, Regional Development and Integration period societies (Zedeño nd), and in the Middle Basin, there are two distinct ceramic components, one belonging to the Regional Development and the other to the Integration period. The late Yumes, the Integration period component, is the local variant of the Milagro-Quevedo archaeological culture (Stemper 1993). In addition, to the south and west Regional Development Jambelí pottery has been identified as well (Véliz 1998). This evidence led us to think that our survey material and excavations would potentially yield evidence from the Formative to the Integration period.

Pottery from the Study area: Method of Classification

Pottery classification was undertaken to:

a) Establish the local chronological sequence and then arrange sites within a time framework;
b) Establish the range of pottery variability of each chronological component;
c) Define vessel functions and their distribution to explore the range of activities among sites.

The first task was accomplished at the level of period and archaeological culture by comparing diagnostic features of already published and comparative collections. The entire sample of material excavated belongs to the Integration Period, and more specifically to the Milagro-Quevedo phase, locally known as the *Cultura Milagro-Quevedo,* which is dated from about AD700- to AD1600. All pottery forms compared to published material are Milagro–Quevedo and thus all the settlements of this study belong to this 900-year period.

Having ascribed the pottery to the Milagro-Quevedo phase, we sought further divisions. Prior discussing this task it is necessary to describe what is known about Milagro-Quevedo pottery.

Previous Classifications of Milagro-Quevedo Pottery

The first attempt to classify a Milagro-Quevedo assemblage was made by Emilio Estrada who classified the pottery from a mound at Chilintomo using paste and rim shape as diagnostics (Estrada 1957b). His types were *Guayas Ordinario* (Guayas Plain), *Guayas Grueso* (Guayas Coarse), *Guayas Rojo Pintado* (Guayas Red Painted) and *Guayas Gris Pulído* (Guayas Gray Polished). Estrada was not able to present mutually exclusive types, and thus proved that these characteristics did not vary through time so as to serve for chronological purposes. Although, it can be suggested that Estrada's proposition might not necessarily have to be thrown out just yet, his results were no very useful. A graph of the type proportions in Estrada's cut shows, however, that *Guayas Gris Pulido* occurs early in the sequence, although, his results were affected by small sample size (Figure 42, Appendix A).

Domínguez (1986, 1990) presented a study of Milagro-Quevedo pottery from a trash midden context at Peñón del Río. Using the taxonomic system known as modal analysis, Domínguez classified Milagro-Quevedo vessels into 34 vessel forms corresponding to 5 vessel categories (ollas, bowls, plates, jars and urns). She defined three types of paste (fine, medium, and coarse) and a wide range of surface designs. In addition, she identified two Milagro-Quevedo components: an earlier one with higher quality vessels and better finishing techniques, and a later component with simpler technology (Domínguez 1990), but there is no indication of just which forms have chronological significance to allow dividing local occupations into smaller time frames

The Yaguachi Pottery

Analysis of the Yaguachi pottery started with the idea that Estrada's types might indicate differences in time and that what prevented him from presenting a convincing case was his small sample size. We first looked at a sample excavated from VL-T1 and divided into types Estrada identified, but we found all types in all levels in similar frequencies. Moreover, proportions do not change consistently so as to define chronological significance for the types. The material selected was from secure unmixed contexts, so it seems very unlikely that either paste or decoration indicate changes in time in the way Estrada thought. Of course, most of the paste used is found in nearby clay deposits so it seems very unlikely that it would have temporal or cultural significance. Surface decoration also varied without pattern in the stratigraphic sequence. Perhaps variability in temper or specific inclusions of the paste could have chronological significance, but at this point such research is beyond our reach.

Another way to classify the local pottery uses a modal approach based on vessel forms (Raymond 1995). These classifications sought two things: first to classify vessels into units that might have chronological meaning and second to understand technological and functional variability in the pottery and link this with activities that represent differences in rank, status and wealth. Rim sherds representing 10% or more of the circumference of the vessel mouth were drawn to reconstruct vessel shape (Orton et al. 1993, Shepard 1968). Other diagnostics such as sherds with points of inflection or angular points were also treated in this way to help the reconstruction of vessel silhouettes. Vessels add-ons, such as handlers, supports, and other decorative elements, were also included, as were decorated body sherds, since they show the assemblage's range of variability in decorative techniques. On basis of these silhouette reconstructions, vessels were classified into morphological categories such as ollas, jars, urns, miniature vessels, bowls and plates. Within each vessel category, vessels were further grouped according to similarities of particular characteristics such as paste, color, decoration and form of lips.

Vessel Categories

Ollas are vessels that have a restricted mouth and round body. This is the largest part of the sample. The main function of the ollas is cooking. Jars have a restricted mouth and oval body; the main function assigned to this type of vessels is water storage, water transport and drinking.Urns are large vessels with either restricted or open mouths. They are found generally in funerary contexts. This form has been found associated with burials, but one urn rim was recovered at VL-T2. Thus this form might also have been used for *chicha* drinking, most likely during ceremonies (DeBoer 2001). Distinguishing these functions should ideally depend on the contexts where the vessels were found, but the ones described here were all found in burial contexts. Bowls do not have restricted openings; the vessel's width is greater than its height (Balfet et al. 1992, Rice 19987, Sinopoli 1991). Their body shapes vary from round to ellipsoidal. They mainly functioned as serving and storing vessels. Plates also lack restricted openings; they are shallow and the wall-base angle is larger than 120 degrees. They functioned mainly as serving vessels. Thus a total of six vessel categories were defined: miniature vessels, ollas, jars, bowls, plates and urns (Tables 2 through 5).

Having established these basic morpho-functional categories, the next stage was to organize them into formal groups, within the category. Ollas, for example, were divided into 19 forms, which means that there are 19 well-differentiated forms within the category olla. These 19 forms represent the range of variability of ollas. This simply means that any olla from the sample corresponds to one or another of the 19 forms. These forms were based on shape, paste, and decoration.

Miniature vessels were grouped into three forms, all found in the burial mound VL-T1 in the Vuelta Larga site as burial offerings and thus associated with ritual functions. They are mostly fine grained, made in either reducing or oxidizing firing atmosphere; most of them have everted rims, rounded lips and ellipsoidal bodies (Appendix B).

Ollas were classified into 19 forms, of which more than 90% contain medium size inclusions and only about 10% contain fine grain inclusions. Most were fired in an oxidizing atmosphere and had smoothed surfaces; a few had smoothed and slipped surfaces. In regard to decoration, they are red pained, and have four basic forms of incising; parallel zigzag, parallel curving lines, hatch and parallel straight lines (Appendix B).

The six jars present have been classified into three forms. Their majority contain medium grain inclusions, while only one contains fine grains. All were made in an oxidizing atmosphere and are smoothed or smoothed and slipped or smoothed and painted (Appendix B).

The sample also contained seven forms of bowls, most of which were manufactured with medium size inclusions; a few contained fine grains. The large majority was fired in a reducing atmosphere, and all have smoothed surfaces, some in combination with slip, and others with painting and a few with burnishing. Decoration ranges from appliqué to incision in concentric circles (Appendix B).

In addition, eight forms of plates were defined: the large majority was made with medium grain inclusions. The majority also was fired in a reducing atmosphere and all were smoothed, combined with slip and black and red painting. A few show surface incision in lines and more complex motifs (Appendix B).

Urns were divided into four forms, all of them made with coarse inclusions and most in an oxidizing atmosphere. All have smoothed surface and red paint around vessel's lips and shoulders.

Table 2 shows the distribution of each form in the levels excavated at VL-T1, while Table 3 shows their distribution at mound J9. Table 4 indicates the distribution of those forms at the VL-T2 mound; while Table 5 indicates how they are distributed in various others test pits and profile cleanings.

As can be observed in the tables, the vertical distribution of these forms is not at all patterned as to define forms that were chronologically sensitive. Most of the forms are present in various levels, and no clear pattern emerges from these stratigraphically controlled sites.

Table 2 Pottery Forms Found at VL-T1 (Divided by Stratigraphic Level).

LEVEL	OLLAS					JARS							URNS			MINIATURE			BOWLS					PLATES							
	F2	F3	F5	F6	F8	F9	F10	F12	F15	F19	F1	F2	F1	F2	F3	F1	F2	F3	F1	F3	F4	F5	F6	F1	F2	F3	F4	F5	F6	F7	F8
r-s		1						1											1					1							
010-030																															
030-179															1																
000-050				1																										1	
050-070		1						1																						1	
090-110																															
100-120															1																
110-130				1																1										2	1
130-150																															
170-190																												1			
190-210						1												2						2						1	
210-230																								2							
230-250																		1													
250-270																								1						1	
270-290			1																										1		
290-310																													1		
310-330																						1								1	
330-350									1	1			1			1								2							
350-370											2													2						2	1
370-390																	1		1											2	
390-410												1							1												
410-430							2				1														1		1			1	
430-450	1																				1		1	1						1	
450-470																								1							
490-510							1																								
section N														1	1																
Looted					1						1				1			1								1				1	
TOTAL	1	2	1	2	1	1	3	2	1	1	4	1	1	1	4	1	1	4	3	1	1	1	1	12	1	1	1	1	2	14	2

Table 3 Pottery Forms Found at Mound J9 of Jerusalén Site.

LEVEL	OLLAS							JARS	URN	BOWLS	PLATES	
	F1	F2	F11	F13	F16	F17	F19	F3	F4	F1	F1	F7
r-s	2		1		1	1	1		1	1	1	
100-120		1	3	1	3			1		1		1
120-140												1
TOTAL	2	1	4	1	4	1	1	1	1	2	1	2

Table 4 Pottery Forms Found at Mound Vl-T2, Vuelta Larga Site

LEVEL	OLLAS							BOWLS				PLATES			
	F1	F4	F6	F7	F8	F10	F16	F18	F2	F3	F4	F1	F6	F7	
r-s	1			2	1	1	1	1	2				2	3	
4					1										
5											3	1			
6		1								1					
8				1											
TOTAL	1	1		3	2	1	1	1	2	1	3	1	2	3	22

Table 5 Frequency of Forms by Levels at Domestic Contexts (Various Housemounds)

LEVEL	OLLAS								BOWLS			PLATES		
	F1	F4	F6	F7	F8	F10	F16	F18	F2	F3	F4	F1	F6	F7
r-s	1			2	1	1	1	1	2				2	3
4					1									
5											3	1		
6		1								1				
8				1										
	1	1		3	2	1	1	1	2	1	3	1	2	3

Vessel Function

Analysis of each form category was pursued in order to define what function the vessels would have had. We looked closely at factors such as wall thickness and overall shape. The three main vessel functions we sought to identify were cooking or food processing, storing, and serving (Balfet et al. 1992, Rice 1987). Hence, the sample was also divided into vessels that were used for serving, cooking or storing, as well as urns that have funerary functions. Appendix B indicates which forms correspond to these four functions. Both the proportions of serving and cooking vessels as well as decorated and undecorated pottery will be discussed in later sections.

Summary

The study of ceramics in the area, although it has a long tradition, needs further refinement to define more specific time divisions. The ceramic assemblage registered in the area corresponds to what has been defined as Milagro-Quevedo pottery, belonging to the Late Integration Period.

At the moment all efforts to divide the 900 years of the Milagro-Quevedo phase have been futile; as a result this study has become a synchronic analysis of the political dynamics of the Milagro-Quevedo Yaguachi chiefdom of the Lower Guayas Basin.

Spatial Dimension

Procedures for Finding Sites

Any regional study, except perhaps those that are on islands or otherwise well bounded, involves some subjectivity in defining the area to work in. Further analyses are sometimes biased by factors like a boundary effect. Various factors are involved in the definition of an area to work in. Archaeologists generally have tried to define a study area seeking some sort of unity, sometimes in terms of environments, sometimes in terms of the extent of culture areas, and sometimes in terms of the requirements of specific sampling strategies.

In this study, the area surveyed does not conform to any culturally bounded unit. The survey focused on this area because it was clearly manageable and divided by both natural and artificial features. The Guayas River to the west forms the natural barrier that was also present during prehispanic times, and to the south and southeast the Boliche and Taura Rivers were used as boundaries while at the northwest the expansion of the Durán suburbs marks the limits. Finally on the northwest and northeast, the limits were set at the modern road connecting Milagro, Yaguachi and Durán. Of course, in areas along the road we also tried to locate sites, but survey did not extend farther than 100 m beyond the road. Clearly, this in no way constitutes a "culturally bounded" unit, but it does represent part of the core of the late Yaguachi chiefly society. It contains the still largest undestroyed sites in the region, such as Jerusalén, Cerrito Rico and La Ensenada; in addition, it contains the largest area covered with raised fields, in the entire Ecuadorian lowlands, as far as we know.

The study area corresponds to about 429 km² (Figure 2). A total of 32,921 shovel tests and 940 auger holes were excavated in order to locate sites, obtain cultural material to place those sites in time and space, and finally to understand patterns of local settlement organization. As discussed in the methodology section, shovel tests and auger probes were placed in transects

100 m apart. Thus in each 1 km², 100 tests were made, but given that units contained rivers and other features, in some units fewer than 100 tests were dug, while on others, this number increased because site definition required using more shovel tests for defining site boundaries.

Auger coring was used in places of heavy deposition close to identified occupational areas. Most auger holes reached 3 m deep; others stopped when waterbed table was found. Auger testing did allow defining more accurate site boundaries, but by itself, it did not allow us to find more sites than the ones found through shovel testing. Most times, auger coring gave the chance to locate deeper deposits on sites already defined with shovel tests, but not a single new site was found by auger methods only.

Site Chronology

My intention was to define a regional chronology based on excavated materials and with that, order sites within the chronology. Then patterns for each phase would be compared to define local settlement changes through time. Since occupation in the area belonged to only one component, the Milagro-Quevedo phase, which, although long (900 years approximately), could not be subdivided, there was no choice but to produce a synchronic study. Hereafter all analysis, then, concerns the Milagro Quevedo phase, the only component present in the area.

Potential Missed Sites

In any regional survey there is the possibility that the sampling strategy failed to locate some sites. In this case, early sites less than 100 x 100 m might fall entirely between shovel tests. But in that case, sherds of early sites if they existed in the area should have appeared in the many river cuts, road cuts, and deep channels dug in banana and sugar cane plantations, all of which were examined. Taking just the 32,921 shovel tests as a sample of quadrats each the size of a shovel test we can explore the level of statistical confidence we can have concerning the presence of sites earlier than Milagro-Quevedo in the area. In effect, we ask how likely it is that this survey missed sites earlier than Milagro-Quevedo. As Drennan (1996) indicates, a sample size of 7,000 shovel tests that finds no material earlier than Milagro-Quevedo gives us 99% confidence that the sample came from a population in which test with sherds of periods earlier than Milagro-Quevedo are less than 0.1% of all the possible tests. This means that there is more than 99% confidence that fewer than 0.1% of the total number of small quadrats the size of shovel test that would fit into the study area have earlier sherds in them. In other words, less than 0.1% of the study area (0.1% of 429 km^2 =0.429 km^2) has early sherds that could be found by shovel and auger test (at the 99% confidence level). Since the sample is considerably larger than 7,000, we can extend Drennan's approach to stronger statement. If only 0.01% of the study area contained occupation earlier than Milagro-Quevedo, there is only a 3.7% chance that this sample of 32,921 shovel tests would have failed to find it ($0.9999^{32,921}$). Thus we can be more than 96% confident that there is less than 4.29 ha (0.01% of 429 km^2) of occupation earlier than Milagro-Quevedo in the study area. The chances, then, that any substantial early occupation was missed by the shovel test sample are quite small.

It also might be that early Formative and Regional Development sites in the area are underneath heavy levee deposition, to deeply buried to be found in shovel tests. However, it should be noticed that Chorrera occupation at Peñón del Río started at the surface and many deposits were only a few centimeters deep (Zedeño nd). Regional Development sites around Guayaquil are often rather shallow and some have been found through surface survey, even the Valdivia site reported by Gonzales de Merino (1984) cultural deposits were found at less than 50 cm below surface.

Site Definition

Regional analysis of settlement organization relies heavily on the notion of archaeological site or archaeological settlement. As already mentioned the idea of exactly what represents a site, or a meaningful unit of analysis, is much debated. Finally, the definition of site depends on suitability to research project goals, rather than any kitchen sink list or rigid principle. Important among factors influencing how a site is defined are the scale of analysis and the nature of the questions asked. The question of scale is very relevant as resolution varies in inverse proportion with the scale of analysis (DeMontmollin 1988). Focusing on household studies one can define an archaeological site any structure, domestic or non-domestic, found separated by considerable distance from other similar features, but, when focusing on, say, agricultural farmsteads, the previously defined site becomes one element of a much larger site, and this cluster of structures may be defined as part of a still larger site in a regional scale analysis. Simply put, the notion of archaeological site is a methodological tool used by archaeologists to organize data, an mostly the definition is arbitrary. In this research defining a site proved to be a complicated matter; finally sites were defined by combining variables such as clustering of mounds and cultural material evidence obtained from subsurface testing.

In surveys carried out in many parts of the world focusing on locating scatters of surface debris, archaeologists have wondered whether surface scatters separated by a buffer area were part of one or several sites. In such cases, determination of site size and number of sites is difficult if separate scatters may be connected below the modern surface to form one site. Regional surveys employing shovel tests and other probing face a similar problem in defining what is a reliable distance between tests yielding cultural material to use in defining meaningful site boundaries. Generally a site is defined as a cluster of tests that yield cultural remains. Areas with high artifact density would be favored over others, such as occupational floors kept clean, although checking negative tests for evidence of anthropogenic soils helps resolve this problem. The main issue, nevertheless, is how large a buffer zone or area without signs of occupational activity needs to be for confidently defining site boundaries.

This research, as it wrestled with this issue, used various lines of evidence; sites were defined based on the clustering of mounds with additional information from subsurface testing. Information on cultural activity from shovel tests and auger holes included not only the presence/absence of artifacts, but also close examination of changes in soil color and structure. First we tried defining sites based only on the clustering of mounds, which produced 21 sites in the area. Adding presence of cultural material found in shovel and auger tests, road cuts and agricultural canal cuts, reduced the number of settlements in the area to 16 as what had previously been considered separated sites were combined (Figure 12).

Settlement Hierarchy

Exploring variables such as site area, number of mounds, mound area, total mound volume at each site, tended to show three groups making a three-tiered settlement system (Figures 7 through 10). One variable, mound area, forms only two groups which might be showing differences between domestic and public mounds, or possibly differences between elite and non elite dwellings.

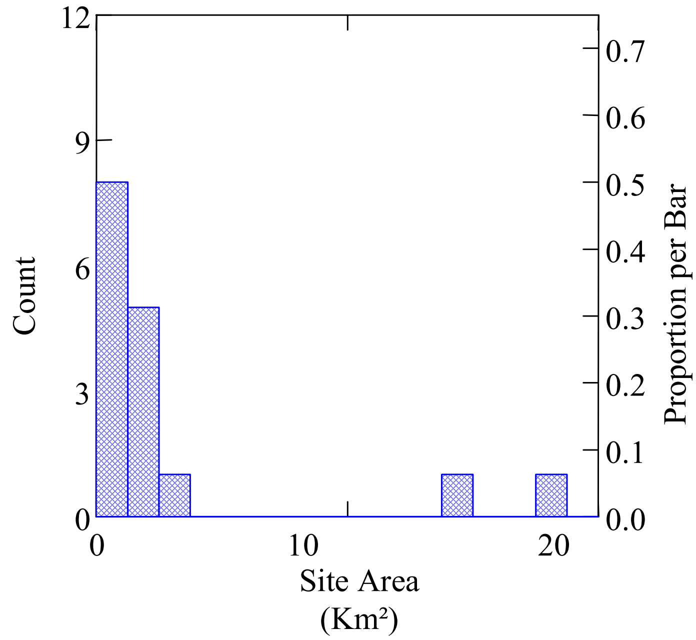


Figure 7 Settlement Size based on Site Area

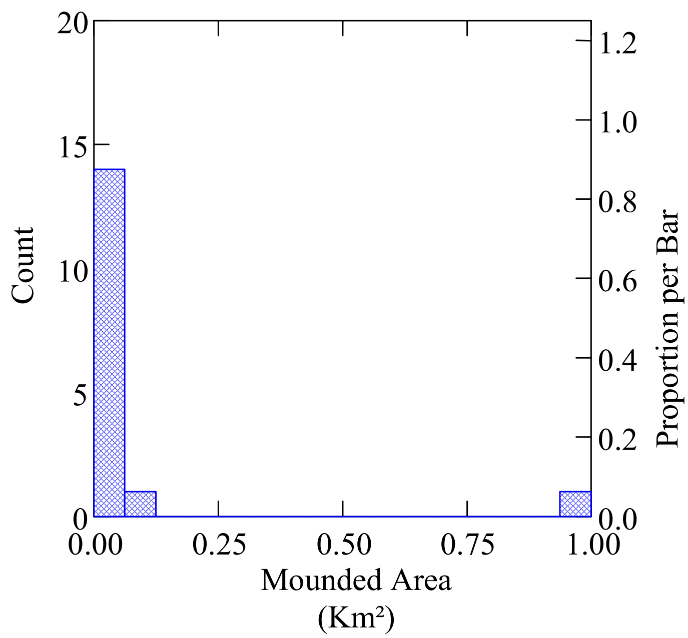


Figure 8 Site size based on Mound Area

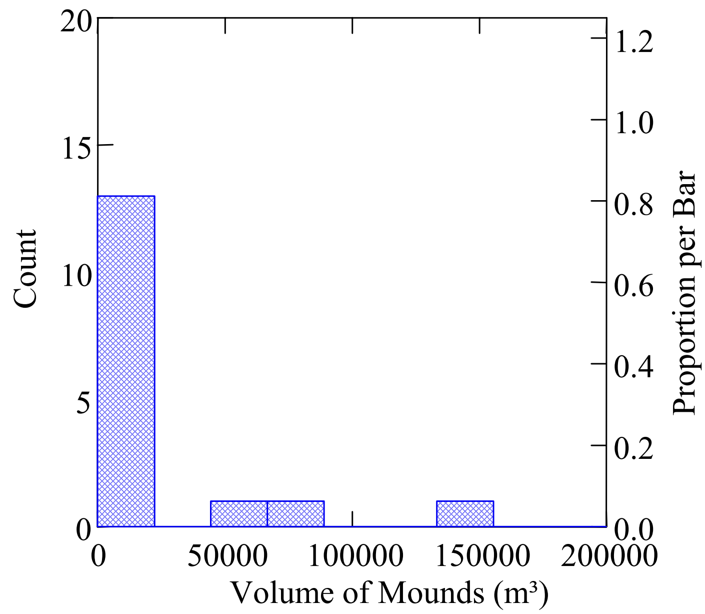


Figure 9 Site Sizes Based on Mound Volume

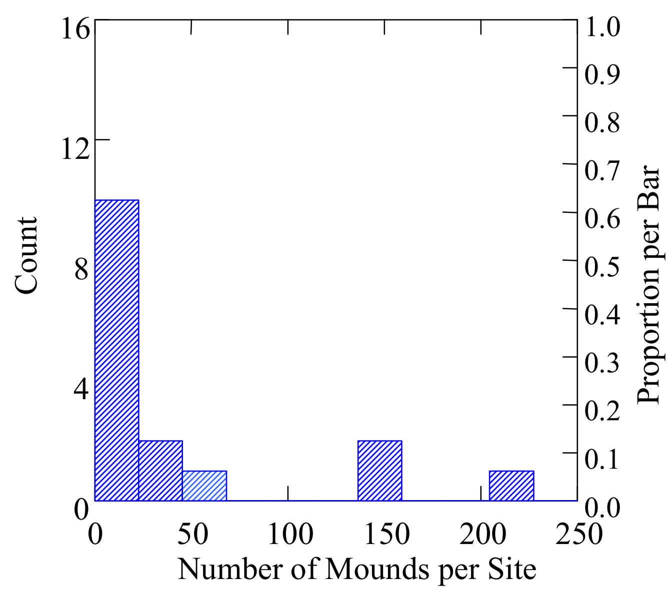


Figure 10 Site Size Based on Number of Mounds per Site

Table 6 Measurements of Local Sites

Sites	Site Area m²	Mound Area m^2	Mound Volume m^3[1]	Number of Mounds
Cacique de Oro	1,814,473	934	1,216	4
Cerrito Rico	3,057,778	94,935	151,557	209
Druet	615,383	3,092	4,448	26
El Local	1,553,258	356	553	5
La Ensenada	856,118	14,945	51,573	59
Iguano Macho	65,960	80	160	1
Jerusalén	17,750,403	24,149	76,830	137
La Cepa	60,699	45	76	1
Quijíje	1,615,433	548	1,009	9
San José	352,733	1,308	2,028	2
San Mateo	2,497,209	1,051	6,453	3
Santa Rosa	1,111,386	1,714	2,231	5
Santay	221,398	3,776	3,764	26
Vera	178,674	622	1,790	2
Vuelta Larga	1,293,732	1,516	15,957	7
Yaguachi	12,187,997	4,098	4,352	148

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[1] Formulas used to calculate volume where

Irregular: $V = lenght \times width \times height \times \frac{1}{3}$

Pyramidal: $V = lenght \times width \times height \times \frac{1}{3}$

Circular: $V = \pi r^2 \times height \times \frac{1}{3}$

Elliptical: $V = \pi \times lenght \times width \times height \times \frac{1}{3}$

Where $\pi = 2.13149$

The question now is which of the 16 sites correspond to these three groupings? Table 6 shows four variables measured for each site. This table indicates that sites can be classified in four ways, which raises the suspicion that settlements can be classified in as many ways as there are variables. For instance, taking the areal extent of each site, Jerusalén with 17,750,403 m², and Yaguachi with 12,187,997 m², are at the top of a settlement hierarchy. When using mound area, Cerrito Rico and Jerusalén are at the top. We are faced with the problem of how to reach an optimal classification of sites, minimizing the most important sources of bias. If we take only the site area, settlements with dispersed dwellings are ranked higher than ones where occupation is more closely spaced. For instance, Yaguachi, a village of many dispersed housemounds, ranks higher than La Ensenada, which has many large mounds, but packed close together. Mound area overcomes the bias imposed by the degree of clustering since this variable is not related to how mounds are distributed within a site. However, by using mound area, we only have part of the information that seems important. In this case, a site with large but low platforms will rank high, while other sites containing high mounds will not. Mound volume provides a good measure of site size. Another variable frequently used is number of mounds; but with this variable, a site with many small mounds will rank higher than sites with fewer large mounds.

Site Ranking

The variables that seem least biased are mound area and mound volume. Both measurements were used to obtain a combined ranking to form the settlement hierarchy. In Table 6 columns 3 and 4 are site rankings for mound area and mound volume for each site obtained from values of Table 5. Column 2 indicates the average ranking of the 16 sites. Average rankings range from rank 16 for Cerrito Rico, to La Cepa, which ranks last. Table 7 shows three groupings, one formed by sites ranking 16 to 14 , other ranking from 11.5 to 11, and another grouping sites ranking from 9.5 downwards.

Furthermore, Figure 5 shows three groups of settlements, one formed by Cerrito Rico, Jerusalén and La Ensenada. A second group with somehow similar ranking forms sites like Santay, Druet, Vuelta Larga, and San Mateo. These sites are almost identical in ranking, a third group is formed by Yaguachi, San Jose, Santa Rosa, Vera, Cacique de Oro, Quijije, El Local, Iguano Macho and La Cepa.

Table 7 Local Site Rankings

Sites	Average Site Ranking	Rank Based on Mound Area	Rank Based on Mound Volume
Cerrito Rico	16	16	16
Jerusalén	15	15	15
La Ensenada	14	14	14
Santay	11.5	13	10
Druet	11.5	12	11
Vuelta Larga	11	9	13
San Mateo	11	10	12
Yaguachi	9.5	11	8
San José	8.5	8	9
Santa Rosa	7	8	6
Vera	6	5	7
Cacique de Oro	5.5	6	5
Quijije	4	4	4
El Local	3	3	3
Iguano Macho	2	2	2
La Cepa	1	1	1

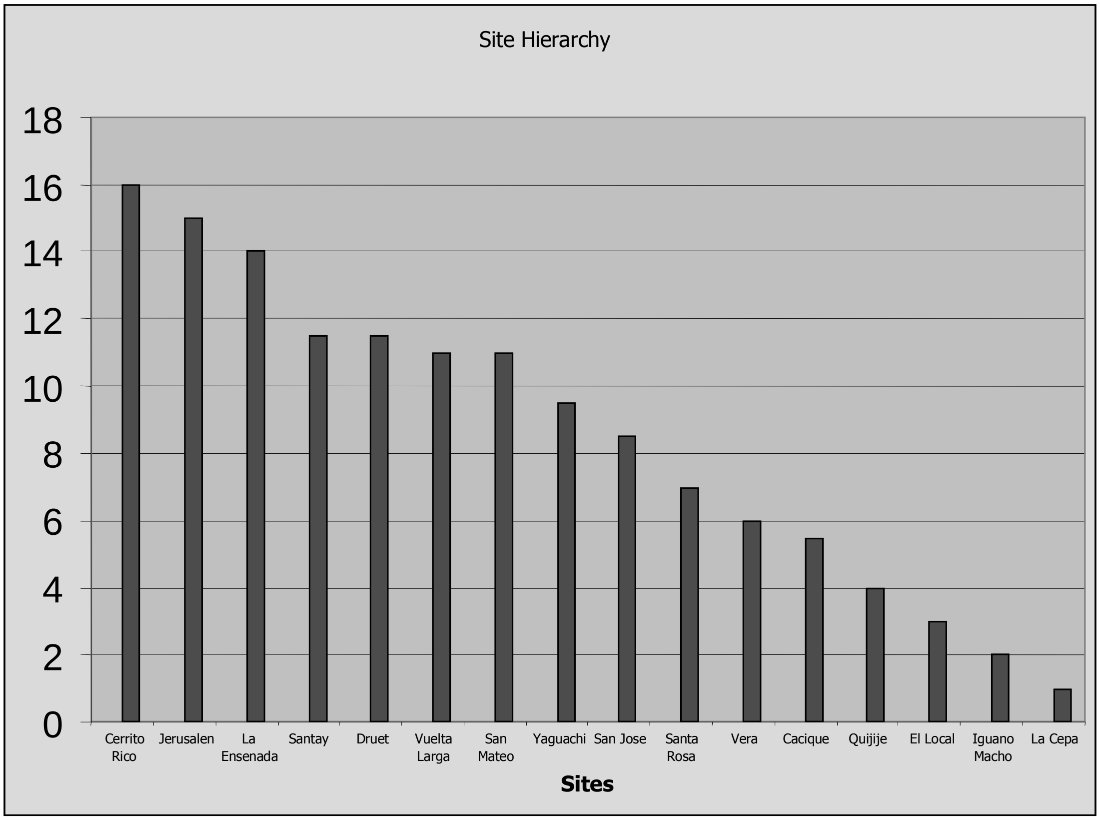


Figure 11 Final Local Site Rankings (Final Ranking)

In summary, this exercise indicates, that the use of a single variable to organize settlements in regional hierarchy is not recommended, at least for this region. Using more than one variable makes it possible to avoid some biases. By identifying such biases we can search for more reliable variables, especially when working with complex sites like the ones at the study area composed of mounds of various sizes with different degrees of clustering.

Brief Site Description

The first tier in the hierarchy can be considered primary centers for political decision-making. Second tier settlements are considered secondary centers, or sub-centers, places where part of decision-making activities could have taken place and products could have been stored. Third tier settlements are considered "villages" or archaeological communities inhabited by mostly non-elite people, most likely functioning as agricultural villages. Here we provide a very brief description of each site.

Primary Centers

1) Cerrito Rico

This site corresponds to a group of 209 mounds, of various forms and sizes. This complex is found in the south of the survey area, at the southern border of the raised field area. Both public mounds and domestic dwellings are grouped in the area. Overall, the area of the site is not very large, but having the largest number of mounds indicates that it is a very densely packed site. The number of mounds might actually even be larger as some classified as raised fields may well be domestic mounds. This site lies close to the Guayas and the Taura rivers, connected by smaller *esteros*. This site had not been reported until this research took place. As shown in site map (Figure 36, Appendix A) mounds are of various shapes and sizes.

2) Jerusalén

This site was first reported by (Meggers (1966) who described it as "Yaguachi Viejo." Later (Viteri Gamboa 1968) listed it along with many others in the area. The site is again mentioned by (Buys and Muse, 1987). In that work, Jerusalén is reported as the area's regional center. Then, Véliz (1990) mentions it as the possible living quarters of *Cacique Guayaquile.* Recently Muse considers it the primary center of the area (Muse 1991). And Stemper (1987) also mentions Jerusalén as the largest site in the lower Basin.

Although this site has long been mentioned, no systematic work had been carried out until this research took place. The site is the largest in the study area and has a total of 137 mounds. It is formed by "barrios" with the main center at Jerusalén proper and other mounds dispersed in different satellite clusters around the site's main center (Figure 43, Appendix A). At the main center, public mounds are found around rectangular "plazas." Mound 1 at Jerusalén is the largest and tallest in the entire region and, in conjunction with others, forms the site's main plazas. domestic dwellings are found towards the northeast and southwest of the main center.

3) La Ensenada

La Ensenada is close to Cerrito Rico, towards the southern border of the study area. It consists of 59 very clustered mounds divided at the center by two local *esteros* (Figure 37, Apendix A). If we consider the number of mounds and their sizes, this site has the most mounds per unit of area. Mound 11 is unique in that it contains a ramp, which so far is the only one of that shape found in the Lower Basin. Ramped mounds like this are more characteristic of Andean and North Coast mounds. In general the site is very compacted; shovel tests around the site indicate that occupation corresponds very much to the area with mounds.

Secondary Centers

Second tier sites are considered secondary centers. These sites in general might have functioned as the link between primary centers and rural settlements. Secondary centers, or sub-centers, found in the study area are Santay, Druet, Vuelta Larga, and San Mateo.

4) Santay

Santay is located at the eastern border of Hacienda Santay, in an area close to the modern village of Jaboncillo. It has 26 mounds packed in a small area. Mounds at this site are basically small. The site is in the middle of a developed area where large scale modern canalization has been carried out, redistributing the *esteros*. Local people indicate that the large modern Jaboncillo canal corresponds to an old *estero* that passed approximately 30 m from the site.

5) Druet

This site is northwest of the prime center of Jerusalén and very close to it. It contains 26 mounds, all of them circular concentrated in a very small area. Most of the mounds correspond to domestic dwellings (Figure 12).

6) Vuelta Larga

Seven mounds dispersed in a large area around the modern village of Vuelta Larga form this site. Of those VL-T1 (Mound 1), VL-T2 (Mound 2) and VL-T3 were tested. These tests are discussed in more length in Chapter 7, but at this point we can mention that VLT-1 corresponded to a burial mound that has been constantly under looting attack. Here we uncovered 182 burials in a cut carried out to clean up a profile of the mound.

7) San Mateo

This site is near the southeast of the study area, between Jerusalén and La Ensenada. It is particularly important to note that San Mateo is the closest secondary site to the Boliche River. Some mounds seem to have disappeared when the land was converted into a banana plantation. This site contains the largest mound so far registered in a secondary center in the area, and Mound 2 continued to be looted as this research was carried out.

Rural Villages

8) Yaguachi

Yaguachi is a mounded area that encompasses an area of about 14 km^2 at the west side of the Chimbo River. It is formed by a complex of 148 mounds clustered along a large riverbank. It is located less than 400 m from the modern town of Yaguachi. In contrast to other sites in the area, most of the 148 mounds are of small size and not very high. Judging by their morphology it is believed that most of those mounds supported house structures.

9) San José

San José is the only site that is entirely inside the raised field zone. It is located in an area that floods entirely during the rainy season. The site consists of two mounds and an area around that yields material. This site is the most isolated of all and is connected to Santay, Quijíje, Yaguachi, Cacique de Oro and Vera by the local small *esteros* that go into the swampy area of the raised fields.

10) Santa Rosa

Santa Rosa is located toward the southeast of the study area, close to the Chimbo River; it is connected to Jerusalén, la Cepa and El Local. Santa Rosa has one cluster of five mounds and a surrounding area. Nowadays the area of the site is used for sugar cane cultivation.

11) Vera

Vera is located close to Quijíje, San Jose, Santay and Cacique de Oro. All these sites are connected by a series of small *esteros* located around the sites. Most of the mounds at Vera are currently in use by modern dwellers. The land around Vera is grassland used for livestock.

12) Cacique de Oro

Cacique de Oro is located in the north central zone of the study area along the *estero* Jaboncillo, which connects it with Quijije and Santay. It consists of five mounds that most probably correspond to housemounds. These housemounds are in use today, as modern inhabitants have built their houses over the archaeological mounds. Most of the land around the mounds has been obliterated due to the heavy use in agriculture.

13) Quijíje

Quijíje is a small cluster of four mounds and a large area around them that yields cultural material. One of the mounds (Tola Meza) has been looted. All the mounds at this site seem to correspond to habitations. Quijíje is connected through the Estero Jaboncillo with Cacique de Oro. It is relatively close to Yaguachi, San José and Santay.

14) El Local

El Local is close to La Cepa and is connected to it by a small *estero* that during the rainy season carries water to the Estero Mojahuevos at the south. El Local has four mounds, and the area is now used for a banana plantation and sugar cane cultivation. The material found in and around the mounds is located about 50 cm below surface.

Isolated Households

14) Iguano Macho

The Iguano Macho site has one single isolated mound surrounded by non-mounded areas. The Iguano Macho mound is located near a small *estero* that connects the site with the Chimbo River and with Santa Rosa and Vuelta Larga. The area surrounding Iguano Macho is under cultivation by local smallholders.

15) La Cepa

La Cepa corresponds to a site classified as isolated housemounds that most likely belong to isolated rural households. These sites correspond to Buys and Muse's (1987) estancias. La Cepa is close to an ancient meander of the Chimbo River. It has one single mound possibly belonging to a domestic structure (Figure12)

The archaeological settlements in general are formed by both mounds and non-mounded areas. Most of the mounded areas, (those that most likely supported domestic dwellings) are still being used as platforms on which local people build their houses, protecting themselves from the flooding during the rainy season. At the same time, local people have conveyed that building the house on a platform protects them from serpents and in *"tiempos antiguos"* from crocodiles.

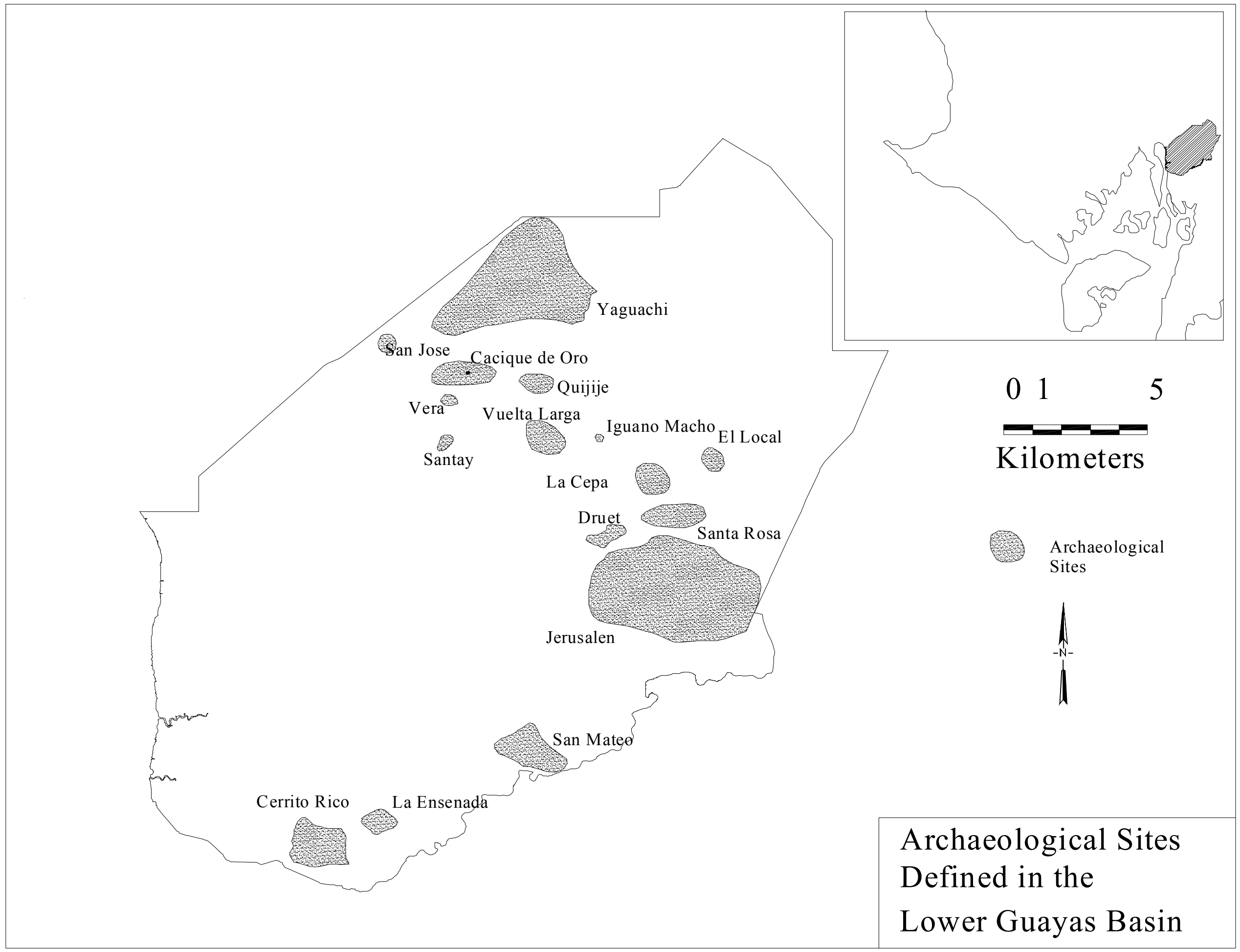


Figure 12 Settlements Registered at the Study Area

Regional Demography

Previous Demographic figures

Studies of demography in the Guayas basin are very sparse, and those that exist do not use direct archaeological data. Mathewson has provided some general estimates of local population relying on labor requirements and a unilineal evolutionary model of population growth (Mathewson 1987a). He proposed population figures of 400,000 to 500,000 inhabiting the larger Guayas Basin on the eve of Spanish arrival (Mathewson 1987a), basing his estimates on measures of labor required to construct, maintain and produce the raised fields found in the area. He assumed that 20% of the area with raised fields (20% of 500 km^2) was under cultivation, so the area supported 100,000 to 150,000 people given a population density in areas of raised fields of 1,000 to 1,500 people per km^2. He then added a population of 325,000 people for the rest of the region by assuming a density of 10 persons per km^2 living on non-raised field areas. If for the sake of argument I use Mathewson's figures, the study area would have supported a population of 100,000 to 150,000 people.

Espinoza Soriano (1988) based on ethnohistoric data, estimates the population at 20,000 to 25,000, but it is not clear whether these figures represent the total population of the Guayas Basin or only of the Daule chiefdom (Newson 1995).

Newson (1995) indicates that, although Oviedo describes the Guayas Basin as "*bien poblado,*" Mathewson's figures seem quite inflated. She combines the population densities offered by Mathewson with information on the Spanish "*encomiendas"* to indicate that some 213,780 persons would have inhabited the interior of the Basin, using Mathewson's 10 person per km^2 density. In addition, she estimates that 25,980 inhabited the southern Basin for which she uses a figure of 5 persons per km^2.

Population Estimates for Yaguachi

The two lines of evidence just discussed provide different figures, and it is clear that they are affected by problems of the reliability of data and of the way in which data was used. In the case of Mathewson's estimates, the numbers are inflated because he assumed that production was only used for local subsistence. Such direct correspondence between population and resources does not always work given the fact that resources can be used for trade and to generate surplus, activities mentioned in ethnohistoric accounts. The data presented by Espinoza Soriano and Newson might not be at all accurate, given that not every *ecomendero* would provide credible information on their domains in the New World to the Spanish crown. The archaeological evidence has biases of its own, which originate in most cases in the preservation of the archaeological record, but there are statistical methods that can help the archaeologist to wrestle with such issues. Here we use the archaeological evidence to obtain some rough estimates of population at the regional level.

Naroll has observed a strong correlation between the area of occupied floors or area under roof and population size, suggesting that population can be estimated from occupational floors with the index of 1/10 person/m^2 (Naroll 1962). In our case, it is hard to estimate local population with this method given that at this point it is impossible to determine the area that was roofed, or the area of occupied living floors. In addition, it is likely that not everybody lived on housemounds, and it is hard to estimate the number of housemounds that have been obliterated in the area.

We attempted to use the burial sample excavated from VL-T1 (Mound 1) to estimate population. In an excavated volume of 66 m^3, 182 burials, including primary and secondary, were found. Our excavation area was a small sample of the mound, some of which has been heavily looted, but the 182 burials in 66m^3 produce and average of 2.75 burials/m^3. At this density, the total of 1,400 m^3 in the mound VL-T1 would have contained 3,850 burials, which is the total number of people that VL-T1 must have contained. VL-T1 is, as far as we know the only burial mound at Vuelta Larga, and we could take this number to represent all the people that lived in the site. Given that the occupation corresponds to 900 years or some 30 generations of 30 years each, we could estimate that about 128 persons lived in the site at any given time. The problem is that we are not sure that all dead persons were buried in the mound or that all buried people were from the site around it. Until this issue is resolved this demographic reconstruction is built on shaky assumptions.

Schreiber and Kintingh (1996) observe very poor correspondence between site size and population, but Kvamme (1997) indicates that this poor correspondence has to do with the way data is transformed. When he uses the logarithm of site size, correspondence between site size and population becomes quite high. In addition, Kvamme indicates that site function greatly influences the relationship between site size and population.

A different approach to reconstructing demography from archaeological evidence was proposed by Sanders et al. (1979) for the survey data from the Basin of Mexico. This reconstruction came from discontent with estimates of population based on site size alone. They suggest that: "The most direct way of estimating population of archaeological sites is to multiply the number of house mounds (i.e. family residences) by some derived figure of mean family size" (Sanders et al. 1979: 38). Clearly, for the Guayas Basin the same problems that prevent Narroll's approach apply. Sanders et al. (1979) however, provided an alternative, which is to estimate population based on sherd density along with site size. Their method also utilizes information from the early 16th century colonial population censuses.

In this research we have taken the residential density figures provided by Sanders et al., and we have classified the sites in the lower Guayas Basin in terms of correspondence with the Basin of Mexico numbers. These are of course, very different environments so, this approach can only provide a rough estimate of the regional population. It is, nonetheless, important to undertake this effort to estimate Guayas Basin populations on the basis of settlement remains rather than potential productivity.

Table 8 Correspondence of Site Typologies of the Lower Guayas Basin and the Basin of Mexico

Lower Guayas Basin typology	Sanders et al.	(1979) typology
Primary Centers (core)	Light-to-moderate occupation	1,000-2,500 persons/ km²
Secondary Centers and Primary Centers (periphery)	Light occupation	500-1,000 persons/ km²
Rural Villages	Light-to-scanty or light occupation	500-1,000 persons/ km²
Isolated households	Scanty to light occupation	200-500 persons/ km²

Having classified the sites in terms of the Basin of Mexico's residential density typology, the next step was to calculate each individual site's population based on its area and then add them up to obtain figures for the population of the region. Thus, the number of people in each individual site was obtained by multiplying its area (in km²) by the corresponding density.

Cerrito Rico and La Ensenada are both very compact settlements so the correspondence is straightforward. In the case of Jerusalén, it seems that the core corresponds to light-to-moderate occupation, while the periphery corresponds to light density of occupation.

As shown in Table 9, estimates of the total local population range from a minimum of about 26,000 persons to a maximum of about 57,000 persons. Certainly, the range is quite large but with these numbers, the population of my study area in the lower Guayas Basin most likely was about 30 to 40 thousand people.

Table 9 Estimates of Local Population Calculated Based on Sanders et al. (1979) 's Figures.

Site ID	Area (km²)	Minimum Population	Maximum Population
Primary Centers			
Cerrito Rico	3.058	3,058	7,645
Jerusalén Core	2.900	2,900	7,250
Jerusalén Periphery	14.850	7,425	14,850
La Ensenada	0.456	456	1,140
Secondary Centres			
Vuelta Larga	1.294	647	1,294
Druet	0.615	307	615
San Mateo	2.497	1,248	2,497
Santay	0.221	111	221
Yaguachi	14.187	7,094	14,187
Rural Villages			
Santa Rosa	1.111	556	1,111
San José	0.353	177	353
Vera	0.178	89	718
Cacique de Oro	1.814	907	1,814
Quijíje	1.615	808	1,615
El Local	1.553	777	1,533
Isolated Households			
Iguano Macho	0.065	13	32
La Cepa	0.060	12	30
		26,585	56,905

In summary, these are not ideal estimates, but they make a starting point from which to advance in the discussion of labor investments, the amount of production necessary to feed the population and, the ways in which local authorities strategize about keeping people in their domains.

Local Settlement Dynamics

Distance Between and Among Sites

Christaller (1966) indicates that central places will tend to be equidistant from each other, but in our study area centers are not spatially patterned in this form. As indicated in Table 10, Cerrito Rico and La Ensenada are found near the southern border, little more than 2 km away from each other. Jerusalén is found to the west side, in the center of the study area, 16 km from Cerrito Rico and 13 from La Ensenada. Second level sites are located close to primary centers: Santay is 6 km from Jerusalén; Vuelta Larga, 6.5 km; and, Druet less than 1 km. San Mateo may be connected to all three centers; it is 6.8 km from Jerusalén, 5.3 from La Ensenada, and 8.3 from Cerrito Rico. Third level sites are all near to secondary sites: Druet is connected with El Local, Iguano Macho, La Cepa, and Santa Rosa; Santay is connected with Vera, San José, Quijíje and perhaps Cacique de Oro. Vuelta Larga seems to have been connected with Vera and Yaguachi.

Table 10 Distance Among Sites in the Study Area

	Cacique de Oro	Cerrito Rico	Druet	El Local	La Ensenada	Iguano Macho	Jerusalén	La Cepa	Quijije	San José	San Mateo	Santa Rosa	Santay	Vuelta Larga	Vera	Yaguachi
Cacique de Oro		18.01	6	6.5	16.6	2.28	7.6	6.6	1	5	13	4.8	2.4	1.3	1.7	3
Cerrito Rico	18.01		15.00	17.00	2.27	18.20	16.00	20.00	18.00	19.00	8.30	12.00	16.00	16.80	17.00	22.00
Druet	6.00	14.70		4.50	13.10	3.50	0.90	4.10	8.00	10.00	8.10	2.30	6.30	4.56	7.50	9.10
El Local	6.50	16.50	4.50		14.80	3.40	1.50	2.00	9.00	12.00	9.50	0.90	8.30	5.30	9.10	8.30
La Ensenada	16.60	2.27	13.00	15.00		15.90	13.00	18.00	17.00	18.00	5.30	16.00	14.00	15.50	16.00	20.00
Iguano Macho	2.28	18.20	3.50	3.40	15.90		5.80	3.60	5.00	8.00	12.00	1.80	5.20	1.20	5.50	6.30
Jerusalén	7.60	16.01	0.90	1.50	13.40	5.80		4.60	11.00	13.00	6.80	2.60	6.10	6.50	9.20	13.00
La Cepa	6.60	19.70	4.10	2.00	17.50	3.60	4.60		9.00	12.00	12.00	2.10	9.60	5.60	9.40	7.30
Quijije	1.30	17.90	7.80	9.00	17.00	4.80	11.00	9.00		2.00	13.00	6.90	2.30	3.60	0.80	1.20
San José	5.10	18.70	10.00	12.00	17.70	8.25	13.00	12.00	2.00		15.00	10.00	3.80	6.10	2.80	2.50
San Mateo	12.80	8.30	8.10	9.50	5.34	11.50	6.80	12.00	13.00	15.00		10.00	11.00	11.90	13.00	18.00
Santa Rosa	4.80	11.76	2.30	0.90	15.70	1.80	2.60	2.10	7.00	10.00	10.00		10.00	3.70	7.90	6.60
Santay	2.38	15.70	6.30	8.30	14.20	5.20	6.10	9.60	2.00	4.00	11.00	10.00		10.90	1.50	6.10
Vuelta Larga	1.30	16.80	4.60	5.30	15.50	1.20	6.50	5.60	4.00	6.00	12.00	3.70	11.00		3.00	5.10
Vera	1.66	17.10	7.50	9.10	16.10	5.50	9.20	9.40	1.00	3.00	13.00	7.90	1.50	2.99		5.10
Yaguachi	3.00	22.10	9.10	8.30	20.30	6.30	13.00	7.30	1.00	3.00	18.00	6.60	6.10	5.11	5.10	

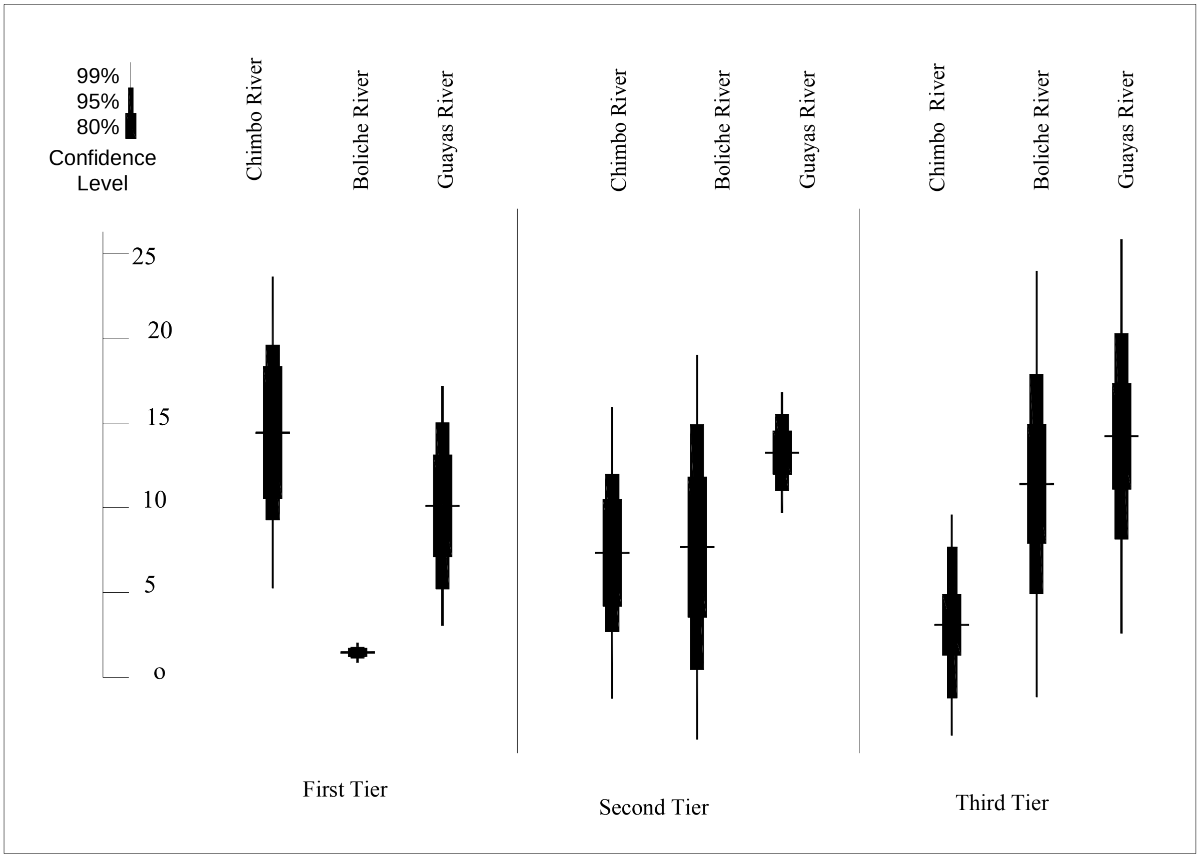


Figure 13 Bullet Graphs of the Distance between Sites and Main Local Rivers

Political Centralization

River networks and the raised field areas played key roles in determining the locations of main centers. Cerrito Rico and La Ensenada are close to the Guayas and Boliche rivers connecting, with the Guayas River as well. Their location on the southern border of the raised field zone seems to indicate that their inhabitants located close to the raised fields so as to maximize investment of labor and to protect and claim land property rights over those fields. It is very strange that Cerrito Rico and La Ensenada are so close to each other. It is also odd that the large Jerusalén center is located far away from raised fields, a fact that will be discussed later. Secondary centers also do not comply with any principles of equidistant spacing; the only patterning is that they are located close to raised fields and close to watercourses, suggesting that they functioned as storage and distributional places. Site Druet, even though located far from raised field zones, it is very close to the primary center Jerusalén.

Clearly, people settling zones within raised fields took part in the production and maintenance of such agro-hydraulic features. There is no clear-cut patterning indicating the extents of the raised field area that people at each site exploited. It can only be assured that inhabitants of these sites exploited areas closer to their communities. Sites located within raised field zones like Cerrito Rico and La Ensenada most likely exploited the adjacent area, but the remaining question is how large the territory was exploited by each one of them, and more importantly, how local people used these large areas.

Sites in the study area had a tendency to nucleate, as Table 10, shows, through nearest neighbor analysis.

Table 11 Nearest Neighbor Analysis

Observed Mean Nearest	Meters
Neighbor Distance	93.21
Standard Deviation	187.72
Expected (Random) mean Nearest	Meters
Neighbor distance	401.07
Standard Error Expected	13.91
Nearest Neighbor Ratio	0 .23

A nearest neighbor ratio of 0.23 indicates very strong clustering and the result is highly significant ($t=22.128$, $p< 0.001$).

Soil Fertility and Settlements

Current models of political economy indicate that in systems where chiefly power rests on the control of agricultural resources, we expect centers of chiefly societies to be located on or near good agricultural soils (Drennan and Quattrin 1995). If political power in the lower Guayas Basin was tied to control of good agricultural areas, we would expect centers to locate around the most fertile areas. Two of the three first tier sites, however, Cerrito Rico and La Ensenada are found on Cg type soils, wet and water-saturated, and ranking lowest on the fertility scale. Jerusalén, the other first tier site, is found on three soil types: 13.15 km^2 (74.5%) is on LC'dv-Cdv soil type, which ranks highest in fertility conditions. The Cgdv soil type, which ranks high in the fertility scale, comprises 2.96 km^2 (16%), while the Cg-L soil type, which ranks in the middle, corresponds to 1.55 km^2 (8.7%) of the site. Second tier sites are found on two soil types:

San Mateo is on Cg soils which ranks second lowest in fertility, while Druet, Santay, and Vuelta Larga are found entirely on Cg-L type soils, which rank in the middle of the scale. Third tier sites are found on both Cg-L and Cgdv soils. Only 0.13 km² (0.09%), of Yaguachi is found on Cgdv soils types; the remaining 13.8 km² (99.9%) is on Cg-L soils. Vuelta Larga, Quijíje, Cacique de Oro and Iguano Macho all are on Cg-L type soils, while El Local, Santa Rosa and La Cepa are on Cgdv soils.

Thus second tier sites are found on soils ranging from low to high fertility. Third tier sites, those most likely corresponding to agricultural populations, are found largely associated with soils ranking high in fertility potential. No settlements were found on the most fertile soils, which might indicate no preference for the areas best suited for agriculture. Modern agriculture however, is heavily practiced in these areas, and perhaps as a consequence, some sites have disappeared.

In any event, this patterning conforms most to a political system where power did not rest on the control of the most fertile lands. This is not to say that political power may not have rested on the control over intensive agriculture systems which will be discussed later, but that elites perhaps opted for using raised fields instead of taking over the lands suitable for agriculture with less labor investment.

Table 12 Site Distribution with Relation to Soil Fertility

Archaeological Sites	LC' Cdv -Cdv	Cg-L	Cgc	Cgdv	Cg
Fertility Ranking*	2	3	4	5	6
Cerrito Rico			x		
La Ensenada			x		
Jerusalén	X	x		x	
Druet		x			
San Mateo					x
Santay		x			
Vuelta Larga		x			
Yaguachi		x		x	
Santa Rosa	X				
San José		x			
Vera		x			
Cacique		x			
Quijíje		x			
El Local	X				
Iguano Macho		x			
La Cepa	X				

1 = most fertile soil, 6 = least fertile soil

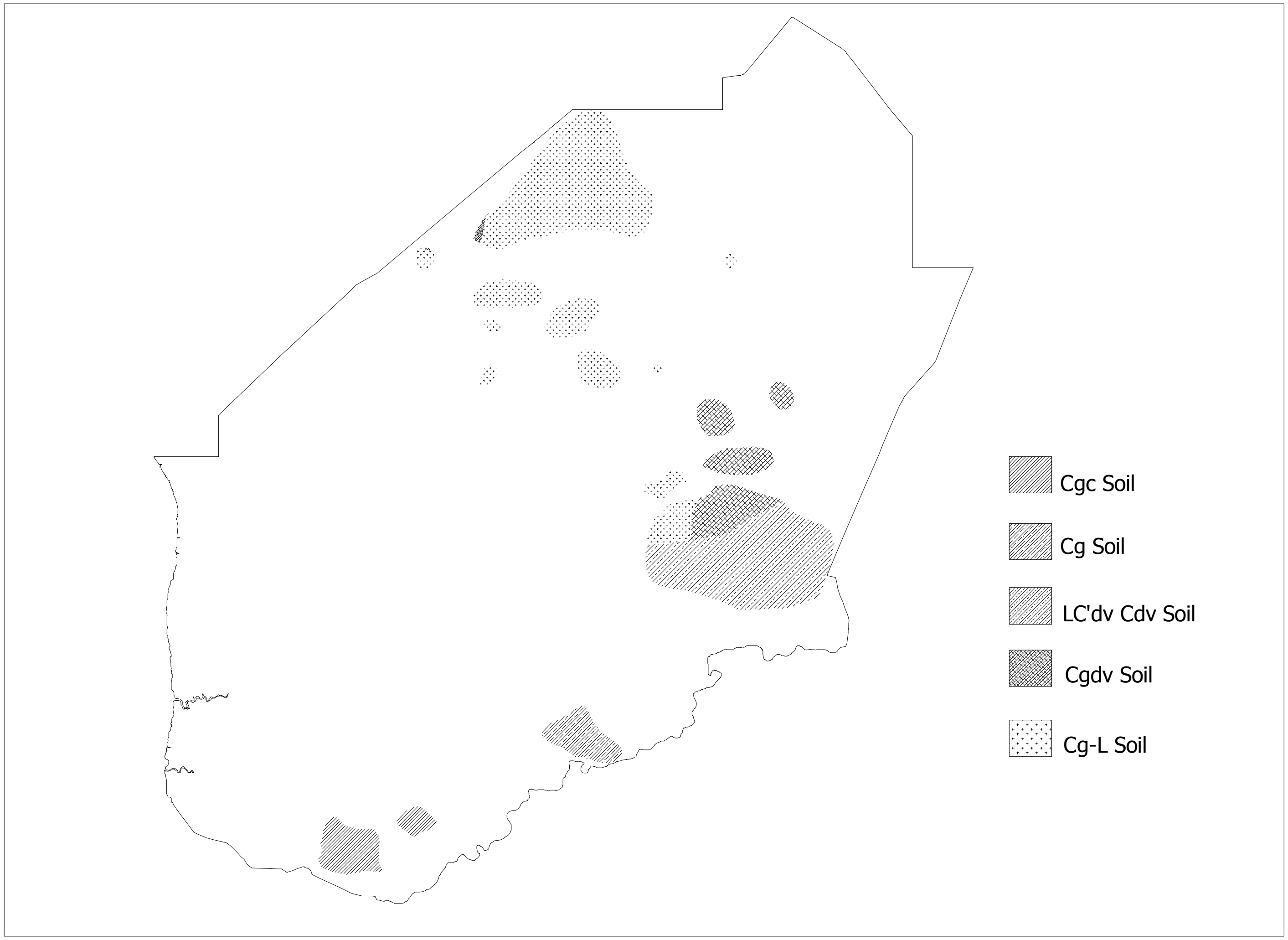


Figure 14 Map of Distribution of Settlements in Relation to Local Soils

Exchange Routes and Settlements

The local river system seems to have been a very important natural feature that allowed transportation and communication, and the flow of local goods. A few decades ago, it was possible to see large *balsas* (rafts) transporting goods from the *pie de monte* to the port of Guayaquil. Early colonial accounts indicate the presence of major bulking places along the Babahoyo and Chimbo rivers as well as their tributaries.

Patterning of Milagro-Quevedo settlements in the study area in relation to rivers indicates that, although first tier sites located close to the major rivers, Chimbo and Boliche, they were even closer to smaller *esteros* connecting with those rivers. Local *esteros* cross over all three large settlements Cerrito Rico, Jerusalén and La Ensenada. These *esteros*, in the case of Cerrito Rico and la Ensenada connect them to the Boliche River. In the case of Jerusalén, the large Estero Mojahuevos connects this site with the Guayas River and a large raised field area. Cerrito Rico is also located about 4 km from the Guayas River, and connected to it by local *estero*s as well.

In general, second tier sites are located close to the main rivers and large *esteros*: San Mateo is near the Boliche River; Vuelta Larga and Santay are found close to the Estero Jaboncillo; while Druet is near the Estero Mojahuevos. Third tier sites are near *esteros* communicating with second tier sites, and, in the case of Yaguachi, near the Chimbo River. Vera, Quijíje, Cacique de Oro and Iguano Macho connect to Vuelta Larga thorough the *estero* system. La Cepa, Santa Rosa and El Local connect with Jerusalén and Druet, while San José and Quijíje connect with Santay and Vuelta Larga. In general all sites are connected to others forming a real web (Figure 15).

When comparing distances to the three major rivers, the mean distance of first tier sites to the Chimbo River is 14.43 km; to the Boliche River, 11.41 km; and to the Guayas River, 14.21

km. Mean distance from second tier sites to the Chimbo River is 7.34 km; to the Boliche River, 7.68 km; and to the Guayas River, 13.25 km. Mean distance from third tier sites to the Chimbo River is 3.10 km; to the Boliche River, 11.41 km, and to the Guayas River, 14.21km. First tier sites are located at 1.47 km from the nearest main river, while secondary sites are located 2.21 km and third tier sites locate at 3.70 km. First tier sites are more than twice as close to the main rivers than secondary sites are. Third tier sites are the farthest away from the main rivers, although they seem to be closer to smaller *esteros* through which they were connected to the centers and subcenters.

This patterning seems to establish that site location was influenced by distance to the local drainage system. It is also clear that the sites all connect to each through the web of *esteros* and rivers in the area. Thus, we can argue that centers may have functioned as redistribution centers, places from which trade took place. People inhabiting subcenters and rural communities might have transported agricultural products to the centers to be redistributed and perhaps traded. People living at the regional centers, by locating close to the main rivers might have been at an advantage in controlling the flow of exotics in the area and thus involved in alliance building (Muse 1991).

Subcenters are also close to the main rivers, but with the exception of San Mateo, they are not as close as first tier sites. They are located in areas between centers and productive zones and thus they seem to have been involved in agricultural production, perhaps through organization of labor and in the distribution of harvest to the main centers. Third tier sites, with the exception of Yaguachi, are placed inland, farther from the main rivers, and connected to first and second tier sites by *esteros*. They are close to productive areas, and mostly on soils with regular to high fertility. Their location seems not to have been influenced by distance to the main rivers but instead by the presence of highly productive areas, or areas converted to high productivity (this will be discussed at length in other sections). Their position farther away from the main rivers indicates that they were less connected to the main exchange routes and thus rural households seem not to have been directly involved in long distance exchange relations.

Table 13 Distance (in km) From Sites to the Major Local Rivers

Archaeological Sites	Chimbo River	Boliche River	Guayas River
Cerrito Rico	20.11	1.10	3.95
La Ensenada	18.48	1.20	6.52
Jerusalén	4.71	2.11	17.50
Druet	5.50	5.30	14.91
San Mateo	14.22	0.20	14.00
Santay	6.31	14.63	10.39
Vuelta Larga	3.35	10.61	13.70
Yaguachi	0.40	15.64	12.23
Santa Rosa	2.97	6.70	17.30
San José	6.61	15.40	11.90
Vera	5.60	13.73	13.30
Cacique	2.39	14.11	12.97
Quijíje	3.90	13.40	11.20
El Local	1.60	7.10	16.79
Iguano Macho	2.70	9.20	16.06
La Cepa	1.74	7.49	19.18

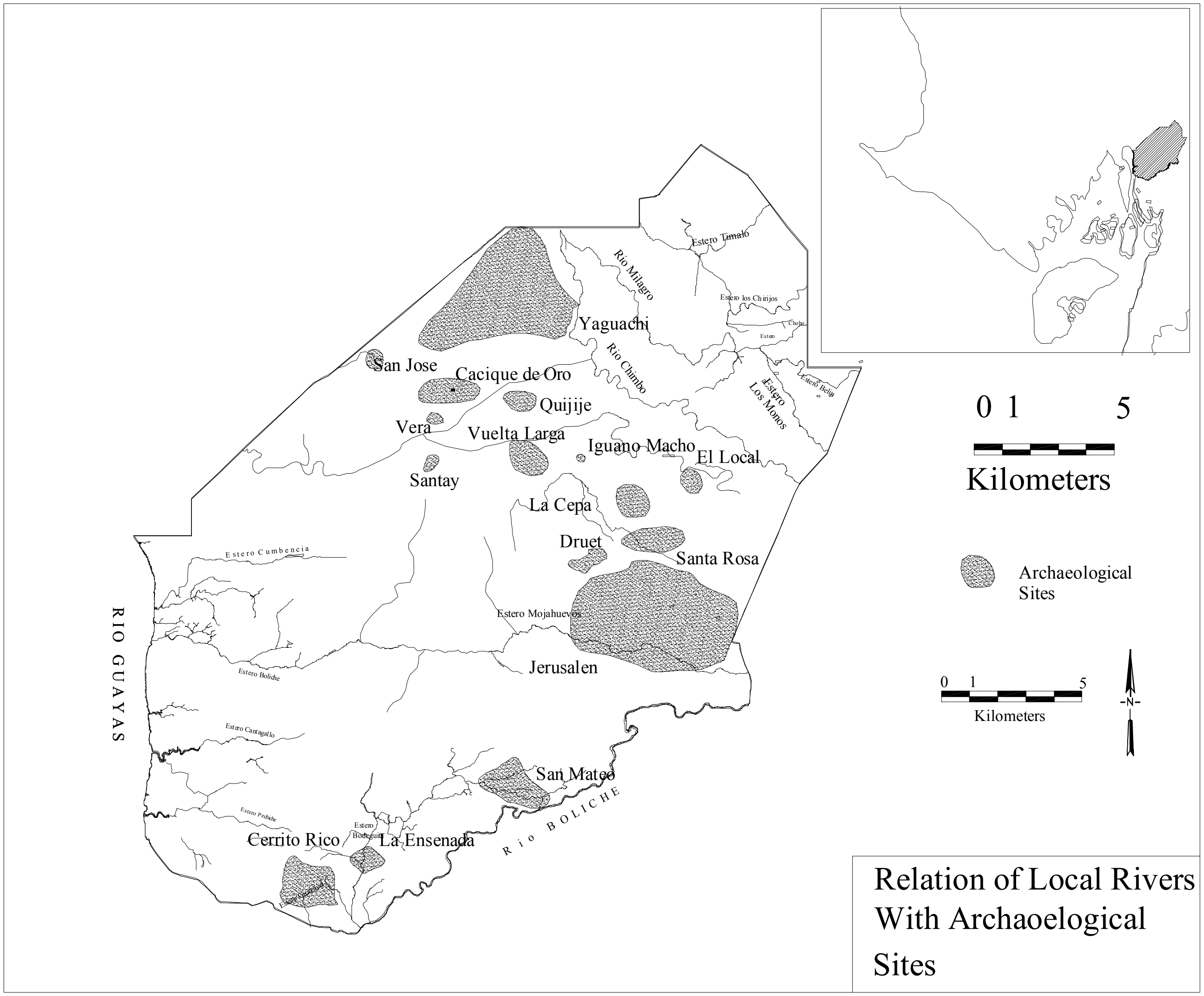


Figure 15 Distribution of Sites in Relation to the Local River Network

Summary

In summary, site definition is not clear-cut in the region, but various lines of complementary evidence suggest some patterns. Altogether 16 sites were defined in the area with 641 mounds of both public and domestic functions. There is an indication of a three-tier settlement system formed by centers, subcenters and rural villages, with some isolated households in addition. Reconstruction of local demography indicates that about 30,000 to 40,000 people occupied the area. Regional population density is low, but because sites are found clustered, density increases at the settlements. Contrary to what was expected, large centers do not occupy the most fertile lands, but are sometimes on the worst soils. Centers are located close to the main rivers, supporting the assertion that people in the centers were most likely engaged in exchange relations. Rural populations were found in the most fertile lands and farthest away from the main rivers, supporting the idea that these people were detached from river-based interregional exchange, and as expected were settling the most productive soils. Next we will explore raised fields and see what were the relationships between settlements and this system.

C h a p t e r 6

RAISED FIELD TECHNOLOGY

Introduction

Raised field cultivation is a technological development widely used in the process of agricultural intensification. The main characteristic of intensive agriculture is that it provides a much larger output per unit of area than extensive systems. Intensive agriculture is tied to highly sedentary societies since the use of this technology requires long-term activities and it often involves water redistribution.

Raised field systems are composed of elevated surfaces and areas in between that serve as channels where water either is drained or contained (Erickson and Candler 1989). They allow water redistribution and consequently drain water-saturated areas, or in some cases, maintain soil humidity. In highland areas of Ecuador raised fields are usually a water-redistributing system that permits maintenance of soil humidity and at the same time protection from frost. In such environments they function as means of water distribution. Conversely, in most lowland areas, raised fields constitute part of drainage systems in areas subjected to frequent flooding. In the case of the Guayas Basin, the use of raised field technology made possible to drain areas subject to constant flooding. It also functioned to distribute water since maintaining water in channels for some time holds it to fight adverse dry conditions during the dry season. In the area close to the Guayas River, the system seems also to have combated the salinity from seawater in the Guayaquil Gulf.

Raised Field Taxonomy

Geographers working with raised fields have proposed various taxonomies to identify these features across the landscapes where they occur. Denevan (1982) and Denevan and Turner (1974) offered a classification placing emphasis on overall field patterning: combed, checkerboard and ladder patterns. Denevan and Turner (1974) also presented a three-way typology: *caño*, checkerboard, and clustering of loosely parallel ridges.

Caño types were found associated with oxbow lakes in the Venezuelan Llanos (Gasson 1998), Zucchi 1979) and Colombia's San Jorge area (Parsons and Shlemon1982, Plazas 1987). Checkerboard patterns are found in high altitude regions, such as the Peruvian–Bolivian Altiplano (Erickson 1989,1993) and the Sabana de Bogotá region (Broadbent 1987). Erickson (1989), found three patterns in the Huata area of the Peruvian Altiplano: open checkerboard, riverine, and irregular, embanked and linear. Clustering of loosely parallel ridges are found in lower areas such as Llano de Mojos (Denevan 1966, Walker 1999) Pulltrouser Swamp (Turner 1983b), and the Guayas Basin (Denevan et al. 1985). The list goes on and classification depending of patterning is very diverse (Denevan 2001).

Mathewson (1983:841), in an effort to provide a more specific taxonomy, indicates that raised field forms patterns both in aggregate and individual, and mentions that those aggregated and individually forms seem to have a degree of association with distinct biotopes in different parts of the New World. He places raised field taxonomy within a biotope classification formed by riverine, swamp, marsh, savanna and lacustrine environs. Furthermore, he views riverine biotopes as places where permanent house gardens cultivation first developed. He classified the Guayas Basin's raised fields in the swamp biotope.

Raised fields in the Guayas Basin went unnoticed for a long time. It was not until James Parsons (1969), while landing at Guayaquil airport identified them in nearby Durán that they become the focus of attention. After noticing them, Parsons cleaned channel cuts and collected a sample of pottery corresponding to the early Formative Valdivia phase. On this basis, he reported that raised fields in Durán might be the earliest found in the New World. Its association with Valdivia pottery brought general attention, and although the accuracy of this early date has been questioned on the grounds of unclear contextual association, his work prompted sudden interest in the area which resulted on a number of important contributions dealing with local raised field technology (Alvarez 1984, 1989, Buys 1987, , Martínez 1987, Mathewson 1987a, 1987b, Stemper 1993).

One of those contributions was the first systematic work conducted by Mathewson (Mathewson 1987a, 1992) in the area of Samborondón, near Guayaquil. Although raised field technology was the focus of that study, limited archaeological data was used to draw conclusions about possible links (Mathewson 1987b). Perhaps Mathewson's most important contribution is that in addition to studying raised field technology around Samborondón, he mapped most of the raised fields spread over the larger Guayas Basin (Mathewson 1987a) and in collaboration with Denevan and Witthen classified them into nine zones or raised field complexes (Denevan et al. 1985). Of those nine complexes, four: the Bulu-Bulu, Chilintomo, Peñón del Río (Durán) and Taura are located in the Lower Basin (Table 14). He claimed that the extent of the raised fields in the Guayas Basin is about 500 km². The area of study of the present research corresponds to a large part of the Taura and some small parts of the Peñón del Río (Durán) complex.

Two other important contributions to our understanding of raised fields in the Guayas Basin are Stemper's study of the Colimes complex near Daule (Stemper 1987, 1993), and research on the Peñón del Río (Durán) complex carried out by members of the Centro de Estudios Arqueológicos y Antropológicos (CEAA) of Escuela Superior Politécnica del Litoral (Alvarez 1984, 1989, Martínez 1987). Both of these studies specifically linked the use of raised field technology to factors of sociopolitical complexity. Stemper concluded that the use of raised field technology was essential to securing to the chiefly elite the surpluses that provided them with resources to participate in supraregional trade networks (Stemper 1993). In Peñón del Río, the major archaeological site has been identified as a node for distribution of staple goods from nearby lands to main centers (Muse 1991).

In describing the specific characteristics of the overall Guayas Basin raised field complexes (Table 14), Denevan et al. (1985: 181) stated that the Taura complex (Figure 17) contains medium sized, circular to rectangular platform fields, with some bundles of sub-parallel, linear ridges. Mathewson (1987b: 232) also indicated that Taura fields vary in both size and shape with the majority being circular and nearly circular shape, with sub-parallel shapes also evident. The adjacent Peñón del Río raised field complex, also known as Durán, contains long, linear ridged fields, with general north-south orientations; these raised fields are long linear, some fields are longer than 1 km (Mathewson 1987b: 231).

Since the buffer zone that separates the Taura and Peñón del Río or Durán complexes, correspond to areas of modern habitation where ancient raised fields would be undetectable, we will treat them as just one large complex, separated in modern times by demographic expansion. Further mention of raised fields in this study refers to parts of the Taura and Peñón del Río (Durán) complexes.

Departing from Denevan et al.'s (1985:181) characterization of the Taura and Peñón del Río raised fields, a further classification was made based on the clustering of individual shapes instead of an aggregate patterning. Contrary to what occurs in areas such as the Sabana de Bogotá, Llanos de Mojos or the Lake Titicaca Basin, in the lower Guayas Basin, aggregate patterning of raised fields is impossible to define; instead it is easier and more reliable to identify clustering of individual shapes. Based on this classification, it was possible to define nine clusters containing four raised field categories; these four categories corresponded to two raised field shapes, further classified by size. The four types correspond to small rectangular raised fields, small circular raised fields, large rectangular raised fields and large circular raised fields (Figures 17-20). Definition of raised field zones was based on visual inspection of aerial photographs at large scales. First, pairs of aerial photographs were observed with a stereoscope that permitted three-dimensional views of the area's surface. Larger raised field and large mounds were located in this step. To identify smaller raised fields and mounds, these photographs were scanned, and the images in digital format were enlarged to the maximum extent possible.

Table 14 Distribution of Individual Raised Field Types in the Guayas Basin

Complex	Location	Types
Babahoyo	North edge of the Lower Basin, and middle Basin	Irregular to rectangular platforms with some checkerboard patterns
Bulu-Bulu	East Lower Basin	Apparent ditched fields with little or no raised surface
Colimes	Lower High Basin	Tight checkerboard, parallel platforms within oxbows.
Chilintomo	Northeast of Lower Basin and piedmont	Extremely irregular and regular rectangular platforms, possibly for specialized arboriculture.
Daule	Middle Basin	Irregular to rectangular platforms mostly in abandoned river channels.
Peñón del Río	East Lower Basin	Long linear raised fields with general north-south orientation.
Piedmont	Southern Basin and Andean Piedmont	Irregular to rectangular platforms with some checkerboard patterns.
Samborondón	Middle Basin	Bundles of short, linear ridged fields interspaced with mounds of rectangular platforms.
Taura	Southwest Lower Basin	Medium sized, circular to rectangular platform fields with some bundles of sub-parallel, linear ridges.

Taken from Denevan et al. (1985: 181)

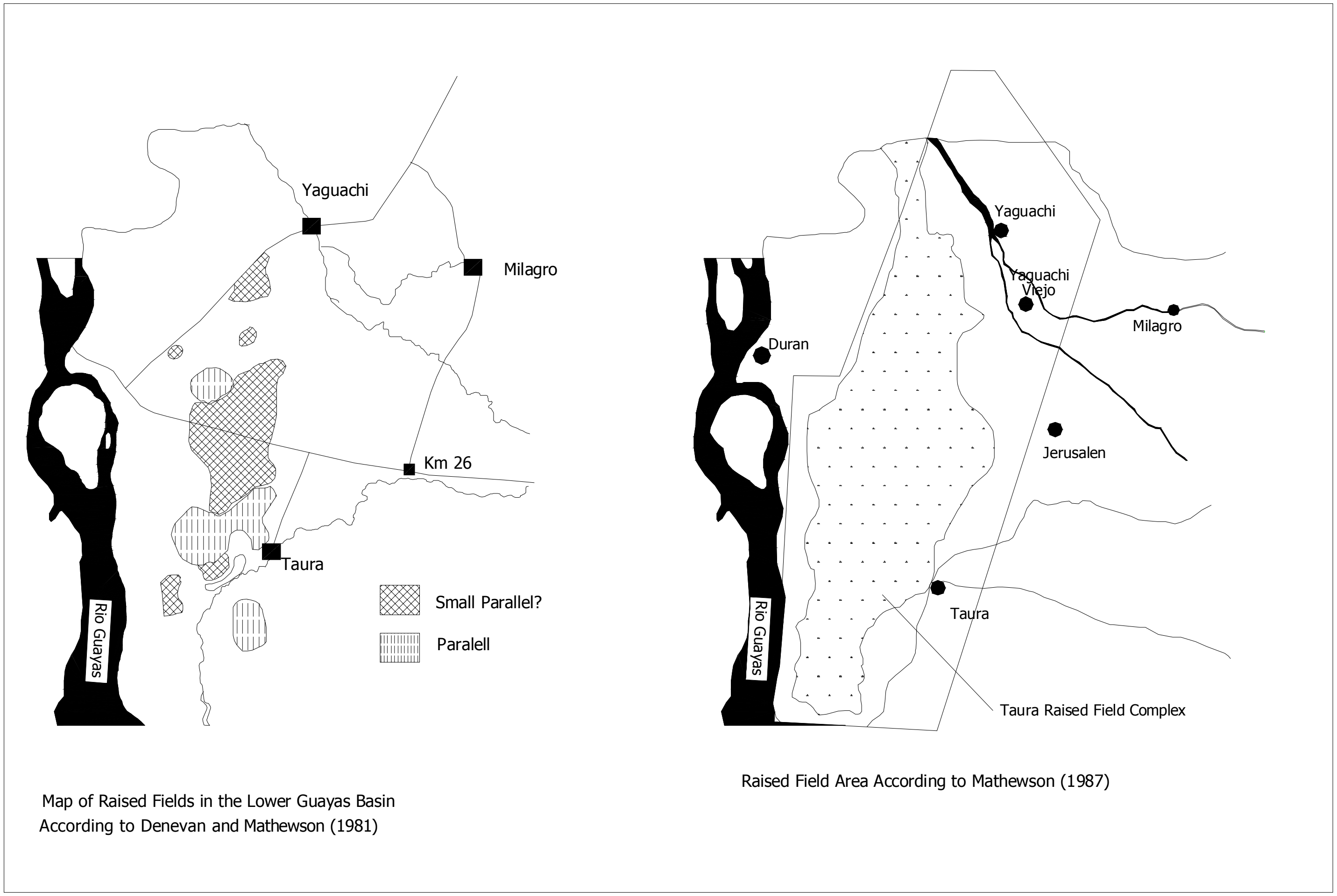


Figure 16 Raised Fields Registered in the Area (According to Denevan et al.1985)

Figure 17 Local Small Rectangular Raised Fields

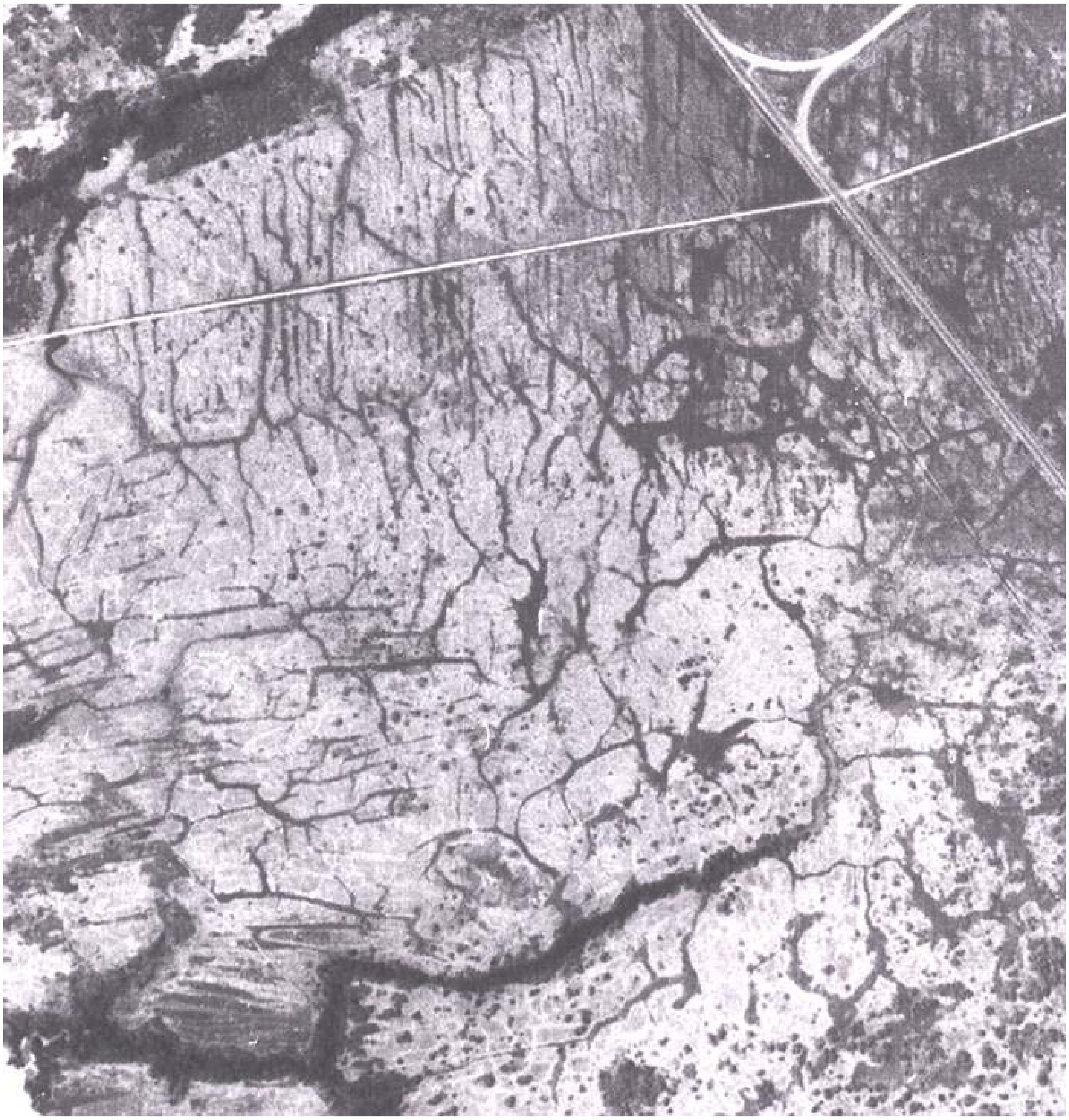


Figure 18 Local Large Rectangular Raised Fields.

Figure 19 Local Large Circular Raised Fields.

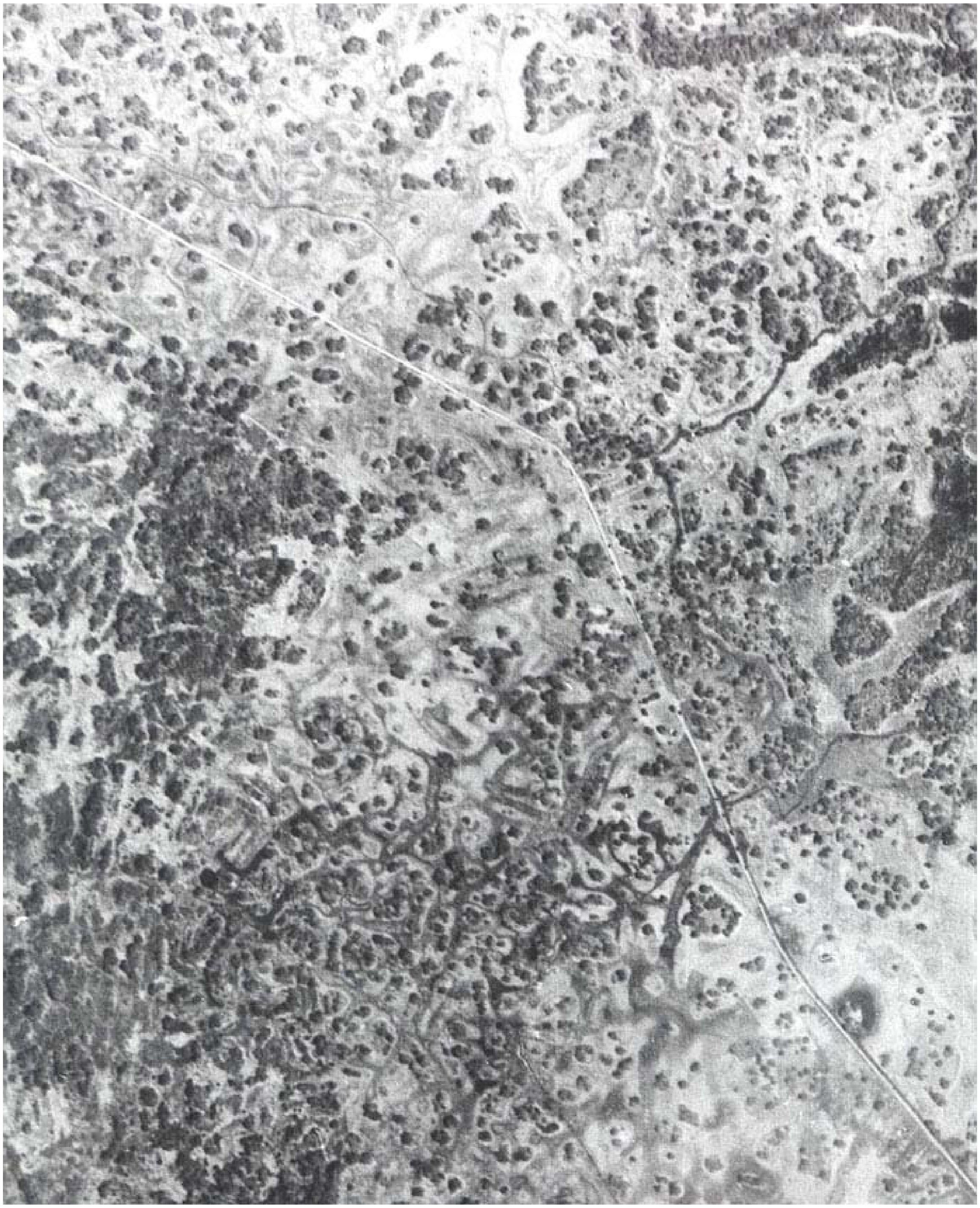


Figure 20 Local Small Rectangular Raised Fields.

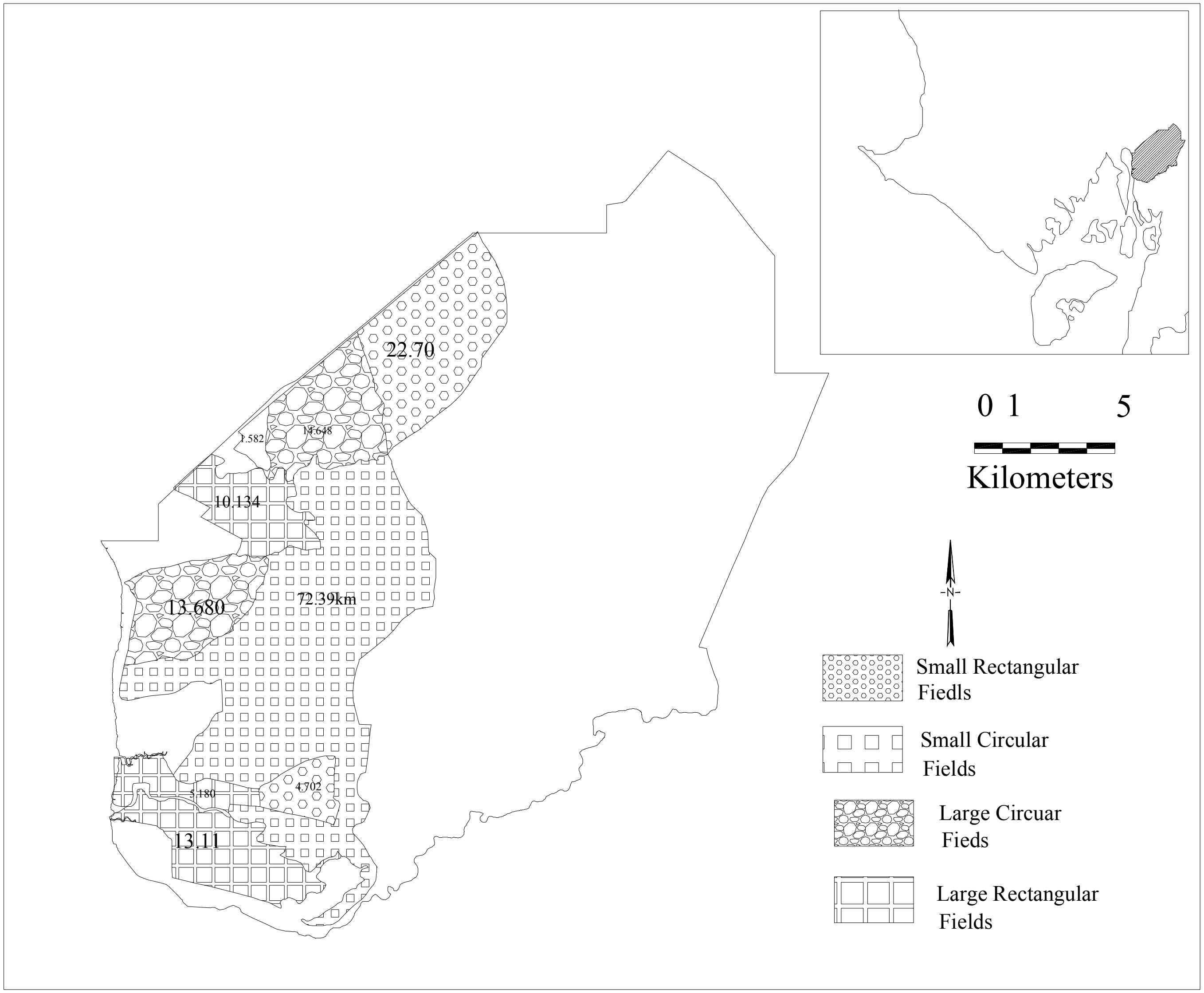


Figure 21 Raised Field Clusters Found in the Study Area

Table 15 Measurements of Circular Raised Fields Sampled

Raised Fields	Area (m²)	Volume (m³)[1]
Small Circular Fields	15	2.50
Small Circular Fields	15	2.50
Small Circular Fields	16	2.67
Small Circular Fields	15	2.50
Small Circular Fields	14	2.33
Small Circular Fields	15	2.50
Small Circular Fields	133	22.17
Small Circular Fields	130	21.67
Small Circular Fields	171	28.50
Small Circular Fields	93	15.50
Small Circular Fields	55	9.17
Large Circular Fields	455	75.83
Large Circular Fields	539	89.83
Large Circular Fields	529	88.17
Large Circular Fields	432	72.00
Large Circular Fields	677	112.83
Large Circular Fields	498	83.00
Large Circular Fields	1124	187.33
Large Circular Fields	462	77.00
Large Circular Fields	404	67.33
Large Circular Fields	732	122.00
Large Circular Fields	730	121.67
Large Circular Fields	885	147.50
Large Circular Fields	488	81.33
Large Circular Fields	482	80.33
Large Circular Fields	1409	234.83
Large Circular Fields	696	116.00
Large Circular Fields	587	97.83

1[1] Volume calculations here are based on 50 cm height, which based on raised field profiles and field observations seem to represent the minimum height of local raised fields.

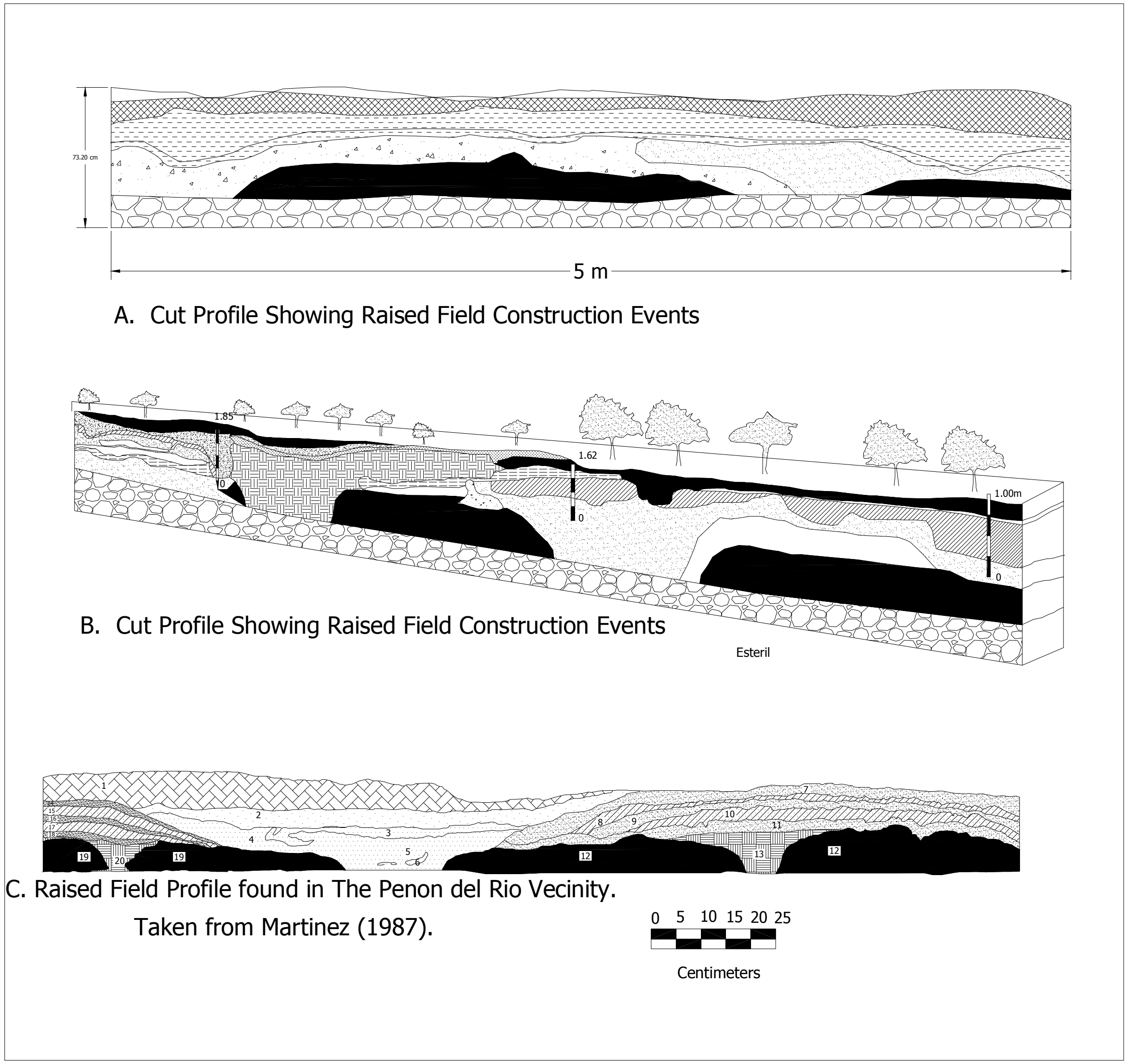
Table 16 Measurements of Small Rectangular Raised Fields.

Length (m)	Width (m)	Area (m^2)	Volume (m^3)	Area not cultivated (m^2)[1]
5	2	10	1.67	8
4	3	13	2.17	10
4	6	24	4.00	13
5	5	26	4.33	26
5	2	11	1.83	13
6	3	17	2.83	12
7	6	44	7.33	16
4	3	14	2.33	12
4	4	15	2.50	12
4	4	18	3.00	12
4	2	8	1.33	15
5	3	16	2.67	22
4	4	15	2.50	18
3	3	10	1.67	6
3	1	4	0.67	5
2	2	3	0.50	14
2	2	4	0.67	9
7	4	28	4.67	7
6	3	18	3.00	22
4	5	24	4.00	19
5	5	27	4.50	20
4	2	7	1.17	12
6	3	16	2.67	4
7	3	18	3.00	13
9	2	18	3.00	8
7	2	13	2.17	18
8	2	16	2.67	10
6	3	19	3.17	12
4	3	12	2.00	13

1] Area not cultivated represents the area between raised fields, in other words it corresponds to channels

Table 17 Measurements of Large Rectangular Raised Fields.

Length (m)	Width (m)	Area (m^2)	Volume (m^3)[1]	No cultivated area
52	3	156	26	88
86	5	387	65	89
92	4	357	60	48
26	4	112	19	52
33	6	201	34	69
31	6	177	30	58
29	8	239	40	63
46	4	201	34	89
38	10	384	64	99
22	4	92	15	49
33	4	128	21	71
18	6	113	19	32
44	6	282	47	88
86	8	714	119	120
19	7	141	24	57
25	8	188	31	72
28	4	98	16	95
33	6	210	35	71
39	7	268	45	78
42	8	344	57	88
66	5	350	58	182
72	4	295	49	99
65	2	137	23	126
54	4	211	35	123
58	3	151	25	72
36	2	83	14	88
28	3	81	14	32
73	5	358	60	88
76	4	301	50	98



A. Cut Profile Showing Raised Field Construction Events

B. Cut Profile Showing Raised Field Construction Events

C. Raised Field Profile found in The Penon del Rio Vecinity.
Taken from Martinez (1987).

Figure 22 Profiles of Local Raised Fields

For purposes of getting a more accurate picture of raised field distribution, the earliest photographs that could be found were sought, since those give more accurate estimates of the area covered by raised fields prior to late destruction.

Raised Field Patterning and Distribution

Distribution in Relation to Soils

In large parts of the study area, soils are not very well suited for agriculture in their natural state, instead they need artificial drainage to be able to sustain agricultural production. This makes it possible to argue that pre-Columbian inhabitants of the lower Guayas Basin engaged in raised field construction seeking to "artificially treat" the vertic soils lacking drainage to transform them into agriculturally productive fields. In confirmation of this notion, most raised fields are located over soils affected by water saturation.

Table 18 Area of Raised Fields Found Within Soil Types.

Soil Fertility Type	Area containing Raised Field (km²)	Percentage of Raised Field %
Cg	45.90	25.55
Cgc	25.66	13.87
Cgdv	54.57	29.19
Cg-L	60.17	31.21
LC-dv	0.24	0.13
Total	186.54	100.00

Extent of Raised Field Zones

Production capabilities and labor investment are two important aspects of this research. Reconstructing demography from the archaeological evidence and the amount of labor needed for raised field production helps to define patterns of labor allocation. By defining the amount of production needed to feed the regional population and comparing with production capacity estimates, surplus production can be estimated.

The first task was to measure the area of each raised field in the entire study area, but this proved to be too time consuming. The alternative approach was to sample some areas and measure raised fields corresponding to the four types during the field survey and laboratory processing phases. Length and width of rectangular raised fields and radius of circular raised fields were measured in the field. This was done to determine area and volume of each field, and calculating the area and volume for the samples, obtain projected figures for the total area of raised fields.

Since determining the extent of the total area under cultivation (raised surface) required knowing the ratio between raised surface area (cultivation area) and adjacent zones subject to channeling, field measurements of the adjacent non-cultivated areas were also taken. Areas surrounding rectangular shapes were easily measured in the field (Tables 15-17), but due to their irregular shapes measuring the non-cultivated areas surrounding circular raised fields was impossible. In this case, raised field outlines were drawn on a aerial photograph in digital format and their areas calculated. This was done for areas with various degrees of clustering of circular raised fields so as to get a less skewed group of figures. The ratio of cultivated/adjacent areas was obtained by subtracting the total elevated area, or area under cultivation, from the total area of the photograph where the fields were located. The cultivated area of small rectangular raised fields represents 51.38% of the total area covered by complexes of small rectangular fields. For large rectangular raised fields, this proportion reaches 56.86%. For small circular fields the proportion is 46.31%, while for large circular fields, it is 54.93%. The cultivated area of individual small rectangular fields ranges from a minimum of 3 m^2 to a maximum of 44 m^2, with a mean of 16 m^2. The adjacent area defined as not cultivated ranges from a minimum of 4 m^2 to a maximum of 26 m^2.

For calculating raised field volume, I have used 50 cm for the height. This represents a volume most likely moved at every event, during construction and reconstruction activities. Given that the flooding events in the region raise the water level about 50 cm in some areas, and 1 m in others, 50 cm is a conservative estimate the average height of construction.

Tables 19 to 22 show figures for volume of soil required to raise the cultivated surface by 50 cm. The volume of soil moved to construct the smallest raised fields to 50 cm height ranges from a minimum of 2 m^3 to a maximum of 22 m^3, with a mean of 8 m^3 and a standard deviation of 4 m^3.

Table 19 Measurements of Small Rectangular Raised Fields

	Cultivated (m^2)	Not cultivated (m^2)	Volume (m^3)
N of cases	29	29	29
Minimum	3	4	2
Maximum	44	26	22
Sum	467	383	232
Mean	16	13	8
Standard Dev	9	5	4
Variance	73	29	19

The cultivated area of large rectangular raised fields ranges from a minimum of 81 m^2 to a maximum of 714 m^2 with a mean of 233 m^2. Non-cultivated area ranges from a minimum of 32 m^2 to a maximum of 182 m^2, with a mean of 233 m^2. The volume of soil needed to raise the surface 50 cm in the large rectangular raised fields ranges from 40 m^3 to 357 m^3 and a mean of 116 m^3, with a standard deviation of 67 m^3.

Table 20 Measurements of Large Rectangular Fields.

	Cultivated (m^2)	No cultivated (m^2)	Volume (m^3)
N of cases	29	29	29
Minimum	81	32	40
Maximum	714	182	357
Sum	6756	2384	3378
Mean	233	82	116
Standard Dev	135	31	67
Variance	18189	953	4547

The area of cultivation of small circular raised fields ranges from a minimum of 14 m^2 to a maximum of 171 m^2, with a mean of 61 m^2 and a standard deviation of 60 m^2. The smallest circular raised field would have required a volume of 9 m^3 and the largest took approximately 114 m^3. The mean volume is 41 m^3 with a standard deviation of 40 m^3.

Table 21 Measurements of Small Circular Fields.

	Area (m^2)	Volume (m^3)
N of cases	11	11
Minimum	14	9
Maximum	171	114
Range	157	105
Sum	671	449
Mean	61	41
Standard Dev	60	40

The area of large circular raised fields ranges from a minimum of 404 m^2 to a maximum of 1409 m^2 with a mean of 655 m^2, and standard deviation of 269 m^2. To produce a build up of 50 cm in the smallest of the large circular raised fields required about 269 m^3, and the largest required 940 m^3. The mean volume required for these groups was 437 m^3 a standard deviation of 180 m^3.

Table 22 Measurements of Large Circular Raised Fields.

	Area (m^2)	Volume (m^3)
N of cases	17	17
Minimum	404	269
Maximum	1409	940
Range	1005	670
Sum	11129	7421
Mean	655	437
Standard Dev	629	180

Table 23 provides measurements of aggregate areas and volumes of local raised fields corresponding to the total of each individual form. The first column indicates the four types of individual raised field forms. The second column indicates the area in which each individual form cluster is found. The third column indicates the proportion of cultivated area, which, as explained before, was obtained from the difference between the area of the raised field elevated surface, and the adjacent areas subject to channeling. The fourth column is the area of elevated surface obtained from this proportion. Finally, the last column refers to the volume of earth involved in elevating raised fields by 50 cm.

The results indicate that small rectangular raised fields represent by far the largest zone with an area of 89.56 km², of which approximately 46.15 km² were elevated surface under cultivation. Large rectangular raised fields cover 28.12 km², and a total cultivated surface for this type was 16.04 km². Small circular raised fields cover an area of 40.04 km² and their elevated surface is 18.54 km². Large circular raised fields are distributed in an area of 28.21 km of which approximately 55 % corresponds to the area subject to cultivation. The total raised field area corresponded to 186.5 km², while the cultivated area corresponds to 96.8 km². On average 52% of the total raised field area corresponds to elevated surface under cultivation. These percentages are higher than the 20% estimated by Denevan and Mathewson (1985). They are also higher than figures presented by Knapp and Denevan (1985) for the northern Ecuadorian highlands. One explanation is that this area appears to have the highest raised field density of the entire Guayas Basin and higher than the northern highlands.

Table 23 Measurements of Raised Fields in the Study Area

	Total Area (km^2)	Cultivation %	Cultivated Surface (m^2)	Volume (m^3)
Large Circular Fields	28.73	55	15,780,000	7,890,000
Large Rectangular Fields	28.21	57	16,040,000	8,020,000
Small Circular Fields	40.04	46	18,540,000	9,270,000
Small Rectangular Fields	89.56	51	46,010,000	23,010,000
Total	186.54	52	96,300,008	48,190,000

Labor Estimates

Calculating labor requirements of raised field construction has become standard for studies dealing with the use of raised fields and their relationship to societal complexity. But most studies seek figures for raised field construction only, while raised field maintenance is overlooked. In areas like the lower Guayas Basin, where every flooding event reforms the landscape, initial construction of raised fields and periodic reconstruction events do not differ much in labor requirements. After each flooding event, soils deposited into the channels have to be added onto the raised surfaces, producing constant rebuilding. In almost no time, the labor required for rebuilding surpasses the labor used in first construction.

Various scholars have proposed different indexes of person-days required to build given areas of raised fields (Table 24). They mostly derive from experimental and ethnographical research (Erasmus 1965, Erickson 1989, Mathewson 1987a, Turner 1983a). Measures of aerial extent provide indexes of person-day/m^2 of labor required to construct a given area, while volumetric indexes provide basis to calculate how many person-days are required to add a given volume of soil to any surface. Both aerial indexes and volumetric figures are used here to estimate broadly the amount of labor required to build the area's raised fields; these estimates are summarized in Table 24.

Mathewson's (1987a: 326) experimental work conducted in the nearby Samborondón region indicate that in a 6-hour working day, a person is able to move between 1 and 2 m^3 of soil to an average distance of 10 m . In Mesoamerica, Puleston (1977) indicates that 2.7 m^3 is moved per person per day. Measurements of soil moved by local shrimp farmers are estimated in 1.6 m^3 in a 7-hour workday.[2]

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[2] This index is based on information from participant observation and interviews with local farmers.

In terms of aerial extension, Erickson (1993) indicates that 2,665 m^2 of raised field can be constructed and maintained by a household of five persons in a year.

Table 24 Labor Investment Estimates for Raised Field Construction (Volumetric Figures)

Zone	Amount of Raised Field construction per person per Day	References
Guayas Basin	1m^3 dry, 2m^3 wet	Mathewson (1985), Denevan and Mathewson 1985)
Pulltrouser Swamp	2.7 m^3	Puleston (1977)
Titicaca Basin	 5 person household cultivated 2,665 m^2 per year	Erickson (1993)

Using Mathewson's higher figure of 2 m^3/person-day, raising the total cultivated surface in the study area to a height of 50 cm would have taken approximately 24,095,000 (48,190,000 m^3 / 2) person-days. If we consider the constraints imposed by the local climatic cycle (Mathewson 1987: 326) the optimal time for construction would be about 100 days per year, a time in which soils are neither totally wet nor completely dry. This means in other words that to a working population of about 2,410 persons may have taken approximately 100 years to build the area's fields.

Here we face a new problem, which is that the first year's effort went into building the raised fields, the second year to building new fields and maintaining the ones already built the last year, and during the third year, effort went into building new raised fields and maintaining the ones built during the first and second years. Thus, as time passed the work put into raised fields more than doubled and thus, the estimates need to be much higher than the ones just reported.

Using the population figure of 40,000 for the area (see Chapter 5), we might estimate an available labor force of 8,000. This labor force could construct the study area's raised fields in about 30 years. However, adding building and maintenance together makes labor requirements grow in a geometric progression. These figures only confirm that the task of building and maintaining the raised field required large inputs of labor. Looking at local population, labor is the scarce resource that local authorities must secure in order to optimize production. Scholars have argued that what is seen today is a aggregation of long term building episodes. Population and length of occupation are key variables to consider. But it is also necessary to consider the specific characteristics of particular raised field technology in the Lower Guayas Basin. The estimated working population (see Chapter 6) for the area could have built and maintain only 1/30 of the total raised fields each year. This may well be indicating that not all raised fields were in use at the same time. With the figures provided before, it can be estimated that about 1/30 of the raised fields were in use at the same time.

Erickson's (1993) data on long-term experiments in the Andean Altiplano, observes that 2,666 m^2 of raised fields were built and maintained by a household of 5 working people. Following these estimates in the study area of 186.54 km^2, some 35,000 people would have been required. These numbers fit well with the population estimates of 40,000 people for the area.

Thus we would conclude that perhaps not all raised fields were in use at the same time if we take indexes of the labor force required to construct their volume, but if we take indexes based on the aerial extent of raised fields all of them may have been under cultivation each year.

Table 25 Measurements of Potential Population that could be Supported in the Guayas Basin

Location	Total Area of Raised Fields	Are Cultivated within Raised Fields	Persons that can be supported by production of 1 km² of cultivated area*	Total supported Population*
Guayas Basin	500,000	100 (20%)	1,600 (manioc)	160,000
Guayas Basin	500.000	100 (20%)	1,900 (maize)	190,000
Study Area	186.542	96.38	1,600 (manioc)	154,208
(Yaguachi)	186.542	96.38	1,900 (maize)	183,122
*Based on (Denevan 1982)				

Number of People Raised Field Production Can Support

Table 24 provides figures of the potential population that raised field production could support based on cultivation of maize and manioc. Denevan (1984) estimated the Guayas Basin at 160,000 because the raised fields could support that many people with subsistence based on manioc. There are problems with this estimate given that his calculations of total cultivated area are only 10,000 hectares or 100 km^2 for the entire Basin. But the estimate of cultivated area in the Yaguachi study area alone is about 9,600 hectares (96.38 km^2), very close to what Denevan estimated for the entire Guayas Basin. Using the index of 16 persons per hectare or 0.01 km^2 proposed by Denevan, the study area could support a total population of 153,600 persons on manioc. The archaeological evidence, however, so far does not include the conspicuous pottery items associated with manioc consumption (DeBoer 1996). Local vessel forms discussed in Chapter 5 (see Appendix B) are most likely grain containers, and the adjacent Peñón del Río fields contain maize phytoliths (Pearsall 1987), supporting the idea that the main crop was maize. Using figures based on maize, the area could support a population of 182,400 persons.

Complementary Resources: Fauna

During the flooding season, the channels between raised fields support a large variety of fish and other fresh water resources, which no doubt would have complemented the local diet, resulting increments in the potential supporting population. This addition includes rich protein sources. Results of faunal remains analysis performed by Peter Stahl (Appendix C) indicate the presence of a relatively large proportions of C*helydrea* or t*ortuga mordedora* (snapping turtles), as well as swamp turtles or *tortuga de agua dulce* (*Kinosternon)*, and small numbers of *Bufo* (toad), *Lutra* (water fox) and *cairinia moschata* (domestic duck). These species are mostly found in local *esteros* and they surely inhabited channels surrounding raised fields. Swamp turtles are now found along most channels in the abandoned raised field area. After the flooding season today, most *esteros* and channels contain large amounts of fish, some of which can be captured even by hand as flood waters dry up. Terrestrial fauna such as *Didelphys, Cavia, Tayassu, Manzama, Odocoileus*, *Lama* and *Sylvilagus*, all found in the sample excavated, added an important source of proteins.

Measuring Surplus

Sahlins (1972) notes that before calculating surplus, it is necessary to subtracts for costs of production, which in the case of agricultural production correspond to material used for seeds, and wealth used to obtain labor for the subsequent year. These costs, however, are not easily recognizable as it is difficult to determine production used in consumption, and it is even more difficult to quantify the volume of production exceeding consumption saved for the next productive year. Exerting caution, I will discuss surplus in terms of percentages of the total production.

The estimated population for the area of 40,000 people represents only between 22% to 26% of the population that the raised field system could potentially support either producing maize or manioc. Phrasing this in different way, local population would have been able to consume about 1/4 of the total local potential production. That leaves in the worst of the cases about 70% of that production that may well be used for activities other than subsistence of the local population. Now, even if we assume that out of this 70% at least 40% was used in the production of the next harvesting season, there is about 30% of potential surplus, about the same volume used for local subsistence. This rather high volume would have produced enough incentives to the local chiefly elite to engage in any strategy possible to gain access to such surpluses.

This figure may seem so large as to make it difficult to understand how this surplus could be used without a lot going to waste. External trade might have been involved. Long distance trade may be problematic because of the costs of transportation (Drennan 1986), but the Guayas Basin river network provides efficient transportation and open access, for example, to groups such as the Puná Chiefdom that inhabited the Guayaquil Gulf. Their area is rich in maritime resources, but poor in agricultural production, providing natural "market" for lower Guayas Basin agricultural production. But even considering this case, the production would have been to high for consumption, tribute and trade. The logical explanation is that not all raised fields were cultivated at the same time; perhaps they rested for a fallow period and thus the cultivated area is smaller, as well as the volume produced.

Raised Field Spatial Organization

A wide range of arguments has been made about the social meanings of raised field spatial patterning. Some have argued that raised fields with well-defined spatial patterning are well-planned tasks that more likely were organized and planned by the managerial elites of centralized ancient states (Erickson 1993). The underlying principle of this argument is that the degree of planning indicates or reflects the level of complexity attained by their builders. Another argument is that differences in individual shapes and aggregate patterns may indicate differences in time or the work of different ethnic groups (Erickson 1993). In regard to craft production, top-down administration is argued to result in some degree of standardization, usually reflected in the shapes of produced work. Similarly, the more centralized the construction of raised fields is, the more standardized raised field individual shapes and global patterning may become.

Within the study area, overall raised field patterning is rather chaotic; what we find is some clustering of individual forms. Accepting for the sake of argument at this point that well planned fields indicate central planning, on one hand clear absence of spatial aggregate patterning undermines the argument that raised field construction was organized by strong central authorities, on the other hand, the homogeneity of shapes and sizes of individual fields argues for a top-down administration. We can go further and argue that the correspondence of central planning and top-down administration is much clearly seen in state societies.

If again, for the sake of argument it is accepted that the presence of a variety of raised field sizes and shapes indicates the presence of many distinct ethnic groups, the study area should correspond to a rather homogeneous group. If differences in individual shapes indicate differences in times of construction, then some organized spatial arrangements of aggregate raised fields should emerge in the area. Instead, individual shapes are found clustered in areas that seem more related to the surrounding geomorphological characteristics. In general, terms, the clustering of large rectangular raised fields occurs in areas of major deposition, usually in the confluence of two *esteros* and lower areas. Small rectangular raised fields usually are found in the relatively higher zones. Meanwhile, circular shapes are found in areas that most of the year are under water, and their construction seem to have followed most wetland systems where soil was piled, make islands to win land over the swamp. In this case, the effect was not draining land, but producing buildup to gain ground surface.

Land Ownership

One of the aims of this research was to determine whether productive units such as agricultural communities or households maintained property rights over "defined areas of raised fields," which researchers call plots or pockets. Earle (1998:105) posits that in the case of Hawaii, property rights were shown by individual stones marking boundaries or by lines of rocks dividing raised field areas. As of now, it is impossible to argue for property division markers in the study area. If there ever were physical markers other than natural features, they do not exist now. Raised field clusters are broken into sections by rivers and *esteros*, using these as boundaries is very problematic. The ever-changing watercourses would have made it impossible for people to locate boundaries even from one year to another, not to mention over periods of 10 years or complete generations.

The evidence does not support the idea that individual households were close to the plots they exploited (see Drennan 1988), because the inhabitants lived in large relatively nucleated communities. Neither is there a pattern of location like the one Stone (1996) observed in the Jos plateau where plots become long strips in which people locate at one extreme to afford close contact with neighbors. To the contrary most local agricultural households clustered along the fringes of the raised field area and agricultural workers traveled to their cultivated plots.

The configuration of this pattern seems likely to correspond to a system of communal property or perhaps chiefly elites' domains. Further, the absence of settlements within the raised fields and the large extent of the raised field zones do not support at this point the idea that individual agricultural households independently and autonomously engaged in cultivating the raised field plots. Even more strongly, the pattern fails to support the idea that individual households constructed them independently from local chiefly authorities. Instead, the spatial patterning supports two possible scenarios: one of communal land ownership or land ownership by chiefly elites.

Spatial Relationship Between Settlements and Raised Fields

Up until now, I have presented and discussed the evidence of settlements and raised fields, but the spatial relationship between the two has not been much discussed. This is an essential part in searching for explanations of how labor invested in raised fields was organized. We know that the raised field system required large working parties deployed with certain periodicity. We also know that, as a whole the study area had a population density ranging from 63 to 133 persons per km². We need to establish how this population was located in relation to the raised fields.

Of the 16 settlements defined, seven are located entirely in raised field zones. Two of the five are first tier sites; one is a second tier site and 4 are third tier sites. These sites are Cerrito Rico, La Ensenada, Santay, San José, Quijíje, Vera, and Yaguachi. While most of the sites are found inside raised field zones, two, Santay and Yaguachi are found outside raised fields. Since both Cerrito Rico and La Ensenada seem also to contain the largest proportion of elite dwellings (see Chapter 7), then it seems that most elite households in the area are located in the raised field zones, although that is not the case for households located at Jerusalén. In the northern part of the study area, San José, Vera and Quijíje are located entirely in the raised field zone. About 2% of Santay and approximately 71% of Yaguachi are found inside the area of raised fields. Most of northern sites that locate near or within raised fields correspond to the third tier. This pattern is contrary to that of the southwest region in that villages of agricultural producers do not locate near large centers; they locate bordering the raised field zone giving support to the argument that in this part of the study area, site location was tied more to the location of productive areas than to the location of primary centers.

Another secondary site that is located near but not in raised fields is San Mateo, which is found 700 m from the boundary. San Mateo is not only located close to the raised fields, but also near the major Boliche River, allowing people living at the site to engage in distribution. Vuelta Larga is located 1.8 km from raised fields, although there are apparently partially destroyed fields closer. The other secondary center, Druet is located 3 km from the closest area of raised fields. El Local, Iguano Macho, Santa Rosa, and La Cepa are third tier sites found at considerable distances away. Jerusalén, the other primary center, is found far away from raised fields; the distance between the easternmost boundary of raised field area and the westernmost boundary of the site is 5.6 km, although there was easy access to raised fields provided by the Estero Mojahuevos, which connects this site with the Guayas River. The Cerrito Rico mounds are found mixed with raised fields, which leaves little doubt that the inhabitants of the site used them. This is also the case of La Ensenada, found within the raised fields.

Summary

Overall, the information presented in this chapter indicates that there is no specific spatial patterning dividing the area into individual raised field plots that might be the property of specific households or small communities. This makes it hard to argue for a productive strategy of smallholders providing surplus production to local chiefs by individually managing plots of raised fields. Second, the area subjected to cultivation seems to have been larger than what previous researchers have thought. A closer analysis indicated that the 20% cultivable land defined by Denevan is much higher at least for the study area, even considering fallowing and disuse as Denevan did. As a result, measurements of labor input and demographic calculations are higher than the ones provided by previous researcher. Third, calculations of building, maintaining and cultivating raised fields require close chronological control. Although we have not been able to resolve the issue of exactly when these fields were constructed just yet, construction may well have taken a rather long time. The complete absence of evidence of earlier settlements suggests that their construction could have not started prior to AD 500 to 700.

At this point, the hypothesis derived from this work is that raised field construction started in the Middle and Upper Basin around 1,000 years earlier and most likely expanded to the Lower Guayas Basin during the late Integration Period. Chroniclers of the 16th century do not register raised fields being used. If the occupation in the area is the result of the expansion of Middle Basin groups into the Lower Basin, then we have to argue that raised field construction started at the beginning of the Integration Period since the earliest occupation belongs to that time. In terms of the time that it might have taken to build local raised fields, given the geomorphologic conditions, it is very unlikely that their construction could take a long time. Nevertheless, the archaeological evidence indicates the labor force required would have made this effort a long-term enterprise. Local sites are located within the borders of the raised field zone and several that are not within the border, are close to it, suggesting that the main factor accounting for site location is distance to the raised field zone. Local raised fields generated large outputs that could potentially feed quite large populations. These large outputs provided large food surpluses that could have been used by local elites to engage in self-aggrandizing activities. Finally, these results undermine the idea that individual households were in charge of local raised field production. Their spatial distribution indicates that most households clustered in agricultural villages and around the three local centers instead of living close by the actual plots that they farmed

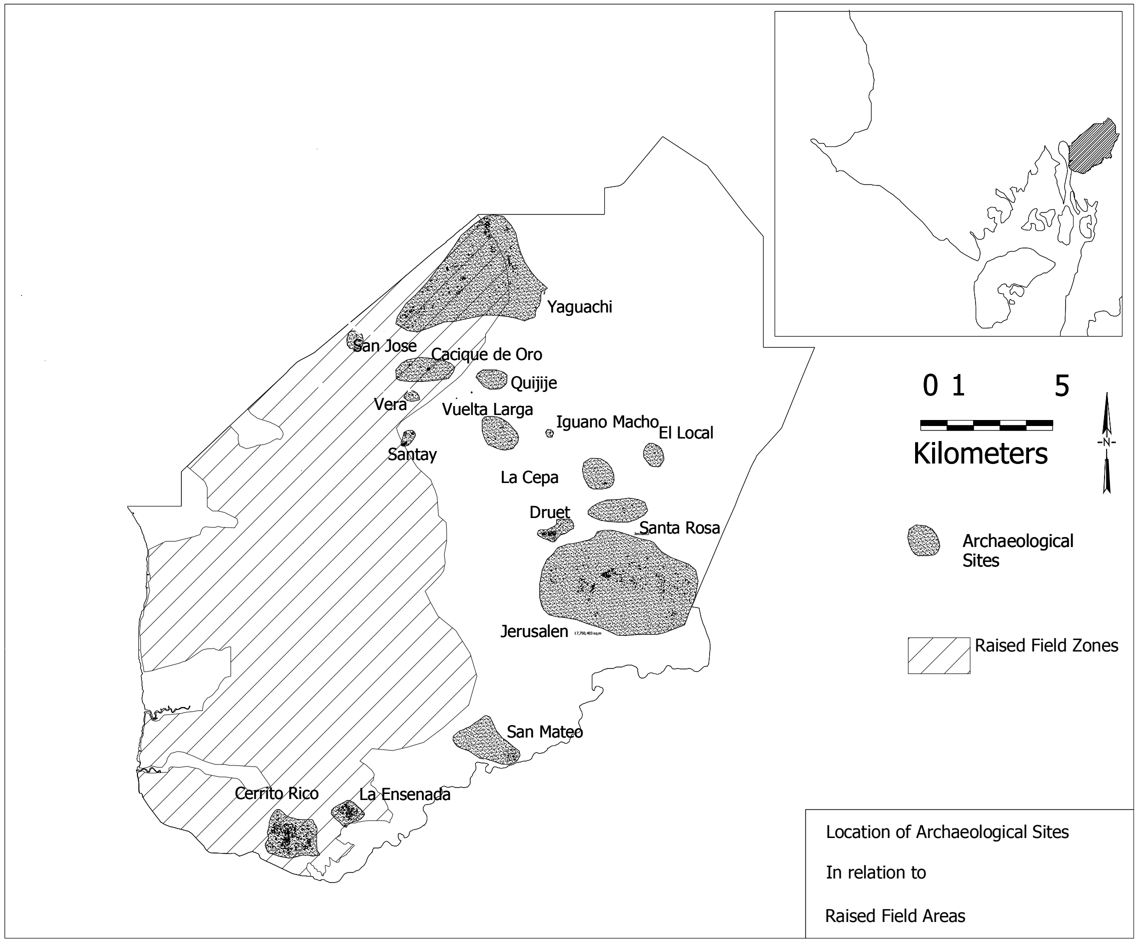


Figure 23 Distribution of Local Sites in Relation to Raised Fields

Chapter 7

COMMUNAL ACTIVITIES, HOUSEHOLD ECONOMY AND SOCIAL STATUS

Up to now we have discussed the evidence from the regional perspective, looking at how at the regional level settlements place themselves in relation to other settlements and to key features of the landscape. At this point there is a need to be more specific and study the same social processes at lower scales, those of the communities and households, since it is in the interplay of these components that social relations are produced and reproduced. A key feature in the current research is the question of labor organization, which needs to be studied through the interplay between the community and households. Studies of labor organization need to look at the deployment of labor in both spheres (Deitler 2001).

For the most part studies of chiefly political economy make a clear distinction between a public and domestic spheres. Sahlins (1972) makes the distinction between domestic modes of production II and I, which represent the domestic and public spheres. In addition, scholars agree that the dynamic of political economies is observed in the interaction of individuals and groups in these two sociopolitical arenas. The key factor for the development of complex political systems is the transformation of domestic labor into communal (Hirth 1993b). This simply means that part of domestic labor (private) becomes alienated and used for communal (public) purposes (Kolb 1994, Pauketat 2000, Sahlins 1972).

Thus, the interaction between public and private is also the interaction between the communal based organization on the one hand and the organization at the level of the household on the other. Consequently it is worth exploring how large or small was the labor allocation that was deployed to activities beyond the household, since through those activities households become engaged in a web of social relations that engages them into a communal arena. By engaging in such relations households end up loosing some of their labor organization autonomy. In the next section, I evaluate both public and domestic activities in order to explain how labor might have been organized in the study area. I will try to show that most of the works were communally oriented instead of focused on the household sphere.

Public sphere

The public sphere is the place where social prestige is acquired and negotiated, economic entrepreneurial activities are developed and ideological systems are created, utilized and reinforced (Blitz 1991, Kolb 1994, Milner 1998, Pauketat 1997b). The community is said to be the smallest unit where the dynamics of the local political economy are manifested. It is at this level that individual activities transcend their immediate household organization. This is also the arena where the dynamics of chiefly economies seem to be manifested and contested.

Rather recently great emphasis has been placed on studying different aspects of social organization at the level of the community (see Yaeger and Canuto 2000). This work is largely focused on social relations of production and distribution, treating communities as the lowest supra-household arena where social production and reproduction takes place. Some confusion exists concerning how a community can be defined archaeologically (Pauketat 2000), since the community can mean either ethnic ascription, or simply a geographically clustered group. A community is a social institution to which people belong to create group identity that might not be expressed at the level of the individual household. And thus, the community involves a series of features that in combination provide a "uniqueness" that expresses group identity (Engels 1972).

Like household studies, community studies have the problem of how the social entity is linked to physical manifestations that can be observed in the archaeological record. Since social production beyond households can be expressed in communal ritual, communal work, and so forth, it is hard to link a community with any particular space. Instead, communal production and reproduction of society takes place in many spheres of interaction and situations. Discussions of just what is the right definition of the community in archaeological perspective will probably keep on developing. For our purposes here, instead of focusing what communities are, it is more profitable to understand what communities do. Clearly there are activities that could have only be carried out with a level of organization beyond the domestic sphere.

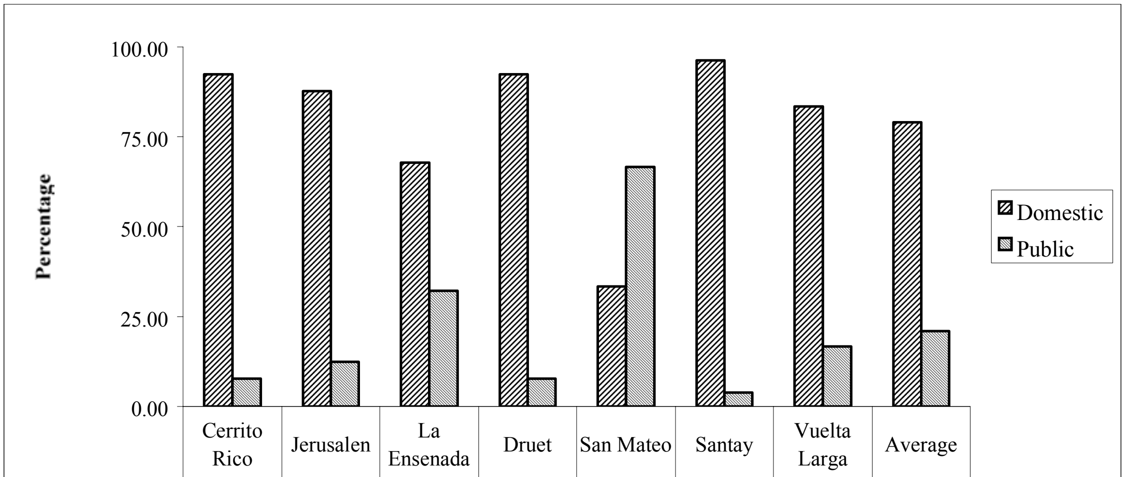
Clearly, it will indeed be hard to identify, quantify and qualify the entire range of public activities that took place at a particular site or region. This holds true for the Yaguachi territory, but we can identify some of the most important social activities that took place in the area and that were developed clearly beyond the domestic sphere. Here we concentrate on activities of public mound building, public burials, and feasting.

Public Mound Building

After close examination, public mounds were defined as those ≥ 2.5 m. These mounds are generally large in size, but most important their top platform is rather small, which makes it unlikely that they supported habitation structures. All of these public mounds are found at primary and secondary centers, and they are absent from third level sites.

As shown in Figure 24, the average ratio of public mounds to domestic dwellings at sites that contain both of those mounds is 20% to 80%. The two largest of the three main centers have a proportion below average. Cerrito Rico has only approximately 8% public mounds, and Jerusalén contains 12%. In La Ensenada, on the other hand, the proportion is about 1/3 of the mounds at the site. At secondary centers, like Druet and Santay, ratios become 8% and 4% respectively, but in Vuelta Larga the proportion increases to 17%. An unusual patterning is observed at San Mateo, where actually the ratio is in favor of construction of public mounds which represent ¼ of those present.

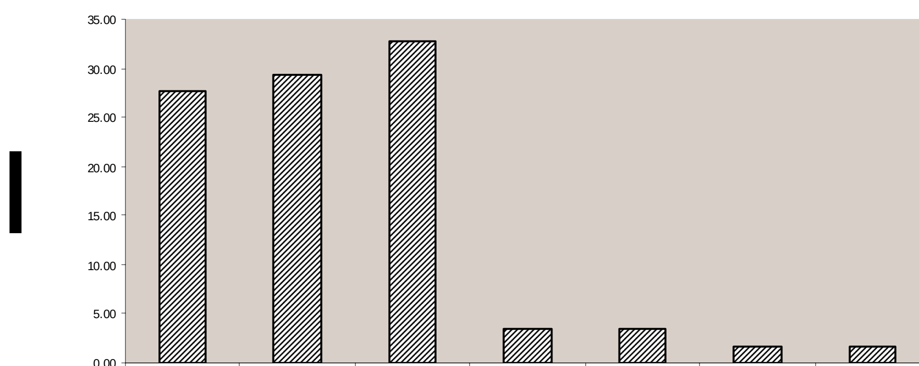
Some of the patterning observed in the proportions in question needs further exploration, but at this point we see that something unusual is occurring at La Ensenada and San Mateo. First a small sample size can provide unreliable proportions. Of all mounds registered in the study area, however, the largest percentage (33%) is found at La Ensenada, followed by Jerusalén with 29% and Cerrito Rico with 27%. As expected second tier settlements had smaller percentages of public mounds, but overall San Mateo only provides 3% of the public mounds in the region, a proportion similar to the other sites in the second tier.



	Cerrito Rico	Jerusalen	La Ensenada	Druet	San Mateo	Santay	Vuelta Larga	Average
Domestic	92.34	87.59	67.80	92.31	33.33	96.15	83.33	78.98
Public	7.66	12.41	32.20	7.69	66.67	3.85	16.67	21.02

Figure 24 Ratio of Domestic and Public Mounds at First and Second Tier

What is observed at La Ensenada indicates that smaller numbers of domestic dwellings were erected at this place, and thus, there is a larger proportion of public construction compared to domestic, than at Cerrito Rico and Jerusalén. Such a situation and the fact that the site contains the only ramped mound in the region could indicate that the site emphasized public activities more than the other two local centers.



	Cerrito Rico	Jerusalen	La Ensenada	Druet	San Mateo	Santay	Vuelta Larga
Public	27.59	29.31	32.76	3.45	3.45	1.72	1.72

Figure 25 Proportions of Public Mounds per Site (I and II Tier Sites).

In the case of San Mateo, it is the secondary site closest to the Boliche River and thus the unusual proportion of public buildings might well be indicating some sort of site specialization on redistribution.

Labor Investments

Turning to the amount of labor needed for moving soil to construct larger public mounds (Erasmus 1965), the total volume of mounds 4 m or higher is 193,652 m^3. Taking an average of 1.5 m^3 of earthmoving per person per day means that 129,101 person-days were required for construction. Erasmus indicates that in chiefdom societies, demands of corvee labor deployed to communal activities are about 45 days a year (Erasmus 1965). Thus, about 2,869 individuals could have built all the public mounds in the study area in one year. The earth moved for high mound construction for public mounds still present in the area could have been done in about three years by working parties of 1000 people. Working parties of 500 people could have built the area's public mounds in about five years. And 287 would have moved this amount of soil in about 10 years.

These are only measurements of earth moving without the actual energy spent in the construction of the mound, which needs to consider the fact that as the mound rises in height, so does the effort to build it. Consequently, increases in mound height must have resulted in a decrease of the index of earth moving in some direct proportion to the mound height. In addition, the dynamic climatic processes with many flooding events must have eroded the mounds' surfaces washing away large parts of the fill each year. Therefore, the amount of labor required would have been larger as part of the fill was constantly washed away.

While with the current state of knowledge of the area and with current methods, it is impossible to reconstruct the amount of labor that went into the construction of public buildings, it is clear that amounts of labor for public construction would have been much higher than calculations based in their volume. This labor requirement is very small compared with the one calculated for constructing and maintaining raised fields. In any case, the construction of mound building represented a large burden to local households. This task the local population performed in addition to providing labor for working at local intensive agricultural systems.

Social Aspects of Mound Construction

Considerable amounts of labor were deployed to public mound building. Large mounds like Mound 1 at Jerusalén and La Ensenada Mound 9 required very large volumes of soil. Calculations of labor indicate that a large working force was used on such constructions. Mound profiles obtained through cleaning of looters' holes at mounds 2 and 3 at Jerusalén lack evidence to indicate that complex activities were carried out at these places. These mound profiles do not present evidence of living floors, or other activities. This fact undermines the idea that such large investments resulted in important activities taking place at those mounds.

Pauketat (2000) indicates that in the case of Cahokia, the function of the mound itself seems less important than the social functions of mound building. In this sense, mound building is seen as providing the possibility to attain and enforce social and community cohesion (also see Pauketat and Emerson 1997a, 1997b). Further, Kolb (1994) maintains that the investment of energy in mound building reflects degrees of community bonding between commoner and elite members through the creation and reinforcement of the dominant ideology.

Drawing on similar lines of thinking, the evidence indicates that large public mound building was carried out at regional centers. Population concentrated around these centers and participated in these public activities, very likely under the management of local elites. Here the Yaguachi elite inhabiting the areas around the centers of Cerrito Rico, Jerusalén and La Ensenada likely should have been able to command a large commoner population to work in mound building. In doing so, chiefs provided "benefits" maintaining the population at work and making them participants in his or her ritually based ceremonies. As in the American Bottom, it is not at all hard to believe that community-based rituals were associated with mound building activities (Pauketat 2000).

Mound building appears to have been the main corporate strategy (Blanton et al. 1996) used by local chiefly elites to emphasize communal integration. This contradicts in part the interpretation that network strategy was key in the political relations among local kin groups (Muse 1991). No doubt, components of network strategies were at play as well, but the evidence of massive public works is largely unmatched with evidence of surplus exchange so as to consider the latter the main fuel for group solidarity and polity compactness.

Feasting Activities

The ethnographic chiefdom literature clearly shows that chiefs use many strategies to obtain labor for public works. Important among these strategies is feasting (Hayden 1995). Hayden (2001) indicates that through feasting, local leaders convey messages of group solidarity. Chiefs' prestige seems to provide the social capital that makes people want to belong to the group close to them. In addition, this provides the context for the sanctification of authority, which goes hand-in-hand with communal ritual activities (Dietler 20001, Kolb 1994).

Dietler (2001) and Hayden (1995, 1996, 1988) indicate the wide range of variability in feasting activities and the multiplicity of functions that feasting has. Porter (2000) argues for the existence of two main types of feasting in small-scale societies, one whose main purpose is to integrate members and the other that is used to differentiating them. While most of what has been discussed in the recent literature dealing with feasting has focused on feasting for differentiation, Porter indicates that feasting is often for “integration”. According to Hayden (1995) we must differentiate feasting activities that occur within groups and between groups, since according to him within group feasting activities help in forming group identity and community cohesion.

It seems that as Drennan (1996) points out local chiefs strive to obtain labor and thus most of their efforts would have been directed towards gathering people around the centers. Consequently, the core of the feasting activities most probably sought to attract local populations towards the centers. In addition, these feasting activities would have been most likely work feasts, in which according to Dietler and Herbich (2001) communal hospitality is used to orchestrate voluntary collective work. Dietler (1996) indicate that work feasting is part of a much larger set of labor mobilization strategies. They indicate that feasting imposes obligations on large groups of people, and through these obligations, hosts recruit labor through these feasting activities, work parties that benefit elites are seen not as corvee labor, but instead as “collective work events.” This provides large benefits to the chiefs, reducing tensions and discontent, resulting in chiefly authority becoming stronger and more easily accepted.

Evidence of Feasting Activities

Communally ritualized activity through feasting most likely occurs in central places (Blitz 1993), where chiefly elites associate themselves with the larger community. Thus, the place to look for feasting activities, public or communally based, would be central places most likely inhabited by local leaders who were in charge of performing those celebrations (Hayden 1996, 2001). Since the argument I am supporting is that feasting was probably the means by which local leaders attracted people, and developed in them a strong sense of community, I would expect both public places such as central plazas and perhaps leaders' dwellings to show conspicuous evidence of feasting.

Here we focus on the core of Jerusalén center formed by the main plaza and central public mounds. Both in the main two plazas and adjacent areas we carried out limited testing. The presence of such central plazas around the main "civic" center by itself may indicate the existence of some kind of public activities, and perhaps communal feasts hosted by local chiefs. Table 26 presents the proportions of decorated vessels occurring at the main plaza, housemound 5 at the core and housemounds at the periphery. The proportions of decorated sherds are highest at Jerusalén's main plaza, and much lower at the housemounds of the core and the periphery. The main plaza also contains the highest proportion of serving vessels, with lower proportions in the housemounds of the core area and still lower proportions in those of the periphery.

Table 26 Comparison of Proportions of Decorated Vessels and Serving Vessels between the Core and Periphery of Jerusalén (95% Confidence Level)

Jerusalén Site	Decorated sherds	Serving vessels
Main Plaza	42.0% ± 1.97%	56.0% ± 1.98
Core	29.0% ± 2.10%	44.0% ± 19.8
Periphery	28.0% ± 1.79%	20.0% ± 1.6

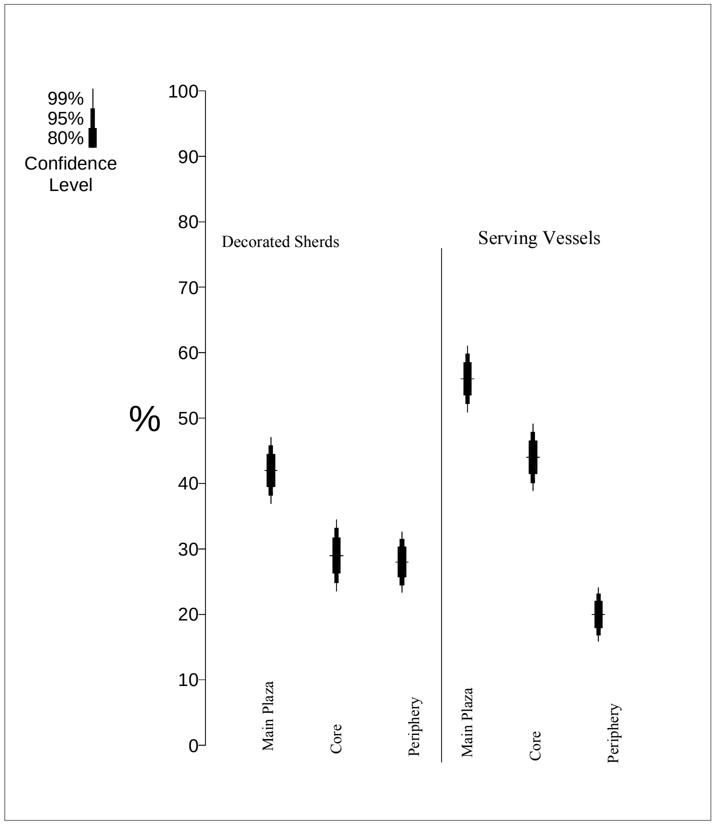


Figure 26 Bullet Graphs Showing Proportions of Decorated Sherds and Serving Vessels at Jerusalén.

b) *Evidence of food consumption*

Feasting activities in general involve the consumption of large quantities of food and a variety of exotic items, some of which are obtained from far way (Dietler 2001, Porter 2000). Porter (2000) indicates that feasting that has the purpose of strengthening communal ties involves the consumption of many ritualized foodstuffs. Food consumption patterns in the Jerusalén core indicate a rather larger variety of animals consumed than those consumed at the periphery. Table 27 shows that all taxa present in either sample were among the remains at the core.

Of interest is the presence of a considerable proportion of *canis* in the overall sample; more specifically these taxa have the largest proportion at the site's core, although this may well be related to sample size. This *canis* were found in direct association to public spaces like the main plaza. We can only suggest at this point that they might have been consumed during ritual events, and /or perhaps ritually sacrificed. Future taphonomic studies should address the issue. Guinea pig (*cavia*) is found only at the core of Jerusalén, this rodent is native to the Andean region, and thus must have been imported to the Lower Guayas Basin. Guinea pig has played an important role in the Andean ritual and even today it is a *status* food item among modern Andean peasants. The other species correspond to both terrestrial and riverine fauna mixed with some other marine items, but overall the proportions are higher at the core of Jerusalén indicating that these sources of meat seem to have played an important role in the feasting activities of the local Jerusalén chiefs.

For comparing differences in diversity between core and periphery, Simpson's index was used. This mathematical tool measures the richness and diversity of the faunal assemblage. Richness refers in this case to the number of taxa present in the collection while diversity indicates the proportions in which each category is present (Leonard and Jones 1989). Simpson's index provides a value from 1 to 0, the transformation 1- L provide a value of 1 for maximum diversity and 0 for the minimum. This was obtained through the formula:

$$L = \frac{\sum (nj - [nj - 1])}{N(N-1)}$$

Where
nj = number of items in a category j and
N= total number of individuals at all categories.

The diversity index of the core is 0.82 and the periphery 0.91. This shows that the faunal assemblage from the periphery of Jerusalén is more diverse than the one at the core. But the in the core taxa such as *Canis, Chelydrea, Odocolileus* and *Kinosternon* are present in larger proportions. On the other hand, *Cavia, Tayassu*, and *Didelphis* are found only at the core. This variety of foodstuffs at the center may well be showing that certain varieties of meat were consumed only at the core of the site, and thus were probably used in feasting activities. Thus, the periphery is more diverse. The core is dominated by three taxa , the periphery contains fewer taxa, but the proportions of the taxa present are more even than the ones at the core and that could be the result that for subsistence there was not much larger preferences for meat consumption.

Table 27 Minimum Number of Individuals (MNI) and Proportions of Assemblage Found at Jerusalén

				MNI									
	Canis	*Cavia*	*Chelydra*	*Odocoileus*	*Tayassu*	*Kinostern*	*Mazama*	*Didelphis*	*Sylvilagus*	*Bufo*	*Cairina*	*Lutra*	Total
Core	4	1	14	14	2	12	1	1	2	1	1	1	54
Periphery	1	0	2	2	0	4	1	0	1	1	1	1	14
Proportions													
	Canis	*Cavia*	*Chelydra*	*Odocoileus*	*Tayassu*	*Kinostern*	*Mazama*	*Didelphis*	*Sylvilagus*	*Bufo*	*Cairina*	*Lutra*	
Core	7	2	26	26	4	22	2	2	4	2	2	2	100
Periphery	1	0	14	14	0	29	7	0	7	7	7	7	100

Burial Activities and Burial Patterning

O'Shea mentions six basic observations that can be made on excavated burial assemblages. First are physical characteristics, of which sex and age are the most conspicuous. Close examination of physical characteristics can help to define demographic patterns and contribute to the identification of pathologies and trauma, and lead to the identification of genetically linked groups. The second observation is preparation, which includes cremation, inhumation posture for articulated burials and patterns of bone disposition. Detailed observation of these features could indicate the presence of "complex" disposal programs, including ritual mutilation, exposure, partial interment, exhumation and reburial. The third aspect is the mortuary facility employed, involving grave shapes, dimensions, orientation and depth, which can be used for measuring energy expenditure (Binford 1971). The fourth type of observation is of the quantity and quality of furnishings, or the material goods associated with the dead. The fifth observation is burial location, and the scale of archaeological analysis, be it regional, site-based, household or individual. And finally, the sixth observation focuses on environmental factors, which can indicate the conditions in which the burial took place.

O'Shea (1984) indicates the need for middle range theories to link certain "types of variability to specific varieties of social behavior." Two of the most important aspects of mortuary variability are the amount of energy expend in burial and the pyramidal distribution of treatments or symbols. The existence of discrete levels of energy expenditure will reflect the existence of corresponding vertical differentiation in the living society (Binford 1971). The pyramidal distribution reflects the fact that "positions of successfully higher social importance are held by progressively smaller number of individuals" (Goldstein 1976)

These observations indicate two aspects or levels of analysis of burial assemblages; one is to infer social structures involving the individuals interred and the other is to study the contexts in which burials took place. Societies buried their dead, either in communal, kin-based cemeteries or in locations near or under the dwelling the deceased lived in (Binford 1971, Ubelaker 1981). Burial location is an important indicator of the social structure of past groups since a public place like a cemetery, where the community by and large bury their dead most likely corresponds to a society with strong sense of community (Gamble et al. 2001). In many societies, burial in the communal sphere would have fostered community cohesion based perhaps on ancestry claims.

With these principles laid out, I will turn the attention to the particular nature of the Milagro-Quevedo burial practices and then concentrate on specific patterns of variation of an assemblage excavated in the context of this research. This analysis will enable us to understand better:

(a) The nature of local variability in Milagro-Quevedo burial practices in the Lower Guayas Basin. Understanding the complexity of the burial program will reveal aspects of both horizontal and vertical ranking[3].

(b) Patterns of distribution wealth goods of local and foreign origins. This will define some aspects of the structuring of local social ranking.

A brief assessment of what is known in regard to burial practices in the Lower Guayas Basin societies indicates the pervasive presence of burial mounds filled with primary and secondary burials. Most sites reported during the fifties and sixties corresponded to mounds containing large numbers of burials (Estrada 1954, Evans 1954, Meggers 1966, Zevallos Menendez 1995), which created the belief that all local mounds contained burials. Three types of

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[3] O´Shea uses horizontal ranking to differentiate with vertical ranking which refers to hierarchical positions individuals have within a social group, horizontal ranking on the other hand refers the position social groups have among themselves, ie. kin groups, moeity,etc.

burials are found in these mounds. One corresponds to deep shaft "chimney" burials; a second corresponds to burial in a single urn; and the third corresponds to grave burial without an urn (Acuña, 1995, Evans 1954, Estrada 1954, Holm 1981, Stemper 1993, Viteri Gamboa 1968, Zevallos Menendez 1995). Chimney burials are deposited inside an urn that is the bottom of a stack of two to ten urns, placed upside down with their bottoms broken out, recalling a chimney (Figures 52-53). Some interments included only a single individual, while others included multiple individuals. Multiple burials have usually been found in urns and chimneys. Some burials were primary, while others were secondary.

Near the Yaguachi study area, at La Elisita, Estrada (1954) reports more than forty burials, of which more than half corresponded to single urn burials. The remaining corresponded to double urn and multiple urn burials (Figure 41). Estrada also reported a square coffin at the center base of the mound, thought to be the burial of a chief. Burial mounds in the vicinity indicate that perhaps each community maintained its own burial mound, and that chimney and urn burial might indicate differences in social status.

Burial practices seem to have occurred only in public areas. We have not found burials associated with housemounds. Thus, we argued that burials were public activities that might have involved complex rituals, which no doubt also contributed to maintaining communal cohesion. The placing of bodies along with others or incorporating secondary burials with primary ones gives some support to the idea that this task was communal rather than being performed by independent households. In addition, the presence of primary and secondary burials and differences in the treatment of the dead is consistent with the notions of ranking. This subject has only received slight attention in the area thus far.

Based on the excavated assemblage of 182 individuals from Vuelta Larga, I will try to provide some understanding of the patterns of burial variability, linking them to aspects of the Yaguachi social structure. Specifically we address two main issues, one concerning with hierarchy (Binford 1971) or ranking and the second dealing with other aspects of social organization (Brown 1971, O'Shea 1984, Peebles and Kus 1977). The former refers to burial variation that might indicate ethnic differences, political segments (moieties), and kin groups. The latter refers to differences of wealth and social status, concurring with Goldstein (1976: 54) that " a person treated differently in death was probably also so treated in life."

The Burial assemblage from Vuelta Larga Mound 1

As noted before, 182 individuals were identified in the VL-T1 excavated assemblage. Of these, 104 (58%) were primary and 76 (42%) were secondary interments. Only 4 burials were found in urns; the remaining 78 were found lying over silty fill from the adjacent area. These low proportions of individuals in urns might be misleading because we suspect that the urns might have contained larger number of individuals undetected because of advanced bone decay. Secondary burials consisted of piles of dismembered individuals, or, in some cases, of a single individual. These secondary burials contain offerings including metal ornaments, such as copper-arsenic alloys, and copper-gold alloys, in large quantities, as well as shell beads and obsidian artifacts.

c) *Primary Burials*

Primary burials were not placed in urns. The total sample of primary burials consists of 104 individuals. This sample was subject to multivariate analysis searching for units of social significance, including social ranking. Variables are body orientation, body position, individual age and sex, and information on offerings (Appendix E).

d) Sexing and Aging

For age determination, key diagnostic features of each skeleton were measured following Buikstra and Ubelaker (1994). Close attention was devoted to teeth, cranium sutures and long bone joints. The same guidelines were followed to determine individual sex where close attention was paid to the pelvis, and within it, the sub-pubic region, the sciatic notch and skull morphology (Buikstra and Ubelaker1994:16). For age, intervals were used: child 0-10 years, subadults (11-18), and adults (18 and over).

The total primary burial sample contained 104 individuals: 10 are children, 10 are sub-adults, 38 are adults and 46 are of unidentified age. These unidentified primary burials for the most part lacked or had badly preserved diagnostic parts for accurate age determination. The sample contains 25 males, 26 females and 53 of unidentified sex. As with age determination, skeletons of unidentified sex usually lacked diagnostic parts, or if not, preservation was so poor that accurate determination of sex was impossible.

e) Body Orientation

Body orientation refers to the direction the upper body points to. Of the sample, 62 burials (58%) were oriented towards the northwest; 6. representing 6% were oriented towards the northeast; 7 (7%) were oriented toward the north; 4 (4%) toward the east; 3 (3%) towards the southeast; and finally 1 (1%) toward the west. The remaining 28 burials, representing about 27% are of undefined orientation.

f) *Body Position*

Of the total sample of primary burials, 59 (57%) were found in an extended position with their faces up, while 5 (5%) were found in extended position with the face down. Only one primary burial was found with legs flexed, while 12 (12%) were found in a supine position. Finally 3 (3%) were found in cubital position.

g) *Sex and Body Orientation*

Of the 60 burials oriented towards the northwest, 18 (29%) are females, 10 (16%) are males and 34 (55%) are undetermined. Of the ones whose sex was determined, the ratio is almost 1:2 meaning that in this sample, females have higher tendency to be oriented towards the northwest. Only one male and two females are oriented toward the east, and only one male is oriented toward the north. One male and one female are oriented towards to the northeast, and one female and one male are oriented towards the southeast.

h) *Age and Body Orientation*

Of the 10 children identified in the sample, 9 (90%) are oriented to the northwest and one (10%) is oriented to the northeast. Sub-adults on the other hand seem to be randomly oriented.

i) *Sex and body position*

Of the burials found in extended position, 7 are males, and 17 are females; one female is found with the face down, while in the same position were found 4 males. In supine position there were 5 males and 3 females.

Offerings

A Word on the Provenience of Local Wealth Goods

With the exception of the pottery, offerings are believed to be foreign goods. In regard to metal, the closest production site is located in the center of the Sicán polity on the north coast of

Peru (Shimada 1985). Muse (1991) suggests that copper-arsenic alloy pre-forms may have been brought from Sicán. In Peñón del Río metallographic analysis indicates that copper-arsenic alloys were made at the site (Sutliff 1989). So far research in the Guayas Basin, and the southwestern coast of Ecuador has not provided any evidence for local metal production. What is certain is that the raw material is not present in the area. Shell beads are another type of foreign material that had to be brought from the sea, where either the Manteño or the Puná Chiefdoms maintained a monopoly on spondylus exploitation and trade (Jijón y Caamaño 1997, Lenz-Volland 1986, Moreno Yánez 1988, Muse 1991, Volland 1995). Three quartz beads were also found, and the only quartz workshop so far reported in Ecuador is located in the southern highlands, in the Paute Valley (Bruhns 1987). Lastly, one obsidian blade was present and associated with a burial, and as already mentioned, its closest source is located in the northern Andean region of the country.

j) Copper-Gold Alloys

One female adult and one male adult were found with two nose rings each of gold-copper alloy. A third male of undefined age was also found with one earring of the same material. The first two were oriented to the northwest, and both were adults (Burial Nos. 78 and 79), while the third one is of undefined orientation (Burial 134).

k) Copper-Arsenic Alloys

Copper-arsenic ornaments and tools are in larger number associated with males, although some females are found with only closed rings. Tweezers, contrary to what was expected were not found associated at all with females; instead, all 26 tweezers found with burials were associated to males. This is also the case with rattles, of which 26 (96%) were found associated with males.

l) *Shell Beads*

Shell beads were associated with both males and females, a larger number of female burials contain shell beads. In terms of age, most burials associated with shell beads are adults; there is a small percentage of subadults as well.

m) *Obsidian Blades and Spindle Whorls*

One male adult was buried with an obsidian blade. One male adult and one female subadult were found with one spindle whorl each; one female of undefined age, but within subadult to adult range was found with three spindle whorls. Of these, the ones found associated to females are not fired, but only sun dried.

In summary, burial practices, indicate that burying the dead was an activity that took place in public space accompanied by ritual. Burial practices were complex, and involved the construction of "chimneys" and the reburial and placement of cadavers in urns. Offerings associated with the burials indicate that goods made of gold and cooper were found mostly with males, and that both adults and subadults were associated with metal goods. This suggests a social system based on hierarchical positions that individuals hold.

The Domestic Sphere

Households House Structures and Housemounds

The household has been said to be the smallest unit of social reproduction (Netting 1993, 1990, Sahlins 1972). It has also been defined as the social unit composed by a group of individuals linked by kinship, co-residence and common activities (Goody 1972). In more economic terms, a household is the minimal unit of labor pooling (Wilk and Rathje 1982). Although a household does not equate to a family, in many cases it corresponds to an extended or nuclear family (Bermman 1994, Wilk 1984, 1988a, 1996, 1997). In this section, I bring households into the analysis to study whether they present variability in terms of wealth. Here I want to explore whether there is evidence that indicates differential access to resources and if that is so, I want to study the factors linked with those household access to wealth.

Household Wealth, Household Activities and Organization

The study of household wealth differences has boomed in recent years, but we still debate what constitutes measurements of wealth in prehispanic times. While, acknowledging the many complex dimensions that household wealth can represent in the archaeological record, most studies agree that social differences among households are closely tied to their access to resources (Sahlins 1972). As in modern times, precolumbian households are ranked based on size, associated wealth, the range of activities and their location within the political system of the larger society their members belong to. Socioeconomic differences among households have been studied by measures of residential architecture, burial disposal, and the ubiquity and quality of artifacts (Smith 1987). These three variables, either alone or grouped, have provided important evidence for understanding social ranking from the household perspective (Hirth 1993b).

Scholars working in areas where house structures are still standing have noticed that one of the clearest indicators of wealth in rural households is residential architecture (Smith 1987). Architecture in some cases is highly displayable and durable and thus is very visible archaeologically (Wilk 1984). It lends itself to measuring in terms of energy expenditure, to identify larger and fancier houses (Hirth 1993b). In areas not endowed with rich and measurable architectural remains, housefloors are important measure of social structure. Even where housefloors are not easily recognizable or studies have not emphasized the exact definition of house floors, the quality and quantity of goods such as decorated pottery or exotic goods have been used to define wealth differences (Hayden and Cannon 1983, Killion 1990, Netting 1990, Widmer and Storey 1993).

Data in households in the northern coast of South America are very poor; only recently have ethnoarchaeological studies on the northern Ecuadorian coast brought attention to some of the dynamics involving rural households (Allum 1997). Most of these studies from which comparative evidence can be drawn indicate that local households consist of individual structures, compared with rural compounds observed in other regions.

Since the material of which Guayas Basin houses were built did not preserve, there is no way of exploring differences in architecture. Materials used in the area seem to have been bamboo and perhaps wood for walls and floors, and large leaves for roofing. In consequence, differences in material were probably not accentuated, and even so, there is no ways to pursue this line of inquire archaeologically.

On the north coast of Ecuador (Medina 1997) indicates that the traditional form of household composition was extended families, and their ideal location was along river banks and near *esteros*. He further indicates that the typical dwelling consisted of a structure resting over four poles with the living floors 4 m above the ground surface. A kitchen and additional rooms can be joined to the main structure (Medina 1997). This form of construction is locally known as *barbacoas* and is used by rural peasants and coastal ethnic groups like Tsachillas and Chachis. For the most part kin-based groups cluster together in the region as with the Tsachillas (Delgado 1997b). Further, early Spanish accounts indicate that the Guayas Basin's mounds accommodated only one or at best a few *barbacoas* (Newson 1995).

House Structures, Housemounds and Households

A household is a "social unit;" materializing that social unit is not straightforward in the sense that correspondence between household and house structure is not always warranted. Many studies of households wrestle with this problem. Some have acknowledged it, but others have simply not addressed the issue. Here I argue that most house structures were built on mounds.

Ethnohistoric information and ethnographic data indicate that for the most part one house structure was built on each mound. Modern local peasants continue building house structures on mounds, and they usually have one main structure with additional ones for kitchen, latrine, and so forth.

Larger mounds can be argued to have supported a larger number of structures. This possibility cannot be denied, but in this case, it is most likely that the extra structures were a product of the expansion of the household, rather than a proliferation on number of households. In the following section, I explore the distributions of (a) proportions of decorated sherds per housemound, (b) proportions of serving vessels of housemounds at each hierarchical level, and (c) housemound area in each tier of the settlement hierarchy. Further, I compare distributions of items such as processing tools, obsidian, and spindle whorls. Finally, I evaluate whether total sherd weight, the proportion of decorated sherds and the proportion of serving vessels correlate with the area of the housemound. At the same time I explore whether households that are located in areas of raised fields show larger variability in terms of housefloor area than the rest.

Proportions of Decorated Sherds per Housemound

In general, wealthier households would have larger proportions of decorated pottery in their ceramic assemblages. This follows from the idea that larger labor investment goes into producing decorated vessels which thus have higher value. Decorated vessels also correspond to fancy ware that either is used on special occasions or shows the degree of which members to these households were well off.

Table 28 presents data on the proportions of decorated sherds per housemound in the area. Comparing these proportions at the tier level, we find that the first tier sites have an average of 29 decorated sherds. It the second tier, the percentage of decorated sherds decreases to 23%, it decreases even more in the third tier households, where the proportion becomes 19%. Thus the proportion of decorated vessels decreases in direct relation to the site position in the settlement hierarchy. As the error ranges illustrated in Figure 27 show, we can have considerable confidence that these differences are not due simply to the vagaries of sampling.

Table 28 Proportions of Decorated Sherds at Local Housemounds Grouped by Tiers

I		II		III	
Sites	%	Sites	%	Sites	%
Cerrito Rico	21	Druet	12	Cacique de Oro	24
Jerusalén	36	San Mateo	26	El Local	30
La Ensenada	32	Santay	31	Iguano Macho	12
Average	**29**	Vuelta Larga	24	La Cepa	25
		Average	**23**	Quijíje	18
				San José	10
				Santa Rosa	19
				Vera	13
				Yaguachi	21
				Average	**19**

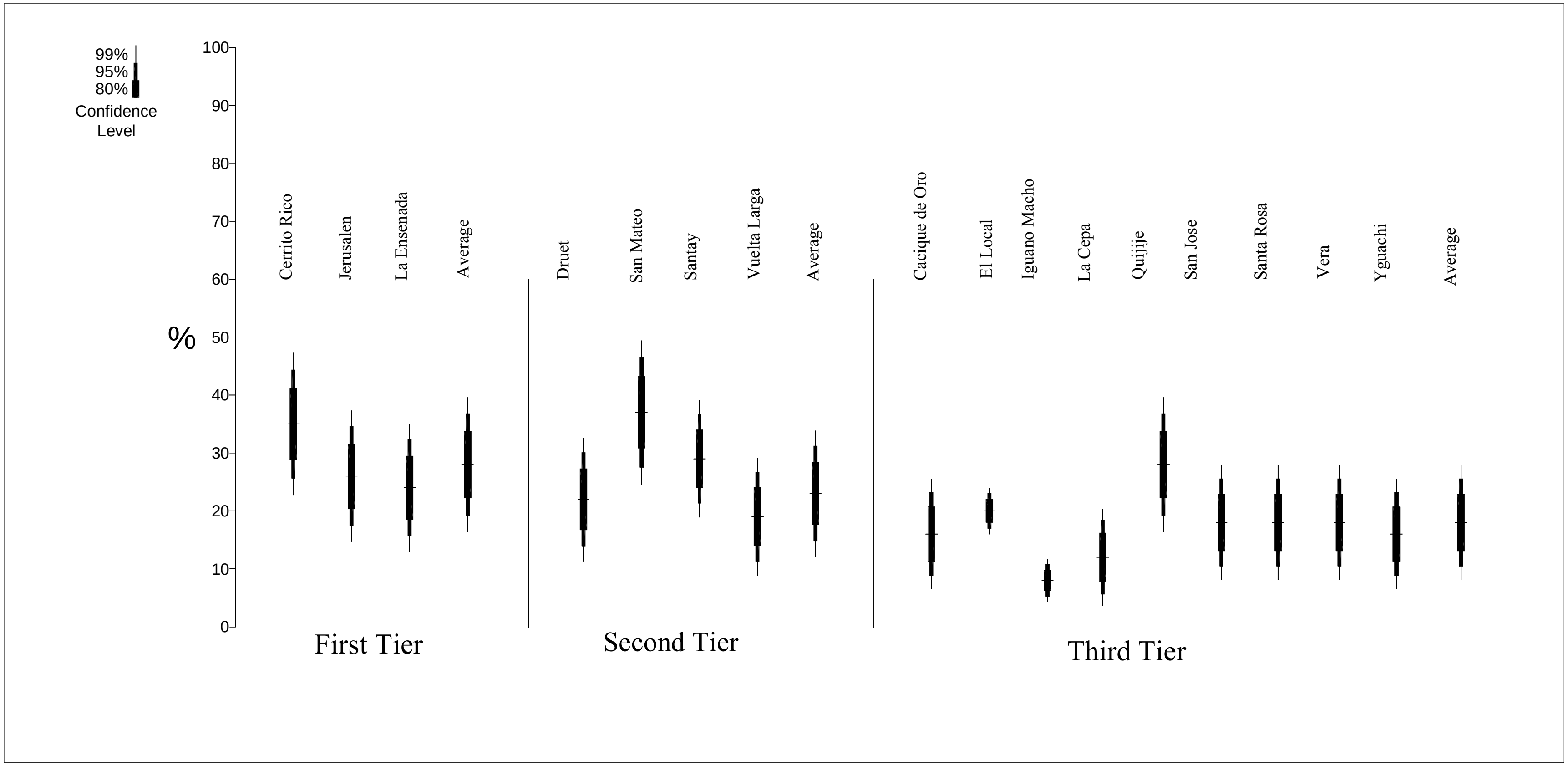

Figure 27 Bullet Graphs of the Proportions of Decorated Sherds Occurring at Local Sites, Grouped by Site Hierarchy.

Serving vs. Cooking Vessels

Among other factors that can indicate wealth, is the proportion of serving to cooking vessels associated with local households. Larger proportions of serving vessels could indicate a household's involvement in feasting and thus wealth and status (Clark and Blake 1994, Hayden 1995). Usually scholars agree that wealthier households contain larger proportions of serving vessels. With such principle in mind the sample of serving vessels associated with housemounds was analyzed.

As Table 29 indicates, among the sites of the first tier, the proportion of serving vessels on average is 28% vs. 72%, for cooking vessels. In the second tier, the average is only 23% serving vessels, and at third tier sites the average is 18% serving vessels. This data supports the idea that at centers serving activities were more frequent, supporting the assertion that wealthier people inhabited regional centers.

Housefloor Space and Housemound Area

As explained previously, access to resources can also be marked by the size of the household. Larger households would have better chances to engage in wider ranges of activities and also accumulate more wealth than smaller households. One could instead, argue that larger housemound areas could also have supported a larger number of structures and thus many households and that size cannot be equated with household wealth. Even in modern times, however, single structures that represent single households appear on separate mounds, regardless of the mound size. When there is more than one structure it generally belongs to the same family and thus members of the same household. Since here we are interested more in households than in structures, it makes more sense to equate housemound size with household size.

Table 29 Proportions of Serving Vessels Associated to the Area's Housemounds

	I		II		III
Sites	%	Sites	%	Sites	%
Cerrito Rico	35	Druet	22	Cacique de Oro	16
Jerusalén	26	San Mateo	37	El local	20
La Ensenada	24	Santay	29	Iguano Macho	8
Average	**28**	Vuelta Larga	19	La Cepa	12
		Average	**23**	Quijíje	28
				San José	18
				Santa Rosa	18
				Vera	18
				Yaguachi	16
				Average	**18**

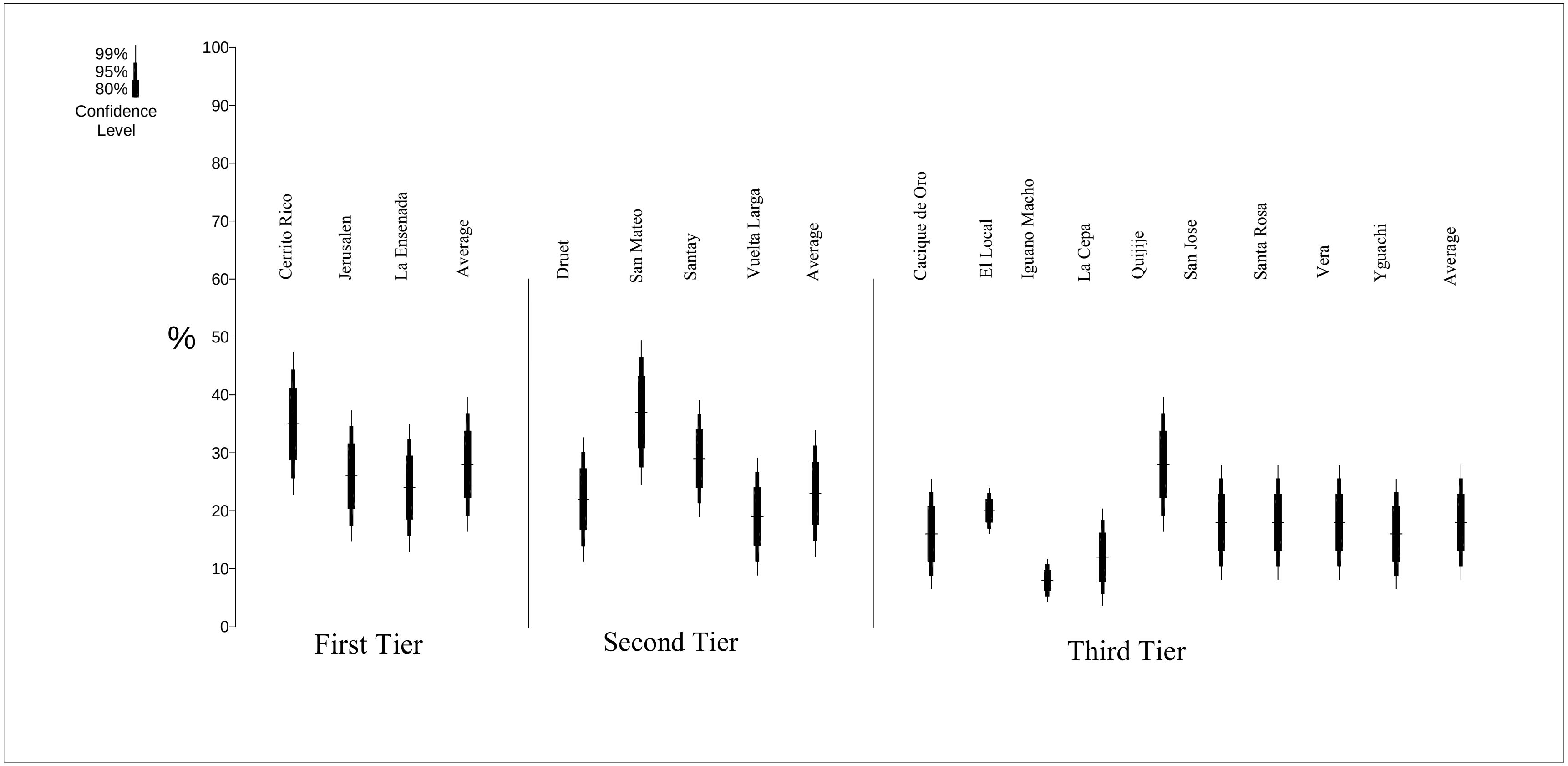

Figure 28 Bullet Graphs of the Proportions of Serving Vessels Found at Each Site and Grouped by Tier.

Figure 29 shows that the range of variation of housemound areas at the first tier sites is larger than the rest. These housemounds also have a large number of outliers. Housemounds located at second tier sites have smaller areas than those found at the first tier sites, they present fewer outliers. At the third tier sites, housemounds are still smaller in comparison with those found at the first and second tier. Thus major variability occurs at the first tier sites, and the least variability occurs at the third tier sites.

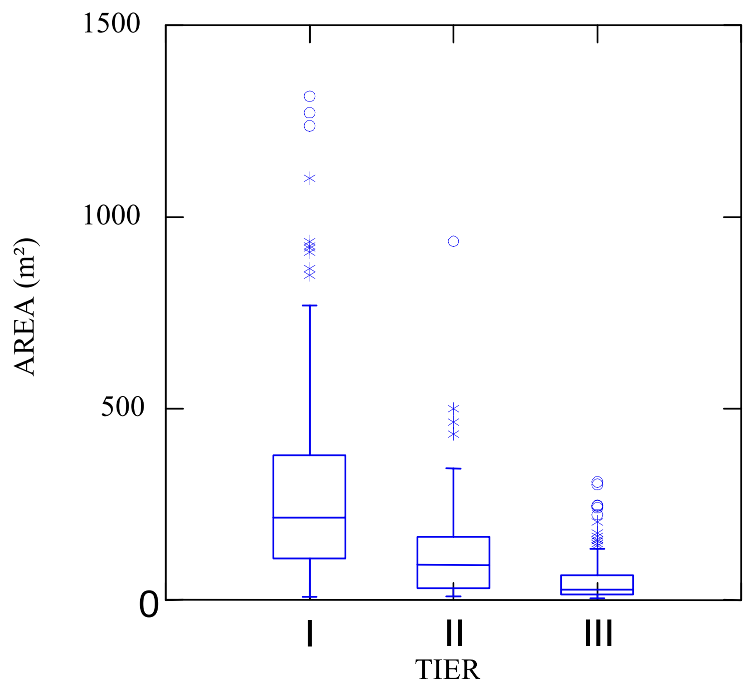

Figure 29 Graph Showing the Range of Variation of Housemounds Area at Each Tier Level

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Relationship between Housemound Area, Weights of Sherds, Proportions of Decorated Sherds and Proportions of Serving Vessels.

In previous sections, we found out that variation in housemound area is related to housemound location within the tier system. Larger housemounds were found at first tier sites, and the smallest at the third tier. Larger proportions of decorated sherds and serving vessels were also found at first tier sites. Here we explore the relationship between those variables.

The scatter plot in Figure 30 shows that there is a correlation between housemound area and the total weight of sherds associated to those housemounds. By the direction of the slope we know that it is a positive correlation; as area increases so does the total sherd weight. This correlation is moderately strong and of very high significance($r=0.592$, $p<0.001$). This is not to say that just that making sherd collections on larger areas will produce larger volume of sherds, because we compared a sample of sherds from equal numbers of shovel tests associated with each housemound.

A positive correlation of similarly moderate strength and very high significance is found between housemound area and the proportion of decorated sherds ($r = 0.62$ $p< 0.0001$). As Figure 31 indicates, as housemound area increases so does the proportion of decorated sherds.

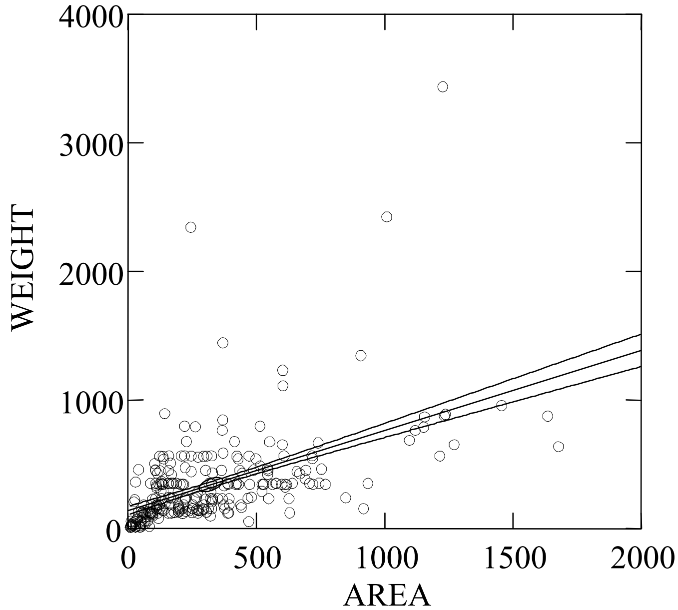

Figure 30 Scatter Plot Measuring Sherd Weight and Housemound Area.

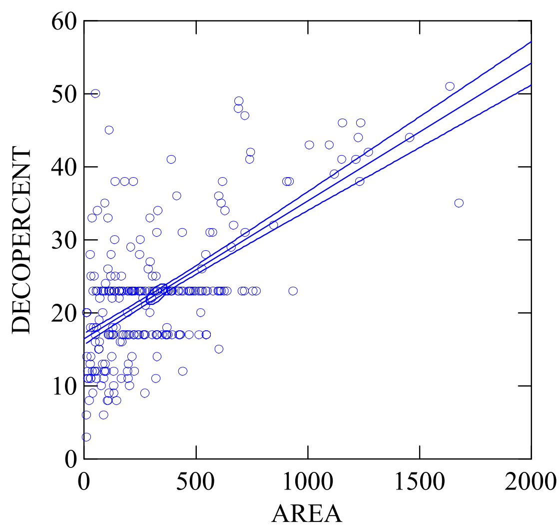

Figure 31 Scatter Plot Showing the Relationship Between Housemound Area and the Proportions of Decorated Sherds

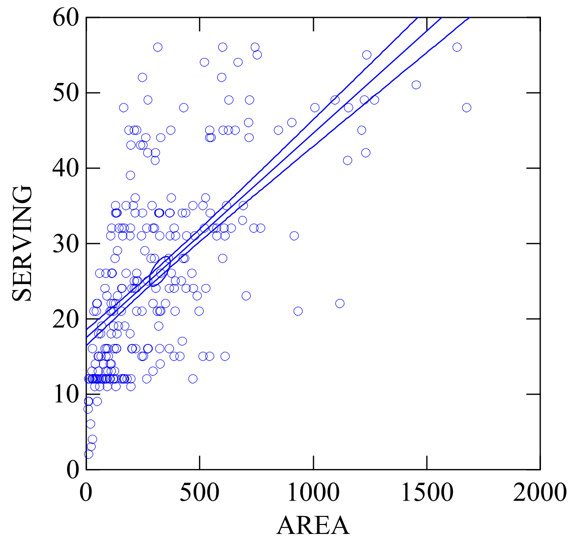

Figure 32 Scatter Plot Showing the Relationship Between Housemound Area and Proportions of Serving Vessels.

Household Location

Table 30 indicates the relationship between housemound and soil quality measured in terms of fertility ranking. No housemounds were found on LCdv soil, which has the highest fertility potential. Of those found on second rank soil, 100% correspond to housemounds at sites in the first tier of the settlement hierarchy. Only 3.6% of the housemounds located on Cg-L soil which ranks third are at first tier sites. On this soil, housemounds at second tier sites are 23.9%, while those at third tier sites make up 72.5%. Of the housemounds located on Cgc soil, that ranks fourth, 100% belong to sites of the first tier. Of housemounds located on Cgdv soil, which ranks fifth, 61.8%, are in sites in the first tier, while 38.2% are at sites of the third tier. Finally, all housemounds located on Cg soil, which ranks lowest on the fertility scale, are at second tier sites.

Table 30 Relation of Housemounds of First, Second and Third tier Sites with Soil Fertility.

a) Frequencies					
Soil Type	Soil Rank	I Tier	II Tier	III Tier	Total
LC'dvCdv	2	91.0	0.0	0.0	91.0
Cg-L	3	8.0	53.0	161.0	222.0
Cgc	4	233.0	0.0	0.0	233.0
Cgdv	5	21.0	0.0	13.0	34.0
Cg	6	0.0	1.0	0.0	1.0
Total		353.0	54.0	174.0	581.0
b) Row Proportions					
Soil Types		I Tier	II Tier	III Tier	Total
LC'dvCdv	2	100.0	0.0	0.0	100.0
Cg-L	3	3.6	23.9	72.5	100.0
Cgc	4	100.0	0.0	0.0	100.0
Cgdv	5	61.8	0.0	38.2	100.0
Cg	6	0.0	100.0	0.0	100.0
Total					
c) Column Proportions					
Soil Types		I Tier	II Tier	III Tier	
LC'dvCdv	2	25.8	0.0	0.0	
Cg-L	3	2.3	98.1	92.5	
Cgc	4	66.0	0.0	0.0	
Cgdv	5	5.9	0.0	7.5	
Cg	6	0.0	1.9	0.0	
Total		100.0	100.0	100.0	

* *No housemounds were found over LCdv, which ranks number 1 in the fertility scale.*

These patterns indicate that, while a considerable proportion of housemound, or households of the first tier sites are located on good soils, the majority of them are found on Cgc soils, which rank in the lower part of the soil fertility scale. Second tier housemounds, on the other hand, are located on or close to soils that rank high. The same is the case for third tier housemounds which are found primarily on Cgl soils, which rank third. First tier housemounds are larger in area, and have higher frequencies of goods indicating wealth, but this concentration of wealth is not related to location on high quality soils.

Housemound Area and Raised Fields

If households living in areas near raised fields were working their own plots independently and their production was their own business, we expected that these housemounds would show greater variability in terms of wealth indicators than those that are not near to raised fields. Housemounds inside raised field zones are much smaller than those found outside While the median housemound area in raised field zones is 78.6 m^2, the median area in the zones with no raised fields is 162 m^2, more than twice the size of the area of the ones found inside raised field zones.

As indicated by the spread of the steam and leaf (Figure 33), the range of variation of housemound areas of those found inside raised field zones is considerably smaller than the ones found outside raised field zones. This contradicts the idea that producers on raised fields had more chances to become wealthier; instead it shows that local producers (those living near raised fields) did not have larger houses. This could support the idea of a top down organization of production.

a) Housemounds In areas of raised fields

Minimum: 12
Lower hinge: 30.1
Median: 78.6
Upper hinge: 169.1
Maximum: 936.5

```
0   000000111111111111111111111111111
0 H 2222222222222222222222233333333333333333
0   444444444444555555555555555
0 M 666666667777777777777
0   8888899999
1   000000000000011
1   2222222223333333333
1   44444455555
1 H 66667777777
1   88999999
2   00111
2   222223
2   44555
2   667777
2   99
3   001
3   2223
3   45
3   7
* * * Outside Values * * *
3   8
4   003345
5   145
```

b) Housemounds outside areas of raised fields

Minimum: 5.2
Lower hinge: 50.8
Median: 162.1
Upper hinge: 370.3
Maximum: 1314.9

```
 0   111111111111111111111111111111111111111111222*
 0 H 5555555556666666666777777888889999999
 1   000001111111112222222333333333333334444444
 1 M 555555666667777899999
 2   00111111122222223333444444
 2   55556666677788899
 3   000000011222222222224
 3 H 556666667777788999
 4   012222223333444
 4   56677788899
 5   112222444
 5   5677799
 6   00001112223
 6   6799
 7   011244
 7   56
 8   4
* * * Outside Values * * *
 8   6
 9   0123
11   0
12   37
13
```

Figure 33 Steam and Leaf Plots of Housemound Areas

Household Activities

Scholars working at the level of the household suggest that wealth differences can also relate to the range of activities in which their members engage. To study activities, I compared the proportions of tools, which can be assigned to particular types of activities. Table 31 shows the frequency of tools found at sites of each level of the hierarchy. Out of all tools found at the first tier sites, about 36% corresponds to food processing tools, while approximately 42% correspond to obsidian tools. Spindle whorls correspond to about 22%. At second tier sites there is a big change; food-processing tools become 87% of the assemblage while the obsidian tool proportion drops to 9%, and the proportion of spindle decreases to 4%. At third tier sites, food-processing tools are almost the entire tool assemblage. Obsidian tools are a fraction of 1% and spindle whorls are absent altogether. As the bullet graph in Figure 34 shows, these differences in proportions are highly significant.

Obsidian tools were used for cutting, drilling, and other tasks involved in craft activities. Perhaps woodworking or, shell and bone crafting were among these crafts. There was clearly much more of such activities at first tier sites than at second and third tier settlements. In many northern Andean societies cloth production was a very important activity and many argue that textiles were items of wealth and important for alliance building (Langebak 1992). Here I take spindle whorls to indicate the presence of cloth production. This activity was also heavily concentrated at the first tier sites. At the other end of the hierarchy, food processing was the overwhelmingly dominant activity at third tier sites.

Table 31 Frequency of Various Tools at Each Hierarchical Level

Tools		I Tier	II Tier	II Tier	Total
Food Processing		54	179	400	633
Obsidian		62	18	1	81
Spindle whorls		33	8	0	41
		149	205	401	755
Column Proportions					
Food Processing		36.24	87.32	99.75	
Obsidian		41.61	8.78	0.25	
Spindle whorls		22.15	3.90	0.00	
Total		100.00	100.00	100.00	

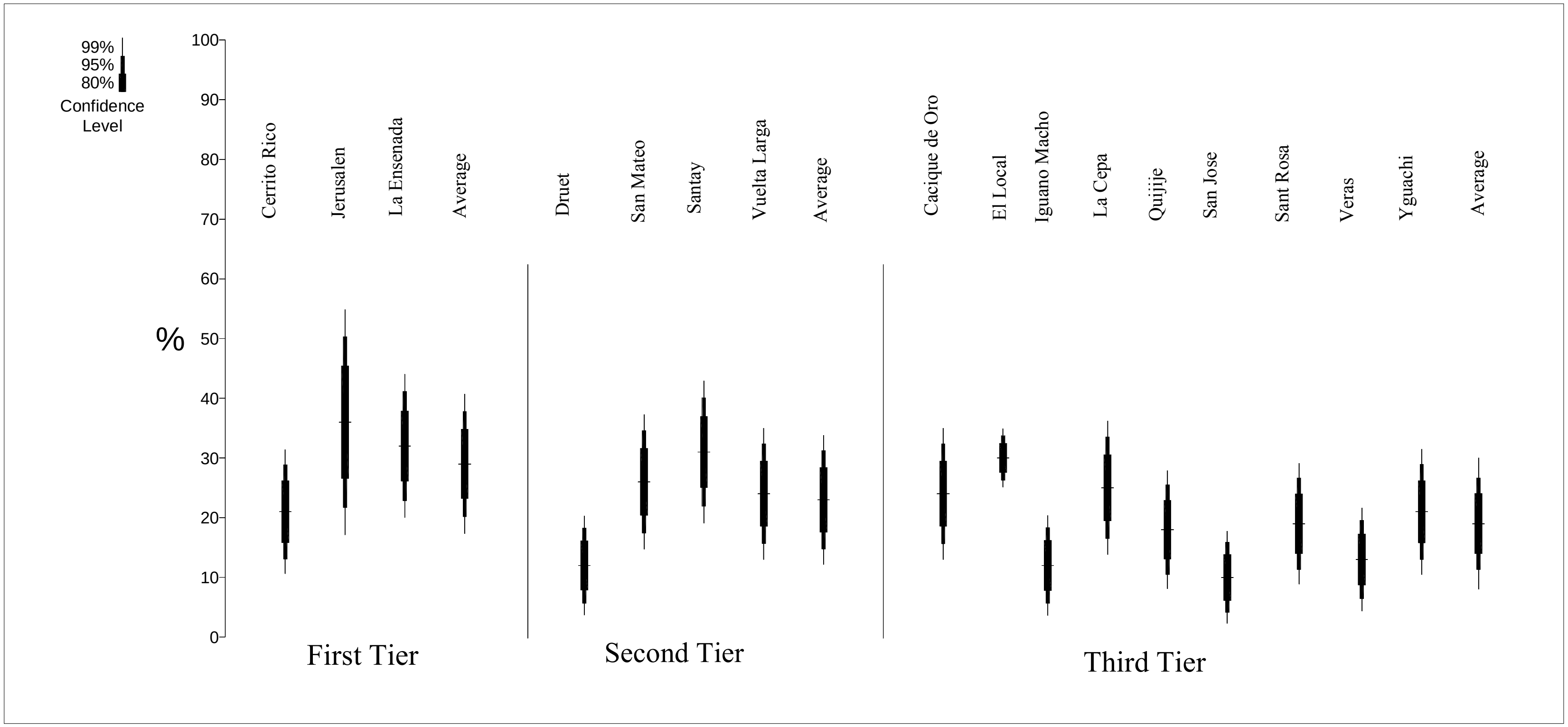

Figure 34 Bullet Graphs Showing the Proportions of Decorated Sherds at Sites Grouped by Tier

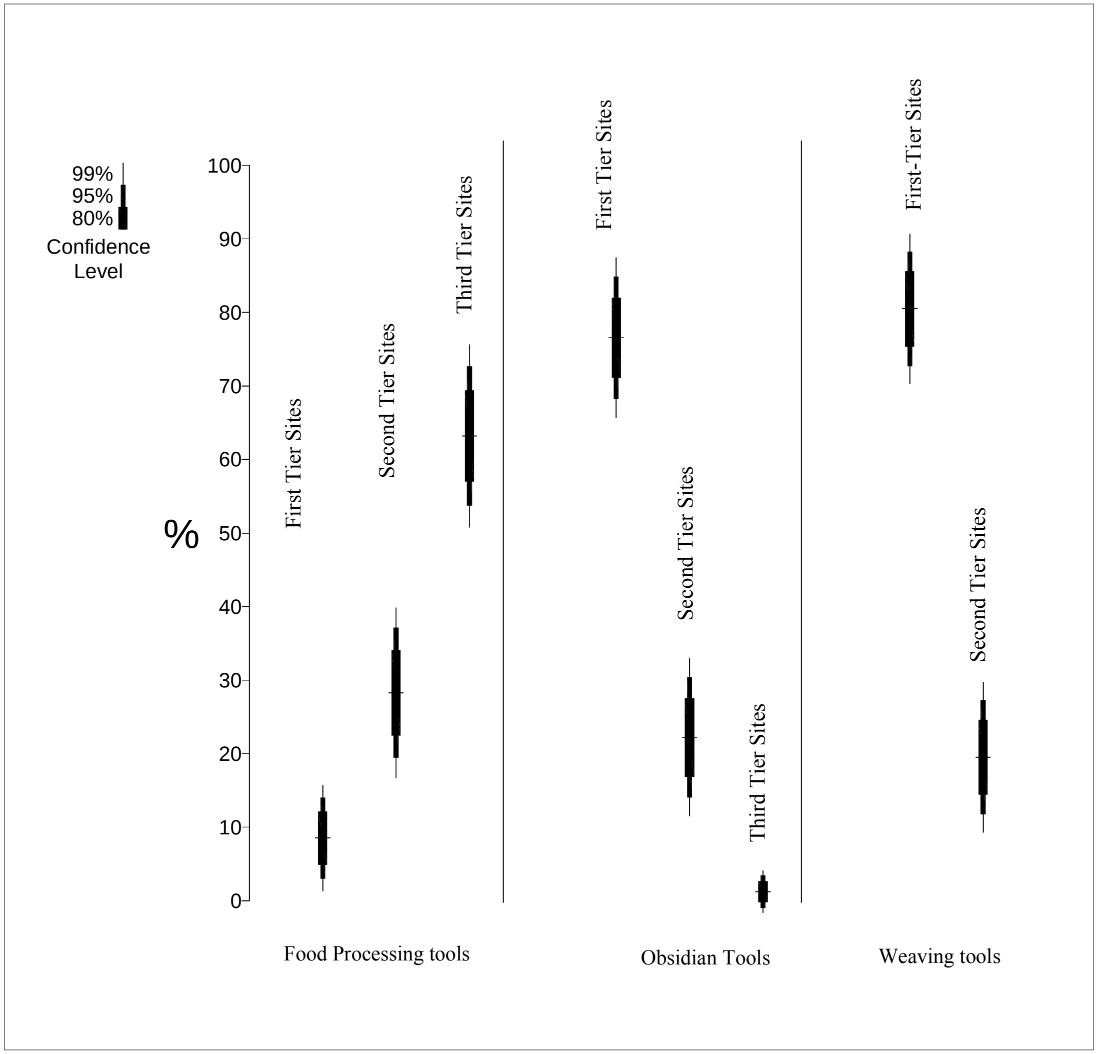

Figure 35 Bullet Graph Indicating the Proportions of Tools in the Material Recovered in the Area

Table 32 shows the distribution of utilized flakes, which represent tools, and non-utilized flakes, in which I have included debitage and pre-forms, and finally nodules. These three categories constitute stages in the production process and thus the presence of the three indicates that at least the last stages of the productive process took place in the study area.

Table 32 Distribution of Obsidian Tools and Unfinished Fragments Associated with Housemounds

Obsidian Distribution				
a. Frequencies (n)	I	II	II	Total
Utilized flakes	62.1	18.0	1.0	81.0
Non Utilized	33.0	2.0	0.0	35.0
Nodules	3.0	3.0	0.0	6.0
Total	98.1	23.0	1.0	
b. Column Proportions				
Utilized flakes	63.3	78.3	100.0	
Non Utilized	33.7	8.7	0.0	
Nodules	3.0	13.0	0.0	
	100	100	100	

There is a larger proportion of tools than of non-utilized flakes and nodules everywhere. That might indicate that only the last stages of production took place locally. It could also indicate that due to the scarcity of raw material, not much was left unused. Comparing the proportions of non-utilized flakes, the larger proportion in the first tier sites indicates that obsidian tool production largely occurred at these sites, and at the other extreme of the site hierarchy (third tier sites), no production seems to have taken place.

Household Variability

The evidence presented here indicates that housemounds found at the first tier sites are the largest of the entire study area. They also contain larger proportions of decorated sherds and serving vessels. As indicated before, I take larger housemounds to correspond to larger households. Based on Netting's claims I argue that the correspondence between larger housemounds and a wider range of activities demonstrates that larger households carried out a wider range of activities. These larger households most likely correspond to the wealthier ones since as Netting (Netting 1993) argues, households become wealthier by expanding their labor pool in order to perform wider range of activities.

Summary

This chapter has focused on sociopolitical organization and domestic economy, by studying evidence related to communal activities and household variability. The evidence from public activities, such as mound building, burial practices and feasting indicates that emphasis was placed at the level of the community. Social organization was apparently characterized by strong communal identity constantly reinforced by local chiefs through ritual activities involving large feasting events. These ritual activities would have worked to the benefit of an elite, but not in as direct a way as Hayden (2001), and Dietler (2001) conceive. Public mound building would also have worked to integrate the community through participation in communal activities that provided direct benefit to the community at large, since local chiefs seem not to have resided on these mounds. Public burial mounds would also have contributed by connecting people with particular places and thus reinforcing the sense of community. The sophisticated local burial program indicates a complex array of structure that needs further analysis, but burial mounds are high enough to be seen by most people, and their presence in everyday life would also have contributed to a strong sense of community. In this way, as Porter (2000) argues, local people might have willingly devoted their labor power to the community. The chief might, of course, have used this willingness of the people to further his/her own interests.

The first tier settlements seem to have been the places where most non-agricultural activities took place. Households close to the main plazas were most likely inhabited by the chiefly elite. This is the case of mound J9, where there is clear evidence of obsidian tool making and cloth production. The small range of variability that materials associated with rural households suggest that agricultural production was organized at the level of the community. The small differences between housemounds located in raised field areas and those far from them indicate that that raised field production had little to do with competition for wealth among commoners. Given the potentially large return that these raised fields have, we expected that households close to the raised field zones might show substantial wealth differences and turned out not to be the case.

Chapter 8

CONCLUSIONS

THE YAGUACHI CHIEFDOM POLITICAL ECONOMY

As stated at the beginning of the text, this research was conducted seeking to understand the characteristics of the local political economy involving agricultural production using raised field technology. The main emphasis was on finding evidence to reconstruct the way in which local labor was organized. This has allowed us to present a model of sociopolitical organization during the late Integration Period in the territory of the ethnohistoric Yaguachi chiefdom. To do this, I explored three main lines of evidence which resulted from analysis at three different scales: the region, the community and the household.

The underlying structure of this research was the contrast between two models of the roles that elites and non-elites have in any complex political system. The top down view assume that levels above that of the household are in charge of managing works such as raised fields, while a bottom up view is the opposite. Such dichotomy provides a heuristic tool for assessing how far in either of the two extremes the organization of raised field production in the Yaguachi chiefdom really was.

Local Cultural Development

Before turning to how the system was organized, it is necessary to consider the local cultural history. This work has not provided evidence for the kind of diachronic study that could help us to understand how complexity arises in the area and what relations raised field production had to it at earlier stages. Results of the survey included no sites earlier than the Late

Integration Period (AD 750-1450), even tough; the methodology applied various strategies to look for earlier sites. While it is impossible to be 100% sure that there are not earlier sites in the surveyed region, we have a high level of confidence that the amount of occupation, if it existed at all, was very small. In nearby Peñón del Río, there is evidence of early Formative occupations (Muse 1991, Zedeño nd). As mentioned in Chapter 3, Gonzáles de Merino (1986) indicates the presence of a Valdivia occupation few kilometers from the eastern boundary of the study area close to the modern town of Milagro. In the study area, however, no such sites have been located.

It seems then, that this area was inhabited only fairly late by expanding populations at the beginning of the Integration Period. In the case of Peñón del Río, the Chorrera occupation might be related to a tradition of sites located along the Babahoyo riverbank. (Evans 1954 1957). This occupation is not seen across the larger area. In nearby Peñón del Río as well, Martínez (1987) claims to have found an association between Regional Development pottery and raised fields. She thus claims that raised fields might have been constructed and used during that Period. The evidence to support that claim seems very small. It seems most likely that Formative Chorrera and Regional Development groups inhabited the shoreline of the Babahoyo River and occasionally wandered into nearby inland regions. Then in the Integration Period, a new cultural tradition expands from the Middle Basin.

To support this claim we can look at the variation in local Integration Period settlements. For instance in the Upper Basin (Guillaume-Gentil 1994, 1996, 1998) the Integration period mounds are the accumulation of construction that started in Late Valdivia times. In the region close to Daule, Stemper, (1993) suggests that raised field use and perhaps mound building started during the Regional Development Period. In the middle Basin, Acuña (1995) showed that

Integration Period burial mounds were the result of a process that started in the Regional Development Period. Further, the ceramic assemblages from the middle and upper basin at least in the late Periods show a wide range of differences such that Estrada (1957b) divided the period into Milagro and Quevedo. All this evidence provides support for the assertion that the cultural tradition studied in the Lower Guayas Basin was formed elsewhere, and that understanding the early stages of the relationship between raised field technology and chiefly formation should be studied in the Middle or Upper Basin.

The Yaguachi Use of Raised Fields

In Chapter 6 I indicated the existence of controversy over when raised field agriculture appears in the area. Since raised fields cannot exist without a population to build and maintain them, we have argued that their construction and use was a late phenomenon. Nevertheless, lets explore once again contrary positions. Marcos (1986) has argued that this technology might have been in use since the Formative based on the Chorrera occupation at Peñón del Río. If that were the case, then we should find many Chorrera communities such as the one at Peñón de Río associated with the large Taura system. As discussed previously, while it is impossible to be absolutely certain that there is no Chorrera occupation at all, our sample allows us to be extremely confident that Chorrera occupation, if existed was tiny. Stemper (1993) suggests the use of raised fields in Daule region starts during the Regional Development period. We are also highly confident that no substantial Regional Development Period occupation occurs in the Yaguachi study area. This evidence allows us to suggest that the Yaguachi chiefdom in the area was the result of the expansion of Milagro-Quevedo groups from the Daule region or elsewhere in the Middle Basin towards the lower, more inundated and less hospitable terrain. These groups succeeded in "conquering the swamp" and as a result this chiefdom became one of the most important in the area. Further analysis of stylistic relationship between Middle and Lower Basin ceramics could help us to define the viability of this hypothesis.

Signatures of Local Organization

In Chapter 2, I presented a series of archaeological expectations derived from the centralized or top-down model and from the household autonomy or bottom-up view. These had to do with the way in which settlements organize themselves on the landscape, and this aspect of the expectations was assessed through a regional analysis. In addition activities at the centers were examined through the analysis of labor allocation in the local community, based on a comparison between core and periphery at the Jerusalén site. At the level of the household I looked for the degree of nucleation, variability in activities at different settlement tiers. In addition, I explored the range of public activities and variability in the burial assemblage.

Settlement Organization

The area contains a site hierarchy composed of three levels with (a) centers, (b) subcenters or secondary sites and (c) third level sites consisting of agricultural villages and isolated households. Three centers occur in the area, and as far as presently available information indicates, they are contemporaneous. They seem linked to each other. Distances between them are within a day's walk, and if we consider traveling by rivers this distance becomes shorter. While Cerrito Rico and La Ensenada are located on the border of the raised field zone, Jerusalén is about 4 km away from them.

The centers are close to the main river systems and thus their location seems to be influenced by accessibility to networks of external exchange. The placement of Cerrito Rico and La Ensenada close to the Guayas River, which is the main connection to the open Pacific shoreline seems to have been key in that it allowed chiefs inhabiting those sites to directly oversee exchange activities with nearby societies like the Puná and Túmbez to the west and south and the Manteño-Huancavilca to the north. In addition, Jerusalén´s placement close to the Chimbo and Boliche rivers seem to have been key in managing trade activities with eastern regions such as the Cañari in the Cuenca region and other Milagro–Quevedo groups closer to the *pie de monte*.

At all three centers there is conspicuous evidence of public buildings. In Jerusalén the site core is formed by large mounds surrounding plazas. These large mounds, according to the tests carried out, seem unlikely to have been residential. Moreover, there is lack of evidence of much ritual and public activities on the top of the mounds. The larger proportions of serving vessels and decorated sherds at the primary centers indicate that at those centers public activities took the form of ceremonies. In addition, evidence from Jerusalén indicates that in the core zone, the proportion of serving to cooking vessels was the largest. Evidence of consumption of meat from long distances and the fact that such meat had high status in the area from which it came support the idea of feasting. On the other hand, the frequency of dog remains, perhaps eaten, supports the idea of ritualized feasting.

Feasting activities that took place at the centers would take the form of work parties that Dietler (2001) recognizes as part of strategies for obtaining labor. These activities, which I argued involved a large part of the local population, served to cement the idea that mound building and perhaps raised field construction and maintenance were for the well being of the community. Such activities more like the modern *Minga* and *Faena* are indeed constructed under the idea that it is communal and thus it is for everyone's benefit. This sense of communality would have been the perfect political opportunity for the chiefs, in that communality could further their aggrandizement activities. Non-elites discontent would be minimized and chiefly persuasion greatly simplified.

We concur with Drennan's observation that the scare resource for surplus mobilization seems not to have been land, but instead labor (Drennan 1987b, 1995a). Even if we accept the most liberal estimates of population in the area, we must agree that it is not large and thus it seems that ample resources were available.

The overall tendency to nucleation around centers and villages gives support to the idea that chiefs attracted population towards the centers and towards clustering agricultural households. At the same time, this nucleation that seems to have pulled people away from the lands that they cultivated does take support away from the idea that the large raised field area was the property of individual households (see Drennan 1988, Stone 1991).

The second level of the hierarchy is formed by sites that do not contain such a large volume of mound construction, and have no public mounds. These settlements seem to have engaged in some feasting but on a much smaller scale than at the first level sites. Most of them are located in areas between regional centers and between those regional centers and the third level sites, which supports the idea that they represent nodes of distribution of both agricultural production and perhaps wealth goods. Production could have been stored in the second tier sites and then sent to the main centers with goods to finance production coming back in return. Third level sites are of two types, nucleated rural villages and isolated farmsteads. Their placement on the landscape shows that both agricultural villages and isolated farmsteads seem to be under the rule of a center, either through the mediation of a secondary center or directly from the primary center.

A hydrological web connects almost every single site to all others. Such rivers and *esteros* provided the structure for well-established systems of communication, transportation and redistribution in the area.

Intensive Systems

The evidence presented in Chapter 6 indicates that construction of the raised field systems required large amounts of labor that seem to have been extracted from the household pool. The dynamic nature of the system in the region creates the needs for large numbers of people working for short but recurring events. These were probably much more frequent during El Niño events.

The lack of early sites in the region allows us to conclude that these fields were built rather rapidly and thus involved large amounts of labor power. The absence of clear boundaries and "well defined patterning" argues that most likely the local communities that formed the Yaguachi chiefdom used the entire raised field area. Clearly the production of these systems was large and provided the opportunity for local chiefs to engage in wealth accumulation.

Communities and Households

In Chapter 7 I established that the community was the arena where household labor was transformed and in this process households, lose their organizational autonomy. In the Yaguachi area, public mound building and feasting seem to have been strategies utilized by local chiefs to draw people to the center and thus maintain a larger population subjected to them.

In addition, communal burial practices that incorporated mound-building and re-burial must have worked as an important factor in bonding together members of the community. Large mounds with burials inside would have encouraged development of strong communal sentiment and ties (Pauketat 2000, Pauketat 1997b). In times of turmoil, for instance, reburial and mound building could have been used to challenge public discontent (Kolb 1994).

n) *Households*

Among the archaeological signatures for top-down and bottom-up models were patterns of wealth variation at the level of the household. In the bottom-up model, rural households will tend to locate near their plots and show a large range of wealth variability. On the other hand a top-down organization of labor in the area would have produced more household nucleation in productive areas and would show little variability in wealth. Chapters 5 and 7, show that settlements are basically nucleated, as indicated by nearest neighbor analysis. They locate on soils with the highest fertility rank in the area and around and inside raised field zones. By exploring housemound floor area, sherd weight, proportions of decorated sherds and percentages of serving vessels, we found that wealthier households are identifiable by larger mound area, larger percentages of decorated sherds, larger proportions of serving vessels and more diverse tool assemblages. This larger diversity is taken to represent a wider range of activities that these wealthier households engaged in. Comparing housemounds (which I argue are the physical representation of households), it is found that rural households in the third level sites contain the lowest variability in terms of size in the region. Their mean size is smaller than the mean size of housemounds found at primary and secondary centers and they show very small size variability.

We expected that in a bottom-up system, households close to or residing in raised field zones would be wealthier than others. Our analysis showed that this does not hold for the area; to the contrary, households in the raised field areas are smaller in size, and have lower proportions of everything that seems to be indicating household wealth. If we add households at the centers to the comparison, the differences become even more pronounced. Further, the conclusion that can be reached is that the association to raised fields does not produce richer households.

How Was the Local Raised Field Production Organized?

Although the archaeologist cannot bring back exact scenes of the organization of raised field production, we can reconstruct some of the characteristics of such organization through the analysis of their physical signatures with the help of middle range theories. The following summary of the archaeological evidence that top down organization would produce was presented in Chapter 2, and is used here as an outline to summarize the archaeological evidence actually found.

It was expected that there would be a well-defined settlement hierarchy with specialized functions in different settlements. There would be administrative sites with central place functions, characterized by public architecture consisting of mounds, and perhaps surrounding public spaces such as plazas. These sites would most likely contain central storage facilities. Their material culture would include items of public display, used for public activities such as feasting and planting and harvesting ceremonies. These sites would have higher proportions of serving vessels for *chicha* drinking. Elite households would contain more wealth in terms of quantity and quality, especially wealth goods (Smith 1987) correlating to their location within local settlement hierarchy. Variation is expected in secondary centers which, like the one at Peñón del Río are expected to function as storage places and redistribution nodes. These are expected to be located in strategic places, forming distribution nodes close to major communication networks. Finally, a large number of non-elite agricultural settlements are expected to be connected to either central places or second tier settlements. These non-elite settlements would have a tendency to cluster and form agricultural communities.

We found a three tiered settlement hierarchy in the Yaguachi area. At the top, three sites comprised the local regional centers. At the next step downward, subcenters form the second tier, and at the bottom, agricultural villages, farmsteads and isolated households form the third tier of the hierarchy. Centers contained higher proportions of serving vessels than sites of the second and third tiers. Elite households are identifiable by the presence of larger quantities of better made goods using a better quality of raw material. Wealth goods such as metals and obsidian were found almost exclusively at housemounds located around centers. Contrary to our expectation, regional centers were located close to the main rivers indicating that they were also very much involved in regional exchange activities. At the moment, we don't know whether subcenters contain large storage facilities, but it is more likely that centers, which are located close to the transportation system, are prime candidates to contain large storage facilities. Also contrary to what was expected, regional centers were found near raised fields, along with a large producing population. The Yaguachi settlement pattern shows a strong tendency to cluster around the centers, especially those that are located near raised fields. From settlement location only, the settlement pattern found indicates even stronger centralization than expected since it was the centers where decisions on raised field production took place and it was through the centers that such production organization was enforced, not coordinating with subcenters as our original model expected.

We also expected that: non-elite households would show little or no variation in the quantity and quality of goods for their own use. This lack of variation would result from the fact that, under top-down control, non-elite households would lack incentives to compete with other non-elite households to produce more. If surplus production were obtained from communal labor and for apparent communal purposes, individual households would not be able to engage in competition for gaining wealth.

The analysis presented in Chapter 7 indicates that non-elite households presented quite small variation in terms of wealth, measured on the basis of household size, frequency of decorated vessels and frequency of serving vessels. For instance, data from Jerusalén's core (elite quarter mostly) present high wealth variation. When the wealth variation among households found in centers, is compared with the wealth variation among households in agricultural villages, the range of variation differs greatly. At Jerusalén, for example housemound area has a large range of variation, while in sites like Yaguachi this range is small. When the range of variation in wealth among households within raised fields (producers), is compared to the range among those not in raised field zones, these latter show a larger range of variation. All this evidence allows us to conclude that non-elite households show a small range of variation.

We expected that nucleated non-elite settlements would be located near large raised field plots, perhaps not far from the specialized managerial elite. Such patterning would result from the elite's need to better manage the organization of labor employed in raised field production, and the need to optimize labor output by reducing traveling distances (Drennan 1988). The chiefly elite's attempt to be more efficient in overseeing raised field construction, maintenance, and production would have produced a tendency for agricultural households to cluster close to raised fields.

The resulting settlement pattern, discussed in chapters 5 and 6 indicates a strong tendency of settlements to cluster. Most settlements cluster around the centers. Centers are located close to rivers which facilitates transportation, but they were also located (two of the three) near raised field zones. In doing so, they controlled production and engaged in competition to attract labor and thus increase the size of the area under production. The presence of these sites along raised field zones indicates that elites living at the centers were directly engaged in managing raised field labor organization. By locating in the area, they optimized resources by reducing traveling distance, and maintained better control over the producing population.

Another expectation was that raised field plots would be large, beyond the management capabilities of single households, or even household clusters. Based on various experimental works, it is assumed for the Lower Guayas Basin that individual households would manage an area no larger than 1.2 km^2 (Erickson 1993).

As discussed in Chapter 6, it was impossible to define raised field plots. There were rather large pockets of raised fields of two shapes, circular and rectangular, with two different sizes. Our analysis did not register any sort of plot boundaries. Given the dynamics of the system in which the raised fields are located, it seems more likely that large raised field pockets were cultivated at the same time. This task, it is argued here was performed by communal working parties.

The last set of expectations was that burials practices for the common people would be communal, and thus burials are expected to be found in groups. Individual ranking might be distinguished in commoner burial assemblages, but since top-down management is a group-oriented task, individual differentiation will tend to be small.

Data on 182 burials from Vuelta Larga presented in Chapter 7 indicates that the Yaguachi chiefdom had a very complex burial program that involved reburial (secondary disposal), mass burial, single burial, urn burial and chimney burial. All these activities were found at one burial mound. Recalling what it was said earlier, burial was a very public activity that, in our opinion, reinforced the idea of communality.

These lines of evidence point to the conclusion that in the area the organization of raised field production was in the hands of the local community. It was in community organization that local chiefs concealed their own personal agendas through an ideology that manifested high communal ties. As Blanton et al. (1996) suggest, in a corporate strategy, local chiefs are "down with the people" and their own personal aggrandizement has a low profile, although it is not less important than what is seen with more individualizing chiefdoms. The attitude of "being down with people" is manifested through burial practices that included in the same place to chiefly elites, and the commoners. It was mentioned in Chapter 2 that continuity is claimed between the Milagro-Quevedo culture and the Tsachilla ethnographic community. Tsachilla chiefs appear to have positions equal to those of their people, but they are about to use their positions to obtain advantages from the rest, and most of the time the others do not perceive these advantages.

The way in which settlements were organized, the way in which settlements related to productive zones, and the overall wealth variability in the area, provide little doubt that local groups organized raised field production and earth-mound construction in a top-down manner, not exactly as our model originally expected, but a top-down manner nonetheless. Local raised field construction and subsequent production moved considerable numbers of people, and local chiefs engaged in activities for external alliance building to obtain exotic goods to finance those public works. In this way, as has been established in the Venezuelan Llanos, the most successful local chiefs established themselves as good managers of both local and external affairs (Spencer et al.1994).

Future Research

I have sketched the local dynamics of labor organization concerning raised field production in the Yaguachi area. This is by no means the only plausible interpretation and, of course, new data could substantially change this construct. If that is the case, the whole purpose of research will be served. The conclusions of this work are not the final word but the beginnings of inquiring about the many social phenomena of the area.

Further inquiry requires a research program that among other things should include the following:

A more detailed analysis of site organization in order to define the range of specific activities that took place at each one of them. In doing that, we can be better prepared to reconstruct specific events such as feasting, redistribution circuits, competition, etc.

We also need to collect samples for dating, and study the ones already collected in order to achieve more precise chronological control that will allow us to answer questions such as whether the regional centers were contemporaneous or not. By answering that, we can determine whether the system corresponds to one regional polity as the ethnohistoric accounts indicate, or is formed of competing groups.

To resolve questions of dating raised fields and to associate them with mound construction in the area, analysis of local geomorphology needs to be carried out. Samples from soil coring and profiles of both raised field and mound bases could help identify the matrix over which raised fields were first constructed and then compare it to the one over which mound construction took place in the area. It will be important to analyze soil samples from both the production and consumption zones. Paleoethnobotanic analysis could first tell us the range of taxa cultivated on raised fields, and through the analysis of remains from living floors we can identify whether all items were for local consumption. If they were, we can study whether all segments of the Yaguachi society had equal access to these products.

More specific analysis of the burial assemblage needs to be carried out. For instance, it will be worth investigating whether there were diet differences among the various social segments of the Yaguachi community (Powell 1991). There are no apparent signs of trauma of the type that would indicate heavy warfare, but further analysis might reveal such evidence.

As this work is being written, some mound burials are being looted by people seeking gold; given this situation, one of the main concerns is to investigate burial mounds to get a better understanding of the social configuration of Milagro-Quevedo society. Of course, my own interest is that local people would ultimately, by reading this work, among others, see the importance of preserving those sites for future research.