THE ORGANIZATION OF AGRICULTURAL PRODUCTION IN THE EMERGENCE OF CHIEFDOMS IN THE QUIJOS REGION, EASTERN ANDES OF ECUADOR

by

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This dissertation examines the emergence of the ethnohistorically documented Quijos chiefdoms, in the eastern Ecuadorian Andes. It evaluates different alternatives that link the rise of centralized leadership with the organization of agricultural production. To this end I reconstructed the demographic history of a 137 km² region through a full coverage systematic survey, and the patterns of food production and consumption through the analysis of pollen, phytoliths and macroremains from the excavation of 31 tests at locations representing different environmental setting and settlement types.

Based on a ceramic chronology established for this project (through the analysis of ceramic materials from 15 test pits and associated carbon dates) I propose a sequence starting at about 600 B.C., with the first manifestations of a regional system of centralized authority appearing after about 500 A.D. The most distinctive expression of this is what appear to be central places in each one of the three subregions encompassed by the survey. The analysis of botanical remains at these locations, and at others representing smaller and peripheral settlements did not show, however, signs of economic differentiation in terms of production or consumption patterns. Thus neither the varying local environmental conditions nor social status, alone or combined, produced distinctive agrarian practices or foodways. Along the same lines, the central places do not seem to have emerged as a strategic move towards controlling agricultural resources, and evidence of staple mobilization or trade networks involving the circulation of local or foreign durable prestige goods is null. Additionally, an analysis of a sample of obsidian artifacts collected through survey and excavations suggests that closeness to source, rather than status, determined the abundance of obsidian materials, while manufacture technology seems to have been standard across settlement types.

I propose that frameworks that emphasize the control of economic resources or the importance of specialization of production in the development of complex societies are not useful for characterizing the social and political dynamics of the emerging Quijos chiefdoms, and that current understandings of this region as a hub of exchange activity can be readdressed in light of these findings.

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PREFACE

After having to cancel my original plan to conduct my research in southwestern Colombia early in 2002 I was struggling to find a new study area where I could conduct my fieldwork while keeping as much of the project's design as possible. It was Florencio Delgado, Assistant Professor at the Universidad San Francisco de Quito, who first suggested that I work in the Quijos region of Ecuador. In February of 2002, after together visiting this and other regions of Ecuador, I decided to follow his recommendation, which proved an excellent fit for my research questions. I am foremost thankful to him for presenting this possibility to me and for helping in many aspects to setting up and running this project. His wife, Josefina Vásquez, and her family offered the warmest hospitality in Quito. The project was funded by the National Science Foundation (Dissertation Improvement Grant No.0138138) and the Wenner-Gren Foundation (Dissertation Fieldwork Grant GR-6867), both of which were generous and flexible in supporting my revised plans. The Instituto Nacional de Patrimonio Cultural de Ecuador, especially Mónica Bolaños, was kind in quickly granting me official permit to conduct this research. Local permits in the field and logistics ran smoothly thanks to the Gobierno Municipal de Quijos, its mayor, Renán Balladares, and *concejal* Hugo Jati, in Baeza. Through Hugo Jati I was able to reach out to many people that collaborated with several aspects of our stay in Baeza. The owners of farms throughout our study area deserve profuse thanks for allowing us to survey and dig on their land. Jorg Henninger of GTZ granted us excellent office and laboratory space at the quarters of the Centro de Interpretación Ambiental de Baeza. Gustavo Mosquera from the Fundación Antisana generously shared with me copies of a variety of soil and environmental studies for the region that I used for my analyes, and Alden Yépez also helped me find maps and other geological information.

The most crucial aspect of the project, that is, the collection of adequate data with which to address the research questions, was accomplished in its majority thanks to the collaboration of the Unión Huacamayos. Its then director, Benito Nantipa, and secretary, Bertilda Alvarado, chose 15 people from the different communities that form the Unión to join the project with the genuine interest of learning about archaeology and the past of the Quijos region. This team truly commited to the project and gave to it in excess for what they received in exchange. Their very hard, consistent and meticulous work was simply admirable, and was at the core of the success of the project.

People from different universities also contributed to this research. At the Universidad de Los Andes, I must thank Carl Langebaek and Elena Uprimny for long-term encouragement and interest in my career. The nearly 30 students from this university that traveled to Ecuador deserve special thanks for carrying out the work during the initial stage of the project, which coincided with a season of daily torrential rains, landslides, and cold winds that they tolerated while still trying to discover the "joy" of doing archaeology. I extend my gratitude to the students from the Universidad San Francisco de Quito and from the Pontificia Universidad Católica de Quito who worked with us on weekends, especially to Estanislao Pazmiño. At the University of Pittsburgh I thank the Center of Latin American Studies for continued support during my graduate studies. The professors I worked most closely with in the Department of Anthropology, Olivier de Montmollin, Marc Bermann and my advisor Robert Drennan provided me with an engaging intellectual experience as a graduate student, and I thank them for their bottomless repertoire of useful suggestions on my work. My advisor Robert Drennan merits extra recognition for his detailed attention to and thoughtful suggestions on all stages of dissertation research and writing. I also thank Kathy Linduff for her useful insights on my dissertation work.

I started writing this manuscript in Pittsburgh with support of the Howard Heinz Foundation, which also supported my first years as a graduate student. Then I moved to Lethbridge, and at the University of Lethbridge, Catherine Kingfisher, chair of the Department of Anthropology found me nice office space and a convenient teaching schedule so that I could smoothly continue writing my dissertation from Lethbridge. Gaspar Morcote and Juan Carlos Berrío from the Instituto de Ciencias Naturales of the Universidad Nacional de Colombia very thoroughly conducted botanical analyses. Gaspar Morcote's visit to the field was a high point in learning about plants and their archaeological remains. This would have never been as productive without the collaboration of Jaime Rodríguez, director of the Granja Experimental de Baeza, who was extremely kind to let us take botanical samples and to visit and ask anytime we wanted. Diego Quiroga, Dean of Graduate Studies at the Universidad San Francisco de Quito allowed us to use the ethnobotanical collection of the university, crucial in aiding the interpretation of botanical remains as well. Alexandra Trejo from the Universidad Nacional de Colombia floated all of the near 250 soil samples during two intense months in Baeza, and Mauricio Vaca from the same university was also instrumental in the last stage of the project. Charlie Knight of the University of Vermont generously traveled to Ecuador and analyzed the obsidian materials. All carbon samples were dated at the NSF AMS Laboratory at the University of Arizona. To end with this incomplete list of people that made this work possible, I sincerely thank Patrick Wilson for generously lending his time, arms, culinary, social and many skills during fieldwork, and for proofreading drafts of these chapters.

1. THE ECONOMIC ORGANIZATION OF CHIEFDOMS

It can be said without risk of raising controversy that the economic organization of chiefdoms has not been one of the most studied aspects of these societies. In Welch's words, "…the current situation in anthropology is that there is some consensus about the political structure of chiefdoms but disagreement over the structure of their political economies" (Welch 1991:2). Understanding chiefdom economies (seen generally as the way in which goods are produced, distributed and consumed), was initially, and for a long time, centered on Sahlins's and Service's idea of the chief as responsible for the redistribution of subsistence resources among specialized populations inhabiting a range of environmental zones. In fact, this very condition of environmental diversity would have promoted the emergence of this form of socio-political organization (Sahlins 1958; Service 1962). The specific implications of this theory have been questioned repeatedly (Earle 1977, 1978; Peebles and Kus 1977; Feinman and Nietzel 1984). Environmental diversity is no longer considered the privileged context for the emergence of chiefdoms, nor are chiefs necessarily thought to have acted as redistributing agents to supply their population with products from diverse ecologies (Earle 1977). Redistribution disappeared from the definition of chiefdom, leaving economics open to documentation in specific cases (Welch 1991).

This research is concerned with the emergence of chiefdom societies with special emphasis on their economic organization. It investigates the case of the Quijos chiefdoms in the eastern piedmont of Ecuador based on the examination of their population patterns through time, and patterns of agricultural production and consumption during the period of chiefdom emergence. Therefore, I look at the social and environmental aspects of the agrarian economy, and their relationship to political dynamics. The study of this case aims to contribute to a pool of cases through which to compare the economic organization of developing chiefdoms.

ECONOMIC ORGANIZATION OF EMERGING CHIEFDOMS

As mentioned above, a specialized economy is no longer seen as the only alternative for the economic organization of chiefdoms but the question of how exactly chiefdom economies should look after Sahlins and Service has not produced a debate comparable to the one that disproved the validity of redistribution as the essence of the economic organization of chiefdoms. In other words, the alternatives have not blossomed with the same fervor with which Sahlins' and Service's theory was questioned. The case of emerging chiefdoms is still more obscure, and debates about the economic implications of this process have often revolved around the assumption that centralized leadership comes with economic burdens that must be fulfilled by the chief's domestic circle or attached population. Given that chiefdoms worldwide emerged in the context of populations of varying sizes and distribution, in a vast range of environmental settings, and displayed variation in terms of the degree and kind of differentiation between elites and the common populace, one could expect variability in terms of their economic organization, just by estimating that the provisioning of a material basis for daily life and social and political activities would have different purposes and constraints in each case.

In fact, sequences of chiefdom development vary in terms of the ways in which different fields of economic organization such as production, exchange, specialization, intensification, control of staple production and/or long distance trade played themselves out, and in terms of their contribution to the emergence of a centralized system of authority. A few cases can be used to exemplify some aspects of this variability. Drennan and Quattrin (1995) suggest that the control of agricultural resources was not a factor in the development of chiefdoms in the Valle de la Plata in Colombia, and Jaramillo (1996) presents a parallel case regarding access to valuable goods in the same region. Kristiansen (1991, 1998) makes exactly the opposite case for Scandinavian chiefdoms, which saw an unprecedented rise in social stratification and resource control as a network of long-distance exchange developed during the Bronze Age. For the case of the chiefdoms of the Southeastern United States, Anderson (1994) sees changing climatic factors influencing crop yields connected to the fluctuating nature of political authority among the Savannah River chiefdoms; and Blitz (1993) argues that chiefly leadership in the Tombigbee region emerged, in essence, as a form of economic organization. In another case study, Earle

(2002) sees intensification and control of surplus production as the hallmark of the evolution of Hawaiian chiefdoms. This variability and its causes have not been thoroughly studied.

Characterizations of chiefdom economies have also tended to assume agricultural intensification linked to chiefdom development. At one point in time, it was even assumed that chiefdoms were by definition agricultural societies, and that the emergence of chiefly authority in conjunction with intensification of production reflected the necessity of a managerial apparatus to coordinate production activities or buffer risk (Ford 1977; Lightfoot and Feinman 1982; Peebles and Kus 1977; Roosevelt 1980; Spriggs 1986; Upham 1983). The empirical evidence documenting the existence of chiefdoms with different productive bases, such as fishing or a combination of different strategies (Ames 1995; Bender 1990), demonstrated that chiefdoms in some areas of the world did not emerge in association with the first implementations of agricultural intensification or risk minimization strategies (Netting 1990; Scarry 1986), thereby ruling out this as an accurate generalization about chiefdom economies. Netting (1990) went further to emphasize that, indeed, chiefdoms could have emerged accompanied by virtually any kind of economy, as they are in essence a political phenomenon, not an economic one. In fact, there are documented cases such as the emerging chiefdoms of the Valle de La Plata in southwestern Colombia, in which, although agriculture was an important subsistence activity, people also made considerable use of wild plants (Quattrin 2001). Finally, it was also once common to characterize productive activities in terms of agricultural technologies, as if these were a layout for social and political organization (Wittfoggel's "hydraulic societies" is a fine example). Assumptions about chiefdom economies derived from ethnohistoric records are also frequent in the literature. Setting aside the obvious biases, these records are applicable for too short a time-span to be able to account for early stages of chiefdom development.

More recently, some scholars have explored variations in economic organization within specific chiefdoms (Welch 1991). The rationale is that economies in emerging complex societies may be differentiated, that more than one pattern of production and consumption could have coexisted within a chiefdom, given variations in population, environment, and social status within the same sociopolitical unit. Therefore, the economies of different sectors of the population may see themselves affected distinctively in a process towards increasing social hierarchy (e.g. Hastorf 1988). This proposition is central to this research, which seeks to understand if and how the emergence of a social hierarchy in the Quijos region can be linked to transformations in the agrarian economy that affected specific sectors of the population or the whole. Below I review three models of chiefdom economy from which the specific research questions were extracted.

Control of a population's resources

This is one of the most popular approaches to the economy of complex societies. Timothy Earle, who has contributed to this view to a substantial extent (but also see Gilman [1991,1995]; Hayden [1990,1996]; Price [1982]; Steponaitis [1981]), sees economics as of paramount importance to understanding the development of complex societies (Earle 1987, 1991, 1996, 1997, 2001). In a recent synthesis of his work, Earle (2002) explains his well known assertion (that control over the economy is inevitable in the evolution of human societies) to its fullest; "I now believe that social evolution is directed by changes in the economy. Social institutions appear to be built by an emergent political economy involving complex interactions of intensification, surplus mobilization, and controlled distribution" (Earle 2002:ix). The ultimate cause of this outcome, according to Earle, is that political leadership and activities are costly and that it is the commoners' burden to finance them. Two financing alternatives are possible, staple or wealth finance, depending on whether political activities are supported directly from staple production or from the transformation of the former into wealth items (Earle 1990, 1991, 1996). The process of financing leadership, according to Earle, accounts for both the evolution and failure of societies, in terms of how far they get towards a stage in which the financing system is well set (when leaders realize their full exploitative capacity) and irreversible (when commoners have been successfully incorporated into an ideology of compliance). It is at this stage that the conversion of staple goods into wealth items flows unimpeded, and by extension, material accumulation and control. Political systems that are not based on intensification of staple production typically collapse or else fall prey to more ambitious polities (as in the Wanka case [Earle 1997]).

This view, according to Earle, is particularly relevant to those dealing with chiefdoms, precisely because this dynamic of financed leadership is, in this model, set in motion exactly at the moment of chiefdom emergence. In short, chiefdoms passed the threshold of the Domestic

Mode of Production, common in the tribal form of social organization, and adopted political economies in which leaders attempt to maximize production outside of the household sphere: "The political economy is the material flows of goods and labor through a society, channeled to create wealth and to finance institutions of rule" (Earle 2002:1). These political economies are inherently competitive and tend to compound because more is always better "(more resources = more power)" (Earle 2002:9). From this perspective, chiefdoms vary in terms of how much they presage the state (as Earle sees it), which is, the extent to which leaders can extract resources from their populations. However, the success of a chiefdom along this path is ultimately contingent upon the environment: "the local ecology, its potential for long-term intensification, and the ability to control surplus production from the subsistence economy" (Earle 2002:18) limit or encourage political development.

Other discussions about the emergence of leadership in complex societies also emphasize the primacy of economic factors. According to these, leaders tend to come from economically dominant groups that have the capacity to attract followers through resource displays in acts of factional competition (Brumfiel 1994), competitive feasting (Hayden 1996; Hayden and Gargett 1990), or through trade control—as in the Olmec case according to Clark (1994).

This research aims to contribute to understanding the development of social hierarchy in the Quijos region, and a main goal is to evaluate the extent to which economic control was linked to its emergence. The notion of control over surplus production is particularly relevant to this study, since it has been argued to be an important dynamic in some chiefdoms in Northern South America (Athens 1980; Gassón 1998; Spencer et al. 1994; Stemper 1993). This argument is usually made for regions where people built conspicuous agricultural landscapes, raised fields for the most part, yet there is no complete agreement that these agricultural systems were controlled by political leaders (Mathewson 1987; Muse 1991), or that the manipulation of agricultural production generates (instead of just maintain) political rank (Hastorf 1990). Outside of regions of "monumental agriculture" in Northern South America, more emphasis is put on the idea that chiefs did control agricultural surplus, particularly corn (Reichel-Dolmatoff 1960; Roosevelt 1980; Salomon 1986; Sanoja and Vargas 1978,), but also manioc (Carneiro 1983; Heckenberger 1998), or else in highlighting the importance of corn in the performance of public activities and as a marker of status (Gumerman 1994; Hastorf 1993; Super 1988), which makes it likely that this was mobilized by political centers. The control model, thus, will be tested by evaluating the extent to which emerging elites controlled the best agricultural resources or sought to maximize or mobilize corn production.

On a more general level, this model is worth testing because of the impact it has had in the way complex societies are conceptualized. The staple-wealth finance distinction, for example, has been avidly embraced to characterize the economy of both emergent and established complex societies of all kinds in different parts of the world, and even more so ever since it was incorporated into the corporate-network approach (Blanton 1996) to characterize variations in the sources of power (Blanton 1998; Feinman 2000; Feinman et.al 1999; Earle 2001; Rosenswig 2000; Stein 1994; Trubitt 2000), making the latter indistinguishable from the sources of both social hierarchy and finance in complex societies. The influence of the control model is unquestionable, and has even reached the point where this view of the economy of chiefdoms has somehow crept into the definition of chiefdoms in the minds of some scholars, the only question being whether finance comes from one source or another (or changes through time), in a fashion similar to the former belief that redistribution was, *par excellence,* the language of economic life in chiefdoms. The recent skepticism about the chiefdom concept (largely rooted in the realization that forms of economic control seem elusive in the archaeological record of many chiefdoms, and even states, worldwide) (Crumley 1995; McIntosh 1998; Stein 1994; White 1995; Yofee 1993), comes as no surprise.

Specialization of production

Economic efficiency resulting from specialized production, with associated forms of social interdependence, has long been linked to the origins and functioning of complex societies (e.g. Sanders and Price 1968; Sahlins 1958; Service 1962; Wattenmaker 1998), and continues to be prevalent in the literature: "Specialization is the economic essence of complex society" (Earle 1996:165). Complex societies may vary in terms of which kinds of specialization develop and what their role is, but in any case, evidence of specialization is expected in every chiefdom and state. In what Brumfiel and Earle (1987) have called the "adaptationist approach to specialization", different sectors of a population, faced with the demands of population growth, would emphasize the production of items suited to their environments under the coordination of managerial elites. In the "political approach to specialization", instead, specialization emerges without association with the needs of the population at large. Concretely, it develops to facilitate the mobilization of staples and crafts required to finance the needs of an ever-growing elite and non-productive sector. Earle (1996) characterizes the Hawaiian chiefdoms and the Inka empire as examples of this phenomenon. The essential commonality between the two cases is a highly diverse environment.

The idea that environmental diversity provides a privileged scenario for the emergence of specialized economies has been extensively used for understanding the economic organization of complex societies in Andean South America. The verticality model has and continues to be used for several locations and time periods (e.g. Cárdenas and Bray 1998). As formulated by Murra (1972), this model of ecological complementarity explains the use of resources at multiple locations by emphasizing the economic self-sufficiency of political units at the expense of territorial continuity. It has been argued that a variant of Murra's archipelago model existed in the Northern Andes in the form of a system of microverticality. This system is a result of an environmental condition fundamentally different from that of the Central or *puna* Andes, that of the *páramo* Andes, in which ecological variability is present in the form of small and tight pockets of highly diverse areas due to the narrowness of the inter-Andean strip. This makes it possible for each family or village to have direct access to different ecological zones. Under this system people avoid dependence for access to basic resources, particularly food (Oberem 1974; Brush 1977).

These two models (macro-verticality and micro-verticality) would seem to establish a contrast between centralized redistribution and accumulation, and dispersed reciprocity between households. Only the former has been commonly thought to contribute to the emergence of institutionalized political offices, since centralization of the circulation of goods would provide a situation that would privilege the exercise and enhancement of authority. Recently, it has been argued that this link between political ascendance and verticality systems is the only reason why the model continues to be relevant for understanding ancient Andean societies in a way that does not contribute to essentialist ideas of *Andean* reciprocity (van Buren 1996). Yet, while kin or village-based systems of exchange of subsistence goods are less commonly seen as relevant to the understanding of political authority, it has also been argued that they can contribute to processes of political integration, even if indirectly so, since they serve to reinforce the internal ties and the sense of belonging to a wider unit that support a system of regional authority

(Sahlins 1972). Therefore, as has been argued for some Andean chiefdoms, these exchange systems can be a strong and pervasive source of political cohesion in non-strongly centralized or in heterogeneous political units (Osborn 1989; Rappaport 1988). Salomon (1986) however, argues that the authority of numerous Northern Andean chiefs rested heavily on their ability to regulate exchange (in the context of microverticality) over both medium and long distances, since no area, no matter how internally diverse, contained all of the resources necessary for the "socially accepted" lifestyle of any ethnohistorically known North Andean chiefdom. This condition created variation in terms of the structure of villages and regions, particularly when what was at play was the "socially accepted" lifestyle of elites.

Archaeological and ethnohistoric research concerned with the economies of Northern South American chiefdoms suggest that exchange, specialization and systems of economic complementarity based on ecological diversity played an important role in the organization of the Muisca and Tairona chiefdoms in northern Colombia (Cárdenas 1987; Groot 1990; Langebaek 1987, 1991, 1992, 1996; Reichel-Dolmatoff 1951), as well as in chiefdoms in southern Colombia and northern Ecuador (Bruhns 1989; Carneiro 1991; Gnecco 1996; Llanos 1993; Oberem 1974; Muse 1991; Rappaport 1988; Salazar 1992; Salomon 1986; Uribe 1985; Zeidler 1991). But in the chiefdoms of the Valle de La Plata, productive specialization does not seem to have been present in the dynamics of chiefdom emergence (Drennan and Quattrin 1995; Taft 1993; Quattrin 2001). In the latter case, archaeological evidence at the regional level indicates that neither patterns of population distribution expected under a system of productive specialization, nor actual specialization in productive patterns, accompanied the emergence of chiefdoms (Drennan and Quattrin 1995; Quattrin 2001).

There is also the notion that productive specialization does not have to be a function of environmental diversity, and that it may even take forms that have little or no relation to environmental variables. For example, among different contemporary Amazonian groups there is no necessity to exchange goods that are produced in a specialized manner (since most communities could easily be self-sufficient), but they create a demand not rooted in environmental variability, and the necessity of exchange turns out to be "artificial" from a strictly ecological perspective. In this case, the explanation for specialization relies on the cementing of alliance formation (Kimura 1985). In other cases (Earle 1996; Hastorf 1993), environmental diversity resulted only in dietary differences across populations, regardless of the potential for vertical exploitation and exchange.

Overall, few cases possess adequate archaeological documentation to prove the existence of a system of economic complementarity and its connection to the development of political authority. More common is the use of ethnohistoric accounts in the absence of archaeological information to describe the economies of chiefdoms for diachronic sequences and to extrapolate connections between authority and specialized production. It has been taken for granted that certain locations were optimal for systems of economic complementarity, and that certain spatial distributions of communities were related to such a system of production, but actual specialization of production has seldom been shown empirically to exist. Perhaps the most problematic aspect of the empirical record in the Andes has to do with the lack of temporal depth. Only a few scholars (e.g Stanish 1992) have questioned whether the patterns observed by the Spanish in the central and northern Andes during the 16th century had a long history or just constituted a late development, therefore hampering the value of the model for understanding socio-political change.

It is of relevance for this research then, to consider specialization of production as an alternative for understanding the relationship between economic organization and chiefdom development in the Valle de Quijos.

Elite and commoner productive differentiation

Another approach to the economy of chiefdoms emphasizes the local scale to understand decisions regarding agricultural production, without making necessary linkages between the role of economic factors (e.g. intensification) in the development of complex societies (Netting 1990). In a bottom-up view that opposes the control of resources model, commoner households are not herded by the chief to pass the threshold of the Domestic Mode of Production characterized by small household size and underproduction. Typically, chiefs are the ones that feel inclined to produce more, explaining why they often marry multiple women and have larger households. As observed in ethnographic and archaeological cases, household size and intensity or diversity of production often vary as a function of the social and political position of the household (Dillon 1985; Hayden 1986; Henderson 2003; Netting 1990; Sahlins 1972; Stone

1993; Wilk and Netting 1984), and in this sense the production of some households is affected by leadership, but not as a result of a chief imposing demands over "the people" in general. From a diachronic perspective, if the emergence of chiefdom level societies is marked by the first signs of permanent political and social differentiation, a parallel process resulting in the differentiation of the productive practices can be expected.

The investigation of productive practices across social sectors in chiefdoms though, has typically not been documented archaeologically to an extent that permits one to characterize the production practices of domestic units of different social and political status in different cases. In the case of Moundville, for which a close reconstruction of production and consumption patterns is available, the literature suggests that there was mobilization of agricultural goods from farmsteads to Moundville. However, the farmsteads that provisioned Moundville were the ones in proximity to the center, and in this sense, Moundville was not dependent on regional support for the provisioning of agricultural goods, relying instead on support from the immediate communities (Scarry 1986; Welch 1991, 1996; Welch and Scarry 1995). In this case there are two systems of production, one that is autonomous, and one that is compromised by its proximity to the chiefly center. It is not possible to compare the Moundville case to other archaeological cases of chiefdoms for which economic reconstructions do not provide this kind of detail. But this case reveals the necessity of asking and answering the question of how wide is the impact of resource mobilization, when this occurs in the context of chiefdom emergence, and whether different kinds of chiefdoms may be associated with this variation. Sahlins, for example, proposed the existence of qualitatively different chiefs in the Pacific islands, who, as far as the economy is concerned, were different in the degree to which they got directly involved in the supervision and control of production and in the degree to which they appropriated the resources of those outside of his own household (Sahlins 1958:11-12), although without suggesting that the difference is evolutionary in nature (as Earle would).

These types of differences seem to have existed among the chiefdoms of Northern South America, and were noted by the Spanish of the 16th century as they referred to the "development of division of labor" to explain how different chiefs received different amounts of contributions from either the immediate or the distant villages of the chiefdom (Langebaek 1992). For other North Andean chiefdoms, it appears that the typical form of tribute was not staple goods but labor on the chief's corn fields, making the chiefs' systems of production not so different from the ones of the commoners', since the latter could also mobilize their personal networks to organize *mingas* (labor parties, also known as "beer farming"). Therefore, the way in which the chiefs' corn fields were worked was the same as the commoners', just writ large. The difference was only implied in that the chiefs' social networks were regional in scale (Salomon 1986:80-81).

Thus, in dealing with the agrarian economy of chiefdoms, one can simultaneously evaluate different models that work with similar variables, and this is what this project sets out to do. This is relevant as it has been argued long ago that production in complex societies, besides fulfilling dietary needs, is crucial in the outlining of social and political relations (Sahlins 1972). Therefore, its understanding is fundamental to addressing questions such as the rise of complexity (Hastorf 1999; Johannessen 1988, 1993; Welch and Scarry 1995). It is paramount to this kind of research to understand the interplay of environmental and socio-political variables in shaping productive patterns. While the former may set out obvious limits, the role of the latter is more complex. Household economies can be affected by the wider social and political units of which they are part, and agricultural production may be an arena of social and political competition that is transformed in the evolution of leadership (Earle 1982; Sherrat 1999); but understanding if and how this happens in specific cases can strengthen debates on the political and economic organization of chiefdoms and could potentially contribute to a better understanding of variations in chiefdom-level societies.

ARCHAEOLOGICAL AND ETHOHISTORIC BACKGROUND

The case chosen to evaluate these different models that relate the emergence of chiefly authority to different systems of agricultural production is located in the eastern piedmont of Ecuador (Figure 1.1). Just as many other regions lying in between areas believed to be centers of cultural development, the Valle de Quijos is often characterized as an intermediate area between the well-known chiefdoms of the Ecuadorian Andes and the lesser known Amazonian societies.

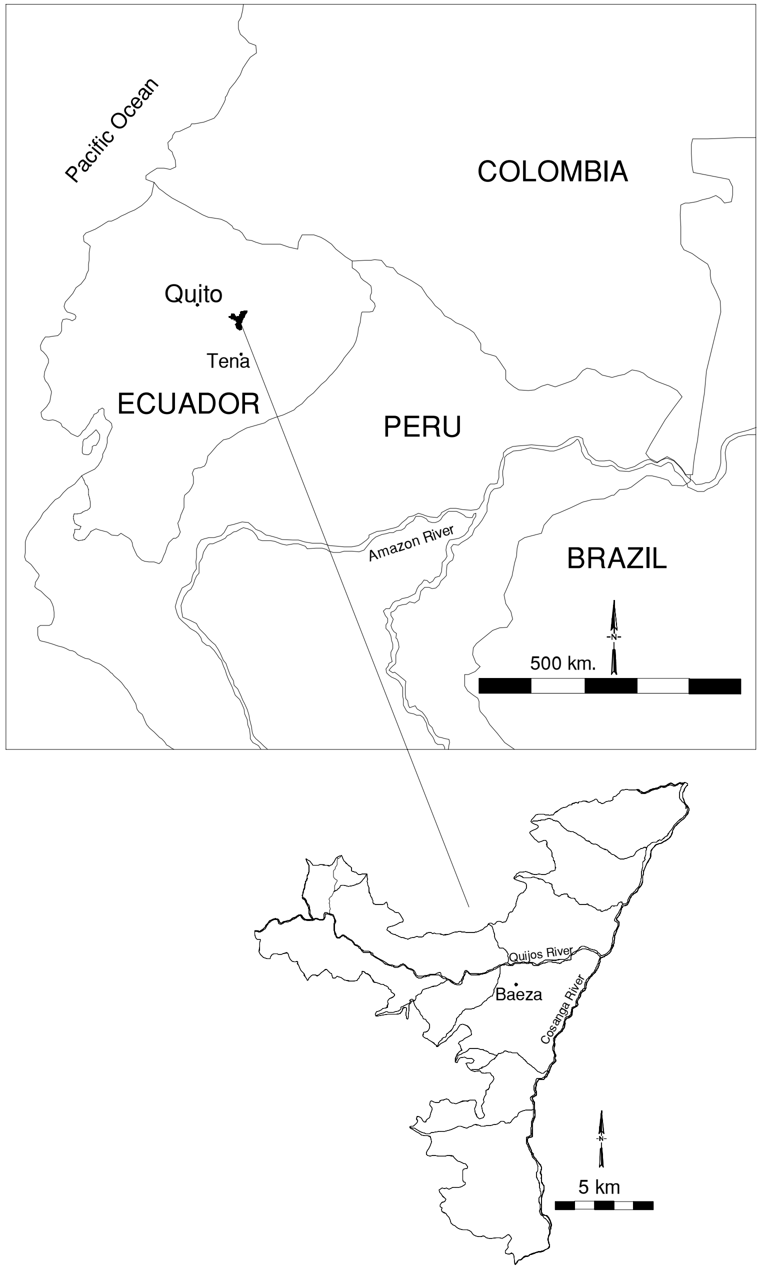


Figure 1.1. Location of Research Area.

In the minds of anthropologists, archaeologists, and local intellectuals, the Quijos were privileged to have had access to a wide range of environmental diversity and to control one of the main natural passes that linked the Andes and the Amazon, and are believed to have engaged in intense trade transactions between the two main regions. In terms of cultural affiliation, the archaeology of the Eastern Piedmont of Ecuador has been incorporated into the context of Amazonian archaeology, even though geographically speaking the region is closer and more physically akin to the cold and mountainous Andes than to the warm flatlands of the Amazon.

Archaeological investigation in the region (other than contract work) begins and ends with the work of Father Pedro Porras, who in the 1960s, as a side activity to his main responsibility in the Misión Josefina, collected abundant evidence to confirm the presence of pre-conquest peoples in the region, of whom the Spanish produced a written record of acceptable detail, and claimed to have found the ruins of the old Spanish city of Baeza. Porras also wanted to solve the enigmatic presence of Panzaleo pottery (which he later named Cosanga-Píllaro) at numerous locations in the central and northern highlands of Ecuador. He had conducted excavations in Tungurahua, a province in the central highlands where this pottery is found, and suspected that the origins of Panzaleo pottery laid somewhere in the eastern flanks of the Central Cordillera, given that this was consistently more abundant in areas adjacent to the natural passages that link the Andes with the Amazon. In the preface of his most complete work on the issue, "Fase Cosanga" (1975), he stated that the finding of abundant Panzaleo ceramics in the town of Baeza confirmed his suspicions: that the origin of Panzaleo pottery was in the eastern flanks of the Andes (Porras 1975:20). He conducted several excavations in the Quijos region and provided absolute dates that gave additional support to his assertion, and argued that the spatial extent of the use of this pottery was due to forced migration that eventually pushed the inhabitants of the eastern flanks towards the highlands. The details of this work will be discussed more extensively in Appendix A.

Years later this phenomenon was given its own name, the "Panzaleo Enigma" (Bray 1995a), and continues to be one, if not the most (according to a number of Ecuadorian archaeologists), puzzling aspects of the archaeology of the country. According to Bray (1995a), the mineralogical composition of Panzaleo ceramics found at different highland locations suggests the eastern piedmont as the locus of their production (discarding the possibility that highlanders were making their own version of Panzaleo pottery). Since most ceramic forms found in the highlands are *compoteras* (bowls with a pedestal) and jars, Bray believes that exchange between the two regions existed and that the use of Panzaleo pottery in the highlands is linked to ceremonial activities in which lowland cuisine made for an important component of feasting rituals (Bray 1995a). This, and not forced migration, as Porras proposed, would explain the distribution of Panzaleo pottery in the northern and central Ecuadorian highlands. So, this discussion has been going on for approximately thirty years, but with the exception of Porras, no one has undertaken archaeological research in the Quijos region, and no other questions have been proposed to understand the dynamics of the Quijos chiefdoms.

Most of the findings of Porras came from habitational areas visually recognizable by the presence of residential and agricultural terraces and canals, where ceramics, obsidian flakes, and hand axes and other polished stone artifacts are easily found. He conducted excavations in several locations across the region, and based on inspections and interviews with locals suggested that the territorial extent of the pre-Hispanic occupation encompassed, at the very least, the totality of the Quijos and Cosanga River drainages. He also observed numerous stone roads and sites with apparently voluminous mounds surrounded with stone stelaes. The adjectives and tone of the descriptions of these sites convey the idea of monumental constructions, yet the measurements and drawings provided indicate rather small works such as mounds that are 5 x 2 m on the sides and 30 cm high. The anthropomorphic "statues" mentioned in the text find no resemblance in the photographs included, which show stones barely carved and with hardly recognizable human features that are—to give one example—95 cm long and 26 cm wide.

Porras' reconstruction of the history of human occupation of the region conveys a possible period of pre-ceramic occupation whose length is not known, followed by a 1,500 year period of ceramic occupation (between approximately 400 B.C and 900 A.D), and posterior abandonment of the region which resulted in migration to the higher Andean valleys where the Cosanga-Píllaro pottery is found associated with dates somewhat later than the ones he provides for the Quijos region. Why he presented the sequence and dates in this way is discussed in Appendix A, but for now suffice it to say that he argued for a situation of territorial stress, as the local population fell under the pressure of numerous Amazonian hunter-gatherer groups (Cofanes, Amaguas, Zaparos, Tucanos, etc.) eager to appropriate the abundant game resources of the region (Porras 1975:154). Porras' developmental trajectory though (ending about six hundred years before the conquest) does not account for the apparently large population that the Spanish found in the Quijos region, which had initially inspired him to search for the ruins of the old Spanish city of Baeza.

As far as early Spanish sources, the first known documents to mention Quijos chiefdoms date to 1535, which coincides with the founding of the *Gobernación de Los Quijos*. The limits of the *Gobernación* corresponded to the extent of pre-Hispanic occupation, which supposedly covered all of the eastern flanks of the *Cordillera Blanca* between the Oyacachi and Napo rivers and a portion of the upper Ecuadorian Amazon. It is difficult to know from these accounts whether the region that fell under the *Gobernación* was in the beginning culturally, ethnically, or politically unified.

Oberem (1980:40-49) and Newson (1993, 1996) exhaustively discuss demographic data provided by the Spanish using different approaches to estimate the size and distribution of population in the *Gobernación*. The one thing that consistently appears, independently of which demographic estimate is used, is that the Quijos were the most populated chiefdoms, and references regarding political structure invariably place them as the most consolidated political unit of the region as well. This supposedly accounts for why the Spanish chose to name the new colonial territory as *Gobernación de Los Quijos*. The most influential of the Quijos chiefs was said to live somewhere along the Cosanga River, or close to the Spanish city of Baeza, and other minor chiefs were said to be subject to him, but this aspect of the ethnohistoric sources is very confusing. The emphasis is sometimes placed on the role of chiefs in times of war, or as both political and religious leaders, or in the organization of production and maintenance of a trade network. The principal chief is generally portrayed as a much more stable figure of authority, who supposedly received food "donations" from his subjects, who were also willing to offer their labor for cultivation of the chief's plots and forest clearance in the immediacy of the chiefly center (Oberem 1980:224-225).

The one aspect from the early Spanish documents that has consistently called the attention of scholars is the trade network that the Quijos supposedly maintained with other polities (Bray 1995b, 2005; Oberem 1980; Renard-Casevitz et al. 1988). Among the most appreciated products foreign to the highlands were "cinnamon" (a spice from *Ocotea quixos*, a tree similar to the old world cinnamon), *bandul* (used as bodily paint), coca, chili peppers, and feathers of tropical birds. Known archival sources also refer to shipments of "Quijos clothing" into the highlands, but do not mention ceramics. In exchange, the Quijos acquired mainly salt (Salomon 1986:110). Oberem (1980) links the disarticulation of chiefly authority early in the colonial period to the collapse of the trade system, but according to Salomon (1986) neither then nor earlier were trade relations between the inhabitants of this region and the populations of the central and northern highlands characterized by massive traffic, or at least not comparable with the intensity of commercial transactions between chiefdoms of the northern highlands and the western piedmont (Salomon 1986:108).

The one view missing about the Quijos chiefdoms is that of their internal dynamics. The debate about their networks of external trade has served to explain what happened to the chiefdoms of the central and northern highlands (supposedly they manipulated long distance exchange to use exotic products as part of their political and ritual paraphernalia) (Bray 1995a,b, Salomon 1986; Terán 1995), yet tells us nothing about how or whether the Quijos chiefdoms were affected in the process of becoming providers. The characterization of the Quijos region as part of the Amazonian dynamics exacerbates that vision, since typically, Amazonian pre-Hispanic societies have been seen as playing an important role in the process of political development of highland chiefdoms while they remained apparently unchanged through time. The case of the Quijos chiefdoms is thus an open field of inquiry. The most basic information needed to understand their development has, until now, not been collected, and the debate about their local dynamics uninitiated. The region though, presents an excellent opportunity to test various predominant themes in the archaeology of chiefdoms of Northern South America and elsewhere, and therefore contribute to our general understanding of chiefdom development and economic organization.

RESEARCH OBJECTIVES

This research focuses on the economic organization of the pre-Hispanic societies of the Valle de Quijos in the context of the socio-political changes that resulted in the emergence of the Quijos chiefdoms. Of all of the components that made up the economy of the Quijos chiefdoms, this project focuses on agricultural production. Thus the specific contribution of this investigation will be to gain an understanding of how agricultural production was organized during the emergence of a system of regional political authority. To that end I evaluate alternatives such as control of agricultural resources and specialization of production, which pose different implications in terms of the relationship between emerging leadership and organization of production. In the frame of these models, I also explore whether the emergence of a social hierarchy was accompanied by different production practices between elites and non-elites. In other words, this research seeks to know whether social differentiation paralleled economic differentiation as a step towards understanding the possible basis of the emerging social hierarchy.

Two types of information were needed to test such alternatives: a reconstruction of the settlement and demographic history of the region, and patterns of agricultural production and consumption at different environmental and social settings during the period of chiefdom emergence. This information was collected through a systematic regional survey (137 km^2), and through the excavation of 31 test pits for the extraction of botanical remains located in settlements of different kinds (nucleated and dispersed), at different altitudes, and on soils of different productivity. The exploration of production and consumption patterns at different locations is regional in nature, as it focuses on analysis at the regional level, and should not be confused with a community or household approach, because it does not study patterns at that scale.

The specific objectives of this research are, first, to reconstruct the history of sedentary occupation in the Valle de Quijos and determine, in terms of patterns of settlement organization, how and when chiefdoms emerged in the region. Second, to establish whether control of regional resources was important in the development of chiefdoms, by exploring the relationship between areas of different productivity and patterns of occupation during the sequence, and to determine the relationship between this and production and consumption practices during the period of chiefdom emergence. Third, to evaluate the importance of a specialized economy in the development of the Quijos chiefdoms, by observing the distribution of population through a range of environmental zones and patterns of agricultural production and consumption related to both altitudinal zones and settlement types. Fourth, to assess more generally the relationship between social differentiation and patterns of production and consumption.

As a case study, this research is not intended to establish generalizations about the economy of developing chiefdoms, but to provide information that, in comparison with other cases, will contribute to advancing the current debate on this issue. The alternatives proposed relate to the possibility that the development of a regional system of authority was linked to certain forms of production and distribution that contributed to such a system. If none of the scenarios evaluated point to a relationship between the development of social hierarchies and forms of economic control, specialization or differentiation, it will be concluded that the dynamics that led to the formation of the Quijos chiefdoms should be investigated outside of the economic realm.

2. FIELD METHODS I: REGIONAL SURVEY

The collection of settlement information through regional survey was the first stage in this project towards its central objective of investigating the development of chiefdoms in the Eastern Piedmont of Ecuador. The motivation for reconstructing regional settlement organization and demographic trends through time in the Valle de Quijos goes beyond providing a "general picture of the population." Regional settlement patterns in this case are used as a window into the socio-political organization of complex societies, whose changes through time can be traced. This approach to settlement patterns neither suggests that regional perspectives are intrinsically better than others for understanding the development and functioning of complex societies, nor that they require other kinds of complementary information to be considered reliable accounts of the development of complex societies at the regional level. Yet, it is driven by the idea that certain dynamics in the development of complex societies (such as the development of socio-political differentiation and hierarchy) impact entire regions and have archaeological manifestations amenable to identification at that scale. Settlement information serves three main purposes in this project. First, it is used to monitor settlement and demographic changes related to the emergence of chiefdoms, the most fundamental being the formation of population concentrations thought to reflect the emergence of social and political centers, namely, the emergence of social and political inequality. Second, it allows testing models about the organization of agricultural production as it relates to the emergence of social differentiation through the examination of settlement distribution relative to altitudinal zones and productive potential. Third, along the same lines, settlement information will serve as the basis for investigating agricultural production and consumption practices at specific locales in the region during the period of chiefdom emergence.

Regional archaeology has not been very common in the archaeology of Ecuador, generally more focused on the study of monumental sites. A few regional studies have been conducted in the coastal region (Delgado 2002; Stemper 1993; Zeidler 1994), as well as in areas of the Western piedmont (Lippi 1998) and the Northern highlands (Bray 1992; Echavarría et al. 1995), but none in the vicinity of the Quijos region. Information regarding the settlement organization of pre-Columbian societies in this region is limited to Spanish accounts that mention contact and colonial period settlements and some demographic information (Hortegón et al. 1989 [1559-1621]; Oberem 1980). For pre-Conquest periods Porras proposed some scenarios regarding population movements into the region and outside based on site excavations (see Chapter 1), but a regional reconstruction of settlement patterns through time is not available.

REGIONAL SURVEY IN THE VALLE DE QUIJOS

Regional surveys vary in a multiplicity of ways, and this affects the type of information collected and the kind of analysis for which it is suitable. In this project, many decisions had to be made before and during fieldwork to maintain consistency between the survey methodology and the research questions, and this chapter explains the conditions and rationale that led to those decisions. The Valle de Quijos is located in the eastern flanks of the Cordillera Blanca or Cordillera de Guamani, the easternmost Andean range that forms Ecuador's main volcanic corridor. The natural and only entries known to have been used to access the region from the high Andean plateaus are through the Papallacta and Oyacachi river valleys, both running west-east and forming deep and narrow canyons subject to constant landslides. On its way down from the *páramo* the Papallacta River meets the Quijos River, which descends from the snow-capped Antisana volcano to continue the west-east canyon that eventually opens into the Quijos Valley.

Survey Area, Limits and Scale

The regional survey was initiated in the area around the modern town of Baeza, located in a small plateau west of the conjunction of the Quijos and Cosanga rivers. The survey area was gradually extended west, east, and north, following the course of the Quijos River and south, following the course of the Cosanga River; it has an extent of 137 km². For the definition of the northeast, northwest, and southern limits geographical features were chosen, specifically, three tributaries of the Quijos and Cosanga rivers. These are, on the west, the Laurel River and the Quijos itself when it joints the Papallacta River, the Sardinas Grande to the east, and the Yanayacu Grande to the south. The eastern boundary of the survey is delimited by the Quijos and Cosanga Rivers, and the western and northern portions were delimited following the course of mountain ridges and streams (Figure 2.1). With the limits of the survey area, I do not claim to represent boundaries that were socially meaningful at any point in time, although it is conceivable that some of the major rivers that delimit the area could have represented some kind of social boundary. Regardless, an important motivation was to make sure that the geographical features chosen were clear enough so as to know exactly from where to start when expanding the survey area in the future. The survey area includes an altitudinal variation ranging from 1,600 to 2,800 meters above sea level (Figure 2.2).

Obviously, the extent of a polity or of a set of polities would be the ideal limits for a survey area, yet it is not possible to determine such a boundary when beginning a survey. In the Northern Andes, chiefdoms operated in large regions that comprised the territory of more than one polity. Typically, in the settlement maps of chiefdoms in this part of the world, possible political boundaries are established by drawing a line through areas of very sparse settlements or unoccupied areas, that separate more densely occupied zones of settlements that cluster around a more populated central area. This project aimed to include the territory of at least one polity for each one of the periods of occupation, and for that purpose the archaeological and ethnohistoric information available for the region was examined with the hope of getting a preliminary idea of what could have possibly been the extent of pre-Hispanic occupation in the region at any given time. Neither ethnohistoric sources nor the archaeological studies undertaken by Porras were likely to provide very informative insights for all periods of occupation, otherwise this survey would have been unnecessary, but both served as a general guide to get started by covering an area that appeared to have the potential to include a variety of settlement types in different periods. Naturally, it was not until the survey was completed and settlement maps were produced that we could form a concrete idea of the settlement trajectory in the region. A clear impression produced by the general settlement map, and the settlement maps by period, is that occupation probably extends beyond the limits set for the first field season of this project, as seen by the presence of settlements along much of the borders of the survey area (Figure 2.3).

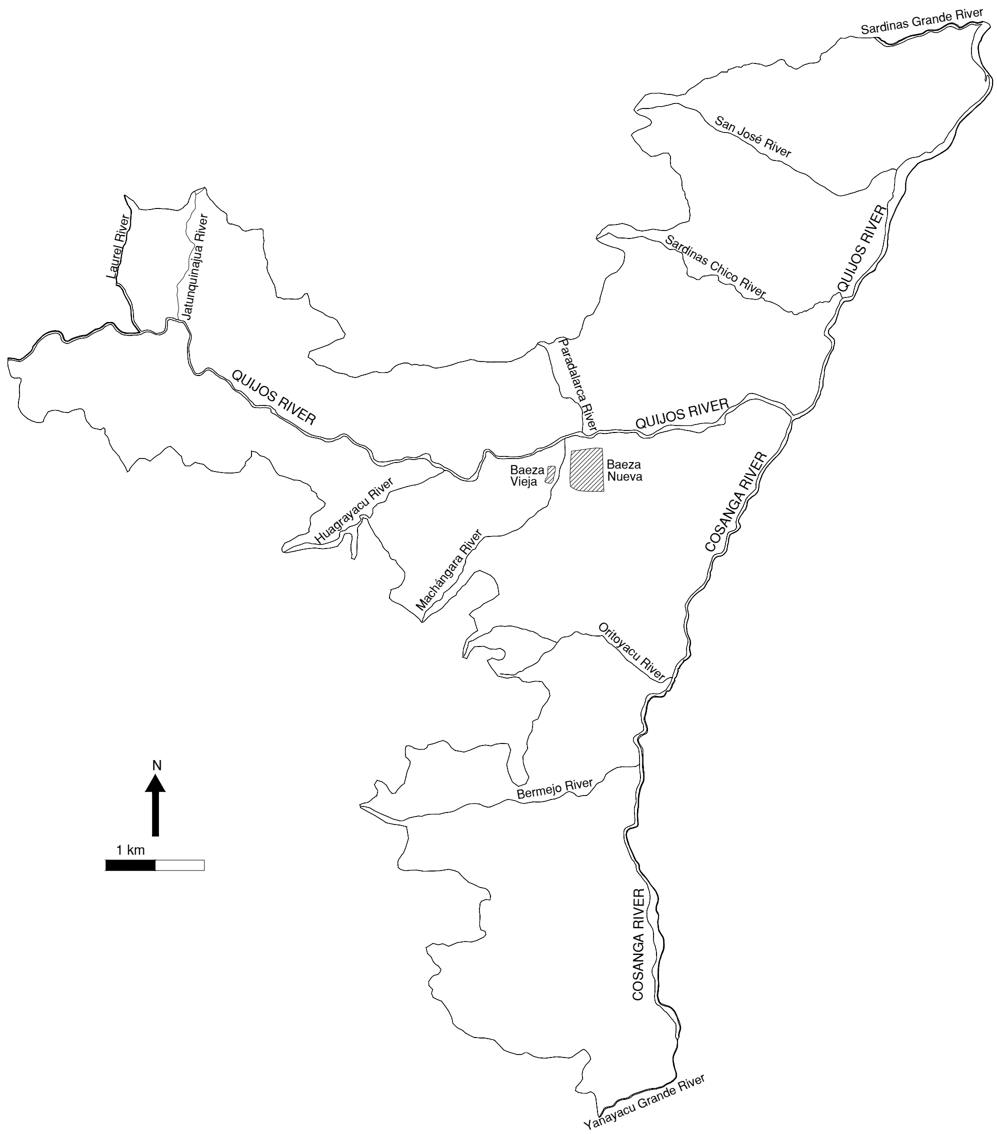


Figure 2.1. Valle de Quijos Rivers.

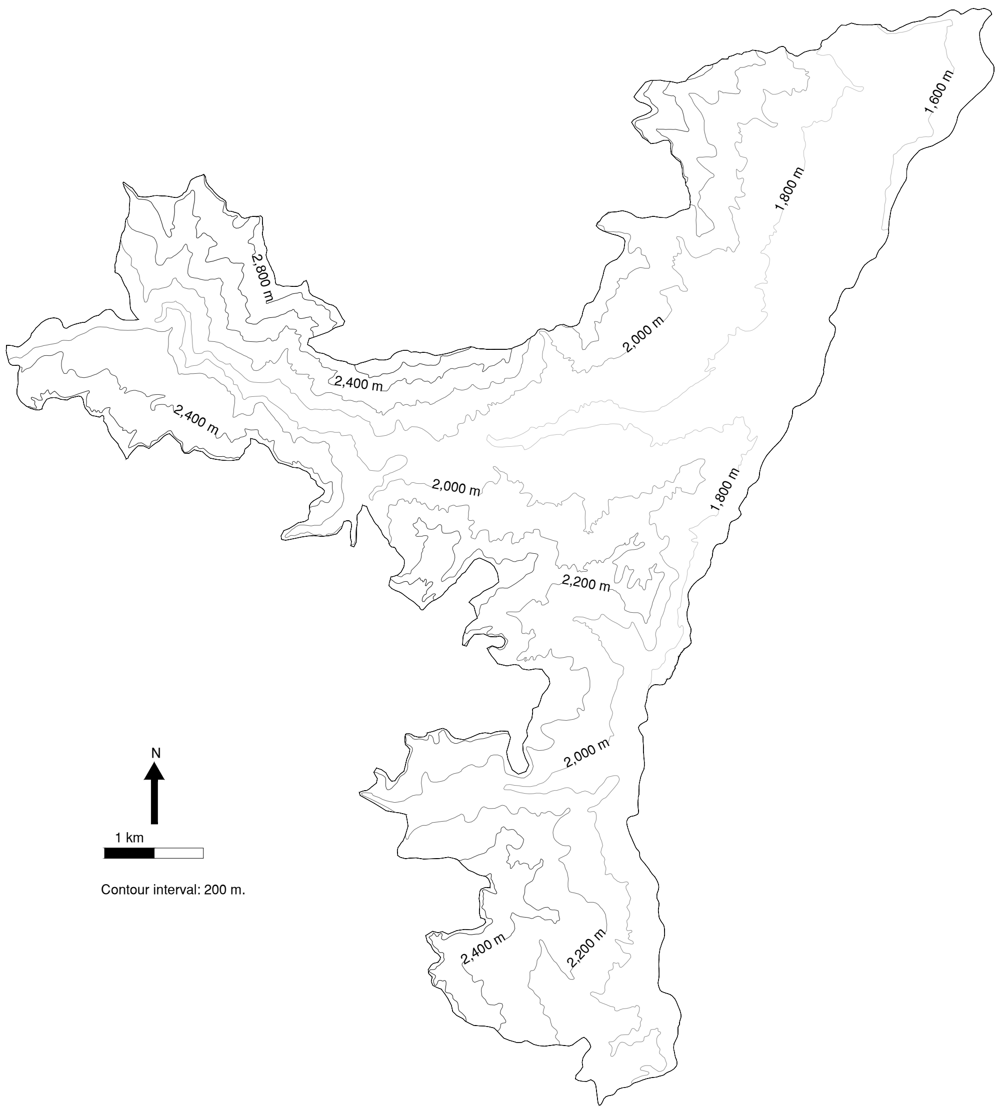


Figure 2.2. Valle de Quijos Topography.

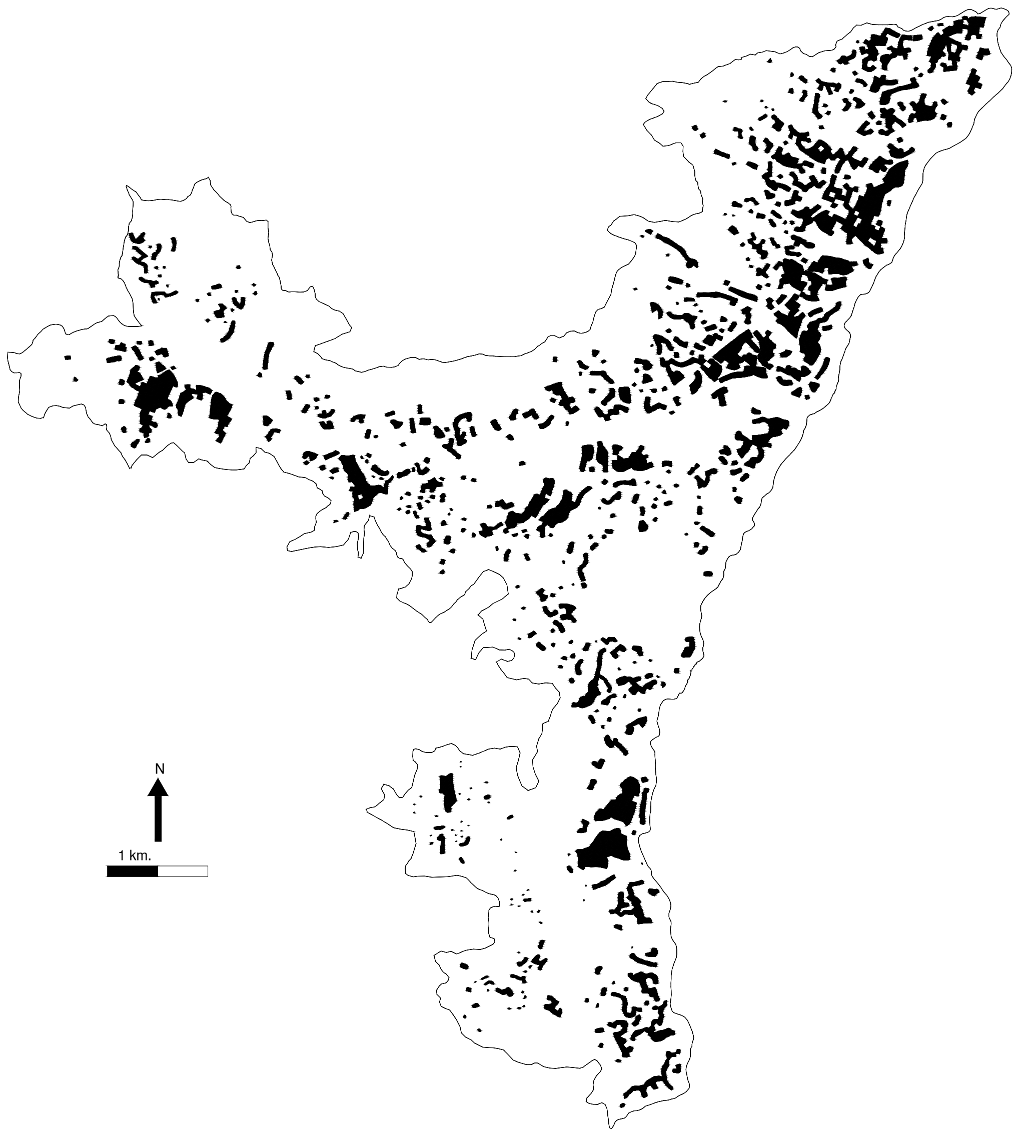
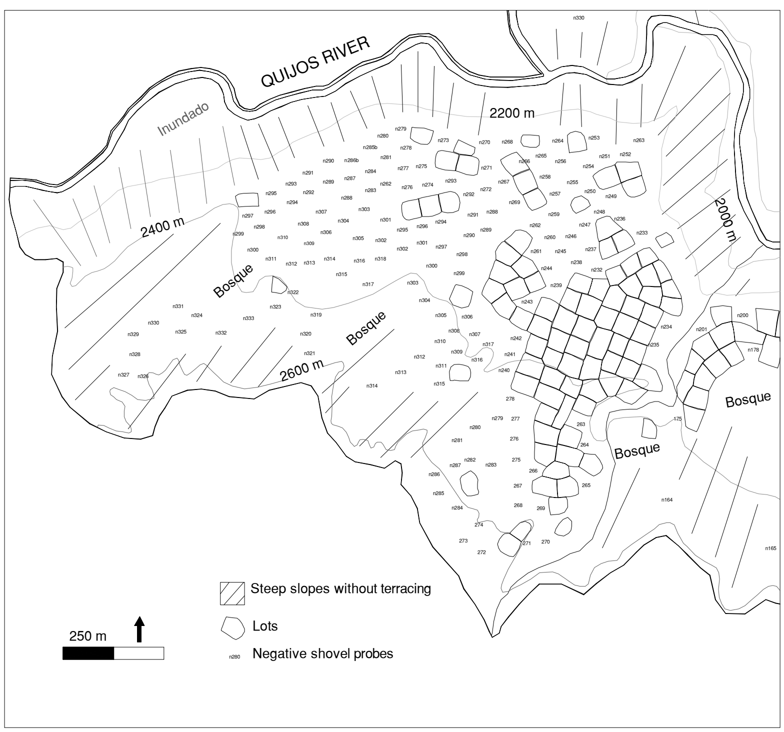


Figure 2.3. Survey Lots.

The greater extent of pre-Hispanic occupation beyond the survey area can also be inferred from ethnohistoric accounts, from Porras' reports, and from the testimony of the modern population. In the future, the survey area will have to be extended. Yet the area surveyed, 137 km², is adequate to start identifying changing patterns in settlement organization and to start addressing questions related to the socio-political organization of chiefdoms in the region. How large an area should be to lend itself to this kind of inquiry is of course relative to the dynamics of each region, but patterns known for relatively close areas can be used as referents. In the case of the Northern Andes comparative material exists, both archaeological and ethnohistoric, to suggest that individual polities that composed regional chiefdoms ranged between 40 and 70 km² (Drennan et al. 1989; Langebaek 1995; Salomon 1986). The area surveyed thus probably covers, at the very least, one such political unit and contains the kind of settlement heterogeneity with which we can start understanding how chiefdoms developed in the region.

Coverage

One of the crucial aspects of survey methodology has to do with the extent and type of inspection of the landscape that leads to the location of settlements. This provides information about what kinds of settlements are found by a survey (only large, large and small, or others), and an idea of what portion of settlements was recorded relative to a potential universe of them. The principles and strategies that archaeologists employ can vary and are validated by reference to consistency with the research goals. A full-coverage survey seemed the most suitable alternative in this case, since an inspection of the entire area appeared to be the most reliable way of producing information regarding the extent of occupation in each period and of accounting for variations in occupational density within the region. Very importantly, it was also the only way in which we could detect which areas had not had occupation in different periods. Having a record of areas densely occupied vs. areas sparsely occupied or unoccupied was crucial for monitoring the emergence of regional centers and for examining changing patterns of occupation across the altitudinal range and zones with different agricultural potential. The boundary of the survey map, thus, represents the total area that was inspected by survey groups. Empty spaces in the general settlement map represent areas that were inspected but where evidence of human occupation was not found. On a few occasions survey groups were denied permission to inspect certain properties, but these were isolated cases that do not alter the general picture of the settlement map to a meaningful extent. The total area within the limits of the survey where testing was not possible is 0.8 km². Very dense forest on the other hand, represented a much more frequent obstacle for inspection, and dealing with it did not always turn out to be successful. We did insist on surveying thickly forested zones despite its being a disproportionately slow and difficult process, but some of the empty areas in the map reflect areas that we could not even penetrate. Yet these were never so large that we felt it necessary to design special testing or sampling strategies to cover them. Any other empty spaces on the map represent areas entirely unsuitable for human occupation, such as steeply inclined slopes or areas constantly inundated by the main rivers. Thus the settlement maps produced reflect very closely the extent of human occupation in the region during each of the periods investigated, instead of reflecting unevenness in coverage (Figure 2.4).



166995, 9948620

Figure 2.4. Close-up of Survey Field Map.

Intensity and Methods of Collection

Evidence of occupation was collected by systematically verifying the presence or absence of archaeological materials in areas no larger than one hectare (either by digging a shovel probe or carrying out a surface collection). The most common remains collected were ceramic sherds, followed by obsidian flakes and artifacts of polished stone such as axes. Shovel probes were the most common means of collection, due to the high density of vegetation in the region; 67.8 % of the collections were shovel probes. Thick grass, bushes, or forest, combined with the lack of agricultural activity, made opportunities for surface collection rather scarce; only 32.2% of all collections were surface collections. One common concern about regional surveys that use sub-surface methods of collection has to do with the chances of missing or misrepresenting sites due to unevenness in the subsurface artifact density and distribution (Shott 1989), especially when there are no signs in the landscape that provide evidence of human occupation. These critiques tend to overlook the specific nature and goals of regional surveys in two ways. First, since a large region is inspected, occasional misrepresentations are easily compensated for by the extent of the survey area. In other words, occasional undetected sites would not distort overall trends in regional density and distribution. This relates to the second point, which is that the goal of this type of survey is to reconstruct regional settlement patterns, not local sites in detail. Regional settlement patterns will not be much affected by the occasional missed site (which should not be larger than one hectare); instead, the validity of the regional survey—and its results—is enhanced as the size of the full-coverage survey reaches larger proportions. The goal of this project was, of course, to minimize the frequency of missed sites, and this was ensured by fully covering the region and by selectively choosing the locations on which to do shovel probes. Utilizing landscape features, the selection of shovel probe locations was designed to enhance the prospect of finding evidence of human occupation if it existed. Therefore, within a possible collection area we read the landscape looking for positive signs of human occupation, such as terracing or mounds, and other areas favorable for habitation, while also seeking to avoid contexts where human occupation or its detection was unlikely either because of inhospitable living conditions or poor preservation of artifacts—for example, where we found evidence of landslides or flooding.

Awareness that the likelihood of finding sherds in a shovel probe depends not only on whether a given area was ever occupied but also on what specific context the shovel probe is targeting made us pay attention to what we could be potentially targeting with a shovel probe. Therefore, even when we had identified promising landscape features, such as an artificial terrace, we attempted to conduct our shovel probe on the terrace in a given area with the best probability of uncovering sherds. For example, the zone just outside of residential areas generally contains large numbers of sherds (Drennan 1985; Killion 1987; Hayden and Cannon 1983; Jaramillo 1996; Kruschek 2003). Since so many of the residential areas in this rugged region were built on easily recognizable artificial terraces, we systematically dug the shovel probes towards the edge of them.

Shovel probes measured 60 x 60 x 60 cm. Both grass and roots grow at a very fast pace in this region, creating a very thick vegetation layer (generally between 15 and 25 cm) that needs to be removed before any soil can be exposed. Reports of previous excavations by Porras (1975) and Delgado (2000) suggested that approximately 60 cm was a common maximum depth for cultural remains. A narrower shovel probe could have been less time consuming but in preliminary experiments it seemed that it was difficult to remove the soil at 60 cm depth from a probe with narrower sides; this would have almost invariably resulted in a disproportionately narrow probe at the bottom. These probes did not have stratigraphic control because the purpose was simply to quickly collect a small sample of sherds of all of the occupations that could have occurred in the area.

In cases where vegetation cover was less dense the use of surface collections was the preferred method. Lack of sherds on exposed soil was not taken as an indication of lack of occupation, though. In these instances, we opted for excavating a shovel probe anyway. We made this a standard procedure because the areas with exposed soil were generally very small and only rarely entirely free of vegetation. This proved useful, in fact; many shovel probes turned positive in areas close by small patches of relatively low vegetation density, but where no sherds were visible on the surface. A concern that emerged very early in the project was that conditions for surface collection were perhaps not too promising, because areas free of vegetation, or in which the soil had been naturally exposed or else uncovered and mixed for cultivation purposes were very rarely found. More frequently, a generally small area (of a few square meters) had been stripped of its vegetation cover by cows. Typically, cows plunge their hooves deep into the grass, and as they walk, they tear apart the vegetation cover and unintentionally expose the soil underneath. This is commonly the case on the edges of terraces located on steep mountains, which are often destroyed by cows that have a hard time keeping their balance as they start going down the hill, or as they struggle for the last step to finally land on a flat surface after walking up the hill. On more level terrain the presence of large herds of cattle creates the same effect, except that the holes left by their feet constantly fill with rain water to create swamps. In these cases, faced with the obvious inconvenience of digging a shovel probe, we performed what we called "swamp collections;" a "surface" collection in a swamp in which some of the soil converted into mud was observable through the water between removed grass, roots, and cattle excrement. Sherds were reasonably visible in these contexts, or else easily detectable by "subsurface" hand inspection in these swamps. Better opportunities for surface collection appeared when farmers cut drainage canals or other landscape modifications, but these were not very common either. All of these circumstances combined discouraged us from trying to make surface collections more systematic by, for example, using a standard area within a hectare to perform the collection, or standardizing the time a surface collection should take in order to avoid biases in terms of quantities of sherds collected.

Each collection, shovel probe or surface, was named with a lot number. All sherds from shovel probes were recovered. Likewise, in surface collections all sherds seen were collected, except when the quantity of sherds was too large to make it practical to collect them all. In these cases, the emphasis was on collecting all types of sherds encountered (rims, body sherds, decorated sherds, non-decorated sherds, large, small), without privileging any particular type because of its appearance. For each collection we filled out a card with a previously assigned number (which was the lot number assigned to each new collection) in which we recorded a GPS reading in UTMs, density (none, low, medium, high) and type of vegetation (forest, shrub, grass, stubble field, cultivated field), mode of collection (shovel probe, surface collection), type of materials collected (ceramics, lithics, polished stones, others) and number of bags for each one, names of the team members and date, and the site number associated with the lot. The lot number on the card was used to mark the area represented by the collection on the map and/or aerial photograph, to name the GPS reading, and to mark the bag(s). The space on the back of the card was used to write any relevant observations about the landscape, such as the presence of artificial terraces for residential or agricultural purposes, whether the collection was made in one of them, approximate size of the terrace and of the set of terraces in case it was just one in a number of them. Sites were defined as areas composed by continuous lots, and additional forms were filled out for them, in which general information about the vegetation and landscape characteristics of the whole site were recorded. We used aerial photographs at a scale of approximately 1:10,000, and printed enlarged versions of the 1:50,000 maps available for the region produced by the Instituto Geográfico Militar de Ecuador. On the map or aerial photograph we also marked negative shovel probes, and recorded their GPS coordinates, to keep track of areas inspected but where there was no evidence of occupation.

The Production of Settlement Maps

The final product of the survey, settlement maps by period of occupation, conveys an image of the areas in which people settled at different points in time. These maps are an image composed of the many lots that contain ceramics from each period. The areas of individual lots are not the actual areas over which ceramic collections were performed, but the area that we considered fair to represent by a shovel probe or a surface collection. Using this logic, ten adjacent positive shovel probes excavated at approximately 100 m from each other, would not represent an area of 60 x 60 cm multiplied by ten, neither would they necessarily represent 6 ha of occupation. Each one of the ten shovel probes may represent an area of different size and shape, depending on the area that, within a maximum of approximately 1 ha, was amenable to human occupation or else had clear signs of having been modified for this purpose. How these areas are determined depends mostly of the characteristics of the terrain and on the observations regarding landscape modification. In the hypothetical example of a perfectly flat and uniformly inhabitable area of 1 km^2, a grid could be traced to produce 100 perfectly squared hectares. If a shovel probe is placed on each one of the 100 ha, and all of the shovel probes turn out to be positive, it would seem reasonable to say that the 100 shovel probes taken together represent an area of 1 km^2 of occupation. However, if this same area was cut diagonally by a 10 m wide river, the areas represented by, at least, the shovel probes placed in proximity to the river would not be perfect squares, but would instead have variable shapes and sizes given that the river cuts the grid in a manner that impedes accommodating perfect squares. If we were to add more geographical features to this hypothetical scenario we would approach the physical reality of most survey areas as being quite a bit more variable, in which rivers, streams and mountains of capricious shapes preclude the ability to impose a perfect grid as a layout for the spacing of shovel probes and the delineation of the areas that they represent. Therefore, the 100 m or 1 ha resolution is a flexible figure, whose main utility is to provide a standard for the spacing of shovel probes, and a standard maximum for delineating the areas that shovel probes or surface collections represent. Due to topography and other geographical features, such shovel probes can sometimes be placed at more or at less than 100 m from each other, and the areas that they represent can be—but are not always—equivalent to a hectare.

The same rationale applies to surface collections in this survey. Unlike other regions of the world where the surface distribution of remains (ceramic scatters) have been used to indicate the extent of occupation in different periods (e.g. Blanton et al. 1993; Sanders et al. 1979), in the Quijos region surface distribution of remains speaks little of the actual space in which archaeological remains are spread. The conditions for surface collection would make this assumption misleading, because in this case, the area over which archaeological materials were collected does not represent an area of human activity marked by the dispersal of garbage, but simply an area in which such garbage became visible to survey teams. Those areas were so irregular that we did not even attempt to measure them. In many cases, surface collections were composed of sherds picked up in a few small patches of exposed soil here and there within an area of a maximum of one hectare, and many times by sherds collected in just one small patch. Regardless, the areas that surface collections or shovel probes represent do not have the shape of the actual areas were the collections were made; they were extended to represent areas generally no larger than one hectare based on natural and human-made landscape attributes. This assumes that the remains of occupation are surely spread in larger areas than the ones in which the collections were made, but that they were simply not visible on the surface. Extrapolating the information of one collection to a small surrounding area thus does not tie the representation of areas occupied to the meaningless extents imposed by the survey surface conditions.

An alternative to this form of producing maps would be to draw the exact provenience of sherds picked up in surface collections and the exact location of shovel probes. Such a map in this region would look more like a domino, a white surface populated by many miniature dots hardly visible at the scale of the region, showing the precise origin of the sherds collected. This kind of map, however exact and grounded in indisputable observations, is less pertinent for the purposes of this research, since it can only be taken as an image of the sampling strategy but not as an image of the actual space in which people lived, unless there was a way to argue for the inappropriateness of assuming that people actually inhabited areas in-between the spots where positive shovel probes and surface collections were performed.

Settlement maps produced in the way of this project provide a visual representation of settlement distribution and density in a region, and form the basis for estimating population using area of occupation as a correlate of population size. With the resolution at which ceramic collections were performed, the maximum area of any lot would generally not be more than one hectare, an area so small that it would not turn into a gross overestimation of the actual extent of area occupied by period in the event that, say, only two thirds of the area of a lot had actually been occupied in period *X* compared to the whole extent of the lot area in period *Y*. In the future, investigations of occupational density in each period may be conducted in more sophisticated ways to deal with potential sources of distortion, but for now, and as far as the regional map is concerned, it is the aggregation, dispersion, or absence of occupied areas at a large regional scale that indicates the patterns, not minimal variation in the extent of each lot—which in any case, is not pertinent or even observable at this scale. The patterns important to this research have to do with broad trends in settlement distribution and density, and will be interpreted with the use of bridging arguments that link spatial behavior to social, political, and economic behavior.

Sites, Social Units, and Scale of Analysis

Sites were defined as aggregations of continuous collections, by drawing a boundary around a set of continuous lots. These are not meant to represent social units, though, because it is extremely difficult to characterize their nature and to sort them in a way that would allow the delineation of a settlement typology that could meaningfully account for different kinds of social units. With the information at hand—sherd collections associated with landscape features—it is complicated to say that a given group of collections represents, for example, a corporate group, or a community or village using typologies created for other regions (Flannery 1976), or envisioning a particular typology for this region as others have done for other regions (de Montmollin 1989). It would be quite controversial to choose a scale at which these small social units should be characterized (the site, a group of sites, a landscape unit), what criteria should be used to draw their boundaries, and how to assign functional attributes in the absence of architectural remains. Field observations, particularly those related to landscape modifications that provide evidence of the presence of residences and agricultural terraces, are the closest we got to a physical description of inhabited areas. Some of them were large and contained many such features, while others formed small groups or even individual units. These were useful to delineate sites and to keep in our records for future research concerned with the internal composition of units smaller than the region, but cannot at this stage stand for socially meaningful units.

This does not represent a handicap for the analysis of settlements, which can still be conducted with reference to broad patterns of settlement distribution that are distinguishable in this survey. The use and design of scales of analysis, generally conceptualized as a progression that starts with the local (the household), as a building block that composes larger units, serves the main objective of providing appropriate contexts in which to test different theories related to the behavior of humans in the past or present. Settlement typologies and settlement hierarchies sustain similar uses, although they have been mainly studied with the purpose of looking at the interaction among different components of a settlement system. The use of several scales of analysis, settlement typologies, and settlement hierarchies, also helps detect the loci and extent of variability in the operation of different social phenomena, and are therefore fundamental in the study of any heterogeneous society, such as a chiefdom. The regional scale at which this investigation is focused excludes analysis at scales smaller than the region or large portions of it at this stage. On the other hand, the archaeological record of the region does not seem to lend itself to the delineation of detailed settlement typologies or settlement hierarchies on the basis of regional data. In sum, the delineation of sites in the way they were defined in this project, is useful for organizing data and for exploring regional patterns of population density, but does not allow, for example, tracing change in any meaningful way at the scale of the individual site.

The Evidence of Different Occupations

A concern about any survey methodology in which the collection strategy is designed to obtain a small ceramic sample from each collection unit in the most time efficient manner in order to cover a large area, is the degree to which all the occupations that occurred in a region will be accounted for without bias. Due to the cumulative effect of depositional processes and successive occupations, early occupations are often prone to misrepresentation in regional surveys. This concern is particularly strong for surface collections, while for shovel probes the main concern is whether a single probe will yield materials that represent all of the occupations present in the area of a collection unit (Drennan 2000:51). Indeed, after having excavated a number of stratigraphic tests it was apparent that cultural remains could often be found at much more that 60 cm depth. Also, some of the tests excavated in lots where only late ceramics had been collected yielded early sherds. These two observations raised concerns about the degree to which shovel probes had always been deep enough to allow the recovery of early materials, or the degree to which surface collections were likely to yield early sherds in all cases where early occupation had occurred (with surface collections suspected of not producing early sherds in lots where test excavations had yielded them).

Collection Types and Ceramic Types: In order to explore whether surface collections had yielded samples of early sherds comparable to the ones yielded by shovel probes, the proportion of Early and Late Period sherds in each type of collection (shovel probe or surface) was compared (following Drennan 2002:51). If the collection method did not have an effect on the types of sherds recovered, their proportions should be very similar (Table 2.1).

Table 2.1. Sherd Distributions by Collection Type.

	Early 1 Sherds (n)	Early 1 Sherds (%)	Early 2 Sherds (n)	Early 2 Sherds (%)	Late Sherds (n)	Late Sherds (%)	Total (n)
Shovel probes	454	3.8%	488	4.1%	10,980	92.1%	11,922
Surface collections	228	2.0%	377	3.3%	10,975	94.8%	11,580

This comparison reveals that Early Period sherds, (Early 1 in particular), tend to be a little underrepresented in surface collections, and the opposite is the case for Late Period sherds. There is a chance that, in some cases, surface collections did not yield Early Period sherds in a collection area where there was occupation during the Early Period, or that they yielded less

Early Period sherds than they "should" have. However, this is not of a magnitude that could potentially alter the conclusions of the settlement analysis in terms of population distribution and change in different periods. It could only have much effect on absolute population estimates, if these relied on sherd counts.

With the comparatively little effort and time that surface collections imply, they yield samples of early sherds that are roughly comparable to the ones recovered through shovel probes, despite the initial perception that surface collections could be extremely problematic in terms of yielding samples of Early Period sherds. So, arguments about the unsuitability of archaeological surveys in regions without ideal conditions for surface collection do not apply, at least in this case. It is also worth noting that the proportion of lots where one, two, and three ceramic types are present is practically the same for both surface collections and shovel probes (Figure 2.5). Thus it does not seem that the collection method affected the likelihood that the different ceramic types were represented.

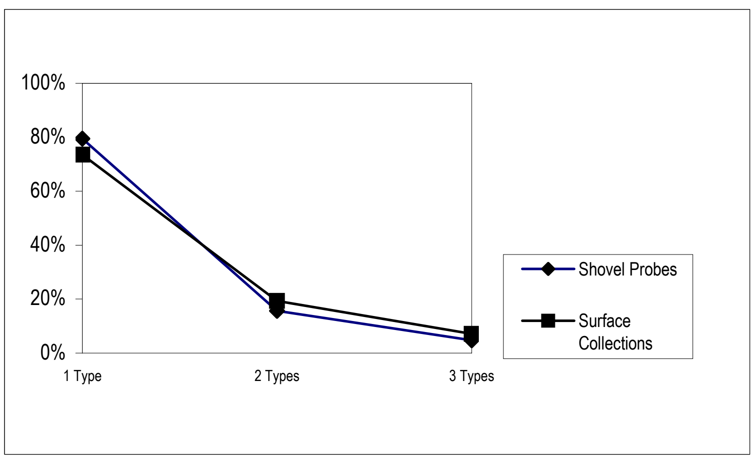


Figure 2.5. Percentage of Survey Lots with Respect to Number of Ceramic Types in Shovel Probes and Surface Collections.

Excavation Data and Survey Data: The second concern, regarding whether the areas occupied during the Early 1 and 2 periods are represented fairly in the survey collections was addressed by comparing the proportion of early sherds in stratigraphic tests to their proportion in the lots that form the settlements in which the tests were excavated. Early sherds sometimes appeared in test excavations located within the areas of lots that had not yielded any early sherds at all. Thus the question emerged of whether early sherds sometimes could have been buried too deeply to be recovered by either a shovel probe or surface collection. The excavations at one location were generally placed relatively close to each other, sometimes as close as a couple of meters, sometimes as much as 200 m. The majority of excavations at a single location were placed within an area of less than 1 ha. Because of their size and quantity, test excavations should yield larger and presumably more reliable samples reflecting the periods of occupation. The percentages of early sherds in excavations (15 2x1 m tests and 31 1x1 m tests grouped in 13 sites) and survey area compared by site in Figure 2.6.

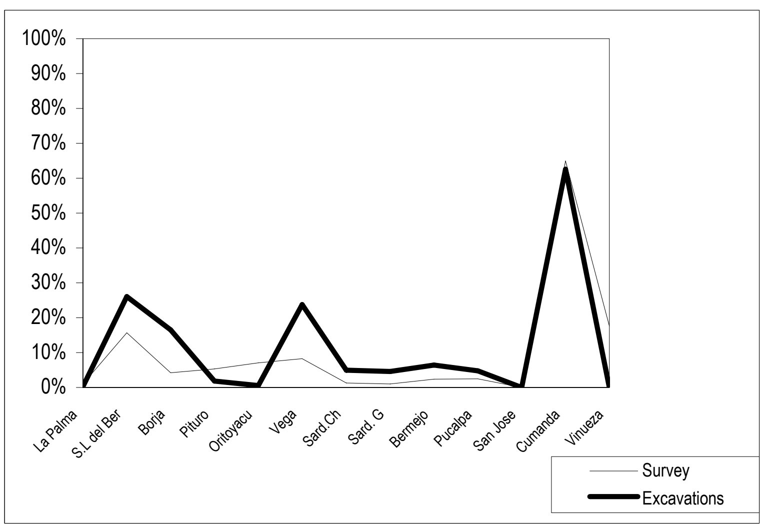


Figure 2.6. Comparison of Percentages of Early Period Ceramic Types Between Survey and Excavations.

The percentages of early ceramics at each site vary little between excavations and survey. It is possible that an individual shovel probe or surface collection may not always yield materials of all of the periods during which the area that they stand for was occupied. However, the grouping of adjacent lots over slightly larger areas provides figures of occupation by period that are very close to those produced by excavations. In the cases where early sherds were found in tests excavated in the areas of lots that had produced only late sherds, the early sherds invariably represent a very small proportion of the total of sherds, both in excavations and in the larger areas of occupation formed by adjacent lots to the one where tests were excavated. This is the case at La Palma, Sardinas Chico, Sardinas Grande, Bermejo, and Pucalpa. At San José no early sherds were found in the survey or excavations. The cases of Santa Lucía del Bermejo and Vega are more puzzling in that the proportions of early materials vary more than usual between survey and excavations (they are higher in excavations than what would be expected from survey data). The comparatively higher proportion of early sherds in excavations at Santa Lucía del Bermejo might be due to the fact that a large number of very small early sherds were found in the deepest levels of test VQ006. In contrast, the comparatively higher proportion of early sherds in excavations at Vega seems to be the result of an underestimation of early occupation at this location due to the unusually high number of late sherds in one of its lots. Despite these two cases, the overall pattern in the graph still suggests considerable harmony between survey and excavation data at locations where 1x1 m tests were excavated. A look at the sites where 2x1 m tests were excavated (La Palma, Borja, Pituro, Oritoyacu, Cumandá, and Vinueza) leads to similar conclusions. These were selected with the purpose of recovering samples of both early and late materials, and appeared in the survey as predominantly early or else multicomponent sites in a way consistent with the excavations. In some cases, early materials appear in even higher proportions in the samples yielded by the survey than the ones yielded by excavations.

Given the infinite factors that could possibly affect the distribution of ceramic materials of different periods in the very small areas that were examined and the small number of observations at each location, it is remarkable that there is such a close match between survey and excavation materials. It could hardly be argued that the locations that were chosen for excavations are not reflective of what could be expected for the entire region because they are spread over most of it. As such, they are unevenly subject to factors that could conceivably affect differentially the preservation and deposition of archaeological materials from different periods, such as steepness of slope and proclivity to landslides, likelihood of inundation, and modern vegetation and use. This does not suggest, though, that the impact of geological events should not be investigated in the future.

The above observations suggest that we can be confident that the survey collections represent the different occupations of small areas very effectively, although not always areas as small as a single lot. The fact that, say, early sherds do not appear in certain survey lots while they did in excavations within these lot areas, should not affect either the overall picture provided by the regional survey, or the analysis of regional population distribution considered alone or in relation to environmental variables.

3. SETTLEMENT ORGANIZATION AND POLITICAL CHANGE IN THE VALLE DE QUIJOS

The objective of this chapter is to reconstruct the history of sedentary occupation in the Valle de Quijos and learn, from the observation of patterns of settlement organization, how and when chiefdoms emerged in the region. The use of settlement information in order to reconstruct changes in socio-political organization has been one of the most prolific trends in archaeology over recent decades. The way this kind of information has been used and interpreted has changed substantially through time. Willey, one of the pioneers of settlement studies, considered settlement patterns as part of a broader package of traits that could be used in temporal and spatial characterizations, for example, “Why cannot the ‘small ceremonial center scattered hamlet’ settlement pattern be a criterion of Phase X in the same way that the pottery type Rodriguez Black-on White is a criterion of that phase?” (Willey 1968:213). Human ecology approaches and locational models borrowed from geography (emphasizing the adaptationist and functional dimension of settlement organization) became popular later, and were to different degrees associated with instrumental views of politics and social organization, emphasizing the administrative nature of political leaders, interpreting the emergence of socio-political complexity as a problem-solving strategy, and the economic rationale of settlement organization (Johnson 1977, 1980; Steponaitis 1981). Other approaches to settlement archaeology assume less about the administrative or economic determinants of settlement patterns or the “nature” of political authority, and instead focus precisely on investigating the rationale of settlement location and how it can illuminate issues of socio-political structure that are not conceived as instrumental in nature (de Montmollin 1989).

More recently, considerations about the cognitive and interactive dimensions of spatial arrangements have opened new discussions that treat settlements as embedded in landscapes that are symbolically constructed. This brand of landscape archaeology claims that not only the spaces physically inhabited should become the black dots of settlement maps, but also non domestic spaces that mark central spheres of action in the landscape such as agricultural fields and ritual landmarks (e.g. Ashmore and Knapp 1999; Barret 1999; Bender 1993; Chapman and Dolukhanov 1997; Crumley and Marquardt 1990; Fisher and Thurston 1999; Thomas 1996; Tilley 1994; Ucko and Layton 1999). The latter claim to challenge what today some see as "old" settlement approaches, although they do not acknowledge that such "old" approaches are not necessarily oblivious to the importance and existence of utilized spaces outside of strictly inhabited areas. More radical branches of landscape archaeology emphasize the power component of spatial cognition, and propose that the constructed landscape actively informs behavior and shapes political responses, thus landscapes are agents themselves and are political (Smith 2003). To this brand of landscape archaeology, the use of maps and settlement information "the old way," appears as just another relic of colonialist archaeology, pretentious in its claim of knowing the one way of reading "the map" (which it does with purely imperial eyes; locating the resources, counting the people, measuring territories…) at the expense of understanding how people in the past experienced their landscapes in ways that a quick reading of Foucault would certainly help us envision more vividly than the "reading" of a map.

This research sympathizes with approaches that investigate the motivations for settlement location instead of assuming that economic, political, or symbolic determinants are necessarily more worthy of consideration in all cases. It endorses the view that the investigation of the development of chiefdoms must be conducted at the regional scale, since these are precisely regional polities (Carneiro 1981; Drennan and Uribe 1987; Helms 1979). But other than their regional character, no other assumptions are made about the "nature" of the political organization of chiefdoms and the rationale of their spatial organization and demographic dynamics.

The particular changes in socio-political organization in the Valle de Quijos will begin to be investigated through the regional analysis of settlements. This is worthwhile in its own right, and also provides, in this case, the basis to evaluate different notions related to the economic organization of emerging chiefdoms. Specifically, with the use of settlement information I will evaluate the distribution of population with respect to altitudinal zones and resource distribution to explore whether there is an association between productive specialization or control of resources and the emergence of chiefdoms in the region. To further explore these issues, settlement information will also constitute the foundation of the direct evaluation of production and consumption patterns at specific locales through the analysis of botanical remains. These themes have been at the center of the discussion of the development of chiefdoms in Northern Ecuador and elsewhere, as indicated in the introductory chapter.

DIMENSIONS OF SETTLEMENT ANALYSIS

A detailed characterization of settlement organization, focused on assessing the magnitude and direction of changes in each one of three different interrelated dimensions of settlement organization and demography through time, constitutes the core of this chapter.

The first dimension has to do with the general regional distribution of settlements in each period. This provides a broad picture of the distribution of population and the extent to which all settlements should be analyzed in conjunction, or the degree to which analysis must be broken down to better characterize sub-regional dynamics that may differ from each other. This often appears in the literature as an effort to define different but interacting polities, which are generally identified in terms of settlements by a distribution that shows a recognizable center and a periphery that eventually fades, thereby defining the approximate boundaries of the polity or the "settlement system." This type of observation is common for chiefdom societies and is based on the assumption that physical distance can be used as a proxy for social distance, which is supported by ethnographic cases. Defining meaningful scales for the analysis of political dynamics is, anyway, an extremely complicated task, especially considering how little we know about interactions among chiefly polities, or what exactly constitutes a chiefly polity to begin with. At this stage of the research I only explore some general patterns (that must be investigated at greater depth in the future) by looking at continuity and fragmentation in the distribution of settlements, and manipulating the scale of analysis if it appears to be a promising endeavor. By doing so we will gain knowledge of when, how, where and if different polities emerged in the region by comparing the spatial distributions of settlements in different periods.

The second dimension of settlement organization examined here is centralization. This aspect of population distribution refers to the presence of large settlements that function as regional centers. In order to signify political complexity unusually large sites must act as central places, where social, ritual, or economic activities take place that attract people attached to the polity. The emergence of centralization and the emergence of hierarchy are the same when there are only two kinds of settlements (population centers and dispersed settlements). When the archaeological record lends itself to it, the importance of a population center is assessed by taking into account not just the size of the settlement relative to the size of other settlements but also the presence and magnitude of architectural or other remains that speak of site function and position in a political hierarchy (e.g. de Montmollin 1995; Kowalewsky et al. 1989; Muddar 1999). In the present case, the only kind of evidence available is settlement information. Settlement function almost invariably correlates with settlement and population size, as the most populated settlements are the ones that often have monumental works and other indicators of the social and political importance of the place. The emergence of settlement differentiation expressed in the development of population centers marks unequivocally a process of social and political differentiation. This is no breathtaking contribution if it only provides an empirical archaeological basis to argue that chiefdoms actually developed in the region. However, specifying when and where these central populations emerged, how many of them and how large, adds to a more nuanced understanding of the process of centralization in different chiefdoms and lends itself to comparison with regions for which similar kinds of information exist. More specifically, exploring this aspect of settlement organization through the examination of degrees of occupational density across the region provides an idea of changes in the existence and magnitude of settlement heterogeneity through time, therefore opening a window into changes in the nature of socio-political differentiation.

The last dimension explored here is population size. This refers to relative and absolute demographic estimates. Comparisons between periods in relative terms are straightforward and generally based on visual inspection of settlement maps. Absolute demographic approximations are more complicated to produce, especially if the factors that affect such estimations are not the same in all of the periods examined. But they allow the expression of demographic changes in the region in terms of actual people, even if the methods used to quantify population are far from perfect. Numbers of people, in turn, become useful for estimating population densities. The reconstruction of population size usually relies on proxies such as area of occupation, sherd quantity, number of sites, or number of structures. Discussions about the shortcomings and advantages of some of the different indicators (Drennan et al. 2004; Kvamme 1997; Schreiber and Kintigh 1996) point to the utility of considering some of them in conjunction in order to use the strengths of each one while mutually outweighing for their weaknesses. In regions such as the Valle de Quijos, where counts of residences are not a possibility, area of occupation, sherd quantity, and number of collections would seem the most appropriate approach. Drennan et al. (2004) discuss at length the implications of using these different indicators and their potential to lead to erroneous estimates, and graph different population change scenarios using each one of them independently to arrive at the conclusion that they change in remarkably similar ways. In their view, if different methods of tracing population changes consistently lead to similar reconstructions of change, such changes must have actually occurred, and the reconstructions are not just the product of distortions introduced by sampling biases or erroneous assumptions. Using the same approach, I examine different indicators of population change (area of occupation, number of collections, number of sherds and number of sites) and arrive at a similarly consistent view of population change (Figure 3.1).

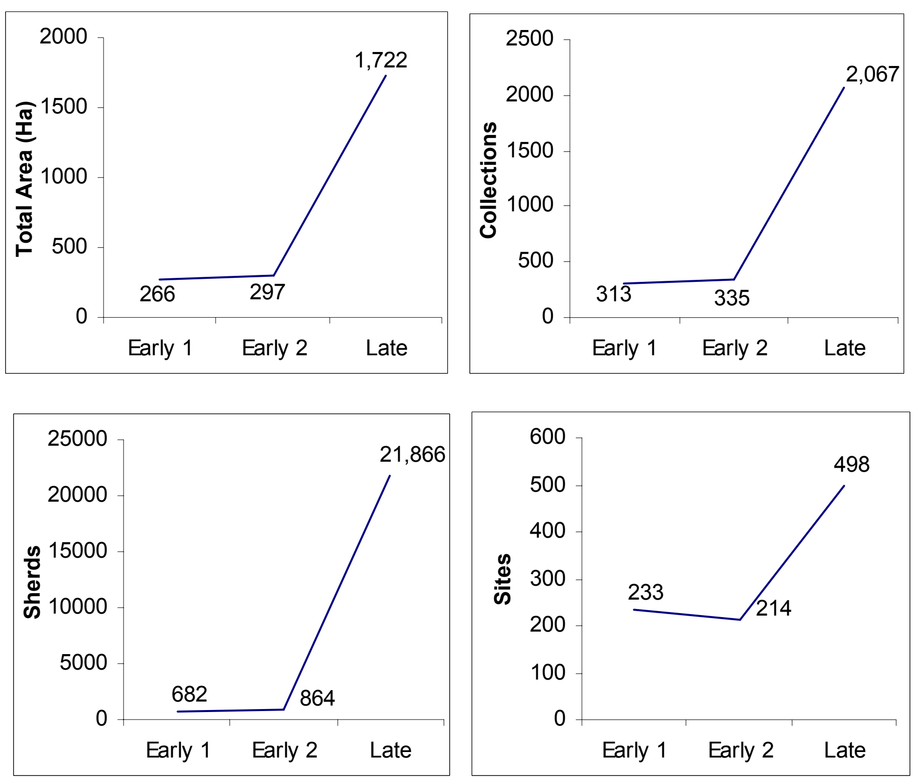


Figure 3.1. Comparison of Four Different Approaches to Demographic Reconstruction.

All of the approaches to reconstructing population change contemplated here lead to the same conclusion, which is, that population grew only moderately from the Early 1 to the Early 2, and soared during the Late Period. Different approaches will be employed to produce absolute population estimates of each period.

These three ways of looking at change in settlement organization and population can, of course, be related. The development of regional or sub-regional chiefly polities is seen in the expansion of settlements over large areas and in the emergence of population centers. This may occur with the emergence of one or multiple regional centers, and may develop into a settlement hierarchy composed of a heterogeneous array of settlement types or by a less differentiated one in which the only distinction is between nucleated and dispersed settlements. Centralization can emerge in concert with or in the absence of changes in population size. Population may grow without resulting in a tendency towards centralization, or may decrease and yet centralize. Drennan (1987), referring to the study of demographic dynamics in chiefdoms, calls attention to the fact that there has been a tendency to perceive different population and settlement variables as changing in tandem and resulting in a unidirectional outcome in the path to complexity. In brief, a dispersed and small population grows, producing an increase in regional population density with a tendency to concentrate into a growing center. This prototypical model however, does not match concrete sequences of demographic change when different variables related to population and settlements are considered (specifically, population size and population at the largest settlement) (Drennan 1987: 317-318). Therefore, independent examination of different dimensions of population and settlement organization, provides us with more interesting ways of understanding population and settlement configurations and change (de Montmollin 1995; Blanton 1998). A common approach to the study of social change in Ecuador (in which respect it is of course not alone) is to identify the temporal span of one or more occupations and incorporate them into a macro-synthesis that lays out stages of developmental change. Thus, the dating of sites in a region that correspond to a fixed span of Formative occupation leads soon to the conclusion that the society in question lived a typical Formative "lifestyle." Findings that could lead to the proposal of different dynamics tend to be intercepted by the already defined scheme of social types based on unilineal evolutionary assumptions, so the study of more and more sites or regions only adds to an inventory in the form of yet another "Formative" or "Integration Period" society. Preconceptions of settlement organization as related to population size loom large in this macro-model of directional change, therefore it is worthwhile to discuss them from an angle that may potentially contribute to making the macro-model less of a monolithic scheme for the understanding of pre-Columbian societies in Ecuador and elsewhere.

SETTLEMENT AND DEMOGRAPHIC HISTORY IN THE VALLE DE QUIJOS

Information regarding the settlement organization of pre-Columbian societies in the Quijos region is limited to Spanish accounts that describe contact and colonial period demography (Hortegón [1559-1629] 1989; Oberem 1980). For pre-Conquest periods Porras (1975) proposed some scenarios regarding population movements in the region based on his excavations (see Chapter 1), but a regional reconstruction of settlement patterns and demographic trends through time was not available, a gap that this research attempts to fill.

The ceramic chronology established in this study shows two clearly recognizable occupations in the region with the possibility of a subdivision of the first one into two. They have been labeled Early and Late, with Early 1 and Early 2 as a tentative division that needs further investigation. As discussed in the section dedicated to the ceramic chronology (Appendix A), the early occupation may have started by around 600 B.C and lasted some 900 years before giving way to a late occupation of similar duration by about 500 A.D. In the subsequent analysis of regional settlement data, Early 1 and 2 will be treated separately; nonetheless, the implications of analyzing them together will be discussed too. Neither Porras nor previous contract archaeology work have considered the possibility of an early occupation prior to the one identifiable by the use of Cosanga pottery. This can be attributed in part to the overwhelming predominance of Cosanga pottery in most of the area, which makes the detection of an earlier occupation very difficult. Also, it had never been within the objectives of past projects to establish sequence of occupation and demographic change in the Quijos region.

The presence of a pre-ceramic occupation is of course conceivable but has not been thoroughly studied. Porras (1975) presents scant evidence of a pre-ceramic occupation in areas very close to this survey area, yet there is not much information to talk about the organization of these presumably hunter-gatherer groups. In this survey lithic artifacts and debitage were very common in excavations, surface collections, and shovel probes; but it is possible that the bulk of the lithics were produced by the sedentary inhabitants of the region since these materials are almost invariably associated with ceramics. Alternatively, the conspicuous extent of the Late Period occupation may have obscured pure pre-ceramic contexts. Evidence of a possible pre-ceramic occupation appeared in the excavation of only one of the 2 x 1 m tests. It consisted of an unusual accumulation of obsidian flakes and cores in the deepest level of excavation at test VQ008, with no association to any ceramic remains. Little can be said from the description of this finding, and therefore further discussion in this respect is not worthwhile.

Early 1 Period

The settlement distribution during this period denotes a sparse and small population (Figure 3.2). Only 313 (about 15%) of the 2121 ceramic collections of the survey produced evidence of this occupation (these yielded a total of 682 sherds). The total area of occupation is 265.5 ha, which represents less than 2% of the survey area. This occupation is thus scant and dispersed throughout the region, although not homogeneously. Most of the population settled in the lowest altitudinal range (1,500 to 1,800 meters above the sea level), in the eastern portion of the survey area, also characterized by having the largest tracts of flat terrain.

Settlement Distribution: Settlements distribute throughout the surveyed area, yet there are some gaps in occupation (more notably, between the northeastern and northwestern subregions and between the northern and southern subregions) (Figure 3.3). These, however, do not correspond to separations between areas of major population concentration, they simply appear to be gaps produced by a very dispersed settlement pattern. The settlement distribution in either the northwestern and southern subregion looks extremely dispersed (most sites are composed of single relatively isolated lots) when compared to the northeastern subregion.

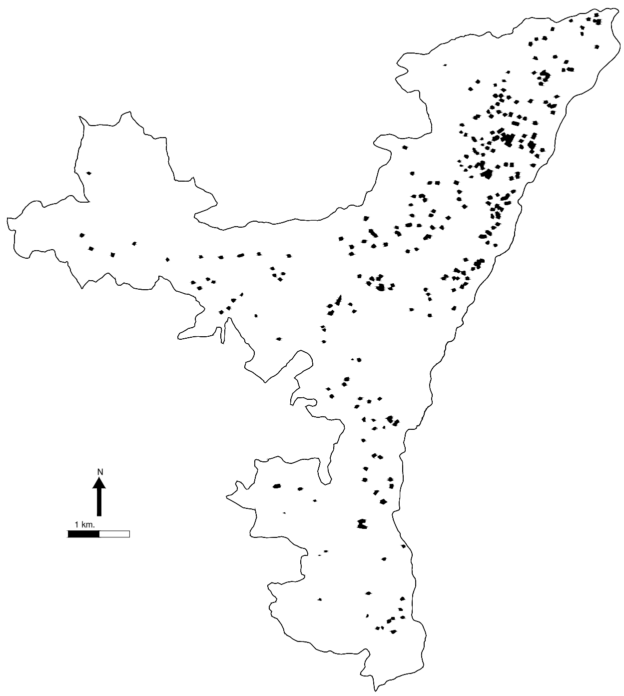


Figure 3.2. Early 1 Period Occupation.

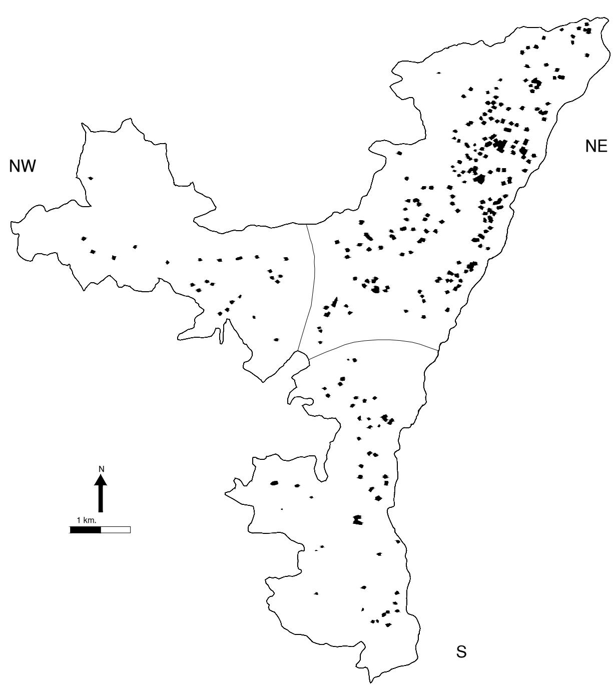


Figure 3.3. Early 1 Period Settlement Distribution in Survey Subregions.

Considering the survey area by subregions, occupation is very unevenly distributed. Only the southern subregion has approximately the expected area of occupation based on the proportion of the surveyed area that it represents (Table 3.1). The northeastern subregion, by contrast, has nearly twice the expected occupation, while the northwestern subregion has only one-fourth of that expected.

Table 3.1. Distribution of Occupation by Subregion (Early 1).

Subregion	% of Total Surveyed Area	% of Total Occupied Area
Northwest	27 %	7 %
Northeast	41 %	71 %
South	31 %	22 %

These calculations do not take into account environmental variables that could have acted differentially as limiting factors for settling in the different subregions of the survey. It appears that this Early 1 Period population preferred the flatter and warmer northeastern subregion, but not to the extreme that people entirely restricted their settlements to this area. During the Late Period people settled more densely in the zones that barely show signs of occupation during the Early 1; therefore, there is no reason to think that they could not have done so earlier than that. Climatic changes that had the potential to affect the altitudinal cultivation limits could partly account for the patterns observed. A period when temperature was lower than today could have conceivably made the lower altitudes more attractive for occupation (and could explain why, during the Early 1, people preferred the lowest altitudinal range); inversely, a period warmer than the present would not pose any inconvenience for the occupation of the high altitude range. For the moment, the presence of settlements at both the highest and lowest elevation ranges when there was plenty of vacant territory throughout, does not speak to a situation in which some people, faced with the unavailability of land at lower altitudes, had no option but to settle at the highest altitudes. The density of occupation in the most densely settled zone was too low to impede the accommodation of a larger population. As we will see, this subregion sustained a much larger population some centuries later.

To conclude, nothing indicates that the Early 1 population formed more than one settlement system. If that was the case, different concentrations separated by gaps of low or nonexistent population should be visible; but instead, population diminishes gradually towards the south, and rather abruptly towards the west. Breaking down the analysis of settlement distribution into subregions is thus neither promising nor necessary.

Centralization: Settlements concentrate more strongly in the northeastern portion of the survey area. The largest settlement (VQ319) occupies 10.4 ha (followed by VQ344 which is 6.4 ha), but this is not isolated; many smaller settlements appear in close proximity forming one of the areas with the highest density of occupation when this is measured as area occupied by grid unit of 500 x 500 m (Figure 3.4).

In fact, 99 of the 265.5 ha of occupation during this period (which is about 33% of the occupation) are within just a 2 km radius of this site (the area within this ratio represents only 8% of the survey region) (Figure 3.5). The proportion of area occupied relative to the area within this 2 km radius is 8%, which is higher than the proportion of area occupied relative to the entire survey area (about 2%), or relative to the northeastern subregion as a whole (about 3%).

Another way of looking at this is to examine the distribution of sites (as defined in Chapter 2) by size (Figure 3.6). This should only be taken as another way of exploring possible patterns instead of a “picture” of them, because this graph, which treats each site in isolation from each other, has the potential to show disaggregate areas of occupation that are near each other yet not necessarily joined as a single site. In this case, sites larger than 2 ha (a break visible in the histogram) represent about 20% of the total area of occupation, thus, 80% of the population lived in very small sites. In fact, 40% of the area occupied (106.6 ha) is accounted for by the addition of many settlements smaller than 1 ha. A histogram showing the distribution of 500 x 500 m grid units with occupation by the area of occupation shows the same tendency (Figure 3.7). Despite the fact that grid units can cut sites arbitrarily, the match between the two histograms is very satisfactory, with the advantage of the latter being that it pools sites that are in close proximity.

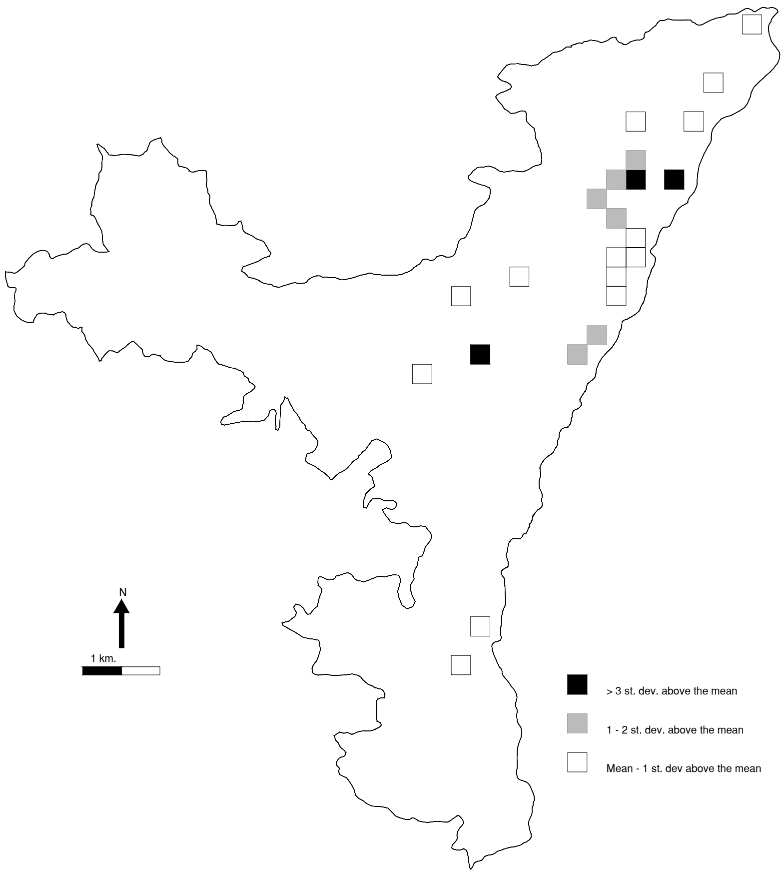


Figure 3.4. Early 1 Period Area of Occupation in 500x500 m Grid Units.

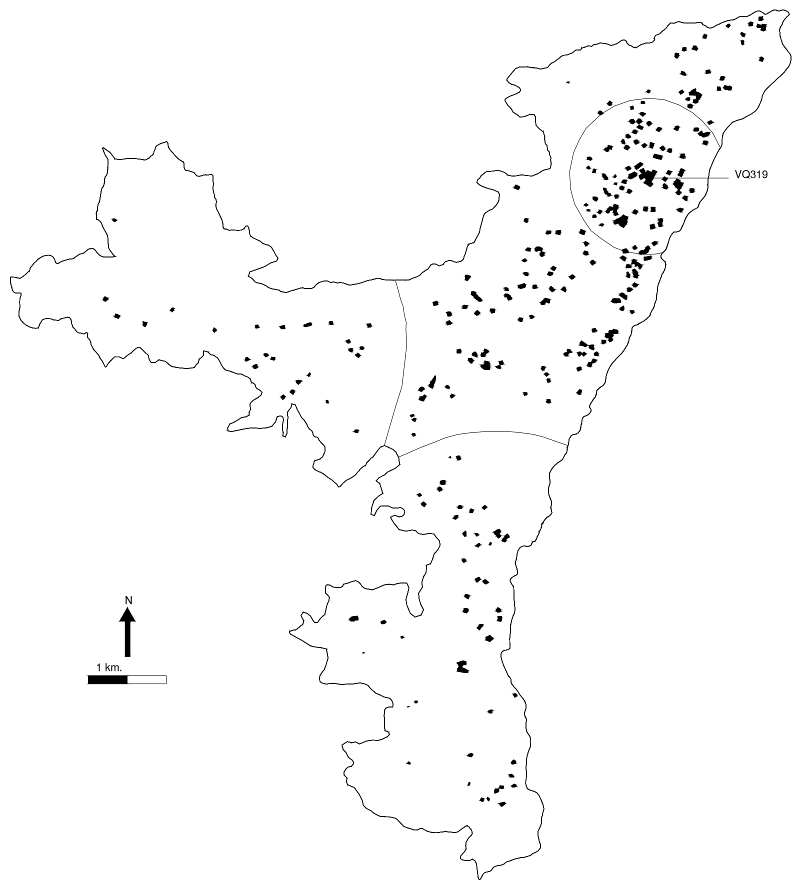


Figure 3.5. Early 1 Period Largest Settlement.

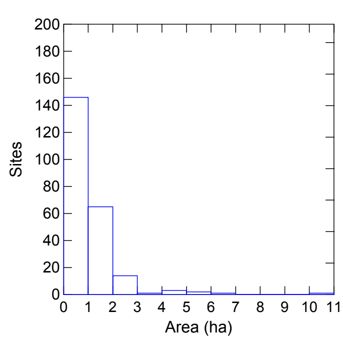


Figure 3.6. Early 1 Period Site Size Distribution.

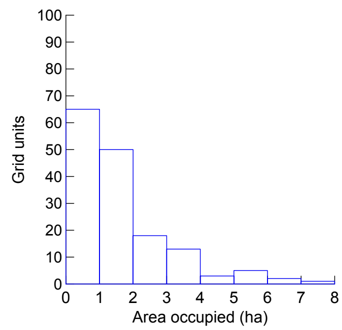


Figure 3.7. Early 1 Period Occupation in 500x500 m Grid Units.

Although the very dispersed nature of settlements and the nature of sites in this case makes it inappropriate to make calculations such as proportion of the occupation concentrated at the largest site, for example, a tendency of the population to concentrate in proximity to the largest site and to diminish as distance from it increases is easily detectable (the contour density map in Figure 3.8 helps to visualize this). This pattern though, seems more an indication of a nascent population that has not grown and expanded substantially beyond a very small area (Flannery 1976:168), instead of a trend for the population of an entire region to concentrate around a central site. Thus, there is no need to say much about settlement hierarchy in the context of a population that is largely local. Despite some differentiation in terms of settlement densities, it is unlikely that a social or political hierarchy existed at this stage.

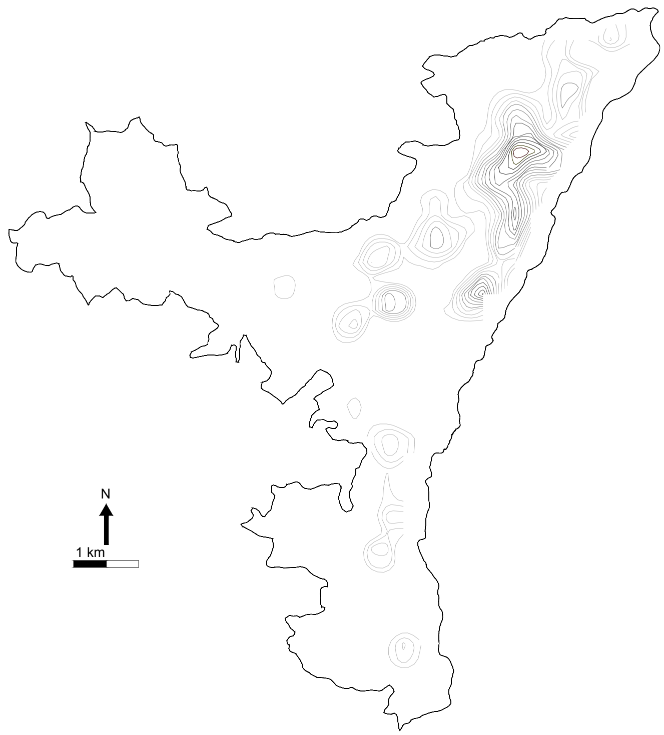


Figure 3.8. Early 1 Period Density of Occupation.

Population size: It is difficult to imagine how an early settlement, say a hamlet may have looked in this period in the absence of excavations of large areas or more detailed mapping produced through an intensive survey or a similar methodology. We do not know how densely or sparsely occupied each individual area was, whether for example, three houses occupied by three nuclear families would typically use the area of 1 ha (.33 ha per house) or the area of 6 ha (2 ha per house). Consideration of population density within settlements is obviously important for population estimates and, more generally, to envision what different settlement sizes (as reconstructed in the regional survey) tell us in terms of the types of social groupings that they represent. This is a question that we do not expect a regional survey like this one to answer, but it is one that is nevertheless interesting to ask and that can be answered using information produced at smaller scales in the future.

Despite the absence of such information for the Valle de Quijos, it is worth looking at other not too distant regions where, through excavations and other methods, archaeologists have been able to reconstruct the settlement structure of early sedentary societies in considerable detail. In the case of Cotocollao (Villalba 1988), a Formative settlement north of Quito (approximately 120 km from the research area), residential areas were excavated in addition to numerous smaller tests. The results of this work were reported by Villalba (1988) with an exemplary degree of detail and clarity. Based on excavation data he estimates between 27 and 37 houses that form household clusters that vary between 250 and 900 m² in size for the Early Formative, a figure remarkably similar to the one that González (1998:133-135) finds for Formative household groups at Mesitas in the San Agustín region in Southwest Colombia (averages per subdivided period range between 371 and 737 m²). The number of houses at Mesitas is also similar towards the end of the Formative Period (31 for the Formative 2 and 38 for the Formative 3). For the Late Formative there is an increase in both occupied area and density at Cotocollao, the estimate of households rising to 106 spread over an area of 26 ha (Villalba 1988:73), which would result in an average of four households per hectare. This is considerably higher than what González finds for the San Agustín region, but resembles the estimates provided by Jaramillo (1996) for the Valle de La Plata, a nearby region in Southwest Colombia. With a less extensive program of excavations in large areas but considerable intensive testing (when compared to Villalba's work at Cotocollao), Jaramillo identified at least one Formative settlement of similar density (he estimates between four and twelve houses for a site smaller than 1 ha that is not located in one of the areas of major occupational density during the Formative Period as seen from the regional survey). In general, the density maps presented display continuous distribution of Formative ceramics in sites smaller than 1 ha, a pattern that according to Jaramillo indicates the presence of a few houses grouped in small areas.

These sets of data can be kept in mind as references to envision possible scenarios for the early occupation of the Quijos region within the limits of what has actually been documented for other nearby regions. Perhaps the single most interesting observation is that despite the very dispersed settlement pattern of the Formative occupation in the Valle de La Plata, even in sites smaller than 1 ha a few houses could have settled. So, a very dispersed settlement pattern in which most of the sites are composed of single collections may not necessarily be the result of people living in isolated individual houses as is sometimes assumed (e.g. Langebaek 1995). Yet, this is not inconsistent with the overall settlement pattern picture of a low and dispersed population.

Population estimates for this period can incorporate the observations outlined above into hypothetical scenarios. The application of demographic figures based on sherd density following Sanders et al. (1979) is a common and logical approach. A figure of 2.5 to 5 people per hectare seems appropriate given the extremely low sherd density in the collections of this period (an average of 2.1 sherds in shovel probes). For Sanders et al. (1979:39) these low densities correspond to a pattern of "scattered village." The use of this figure would result in a population estimate of 664 to 1,327 people. Yet, if each collection area, no matter how small, represents between one and two nuclear families of five people each (the average collection unit is 0.8 ha), the estimate is higher; between 1565 and 3130 people. The latter is similar to what we would arrive to with the familiar 5 to 10 people per hectare figure: 1,327 to 2,655 people. For the San Agustín region, where estimates from survey data can be contrasted to the reconstruction of residential areas, the 5 to 10 people per hectare figure calculated for the survey is the one that most closely resembles the estimates arrived at through the counting of house clusters of the Formative 2 and 3 periods. For the Formative 1, the 2.5 to 5 people per hectare figure presents the closest match (González 1998:109-123).

Regarding possible variations in occupational density, it is worth noting that the range of variation of sherd densities in shovel probes is so low (between 1 and 14 sherds per shovel probe), that it can hardly be taken to indicate actual variations in population densities in different parts of the region. The spatial distribution of shovel probes with more than six sherds (which is very unusual) is restricted to the northeastern portion of the survey with the exception of one lot (Figure 3.9), but this may likely indicate simply the fact that since the northeast was the area from which population initially expanded, it was occupied longer than the new settlements founded outside of it. On the other hand, there is not much reason to expect that an apparently socially undifferentiated population would display contrasting demographic trends, although this needs to be confirmed with more research in the future. In any case, it seems unnecessary to correct for variations in occupational density throughout the region.

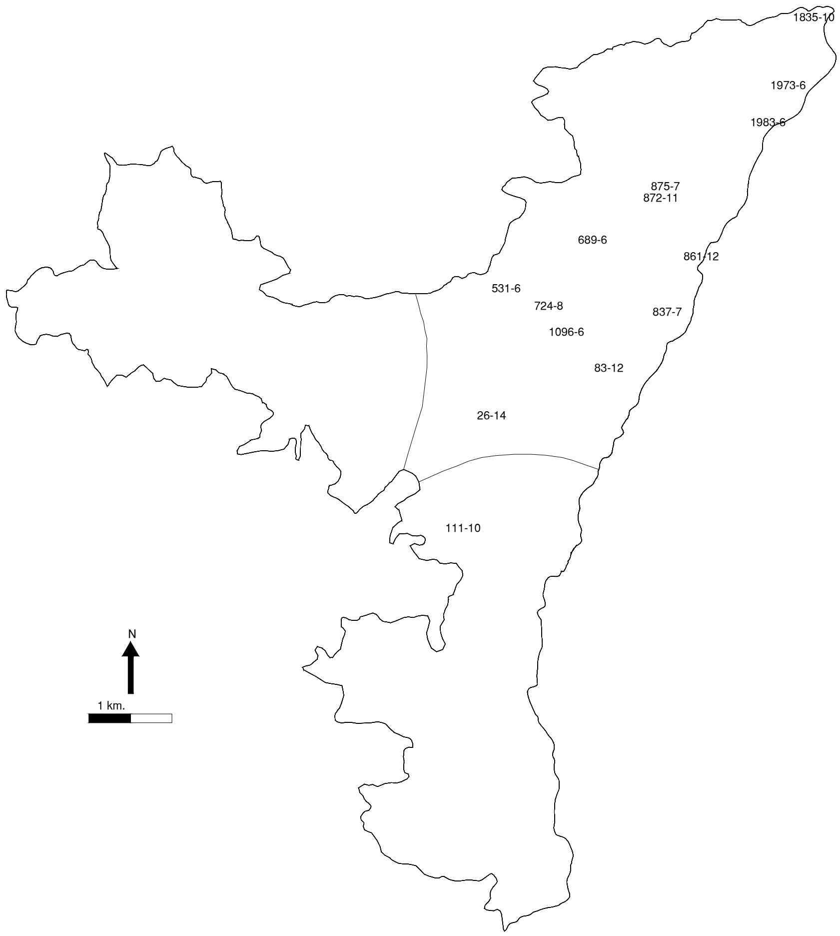


Figure 3.9. Shovel Probes with High Counts of Early 1 Materials.
(numbers indicate lot number and sherd count).

Taking the lowest and highest ends of the different estimates proposed above would lead us to a maximum range of about 700 to 3100 people, for a regional population density of 5 to 22 people per km². Langebaek (1995:77) estimates 3 to 11 people per km² for the Herrera Period (the earliest in the Eastern Highlands of Colombia) and Drennan et al. (1991:313) estimate 8 to 16 people per km² for the Formative Period. The population density estimates provided here seem, in perspective, very typical of early sedentary occupations in the Northern Andes.

Early 2 Period

This period sees little change with respect to the Early 1. The population is similarly dispersed and small (Figure 3.10). Just 335 ceramic collections represent this period (16% of the total of collections), which yielded just 864 sherds. The total area of these collections is 297 ha, more than the Early 1 (165.5 ha), but still represents only about 2% of the survey area. Resembling the Early 1 period, the population is spread throughout the whole surveyed area, perhaps even more, although likewise more heavily concentrated in the northeastern subregion (Figure 3.11).

Settlement distribution: The slight gaps in occupation observed during the Early 1 period are slightly blurred now, probably the result of the growth of some of the settlements that were located towards the western and southern edges of the most populated area and of the general tendency towards more expansion apparent in this period. However, occupation is very unevenly distributed in the different subregions. Similar to the Early 1, only the southern subregion approximates the area of occupation expected on the basis of the proportion of the surveyed area that it represents (Table 3.2). The northeastern subregion has nearly twice the expected occupation, while the northwestern subregion has only about one-fifth.

Table 3.2. Distribution of Occupation by Subregion (Early 2).

Subregion	% of Total Surveyed Area	% of Total Occupied Area
Northwest	27 %	5 %
Northeast	41 %	71 %
South	31 %	24 %

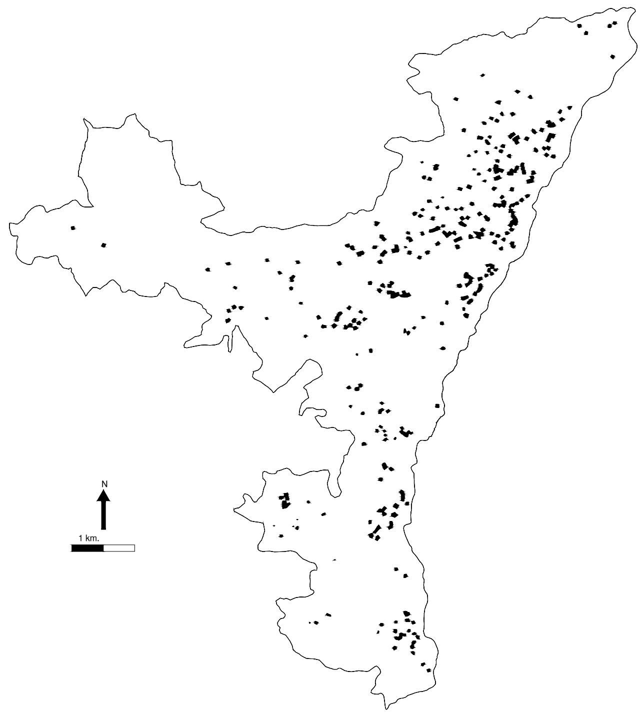


Figure 3.10. Early 2 Period Occupation.

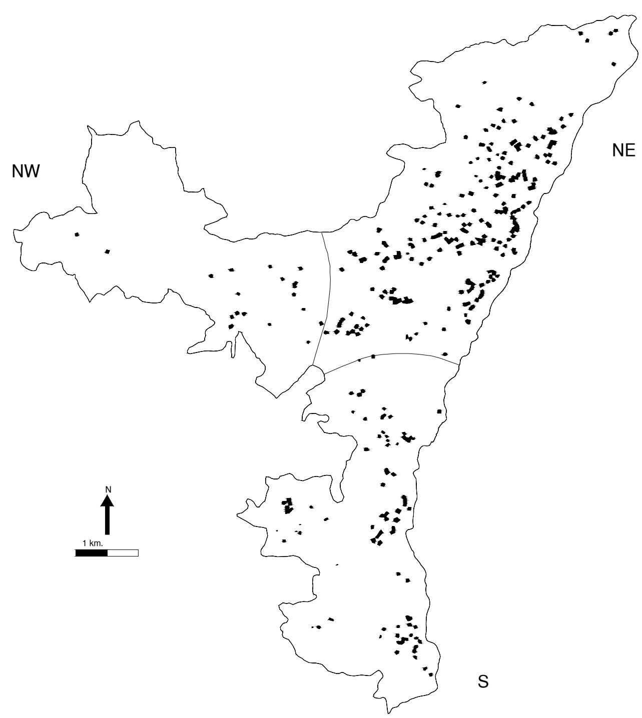


Figure 3.11. Early 2 Period Settlement Distribution in Survey Subregions.

As noted when discussing the settlement distribution during the Early 1 Period, the different patterns of occupation in the different subregions could possibly be due to the seemingly more appealing conditions of the northeastern subregion. Yet, to a lesser extent, people settled outside of this area too. It is inconceivable that they would have done so if the conditions for habitation were so unappealing, given the very low density of occupation in the northeastern subregion.

Centralization: The concentration of settlements in the northeastern subregion continues during this period. Many of the grid units with higher occupational densities maintain the same location (Figure 3.12), and 31% of the occupation is concentrated within a 2 km radius from the largest settlement (VQ205) (Figure 3.13), which is remarkably similar to the Early 1 (the area within this radius represents less than 8% of the survey area). The proportion of the area of occupation relative to the area within the 2 km radius is 9%; which is higher than the proportion of area occupied relative to the entire survey area (2%), or relative to the northeastern subregion as a whole (4%). The largest sites (larger than 2 ha) account for 24% of the area occupied, which means that 76% of the occupation corresponds to sites smaller than 2 ha. The change in this respect, compared to the Early 1 Period, is barely noticeable (Figure 3.14). The picture does not change when, instead of sites, 500 x 500 m occupied grid units are used as units of observation (Figure 3.15). The norm is, similarly, a majority of very small settlements and a few larger settlements that account for less than one-fourth of the total area of occupation during the period.

Interestingly, the slightly denser occupation in the southern subregion is apparently not just an addition in the number of areas with occupation (more collections), but also an increase in the tendency of those areas to form larger settlements. The same can be said of the northeastern subregion, where small settlements in relative isolation become less common. The tendency towards aggregation in the southern subregion looks more similar to the pattern observed in the northeastern subregion during the Early 1, despite the fact that settlements in the southern subregion are not as abundant.

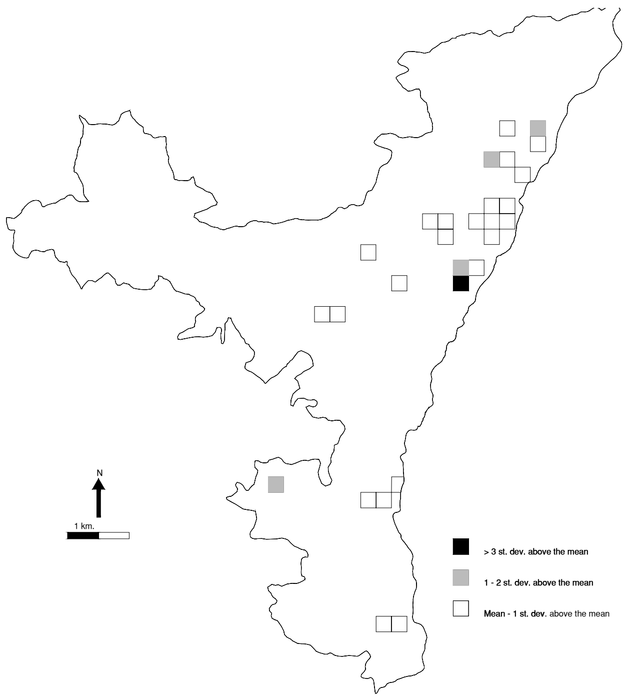


Figure 3.12. Early 2 Period Area of Occupation in 500x500 m Grid Units.

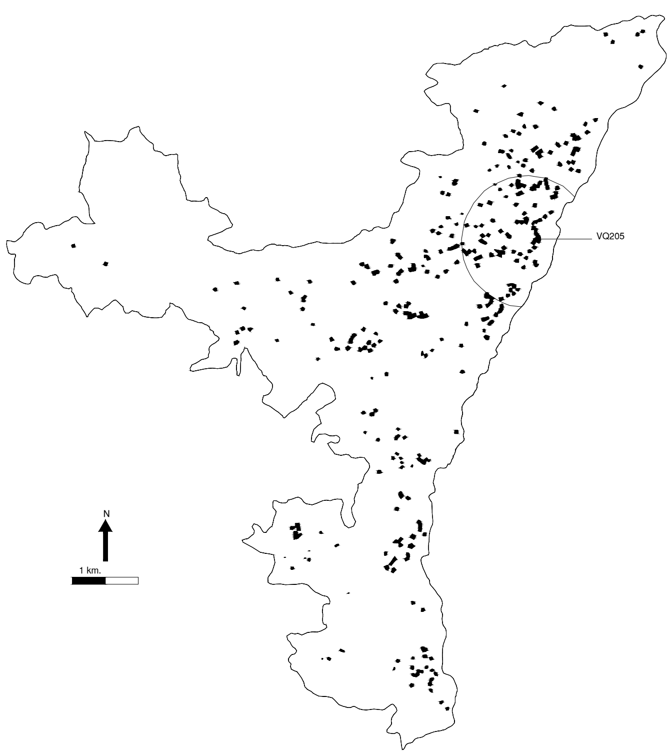


Figure 3.13. Early 2 Period Largest Settlement.

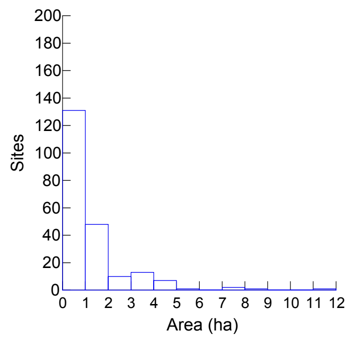


Figure 3.14. Early 2 Period Site Size Distribution.

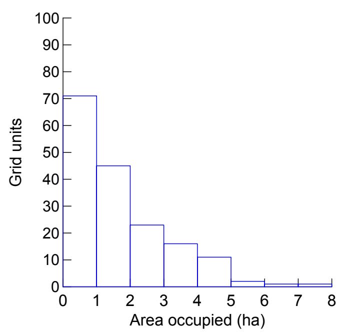


Figure 3.15. Early 2 Period Occupation in 500x500 m Grid Units.

The most general observation thus, is that the density of occupation is still higher in the northeastern subregion, but in contrast with the Early 1 period, there is no visual appearance of a largest site from which other smaller settlements radiate. This is most vividly perceived on a contour map (Figure 3.16), which, compared to the one of the Early 1 Period, shows the emergence of small areas of slightly high population concentration outside of the northeastern subregion, specifically in the southern subregion, as previously noted. This pattern could be reflecting a process by which new settlements are founded even further away from the area of initial occupation in the northeastern subregion. None of these larger settlements, however, had the capacity to attract large populations around them, and despite a tendency towards the formation of denser settlements, the majority of them formed only areas of very low occupational density. Therefore, a process towards centralization did not occur during this period. Despite differences in terms of settlement size and density in a few areas of the survey, and a very weak tendency towards settlement nucleation there does not seem to be any notable degree of settlement differentiation.

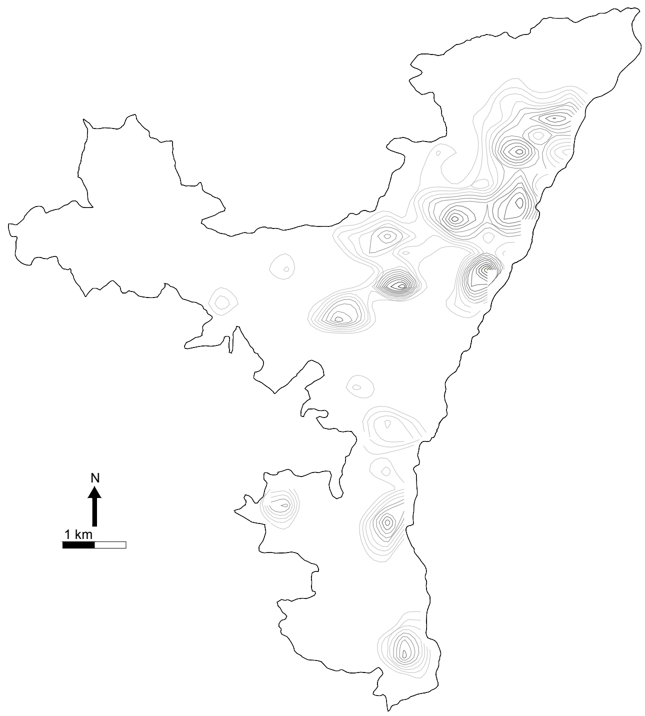


Figure 3.16. Early 2 Period Density of Occupation.

Population size: Using the same rationale laid out in the discussion about the population of the Early 1 Period makes sense for this one, since the extent of occupation and settlement characteristics are very similar. Sherd density is similarly small as well (an average of 2.5 sherds in shovel probes). The figure of 2.5 to 5 people per hectare would produce an estimate of 742 to 1,485 people. A figure of 5 to 10 people per collection unit, assuming that each one represents between one and two families of 5 people, would produce an estimate of 1,485 to 2,970 people. This is similar to simply applying the common 5 to 10 people per hectare figure, which would result in an estimate of 1,675 to 3,350 people.

Variations in occupational density, although assessed with reservations from the quantity of sherds in shovel probes alone, are not dramatic (between 1 and 30 sherds). It is worth noting that the spatial distribution of shovel probes with higher sherd densities (more than seven sherds) continues to be limited to the northeastern subregion with only three exceptions that correspond to collections in the southern subregion, where population growth is more marked with respect to the Early 1. It is hard to argue that this reflects pronounced differences in settlement densities across the region. But the fact that the northeastern subregion continues to be the area where shovel probes have higher sherd densities is probably no coincidence either, and likely is a product of the length of occupation in the area. Further, in the absence of other evidence of social differentiation during this period, there is not much reason to expect that some settlements experienced demographic dynamics that were distinct from others. As a result, there should be no concern regarding distortions in the population estimates for this period introduced by the presence of different settlement densities, although this is an aspect of the demographic history of the region that must be studied in greater depth in the future.

Using the lowest and highest ends of the different estimates would lead to en estimate of about 750 to 3,350 people, for a regional density of 5 to 24 people per km². The change with respect to the Early 1 is thus extremely modest.

Late Period

The regional distribution and characteristics of settlements change substantially during this period. Settlements expand to many areas not previously inhabited, and they also show a tendency towards concentration (Figure 3.17). 2,067 collections (97% of the total of collections) yielded evidence of late occupation; they add up to an area of 1,722 ha (97% of the total of area occupied in all periods, yet only 13% of the total survey area). Thus, regional density increased from 2% to 13% in the transition from the Early to the Late periods. Drennan (2000:53) reports a regional density of 8% for the Regional Classic Period in the Valle de La Plata, so this case does not seem unusual for early chiefdoms in the Northern Andes. Despite widespread distribution of settlements throughout the surveyed area, the density of occupation is not even.

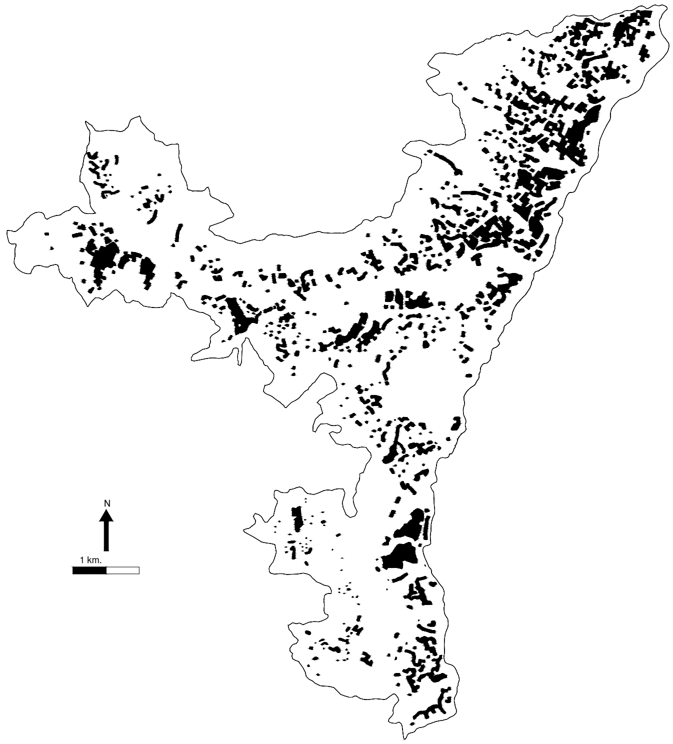


Figure 3.17. Late Period Occupation.

Settlement distribution: There are changes in terms of occupational density in the different subregions. Most of the occupation continues to be concentrated in the northeastern subregion, but it increases notably in the northwest and to a lesser degree in the southern subregion (Figure 3.18). The southern subregion continues to have approximately the area of occupation that would be expected based on the proportion of the surveyed area that it represents (Table 3.3). Likewise, the northeastern subregion continues to have more occupation than would be expected, while the northwestern subregion moves closer to the expected occupation.

Table 3.3. Distribution of Occupation by Subregion (Late).

Subregion	% of Total Surveyed Area	% of Total Occupied Area
Northwest	27 %	18 %
Northeast	41 %	59 %
South	31 %	22 %

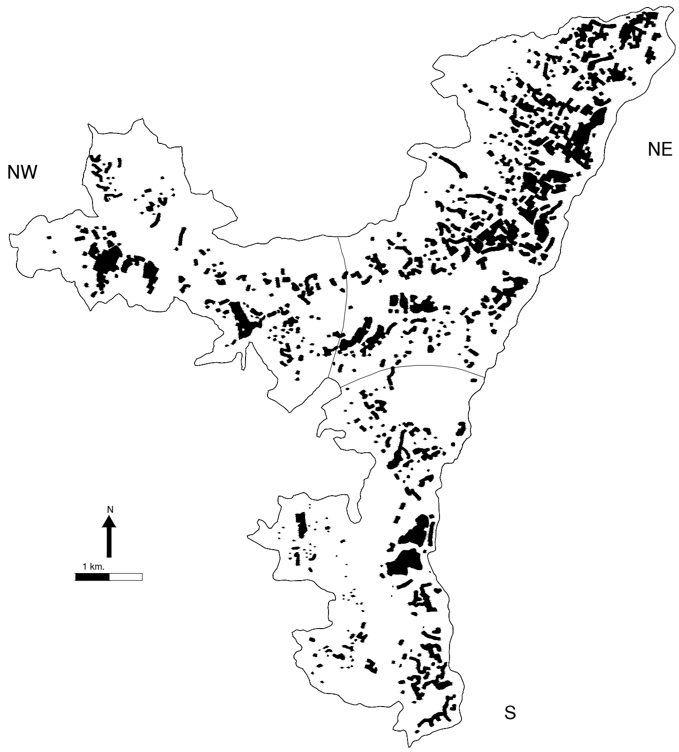


Figure 3.18. Late Period Settlement Distribution in Survey Subregions.

In the northwest the area of occupation is 21.5 times than that of the Early 2, compared to 4.8 times in the northeast and 5.4 in the south. This is a rather sudden increase in the northwestern subregion, particularly taking into account that occupational density had always been low there. Despite these differences, the settlement distribution in each subregion has a similar structure, in that at least one very large settlement in each subregion is accompanied by a series of medium and small settlements. This differs from the Early 1 and 2 periods, in which large settlements outside of the northeastern subregion did not emerge, and therefore the settlement pattern conveyed the idea of gradual dispersion from a core area in the northeast (during the Early 1 in particular) or the presence of a few incipient large settlements outside of the northeastern subregion (during the Early 2).

This is easily seen on a map that shows the density of occupation per grid unit of 500 x 500 m (Figure 3.19). Instead of showing one area of major density with a few areas of lesser density spreading outside of its vicinity (which was the case during the Early 1 or 2), now there are three areas of major density surrounded by areas of lesser density around them, one in each subregion of the survey area. This encourages us to pay attention to subregional settlement dynamics.

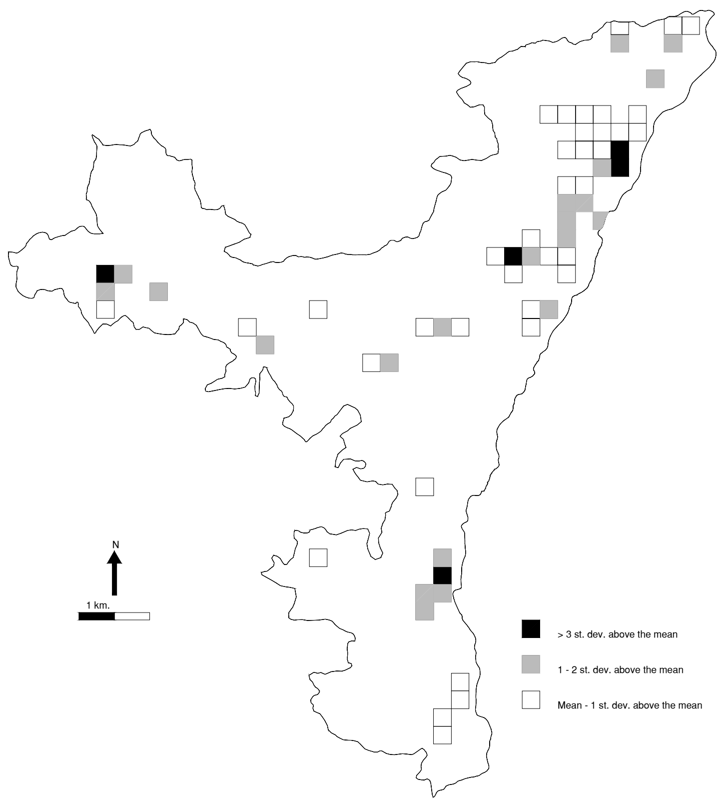


Figure 3.19. Late Period Area of Occupation in 500x500 m Grid Units.

Centralization: Very large concentrations appear in the northwestern subregion and the southern subregion for the first time in this period. These concentrations, in the case of the northwestern and southern zones are similar in terms of their size and in the way they relate to the rest of the settlements in their respective zones. In both cases, they are unusually large when compared to the rest of the settlements (Figure 3.20). The proportion of the area occupied relative to the size of the subregion within a radius of 2 km from them is 38% and 37% respectively (the area within the 2 km radius with respect to the size of each zone is 22% and 21% respectively).

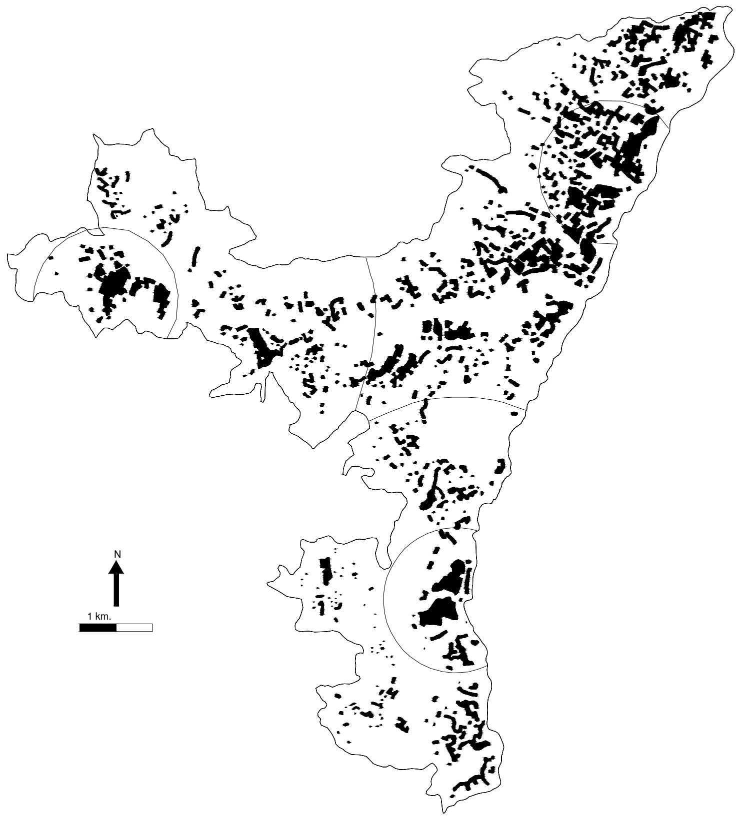


Figure 3.20. Late Period Largest Settlements.

The largest concentration in the northeastern subregion seems more extensive and not so dislocated from the rest of the settlements in terms of size and location. In fact, it is hard to isolate this or other smaller concentrations from each other because the appearance is more that of settlements splattered across the landscape that lack clear boundaries and do not fade from a readily apparent core. Yet, if this is taken to represent the most important concentration in the northeastern subregion, and the proportion of the area occupied within a 2 km radius from this is calculated (36%), it turns out to be similar to the ones observed in the northwestern and southern subregions (the area within the 2 km radius represents only 17% of the area of this zone).

The contour map in Figure 3.21 illustrates the situation just described, showing large areas of high density that are hard to separate from each other in the northeastern subregion versus rather discrete pockets of high density in the northwestern and southern subregions. The proportion of area occupied relative to the area within the 2 km radius in each subregion is, not surprisingly, above the regional proportion (which is13%)—although to differing degrees (38% for the NE, 15% for the NW, 16% for the S).

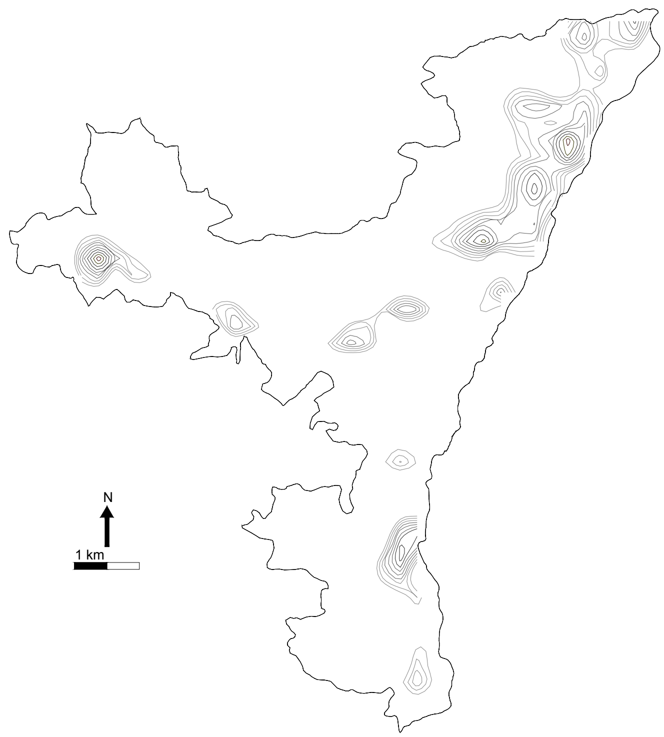


Figure 3.21. Late Period Density of Occupation.

The characterization of a settlement hierarchy in this case is straightforward in that there are essentially only two types of settlements: nucleated and dispersed. The way the largest concentration in the northeastern subregion relates to the regional population changes through time. It accounts for 22% of the total regional occupation (lower than in the Early 1 or 2), demonstrating that population size and proportion of the population that forms the largest settlement (interpreted here in a flexible way that is not limited to a single site) do not have to increase conjointly (Drennan 1987). In fact, the trend seen here matches Drennan's model of population change in chiefdoms very well, in which it is in fact expected that the proportion of the population at the largest settlement will diminish as the regional population grows (Drennan 1987:315).

The presence of multiple unusually dense settlements that have the appearance of central areas is commonly interpreted as a manifestation of multiple small chiefdoms or polities. This interpretation seems plausible in this case. These areas of population concentration can be envisioned as prominent in social or political terms. The people that lived in them could have settled elsewhere in much smaller settlements, as the majority of people did, but instead they chose to be part of these larger populations. The existence of unusually populated areas is almost invariably associated with the existence of leaders, and although this type of inference is generally confirmed with the presence of other forms of evidence such as monumental works, their correspondence to the largest population aggregations is generally unequivocal. Perhaps more nuances related to the activities conducted at different settlements of different size ranges will be perceived when a detailed study of individual settlements is conducted in the future, leading to a better understanding of the types of social groupings that are represented in each range, and of their position in a social hierarchy. The way in which the people, including leaders, that lived in such large concentrations interacted with people settled outside of them is also obscure at this point. Other lines of evidence must be explored to arrive at conclusions of this type, which will allow for a characterization of the type and basis of the hierarchy that was developing in the region at this time, and will help to better understand why it developed in the first place. The characterization of the Late Period agrarian economy in relation to the emerging social differences (Chapter 7) constitutes a step towards this goal.

Population size: Similar population figures to the ones used for the Early 1 and Early 2 periods can conceivably be applied to this period. However, a few factors must be taken into account in this case. First, the rationale for the population estimates of the Early Period occupation was that the two periods had a similar duration (and that in fact there are two early periods) and therefore no corrections were necessary. Thus, the Late Period occupation would last approximately twice as long as either of the Early periods (approximately 1,000 years) and population estimates in this case would have to factor this in to avoid overestimation. While more evidence in the future will allow for precise chronological definition of the Early Period occupation, working with a scenario of maximum occupation during that period (including Early 1 and Early 2) seems more sensible, and therefore no corrections are necessary to account for a longer duration of the Late Period occupation.

Another factor that must be considered is the increase in average sherd density from the Early to the Late Period occupation, as seen in shovel probes. Even if population estimates rely on area more than on sherd densities, spatial units (hectares, for example) should not necessarily be assumed to imply the same occupational density through time. On average, Early 1 and Early 2 shovel probes yielded 2.1 and 2.5 sherds respectively, in contrast with 7.9 sherds for the Late Period. If the two Early periods are considered as one, the average is 2.8 sherds. Reducing the comparison to Early and Late as two blocks of time of equivalent duration, would suggest that either people during the Late period used ceramics more intensively than during the Early period, or that people settled at higher densities. Both alternatives are conceivable. On the one hand, the ceramic assemblage of the Late Period is more varied (in terms of forms when inferred from rims) than the one of the Early Period, in which very few forms apparently composed the entire ceramic assemblage (see Appendix A). On the other hand, an increase in settlement density in units smaller than the region has been reported for periods characterized by notable increase in regional settlement density (e.g. Boada 1998; Gonzalez 1998; Hastorf 1983; Kuijt 2000). It is worth noting that, in some cases, this is an observation derived from close study of the densest population concentrations, and may not apply to other settlements within their respective regions. So, this cannot uncritically constitute a working assumption, both for the reason just mentioned and because of the early stage of research in the region. Yet, the range of variation in the number of sherds in shovel probes is much wider in the Late Period compared to the Early Period, which could suggest that, other things being equal, the density of occupation in areas as small as the ones represented by individual collection units may vary within the region. There is a small percentage of shovel probes that have a very large number of sherds, but 70% of them have between 1 and 6 sherds, which is the range within which shovel probes corresponding to the Early 2 fall, without considering outliers (Figure 3.22). An increase in the use of pottery during the Late Period is not a very convincing explanation since the density change is not generalized, but rather restricted to a small number of lots.

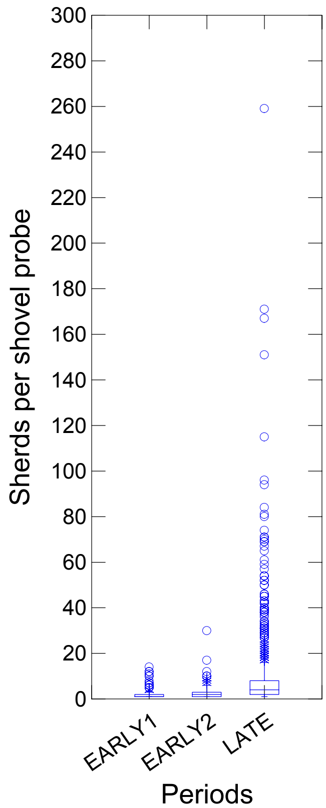


Figure 3.22. Sherds by Shovel Probe by Period.

The spatial distribution of shovel probes with unusually high numbers of sherds (higher than 45) coincides very well with the densest settlements in the region (Figure 3.23). If the densest settlements observed at a regional scale were simply the result of a modest reduction in the spacing between families caused by the expansion of a growing population into previously unsettled areas (for example, if only one family was settled in each hectare regardless of the size of the settlement), high sherd densities in shovel probes would not necessarily correspond to what at the regional level appear as the most densely settled areas. These shovel probes should be distributed randomly across the landscape, spread indiscriminately in both small and large settlements, perhaps owing only to their different contexts. If this was the case, large settlements at the regional level would give the impression of aggregation where it did not really exist.

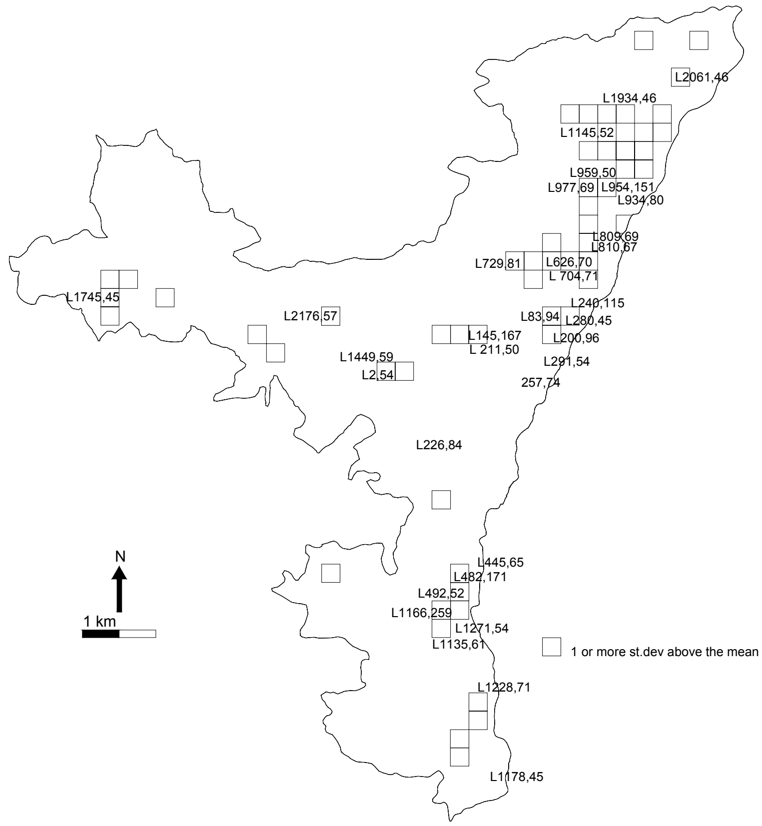


Figure 3.23. Shovel Probes with High Counts of Late Period Sherds and Density of Occupation in 500x500 m Grid Units.
(numbers indicate lot number and sherd count).

Given that this does not appear to be the case, comparing population estimates calculated using different demographic figures for dispersed and nucleated sites to the ones produced using the same figures for all kinds of sites (overlooking for a moment the problematic nature of sites) may prove productive. However, higher sherd densities at larger sites may also just be a reflection of more settlement stability at these sites. The former scenario seems more in accordance with a process of settlement differentiation, which, as a manifestation of a process of social differentiation, could potentially result in different demographic dynamics for different sectors of society (Kertzer 1995). Alternatively, this may also be due to the types of activities performed at large sites, without much connection to their actual populations.

Starting with the simplest figures, an estimate based on the familiar figure of 5-10 people per hectare produces a population of 8,610 to 17,222 people. 5-10 people per collection unit would result in 10,335 to 20,670 people. Using different demographic figures to account for presumed variations in settlement density at nucleated vs. dispersed sites, produces very similar figures. If all sites smaller than 2 ha are assumed to have between 5 and 6 people per hectare, 5 to 10 people per hectare for sites between 2 and 10 ha, 7 to 10 people per hectare for sites between 10 and 20 ha, and 10 to 15 people per hectare for sites larger than 20 ha, the estimate would be 13,028 to 22,422 people.

All of these estimates speak of a considerable population increase from the Early Period, one that went from a maximum of approximately 4,500 people (454 ha x 10 if the occupation of the Early 1 is overlapped with the one of the Early 2) to at the very least about 8,610 people. This is almost a twofold increase. The chance that the Early Period population is under-represented (see Chapter 2) must be kept in mind. In addition, the chance that the Late Period population is over-represented due to lack of chronological refinement and to palimpsest effects that are probably magnified in the eastern portion of the survey is conceivable. Yet, a demographic change of this kind would only imply less than 500 people added each century over a period of 1,000 years, a truly gradual process unless it fluctuated or happened more suddenly in a shorter period of time. Population increases of this kind are not uncommon in a comparative perspective (e.g. the Early to Late Muisca transition [Langebaek 1995:157], Rosario to Monte Albán Early 1 [Blanton et al. 1993:74], Early Aztec to Late Aztec [Blanton et al. 1993:139], PPNA to PPNB (Kuijt 2000:85). A midpoint between the lowest and highest estimates (about 8,000 to 22,000) for the Late Period results in about 15,000 people, and would imply that population quadrupled, which is still not a change of huge magnitude given the span of time under consideration.

Oberem (1980:40-49), based on several ethnohistoric documents has proposed that the 16th century Quijos settled in the Quijos and Cosanga drainages numbered approximately 12,000 adults (and perhaps as many as 16,000 people if children and elders are added). This is well within the range of population estimates calculated from archaeological data.

CONCLUSIONS

At the core of the prototypical model of population and settlement change, where all demographic variables act in an interdependent fashion, is the assumption of a "natural fertility population" (Fricke 1994) that looks for new areas as formerly inhabited ones are filled. In contrast, the sequence in the Valle de Quijos shows that changes in regional distribution of settlements, centralization, and population size and density do not occur in the form of uniformly gradual regional demographic dynamics. The convergence of three different demographic histories into a similar scenario of modest but recognizable centralization during the Late period supports arguments for studying different demographic variables independently. A "natural fertility" scenario in this case, would have produced an even and gradual spreading of the population from the area of more dense initial occupation to other areas, and an even and gradual formation of population centers. Perhaps areas with similar characteristics would have been preferred, but this does not explain why people settled at both high and low densities in areas with little resemblance to the conditions of the "motherland."

The most unexpected path towards population growth and centralization is seen in the northwestern subregion, where the settlements of the Late period emerge practically out of nowhere, increasing more than 20 times compared to those of the Early 2, and where there is no antecedent of any form of population concentration. The Late Period population of the southern subregion develops from a rather scant occupation in the Early 2, but it grows only five times with respect to it. The occupation of the northeastern subregion grows about five times as well with respect to the Early 2, but in the context of a much more populated area that had been the demographic core since the Early 1. The largest concentration here is larger than in any of the other subregions. Nevertheless, using settlement information alone does not lead us to think that this is a manifestation of a qualitatively dissimilar settlement system that operates, in principle, differently from the ones observed in the other two subregions. It should be noted too that the settlements in this zone may owe the impression of boundlessness to the fact that the wide dispersion of archaeological materials on a flat landscape where actual residential spaces are not identifiable may produce an overestimation of the actual settlements. This is in contrast to the case on steep slopes, where residential spaces in terraced areas are distinguishable from the steeply sloping terrain onto which archaeological materials spill, but the slopes do not end up marked on a map as actual areas of occupation unless there are several terraces in an area smaller than 1 ha.

Yet, breaking down the regional demographic picture of the Late Period into subregions or considering it all at once still produces the same general impression, which is that settlement differentiation emerges clearly for the first time and that the new areas of unusually high population density located in dissimilar environmental conditions are best explained by reference to social forces rather than regional population pressure or spatial environmental constraints. During the Late period, a preference for flat land and warmer climate in the northeastern subregion could explain a higher occupation in this area, but such occupation did not need to take the form of aggregated settlements when more than 80% of the land remained unoccupied in this subregion. The concentrations in the northwestern and southern subregions are even more puzzling because more than 90% of the land was unoccupied in each one, allowing people to form smaller settlements, which is in fact, what most did. Considering areas not inhabited is informative, because it allows us to best illustrate the meaningfulness of population aggregation. For example, in a survey area that shows signs of even modest centralization, but that has vast areas of unoccupied territory, one might conclude that this centralization is meaningful, because inhabitants had the option of living in a more dispersed pattern. On the other hand, if a survey illustrates the same modest centralization in a region that is more evenly occupied, one might conclude that the slight degree of centralization is less telling, because there were fewer options for dispersion. In such a case, much greater signs of population aggregation are required before concluding that centralization was occurring. But this does not appear to be the case in the settlement and demographic transition examined here (Figure 3.24). With plenty of opportunities for dispersion, polarization in terms of population aggregation becomes more meaningful.

So, population did not just "grow" during the Late Period. On the other hand, it did not just "nucleate" either. While it is true that the mean site size or the mean area of occupation per grid unit increases in this period, a close observation of the portion of the occupation that occurs at high and low densities indicates that settlement nucleation was by no means the norm in comparison to any of the Early periods (Figure 3.25). A good portion of settlements during the Late Period existed at very low densities. The range of variation is disproportionately high in this period when compared to any of the early periods, but this is not simply the product of a tendency for everyone to live in more nucleated settlements. The most sensible interpretation appears to be that a few settlements grew out of proportion, while others grew only slightly, and a good number simply remained at the low densities that were common since the Early 1. This does not represent just a generalized tendency towards nucleation.

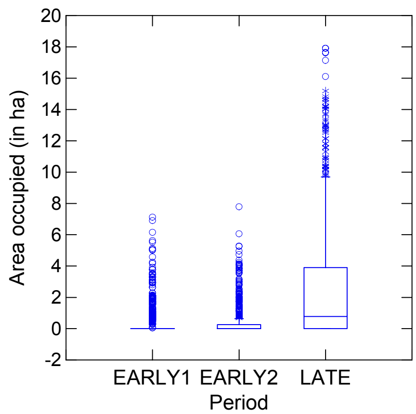


Figure 3.24. Box-and-Dot Plot Comparing the Median and Spread of Area of Occupation in All 500x500 m Grid Units.

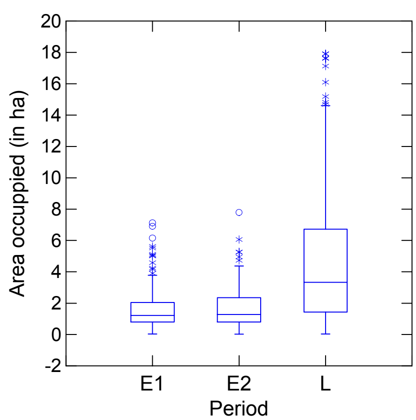


Figure 3.25. Box-and-Dot Plots Comparing the Median and Spread of Area of Occupation in Occupied 500x500 m Grid Units.

Examining the different dimensions of settlement organization and population, and paying attention to the degree to which changes we label regional indeed occurred uniformly among the population of a region, allows for a less synthetic understanding of the process of chiefdom development, and of demographic processes in general (Kowalewski 2003). The changes in settlement organization and population studied here provide clues to the magnitude and direction of socio-political change, and about the exercise of a nascent chiefly authority. The demographic patterns found from the Early to the Late Period, with a large percentage of the population that remains dispersed throughout the sequence, seem to indicate that the emergence of socio-political centralization did not compromise the population's ability to live in what was consistently the preferred residential pattern.

4. VERTICAL ECONOMY AND CHIEFDOM DEVELOPMENT

The objective of this chapter is to explore whether the distribution of population through a range of environmental zones fills the expectations of a system of vertical economy during the Late Period, when chiefdoms emerged in the region. Patterns of agricultural production and consumption at the regional scale are evaluated in Chapter 6, where direct evidence of the agricultural economy during the Late Period is presented. Settlement distribution constitutes a first step towards examining the possibility of a specialized economy. A settlement pattern indicating the use of only one environmental zone, for example, would not warrant investigating whether the productive practices of the Late Period chiefdoms correspond to a vertical economy. On the other hand, if the Late Period population settled in a way that facilitates vertical exploitation but this does not represent a new development in the distribution of settlements across environmental zones through the sequence of occupation, it would be harder to argue that a specialized economy constituted the foundation for the development of chiefdoms during the Late Period. Of course, people might have settled in all environmental zones during earlier periods, cultivating and consuming local products, without engaging in inter-zonal exchange until the Late Period. But that would lead to questioning why, if specialized production represented the basis of an emerging social hierarchy, the latter did not did not develop when such conditions could have been met in earlier periods. Thus, if specialized agricultural production was clearly linked to the processes of social differentiation leading to chiefdom development, I expect it to be reflected in settlement patterns in the form of an increased use of the different environmental zones during the Late Period, when indications of political centralization appeared for the first time in the Quijos region.

The section of the Valle de Quijos incorporated in the survey area contains climatic variability that is sufficient to have sustained a vertical economy. The altitudinal variation between the lowest and highest portions of the survey area is about 1,500 m. Currently, agriculture is not practiced in the region, as the local economy is almost entirely based on cattle ranching. Only on a couple of occasions did we find house gardens or agricultural plots while doing the survey, but in general, local people purchase fresh produce at the biweekly market in the town of Baeza, where peasants from the Amazon and the Sierra go for a day to sell their produce at exorbitant prices. The affluent sector of the population, which travels in private vehicles to Quito or Tena more frequently, supply themselves with fresh produce at these cities, where more variety at better prices can be found. Some local *tiendas* maintain a limited supply of fresh produce too. Agricultural production for subsistence or on a commercial scale is not conceived as a possibility for the contemporary inhabitants of the region, as we concluded from our many conversations with the local landowners. Agriculture is commonly perceived as a low status activity, in contrast with cattle ranching (landowners are usually proud to belong to the *Federación Nacional de Ganaderos*). Abundant rainfall is also frequently mentioned among the local population as a factor that deters them from cultivating despite the high cost of produce at the market. Thus, there is no local contemporary information that can be used to gain insights into the use of different altitudinal zones as related to the agricultural economy of the past.

ENVIRONMENTAL ZONES

Defining ecological niches that relate to farming practices in the past is a complex task. Detailed environmental and vegetation reconstruction are desirable and can be accomplished through relatively straightforward methods, but it is much more complicated to study the way in which agricultural production was organized socially and the technologies and spatial adaptations involved with regard to the means and needs of a specific population (Knapp 1991). The latter is crucial for the definition of productive zones, understood not simply as naturally determined units but as human strategies of environmental use that in some cases may be specifically geared towards counteracting natural conditions. The definition of meaningful environmental zones in different regions of the Andes can vary (e.g. Brush 1976; Shimada 1985; Salomon 1986), which calls attention to the diversity of options available to past and modern populations in the context of a diverse environment. Vertical exploitation is, of course, only one of them. This does not make it easy to predict which environmental, demographic, and socio-political conditions would lead to a vertical economy, as opposed to one focused on the optimization of a particular zone, for example.

For this project, the characterization of environmental zones that are meaningful in terms of a vertical economy must consider conditions that affect the growth vegetation types that are sensitive to climate. Altitude, temperature and humidity are main factors that affect the distribution and types of natural vegetation. A recent environmental study of the region produced by the *Fundación Antisana* and the *Programa Regional de Bosques Nativos Andinos* characterizes different zones of vegetation and climate that I use to provide a rationale for defining ecological zones. This study used maps of vegetation coverage, soil use, aerial photos, and topographic maps complemented by stratified vegetation surveys. Details of image interpretation and field methods appear in FUNAN-PROBONA (1997:77-108; 1998:5-11).

Climate

In general, the climate of this region is characterized by the presence of strong precipitation and high relative humidity. This is due to the influence of masses of warm air originating in the Amazon region, and moved toward the eastern flanks of the Andes by wind currents known as *vientos Alisos*. Temperature varies according to altitude. Of the five meteorological stations at different altitudes that provided information about precipitation, three are located in or near the surveyed area: Borja (1,500 m), Baeza (1,925 m), and Cosanga (1,940 m) (the last is just a kilometer beyond the southern extreme of the surveyed area). Papallacta (3,150 m) and Oyacachi (3,500 m) correspond to high altitude zones to the west and east of the survey area respectively (Figure 4.1). In general, precipitation increases in a west-east fashion and decreases with altitude (more altitude, less precipitation).

In all stations observed, the pattern of precipitation is unimodal, with a period of heavier concentration of rains between the months of March and September, and another one characterized by less intense rains between November and February. There is not a dry period at any point of the year. This fits emic accounts of local weather as varying between two seasons: “rainy” and “very rainy.” The wettest month is June, but in general the difference in precipitation between months is not drastic (Figure 4.2).

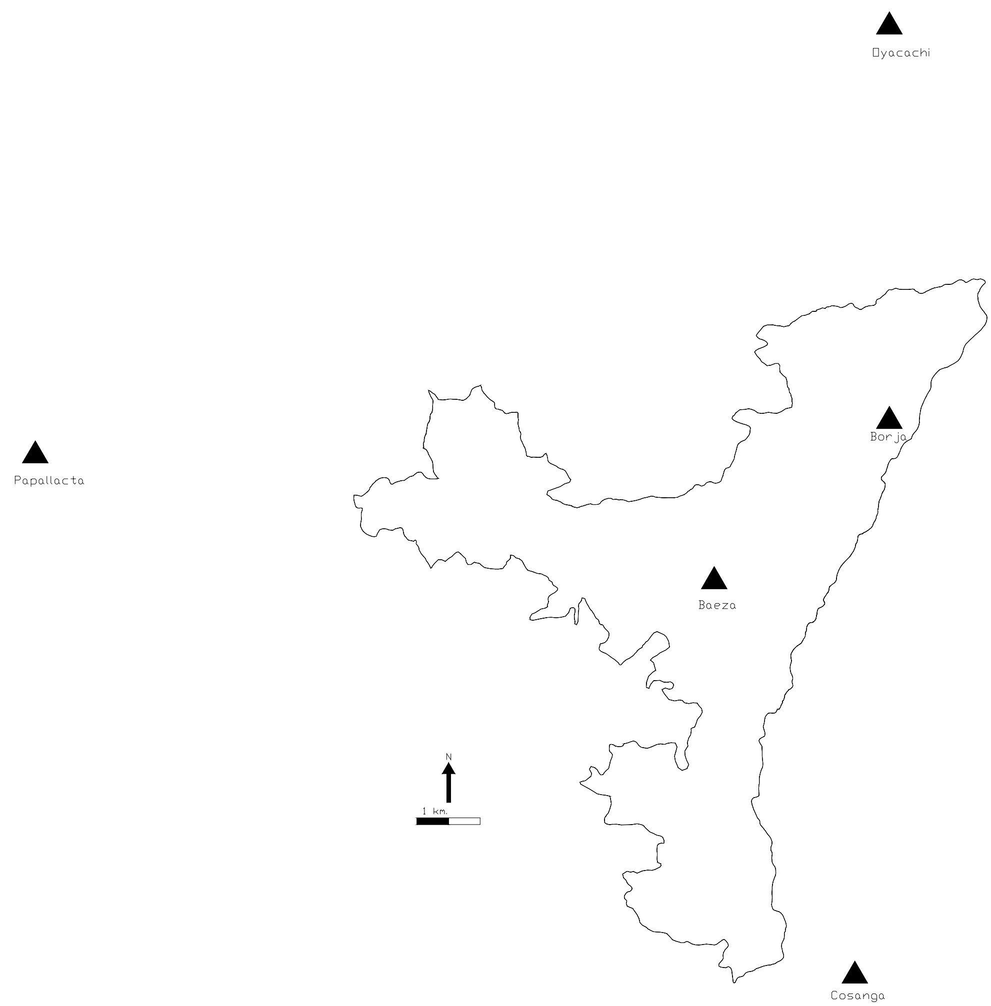


Figure 4.1. Location of Meteorological Stations.

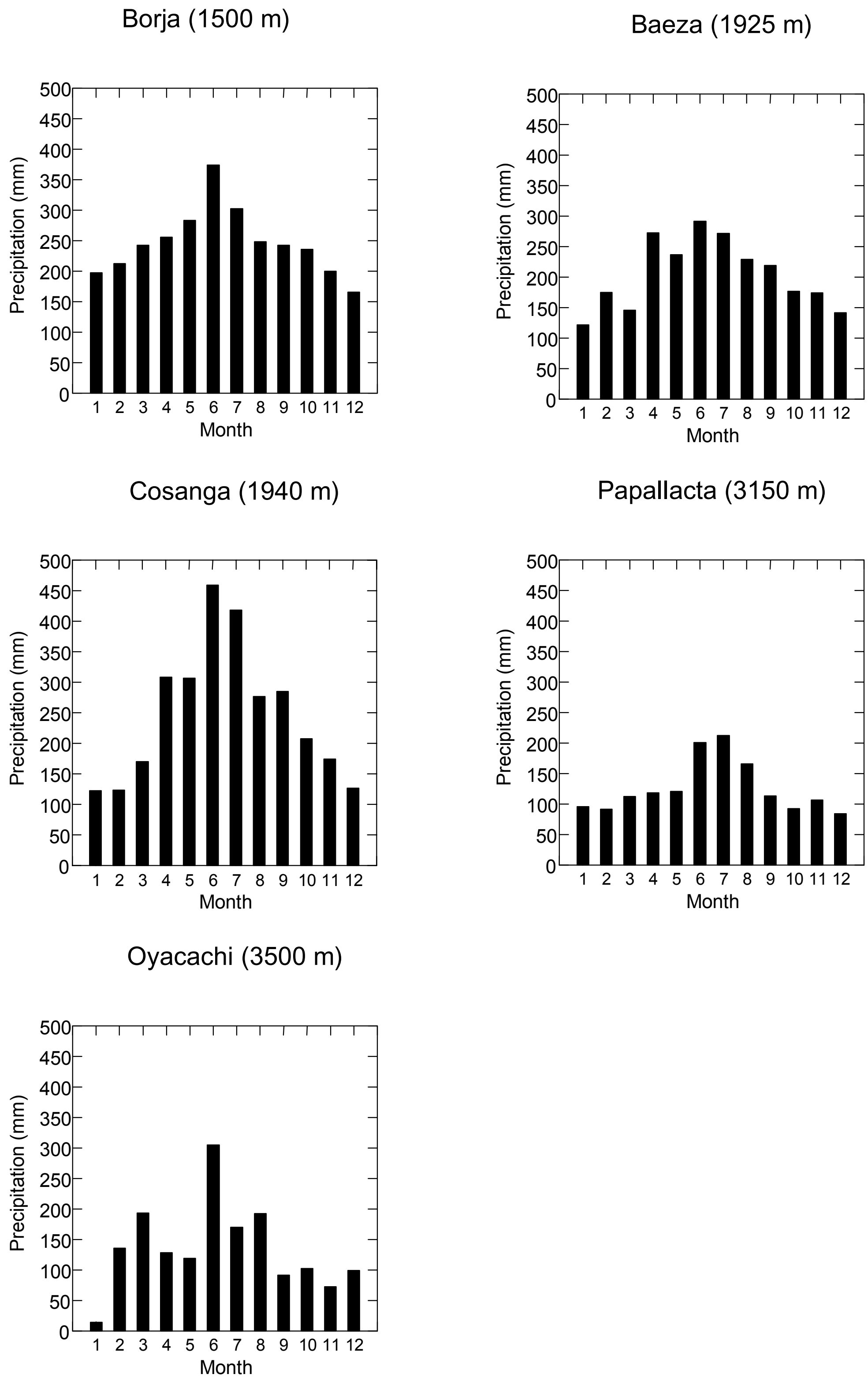


Figure 4.2. Mean Annual Precipitation at Meteorological Stations.
(based on data from IDEA [1987])

The rainfall patterns within the survey area (Borja, Baeza, Cosanga) vary only modestly, with only slightly less precipitation in Baeza (Table 4.1). More variation is seen with respect to the stations outside of the surveyed region at much higher altitudes in the *páramo* (Papallacta, Oyacachi), where only approximately half of the precipitation is reported. Daily rainfall is of long duration, and there are never fewer than 250 days of rain a year at any of the stations. The intensity of rainfall is high, with the most notable impact being the violent overflow of rivers and streams which brings along constant erosive processes and landslides. During but two days of heavy rainfall (July 10-11 of 1997), 70 landslides were reported in the transect Baeza-Tena.

Table 4.1. Annual and Monthly Precipitation at Five Meteorological Stations.

Station	Borja	Baeza	Cosanga	Papallacta	Oyacachi
Altitude (m)	1,500	1,925	1,940	3,150	3,500
Annual (mm)	2,962	2,456	2,975	1,517	1,625
Monthly (mm)	247	205	248	126	135

Temperature decreases by about 5.7˚C for every 1,000 m, and as is typical in the equatorial zone, seasonal differences in temperature are less than daily differences, with the daily high temperature varying more than the daily low temperature (Cañadas 1983). Monthly variation is less than 2˚C, with December and January being the warmest months and July and August the coldest. Daily variation is around 10˚C, which has the potential to affect cultivation more drastically at higher elevations. However, abundant and permanent cloud cover prevents frosts, since there is no great radiation loss and only limited cold air drainage.

Variations in relative humidity are minimal across the study area: it is never less than 85%, with only modest monthly variation. The high precipitation coupled with high density of vegetation and heavy cloud cover (therefore low radiation) are responsible for the high levels of humidity. Likewise, evapotranspiration levels are low. Winds rarely pass 2 m/second, and are characterized as "calm" year round, with minimal monthly variations. Specific variations in temperature and relative humidity related to the different vegetation zones appear below.

Vegetation

Three pure ecological zones (*zonas de vida* or *asociaciones climáticas*) and one transitional zone are present in the study area.

Bosque muy húmedo Montano (bmhM): This corresponds to high altitude areas, from 3,000 to3,600 m. Maximum annual mean temperature varies between 8 and 12˚C, and mean total precipitation is around 1,500 mm (Papallacta and Oyacachi correspond to this zone). The evapotranspiration index (a function of temperature, insulation, wind speed and humidity) is low (0.5). This zone corresponds to the cold - perhumid humidity province (this is the wettest type of climate, with a humidity index of 100 or above).

The characteristic vegetation of this zone is composed of a low and humid arboreal formation, shrub-like, dense and continuous (*bosque enano*) yet the volume per hectare is low. Species such as *achupalla* (*Puya* sp.), *Escallonia* sp*., Weinmannia* sp*.;* grasses of the genra *Festuca, Stipa* and *Calamagrostis*, shrubs such as *Senecio abietinus*, *Aragoa cupressina,* and *Bacharis tricuneata*; as well as other species typical of swampy environments such as *Distichia* sp*., Lycopodium* sp*., Plantago* sp*.,* and *Isoetes* sp.; are the most commonly found. Human intervention is low in this zone due to climate, soils, and topography. This zone is not represented in the archaeological survey.

Bosque muy húmedo Montano Bajo (bmhMB): This corresponds to the 2,000 to 3,000 m altitudinal range. Maximum annual mean temperature ranges between 12 and 18˚C (with 0.57˚ of variation for every 100 m). Precipitation may vary, between 2,000 and 3,000 mm a year, with a tendency to decrease as altitude increases. The evapotranspiration index is low; between 0.25 and 0.5. The climatic/humidity characterization is temperate perhumid. One of the characteristic features of this zone is excessive cloudiness.

The vegetation is composed of a high, very dense, humid to very humid arboreal formation. This type of forest is highly heterogeneous, with high floristic diversity, and marked by an abundance of epiphytes. This is the characteristic vegetation cover of areas with limited or no contemporary intervention in the western and southern zones within the survey area. The vegetation most commonly observed is composed of trees such as s*angre de drago (Croton* sp*.),* *cauchillo (Saphium* sp*.), canelo (Ocotea* sp*.), aliso (Alnus* sp*.);* many arboreal ferns of the genus *Blechnum*, as well as *Campylonerum emifolium* and *Diplazium* sp., and secondary formations of *Chusquea scandens* in areas were landslides have occurred or that are periodically inundated by rivers. Epiphytes are abundant, and represent the genera *Peperomia, Cluisia, Asplundia, Anthurium* and *Philodendrum*, and the families *Araceae, Orchidaceae, Araliaceae, Bromeliaceae, Cyclantaceae, Marcgraviaceae,* and *Ericaceae*. According to Harling (1979), the vegetation in this zone, especially above 2,500 m, can be characterized as cloud forest, with very dense underbrush rich in epiphytes, reeds, and lianas. Trees are between 6 and 20 m high, with round canopies and tabular roots. Among the most common are *laurel (Myrica* sp*.), canelo (Ocotea* sp*.)* and *aguacatillo (Nectandra* sp*.)*. Contemporary human intervention in this vegetation belt is very low due to the lack of roads and very steep slopes.

Bosque muy húmedo Pre-Montano (bmhPM): This corresponds to elevations lower than 2,000 m along the corridor of the Cosanga River and the canyon along the western portion of the Quijos River. These are narrow vegetation belts that frame the course of these rivers. Mean annual temperature is 16 to 18˚C, and mean annual precipitation ranges between 2,000 and 3,000 mm. Evapotranspiration index is 0.25 to 0.5. This belongs to the perhumid humidity province.

The vegetation is arboreal, with abundant epiphytes, palms, and reeds. Density of vegetation is high. Patches of *bosques ribereños de aliso (Alnus acuminata)*, and herbaceous vegetation represented by *Cecropiaceae, Pasifloraceae, Onagraceae, Solanaceae* and *Ponaceae* is very common. Other herbaceous vegetation common in swamps and river banks is represented by *Cedrela montana, Croton* sp*., Carica microcarpa, Brunellia* sp*., Ocotea floribunda, Bunchosia argentea, Ilex* sp*., Miconia nervosa* and *Myrica pubescens*; some of these appear in grassy patches too.

Bosque muy húmedo Pre-Montano (bmhPM)-Bosque muy humedo Montano Bajo (bmhMB): This is a transitional zone at 1,400/1,600 to 2,000 m. The climate is a transition between sub-warm - humid, and temperate - humid, with an annual mean temperature of 18˚C. Annual precipitation is about 3,000 mm, and the evapotranspiration index is 0.35.

The typical vegetation is composed by a high, dense, and humid arboreal formation. Epiphytes abound in this kind of forest. The forest composition is heterogeneous and of high floristic diversity. The characteristic species are *pambil (Iriartea corneto), palma real (Inesa colenda), anime (Dracoydes* sp.*), moral bobo (Clarisia rasemosa), sande (Brosimun utile), uva de monte (Pouruma chocoana), colorado (Pouteria* sp.*)*; and numerous herbaceous species, epiphytes, and reeds that give the forest a dense appearance. It is currently subject to more intense human intervention due to the extraction of lumber and the expansion of the cattle ranching frontier.

The following are vegetation formations within the study area that are the product of very recent contemporary intervention.

Bosque intervenido (Bi): This refers to low-density arboreal vegetation, which is the product of regeneration of forest species selected recently for their lumber potential, and to areas where recent intervention has been modest (selective exploitation), where there is still an important high forest component. Three sub-types of forest compose this category: *Bosque Intervenido Alto y Denso* (with trees of wide canopy), *Bosque Intervenido Bajo y Denso* (with trees of small canopy), and *Bosque Intervenido Disperso* (with characteristics of the latter two but distributed in a patchy manner). This type of vegetation is distributed patchily along a narrow corridor formed by the Quijos and Cosanga rivers (the Baeza-Cosanga and Baeza-Borja roads run along this corridor).

Vegetación arbustiva-Matorral (Ma): Shrub-like formation alone or mixed with the Bi arboreal formation. This is the consequence of past lumber extractions that left a dense arboreal remnant. This is also distributed intermittently along areas close to the main roads.

Pastos Plantados (Pa): Herbaceous species cultivated by cattle ranchers, usually found alone or in association with forests or shrubs, on the lowest elevations and the alluvial terraces of the Quijos and Cosanga rivers. In some cases these grasses are found on steep slopes, which is contributing to a series processes of erosion due to overgrazing. Their distribution is similar to the one of secondary forest and shrub formations.

Pastos Naturales (Pn): Herbaceous species that grow spontaneously without the need of special care. These constitute the last stage in the deforestation process or appear in abandoned plots as a result of soil degradation. These are rare in the study area, and are associated with shrub-like vegetation.

SETTLEMENT DISTRIBUTION IN ALTITUDINAL ZONES

On the basis of the above environmental characterization, two major climatic zones are distinguishable within the survey region, one above and one below 2,000 m. The 1,400/1,600 to 2,000 m zone correspondes to 41% of the surveyed area, while the 2,000 to 3,000 m zone corresponds to 59%. Settlement distribution in each period across these zones is presented below.

Early 1 Period

Settlements are concentrated in the low altitude range. More than three-quarters of the area occupied appears in the low altitude range, and less than one quarter in the high altitude range (Figure 4.3). This difference is accentuated if the proportion of area occupied relative to the proportion of the surveyed area that each zone represents is considered. In this case, the concentration of settlements in the low elevation range, since this corresponds to a smaller portion of the survey, does not speak of an even distribution of settlements across environmental zones. A detailed look reveals that the distribution of settlements within the high elevation range still indicates a preference towards lower altitudes; of 59.4 ha occupied within this altitudinal range, 54.6 are between 2,000 and 2,400 m. Very scant occupation appears between 2,400 and 2,600 m, and none above 2,600 m. The greatest imbalance in expected occupation corresponds to the 2,400-2,600 m range; the occupation is thirteen times smaller than expected, followed by the 2,200-2,400 m range where the occupation is only one-fourth that expected. In contrast, the 1,600-1,800 m range has three times the expected occupation (Table 4.2).

Table 4.2. Distribution of Settlements by Altitudinal Zone (Early 1).

Altitude (m)	Occupied Area (Ha)	Occupied Area (%)	Survey Area (%)	Occupied Area (Ha)	Occupied Area (%)	Survey Area (%)
1400-1600	4.3	1.6 %	1.8 %			
1600-1800	110.8	41.8 %	15.1 %	209.0	78.7 %	40.6 %
1800-2000	93.8	35.3 %	23.7 %			
2000-2200	40.1	15.1 %	25.5 %			
2200-2400	14.5	5.5 %	20.5 %			
2400-2600	1.9	0.7 %	9.7 %	59.4	21.3 %	59.4 %
2600-2800	0	0 %	3.3 %			
2800-3000	0	0 %	0.5 %			

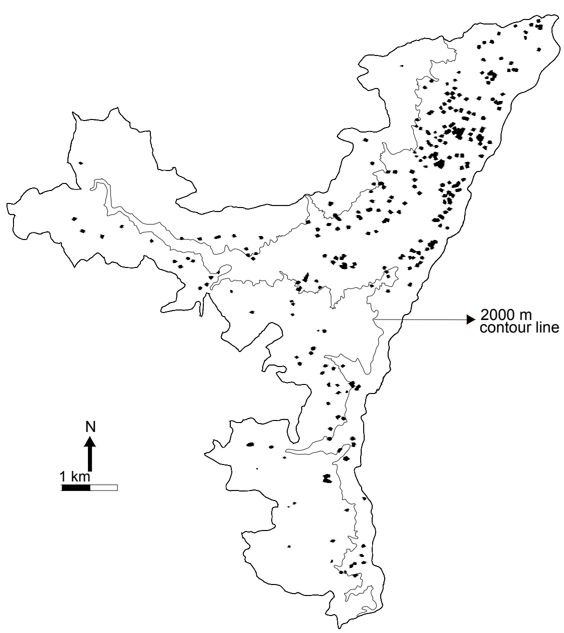


Figure 4.3. Early 1 Period Distribution of Settlements Across Environmental Zones.

The distribution of high altitude settlements with respect to low altitude settlements does not seem indicative of a vertical economy either. If the inhabitants of the northeastern subregion wanted to optimize access to different altitudinal zones, they could have expanded to the high altitudinal range available in this subregion. The low altitude range in the northeast is where most settlements are and thus where higher settlement density is observed. A vertical economy would have been geared towards optimizing access to high elevation products. But this does not appear to be the case. Most of the settlements located at more than 2,000 m are located outside of the northeastern subregion (Figure 4.4). Only 18.5% (11 ha) of the area of occupation above this altitude occurs in the northeastern subregion (the area above 2,000 m in this zone corresponds to 28.4% of the total area above this altitude in the survey region). An optimal use of the whole altitudinal range should be manifested in a stronger concentration of settlements above 2,000 m in the northeastern subregion. Factors other than the exploitation of multiple altitudinal zones must account for the settlements at high altitude outside of the northeastern subregion, because given the very low population densities that characterize this period, it does not make much sense that a desire to produce high altitude products for exchange would lead to the funding of settlements so far away from the area of major population concentration.

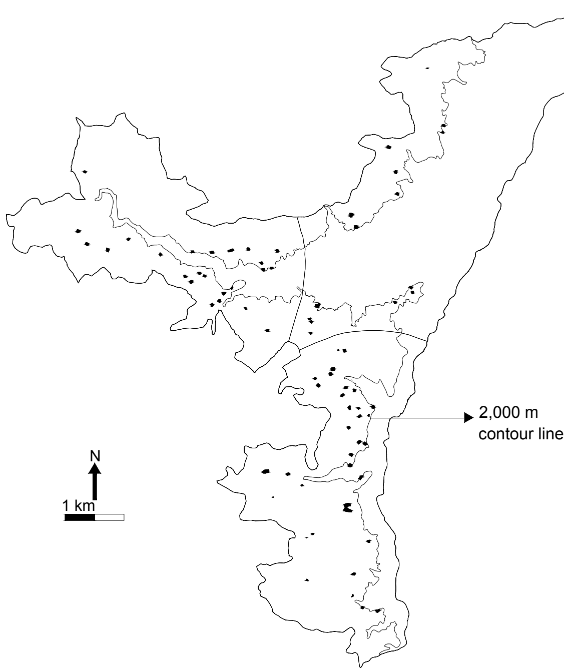


Figure 4.4. Early 1 Period Settlements by Subregion in the High Altitudinal Range.

A more detailed environmental characterization of the pre-Columbian landscape could possibly indicate that the high altitude range of the northeastern subregion did not offer the same climatic conditions as the high altitude range outside of it. If this was the case, the location of high altitude settlements outside of the northeastern subregion could be interpreted as a manifestation of a vertical economy. Likewise, if the survey area is extended to include even higher elevations in the northeastern subregion, and if some concentration of settlements appeared there, one would also feel inclined to think that this is due to a maximization of the altitudinal range. The information at hand provides little indication of a vertical economy, however.

Early 2 Period

Settlements continue to be concentrated in the low altitude range during this period (Figure 4.5). Three-quarters of the area occupied appear in the low altitude range, and only one-quarter in the high altitude range. Similar to the Early 1, this is disproportionate considering the percentage of the surveyed area that each zone represents. An even distribution of settlements across environmental zones did not occur in this period.

Figure 4.5. Early 2 Distribution of Settlements Across Environmental Zones.

The distribution of settlements within the high elevation range still indicates a preference towards lower altitudes; out of 71.6 ha occupied within this altitudinal range, 58.5 (82%) are found between 2,000 and 2,200 m. Very scant occupation appears between 2,200 and 2,400 m, and none above 2,400 m. While the imbalance in terms of expected occupation of the 1,600-1,800 m range is not as marked as in the Early 1 (this zone has only about twice the occupation expected, as does the 1,800-2,000 m range), the greatest imbalance continues to correspond to the high altitude settlements. The 2,200-2,400 range has only about one-fifth of the expected occupation. The distribution across altitudinal ranges seen at this level of detail is even less even than in the Early 1 (Table 4.3).

Table 4.3. Distribution of Settlements by Altitudinal Zone (Early 2).

<table>
<tr><th>Altitude (m)</th><th>Occupied Area (Ha)</th><th>Occupied Area (%)</th><th>Survey Area (%)</th><th>Occupied Area (Ha)</th><th>Occupied Area (%)</th><th>Survey Area (%)</th></tr>
<tr><td>1400-1600</td><td>2.6</td><td>0.9 %</td><td>1.8 %</td><td rowspan="3">225.4</td><td rowspan="3">75.9 %</td><td rowspan="3">40.6 %</td></tr>
<tr><td>1600-1800</td><td>96.0</td><td>32.3 %</td><td>15.1 %</td></tr>
<tr><td>1800-2000</td><td>126.8</td><td>42.7 %</td><td>23.7 %</td></tr>
<tr><td>2000-2200</td><td>58.5</td><td>19.7 %</td><td>25.5 %</td><td rowspan="5">71.6</td><td rowspan="5">24.1 %</td><td rowspan="5">59.4 %</td></tr>
<tr><td>2200-2400</td><td>13.1</td><td>4.4 %</td><td>20.5 %</td></tr>
<tr><td>2400-2600</td><td>0</td><td>0 %</td><td>9.7 %</td></tr>
<tr><td>2600-2800</td><td>0</td><td>0 %</td><td>3.3 %</td></tr>
<tr><td>2800-3000</td><td>0</td><td>0 %</td><td>0.5 %</td></tr>
</table>

The distribution of high altitude settlements respect to low altitude settlements does not seem indicative of a vertical economy in this period either. Just as was the case during the Early 1, the settlement pattern does not suggest a desire to optimize the use of different environmental zones. Most of the high altitude settlements are outside of the northeastern subregion, where most of the population was concentrated in proximity to high altitude lands that were not utilized (Figure 4.6). Instead, the occupation higher than 2,000 m is heavily concentrated in the southern subregion, far from the main area of population concentration in the northeastern subregion. Only 24% (17 ha) of the area of occupation above this altitude occurs in the northeastern subregion. Factors other than the attempt to use multiple altitudinal zones must account for the settlements at high altitude outside of the northeastern subregion. Similar to the Early 1, more detailed environmental information coupled with an extended survey area into ranges of higher and lower elevation could possibly provide evidence of a vertical economy; yet, given the information at hand, such a conclusion is not tenable. Overlaying the Early 1 and 2 periods produces an almost identical conclusion, since the settlement overlap is about 80%.

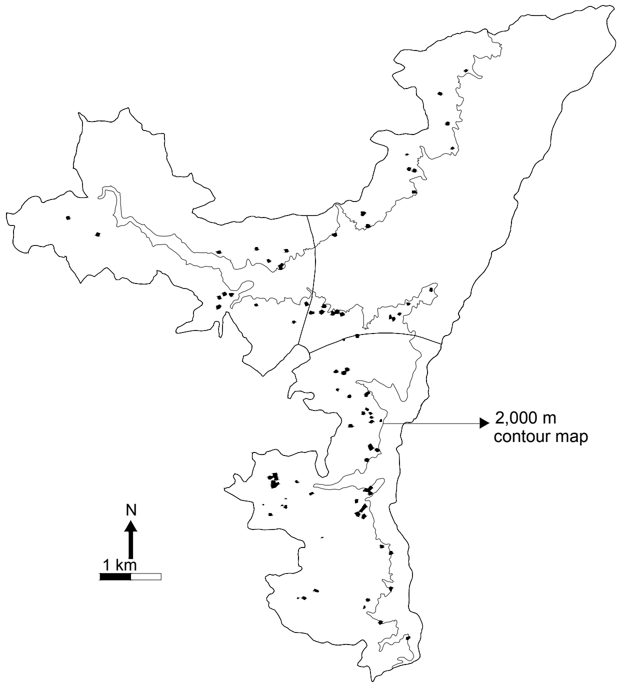


Figure 4.6. Early 2 Period Settlements by Subregion in the High Altitudinal Range.

Late Period

The low altitude range continues to be the area of major settlement concentration, even though a weak tendency towards more even distribution appears in this period (Figure 4.7). This is still disproportionate considering the percentage of the surveyed area that each zone represents. Thus, by the time chiefdoms emerged, the distribution of settlements across environmental zones was uneven. The preference to settle at lower altitudes continues to be evident in the distribution of settlements within the high altitude range. Of the 623.1 ha of occupation, 58.4% appear at the 2,000-2,200 m range, 34.3% at the 2,200-2,400 range, and less than 8% at altitudes higher than 2,400 m. Imbalances in terms of expected occupation are more marked in the 2,600-2,800 m range (where the occupation is one eighteenth that expected) and in the 2,400-2,600 m range (where there is only one-fourth of the expected occupation). The 1,600-1,800 m range has only about twice the occupation expected, thus showing no change with respect to the Early 2.

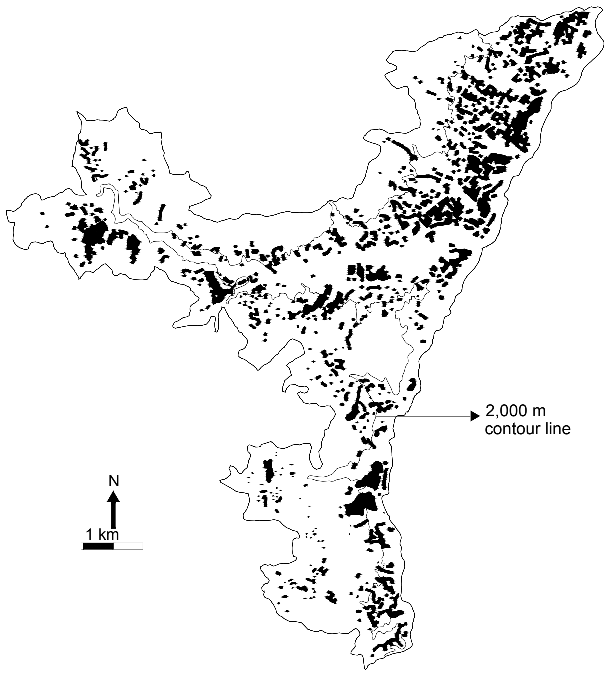


Figure 4.7. Late Period Distribution of Settlements Across Environmental Zones.

Settlements are slightly more evenly distributed across altitudinal ranges than during either of the Early periods, yet it does not approach a degree of evenness that allows one to speak comfortably of an attempt to optimize access to a variety of environmental zones (Table 4.4).

Table 4.4. Distribution of Settlements by Altitudinal Zone (Late).

<table>
<tr><th>Altitude (m)</th><th>Occupied Area (Ha)</th><th>Occupied Area (%)</th><th>Survey Area (%)</th><th>Occupied Area (Ha)</th><th>Occupied Area (%)</th><th>Survey Area (%)</th></tr>
<tr><td>1400-1600</td><td>24.5</td><td>1.42 %</td><td>1.8 %</td><td rowspan="3">1098.9</td><td rowspan="3">63.8 %</td><td rowspan="3">40.6 %</td></tr>
<tr><td>1600-1800</td><td>529.0</td><td>30.72 %</td><td>15.1 %</td></tr>
<tr><td>1800-2000</td><td>545.4</td><td>31.67 %</td><td>23.7 %</td></tr>
<tr><td>2000-2200</td><td>363.7</td><td>21.12 %</td><td>25.5 %</td><td rowspan="5">623.1</td><td rowspan="5">36.2 %</td><td rowspan="5">59.4 %</td></tr>
<tr><td>2200-2400</td><td>214.0</td><td>12.43 %</td><td>20.5 %</td></tr>
<tr><td>2400-2600</td><td>42.3</td><td>2.46 %</td><td>9.7 %</td></tr>
<tr><td>2600-2800</td><td>3.1</td><td>0.18 %</td><td>3.3 %</td></tr>
<tr><td>2800-3000</td><td>0</td><td>0</td><td>0.5 %</td></tr>
</table>

The distribution of high altitude settlements with respect to low altitude settlements does not suggest a vertical economy in this period either, because the high altitude zone of the northeastern subregion continues to be underutilized. Only 15.6% (97.4 ha) of the occupation above 2,000 m occurs in the northeastern subregion (Figure 4.8). The occupation at more than 2,000 m is heavily concentrated in the northwestern and southern subregions, both of which lack the degree of environmental diversity of the northeastern subregion. If the motivations for maximizing the use of altitudinal zones had been strong, one would expect the high altitude range in the latter to be more densely settled, only very dispersed settlements are common in that zone. In contrast, both dense and nucleated settlements appear in the high altitudes of the northwestern and southern subregions.

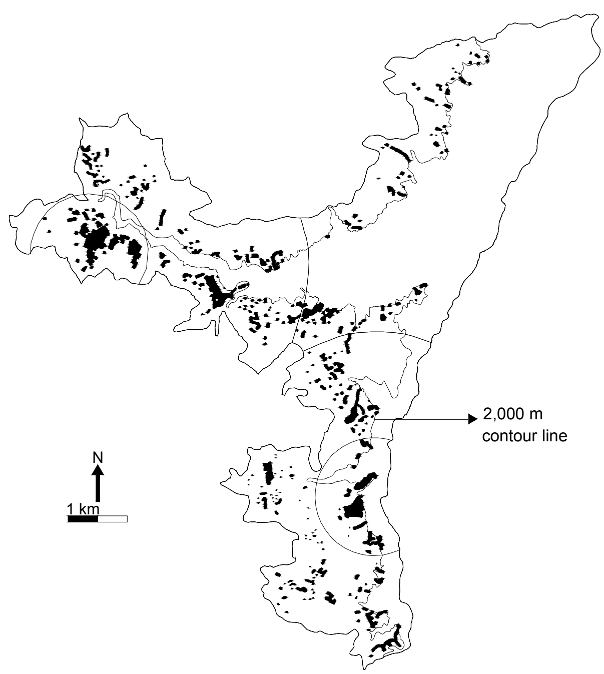


Figure 4.8. Late Settlements by Subregion in the High Altitudinal Range.

Descriptions of specialized agricultural economies suggest that economic complementarity and exchange can occur at several scales. However, the scale at which this is manifested would not change the necessity of population to settle, in a more or less balanced fashion across altitudinal zones, for it to function. During the Late period, there is a sizeable occupation in the high altitude range, which could imply the possibility of a vertical economy. Two population centers emerge precisely at high altitudes in the northwestern and southern portions of the survey, but they are not within direct access to low altitude lands. On the basis of settlement information alone, it seems unlikely that environmental factors related to the cultivation of a variety of products best suited for specific climates and their exchange with other zones determined the distribution of the population during the Late period. The emergence of chiefly polities, thus, cannot be connected to a vertical economy with this evidence.

CONCLUSIONS

A better environmental characterization and expansion of the survey area would serve to refine the current observations regarding settlement distribution and optimization of the use of climatic zones. The data at hand suggest neither a system of centralized exchange nor one of diffuse reciprocity among households in the Late Period. While it is true that a tendency to use more of the environmental range is manifested during this period (Figure 4.9), the imbalance of occupation among the two main zones makes it hard to argue that a vertical economy was at work. Furthermore, if one focuses on narrower altitudinal ranges (at 200 m intervals), the change experienced through time appears to be minimal (Figure 4.10).

The use of actual population estimates (based on a figure of 7 people per lot), though, speaks of a slightly different scenario in which the change in population distribution among the two major climatic zones seems more drastic (Table 4.5). During the Early occupation the population in the lowest altitudinal range is 2.8 times larger than that in the high altitude range, but this is only 1.4 times larger during the Late Period.

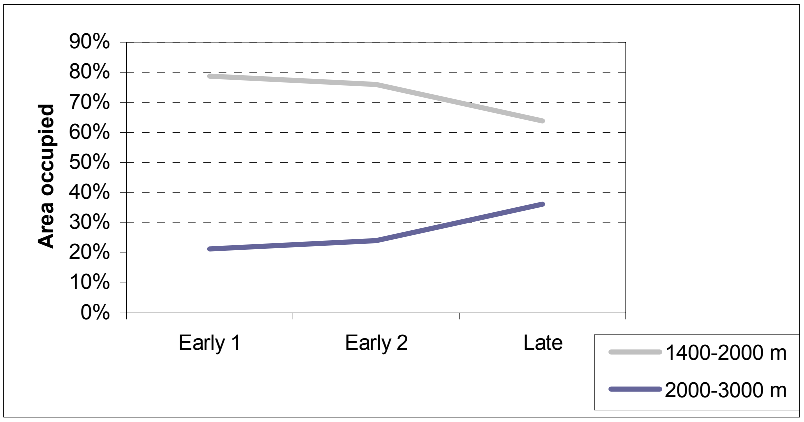


Figure 4.9. Changes in Occupation Across Environmental Zones.

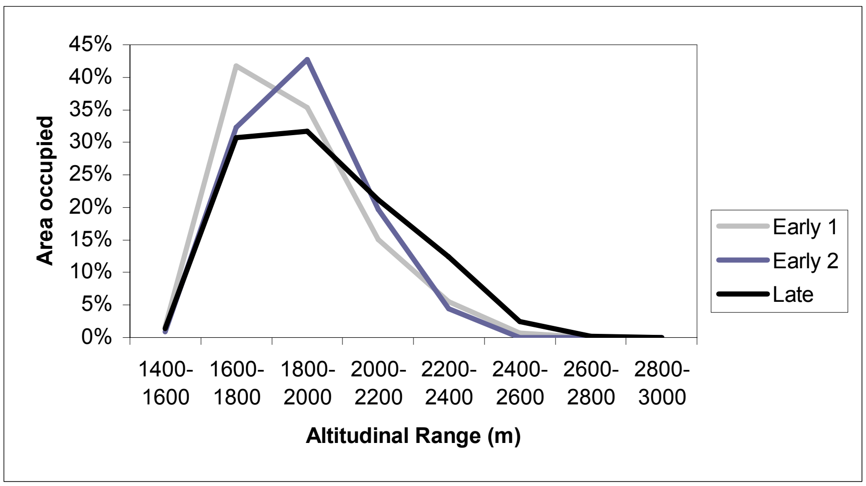


Figure 4.10. Changes in Occupation by 200 m Intervals.

Table 4.5. Population Figures by Altitudinal Zone (Early and Late).

Altitude (m)	Early 1+2	Late
1,400-2,000	3,332	8,491
2,000-3,000	1,204	5,978
Population	**4,536**	**14,469**

These observations will be revisited when discussing the results of the analysis of botanical remains. If this does not yield evidence of a vertical system of agricultural production during the Late Period then it will be argued with greater confidence that the spatial organization of settlements more likely reflects social rather than productive determinants. If the analysis of botanical remains yields evidence of a vertical economy during the Late Period, we will be able not only to relate that to the general process of emergence of chiefly authority, but also to explore whether a system of productive specialization was organized in such way that the circulation of products from different ecological zones was specifically geared to the maintenance of social hierarchy (Bonte 1981; Langebaek 1987,1991; Mayer 2002; van Buren 1996).

5. AGRICULTURAL POTENTIAL AND CHIEFDOM DEVELOPMENT

Central to this research is evaluating the degree to which chiefdom emergence is related to environmental factors that provided the opportunity for the nascent elites to control the best agricultural land, and by extension, to dedicate much of their agricultural activities to the production of corn (see Chapter 1). If this was the case, it is expected that the stronger indications of political centralization during the Late Period will be related to agricultural potential, resulting in different patterns of occupation of highly productive and less productive areas. Some variation in agricultural potential exists in the portion of the Valle de Quijos where archaeological survey was conducted, allowing for the examination of patterns of occupation in areas with different potential for corn production.

Centering attention on corn is relevant because this was the most important crop for pre-Columbian societies in much of the Americas. Not only did it represent the main food staple, but it also had several connotations related to social status when it was consumed in the form of corn beer. Numerous scholars have studied the role of corn in the social and political dynamics of pre-Columbian societies and have arrived at similar conclusions about its importance (e.g. Clark and Blake 1994; Hastorf 1993; Johannessen and Hastorf 1994; Llano and Campuzano 1994; Murra 1960; Pearsall 1999; Salomon 1986; Super 1988; Taube 1989; Tovar 1980), and in the case of the Valle de Quijos ethnohistoric sources point in exactly the same direction (Oberem 1980; Landázuri 1989; Rumazo 1946).

Below is a description of the different landscapes in the region and their spatial distribution so that the differences in agricultural potential can be related to settlement patterns.

GEOMORPHOLOGY AND SOIL CLASSIFICATION

The geological and soil characterization of the region is based on a semi-detailed study conducted by FUNAN-PROBONA (1997), at scale 1:50,000. According to this study the Quijos-Cosanga drainage is characterized by rock formations of different origin and composition that date from the Paleozoic to the Quaternary. This region corresponds to the eastern flanks of the Cordillera Oriental de los Andes, and presents predominantly mountainous reliefs, developed on intrusive sedimentary metamorphic materials.

Six great landscapes or geomorphologic conjunctions and thirteen sub-landscapes that are the product of variations in lithology and relief forms are found within the region. The soils associated with each one of them are the result of the interaction of three main factors; parental material, climate, and relief. The soils of the region originate in pyroclastic material constituted by recent volcanic ashes that are permeable and fine grained. This is the result of Quaternary volcanic activity, and forms the parental material of aeolic deposits as well as that of colluvial and alluvial ones. These soils have a high water-holding capacity (they all belong to the Hydrandepts type, with water content > 100%), for phosphorus fixation and for accumulation of organic matter; additionally they can easily develop toxic levels of aluminum. The latter, though, will not affect plants if the content of organic matter is high (Foth and Ellis, 1997:85). They are grouped under the allophane soil group (PRONAREG-ORSTROM, 1982), typical of climates with very high rainfall that support evergreen and deciduous forests. These are poor soils in general but can be improved through fertilization; they respond well to potassium and to nitrogen, and the rapid process of reversion to fallow should enrich the soil with potassium quickly (in this aspect forest vegetation is very efficient) (Kalpagé 1974:73,94). Fertilization through green manure crops and addition of crop residues can help build up this type of soil without the risk that rapid vegetative growth will deplete its water content.

In this region temperature has a crucial role in soil differentiation due to the varying degrees of weathering of volcanic ash at different temperatures (higher at lower altitudes and lower at higher altitudes). There are two temperature regimes in the Quijos-Cosanga drainage; Isomesic (with soil temperatures between 9˚ and 13˚C, typical of altitudes above 2,800 m), and Isothermic (with soil temperatures between 13˚ and 18˚C, typical of altitudes between 1,600 and

2,800 m). Temperature variations year round are less than 5˚C in each case. The archaeological survey area corresponds to the Isothermic regime in its totality.

Humidity is not a factor in soil differentiation; all soils correspond to the Perudic Regime, meaning that the content of humidity available in the section of the soil that is used by plants is very high year round, producing permanently wet soils. This is because monthly precipitation is higher than evapotranspiration; consequently, constant lixiviation and percolation in the soil are the norm, which in turn produces a tendency towards soil acidity. Lastly, relief influences soil variation. Gentle relief facilitates the formation of deep soils, while on abrupt steeps slopes erosion acts against soil formation. The soil characterization is based on the Soil Taxonomy of the USDA. Below is a description of each of the great landscapes, their sub-landscapes and associated soils specifically in terms of their agricultural potential.

High Eastern Flanks of the Cordillera Oriental (1)

This landscape is the product of glacial activity during the Quaternary. It corresponds to the highest and westernmost elevations of the zone, above 2,800-3,000 m approximately. This unit is divided between two sub-landscapes (Low and Moderate Relief, 1.1, and Mountainous Relief, 1.2). Metamorphic rocks (schists, phyllites and gneiss) predominate in the two sub-landscapes. The archaeological survey does not cover this geomorphological unit and therefore sub-landscape and soil descriptions are not pertinent.

Medium and Low Flanks of the Cordillera Oriental (2)

This landscape is found in the medium and low elevations of the zone, and is divided into two sub-landscapes.

The Moderate Relief (2.1), found in 20.2% of the survey region, is characterized by hills with moderate slopes between 25 and 70%. The soils (Typic Hydrandepts) have been developed over metamorphic rocks (schists, phyllites and gneiss) and are moderately deep, with high levels of organic matter towards the surface but also very acidic and chemically poor. Nutrient content and natural fertility are low, which coupled with the presence of toxic aluminum presents limitations for cultivation. However, these soils have a deposition of horizons that at least shows incipient pedogenesis, which is absent in the other soil types.

The Mountainous Relief (2.2) is composed of rugged mountains with slopes above 70%, constituting 39% of the survey area. The soils (Lithic Hydrandepts) have been developed over volcanic rocks (basaltic lavas, lahars, and breccias). Their chemical makeup is similar to the one described for the Typic Hydrandepts, thus, not very fertile. Additionally, they tend to be poorly developed and shallow, and very prone to mass movements when they are not protected by good vegetation cover, because after a certain degree of water accumulation the soil transforms from a solid to a liquid state.

Quijos River Canyon (3)

This is found in the northern portion of the region, along the Quijos River, forming two clearly identifiable sub-landscapes.

The High Plains (3.1), developed over volcanic rock (basaltic lava) above the Quijos River Canyon, are undulating surfaces with slopes ranging between 5 and 40%, occasionally broken by rivers running north-south or south-north that cross-cut them. 14.1% of the survey area corresponds to this sub-landscape. The soils are Typic Hydrandepts (described above under sub-landscape 2.1), with low natural fertility.

The Rocky Outcrops (sub-landscape 3.2), formed by consolidated and unaltered basaltic lavas, constitute the vertical walls of the canyon formed by the Quijos River in its west-east flow. Slopes are above 100%. In the western higher altitudes these walls reach considerable height, to diminish gradually towards the east when the riverbed descends to the lowest altitudes. This sub-landscape corresponds to 5.3% of the survey area.

Cosanga Corridor (4)

This landscape is found in the southern portion of the study area, along the Cosanga River. It is divided into two sub-landscapes.

The Low Relief (4.1), is not represented in the area of the archaeological survey.

The Low and Hilly Relief (4.2), formed by gentle but irregular hills towards the southern portion of the Cosanga River, with slopes between 5 and 25%, and soils developed on lahars, pebbles, mud, and agglomerates. The soils (Paralithic Hydrandepts) are shallow, chemically poor, very acid, and can present toxic levels of aluminum. For these reasons they have low natural fertility. Similarly to the Lithic Hydrandepts, these soils can pass from a solid to a liquid state if the water content reaches very high levels.

Depositional Environment (5)

This corresponds to alluvial materials that have been moved by and deposited along the fluvial currents forming valleys, terraces, and cones. Three sub-landscapes compose this unit.

The Floodplains (5.1) are longitudinal strips formed along sections of the Quijos and Cosanga rivers on level terrain with slopes lower than 5%. They are constituted by pebbles, sands and mud, and subject to inundation. The soils (Fluvalentic Hydrandepts) are poorly developed, acidic, very humid, and of low fertility. The water table is rather superficial and they tend to be shallow and poorly drained due to this reason and to the presence of thick alluvial materials (pebbles, gravel) at less than a meter of depth. 4.8% of the survey area corresponds to this sub-landscape.

The High Alluvial Terraces (5.2), which represent 0.4 % of the survey area, are small formations along the Quijos and Cosanga rivers in level terrain with slopes lower than 5%. The soils (Entic Hydrandepts) are deeper than those in the other alluvial landscapes but acidic, very humid, and of very low fertility. They lack a Bs (cambic) horizon, thus they are poorly developed soils. The material of fluvial origin (pebbles, sands) is found just below 60 cm.

The Eject Cones (5.3) result from of the movement of pebbles, sands and muds that form conic hills. 0.2% of the survey area corresponds to this sub-landscape. The soils, Skeletal Hydrandepts, are similar to the Typic Hydrandepts but with a high component of thick fragments distributed along the soil profile that increases with depth. These fragments can vary in size (from gravel to stones). This constitutes the most obvious limitation for cultivation in these soils.

Denudative Environment (6)

This is the result of erosion and mass movement of the parent material, common in areas with steep slopes. This type of landscape is distributed in several sectors of the region, particularly where metamorphic and volcanic rocks form the parent material, since these are the most susceptible to this transformation. Two sub-landscapes are identifiable.

The Colluvial Formations (6.1), which result from the deposition of eroded material in the form of rolling relief with convex and moderate to strong slopes. 6.6% of the survey area corresponds to this sub-landscape. The soils (Skeletal Hydrandepts, described above under the 5.3 sub-landscape) present severe limitations for agriculture.

The Colluvio-Alluvial Formations (6.2) are colluvial materials that have been removed and displaced by fluvial currents, forming low relief environments with moderate to strong slopes, generally above 40%. These formations are generated in small watersheds where the slopes are strong and where the parent material is composed by altered rock. This process is facilitated in the region by the strong rain regime. The soils (Skeletal Hydrandepts, described above under the 5.3 sub-landscape) present severe limitations for agriculture. This constitutes 6.1% of the survey area.

AGRICULTURAL POTENTIAL

Pre-Columbian societies used several different varieties of corn, and their different adaptations and productivity are hard to understand by looking at modern varieties, yet, as is the case with the latter it was likely that some pre-Columbian varieties were more tolerant to temperature (high or low) while others coped better with excessive moisture, and even with soil acidity and aluminum toxicity. In short, there is little debate about corn's remarkable adaptability to varied agroecological conditions (Dhillon et al. 2002). However, some very general conditions affect corn productivity regardless of the variety (although this appears to depend on when in the agricultural cycle the conditions are present). In general, the successful cultivation of corn relies heavily on soil fertility (Schurr and Schoeninger 1995) more than on altitude or climate. Much nitrogen and high levels of phosphorous and potassium are most desirable. High and humid lands have been considered marginal for corn cultivation, but in the context of fertile soils the yields are highly satisfactory when protected from frost by growing it after the frost period and harvesting it before new frosts begin (Scarry 1986). Past and modern patterns of land use in the Fúquene and Susa Valleys in the Eastern Highlands of Colombia illustrate that corn can be cultivated and satisfactorily harvested in a cold and humid zone between 2,550 and 2,700 m (Langebaek 1995), with the advantage that corn cultivation at higher elevations reduces the risks of plagues. Quattrin (2001) also found evidence of corn production at all high elevation households in the Valle de la Plata but not at all low elevation households, which is inconsistent with the idea of corn as a low-elevation staple. Corn cultivation in high altitude and humid but fertile zones is and was also common in the central and northern Andes (Johannessen and Hastorf 1994; Salomon 1986; Seltzer and Hastorf 1990). In these cases, frosts are the main risk, but this is not a concern in the Valle de Quijos, where severe heat losses that produce drastic temperature differentials between the day and the night are prevented by the very thick cloud cover that characterizes the region year round.

Another factor that must be considered is water. In a study conducted in the northern highlands of Ecuador, Knapp (1991) finds that there is a lower precipitation limit for corn cultivation, which is about 600 mm of mean annual precipitation. But he also finds that above that, soil type (fertility) is a good predictor of yields, while precipitation is not; likely because of the possibility of irrigation to supplement water from rainfall. Other factors, such as elevation and slope do not show any correlation with yield, positive or negative, suggesting that farmers do not have a preference towards a particular of elevation. Likewise, the lack of correlation between slope and yield suggests that farmers maximizing short term benefits (since erosion is a risk to consider) would not have a preference for flats (Knapp 1991:47). In the Valle de Quijos there was probably no shortage of water, to the contrary, the heavy and incessant rainfall encountered today was noted in Spanish and later travel accounts (Gutiérrez 2002; Oberem 1980; Rumazo 1946), and thus this does not appear to be a recent condition. The subtle variations in precipitation in different areas of the survey region do not suggest that rainfall regimes varied in the region so as to produce a contrast in the conditions for corn agriculture. On the other hand, the altitudinal range is well within what people in the past and the present consider adequate for corn cultivation. Steep slopes, if the extrapolation from the case studied by Knapp is considered a valid one, pose a limitation but not the most serious one, since it can (and was) ameliorated through terracing and ditches to deal with the greater potential for erosion of slope agriculture and to improve the cultivation surface through the creation of thicker soils.

Excess of moisture on the other hand, can be problematic, particularly at planting or shortly thereafter since it can potentially kill seeds and young plants due to oxygen starvation and plant diseases that appear in such conditions. Additionally, root development in corn is poor in saturated soils. When saturated soils are common, ridge or hill cultivation may be preferred because it provides adequate drainage (Scarry 1986), although cultivation in flats can be successful if soil drainage is improved. Delaying planting is a possibility, but not one that would have made much of a difference in the Valle de Quijos due to the lack of an even moderately dry season. However, in the late vegetative growth and flowering, moisture requirements are much higher, and inadequate supplies will surely guarantee poor yields. In fact, corn plants become increasingly tolerant to excessive moisture as they grow. Flooding during late vegetative growth causes yield decrease if soil fertility is low, but by the time of flowering, flooding has virtually no effect on yields (Scarry 1986). A clear advantage of humid zones, is that abundance of water guarantees continuous plant growth. In the case of the Valle de Quijos, as well as in many other humid Andean settings both in pre-Columbian and contemporary times, drainage ditches across agricultural fields surely helped to lower the water table and therefore reduce soil moisture, as well as contributing to making clayey soils more workable (Knapp 1991:67).

Evaluating all of these factors in the context of the local conditions points to fertility as the most relevant factor for identifying variations in the potential for corn cultivation in the Valle de Quijos. In the soil study detailed above not a single soil type is considered fertile; all soil types are of naturally low fertility. However, the more developed soils would have been the easiest to work and the most likely to be improved through simple fertilization techniques. The Typical Hydrandepts kind are the best developed as seen in the transition of horizons in soil profiles, thus, sub-landscape 3.1 must have provided the most attractive settings for corn cultivation, followed by sub-landscape 2.1, with the same soils but steeper relief. Sub-landscapes of colluvial origin 6.1 and 6.2 would be third in terms of their suitability for corn production, since there is plenty of evidence that their main limitation besides fertility (moderate to steep slopes) can be and in fact was, controlled by the prehispanic population through the construction of drainage ditches and terraces. Although we lack estimates of the amount of labor that went into their construction, estimates of the cleaning of drainage ditches among modern agriculturalists in Ecuador are low, just 7.5 person-days per 100 m, although with wooden tools it must have taken about 2.7 times as much (Knapp 1991:68, 110). The original digging of drainage ditches likely did not require excessive extra effort. The building of terraces could have been more demanding, but if the testimony of indigenous crew members, whose main activity is farming, are considered a valid analogy, this is not viewed as a difficult, time consuming and expensive task; as, for example, compared to building a thatch roof for a communal house.

The same cannot be said for sub-landscape 2.2, with very poor and shallow soils and extremely steep slopes that likely made these areas less attractive for cultivation. Thus they rank fourth in our scale. Sub-landscapes 4.2, 5.2 and 5.3 are placed fifth because the limitations of their soils are hard to overcome. In the first environment soils are even less developed that the ones corresponding to the sub-landscapes just mentioned. They lack a Bs horizon and they are very shallow and hard. The last two have high contents of thick alluvial materials and a high water table, which acts in detriment of root growth, and soil management. Lastly, the extremely poor drainage, shallowness and rockiness of Fluvalentic Hydrandepts soils of sub-landscape 5.1 puts them at the bottom in terms of potential. The very slow drainage in this environment makes soils prone to developing a mottled subsoil with anaerobic conditions that are always saturated and unfavorable for cultivation. Furthermore, the risk of inundation is high, and there is no evidence that the prehispanic inhabitants of this region did anything to overcome this condition. Sub-landscape 3.2, which corresponds to extremely steep rocky outcrops where soil has barely developed, is for obvious reasons also at the bottom of the scale. Figure 5.1 shows the spatial distribution of soil categories.

Table 5.1. Soil Ranking, Soil Types and Associated Sub-landscapes.

Rank		Soil Type	Sub-landscape	% of survey area
1	Ds	Typic H	3.1	14.1 %
2	Ds	Typic H	2.1	20.2 %
3	Dsr	Skeletal H	6.1, 6.2	12.2 %
4	Ds/R	Lithic H	2.2	39.0 %
5	Ds/r	Paralithic H	4.2	3.9 %
	Dst	Entic H	5.2	
	Dsr	Skeletal H	5.3	
6	Dss	Fluvalentic H	5.1	10.1 %
	R	No soil, rocky outcrop	3.2	

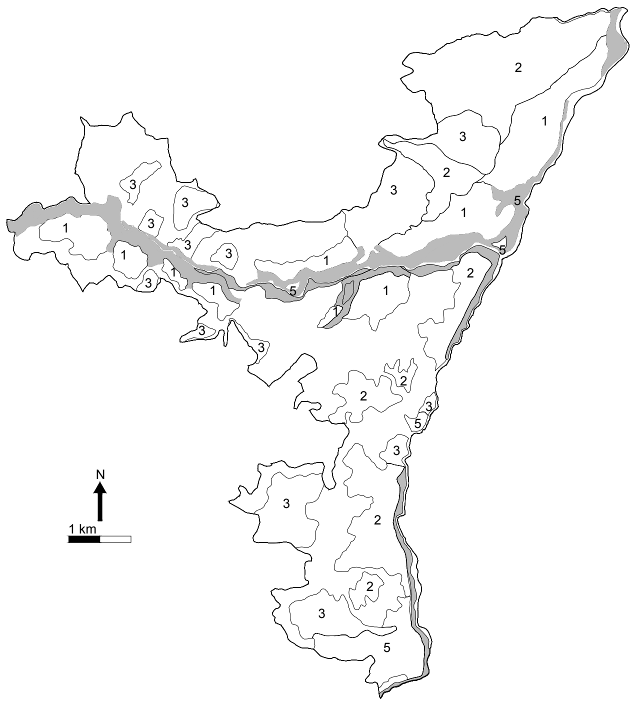


Figure 5.1. Survey Region Soil Map.

All soil categories are indicated with numbers except for 6 (indicated with solid hatch) and 4 (areas without numbers).

Landscape and soil classification had to be extrapolated to the northeastern corner of the survey because the geomorphology and soils map for that area was not available. The extrapolation was done using a 1:100,000 geomorphology map (RECAY 1990), a topographic map and aerial photos. The area to which the information had to be extrapolated is just 25.8 km^2, only 18% of the total survey area, yet, since there is a margin for error in this solution the information that pertains only the area for which the 1:50,000 study was available is included below (Table 5.2).

Table 5.2. Soil Ranking, Soil Types and Associated Sub-landscapes Including Area Extrapolated.

Rank		Soil Type	Sub-landscape	% of survey area
1	Ds	Typic H	3.1	11.6 %
2	Ds	Typic H	2.1	12.0 %
3	Dsr	Skeletal H	6.1, 6.2	12.6 %
4	Ds/R	Lithic H	2.2	47.6 %
5	Ds/r	Paralithic H	4.2	4.8 %
	Dst	Entic H	5.2	
	Dsr	Skeletal H	5.3	
6	Dss	Fluvalentic H	5.1	11.5 %
	R	No soil, rocky outcrop	3.2	

SETTLEMENT PATTERNS AND AGRICULTURAL POTENTIAL

In this section the patterns of occupation in areas with different agricultural potential will be examined. This is important not only to see whether the emergence of the Late period chiefs can be understood as a result of controlling the best agricultural resources, but also to get a better sense of the extent to which settlement location, in general, can be explained as a response to preference for the best land. The three periods of occupation will be examined here so as to detect any changes that may have happened in this respect during the sequence. The relationship between soil categories, settlement and land use is straightforward in that it is assumed that in the generally dispersed settlement pattern that characterized the entire sequence, people must have settled near their fields.

Early 1 Period

The distribution of settlements with respect to land quality shows a strong preference for the best agricultural land (Table 5.3).

Table 5.3. Distribution of Early 1 Occupation by Soil Ranking.

Soil ranking	Area of Occupation (ha)	% of total occupation	% of area by soil ranking
1	106.8	40.3 %	5.5 %
2	84.9	32.0 %	3.1 %
3	29.8	11.2 %	1.7 %
4	23.2	8.8 %	0.4 %
5	7.6	2.9 %	1.4 %
6	13.1	5.0 %	0.9 %

Given the very low density of occupation people must not have felt that it was indispensable to settle on the best land, since so much of it remained unoccupied. The largest concentration of population is in the best soil category (Figure 5.2), but nearly 60% of the occupation corresponds to soils of lesser quality. If soil categories 1 and 2 are pulled together to represent the best land, still nearly one third of the occupation corresponds to less productive land in a context where there was plenty of the best land available. Even the least attractive land (categories 4, 5 and 6) was used; about one sixth of the total area of settlement appears in these tracts of land. Thus, despite the fact that the best lands were preferred, and that the highest settlement densities were found there, a preference for soil quality cannot explain why poorer lands were occupied as well. This picture does not change if the area to which the soil study was extrapolated is removed. Still, most of the occupation corresponds to the best soils, but yet a larger proportion (about a third) is found in the worst soils (categories 4, 5 and 6) (Table 5.4).

Table 5.4. Distribution of Early 1 Occupation by Soil Ranking Including Area Extrapolated.

Soil ranking	Area of Occupation (ha)	% of total occupation	% of area by soil ranking
1	53.6	34.3 %	4.1 %
2	43.7	27.9 %	3.2 %
3	15.1	9.7 %	1.1 %
4	23.2	14.9 %	0.4 %
5	7.6	4.9 %	1.4 %
6	13.1	8.4 %	0.9 %

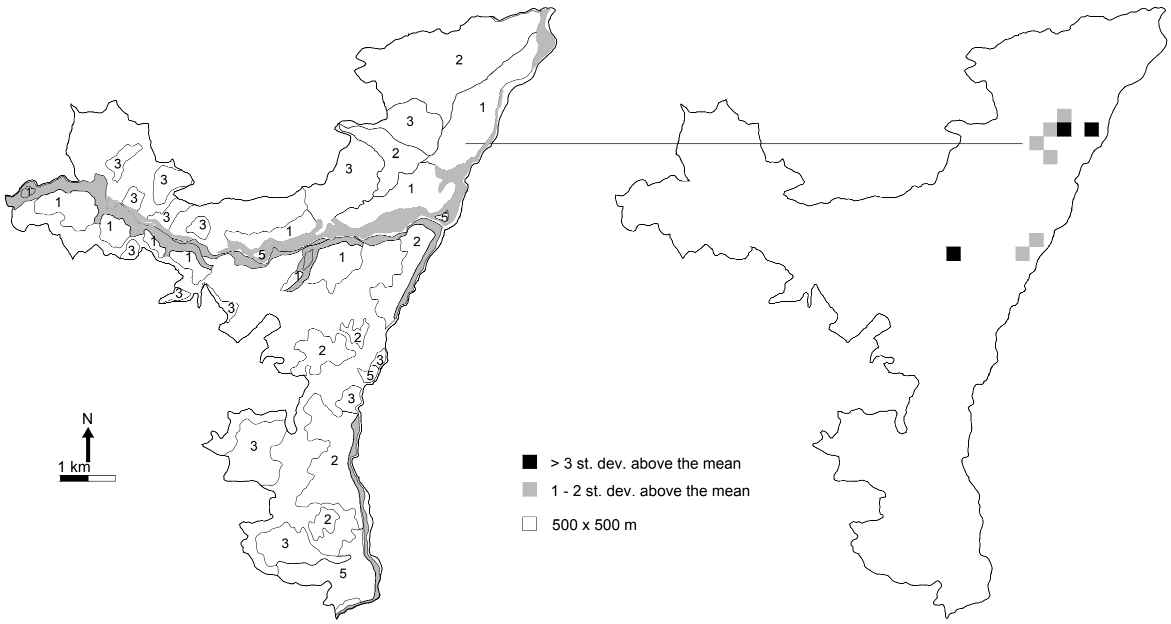


Figure 5.2. Soil Categories and Early 1 Period Settlement Density.

Early 2 Period

The preference for the best agricultural land continues during this period (Table 5.5), about fourth-fifths of the occupation is concentrated in categories 1, 2 and 3. Settlement distribution across lands with different agricultural potential barely changes. The distribution of the densest areas of occupation across different soil categories is similar to what is observed for the Early 1 (Figure 5.3), although the area with the densest occupation is on soil category 2. Only one of these densest areas is located in the third soil category, and not in proximity to other concentrations located in the best soils. Other than that, the pattern is the same, with just a slight increase in the proportion of the occupation located in the worst land (over one fifth in soil categories 4, 5 and 6).

Table 5.5. Distribution of Early 2 Period Occupation by Soil Ranking.

Soil ranking	Area of Occupation (ha)	% of total occupation	% of area by soil ranking
1	120.6	40.6 %	6.2 %
2	71.7	24.1 %	2.6 %
3	39.1	13.2 %	2.3 %
4	28.3	9.5 %	0.5 %
5	17.8	6.1 %	3.3 %
6	19.4	6.5 %	1.4 %

Figure 5.3. Soil Categories and Early 2 Period Settlement Density.

The low density of occupation of the best tracts of land does not suggest that occupation of less desirable areas resulted from lack of alternatives. Consequently, preference for the best land must not have been the only rationale for settlement location. Removing the portion of the survey to which the soil study was extrapolated only increases the proportion of the occupation in the worst soils (4, 5 and 6) to one fourth of the total (Table 5.6).

Table 5.6. Distribution of Early 2 Period Occupation by Soil Ranking Including Area Extrapolated.

Soil ranking	Area of occupation (ha)	% of total occupation	% of area by soil ranking
1	81.5	31.6 %	6.6 %
2	71.7	27.8 %	5.3 %
3	39.1	15.2 %	2.8 %
4	28.3	11.0 %	0.5 %
5	17.8	6.9 %	3.3 %
6	19.4	7.5 %	1.5 %

Late Period

The occupation of the best soils does not change with respect to the Early 2 (Table 5.7). The settlement distribution across the landscapes with poorer agricultural potential is also similar.

Table 5.7. Distribution of Late Period Occupation by Soil Ranking.

Soil ranking		% of total occupation	% of area by soil ranking
1	647.1	37.6 %	33.4 %
2	497.1	28.9 %	17.9 %
3	148.8	8.7 %	8.6 %
4	253.2	14.7 %	4.7 %
5	79.7	4.7 %	14.9 %
6	96.1	5.7 %	6.9 %

The highest settlement densities of the northeastern and northwestern subregions are located on the best land. In the case of the southern subregion, the highest concentration is found in the second best land. In general, the most densely settled areas correspond to soils of category 1 or 2 (Figure 5.4). Even so, these lands are still occupied only at a modest density, indicating that preference for the best land must not have been the only rationale for settlement location. Removing the portion of the survey to which the soil study was extrapolated only increases the proportion of the occupation in the worst soils (4, 5 and 6) to one-fourth of the total (Table 5.8).

Table 5.8. Distribution of Late Period Occupation by Soil Ranking Including Area Extrapolated.

Soil ranking	Area of occupation (ha)	% of total occupation	% of area by soil ranking
1	423.8	35.2 %	32.6 %
2	248.4	20.6 %	18.4 %
3	106.6	8.9 %	7.5 %
4	253.2	21.0 %	4.7 %
5	79.7	6.6 %	14.9 %
6	91.5	7.6 %	7.1 %

It does not appear that the best land was restricted to chiefs and their communities, since there are settlements on the best soils that do not correspond to the aggregations of population that may have been chiefly centers. Furthermore, the areas of densest occupation on the best soils within a 2 km radius of the largest settlements still have substantial amounts of unoccupied territory. In the northeastern subregion, only 45% of the best soil within the radius is occupied; in the northwestern subregion, only 30% is occupied. These percentages do not depart radically from what is expected, given that only about 33% of the best soil type has occupation throughout the entire region. The case of the largest settlement in the southern subregion is consistent with the first two. Here, only 25% of the best local land (category 2) was occupied, compared to 18% throughout the survey area.

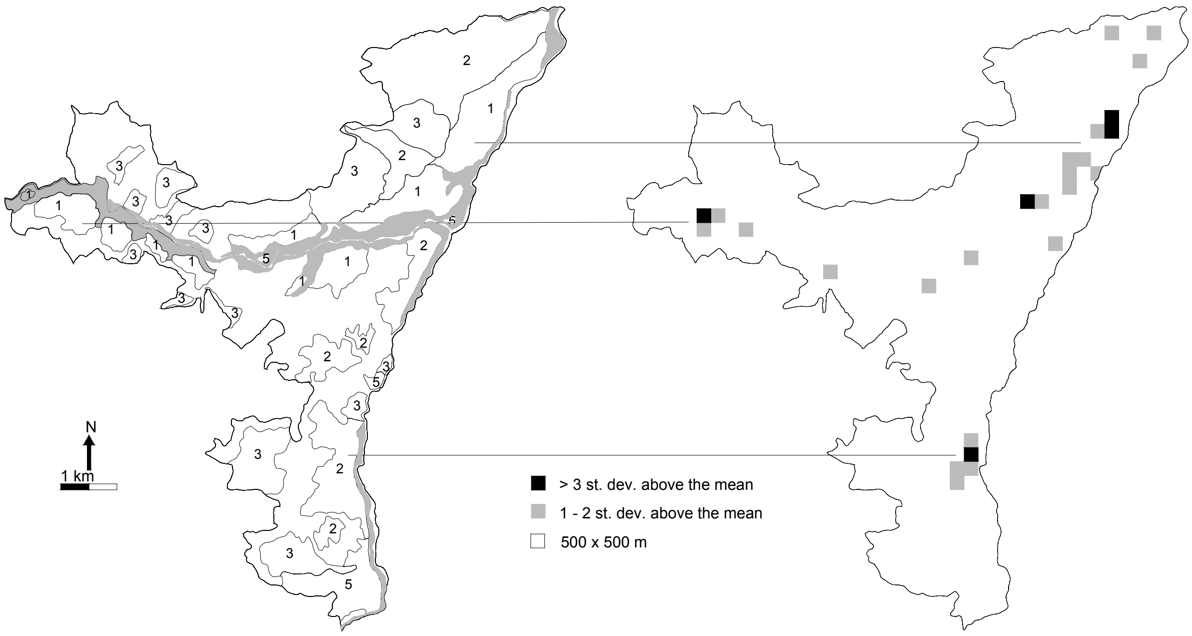


Figure 5.4. Soil Categories and Late Period Settlement Density.

This leads to the interpretation that chiefs were likely not regulating access to the best land for surplus corn production, since this should have produced a notably denser occupation of these terrains. The conclusion this evidence points to is that the emergence of a chiefly authority did not appear to come along with elite control over the best soils, and that motives other than the exploitation of these terrains for corn production may have motivated population nucleation.

CONCLUSIONS

The general patterns of land use look remarkably stable throughout the different periods of occupation if attention is focused on the proportion of the total occupation in each soil category (Figure 5.5). People preferred the best soils in general, however, these high quality tracts of land were never occupied densely enough, even during the Late Period, to draw the conclusion that the gradual occupation of less desirable land was due to shortages in the availability of best land. Indeed, the wide use of the least productive areas in the context of the very low population densities from the beginning of the sequence is the opposite of what one would expect had soil fertility been a main criterion for settlement location.

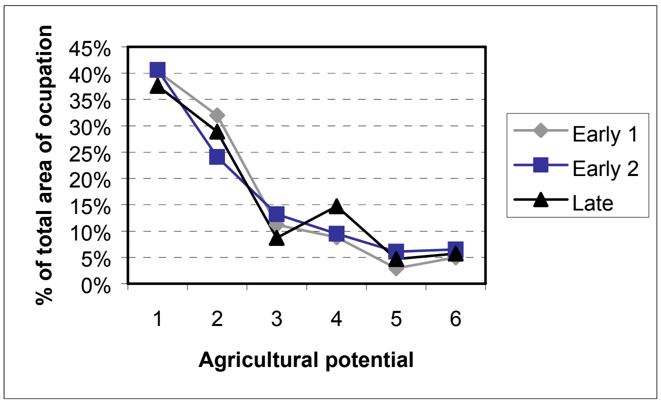


Figure 5.5. Proportion of Total Area of Occupation by Soil Category.

The density of occupation in each one of the soil categories increases in the Late Period, which is what one would expect since population increased more drastically from the Early 2 to the Late than from the Early 1 to the Early 2. This did not occur evenly though; the Late Period increase in the density of occupation on the best soils is of greater magnitude when compared to other soil categories (Figure 5.6). The magnitude of the increase relates to soil quality (the better the soil the greater the increase) if category 5 is excluded. In this case, the increase resembles what is observed for category 2. However, both nucleated and not nucleated settlements appear on the best soils, and there is no match between settlement type and soil type. This is particularly inconsistent with the idea of a population gradually forced by elites to live in the least productive lands. Of course, it is conceivable that control of resources could have happened in the form of land ownership by elites but with land allocations to non-elites expected to produce surpluses, as has been argued for the case of Hawaiian chiefdoms under the control of resources model: "Ownership of productive resources, especially land, was most basic" (Earle 1996:185). This will be discussed again, in Chapter 7, in light of the results of the botanical analysis.

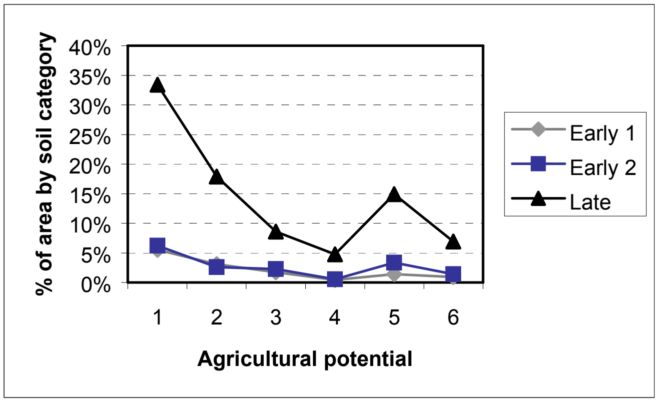


Figure 5.6. Proportion of Total Area Occupied by Soil Category.

In any case, the fact that despite the magnitude of demographic, and by extension, social change, population distribution across soil categories does not change through time is very inconsistent with the idea that emerging elites sought to control the best agricultural resources. The same tendency seen in the Late Period occurred during the Early 2, just in lesser magnitude, when we do not believe that a chiefly form of social organization existed in the region. Indeed, the correlation between settlement density and soil ranking is the strongest and the most significant for the Early 1, when the social structure seems far from unequal (Table 5.9). That the emergence of social hierarchies was not accompanied by a distinctively different pattern of land use makes it hard to link chiefly authority to the control of the best agricultural resources; because if access to them constituted the impetus for the development of social inequality, one would need to explain why this did not develop earlier, such as during the Early 1.

Table 5.9. Spearman's r Correlation Coefficient and Significance for Occupation Density and Soil Ranking.

	Early 1	Early 2	Late
$r_s =$	0.83	0.54	0.71
$p <$	0.04	0.17	0.10

6. FIELD METHODS II: BOTANICAL REMAINS

With the objective of providing direct evidence of the agricultural production and consumption patterns during the period of chiefdom emergence, I selected eight sites to obtain samples of soil for identification of fossil pollen, phytoliths, and carbonized macroremains. The different locales selected represent dispersed and nucleated settlements, low and high altitude settlements, and settlements located in areas with different agricultural potential (Figure 6.1). These choices reflect the project's objective of examining the organization of agricultural production and associated consumption patterns in relation to the emergence of social hierarchies in the region.

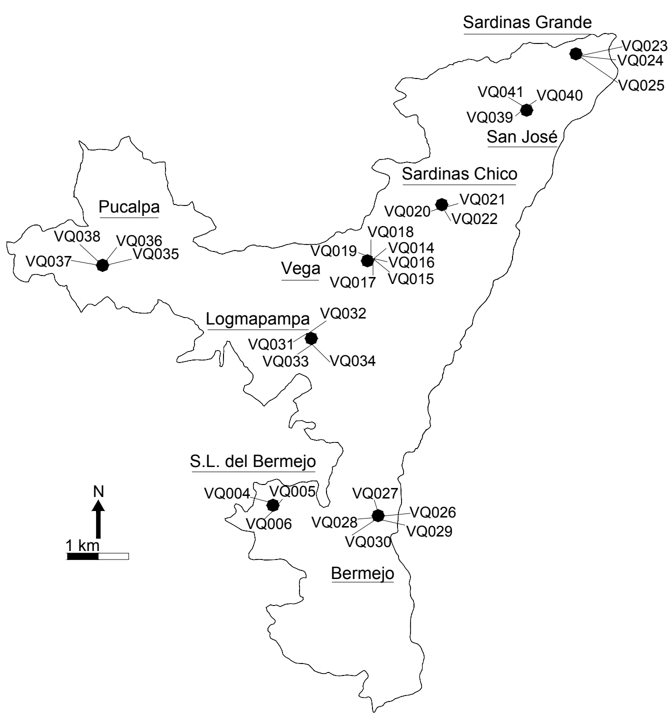


Figure 6.1. Location of 1x1 m Tests.

The relationship between settlement patterns and altitudinal zones (Chapter 4) suggests that an imbalance existed in the occupation of different zones during the Late Period showing a preference for the lowest altitudinal ranges. This does not provide strong evidence for a system of vertical production. Even so, there was a notable change in population distribution from the Early period to the Late, with an increased tendency to occupying more of the altitudinal range, which raises the possibility that a vertical system of production was at play during the latter despite the unevenness of population distribution across altitudinal zones. Similarly, settlement analysis in relation to agricultural productivity (Chapter 5) does not provide a strong basis for suggesting that land productivity was a very important factor in settlement location through time, yet the fact that the Late period central settlements are located on the best types of soil may indicate an interest in optimizing corn production by the elites.

Contrasting agricultural production patterns in different environmental settings and in relation to the nature of settlements (nucleated vs. dispersed) through the analysis of botanical remains is crucial for a more thorough exploration of the emergence of social hierarchies in relation to the organization of agricultural production. The study of consumption patterns is important in this effort as well, as these may reveal disparities in cultivated and consumed products that could indicate circulation practices produced by a specialized agricultural system related to the emerging social hierarchy of the Late period.

This project approaches the study of plant production and consumption through multiple lines of evidence that include the analysis of both micro and macro botanical remains, which has been argued to provide a more complete picture of plant use, including production, consumption, use of wild plants and surrounding vegetation (Hall 1988; Piperno et al. 1991). This approach balances the differential preservation of the different types of remains (Pearsall 2000: 494) and their potential for indicating specific aspects of plant use dynamics. The diverse location of sites and of test pits within sites also contributes to this same purpose. However, the factors that affect the distribution, preservation and recovery of botanical remains in archaeological sites are multiple and not always evident or easy to understand, and therefore the identification and interpretation of patterns is often complicated (Popper 1988). Complete documentation and discussion of the selection of sites and their characteristics, and of the methods of recovery, is thus essential for exposing the possible factors affecting their appearance and interpretation. The factors affecting distribution and preservation are different for pollen, phytoliths and macroremains, so the strategies employed to maximize the chances of recovering adequate samples in each case varied as well; they are discussed separately below in relation to the kind of information they can contribute to answering this project's research questions.

POLLEN

Environmental history and climate reconstruction have been the most common uses of pollen analysis, yet pollen has more recently been the focus of efforts to reconstruct patterns of agricultural production, because it can also reflect cultivation patterns in archaeological sites (Berglund 1986; Fish 1994; Fish and Donaldson 1991; Hastorf 1988; Herrera 1985; Mora et. al 1991; Morrison 1995; Pearsall 2000; Sergerstrom 1991; Vuorela 1973). The representation of pollen from different plants varies according to the mechanisms of pollen dispersal, which depend on the pollination mechanisms of different plants. Wind-pollinated plants are more likely to be over-represented in pollen rain since they produce large amounts of pollen grains that can disperse considerably more than the pollen of water pollinated, zoophilous, and self-pollinated plants (which, in turn, are more likely to be underrepresented). Dispersion also depends on the size and weight of pollen grains. Corn, for example, is a wind-pollinated plant with a short dispersal distance as its pollen grains are large and heavy (Bryant and Holloway 1983:195; Pearsall 2000:258). In general, although some pollen can be deposited in a site through plants brought into and used at a site, or because of pollen traveling long distances by air, species of plants cultivated nearby will usually contribute more to a local pollen rain, and therefore be better represented in pollen samples (Fish and Donaldson 1991; Pearsall 2000).

Preservation of pollen grains, once they enter a deposit, is variable and subject to a series of factors (mechanical, chemical and biological), and which act differently on different pollen types (Bryant et al. 1994). Pollen preserves better in sediments with high water content, which prevents biological decomposition; where there is a lack of seasonality thereby limiting the drastic drying and wetting of the soils that leads to grain breakup; and in acid soils, which limit the kind of biological activity that destroys pollen grains (Bryant and Hall 1993). Certain chemical soil compositions, such as those resulting from the presence of large amounts of aluminum, contribute to pollen destruction as well.

This project focused on sampling at archaeological deposits. The collection of pollen from archaeological deposits has one major advantage over contexts of collection not affected by cultural activity such as lake beds and ocean floors, which is that it allows one to look at possible variations in food production within a region instead of providing an aggregated view that does not control for social or microenvironmental contexts. Conversely, environmental and climate reconstruction based on pollen from archaeological deposits is, thus, not ideal since the pollen rain at these locations reflects a combination of the regional vegetation, human-created plant communities, cultivated plants, and other plants that are part of the human economy (Pearsall 2000:271). These factors though, provide precisely the kind of information that allows one to see variation in plant use within a region.

Considerable attention, however, must also be given to the fact that the pollen rain within archaeological sites can vary considerably depending on the specific context and location at which soil samples are collected. Sampling at indoor spaces, for example, is unlikely to produce a complete picture of the pollen rain, additionally, the pollen present can be destroyed by high temperatures of the kind produced by a hearth. Samples by doorways in contrast, may have a more complete representation of pollen rain. Sampling in agricultural fields is also recommended for reconstruction of agricultural practices (Pearsall 2000:272). Locations of excavation test pits for soil sampling in this project took these factors into account by targeting agricultural terraces and peripheral areas of terraces that appeared to have been residential. Results from other studies suggest that these may be the optimal locations for sampling for pollen remains. In the case of the Valle de la Plata, for example, the most informative pollen samples—those with the highest pollen counts and with pollen from a variety of domesticated plants—came from locations around household perimeters (Quattrin 2001). In that case, plants such as manioc, whose pollen is found only where cultivation took place, were identified, suggesting that areas surrounding habitation structures, where gardens and middens may have been located, are very promising, as ethnoarchaeological studies of house-lots spaces indicate (Killiam 1992:126). This observation is also common in recent literature on archaeological palynology (Bryant and Holloway 1996; Fish 1994; Sergerstrom 1991). Thus, when agricultural terraces were not present, areas located in proximity to habitation spaces were targeted hoping that they would correspond to gardens and/or be close to agricultural fields. The dispersed settlement pattern in the region implies that cultivation fields were adjacent to houses, which is also described in colonial accounts, and remains so for many indigenous and peasant populations in the Andes today.

Although all of these conditions were found in the study area, the samples analyzed yielded extremely poor quantities of identifiable pollen grains. Pollen of cultivated species was particularly scarce. A factor that can possibly account for this situation is the high amount of toxic aluminum present in the sediment, which is very detrimental to pollen grains.

PHYTOLITHS

Phytoliths can be directly associated with both production and consumption because they are generated either by plants growing at or brought onto the site and used (Pearsall 2000:395). Since their distribution is not subject to the dispersal factors of pollination, the context of origin can very reliably speak of their association with either cultivation or consumption. Phytolith analysis has also proven extremely useful in the identification of silent taxa (Piperno 1993), taxa that tend not to appear in most botanical assemblages, such as tubers, because they do not produce a pollen rain and are too soft to preserve in charred form (Hastorf 1999). Phytolith analysis also has a high potential because species-level identification is possible for a large number of families. A list of New World crops that can be identified through phytoliths appears in Pearsall (2000:382-383), showing the important contribution they can make to studies of past agricultural practices.

Phytoliths are released from plants in the process of organic decay or burning, and move very little once deposited in stable soils (Pearsall 2000:393). Contemporary studies of the distribution of modern vegetation and phytoliths in the soil of forested environments show a neat match; phytoliths move very little from the primary locus of deposition (Piperno 1988), which is known as the decay-in-place model. This is because they are tightly attached to the organic and inorganic components of soil, so unless the soil moves phytoliths will not. Consequently, the likelihood of phytoliths moving in soil profiles is only proportional to the movement of the soil itself. Open environments can produce slightly different dynamics due to windblown sediments. However, in very moist and forested environments, like the Valle de Quijos, this should not constitute a problem. Soil movement as a result of alluvial activity is also a cause of disturbance of phytolith assemblages, but we avoided excavating test pits in areas subject to this process. Colluvial movement of soils presents a further problem, and one that could be a significant factor in the region due to the combination of steep slopes and heavy rainfalls with its resultant potential for erosion. This constitutes a concern for the interpretation of all kinds of artifact and botanical remains as well as stratigraphy, and we addressed it by selecting sites on hilltops or locations that seemed geologically stable, avoiding very steep slopes or hill bottoms, thereby limiting the likelihood of materials being introduced from other areas through the colluvial movement of soils.

In any case, the amount of phytoliths brought to a site from a distant location through natural means will always be minimum in comparison to the amount produced by the local plants (Pearsall 2000:395). For this reason, they can very reliably account for local agricultural activities, general plant use, and local vegetation. Additionally, because phytoliths are inorganic remains, they preserve much better and in a wider range of environments (both dry and waterlogged) than pollen grains and do not suffer from deterioration due to microbial growth or from mechanical destruction as it is the case with macroremains.

The placement of test pits for the extraction of soil samples, which included the interior and edges of terraces thought to be used for residences, open spaces lacking features but in proximity to these terraces, and agricultural terraces, provided an array of locations that allow for comparison of production and consumption practices of Late period inhabitants in different environmental and social settings through phytolith analysis. Domestic spaces provide an ideal context for collecting phytoliths related to consumption, while agricultural fields are ideal for collecting those relating to production. Samples from areas adjacent to domestic locations are more complicated to interpret, as the phytoliths presence could be derived from either an adjacent garden or disposed household waste. The preservation of phytoliths in our samples is satisfactory as indicated by the variety of types identified.

MACROREMAINS

Macrobotanical remains are most likely to be directly related to processing and consumption of foods, since they enter the archaeological record primarily when plant parts are manipulated or eaten. Only charred macroremains can be taken as indicators of past practices related to food production and consumption. Non-charred remains, although they can conceivably preserve for a long period of time in certain environments, are more likely to correspond to modern vegetation or activities. Charred materials are not susceptible to decay produced by biological organisms, but are vulnerable to mechanical destruction.

Since carbonized food remains are most likely to be preserved and can most reliably be assumed to come from archaeological contexts, it is understood that most macroremains should be associated with contexts of food preparation or plant manipulation, such as hearths. Agricultural fields may also provide a context for the collection of macroremains, particularly when slash-and-burn agriculture or shifting cultivation was employed, as charred agricultural remains could be preserved. In these different locations, the parts of plant remains recovered can be different and represent different activities (consumption and production) (Hastorf 1988; Miksieck 1983).

A variety of factors contribute to the likelihood of preservation of macroremains. Physical properties of the macroremains themselves, such as density, surface characteristics and size, and factors related to use such as the cause of charring and frequency and method of use and disposal all can affect preservation and recovery (Popper and Hastorf 1988:5) and therefore the patterning perceived by archaeologists (Popper 1988). Not all types of plants have equal chances of being charred, and therefore not all plants are likely to preserve as macroremains. Plants that do not require heating or cooking, and ones that are fragile and more likely to be converted to ash through contact with fire are less likely to preserve. Leafy foods, for example, would most likely not preserve, both because of the lower likelihood that they were cooked over an open fire and the greater chance of them turning to ash through contact with a hearth. Different cooking practices also factor into the abundance or paucity of macroremains, as methods such as toasting or grilling are more likely to produce carbonized specimens, whereas food preparation in stews and through boiling would be less likely to produce such carbonized remains in abundant quantities. Likewise, the cooking of whole grains would increase the chances that carbonized remains would be preserved, while food preparation through grinding would destroy the grains, thereby making preservation less common. Additionally, some foods, such as corn, have large and sturdy non-edible parts that would preserve in carbonized forms, while others, such as potatoes, achira, and arrowroot (tubers in general) are usually underrepresented because their tissues are fragile (Pearsall 1994:155) and do not have non-edible parts that would be likely to be preserve.

Inside residential areas, where features such as hearths are sometimes located, are widely considered to be good locations for the collection of macroremains that indicate consumption practices. With this test pit placing strategy I attempted to target these areas by judgmentally choosing areas inside of what appeared to be residential terraces. In some cases discrete accumulations of ash and carbonized material, usually interpreted as hearths, were found at these locations, while these features were not typically observed in agricultural terraces, for example. Yet, I did not limit the location of tests optimal for the recovery of macroremains to these areas, knowing that typically some macroremains may remain inside the domestic context or in hearths in particular, but that others are swept outside, which leads to a distribution of macroremains in areas adjacent to the residential space. By placing tests in these locations and even at places removed from the immediate surrounding areas of terraces I hoped to avoid what Lennstrom and Hastorf (1995:702) call "feature bias", a tendency to assume that the most complete collections will come from loci such as hearths and pits, and to ignore that knowing where remains are not typically found is as important as knowing where they appear more frequently. They and other scholars suggest that a "blanket sampling" strategy, which consists of collecting sediment from all excavated contexts, provides more comprehensive botanical assemblages (Hastorf 1989:95). Detailed definition of context through area excavations was not possible in our case, but the selection of a variety of locations at each site approximates this principle in that the resulting botanical assemblage is not based on a single kind of provenience, as it has been argued that valid interpretations about the botanical remains of any given provenience are unattainable if different kinds of deposits are not sampled for plant materials (Lennstrom and Hastorf 1995:702). This should include both cultural and non-cultural deposits, because the potentially less productive deposits can be used as controls to interpret deposits with potentially more material (Popper and Hastorf 1988:7), which provides the strongest certainty about which proveniences are more promising. In short, a single provenience can always be more meaningfully understood if it can be compared to another one.

In this case, macroremain appearance and preservation was satisfactory. Cultivated products as well as fruits, weeds and wild species were identified at most sites.

SELECTION OF SITES AND LOCATIONS OF TESTS

The excavation of 31 1x1m test pits was conducted at nine different sites throughout the region, and in multiple locations at each site. The selection of sites for excavation of test pits was based on a variety of criteria pertaining to this research project's objectives, and these criteria were distinct from those used in the selection of excavation sites to determine ceramic chronology (see Appendix A). First, all of the sites selected for excavation for the collection of botanical remains were occupied exclusively or predominantly during the Late Period, the period during which social complexity is thought to have emerged in the Valle de Quijos. In order to identify specific Late Period settlements, I examined the ceramic collections from the regional survey, looking for areas of contiguous lots with Late Period ceramics that also represented variability in the other important criteria explained below. Therefore, I identified sets of contiguous lots with predominantly or exclusively late materials, some at higher and lower altitudes, some part of more or less dispersed settlements, and on different soil types. While I recognize that a more thorough method of site selection would have been possible through digging numerous test pits or shovel probes at each possible excavation location to assess chronology more precisely, I feel comfortable with this approach because the survey materials in an area should generally provide an accurate reflection of the kinds of materials present at smaller scales in that area. This rationale was supported by the 2x1 m test excavations conducted during a previous phase of the field season, when I observed that excavation materials did, in fact, tend to correspond to the survey materials collected in the surrounding area (see Chapter 2). Thus, by not limiting myself to analyzing the material of single lots, but rather looking at consistency in the material from a wider area, I anticipated that the sites selected for excavation were exclusively or predominantly late sites. The excavation results bore this out, as the materials collected from these excavations were almost exclusively Late Period ceramics.

Second, sites were chosen based on the density of occupation, taken from the survey data, to include a range from large nucleated settlements to very small and relatively isolated settlements under the assumption that this variety represents different positions in a wider social structure (a detailed discussion regarding occupational density and social organization appears in Chapter 3). The comparison across settlement types is important for analyzing if and to what extent settlement type corresponds to agricultural uses or consumption practices, to address the question of chiefdom emergence in relation to specialization of production and control of agricultural resources. While these selections were made in the field based on close inspection of the settlement map of the Late Period that allowed for the identification of large, medium and small settlements, posterior settlement data analysis helps to more thoroughly examine differences in settlement density and size, and to rank accordingly the different locations across a scale. Figure 6.2 shows the location of test pits in relation to settlement density as shown on a contour density map. Here the patterns of occupational density are more informative than on the settlement map containing all of the lots, and the former used in conjunction with the graphical display of area of occupation in 500 x 500 m grid units (Figure 3.19, Chapter 3) is useful to define settlement types according to density and size with more precision. Thus settlements selected were ranked from 1 to 4 based on this analysis, with 1 representing large nucleated settlements, 2 moderately large and nucleated settlements, 3 small settlements and 4 very small and relatively isolated settlements.

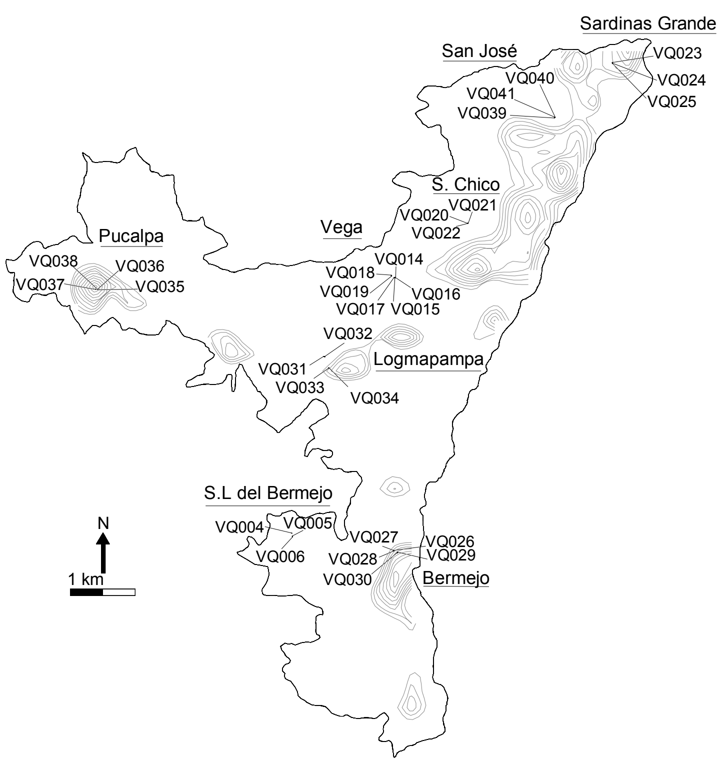


Figure 6.2. Location of 1x1 m Tests in Relation to Late Period Settlement Density.

Third, soil types were taken into account in the selection of site locations. Sites chosen correspond to a wide range of soil types in the region, with soils ranked 1 through 4 (of 6) represented in the excavated sites (see soil ranking criteria in Chapter 5). This is important for assessing if and to what extent the agricultural use of sites was related to the fertility (and therefore use value) of different areas and to settlement type in order to explore the relationship between emerging elite settlements and emphasis on corn production and consumption.

Fourth, sites selected also reflect a range of altitudes (from 1,660 to 2,400 m), which is important for assessing the verticality model of agricultural production and exchange. For verticality to be at work, one would expect to find the crops cultivated to vary across altitudes, thereby utilizing the lower settlements for the production of warmer weather crops (such as beans, chili peppers and manioc) and the higher ones for cooler weather crops (such as quinoa, potatoes and other tubers). This would lead to an organization of agricultural production defined by crop specialization by altitude and exchange of products between altitudinal zones.

As mentioned above, at each site, test pit locations were chosen based on the different areas that are ideal for the collection of different types of botanical remains. One challenge for determining these locations was the lack of extensive excavation of terraces in order to determine with certainty the location of households. Instead, we relied extensively on the observation of terrace type, shape, size, and location. Terraces that were identified as probable residential terraces were readily distinguished from agricultural terraces, the latter tending to be longer and thinner, while the ones identified as household terraces tended to be semi-circular or rectangular but more proportionate in its side dimensions than agricultural terraces. Both agricultural and non-agricultural terraces were sometimes delimited by stone foundations, although the high vegetation density often obscured these from sight. The former often appeared in groups of three or four, although we also observed groups of just two or up to at least twelve, all placed directly one above the other. Those identified as non-agricultural terraces were quite commonly double-terraces, with similarly shaped terraces of roughly the same size one directly above the other, or in some cases with the lower of the two terraces being slightly larger than the upper one. The forms filled out in the field during survey, where we recorded comments about the quantity, kinds, characteristics and preservation of terraces were very useful at the moment of making decisions for site selection. Non-agricultural terraces selected for test pits were classified according to area in four classes: small, medium, large and very large (see Figure 6.3).

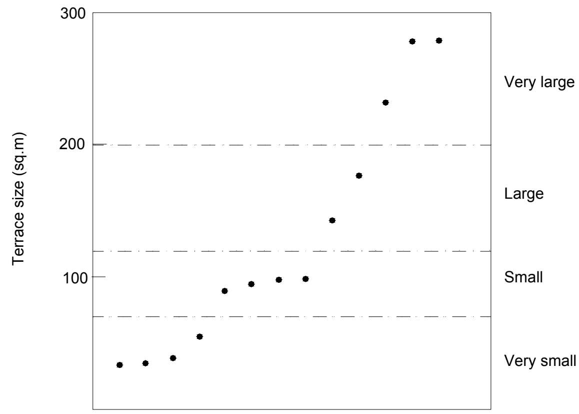


Figure 6.3. Terraces by Size Range.

Table 6.1 summarizes test pit information. The combination of site locations and diverse placement of test pits provides an interesting set of cases for comparison. This includes two of the largest nucleated settlements in the region, each with a different soil ranking (a third one in the northeast portion of the survey, in low altitude, would have been desirable, but this was not attempted due to the high concentration of early settlements in that zone) to be compared to smaller and less dense sites with different soil rankings and at different altitudes. Agricultural terraces in both large and small settlements, representing both high altitude and low altitude locations, and three different soil rankings are also included.

Table 6.1. Summary of Test Pit Information.

Code	Site name	Unit	Altitude (m)	Soil ranking	Settlement	Location of test
VQ004	SL Bermejo	1	2280	3	Small (3)	Off-site
VQ005	SL Bermejo	2	2270	3	"	Small terrace
VQ006	SL Bermejo	3	2270	3	"	Outside of terrace
VQ014	Vega	1	1980	3	Small (3)	Medium terrace
VQ015	Vega	2	1980	3	"	Very large terrace
VQ016	Vega	3	1980	3	"	Off-site
VQ017	Vega	4	1980	3	"	Off-site
VQ018	Vega	5	1980	3	"	Agricultural terrace
VQ019	Vega	6	1980	3	"	Agricultural terrace
VQ020	S Chico	1	1910	3	Small (3)	Small terrace
VQ021	S Chico	2	1910	3	"	Large terrace
VQ022	S Chico	3	1910	3	"	Small terrace
VQ023	S Grande	1	1660	2	Moderately nucleated (2)	Small terrace
VQ024	S Grande	2	1660	2	"	Large terrace
VQ025	S Grande	3	1660	2	"	Outside of terrace
VQ026	Bermejo	1	2000	2	Large nucleated (1)	Agricultural terrace
VQ027	Bermejo	2	2000	2	"	Agricultural terrace
VQ028	Bermejo	3	2000	2	"	Agricultural terrace
VQ029	Bermejo	4	2040	2	"	Very large terrace
VQ030	Bermejo	5	2040	2	"	Very large terrace
VQ031	Logmapampa	1	2080	4	Moderately nucleated (2)	Outside of terrace
VQ032	Logmapampa	2	2080	4	"	Off-site
VQ033	Logmapampa	3	2140	4	"	Very large terrace
VQ034	Logmapampa	4	2140	4	"	Medium terrace
VQ035	Pucalpa	1	2400	1	Large nucleated (1)	Very large terrace
VQ036	Pucalpa	2	2400	1	"	Outside of terrace
VQ037	Pucalpa	3	2400	1	"	Agricultural terrace
VQ038	Pucalpa	4	2400	1	"	Agricultural terrace
VQ039	San José	1	1720	2	Very small (4)	Off-site
VQ040	San José	2	1720	2	"	Medium terrace
VQ041	San José	3	1720	2	"	Medium terrace

EXCAVATION OF TEST PITS AND SOIL SAMPLING

Soil sampling techniques were chosen with the goal of enhancing the chances of finding macroremains, phytoliths, and pollen, keeping in mind that different test pit locations were thought to be better suited for the collection of different kinds of botanical remains. The excavation methods and soil collection techniques were standardized across test pits. As was the case with the excavation of 2 x 1 m test pits (see Appendix A), we tried to follow the natural stratigraphy but this was often complicated due to waterlogged sediments. On numerous occasions the soil removed would come in a semi-liquid state in which determination of color and texture characterization was very difficult. In these cases excavation levels were arbitrarily set at 10 cm intervals. We collected ceramics, lithics and polished stone artifacts as we excavated. Detailed description of 1 x 1 m test excavations appears in Appendix A.

For the collection of macrobotanical remains, manual collection, screening of soil, and soil flotation techniques were employed. For manual collection, as soil was being removed from an excavation, visible macroremains were separated by hand. Manual collection presents several shortcomings: for one thing, many of the remains are too small to be readily visible to the naked eye, thereby leading to the failure to collect samples of smaller taxa. This is compounded by the local soil conditions, whose clayey consistency made manual collection more difficult. Thus in addition, in each level of excavation 10 liters of soil were screened using a 5 mm screen, which we determined was the smallest screen aperture that could be effectively used given the soil texture. This was clearly more systematic than manual recollection, and presumably the size of the screen helps to compensate for some of the smaller macroremains that may otherwise be more likely to escape detection. Yet, concerns about the degree to which the very small remains will not be captured remained. The flotation of soil samples seemed the most appropriate method to compensate for this. 10 liters of soil were collected from each excavation level and carried back to the field quarters for flotation. The size of the soil sample for flotation bordered on being too large, but it seemed appropriate for this project given the limitations of manual recollection and screening. Naturally, soil sample size is contingent on the objectives of each project, making large samples necessary in some cases but not strictly so in others. As Popper and Hastorf (1988: 7) note, more corn remains are needed to identify corn varieties than to document corn cultivation, for example. In the current research, more remains, in general, seemed better than fewer in order to optimize the range of taxa represented. Additionally, preservation at the first site where excavations were conducted appeared to be very good, but the abundance of remains was not such as to allow for sampling in small volumes. As we floated the soil samples from the first 1 x 1 m test pit excavated with Gaspar Morcote, the macrobotanical analyst, we decided that the 10 liter sample size per level of excavation was appropriate at this stage. Explanation of flotation techniques will be provided in the next section of this chapter.

After each excavation was completed one of the profiles was selected to collect soil samples for analysis of pollen and phytoliths. Recommendations of the pollen analyst Juan Carlos Berrío and others found in the literature (Bryant and Holloway 1983; Pearsall 2000) were followed to ensure adequate collection of soil samples. Soil samples for pollen and phytolith analysis were collected simultaneously. Walls with root intrusions were avoided, as well as those rich in charcoal since pollen is often destroyed by intense heat (hearth areas would have been favorable for phytoliths, as these form through burning of plant tissue, yet, since their deposition is not limited to ashy deposits we avoided these profiles for the sake of pollen). Profiles were cleaned thoroughly from top to bottom, scraping the outer surface laterally and cleaning the trowel constantly. Changes in the natural stratigraphy were marked in the profile with a trowel, drawn, and compared to the marks of the levels excavated. For each level of excavation two soil samples were collected (one for pollen and one for phytoliths), from bottom to top. Special attention was paid to not mixing soil of two different natural strata if the excavation level included soil of two strata. Soil extraction was accomplished by digging a small area (about 10 by 5 cm) into the profile with a clean trowel and then scooping out dirt with a spoon that was washed after each sample was taken. Two sterile bags with approximately 10 tablespoons each were filled for each level. These were all stored in a refrigerator, both in the field and in the laboratory, to prevent mold growth, common in moist sediments. Every bag was marked with site name, GPS coordinates, test number, level number, depth and date.

Selection of soil samples for laboratory analysis

Only soil samples for the analysis of macrobotanical remains were analyzed in their totality (245 10 liter samples), in addition to macroremains collected manually and through screening. Out of the same number of soil samples for pollen analysis, 15 were analyzed. Additionally, 42 samples were analyzed for phytolith identification. Thus only in the case of macroremain analysis can we establish comparisons across all the sites. Pollen analysis covers three sites (VQ023, VQ038, VQ041) and phytolith analysis covers four (the same three in addition to VQ027). Our initial intention was to cover more of the range of sites with pollen analysis, although the costs implied would not have allowed for analyzing samples from all sites, but the very poor preservation made it evident that pollen analysis would not be informative and that instead phytoliths could provide better information. It seemed very advantageous to analyze all of the macroremains given the good preservation, particularly since the analyst was able to go to the field and help in designing a strategy for collection and flotation, as well as collecting contemporary specimens in the field, and visiting local herbariums.

For the selection of samples for pollen and phytolith analysis we tried to include contrast in terms of settlement type, altitude, soil type, and test location (Table 6.2). Concerned with the effect of depositional disturbances, test pits selected were ones with very straightforward stratigraphy. Sites for which radiocarbon dates were available were also favored in this selection. In all cases and for all types of botanical remains, the vertical sequence from tests was analyzed. The laboratory procedures and results from these analyses appear in appendices 3, 4 and 5.

Table 6.2. Sites Selected for Pollen and Phytolith Analysis.

Code	Site name	Unit	Altitude (m)	Soil ranking	Settlement	Location of test	C14 date
VQ038	Pucalpa	4	2400	1	Large nucleated (1)	Agricultural terrace	*
VQ023	S Grande	1	1660	2	Moderately nucleated (2)	Small terrace	
VQ041	San José	3	1720	2	Very small (4)	Medium terrace	*
VQ027	Bermejo	2	2000	2	Large nucleated (1)	Agricultural terrace	*

PRESERVATION AND COMPOSITION OF BOTANICAL ASSEMBLAGES

Pollen was poorly preserved and samples that yielded grains did so in very low quantities. Pollen of cultivated plants accounts for only a very small portion of the total assemblage at only one of the sites (VQ038), and does not appear at all at the other two sites. This was unexpected, as pollen grains of a number of different cultivated plants and of wild vegetation have been found in good preservation in a variety of sites in similar environmental conditions (e.g. Mora et al. [1991] in Araracuara and Piperno and Clary [1984] in Panama). In the Valle de La Plata (Quattrin 2001), pollen grains from archaeological sites were recovered in small quantities and yet provided the most solid evidence of production practices. In our case, on the other hand, palynomorphs of utilized plants were extremely rare and only fern and fungi spores appeared in abundance.

Of the soil samples analyzed for pollen, the most productive and the only one that yielded evidence of cultivated plants was the one at the highest altitude (VQ038). This is an agricultural terrace in an area of extremely low population density and limited cattle ranching activity. This was the case for pollen assemblages in the Valle de La Plata as well, with high altitude samples being more productive, which Quattrin (2001:89) attributes to a lack of disturbance by contemporary activities. Interestingly, the second most productive profile, from VQ041, corresponds to a location in the periphery of an apparently residential terrace, while the least informative profile, obtained at VQ023, corresponds to a test placed inside a possible residential area at the lowest altitude site excavated. In this region, altitude and intensity of cattle ranching activity appear to correlate, as farmers prefer the gentler relief and accessibility of the low altitude areas. Altitude and pollen abundance are correlated here, and the pollen analysis also fits expectations in terms of test location (with the tests located in outdoor spaces showing a richer pollen rain).

The analysis of phytoliths was more productive, as all of the samples submitted for identification indicate good preservation of silica bodies. Test location did not seem to affect the representation of plant varieties, and the main shortcoming is the lack of comparative collections for the Andean region (most phytolith research has been centered on lowland vegetation), which does not allow for identification of several types. Besides identifying crops, the phytolith analysis provided information about grasses more consistently than pollen or macroremains (this is because grass phytoliths are comparatively more abundant than those of other plant types).

As far as macroremains, the vast majority of the 241 flotation samples submitted for analysis yielded remains. Only one sample did not contain charred remains of any kind, and 4 samples (1.7%) contained only wood remains. 85 samples (35.3%) contained only remains that were not identifiable, thus 64.7% of the flotation samples produced identifiable remains. Manual collection during excavation yielded 514 remains, of which 33 (6.4%) were not identifiable and 118 (23%) were wood remains. Therefore, 77% of the remains collected manually were identified.

Macroremain analysis from all of the sites and locations at each site lends itself to more systematic analysis than either pollen or phytoliths. Yet, despite the quantity and diversity of provenience of these samples, a close look at their composition is necessary before getting into interpretation about consumption practices. Comparison of the different kinds of proveniences at individual sites gives clues about possible variations accounted for by test location. Such variations are expected since, as explained above, distribution of macroremains at a site is not random; on the contrary, it reflects the ways in which different spaces are used (Lennstrom and Hastorf 1992,1995). Lack of patterning in the kinds of plant remains found at different test locations within sites would indicate that our judgment about sampling loci within sites was misleading, and that large area excavations in the future are fundamental for determining appropriate sampling contexts. For example, if the kinds of plant remains present at agricultural terraces and at interior residential spaces are the same or show a random distribution, we would be forced to question whether these landscape features have indeed been correctly interpreted, because such dissimilar locations are expected to produce dissimilar botanical assemblages. Alternatively, this could indicate a site widely disturbed, where the materials from different locations are the result of similar depositional events. In any case, such findings would preclude any further comparison across sites. Finding patterns does not imply that such large area excavations are not necessary, but would indicate that even at this early stage of research in the region conclusions can be drawn from macroremain analysis because the distribution of different kinds of plants likely indicates independent processes of deposition related to distinct cultural activities.

The location of sites for soil testing, as explained above, is meant to reveal differences in agricultural production and consumption, if these existed, that are accounted for by different environmental and social factors. As the potential for different sites to yield distinct botanical assemblages has been deliberately maximized, it would not be surprising to find that different species predominate at different sites. Yet, this comparison is not aimed at revealing such patterns, but simply at exploring the nature of the botanical assemblages produced at each type of provenience at each site to determine the extent to which the samples from similar proveniences collected at different sites are comparable, and to identify which locations would be more promising for future research. A "pooled reading" from each site, that includes a consolidated list of species from different proveniences does not necessarily make for a comparable set of readings, as not all kinds of proveniences are available for each site. Therefore, in addition to differences in species across sites (if present) I expected different kinds of plants (e.g. cultivated, wild, weeds) to predominate at different proveniences.

For that purpose I examined and compared the overall content of samples, looking at the kinds of plant material at different proveniences within sites. The macrobotanical analyst, Gaspar Morcote, suggested that a meaningful categorization of plant remains should discriminate between crops, fruits, wild plants, and weeds associated with the cultivation of crops. Table 6.3 indicates the species that correspond to each category and ubiquity. The distribution of these different kinds of plant remains should not be random; some kinds should predominate at specific kinds of proveniences. Crops, in particular, are subject to more intensive manipulation in certain contexts, and as a result are expected to predominate in domestic structures or in their vicinity more than in agricultural terraces or off-site locations.

Table 6.3. Plant Categories and Ubiquity.

	Genus (Family)		*Genus* (Family)
Crops	*Amaranthus caudatus* (Amaranthaceae)	**Weeds**	Asteraceae indet.
90.3%	*Canna edulis* (Cannaceae)	93.5%	Cyperaceae indet.
	Capiscum sp. (Solanaceae)		Juncaceae indet.
	Cucurbita pepo (Cucurbitaceae)		Portulacaceae indet.
	Phaseolus lunatus (Fabaceae)		
	Phaseolus vulgaris (Fabaceae)	**Wild**	Rosaceae indet.
	Zea mays (Gramineae)	19.4%	*Passiflora biflora* (Passifloraceae)
			Cecropia sp (Cecropiaceae)
Fruits	*Passiflora ligularis* (Passifloraceae)		*Sapium utile* (Euphorbiaceae)
35.5%	*Prunus serotina* (Rosaceae)		*Sapium sp2* (Euphorbiaceae)
	Rubus sp1 (Rosaceae)		
	Rubus sp2 (Rosaceae)		
	Physalis peruviana (Solanaceae)		

To examine the distribution of plant categories at each provenience I compared the frequency in which different categories of plants occur and the richness within each category at each type of provenience. Results from both flotation and manual collection were used. Since the presence or absence of different plants is most relevant for the current purposes, including macroremains from all collection methods does not skew or bias the data, but instead allows the compilation of a more thorough list of plants present. In any case, the vast majority of plant remains from manual collection also appeared through flotation.

Table 6.4 shows the comparison performed. This is based on the principles of ubiquity measurements (Popper 1988:60), and richness. Richness is indicated by summing up the numbers of species within each plant category for each test within a provenience. For example, if five different cultivated crops were recovered from a given test, this would be counted as 5, instead of the 1 that it would be scored in ubiquity analysis. One potential problem that could arise from the approach followed here in accounting for richness would be in the event that one test at a provenience is very rich in a plant category, while that plant category is absent from all other tests in that provenience. This could give the false impression that the plant category is widely represented in that provenience when, in fact, it is not. This concern does not arise in this case, as there are not wide differences in the richness of plants among tests within each provenience. If richness counts are reasonably even, as they are in this case, a higher count indicates not only that plants of a category are generally present at that provenience, but also, that more than one species of each plant category was likely present (which is exactly what one expects if a plant category truly predominates).

Patterns that emerge from the information on Table 6.4 are graphically represented in Figure 6.4. Most plant categories are present at all proveniences, but their distribution varies. The most straightforward distinction is that between what we interpret as domestic spaces (right column) vs. outdoor spaces (left column), with there being a predominance of crops at the former and a predominance of weeds at the latter. Tests performed outside of what we believe are residential structures show an even mix of crops and weeds, with slightly less weeds and slightly more crops than at other outdoor proveniences, which indicates the liminal nature of these locations. The differences between indoor and outdoor spaces is one of degree, not exclusiveness, and it is subtle yet unmistakable.

Table 6.4. Comparison of Plant Categories by Test Location.

Code	Site	Unit	Provenience	Crops	Fruits	Wild	Weeds	Total
			Agric. Terrace					
VQ019	Vega	6	1	x	x		xx	
VQ026	Bermejo	1	1	xx		x	xx	
VQ027	Bermejo	2	1	xx	xx		xx	
VQ028	Bermejo	3	1	x			xx	
VQ038	Pucalpa	4	1	x			xx	
				7	3	1	10	21
				33.3 %	**14.3 %**	**4.8 %**	**47.6 %**	**100 %**
			Off-site					
VQ004	SL Bermejo	1	2	x		x		
VQ016	Vega	3	2				x	
VQ032	Logmapampa	2	2				xx	
VQ039	San José	1	2	x			x	
				2	**0**	**1**	**4**	**7**
				28.6 %	**0**	**14.3 %**	**57.1 %**	**100 %**
			Outside of terrace					
VQ025	S Grande	3	3	xx			x	
VQ031	Logmapampa	1	3	x	x		xx	
VQ036	Pucalpa	2	3	xx	x		xx	
				5	**2**	**0**	**5**	**12**
				41.7 %	**16.7 %**	**0**	**41.7 %**	**100 %**
			Small terrace					
VQ005	SL Bermejo	2	4	xxxx	x		xxx	
VQ020	S Chico	1	4	x				
VQ023	S Grande	1	4	xxx			xx	
				8	**1**	**0**	**5**	**14**
				57.1 %	**7.1 %**	**0**	**35.7 %**	**100 %**
			Medium terrace					
VQ034	Logmapampa	4	5	xx	x		x	
VQ040	San José	2	5	x			xx	
VQ041	San José	3	5	xx			x	
				5	**1**	**0**	**4**	**10**
				50 %	**10 %**	**0**	**40 %**	**100 %**
			Large terrace					
VQ021	S Chico	2	6	x		xx	x	
VQ024	S Grande	2	6	xx			x	
				3	**0**	**2**	**2**	**7**
				42.9 %	**0**	**28.6 %**	**28.6 %**	**100 %**
			Very large terrace					
VQ029	Bermejo	4	7	xx	x	x	x	
VQ030	Bermejo	5	7	xx			x	
VQ033	Logmapampa	3	7	xx	xxx		xx	
VQ035	Pucalpa	1	7	xx	xxx		xx	
				8	**7**	**1**	**6**	**22**
				36.4 %	**31.8 %**	**4.5 %**	**27.3 %**	**100 %**

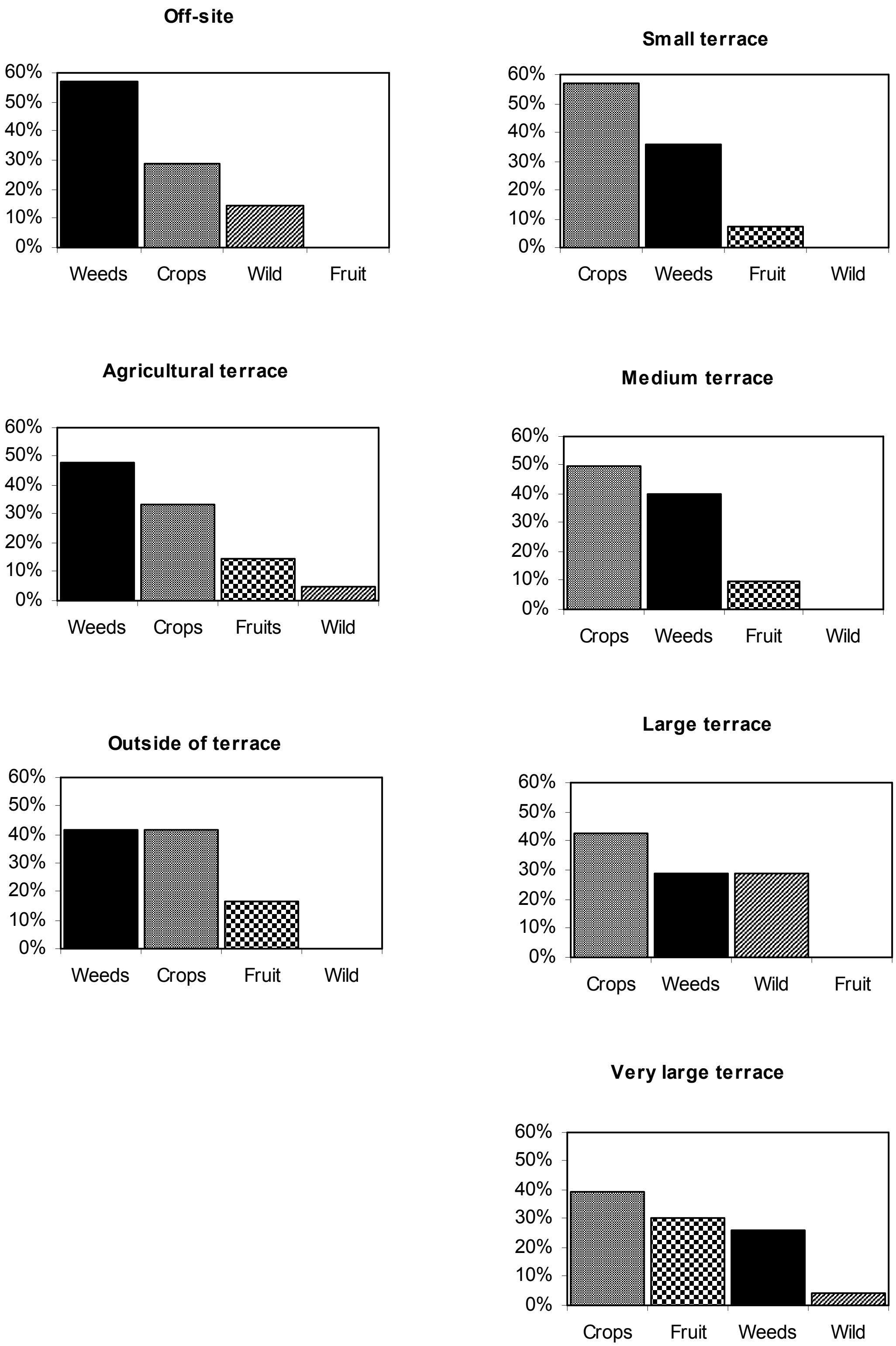


Figure 6.4. Frequencies of Plant Categories by Provenience.

A narrowed comparison of crop and weed frequency by provenience shows exactly this trend (Figure 6.5), as the predominance of each at provenience 1 (agricultural terrace) and 2 (Off-site) clearly reverses. Interestingly, if these weeds are really indicators of agricultural activity, the "off-site" locations, where they abound more than anywhere else, may correspond to gardens or fields close but not attached to residential structures.

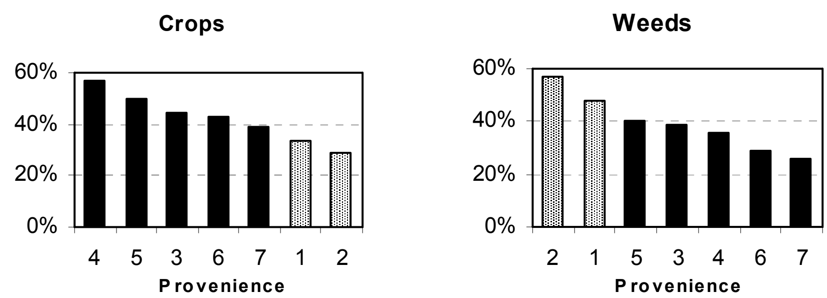


Figure 6.5. Crop and Weed Distribution by Provenience.

The predominance of plant categories at different proveniences can also be tracked by looking at where the most unusual crop species appear (Table 6.6). The crops present at agricultural terraces or off-site locations are invariably *Zea mays* and *Phaseoulus vulgaris*. These are the two most common crops found; they compose the majority of crop remains at most sites.

Table 6.5. Crop Ubiquity.

Crop	*Amaranthus caudatus*	*Capiscum* sp.	*Cucurbita pepo*	*Phaseolus lunatus*	*Canna edulis*	*Phaseolus vulgaris*	*Zea mays*
Ubiquity %	**3.2 %**	**3.2 %**	**3.2 %**	**6.5 %**	**9.7 %**	**38.7 %**	**90.3 %**

Rare crops, present at less than 10% of the tests, such as *Phaseoulus lunatus, Amaranthus caudatus, Canna edulis, Cucurbita pepo* and *Capiscum* sp. did not appear at all at these proveniences (1 or 2), but only at the ones we interpret as domestic spaces (specifically at proveniences 3, 4, 5 and 7). Likewise, remains of Asteraceae, a very rare family of weeds in our botanical assemblages, only appeared at provenience 1 (agricultural terrace).

This constitutes a further indication of the non-random distribution of plant remains at the different types of proveniences. In particular, a higher variety of species and the presence of rare species whose remains are too small to be typically carried away when cleaning (in this case *Amaranthus* aff. *caudatus* and *Capiscum* sp.) likely indicates in-situ evidence of cooking (Lennstrom and Hastorf 1995:706). This may well be the case in the tests that yielded remains of both rare and very small kinds of remains. The one evidence of *Amaranthus caudatus* appeared at VQ036, a test where we think part of a hearth was located, from which a charcoal sample was extracted and dated. A feature of similar characteristics at test VQ030 was dated too, and yielded the only seeds of *Capiscum* sp. Other rare but not small remains (of *Canna edulis, Cucurbita pepo* and *Phaseoulus lunatus*) appeared at VQ005, VQ006, VQ023 and VQ035. A charcoal sample from the last of these was also dated. We identified large concentrations of charcoal or small ashy deposits in all of these tests. The only test without such kind of features where rare remains appeared is VQ034 (details about the 1 x 1 m test excavations appears in Appendix 2).

Wild plants and fruits are less patterned. They appear with less frequency in the different tests, and it is likely that this has to do with preservation more than with actual use. Fruits, in particular, are typically eaten raw and on a seasonal basis, and unless they play a very important role in the diet they are not likely to be processed and consumed in such a consistent manner as to produce large amounts of carbonized remains or a spatial pattern. The case of the wild plants category is slightly different in that it is composed of plants whose pre-Hispanic use in the region is less known. These are all plants used by contemporary people for medicinal purposes or for materials, but this information does not suffice to elaborate on their preservation and distribution in archaeological sites.

Nevertheless, the distribution of crop and weed plants seems sufficient to argue that what was interpreted as outdoor and indoor locations may indeed represent distinct kinds of activities, and that therefore judgment about test locations, greatly facilitated by the sharp definition and good preservation of landscape features, was appropriate. Knowing in detail the nature of the macrobotanical assemblages from different locations helps to address with more confidence the research questions related to consumption patterns.

7. AGRICULTURAL PRODUCTION AND FOOD CONSUMPTION

The sources of socio-political changes reflected in the demographic transformation described in Chapter 3 are not well understood. Unilineal views that argue for an inevitable journey towards social inequality are not persuasive ways of accounting for social transformations that are quite varied, and that may not have even occurred evenly across an individual population (the latter could have been the case in the Valle de Quijos, where, as discussed in Chapter 3, sweeping demographic changes during the Late Period did not take place for the population at large but were rather limited to a few locales while the bulk of the population seemed resilient as far as settlement organization). This project explores one of the multiple avenues that could have led to a process towards increasing social differentiation, through the study of economic organization. Much of the literature on the development of social complexity revolves around economic issues, frequently emphasizing the influence of emerging elites on production and eagerness to appropriate its fruits through mobilization within or beyond their domestic group (Earle 1987; Feinman 2000; Gilman 1991; Hayden 1995; Peebles and Kus 1977; Stemper 1993). In the case of the north Andean chiefdoms, scholars have relied on the model of verticality to account for social and political integration in the face of remarkable spatial disagregation. According to this model, exchange relations must have acted as a social glue, helping to integrate otherwise dispersed "communities" in the absence of centralized control (Salomon 1986), through redistributive mechanisms linked to the political (but not necessarily economic) ascendance of elites (Langebaek 1992). The study of the organization of agricultural production that accompanied the emergence of chiefdoms in the Quijos region aims to contribute to this body of knowledge by evaluating prevalent notions about the relationship between political authority and the organization of production and related consumption patterns in North Andean chiefdoms and elsewhere.

Settlement analysis in Chapter 4, which explores the likelihood that a specialized (vertical) economy emerged in association with socio-political changes, was not conclusive as far as proving or disproving that such a form of organization of production was in place by the Late Period. Settlement distribution expands more along the altitudinal range of the valley from the Early to the Late occupations. During the Early 1 Period, only about 21% of the occupation occurs in the high altitude zone (above 2000 m) despite the fact that this constitutes about 60% of the surveyed area. During the Early 2 Period this figure rises to about 24%, and during the Late Period to about 36% (coming closer to the expected proportion). Yet, an imbalance in population distribution persisted in the latest occupation, when still most people preferred the low altitude zone. Interestingly, the population concentrations that provide evidence of the presence of centralized authority are not limited to the low altitude portion of the region. Indeed, two of the three largest population aggregations that emerged during the Late Period were settled in the higher altitudes. This leaves open the question of whether the tendency towards occupying more of the environmental range during the Late Period was motivated by an intention to optimize the production of certain crops by emphasizing them at locations where they thrive, and whether the emergence of population centers in these high altitude settings is related to such dynamic. In Chapter 5, I explain that settlement distribution in relation to soil productivity provides scant evidence of elite control of the best lands, which would presumably be sought after in the interest of optimizing corn production. Even though there is a tendency towards greater settlement concentration in the most productive zones throughout the sequence, there are reasons why this is most likely not a question of elite control of agricultural resources: First, throughout the sequence population is too small to create population pressure, and despite the small population, less productive zones were widely utilized. Second, the general settlement distribution barely changes when the most obvious socio-political transformation occurred. Finally, the fact that in the Late Period (when population grew the most) growth is concentrated in the most productive zones runs contrary to the idea that elites are restricting access to the best land. Instead, there was plenty of the best land to be occupied by non-elites despite the fact that population centers emerge in the best soil categories. The observations drawn from settlement data in chapters 4 and 5 need to be corroborated by the results of botanical analysis.

Direct evidence of, and comparison between, production and consumption practices will further aid us in answering these questions, and this chapter's objective is to elaborate on the botanical information collected at seven different locations that cover the range of altitude, soil, and settlement variability within the survey area. It is expected that if a vertical economy was in place during the Late Period, the botanical assemblage at different elevations must include evidence of production of the kinds of plants that are typical of the different altitudinal ranges, and evidence of consumption of plants that are not likely to have been cultivated locally. For this to be more clearly linked to the emergence of centralized political authority, the large nucleated settlements should contain more of the non-local crop varieties; reflecting their role as redistributive centers, or more generally, the ability of elites to engage more actively in relations that involve material exchanges. If soil quality was an important factor in crop production, as is especially the case for corn, the cultivation of this crop must be more important, relative to others, at sites on the best soil rankings; and this must coincide with the largest settlements where, presumably, elites settled to exploit such potential. Another possibility is that the organization of production and consumption patterns during the Late Period are not differentiated in relation to elevation or soil quality, indicating that if any contrasts existed, this had nothing to do with environmental factors, and if they did not exist at all, this invalidates the idea that political authority was in any way related to the agrarian economy of emerging chiefdoms in this region.

The rationale for site selection and test-pit location is explained in detail in Chapter 6, and detailed information about the excavation of each test-pit and its ceramics appears in Appendix A. Here we will focus on the botanical remains at each site and their comparison. Of all of the tests excavated, those at one of the locations (Vega) are not included in this discussion. This site turned out to have a substantial Early occupation, which had not been recognized due to premature understanding of our ceramic chronology while classifying survey materials the first time. A few tests at other locations were excluded as well (VQ003, VQ021, VQ037 and VQ026), because they revealed obviously disturbed deposits or contained early materials to a worrisome extent. Tests included in this analysis contained either exclusively Late Period pottery or at least greater than 90% Late material. The radio-carbon dates obtained from three of these sites (at VQ038 in Pucalpa, VQ041 in San José and VQ027 in Bermejo) support chronological assumptions based on the ceramic analysis (see Appendix A), and place these locations unproblematically in the Late Period.

PUCALPA

This is a large nucleated settlement at 2400 m above sea level (this is the highest of the settlements sampled), on the best soil category (ranking 1). Occupation during the Early 1 and 2 periods in this area was scant, with only five very dispersed lots within a radius of 1 km from the excavations. As discussed in Chapter 3, the radical population growth of the Late Period in this subregion is unprecedented. In the specific area where the excavations were conducted, one of the largest settlements of the survey area emerges, and this settlement makes up 38% of the occupation of that subregion during the Late Period (Figure 7.1). It is likely that the extensive landscape modifications in this area correspond to this Late occupation. These include numerous rectangular and semi-circular terraces of varying size as well as sets of agricultural terraces and canals. Macroremains from all tests VQ035, VQ036 and VQ038 were analyzed, while pollen and phytolith analysis was performed for test VQ038 only.

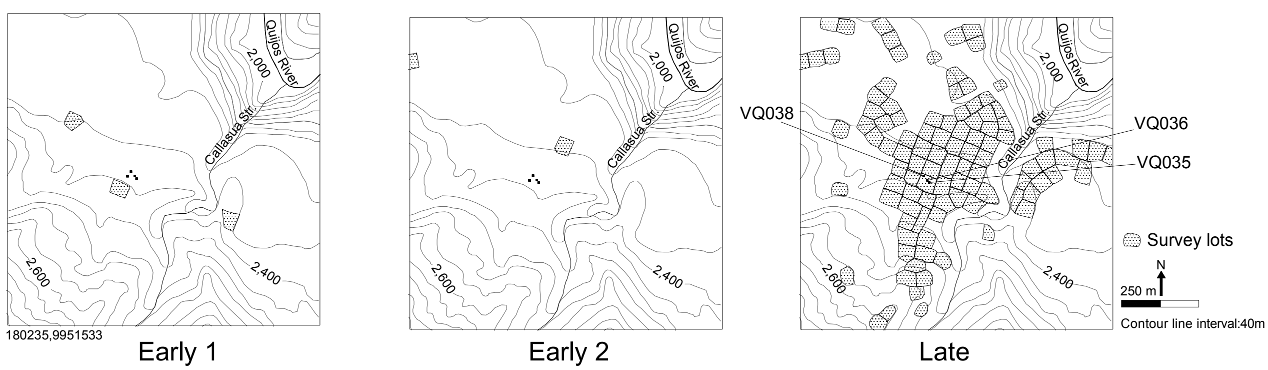


Figure 7.1. Occupation by Period and Location of 1x1m Tests in Pucalpa.

Pollen

Palynomorphs identified for test VQ038, excavated at an agricultural terrace, are mostly fern and fungi spores (Table 7.1, Figure 7.2).

Table 7.1. Pollen Data, VQ038.

Taxa	5 cm	15 cm	25 cm	35 cm	Total	% of total
Subandean forest						
Alchornea	1	1			**2**	**0.4 %**
% by sample	**0.6 %**	**1.4 %**				
Andean forest						
Alnus	1		1			
Hedyosmum	1	1	8			
Myrsine	1					
Solanum	1					
Symplocos			1			
Thalictrum	1					
Montia			1			
Weinmannia	1				**18**	**3.8 %**
% by sample	**3.6 %**	**1.4 %**	**6.0 %**			
Paramo						
Poaceae	1	1	2	1		
Asteraceae	4		9	1		
Umbelliferae	3		1			
Ericaceae			1		**24**	**5.1 %**
% by sample	**4.8 %**	**1.4 %**	**7.1 %**	**4.1 %**		
Crops						
Phaseolus vulgaris			1			
Chenopodiaceae	13	6	2		**22**	**4.7 %**
% by sample	**7.7 %**	**8.2 %**	**1.6 %**			
Fern spores						
Hymenophyllum	41	1				
Monolete psilate	12	4	28	18		
Monolete verrucate	1	3	5	1		
Trilete psilate	13	7	70	11		
Tetraploa aristata	1					
Cyathea	5	5	20	6		
Hemitelia			1			
Hypolepis		12	16			
Thelypteris				1	**282**	**59.7 %**
% by sample	**43.5 %**	**43.8 %**	**76.5 %**	**77.1 %**		
Fungi spores						
Glomus	24	17	11			
Coniochaeta lig.	24	8	2	3		
Cercophora	5			2		
Ustulina deusta	14	7	3	4	**124**	**26.3 %**
% by sample	**39.9 %**	**43.8 %**	**19.3 %**	**18.8 %**		
Total	168	73	183	48	472	

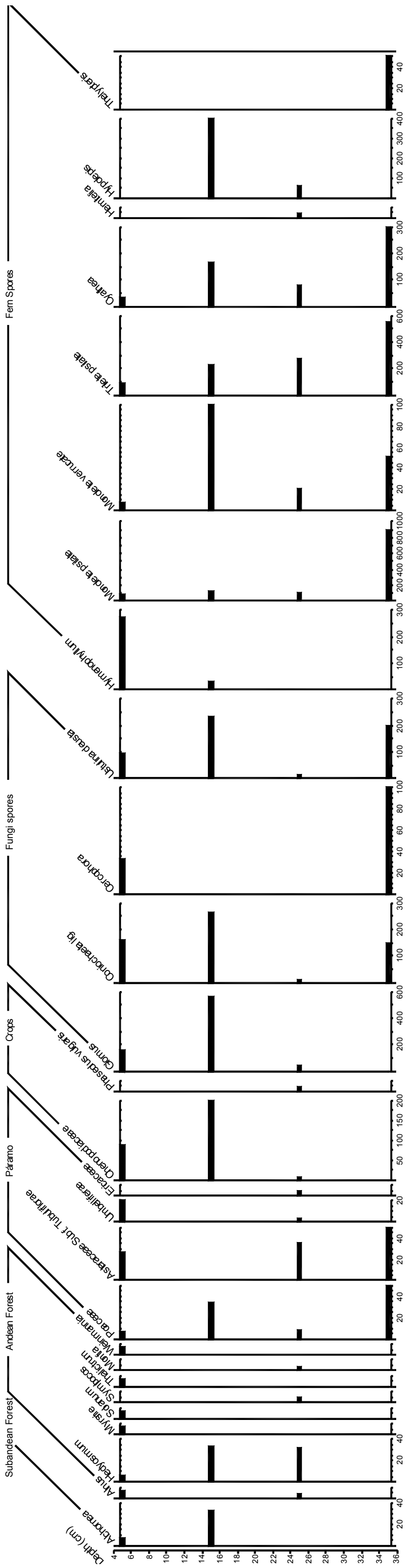


Figure 7.2. Pollen Diagram, VQ038.

The most abundant fern spores correspond to Trilete psilate, typical in cloud forests, Monolete psilate, suggestive of high humidity and disturbed environments, and *Hymenophyllum*, with most varieties of this epiphyte found in middle elevation rainforests, and a few in continuously moist temperate environments (Ulloa and Jørgensen 1995). This type of fern has been reported in Oyacachi at 3200 m above sea level, close to the study area (DIVA 2000:110). *Cyathea* is important too. This corresponds to colonizer arboreal ferns very abundant in Andean cloud forest, although they have a wide altitudinal distribution as long as there is high moisture and preferably in the absence of a dry season. The wood of this tree is very durable and widely used for house construction and fences (DIVA 2000:77,108). The abundance of these pollen types indicates a permanently humid climate.

Pollen from crops includes common bean (*Phaseolus vulgaris*) and possibly quinoa (Chenopodiaceae). These are found in very low quantities (22 grains in total). Since bean plants self-pollinate and therefore their pollen does not travel, these pollen remains indicate that beans were probably cultivated where the soil sample was collected. The same is the case for Chenopodiaceae, in which cross-pollination by wind occurs only at a rate of 10 to 15%. The evidence of production of beans at this altitude is not entirely surprising, as the plant can grow at temperatures as low as 10°C, although its typical altitudinal range is between 800 and 2000 m. Above 2400 m its growth is constrained (Gade 1975:171), thus in this case this crop was being planted at its highest possible altitudinal tolerance. Currently, beans are grown in the Oyacachi Valley, close to this research area, only up to 2000 m. On the other hand, Quinoa, if it was in fact produced at this site, is a more typical high altitude crop that thrives between 2300 and 3900 m.

Pollen of Subandean and Andean Forest is also present, although the former is only represented by one type (Alchornea, known as *Ponce* or *Punze*, common in wet—often secondary—forests and valued for its wood) (FUNAN-PROBONA 1997, Graham and Dilcher 1998). In the surrounding areas, Alchornea predominates below 2000 m. This represents an insignificant portion of the total pollen reading (less than 1%). Four *páramo* types appeared in low quantities, and make up about 5% of the total. Of these, Asteraceae is the most abundant. Species in this family include herbs, shrubs and trees that thrive where there has been human intervention (Guimarães et al. 2002:10; Pearsall 1994:167). Its contemporary altitudinal distribution in surrounding areas is typically above 3000 m (FUNAN 1998:42), but it is not uncommon at lower elevations above 2000 m (FUNAN-PROBONA 1997). Poaceae, present in low quantities, is currently the most important *páramo* vegetation family in northern Ecuador (FUNAN 1998:43). Both Ericaceae and Umbelliferae reflect cool conditions in the area as well. Specimens of the Ericaceae family are frequently epiphytes (key indicators of high moisture) and appear more frequently in *páramo* and sub-*páramo* settings close to and in the area of study (FUNAN 1998:42; FUNAN-PROBONA 1997; Jatun Sacha/CDC 2001) and in southern Ecuador, where fruits from these specimens are consumed (Van den Eynden 1997:218-219). In the Andes of southwestern Colombia it is reported at 2300 m and higher (Espejo and Rangel 1989:171). Some Umbelliferae family species in the Andes have economic value since their tubers are edible and tolerate high humidity quite well, such as *Arracaccia xanthorriza* (known as *arracacha*).

The most varied assemblage by vegetation type is that of Andean Forest species (commonly found between 2000 and 3000 m), which suggests tree rich surroundings. Within this category, *Hedyosmum* (known as *Guayusa* in the region) is the most abundant. This is reported for an altitudinal range of 3000 to 3500 m in the Cayambe-Coca Forest Reserve, adjacent to this research area (FUNAN 1998:41); above 2300 m in the Andes of Southwestern Colombia (Espejo and Rangel 1989:171), and between 1800 and 2900 m in the Oyacachi Valley, also close to the study area (DIVA 2000:20). The leaves of this plant are widely used by indigenous populations as a stimulant beverage and for various medicinal purposes. Other Andean Forest species present such as *Alnus*, *Myrsine* and *Solanum* are commonly used for their wood for construction, crafts or firewood (DIVA 2000, Ulloa and Jørgensen 1995). *Alnus* (known as *Aliso*) is typical of Andean cloud secondary forests, where precipitation is above 1500 mm/year and the ground is saturated. This is a pioneer tree that colonizes rapidly in rocky outcrops and landslides, and also has a history of being intentionally cultivated in wet cleared fields. Thus its distribution is both spontaneous and anthropic. It is prized for its wood for construction and firewood, as well as for medicinal uses (DIVA 2000, Ulloa and Jørgensen 1995). *Alnus* forests are one of the most typical vegetation formations above 2500 m in this region. *Weinmannia* (known as *Encino, Cashca,* or *Matachig*) is also valued for its wood that today is used in construction and as firewood and appears more commonly above 3000 m in the surrounding areas (FUNAN 1998:41) thriving, along with *Symplocos,* in swamp forests (DIVA 2000:21). Today, both *Weinmannia* and *Symplocos* are tolerated in cleared areas because of their economic importance (DIVA 2000:43), although the latter is not tolerated if it attracts rats and squirrels. Lastly, *Montia* and *Thalictrum* are found at very high elevations in the Northern Andes today. In southwestern Colombia, *Montia* is common between 3850 and 4500 m (Lozano and Rangel 1989:56).

In general, the variety of Andean Forest species indicate that the human intervention indicated by crop cultivation did not considerably shrink the forest habitat, yet, it is interesting to note that some of these forest species are, at least today, very frequent in secondary formations and even intentionally encouraged in formerly cleared areas in contrast to other forest types that do not tend to colonize and whose regeneration is not as successful.

Phytoliths

Zea mays (corn), *Phaseolus* sp. (possibly common bean) and *Canna* sp (possibly achira) were identified; as well as several grass species. Since common beans were identified through pollen, and achira through macroremains, it is very likely that this phytolith evidence indeed corresponds to these crops. Corn predominates among the three crops. The grasses are all common species from the Panicoideae subfamily of grasses such as *Panicum* sp1, *Panicum* sp2, *Paspalum* sp1, *Paspalum* sp2; as well as from the Bambusoideae subfamily of grasses such as *Pariana* sp1 and *Pariana* sp2 (these are rain forest types [La Torre et al. 2003]), and from the Poaceae family in general, which are often high altitude grasses that predominate in Andean *páramos* (Marquez et al. 2004) (Figure 7.3). This gives a picture of a climate that was apparently cool and humid, and of the human impact on the vegetation that is consistent with the pollen analysis. In the uppermost section of this test, phytoliths of Diatoms increase in importance. These belong to algae, and thus indicate an aquatic environment that could correspond to the cessation of use of this terrace for agricultural purposes, and its subsequent waterlogging.

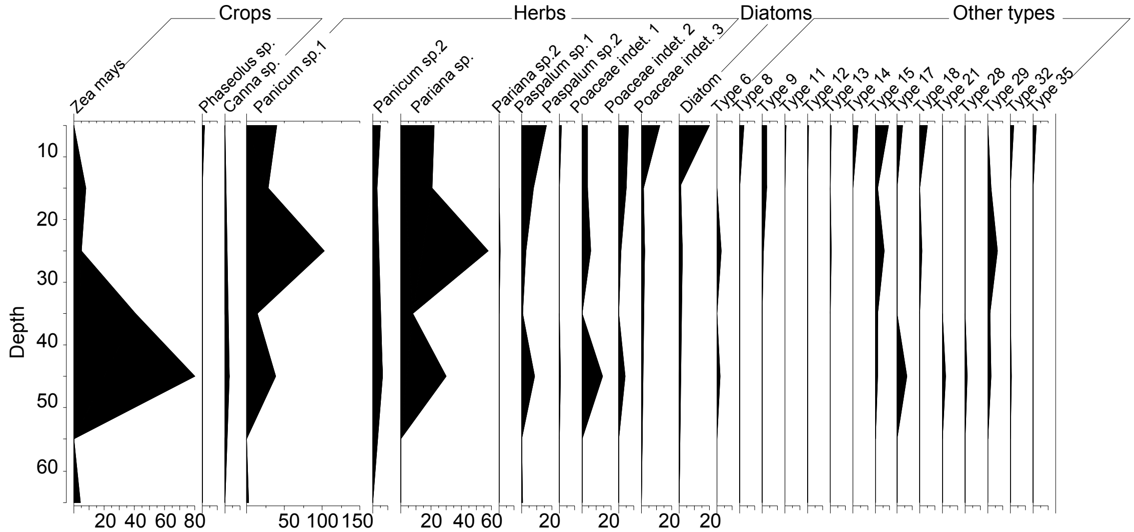


Figure 7.3. Phytolith Diagram VQ038.

Macroremains

The macrobotanical assemblage of this site is composed of three crops *Zea mays*, *Amaranthus caudatus*, and *Canna edulis* (corn, amaranth and achira), two fruit types *Rubus* sp. (wild blackberry) and *Passiflora ligularis* (passion fruit), and two herb types Cyperaceae indet. and Juncaceae indet. (Tables 7.2, 7.3, 7.4).

The evidence of consumed crops; corn, achira and amaranth, seems in accordance with the local conditions. Both corn and possibly achira, identified through phytoliths from an agricultural terrace, seem to have in fact been cultivated locally. Corn is adapted to a wide range of climatic conditions, and was amply cultivated at this altitude with perhaps a slightly longer growth period when compared to warmer conditions elsewhere in the Andes. In the excavation of households at different altitudes in the Andes of Southwestern Colombia, Quattrin (2001) reports corn pollen for the two high altitude (above 2000 m) locations, but only for one of the two low altitude ones, thus questioning the labeling of corn as a low altitude crop. Bray (2001) also reports corn phytoliths from archaeological sites in northern Ecuador at 2800 m. Achira on the other hand does better below 2100 m (Gade 1975:150) but can still be grown at 2500 m (Izquierdo and Roca 2000), and tolerates damp soils well (National Research Council 1989:28). Although evidence of cultivation of amaranth is not available, in the Andes this is a high altitude crop that has its best yields above 2500 m; therefore, it is likely that it was cultivated locally. Corn remains (83 in total, about 58% of the total of identified macroremains) correspond to whole kernels and kernels and chaff fragments, and are disproportionately abundant when compared to other crops (1 remain of achira and 2 of amaranth).

Fruit remains appeared in low quantities (11 in total, about 8% of the total of macroremains identified). Passion fruit is extremely well adapted to high rain-cloud forest environments, thriving in humid soils and in moderately cold climate; it is common between approximately 2000 and 2700 m. Wild blackberry predominates in cool climates, and typically settles in open areas, often in stubble fields, where it is protected by contemporary farmers (DIVA 2000:62).

As far as herb types, Cyperaceae indet. is a sedge typical of marshy environments in temperate climate. It grows after vegetation has been cleared, and it is often associated with agricultural fields. At some archaeological sites its increase in the pollen record is clearly associated with corn cultivation (Piperno 1990:673). Its tubers and seeds are known to be used as a source of food (Pearsall 1994:195); and according to the macrobotanical analyst, it is likely that its appearance in large quantities is due to the fact that this plant was encouraged by the local population. Juncaceae is a rush that in the Andes is typically found in temperate valleys and *páramos*, in poorly drained areas (DIVA 2000:24), and used for its fiber (Gade 1975:145). This is also associated with agricultural fields. 42 remains of Cyperaceae indet. and 3 of Juncaceae were recovered (about 31% of the total of identified remains).

The macroremains of the different plant types do not appear evenly in all tests. While crop appear in all of them, they are notably more abundant at VQ035, placed inside a presumed residential terrace, less so at VQ036, placed outside of the terrace where VQ035 was excavated, and even less at VQ038, which corresponds to an agricultural terrace. Fruit remains only appear in VQ035 and VQ036; while with herbs the pattern is exactly the inverse of crops, these are more abundant at VQ038, less so at VQ035, and even less at VQ036. This is consistent with general expectations about the spatial distribution of plant types in archaeological sites.

Table 7.2. Macroremain Data, VQ035.

Code	Site	Unit	Taxa	Count	%	% of total id.
VQ035	Pucalpa	1	**Crops**			
			Zea mays	75	79.8%	**80.9%**
			Canna edulis	1	1.1%	
			Fruits			
			Passiflora ligularis	3	3.2%	**7.4%**
			Rubus sp1.	2	2.1%	
			Rubus sp2.	2	2.1%	
			Weeds			
			Cyperaceae indet.	10	10.6%	**11.7%**
			Juncaceae indet.	1	1.1%	
			Total identified	**94**		
			Uncharred remains	4		
			Not identified	31		
			Total	**129**		

Table 7.3. Macroremain Data, VQ036.

Code	Site	Unit	Taxa	Count	%	% of total id.
VQ036	Pucalpa	2	**Crops**			
			Zea mays	6	22.2%	**29.6%**
			Ammaranthus caudatus	2	7.4%	
			Fruits			
			Passiflora ligularis	4	14.8%	**14.8%**
			Weeds			
			Cyperaceae indet.	14	51.9%	**55.6%**
			Juncaceae indet.	1	3.7%	
			Total identified	**27**		
			Uncharred remains	26		
			Not identified	9		
			Total	**62**		

Table 7.4. Macroremain Data, VQ038.

Code	Site	Unit	Taxa	Count	%	% of total id.
VQ038	Pucalpa	4	**Crops**			
			Zea mays	2	9.5%	**9.5%**
			Weeds			
			Cyperaceae indet.	18	85.7%	
			Juncaceae indet.	1	4.8%	**90.5%**
			Total identified	**21**		
			Uncharred remains	0		
			Not identified	11		
			Total	**32**		

In general, consumed crops identified through macroremains, correspond very well to the local climatic conditions. Two of them (corn and achira) were also identified through phytoliths from an agricultural terrace, suggesting local production. The plant use patterns show emphasis on species that thrive naturally at this type of location (perhaps with the exception of beans), and therefore the information provided by this site does not support the idea that a vertical economy was at work during the Late Period. The evidence of bean cultivation at this site even provides stronger evidence, as it suggests that people may have been stretching the optimal altitudinal range of bean production instead of exchanging to acquire it from a warmer, more appropriate zone for bean cultivation. Further evidence of this is that remains of the two more predictable high altitude crops, amaranth (in macroremains) and possibly quinoa (in pollen), appeared solely at this location, the highest altitude of the sites sampled. The three types of botanical analysis together yielded remarkably consistent information.

SAN JOSÉ

Three tests were excavated here, in a very small low altitude settlement at 1720 m above sea level. This is the second lowest-altitude settlement selected, on the second best soil type (ranking 2). The trajectory of occupation in the surrounding area (about a 1 km radius from where test excavation took place) starts during the Early 1 Period with a dispersed but relatively compact settlement by this period's standards. During the Early 2 Period, the occupation is, in contrast, very scant; and by the Late Period it grows considerably. The survey lot that corresponds to the place were the tests were located did not yield any Early ceramics, and in the Late Period forms a small site along with a handful of other lots without history of Early occupation (Figure 7.4). The only visible landscape modifications are the terrace where tests were placed and a shallow canal downhill. Macroremains from all three tests (VQ039, VQ040, VQ041) were analyzed, while pollen and phytolith analysis was performed only for test VQ041.

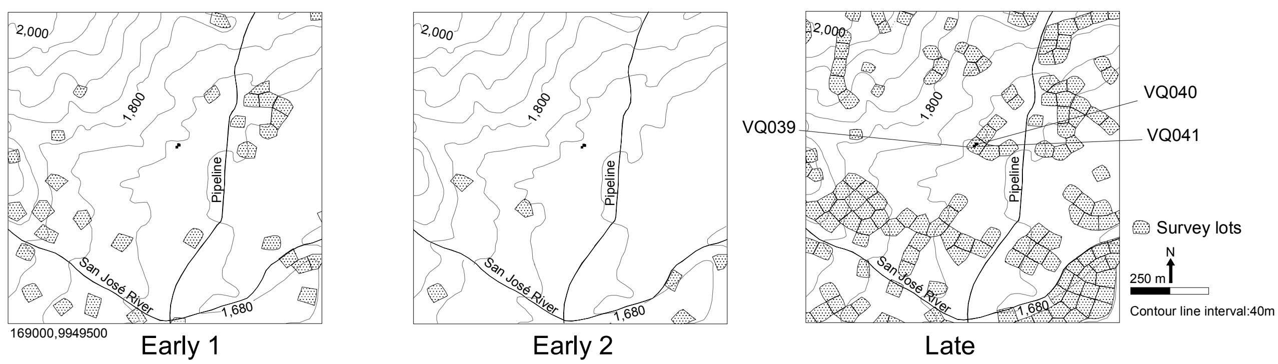


Figure 7.4. Occupation by Period and Location of 1x1m Tests in San José.

Pollen

The pollen analysis at VQ041 yielded predominantly fern spores (Figure 7.5, Table 7.5), which are broadly suggestive of humid conditions. Monolete psilate fern spores, the most abundant in this category, are a very typical indicator of high moisture in disturbed environments (Graham and Dilcher 1998). *Cyathea*, second in importance within this category, corresponds to arboreal ferns common in disturbed areas of cloud forests. *Sellaginella* is more common in Subandean settings in this region of Ecuador (DIVA 2000:111), and thus indicates warm weather and an open forest (this type is not present at Pucalpa). Pollen from crops was absent, and that of the surrounding vegetation is scarce, but a couple of *páramo* species (Asteraceae and Poaceae) are present. Asteraceae indicates human intervention, as explained above. Two types common in swampy environments, Cyperaceae (a wind-pollinated sedge of swampy environments whose tubers and seeds are edible) and Spirogyra (an algae) appear in very low quantities as well.

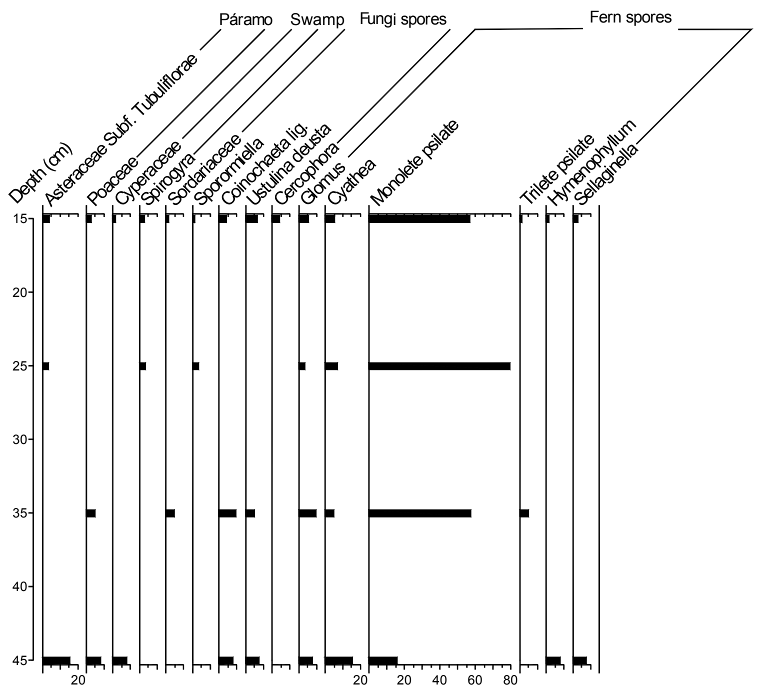


Figure 7.5. Pollen Diagram, VQ041.

Table 7.5. Pollen Data, VQ041.

Taxa	15 cm	25 cm	35 cm	45 cm	Total	% of total
Paramo						
Asteraceae	3	1		2		
Poaceae	2		1	1	**10**	**7.2%**
% by sample	**6.6%**	**3.3%**	**4.8%**	**23.1%**		
Swamp						
Cyperaceae	1			1		
Spirogyra	2	1			**5**	**3.6%**
% by sample	**3.9%**	**3.3%**		**7.7%**		
Fern spores						
Cyathea	4	2	1	2		
Monolete psilate	43	23	12	2		
Trilete psilate	1		1			
Hymenophyllum	1			1		
Sellaginella	2			1	**96**	**69.1%**
% by sample	**67.1%**	**83.3%**	**66.7%**	**46.2%**		
Fungi spores						
Sordariaceae	1		1			
Sporormiella	1	1				
Coinochaeta lig.	3		2	1		
Ustulina deusta	5		1	1		
Cercophora	3					
Glomus	4	1	2	1	**28**	**20.1%**
% by sample	**22.1%**	**6.7%**	**28.6%**	**23.1%**		
Total	77	30	22	14	139	

Phytoliths

Crops (corn and very likely common bean), a palm type, diatoms and grasses are reported through phytolith analysis (Figure 7.6) at VQ041; located in a presumed residential terrace. Corn predominates over *Phaseolus* sp. The grasses are basically the same as those identified in Pucalpa. Diatoms suggest waterlogging. The one novel element is the presence of palms Palmae indet.), which is an indicator of warm weather, consistent with the elevation at this site.

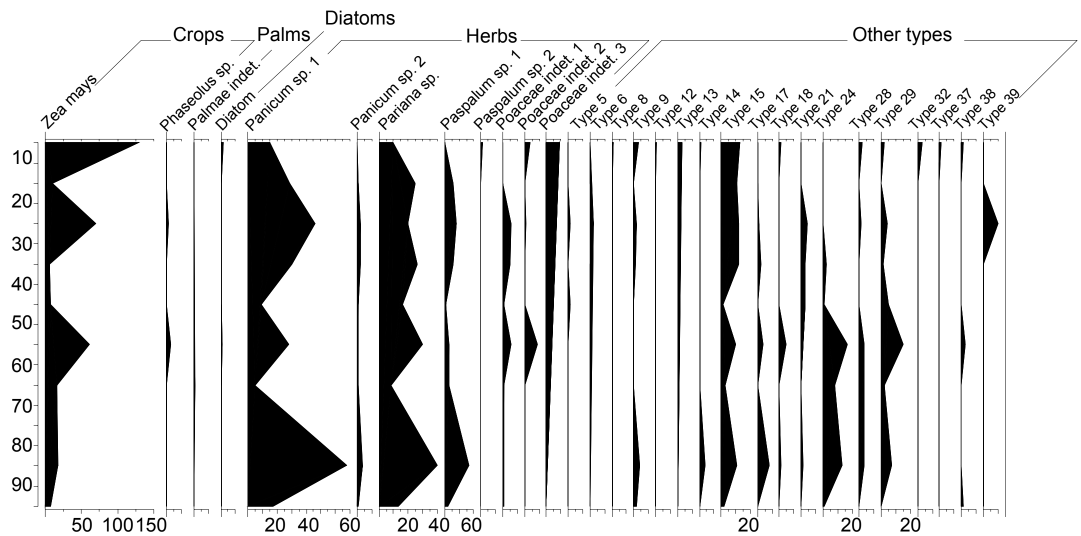


Figure 7.6. Phytolith Diagram, VQ041.

Macroremains

Macroremains include the same crops identified through phytoliths; *Zea mays* and *Phaseolus vulgaris*, and one type of herb identified through pollen (Cyperacea indet.) (Tables 7.6, 7.7, 7.8).

Corn remains are the most abundant among the two crops, consistent with phytolith information (a total of 108, about 29% of the total of macroremains identified). These are mostly constituted by whole kernels and kernel and chaff fragments, and only two cob fragments. Added to common bean remains (only 2), crops make up less than 30% of the total remains identified at this site. Seeds of Cyperaceae indet., the only herb present, numbered 271. This plant type represents more than 70% of all macroremains identified, suggesting high moisture.

Table 7.6. Macroremain Data, VQ039.

Code	Site	Unit	Taxa	Count	%	% of total id.
VQ039	San José	1	**Crops**			
			Zea mays	21	58.3%	**58.3%**
			Weeds			
			Cyperaceae indet.	15	41.7%	**41.7%**
			Total identified	**36**		
			Uncharred remains	0		
			Not identified	2		
			Total	**38**		

Table 7.7. Macroremain Data, VQ040.

Code	Site	Unit	Taxa	Count	%	% of total id.
VQ040	San José	2	**Crops**			
			Zea mays	11	30.6%	**30.6%**
			Weeds			
			Cyperaceae indet.	27	75.0%	**75.0%**
			Total identified	**38**		
			Uncharred remains	1		
			Not identified	27		
			Total	**66**		

Table 7.8. Macroremain data, VQ041.

Code	Site	Unit	Taxa	Count	%	% of total id.
VQ041	San José	3	**Crops**			
			Zea mays	76	25.4%	**25.4%**
			Phaseolus vulgaris	2		
			Weeds			
			Cyperaceae indet.	229	74.6%	**74.6%**
			Total identified	**307**		
			Uncharred remains	1		
			Not identified	0		
			Total	**308**		

Distribution of macroremain types varies across test pits. The largest quantities of crop remains appeared at VQ041 (located in a residential terrace), where the only evidence of common beans was found. VQ039 (in an off-site location) and VQ040 (in a residential terrace) produced only corn and Cyperaceae indet. remains, but corn seems more important at the former than at the latter. Here the expected pattern of plant type distribution does not completely fit expectations discussed in Chapter 6, but an explanation cannot be offered because the nature of VQ039 in terms of use is hard to ascertain due to lack of landscape features.

Pollen, phytoliths and macroremain analysis yielded information that reflects the climatic conditions and the impact of human occupation on the native vegetation. Evidence of disturbance and of moderately warm weather is the clearest information from the pollen record (besides high humidity), and phytolith analysis corroborates this evidence. The lack of forest types is the most obvious contrast between this site and Pucalpa. This can be interpreted as a consequence of a longer history of occupation in this portion of the survey (the most heavily populated since the beginning of the sequence), as an issue of preservation, or as a difference resulting from test location (since VQ041 apparently does not correspond to an outdoor location, like VQ038 at Pucalpa, which would typically yield a better pollen rain than an indoor location). Macroremains, on the other hand, confirm interpretations regarding high humidity (because of the abundance of Cyperaceae), and reflect limited crop variety and the absence of other plants with human uses. Pollen evidence did not provide any information about crops, but the ones identified in phytoliths (while most likely not providing evidence of plant decay in a production context, due to the probable location of VQ041 on what seems to be a residential terrace) and macroremains are so well suited to the local conditions that one would not feel readily inclined to think they could have been brought to the site from another location.

SARDINAS GRANDE

This corresponds to a moderately nucleated low-altitude settlement at 1660 m (the lowest of the settlements sampled), on the second best soil category (ranking 2). A few lots (about nine) represent the occupation of the Early 1 Period within about a 1 km radius of the test location, and even fewer (about five) represent the Early 2, but they do not overlap with Early 1. Population growth during the Late Period occurred throughout, and formed what appears to be a small compact settlement. The test excavations were placed towards the center of this settlement, visible to the naked eye through landscape features that include terraces of various sizes and shapes with stone foundations and canals. Given the paucity of Early occupation in the immediate area of the test pits, it is assumed that these landscape features must correspond, at least in their majority, to the Late occupation (Figure 7.7). Macroremains from all three tests (VQ023, VQ024, VQ025) were analyzed, while pollen and phytolith analysis was performed for test VQ023 only.

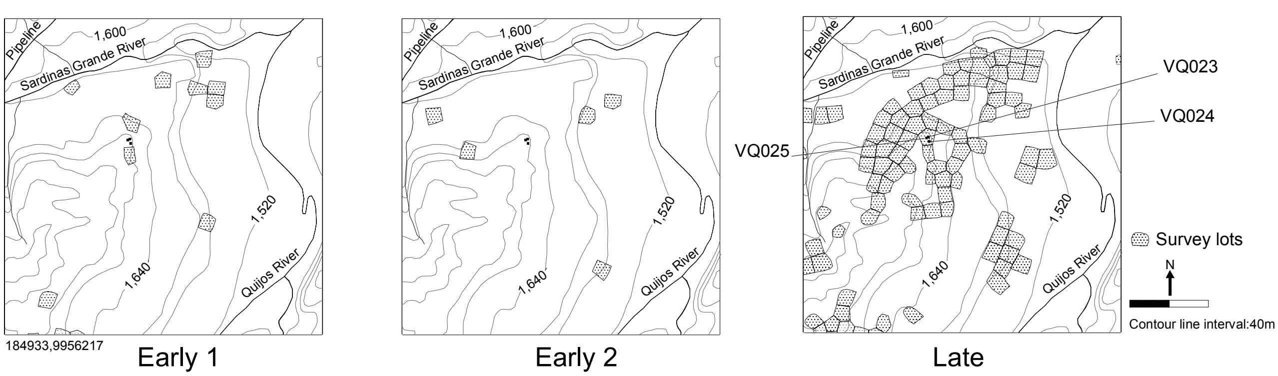


Figure 7.7. Occupation by Period and Location of 1x1m Tests in Sardinas Grande.

Pollen

Test VQ023 was located inside a small terrace with a stone foundation. The soil samples contained only 62 pollen grains (Table 7.9, Figure 7.8). No crops are represented. Most palynomorphs correspond to fungi and fern spores. Only one *páramo* plant family (Poaceae) appeared, and no Andean Forest species were reported. Among the fern spores, Monolete psilate and *Cyathea* were identified (description above). These suggest very high humidity and a disturbed environment.

Table 7.9. Pollen Data, VQ023.

Taxa	20 cm	30 cm	40 cm	50 cm	Total	% of total
Paramo						
Poaceae	1		2		**3**	**5%**
% by sample	**2.4%**		**33.3%**			
Fern spores						
Cyathea	3	2	1	1		
Monolete psilate	3		1	1	**12**	**20%**
% by sample	**14.6%**	**50%**	**33.3%**	**22.2%**		
Fungi spores						
Sordariaceae	31		1	6		
Ustulina deusta	1		1			
Coinochaeta ligniaria	2	2		1	**45**	**75%**
% by sample	**82.9%**	**40%**	**33.3%**	**77.8%**		
Total	41	5	7	9	62	

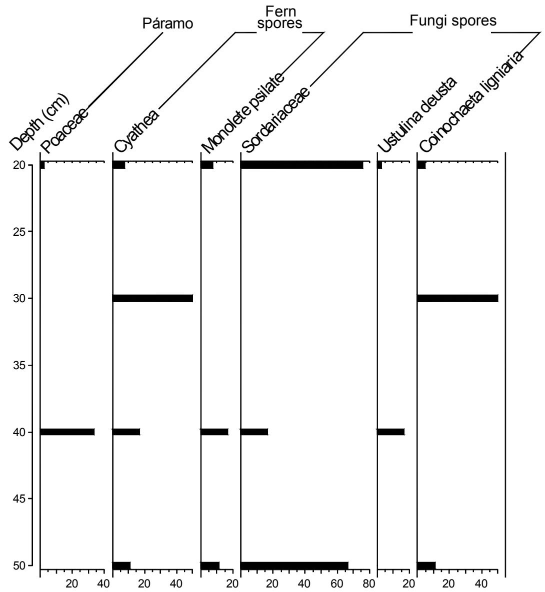


Figure 7.8. Pollen Diagram, VQ023.

Phytoliths

Two crops (*Zea mays* and *Phaseolus* sp.), an undetermined palm species and a variety of grasses were identified (Figure 7.9). Among the crops, corn is clearly more important. The identification of palm remains at this site and at San José further reiterates that warmer conditions were present in this northeastern zone of the survey. Yet, the very small quantities of palm phytoliths, taking into account that these plants generally produce them in abundance and that their identification is not difficult, suggests that palms were only marginally used in the region, and apparently their use was limited to places where they would have been naturally predisposed to grow. As far as the grasses, the same types identified at other sites are present, but those of the Poaceae family are less represented than at the high altitude sites. This points to warmer but still humid conditions and environmental disturbance that resulted in open areas, and is consistent with the pollen data.

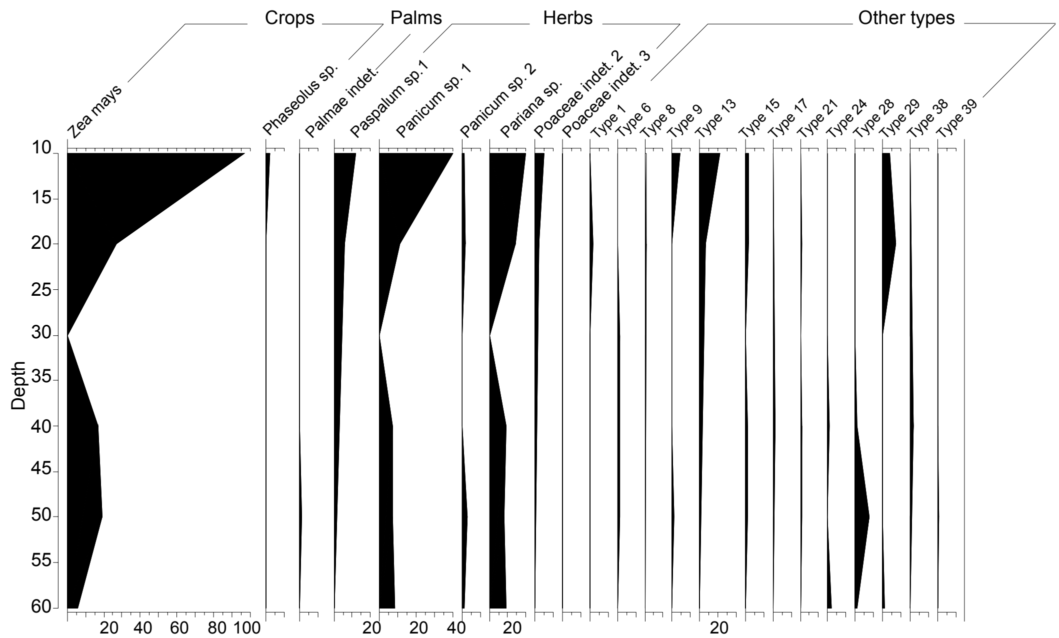


Figure 7.9. Phytolith Diagram, VQ023.

Macroremains

Macrobotanical remains include three crops *Zea mays*, *Phaseolus vulgaris*, and *Phaseolus lunatus* (corn, common beans, and lima beans) and two herb types (Cyperaceae indet. and Portulacaceae indet.) (Tables 7.10, 7.11, 7.12).

All of the crops present are well adapted to the conditions of this area, and therefore, it is conceivable that they were locally cultivated. They make up 30% of the macrobotanical assemblage, the vast majority of which is corn, making up 97% of the crop macroremains (accounting for over 29% of the total). Most corn remains are whole kernels and kernel fragments as well as chaffs, with only three cob fragments. Of the three crops, lima beans have perhaps the most restrictions in regard to temperature, since they require temperatures above 15C° to germinate. The local climate at this low altitude, therefore is apt for its cultivation.

Table 7.10. Macroremain Data, VQ023.

Code	Site	Unit	Taxa	Count	%	% of total id.
VQ023	Sardinas Grande	1	**Crops**			
			Zea mays	45	65.8%	**65.8%**
			Phaseolus vulgaris	3		
			Phaseolus lunatus	2		
			Weeds			
			Cyperaceae indet.	25	34.2%	**34.2%**
			Portulacaceae indet.	1		
			Total identified	**76**		
			Uncharred remains	1		
			Not identified	0		
			Total	**77**		

Table 7.11. Macroremain Data, VQ024.

Code	Site	Unit	Taxa	Count	%	% of total id.
VQ024	Sardinas Grande	2	**Crops**			
			Zea mays	59	54.5%	**54.5%**
			Phaseolus vulgaris	1		
			Weeds			
			Cyperaceae indet.	50	45.5%	**45.5%**
			Total identified	**110**		
			Uncharred remains	0		
			Not identified	1		
			Total	**111**		

Table 7.12. Macroremain Data, VQ025.

Code	Site	Unit	Taxa	Count	%	% of total id.
VQ025	Sardinas Grande	3	**Crops**			
			Zea mays	134	23%	**23%**
			Phaseolus vulgaris	2		
			Weeds			
			Cyperaceae indet.	456	77%	**77%**
			Total identified	**592**		
			Uncharred remains	5		
			Not identified	0		
			Total	**597**		

Of the two herbs identified, Cyperaceae indet. (description and uses above, under Pucalpa), is the most abundant; only one seed of Portulacaceae indet. was recovered. Species of the latter are used in Ecuador as potherbs and salad greens (Van den Eynden 1997:207).

The distribution of plant types, as seen through macroremains, varies across tests. Crop remains are more abundant in VQ023 and VQ024 (both of which were excavated inside of what we believe are residential structures), than at VQ025 (an off-site location). The abundance of herbs is the inverse of that of crops in terms of spatial distribution. This conforms to expectations about the distribution of macroremain types in archaeological sites.

Pollen, phytoliths and macroremain analysis yielded botanical assemblages with very few plant varieties. While preservation issues are a concern in the case of pollen (only 62 palynomorphs were recovered), they are not in the case of phytoliths or macroremains. From the pollen analysis the only conclusion to be drawn is that humidity was high, perhaps even permanent, and that human impact on the vegetation had been felt. From the phytolith and macrobotanical analysis it is feasible to conclude that plants that thrive in this climate were emphasized, although direct evidence of crop production is not available. The possibility of a specialized economy during the Late Period is not supported with information from this site. For this to be the case, there should have been some indication of high-altitude plant use at the site, of which there is none.

BERMEJO

This is a large nucleated high-altitude settlement at about 2000 m above sea level, on the second best soil category (ranking 2). A very scant occupation starts in this area during the Early 1 Period, represented by a handful of very dispersed lots within about 1 km radius of the test location. In the Early 2 Period growth is evident, but settlement is still dispersed. By the Late Period a very large and compact settlement develops here (Figure 7.10). This is an area were intense landscape modification took place. Despite very steep slopes, terracing is abundant throughout and numerous worked stones are found scattered on the slopes and the top of the hill. The largest set of agricultural terraces identified in the survey corresponds to this site, as well as the shovel probes with the most sherds and hand-axes. Surface collections also yielded material in abundance. This settlement is the largest in the southern portion of the survey. Macroremains from VQ027, VQ028, VQ029 and VQ030 were analyzed, while samples for pollen and phytolith analysis were submitted from only VQ027. The preservation of pollen was poor, leading the pollen analyst to decide that it was not worth analyzing the samples from this location.

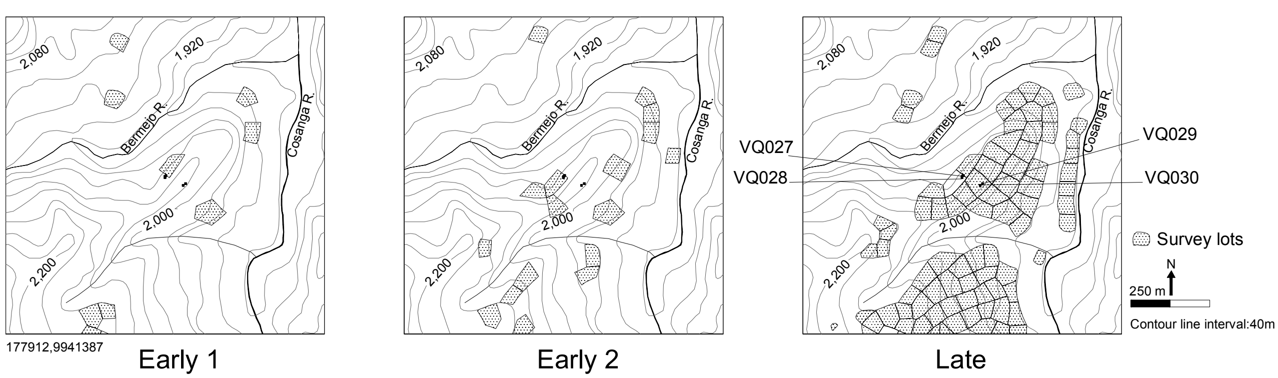


Figure 7.10. Occupation by Period and Location of 1x1m Tests in Bermejo.

Phytoliths

Soil samples from VQ027, placed on an agricultural terrace, yielded phytoliths of *Zea mays* as far as cultivars, and of a variety of herbs from the Panicoideae subfamily of grasses, as well as from the Bambusoideae subfamily of grasses, and from the Poaceae family (Figure 7.11). As described above, these are typical of humid environments and indicate human impact on the natural surroundings in the form of vegetation clearings. Only in the uppermost section of this test did Diatoms phytoliths appear. These belong to algae, and thus indicate an aquatic environment that could correspond to the cessation of use of this area for agricultural purposes.

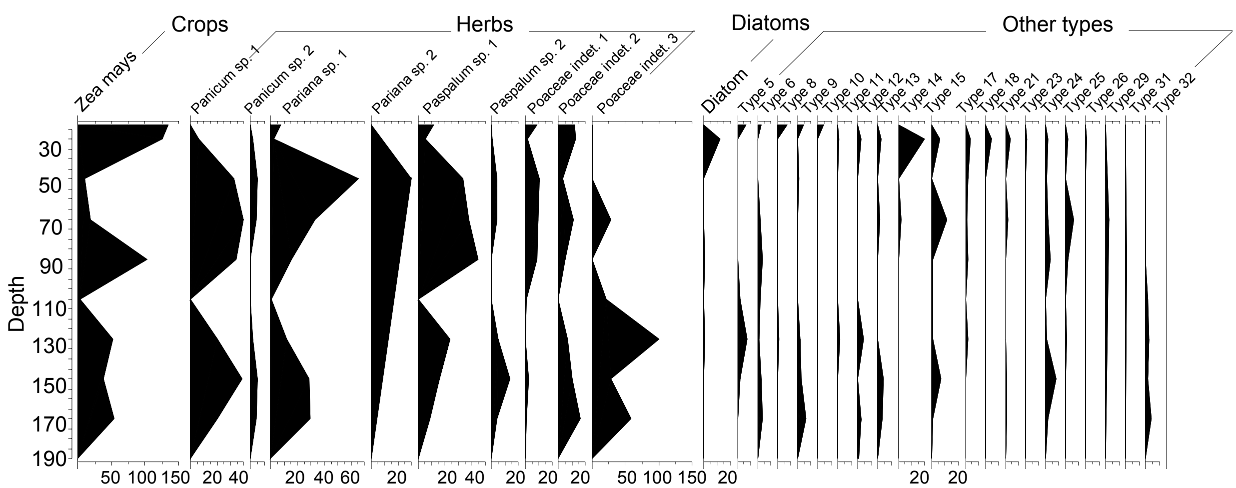


Figure 7.11. Phytolith Diagram, VQ027.

Macroremains

The analysis of macroremains yielded three crops *Zea mays*, *Phaseoulus vulgaris*, and *Capsicum* sp. (corn, common beans and chili peppers); three types of herbs associated with disturbed areas, Cyperaceae indet., Portulacaceae indet., and Asteraceae indet.; two types of fruits *Passiflora ligularis* and *Rubus* sp1. (passion fruit and wild blackberry); and one wild plant variety with a history of human use (*Cecropia* sp.) (Tables 7.13, 7.14, 7.15, 7.16).

Table 7.13. Macroremain Data, VQ027.

Code	Site	Unit	Taxa	Count	%	% of total id.
VQ027	Bermejo	2	**Crops**			
			Zea mays	36	29.0%	**29.8%**
			Phaseolus vulgaris	1	0.8%	
			Fruits			
			Passiflora ligularis	2	1.6%	
			Rubus sp1.	1	0.8%	**2.4%**
			Weeds			
			Cyperaceae indet.	85	68.5%	
			Portulacaceae indet.	1	0.8%	**69.4%**
			Total identified	**124**		
			Uncharred remains	0		
			Not identified	27		
			Total	**151**		

Table 7.14. Macroremain Data, VQ028.

Code	Site	Unit	Taxa	Count	%	% of total id.
VQ028	Bermejo	3	**Crops**			
			Zea mays	39	44.8%	**44.8%**
			Weeds			
			Asteraceae indet.	1	1.1%	
			Cyperaceae indet.	47	54.0%	**55.2%**
			Total identified	**87**		
			Uncharred remains	2		
			Not identified	16		
			Total	**105**		

Table 7.15. Macroremain Data, VQ029.

Code	Site	Unit	Taxa	Count	%	% of total id.
VQ029	Bermejo	4	**Crops**			
			Zea mays	16	32%	
			Phaseolus vulgaris	1	2%	**34%**
			Fruits			
			Passiflora ligularis	1	2%	**2%**
			Weeds			
			Cyperaceae indet.	31	62%	**62%**
			Wild			
			Cecropia sp.	1	2%	**2%**
			Total identified	**50**		
			Uncharred remains	0		
			Not identified	3		
			Total	**53**		

Table 7.16. Macroremain Data, VQ030.

Code	Site	Unit	Taxa	Count	%	% of total id.
VQ030	Bermejo	5	**Crops**			
			Zea mays	15	15%	
			Capsicum sp.	3	3%	**18%**
			Weeds			
			Cyperaceae indet.	82	82%	**82%**
			Total identified	**100**		
			Uncharred remains	0		
			Not identified	16		
			Total	**116**		

The evidence of consumed crops (corn, common beans and chili peppers) does not readily suggest the possibility of exchange, as these are all within their altitudinal limit for cultivation. Phytoliths of corn from an agricultural terrace suggest that this was cultivated locally. Chili peppers thrive best below 1500 m, yet certain varieties can still be produced as high as 2800 or 2900 m in the Andes (Gade 1975:201; Izquierdo and Roca 2000:9; NRC 1989:126). In the Oyacachi Valley, close to the research area, they are not reported above 2000 m (DIVA 2000:48), but Quattrin (2001) reports them at 2100 m in pollen from an archaeological context in southwestern Colombia (this archaeological context corresponds to a period of time when climate was cooler and wetter than present, thus the altitudinal limits for crop cultivation must have been lower). Corn remains (106, 29% of total identified remains) are mostly whole and fragmented kernels and chaffs, only 3 cob fragments were identified. Compared to common beans (2 remains) and chili peppers (3 remains), corn is truly dominant among the crops; which as a whole make for 30% of the total of identified remains.

Fruit remains are low in quantity (4 in total). Passion fruit is very well fitted to altitudes above 2000 m provided there is enough water, and *Rubus* is also typical of cool climates like the one of this area. This tends to colonize abandoned agricultural fields and forest clearings, as mentioned above.

As far as types associated with agricultural fields, Asteraceae indet. and Portulacaceae indet. appeared in very low quantities compared to Cyperaceae; which is most abundant not only within this plant category but also in terms of the whole botanical assemblage of the site (their habitat and uses are described above).

The wild species identified has a wide history of human use in northern South America. *Cecropia* sp. (known as *Guarumo* or *Yarumo*), is typically found in both Andean and Subandean secondary forests, from 1200 to 2400 m, and is rather uncommon in High Andean Forest. Because it is such a successful pioneer tree it constitutes a very reliable indicator of disturbance (DIVA 2000:27). This has been reported for altitudes between 1200 and 2000 m in the neighboring Cayambe-Coca Forest Reserve (FUNAN 1998:38), and Quattrin (2001) reports it only for the lowest altitude (1660 m) of a series of houses excavated at both high and low elevations. The leaves of this tree are highly desirable for medicinal uses, and its wood is sought after as well for construction.

The distribution of the different plant types in this case does not show weeds being more important at agricultural terraces than at residential locations, and the inverse for crops, as would be expected. Yet, consistently, two weed varieties are found at both VQ027 and VQ028, placed at agricultural terraces, while only one is found at VQ029 and VQ030, presumed residential locations. Instead, the very small seeds of chili pepper appeared only at one of the presumed residential locations (VQ030), which is consistent with the idea that such small remains are unlikely to be found far from where they were processed; because of their inconspicuousness they are rarely removed (Lennstrom and Hastorf 1995:706).

The evidence of food consumption reflects local climatic conditions very well. Although direct evidence of crop production from phytoliths recovered at an agricultural terrace is limited to corn, consumption patterns in general do not readily indicate a vertical economy at work during the Late Period.

LOGMAPAMPA

This is a moderately nucleated high altitude settlement at about 2140 m above sea level, with poor quality soils (ranking 4). The Early 1 occupation in the area is small and dispersed in a 1 km radius from where the tests were placed. Although some growth is observed during the Early 2, the settlement pattern continues to be dispersed and is more concentrated in the vicinity of the modern town of Baeza. Occupation grows considerably during the Late Period, and the pattern is nucleated for the most part (Figure 7. . Macroremains from all tests (VQ031, VQ032, VQ033, VQ034) were analyzed. We collected soil samples for pollen and phytolith analyses, but they will not be analyzed at this stage of the project.

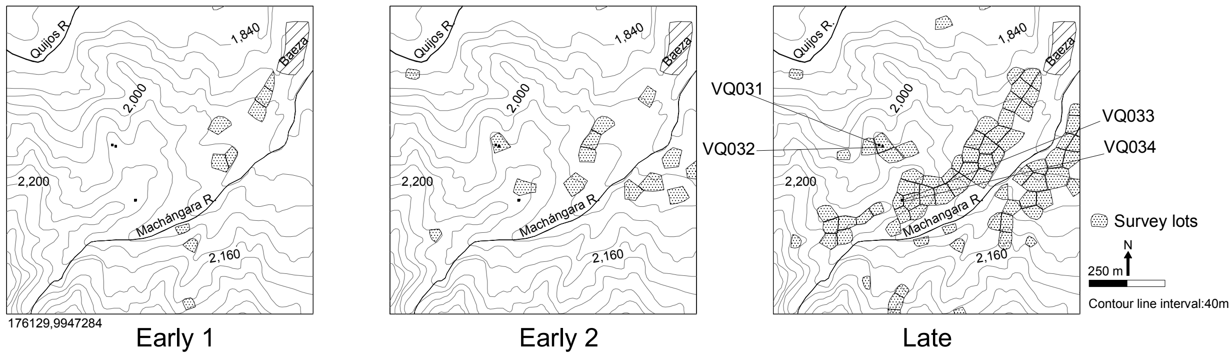


Figure 7.12. Occupation by Period and Location of 1x1m Tests in Logmapampa.

Macroremains

Remains identified include *Zea mays*, *Phaseoulus vulgaris* and *Canna edulis* (corn, common beans, and achira) for crops; *Passiflora ligularis*, *Prunus* cf. *serotina* and *Physalis peruviana* as far as fruits (passion fruit, black cherry, and goldenberry) and Portulacaceae indet. and Cyperaceae indet. in terms of weeds (Tables 7.17, 7.18, 7.19, 7.20).

Table 7.17. Macroremain Data, VQ031.

Code	Site	Unit	Taxa	Count	%	% of total id.
VQ031	Logmapampa	1	**Crops**			
			Zea mays	2	50%	**50%**
			Fruits			
			Passiflora ligularis	1	25%	**25%**
			Weeds			
			Cyperaceae indet.	1	25%	**25%**
			Portulacaceae indet.	?		
			Total identified	**4**		
			Uncharred remains	0		
			Not identified	1		
			Total	**5**		

Table 7.18. Macroremain Data, VQ032.

Code	Site	Unit	Taxa	Count	%	% of total id.
VQ032	Logmapampa	2	**Weeds**			
			Cyperaceae indet.	17	100%	**100%**
			Portulacaceae indet.	2		
			Total identified	**19**		
			Uncharred remains	1		
			Not identified	0		
			Total	**20**		

Table 7.19. Macroremain Data, VQ033.

Code	Site	Unit	Taxa	Count	%	% of total id.
VQ033	Logmapampa	3	**Crops**			
			Zea mays	17	34.7%	
			Phaseolus vulgaris	1	2.0%	**36.7%**
			Fruits			
			Passiflora ligularis	6	12.2%	
			Prunus cf. *serotina*	1	2.0%	
			Physalis peruviana	1	2.0%	**16.3%**
			Weeds			
			Cyperaceae indet.	22	44.9%	
			Portulacaceae indet.	1	2.0%	**46.9%**
			Total identified	**49**		
			Uncharred remains	0		
			Not identified	1		
			Total	**50**		

Table 7.20. Macroremain Data, VQ034.

Code	Site	Unit	Taxa	Count	%	% of total id.
VQ034	Logmapampa	4	**Crops**			
			Zea mays	5	10.6%	
			Canna edulis	1	2.1%	**12.8%**
			Fruits			
			Passiflora ligularis	1	2.1%	**2.1%**
			Weeds			
			Cyperaceae indet.	40	85.1%	**85.1%**
			Total identified	**47**		
			Uncharred remains	13		
			Not identified	0		
			Total	**60**		

Although direct evidence of crop production is not available, it is not likely that the crop macroremains identified are the result of exchange activities, as they all thrive in the local conditions. These do not seem to have been equally important though; of the 26 crop remains 24 are corn remains. Corn was also the only crop present at all of the three tests that had crops. The remains of corn are composed of whole and fragmented kernels and chaffs, and represent 20% of the total of remains identified. Crops as a group represent less than 22%.

Fruit remains constitute about 8% of the total of macroremains identified. The fruit types present reflect the local conditions very well. The three of them are reported for precisely this altitudinal range at other Andean locations (Duque and Rangel 1989:58; Gade 1975:202; Van den Eynden 1997:218-9). *Passiflora ligularis* is particularly well-adapted to high altitude cloud-forest, *Prunus serotina* colonizes cleared forests and fields typically at elevations between 2200 and 3100 m (NRC 1989:223). In Ecuador it has been reported as low as 2100 and as high as 3700 m. *Physalis peruviana* also predominates above 2000 m, although it can grow as low as 500 m (Izquierdo and Roca 2000:9).

Lastly, weeds make up about 70% of the macroremains identified, and the vast majority of them correspond to Cyperaceae indet., an indicator of marshy environments.

Plant types did not appear evenly in the different tests. VQ032, excavated in an off-site location yielded only weed remains. The tests that produced the most varied assemblage of crops and fruits (VQ033 and VQ034) were placed inside presumed residential terraces. This conforms to expectations about plant type distribution in archaeological sites.

All of the plant remains identified through macrobotanical analysis are proper to the altitudinal range of where this location falls. Despite the lack of evidence on crop production, there is nothing in this assemblage that would point to the possibility of external provisioning (such as food remains that were not likely to have been cultivated locally), and consequently, the current evidence does not seem to suggest that the economy was specialized during the Late Period.

SARDINAS CHICO

This is a small, low-altitude settlement at about 1910 m, on soils of moderate to low fertility (ranking 3). Occupation during the Early 1 Period is represented by over a dozen lots, very dispersed, but spread evenly within a 1 km radius from where test pits were placed. During the Early 2 there is barely any change in terms of the extent or distribution of the occupation. The Late Period settlement pattern is more nucleated, but preserves the location of much of the same areas occupied earlier in the sequence (Figure 7.13). Test excavations were conducted on a set of three contiguous artificial terraces that appear to have stone foundations. Overgrown vegetation made it difficult to corroborate, though. Macroremain analysis from two tests (VQ020 and VQ021) is presented below. Soil samples for pollen and phytolith analysis will wait until another stage of the project.

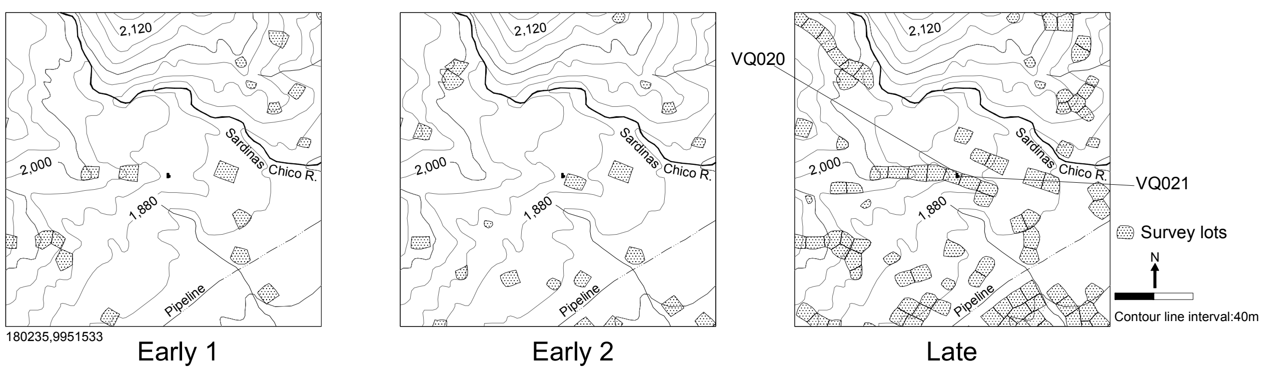


Figure 7.13. Occupation by Period and Location of 1x1m Tests in Sardinas Chico.

Macroremains

Macroremain analysis revealed the presence of *Zea mays* as the only crop, Cyperaceae indet. as the only weed, and two types of wild plants with a history of human use (*Cecropia* sp. and *Sapium utile*) (Tables 7.21, 7.22).

Table 7.21. Macroremain Data, VQ020.

Code	Site	Unit	Taxa	Count	%	% of total id.
VQ020	Sardinas Chico	1	**Crops**			
			Zea mays	29	100.0%	**100.0%**
			Total identified	**29**		
			Uncharred remains	1		
			Not identified	0		
			Total	**30**		

Table 7.22. Macroremain Data, VQ021.

Code	Site	Unit	Taxa	Count	%	% of total id.
VQ021	Sardinas Chico	2	**Crops**			
			Zea mays	50	56.8%	**56.8%**
			Weeds			
			Cyperaceae indet.	35	39.8%	**39.8%**
			Wild			
			Cecropia sp.	1	1.1%	**3.4%**
			Sapium utile	2	2.3%	
			Total identified	**88**		
			Uncharred remains	16		
			Not identified	0		
			Total	**104**		

Corn remains (79 in total) represent about 68% of the total identified remains at this location. This crop's remains were for the most part whole and fragmented kernels and chaffs, and only one cob fragment was identified. Cyperaceae indet. is the second most important component of the botanical assemblage at this site (uses and habitat have been described above), representing 30% of the total identified remains; while seeds of wild species *Cecropia* sp. and *Sapium utile* appeared in minuscule quantities (1 and 2 respectively). These two make up only 2% of the total of macroremains identified. *Cecropia* sp. (habitat described above) is a very reliable indicator of disturbance, and widely used for medicinal purposes and its wood for construction. *Sapium utile* (known as *Cauchillo* or *Palo de leche*) is normally found at low altitudes, from 1300 to 2300 m (Ulloa and Jørgensen 1995); its gum is used to trap birds, and it is also common in disturbed areas (Bonifaz 1997:344).

Plant type distribution in the two tests varies. While VQ020 only presented evidence of a crop, VQ021 yielded evidence of cultivated and wild species as well as weeds. Both tests were placed inside presumed residential spaces, thus it is not clear what accounts for these differences.

All of the plants identified for this site are quite typical of this low altitude setting. They reflect human impact and use of both wild and domesticated resources. The presence of a vertical economy, from this evidence, seems unlikely.

SANTA LUCÍA DEL BERMEJO

This is a small high altitude settlement at 2280 m. The soils at this location are not among the best (soil ranking 3). Occupation within approximately a 1 km radius of the tests is very small during the Early 1, represented by less than a handful of lots. During the Early 2 the number of lots occupied doubles, still reflecting a very small occupation although notably more compact. By the Late Period growth seems proportional to that between the Early 1 and 2, and its distribution remains the same (Figure 7.14). The tests were excavated on two artificial terraces, of several observed in the area, that were probably residential. Agricultural terraces down the slopes are also visible throughout the area, and are very large, comparable to those observed at Bermejo, except not as abundant. Only macroremain analysis is available for these tests (VQ004 and VQ005), while samples for pollen and phytoliths were kept for future analysis.

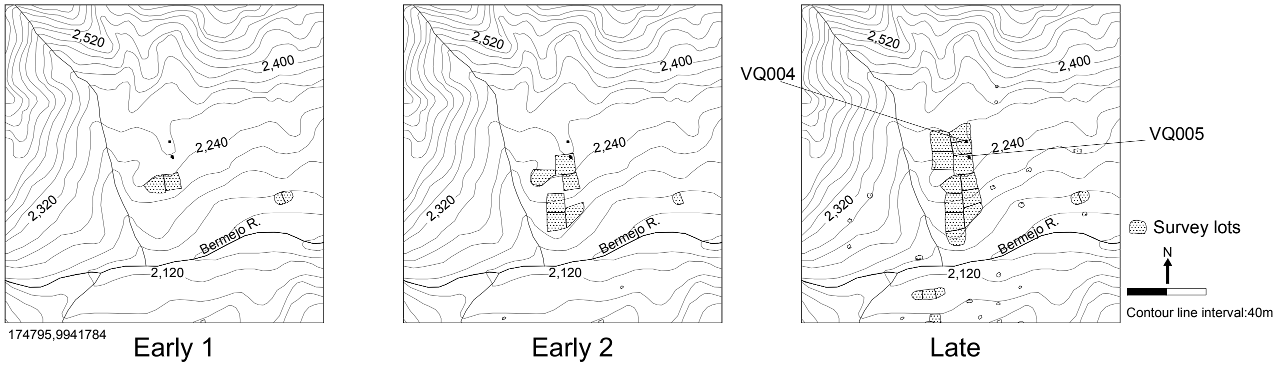


Figure 7.14. Occupation by Period and Location of 1x1m Tests in Santa Lucía del Bermejo.

Macroremains

The remains at this site include four kinds of crops, *Zea mays*, *Phaseolus vulgaris*, *Canna edulis* and *Cucurbita pepo* (corn, common bean, achira, and squash); *Passiflora biflora* and Rosaceae indet. as far as wild plants; and Cyperaceae indet., Juncaceae indet. and Portulacaceae indet. as far as weeds (Tables 7.23, 7.24).

The crops consumed at this site are well adapted to the surrounding environment, and therefore it is likely that they were locally produced. Contemporary cultivation of squash is reported for the region of Oyacachi, bordering the study area, at a maximum of 2200 m. Its suggested range is 0 to 2000 m (Izquierdo and Roca 2000:9), but despite this association with low altitudes, *Cucurbita* varieties in the Andes have been cultivated up to even 3000 m (Gade 1975:93). Achira is well within its suggested range of 1000 to 2500 m (Izquierdo and Roca 2000:9). Corn predominates among the crops (23 remains, 39% of the total of macroremains identified). This crop's remains correspond to whole and fragmented kernels and chaffs, a stalk fragment, and a peduncle fragment. The remains of the three other crops are scarce (10 in total) compared to those of corn. As a whole, crops represent about 56% of the total of identified macroremains.

Table 7.23. Macroremain Data, VQ004.

Code	Site	Unit	Taxa	Count	%	% of total id.
VQ004	Sta.L. del Bermejo	1	**Crops**			
			Zea mays	1	50%	**50%**
			Wild			
			Passiflora biflora	1	50%	**50%**
			Total identified	**2**		
			Uncharred remains	0		
			Not identified	116		
			Total	**118**		

Table 7.24. Macroremain Data, VQ005.

Code	Site	Unit	Taxa	Count	%	% of total id.
VQ005	Sta.L. del Bermejo	2	**Crops**			
			Zea mays	22	38.6%	
			Phaseolus vulgaris	4	7.0%	
			Canna edulis	5	8.8%	
			Cucurbita pepo	1	1.8%	**56.1%**
			Weeds			
			Juncaceae indet.	1	1.8%	
			Cyperaceae indet.	16	28.1%	
			Portulacacea indet.	7	12.3%	**42.1%**
			Wild			
			Rosaceae indet.	1	1.8%	**1.8%**
			Total identified	**57**		
			Uncharred remains	2		
			Not identified	95		
			Total	**154**		

As far as the two wild plants identified, they are also typical of this kind of high altitude setting. *Passiflora biflora*, an invasive vine, is very well adapted to cloud forests and swampy conditions. Rosaceae species also do well at this type of altitude. Of the three kinds of weeds, Cyperaceae is the most abundant; but they are all common in this type of location, and are generally associated with agricultural fields.

Both tests, located inside presumed residential areas, yielded remains of crops and wild plants, but only VQ005 yielded weed remains. Since tests were not excavated at other locations (such as agricultural terraces) it is not possible to elaborate on plant distribution by location type.

The botanical assemblage recovered is what one would expect for the location of this site. Although direct evidence of production is missing, such a close match between environmental characteristics and plant remains points more strongly to the possibility of local provisioning. Thus, this site does not offer evidence of a vertical economy during the Late Period either.

CONCLUSIONS

The production and consumption patterns reconstructed from the comparison of botanical remains from the different sites investigated do not allow for characterizing the Late Period economy as a case of a vertical economy despite the fact that the sharp altitudinal gradient in this region, which places low altitude and high altitude environments so close to each other, presents all the potential for such an economy. (Langebaek [1996:158,170] argues that in the eastern highlands of Colombia microverticality was a possibility only for "pueblos" located in areas of steep gradient). The information about background vegetation, provided mostly by pollen evidence, and to a lesser extent by phytolith and macroremain evidence (as far as weed types), reveals that indeed, climatic conditions at the different settings were diverse; ranging from almost *páramo* climate at Pucalpa, to a similarly humid but warm Subandean climate at Sardinas Grande. At all locations there is evidence of disturbance signaled by species typical of secondary growth formations, and by the presence of weeds associated with agricultural fields. Along with a couple of weeds with edible parts, only fruits add to the inventory of edible wild species in use (yet, some fruit species such as *Passiflora ligularis*, *Prunus serotina* and *Physalis peruviana* are often cultivated), and in general this plant category does not seem as important as the crops, nor was it represented at all sites. Additionally, if wild species had played a prominent role in the diet, it is likely that more variety would have been present in the different botanical assemblages. This all points to a pattern of food procurement apparently more dependant on cultivated than on wild plants, which left tangible traces in the archaeobotanical record of the region through evidence of intervention on the local vegetation, particularly at the low altitude settlements (with barely any pollen from tree forest species) which fall within the area with the longest and most intense occupation throughout the sequence. Yet, despite the fact that crops seem to have constituted the core of the diet, it looks like there was not a general tendency towards optimizing crop variety or stretching the effective ranges of cultivation of different plants. The most consistent observation that emerges from the botanical assemblages at each one of the sites, is that people tended to cultivate or use crops that are well suited to the different locations. Even when evidence of cultivation is unavailable, or when this is available but does not reflect all of the crops consumed at a site, the consumption patterns, more thoroughly documented, are not typical of a specialized or redistributive economy. In a case like that, diet should be independent of the local conditions (Welch 1996:74). Instead, the array of consumed foods at the different sites is what one would expect from a subsistence economy based on availability and ease of producing crops fit for local conditions.

Figure 7.15 summarizes botanical information with respect to altitude, and Table 7.25 includes soil ranking and settlement type as well. A few concrete trends are obvious here. First, corn is present at all sites investigated. This is not surprising given that the entire altitudinal range in the study area is suited for corn cultivation. Second, common beans are the second most popular crop, appearing at all but one of the sites. With the exception of its cultivation at 2400 m in Pucalpa, it is always well within its effective limits. In this case, the crop appears to lean more towards its absolute limit, which is the one at which a crop would not grow or yield at all, temperature being the most decisive factor that cannot be controlled or modified (Gade 1975:95). Third, of the two bean varieties, lima beans appear solely at the lowest altitude settlement, consistent with the fact that this is even more sensitive to low temperature than its common counterpart. Fourth, the most typical high altitude crops of those identified (assuming that the Chenopodium pollen grains correspond to quinoa), appear only at the highest altitude settlement. Fifth, fruit consumption was limited to high altitude settlements, totally in unison with the fact the fruit species identified thrive in cool climates.

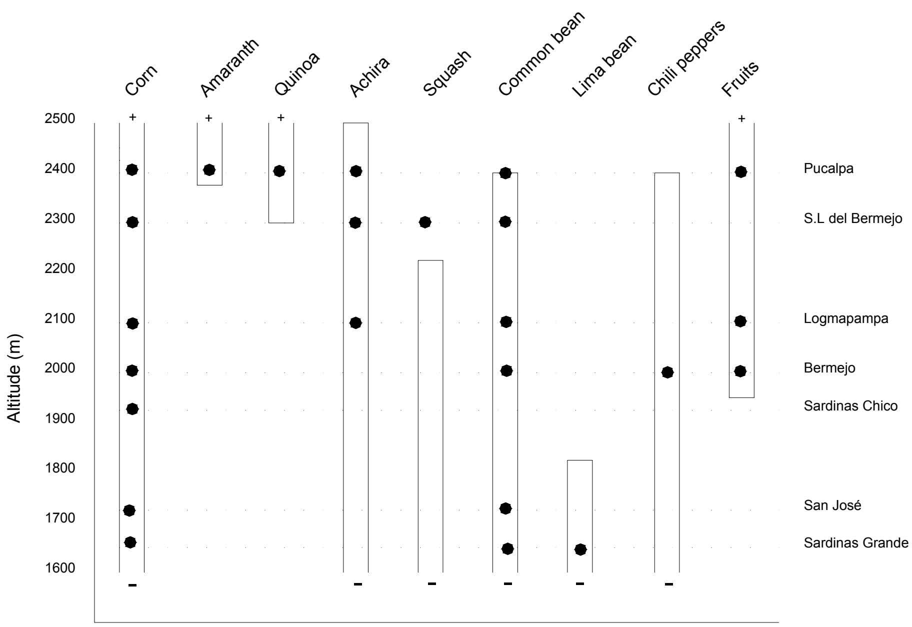


Figure 7.15. Crops by Altitude.
Open boxes with + and – signs indicates that the crop can be grown at higher or lower altitudes. Closed boxes indicate effective limits of cultivation.

Table 7.25. Summary of Botanical Information.

	Pucalpa	S.L. del Bermejo	Logmapampa	Bermejo	Sardinas Chico	San José	Sardinas Grande
Settlement	Large nucleated	Small	Moder. nucleated	Large nucleated	Small	Very small	Moder. nucleated
Soil ranking	1	3	4	2	3	2	2
Elevation (m)	2400	2270-2280	2080-2140	2000-2040	1910	1720	1660
Crops							
Corn	Ph, M	M	M	Ph, M	M	Ph, M	M
Amaranth	M						
Quinoa	P						
Achira	Ph, M	M	M				
Squash		M					
Common bean	P, Ph	M	M	M		Ph, M	M
Chili peppers				M			
Lima bean							M
Fruits							
Blackberry	M			M			
Passion fruit	M		M	M			
Goldenberry			M				
Black cherry			M				

P: Pollen, Ph: Phytoliths, M: Macroremains

None of these tendencies strikes one as a manifestation of active food exchanges. Perhaps the strongest evidence against the existence of food exchange in the region comes from Pucalpa, one of the three large nucleated settlements in the survey area. That beans were being produced at near-*páramo* conditions suggests that people were not exchanging for lower altitude crops. If networks of exchange were in place, they would be most apparent at sites like Pucalpa, which, as an elite center, would be a hub of exchange activity. One would expect residents at these central places to have easy access to crops best suited to other altitudes through exchange, rather than having to stretch the efficient range for crops like the common bean by producing them locally. Since the evidence points to the opposite pattern, we must conclude that agricultural exchange was not well-established, and very importantly, not regulated by elites.

Following with the summary in Table 7.25, it does not seem that soil fertility was related to corn being emphasized at central settlements, or at least not at the expense of other crops. As discussed in Chapter 5, while elite settlements did tend to correspond to areas with more fertile soils (Pucalpa is located on the most fertile and Bermejo on the second most fertile soils), there was an abundance of good agricultural land that was either uninhabited or inhabited in much less centralized fashion, such as the area around San José. But in any case, right across small relatively isolated settlement and large nucleated central settlements, corn macroremains are present and in similar proportions relative to other crops at all sites (Figure 7.16) (here, only tests from presumed residential areas are included). While nearly unequivocal evidence of production, that is, in the form of phytoliths from agricultural terraces, is available for only two large nucleated sites (most of the smallest sites did not have landscape traces such as agricultural terraces that would allow for such certainty in the interpretation of the origin of the phytoliths), one would expect that if corn was truly a more important crop at the central places, this should be reflected in consumption patterns relative to other crops. But with the exception of Santa Lucia del Bermejo, corn invariably constitutes more than 85% of the crop remains. Yet even here, this does not point to soil type as a deterrent to corn production, as it is found in the usual high proportions at Sardinas Chico and Logmapampa, sites that have comparable or less fertile soils. Nor does settlement type account for this slight difference, as both fall under the category of "small" settlements. Thus, from this evidence, it cannot be concluded that emphasis on crops varied according to soil fertility or settlement type. Now, if corn was more important at central places for its consumption in the form of chicha, the carbonized remains that may relate to consumption in a certain cooked fashion (roasted) may not tell us about corn consumption in other forms. Corn types have been used in other regions to aid in this kind of interpretation, the presence of more varieties and of large-kernel types in particular taken as evidence of chicha making (Hastorf and Johannessen 1993). This is something worth investigating in more detail in the future.

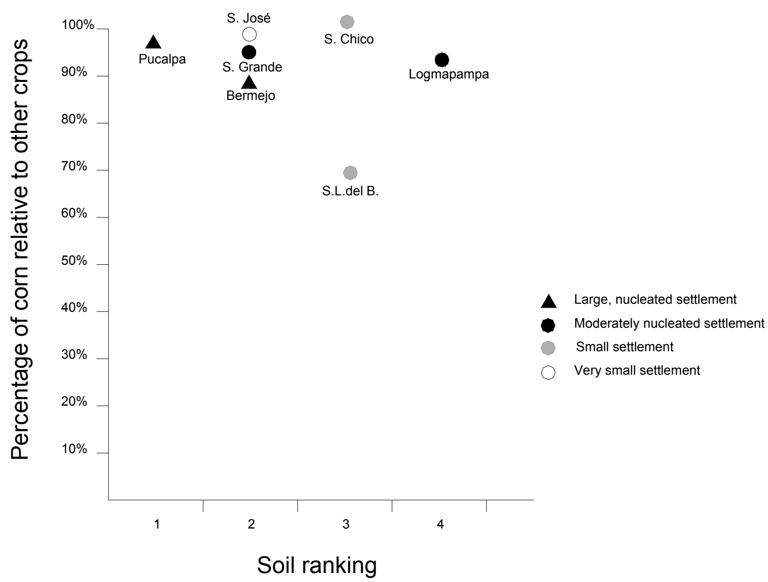


Figure 7.16. Corn Percentages Relative to Other Crops.

In any case, the apparent similar importance of corn at all locations, and the possibility that it was produced even in rather unfertile soils points again to the lack of exchange networks within the region. If such exchange networks existed, it would be reasonable to assume that settlements on less fertile soils would focus on the cultivation of crops better suited to those soil conditions, given that they would be able to acquire corn through exchange. The high proportions of corn found across sites runs counter to this scenario, since if this was the case, one would expect to find corn in higher proportions in contexts of production or at centers of exchange networks than in places where corn was acquired through exchange. Further research may provide direct evidence of corn cultivation at sites with less fertile soils, thereby corroborating the indirect evidence established here on the basis of consumption patterns.

With the evidence at hand, it would seem that the emergence of centralized authority in the Valle de Quijos was unrelated to economic issues involving the production, circulation and consumption of staples either in the context of a vertical economy or of the control of production on the part of elites. Other avenues for investigating the emergence of social hierarchies in relation to food supply, such as the wild versus domesticate predominance that appeared to have marked nascent social distinctions in other parts of the world (Hayden 1990; Hastorf 1998), do not seem to be of relevance here since the consumption of wild species was apparently ruled by availability regardless of status, assuming that this should correlate with settlement type. Thus nothing in the patterns of production and consumption of foodstuffs evokes anything other than productive autonomy and social hierarchies unmarked by food consumption differences. This suggests, more generally, that patterns of production and consumption should not necessarily be expected to vary with status, which has been proven to be the case in other cases of emergent social complexity (e.g. Henderson 2003); and that other means of social integration and political maneuver not based or exchange or economic dependence or control must have been at play at the time chiefdoms emerged in the region.

It is pertinent to mention as a final note that the above interpretation assumes that social differences must have been more consistently expressed between central settlements and peripheral ones, instead of within central places. This assumption is based on survey data, which suggests a rather dichotomous pattern of denser versus sparse settlements. Had inequality and the social mechanisms that support it emerged primarily at smaller scales, the settlement configuration would be less polarized. Additionally, ethnohistoric sources for this region as well as for other regions in Ecuador describe exactly what is inferred from settlement data—that is, with the exception of a few "pueblos" where the chiefs lived, a remaining population of commoners was rather widely scattered throughout large regions (Oberem 1980; Salomon 1986).

8. SUMMARY AND CONCLUSIONS

The objectives of this research converge on understanding certain aspects of the process of social change in the Quijos region that eventually led to the formation of the chiefdoms documented in the ethnohistoric sources from the 16thcentury. As such, this project aims to contribute to a body of literature that is concerned with the emergence of social inequality more generally, and with the interconnection between this phenomenon and the organization of the economy in ancient societies. The relevance of such an approach cannot be overstated, as the literature on early inequality is loaded with propositions about the economic determinants of political authority centered on a universal drive towards accumulation and economic control as a crucial step towards political aggrandizement (e.g. Hayden 1995, 1996; Roscoe 2000). This view has influenced the very idea of what a hierarchical society or chiefdom is to such an extent, that negative evidence of economic control has led some scholars to argue that another societal type must be conceived that accounts for the appearance of social distinctions in the face of economic autonomy (McIntosh 1999; Stein 1994; White 1995). In this chapter I summarize the findings of this research and discuss them in the context of prevailing ideas in the literature about chiefdoms and their economies.

The most elemental information needed to begin this task was a diachronic outline of socio-political configurations at a regional scale. Although a regional approach does not exhaust the multiple dimensions of social life involved in processes of political change and social differentiation (Bermann 1994:3-14), it constitutes a promising window through which such processes can be tracked, and their nature, magnitude and impact on large populations assessed. The regional survey conducted in the Valle de Quijos provided such a perspective, formerly unavailable, on our understanding of pre-conquest dynamics in the region.

Through this study, a sequence of changing political configurations was identified. This started with the formation of a modest quantity of very small, dispersed settlements with a preference for the lower altitudes, and less mountainous and generally more fertile lands of the eastern portion of the survey region during the period labeled here as Early 1. This preference did not preclude occupation of virtually every section of the region investigated, even though the pattern is one of more dispersion and even smaller settlements outside of the eastern section. In general, settlements are very small, with about 40% of the occupation accounted for by settlements smaller than 1 ha (Figure 3.6), and the range of variation in site size (from less than 1 ha to about 10) or density in 500 x 500 m grid units (from less than 1 ha to about 8) is small. The specific forms of interaction and integration that existed among these settlements are not evident from the survey information, but the very weak character of settlement differentiation (limited to the presence of a very few settlements slightly larger than the majority) seems to be most closely in agreement with the interpretation that this settlement organization represents an egalitarian society. The very low population densities (less than 2% of the survey area was occupied), even in the most populated subregion (only 3% of the northeastern subregion was occupied), imply that widespread settlement distribution could not have been related to resource scarcity or environmental conditions of any kind. Further, constraints related to productive activities that require wide land availability (e.g. shifting cultivation), would not have required such wide spacing between settlements. Instead, small settlements and remarkable dispersion are probably better thought of as part of a preference for an autonomous lifestyle in which the local settlement must have constituted the core of social and productive activities. Material traces left by this early population are limited to ceramic fragments of remarkable homogeneity throughout the region (usually undecorated, and with a small array of forms). Thus besides what can be extracted from the nature of settlement organization the issue of social and political configuration during this early occupation remains elusive.

The subsequent occupation, Early 2, is quite similar to that of the Early 1 in terms of the extent, nature and distribution of settlements. A very subtle tendency towards settlement growth in a few areas of the region may indicate the formation of slightly larger social units that are still not enough bigger to argue that the pattern of Early 1 was fundamentally modified. The largest settlements and most densely occupied areas continue to be more typical of the northeastern subregion, and distribution throughout the survey area is essentially the same, although the density of occupation in the southern subregion increases slightly more than in the other two sections of the survey. Similar to the Early 1, small settlement size is the norm; about one-fourth of the occupation is accounted for by settlements smaller than 1 ha, and population densities are similarly low. Changes so modest with respect to the Early 1 warrant no further discussion beyond that which was already provided for this period.

The same cannot be said about the Late Period, when more obvious transformations took place both in terms of population growth and its spatial organization. It would not be accurate to characterize this as an even process, though, equally felt across the population. Rather there was a very strong tendency towards population growth and concentration at a few locations, while most of the population was more conservative in terms of settlement organization, settlement size and distance between settlements. The three largest population aggregations (in the northeastern, northwestern, and southern portion of the surveyed region) are disproportionately large and compact as compared to the most prevalent form of settlement organization: the dispersed small settlement; and I interpret them as the first clear manifestation of social differentiation in the region. These three largest settlements and their surrounding populations, despite their similar configurations, are not, however, the product of a uniform sequence of demographic change in each of the three subregions. To the contrary, subregional demographic dynamics diverged throughout the sequence and converged only in the Late Period; with the emergence of a population center in the northwestern subregion representing the most unanticipated demographic outcome. Given the very low regional (less than 13%) and subregional population densities, these settlement concentrations are hard to explain by reference to environmental factors. With plenty of opportunities for dispersion, given that more than 85% of the usable land remained unoccupied during the Late Period, polarization in terms of population aggregation is more meaningful. Additionally, the presence of both nucleated and dispersed settlements at each one of these environmentally distinct subregions does not suggest a correlation between environmental setting and settlement organization, but instead, social dynamics similarly reflected in spatial organization despite environmental diversity.

In summary, a sequence of demographic change is identified through settlement analysis, revealing changes that resulted in the emergence of differentiated settlement types, interpreted as an emerging social hierarchy, across the region. I consider it important to emphasize the uneven nature of this process of demographic change, not because it is an uncommon occurrence in the history of most (if not all) complex societies, but because the latter is more often than not conceptualized as an all encompassing “regional” dynamic, to the extent that “population growth" or "centralization" very broadly understood, are expectations associated with the emergence of complex polities in general. While regional population aggregations did emerge in the different subregions, emphasis on the asymmetric character of these population changes in the region is relevant because it directs attention to the degree to which the socio-political changes that resulted in the emergence of differentiated settlements were felt by the population that did not take part in the emerging elite sector, and leads one to ask what kind of system of authority and social integration was in place that would allow for remarkable spatial disaggregation. The demographic patterns found here, where a large percentage of the population remains dispersed throughout the sequence, seem to indicate that the emergence of socio-political centralization did not compromise the population's ability to live in what was consistently the preferred residential pattern, but the sources of the observed socio-political changes are not well understood. This project explores one of the multiple avenues that could have led to a process of increasing social differentiation, through the study of economic organization, and towards that end I evaluate different models that could explain possible relations between political dynamics and the organization of the Late Period agrarian economy.

The first model draws on a recurrent view in the anthropology of the Andean region, that of socioeconomic integration through specialized production, or verticality in short. This is assumed to reflect a social adaptation to an ecological reality of dispersed resources, and to harmonize with (and even constitute the source of), an essentially Andean ethos of reciprocity woven through networks of exchange (Isbell 1978). According to the verticality model, exchange relations must have acted as a social glue, helping to integrate otherwise dispersed "communities" in the absence of centralized control, through redistributive mechanisms linked to the political (although not necessarily economic) ascendance of elites. For some scholars, though, these exchange activities must have contributed to political ascendance linked to resource control, the very reason why the model continues to be relevant for studying ancient complex polities in the Andes (Earle 1996; Kolata 1992), and can still be used while avoiding a rather essentialist and ahistorical notion of Andean reciprocity (van Buren 1996). According to this second approach, exchange networks must have been woven in ways so that some could pull more from them than others, and benefit accordingly.

I looked at settlement distribution across environmental zones and at production and consumption practices at locations that represent such zones in order to examine this model. As an expectation, a tendency towards evenly occupying the entire environmental range must have been associated with the emergence of social differentiation in the region, which in turn should mirror patterns of specialized crop production and consumption practices that revealed exchange activity at work. The latter should be most evident at population centers, where exchange and redistributive activity should have been an important field for the drawing of social differences and political authority, even if elites saw no economic benefits from it. Settlement analysis reveals that preference for the low altitudinal range best describes the settlement distribution throughout the sequence. From Early 1 times, population is present at high altitudes, but its general distribution seems counterintuitive under a model of vertical exploitation, at least from a crude least-effort perspective. This is because the northeastern subregion, where most of the population concentrated during the Early 1 and 2, held only a minimal fraction of the high altitude settlements during any of these periods. Had use of the high altitude resources been a consistent preoccupation for Early period peoples, they would have looked to the higher elevations in the northeastern portion of the survey first. Instead, most high altitude settlements of this Early occupation appear in the southern and northwestern portion of the survey (see Figures 4.4 and 4.6). A moderate move towards the high altitude range during the Late Period could have resulted from an attempt to use high altitude resources. The still low population densities in the northeastern subregion, which allowed much of the best lands in the entire survey region to remain vacant, could have hardly created the kind of pressure that would have prompted people to settle on lands of lesser quality elsewhere; thus an incipient vertical economy would seem a more viable interpretation, except that even the high altitude settlements are clustered towards the low end of the high altitude range. Two additional observations are also inconsistent with this scenario, and in particular, with the idea that this was associated with political aggrandizement. First, the amount of the high altitude occupation in the northeastern subregion, where a large population was still settled and where the most populated settlement is located, is the lowest for the Late Period. Second, two of the three Late Period population centers were formed in high altitude locations, in areas that lack the altitudinal diversity of the northeastern subregion. This disjuncture between the location of population centers and access to or occupation of diverse altitudinal zones within their most immediate surroundings does not in principle suggest that economic interdependence was at the core of the process of social differentiation in the Late Period. Yet it does not necessarily preclude this possibility, and therefore botanical analysis was employed to pursue it further.

In a comparison of production and consumption patterns in high and low altitude settings, both nucleated and dispersed, it was expected that a specialized agrarian economy during the Late Period would produce distinct botanical assemblages at different elevations. Thus, evidence of production would consist of plant assemblages that are typical of the different altitudinal ranges, while evidence of consumption would have pointed to plants that are not likely to have been cultivated locally. The large nucleated settlements should contain more non-local crops as an indication of their importance as redistributive, or more generally, exchange centers. From the reconstruction of production and consumption patterns, however, the Late Period cannot be characterized as a case of specialized production. The information about background vegetation in conjunction with crop production and consumption evidence shows that crops constituted the core of the plant diet, and yet the most consistent observation that emerges from the botanical assemblages at each of the sites is that people tended to cultivate and use only crops that are well suited to their own locations (Figure 7.15, Table 7.25), exactly what one would expect from a subsistence economy based on availability and ease of production under local conditions. Not even the two central places included in the sample of sites investigated yielded evidence of food exchange; to the contrary, people were growing beans at near *páramo* conditions in Pucalpa. That at a presumably elite central settlement people were stretching the limits of efficient cultivation of certain crops instead of engaging in food exchange as a means of gaining access to low altitude resources is more suggestive of an agrarian economy characterized by autonomy and self-sufficiency, and uninfluenced by elite demands or elite-related dynamics. Finally, the botanical analysis did not yield evidence of crops, other than corn, associated in the Andes with elite activity (e.g. tobacco, coca), which may not have been possible to cultivate at the two central places sampled (as both are high altitude settlements), and that loom large (coca in particular) in the literature about trade in the eastern flanks of the Andes (Bray 1995b, 2005; Langebaek 1987, 1991, 1992). Only chili peppers, argued to be important in Andean ceremonial preparations (Earle et. al 1987; Gade 1975; Hastorf 1998), are represented at Bermejo, one such central place, but the crop in this case is not necessarily outside of its cultivation limits. While this could still be taken to constitute the one remnant of status marked by food distinctions, the evidence is meager (3 seeds) and not backed by other manifestations that could speak of a trend.

A second alternative that links emerging social hierarchies to aspects of the agrarian economy examined in this research draws from models that see political leadership as contingent upon control of resources and material accumulation (Earle 1996) within the context of Andean complex societies. Control of best land and/or resource mobilization in this case would have presumably been sought by elites in the interest of increasing corn availability (whose productivity is greatly enhanced in good soils), which according to ethnohistoric sources, was the one crop North Andean chiefs consistently used for feasting purposes. The patterns of occupation of areas with different productivity throughout the sequence, however, are not consistent with strategies of resource control or monopoly, and botanical information yielded no indication of resource mobilization. While central settlements did tend to correspond to areas with more fertile soils, there was an abundance of the best agricultural land that was either uninhabited or inhabited in a much less centralized fashion, producing only a nebulous association between settlement type and agricultural resources at any point in the sequence. During the Early 1, the largest settlement corresponds to the best soil category, and about 40% of the population settled in this soil type. That the remaining 60% settled elsewhere, including on the worst possible soils, while only 5% of the area with best soils was inhabited, indicates plain disinterest in accessing the best possible lands when the egalitarian social structure was less likely to produce resource use restrictions. These patterns of settlement distribution in relation to soil productivity see little change during the Early 2. Still, about 40% of the area of occupation corresponds to the best soils, but only 6% of the most productive areas were inhabited. Most notably, there is a small increase of occupation on the worst soil categories, which happened at the expense of less occupation in the second best soil category. This inconsistent association of people-land distribution, in the context of extremely low population densities in the most productive areas, suggests a settlement rationale only erratically governed by optimization in the use of agricultural resources. Interestingly, the Late Period comes with drastic population growth, and yet, the distribution of population with respect to land productivity typical of the Early Period remains intact (Figure 5.5). In summary, the association between land productivity and density of occupation is positive and persistent through time, but contrary to the expectations of the model of resource control, it was at the beginning of the sedentary occupation, when land was plentiful and access most likely to be unrestricted, that the correlation between soil productivity and settlement density is the strongest and the most significant (Table 5.9).

This of course did not have to preclude Late Period elites from increasing corn availability through local production and/or resource mobilization, a third scenario that was evaluated through the analysis of botanical remains from locations that represent different settlement types with different agricultural potential. This analysis emphasized the importance of corn consumption relative to other crops, expecting that this should predominate at central places; but again there is no evidence that this was the case (Figure 7.16). Both central and peripheral settlements, regardless of soil productivity, resemble each other very closely in terms of the importance of corn consumption, at least as seen in the proportion of corn remains relative to other crops, and in all cases, corn appears to have composed the bulk of the plant diet. Although the relatively incomplete preservation of other plants as compared to corn could factor in this conclusion, the cultural history of foodways in the Northern Andes could also account for this heavy emphasis on corn (Hastorf and Johannessen 1994; Llanos and Campuzano 1994; Salomon 1986; Super 1988). This cuisine structure based on one main crop has contemporary counterparts in North Andean and Amazonian indigenous groups, among which practically all daily meals are composed by one ingredient prepared and consumed in the same way (e.g. barley prepared as barley gruel in the central Ecuadorian highlands [Weismantel 1988], or manioc prepared as non-alcoholic manioc *chicha* in the Ecuadorian Amazon [Perreault 2000:178-9]), with other crop contributions to the diet ranking comparatively low. Thus, it is likely that the botanical remains recovered here are indeed reflecting a diet based heavily on one main staple. Therefore, even if *chicha* consumption cannot be fully assessed from the current botanical data and necessitates support in detailed ceramic analysis, area excavations that are more likely to yield processing tools, or the identification of corn varieties specifically used for *chicha*, at least we have learned that everyday food consumption was not an arena of social differentiation or elite distinction. Further, a simple ceramic analysis that looked at presence and absence of jars, bowls, and decorated pottery across the sites excavated shows the presence of all of these elements at all locations. (Decoration in the Cosanga ceramic type is most commonly painted and most frequent in *compoteras*, the bowls with pedestal supposedly associated with ceremonial behavior, and in large jars with anthropomorphic decoration as well.) More exhaustive analysis may indicate that ceremonial *chicha* consumption could have been more strongly associated with central places, but at the very least it is clear that elites did not monopolize this activity and that any exclusiveness that may have existed was not expressed in the possession of what could be called fancy ceramics. Langebaek (1995:155) makes a similar point for the Muisca chiefdoms, arguing that even for the Late Muisca, ceramics associated with feasting activities are difficult to tie exclusively to chiefly centers; Cobb (2003:68) argues along the same lines for the case of Mississippian chiefdoms. These cases, and perhaps the one studied here, may be indicating forms of social differentiation in which the reproduction of social relations is marked by ceremonies that are not exclusive and where exclusiveness itself is downplayed (van der Veen 2003), in a way similar to the one described for "feasts of merit" (typical when access to political office is hereditary) as opposed to "competitive feasts"(Dietler 1996; Junker 2001). It is when the need to mark difference predominates that ceremonialism results in the use of special foods; while ceremonies that simply reaffirm the status quo are characterized by emphasis on quantity and elaboration of common staples (van der Veen 2003).

Another possibility is that higher productivity at central places, instead of resulting in more corn consumption in the form of *chicha* or in other preparations, could have translated into privileged access to luxury or foreign goods in lieu of staples, as documented for other regions (Langebaek 1992; Muse 1991; Earle 1996), but the material assemblage at central and peripheral settlements is remarkably similar in its lack of special items. The presence of Cosanga *compoteras* in elite highland circles for feasting and funerary purposes, used to exemplify how the Quijos economy supposedly gravitated around demands of a trans-regional exchange system, does not seem to have a counterpart in the material assemblages of the Quijos region. If Quijos goods indeed contributed to the political endeavors of highland chiefdoms, this apparently did not result in an equivalent effect for the Quijos polities through the crystallization of a lasting form of material display. The lack of preservation of exclusive status markers (such as feathers, blankets and bark mentioned in colonial documents) could be argued to be responsible for the austere depiction of social hierarchy drawn from this research. But even the acquisition of such items may not have required significant material inputs, as if it occurred, it did not leave traces of differences in the agrarian organization of elites and non-elites.

Additionally, the analysis of a sample of obsidian artifacts from survey collections and test pits, does not suggest specialized production or controlled distribution of raw materials either. The obsidian assemblage indicates a primarily expedient, flake-tool technology, with only a small amount of formalized production debitage. Thus a formalized technology existed alongside the more dominant expedient technologies. However, the spatial distribution of obsidian artifacts that are the product of either expedient or formal technology appears to be random, and edge wear patterns do not reflect differences in use. The only difference is seen in the size of raw obsidian material, but this appears to be related to distance from rivers where large cobbles are found more easily. Yet, in general, everyone seemed to have access to plenty of obsidian and to have used it in similar ways.

Thus, it does not seem that control of a group's wealth, individual accumulation or conspicuous consumption were at the core of social differentiation among Quijos chiefdoms. If, as the classics (Fried 1974; Service 1962) suggest, political authority based on economic control must demonstrate actual control of a group's wealth that goes substantially beyond simple individual accumulation (as status is an attribute of the lineage or of larger kin groups, not of individuals), the emerging chiefs of this region could not have been further from representing a model of leadership based on economic control.

This research has delineated a demographic trajectory that reveals increasing socio-political differentiation in the Quijos region during the Late Period. Interestingly, there was a great deal of similarity in the agrarian economy across the social spectrum and no hint of specialization, interdependence, or resource control in the period when the most dramatic social transformations took place. In other words, the exploration of different alternatives that linked the agrarian economy to political ascendance failed consistently to provide evidence that emerging elites held any type of material advantage, or differentiated themselves through foodways, when compared to the rest of the population. Although much of the literature leads one to expect that status variations would depend on differences in the agrarian economies and relate to different consumption practices of elite and non-elite sectors of society (e.g. Earle 1987; Johnson and Earle 1987; Hayden 1996; Kristiansen 1991; Price 1982), this was not the case. This research was not designed to study the intra-settlement scale of analysis. If this constituted the principal locus of social differentiation, this study did not target it, and there is surely much that will be learned from focusing on this scale in the future. It is unlikely, though, that intra-settlement analysis would reverse the current conclusions because the forms of economic organization investigated should leave the kinds of regional-scale patterns this research would have found. Indeed, that type of differentiation was not expected because this research assumes that social inequalities emerged and were mostly expressed between central elite settlements and peripheral ones, and that the local elite or non-elite scale was not an active ground of social differentiation. This aspect of the processes of social change in the region, however, remains a topic of more detailed investigation, and should include research not only at a smaller scale but a larger one, as it has been argued that chiefly competition, despite being personalistic, is founded in the regional centrality that it can achieve; and in that sense hierarchy is expected to be heavily expressed at the horizontal level at inter-regional scales (Helms 1992,1994).

One more aspect that deserves discussion is how to interpret the Late Period demographic changes in conjunction with economic dynamics. If the sources of political authority and its exercise among the Quijos chiefdoms did not require large-scale "financing" or great material input, the diverse demographic dynamics that mark differences between elites and non-elites cannot, consequently, be related to labor and productive burdens imposed by political aggrandizement, as has often been argued (Hayden 1986; Sahlins 1972; Stone 1993). These demographic aggregations must have owed more to other social factors, such as alliance formation, than to elite household economics. Recent revision of ethnohistoric documentation for the region suggests that transactions of a non-commercial nature, specifically marriage alliances (spouse exchange), were the driving force behind the systems of regional and inter-regional interaction of which the Quijos chiefdoms were supposedly a part (Uzendoski 2004). According to Uzendoski, emphasis on the exchange of products in the form of a vertical economy (Oberem 1980), which characterizes the Quijos as "professional traders," is misleading as it obscures the ultimate importance of regional and inter-regional contacts: "In Quijos, regional exchange would be central to the maintenance of social complexity for political and military alliances, as well as for religious purposes" (Uzendoski 2004:333). These alliances proved to be much more than sporadic or ceremonial connections among chiefs following the Spanish colonization. It was because of the extended kin ties between the *señor principal* of Quijos and Sancho-Hacho, chief of an important highland polity whose sister married the Quijos chief, that Spanish officials in 1558 were invited to Hatunquijos (a renowned chiefly settlement near Baeza) as per Sancho-Hacho's request. These political networks were powerful in terms of interregional strategizing years later, in 1578, when a pan-regional revolt against the Spaniards was plotted with the "great cacique Jumandi," from around Baeza, as a leader. The *revolución de los pendes* (revolution of the shamans) mobilized the local population plus that of at least two adjacent regions (Avila under chief Guami and Archidona under chief Beto), following declarations from these chief-shamans that those who did not collaborate to annihilate the

Spaniards "would suffer shamanistic attacks" (Rumazo González 1946:192 in Usedozki 2004:323). Thus, decades after Spanish presence in the region, a strong power of leadership could be materialized at the regional, and even pan-regional, level. The revolt was quickly controlled by the Spaniards and Jumandi was publicly beheaded, after which the Quijos fled the region, making it "a colonial frontier rather than a colonial project" (Usendozki 2004:324).

The apparent nature of these events suggests a form of leadership well documented for the intermediate area, where according to Helms (1992), the measure of chiefly success was, typically, the capacity to maintain a religious structure and an alliance network that could be called upon, instead of any degree of material accumulation that could be derived from that. The deeds of Jumandi speak of a form of leadership based on religious authority that harmonizes at a general level with the findings of this research, albeit indirectly, and with countless accounts of pre-conquest and contact-period complex societies in the Americas (e.g. Bawden 1996; Burger 1992; Demarest 1989; Drennan 1976, 1995; Flannery 1968; Helms 1979; Kolb 1994; Rappaport 1987) and elsewhere (Kuijt 2000; Stein 1994). While the material correlates of religious authority are elusive in this case, the lack of economic differentiation is not inconsistent with this possible scenario (Burger 1992). If the foundation of emerging social differentiation was not economic, but was, for example, linked to religious authority articulated in a network of alliances, there is little reason to expect that the differentiation between elites and commoners, or the political success of the former, should have an economic expression. Rather, while these dynamics may have contributed to an increase in population at central places through the addition of spouses, their motivations could have been ultimately social and related to prestige (perhaps in the same way that large "life-producing" families, or those that "make kin" [Harner 1972; Weismantel 1995] are associated with high status in contemporary Amazonian and North Andean societies), with little impact on production and distribution practices. It is of course possible that additional staple production or other productive activities (such as craft specialization) could have been facilitated by virtue of a larger labor pool at central places. Yet, as far as the main question that this project focuses on, if more intense staple production or craft specialization were typical at such places, this apparently did not result in an elite structure of agrarian production different from that of the commoners. While this scenario does not preclude the possibility that elite authority among Quijos chiefdoms could have come to result in material control and accumulation at some later point, this remains only one of many possible trajectories.

APPENDIX A

CERAMIC CHRONOLOGY

No different from practically any other part of the world, the bulk of archaeology in Ecuador has been dedicated to the description of ceramics, excavation of monumental sites, and attempts to track the dispersion of ceramic horizons. Within this orientation, attempts to create new ceramic chronologies to fit the variations seen at particular sites within regions are very common. Breaking down known types into more types is a frequent outcome of this approach. No doubt a refined ceramic chronology is not only desirable but also necessary to answer most research questions in archaeology, but it would seem that there is not always agreement about what a useful ceramic chronology is and how far one needs to go before feeling satisfied with the one in particular. The most general assumption though, is that there must always be more types, and that more types is *de facto* better than fewer types. This has been the main factor behind the temptation to incessantly refine (or incessantly criticize) existing ceramic chronologies. There are a number of things that archaeologists can do better with refined chronologies, yet the urgency to work towards chronological refinement should be relative to the time scales in which the social processes to be studied function, which should in turn indicate the temporal resolution at which specific research problems can possibly be dealt with. Awareness of the speed at which certain kinds of changes operate and are expected to be reflected as changes in material culture, ceramics specifically, should be the main factor at the time of deciding how much effort to invest in chronological refinement (Bailey 1983).

The study of chiefdom emergence in the Valle de Quijos, as a long-term process of socio-political change deals with a time scale that most would associate with the bottommost layer of Braudel's time scales layer cake, a scale related to broad and gradual social changes whose effects are fully recognizable in long spans of time. Therefore, using a chronological scheme whose periods are long, generally a number of centuries long, should not, in principle, be seen as an impediment to accomplishing this task. Although justifying this aspect of the research would seem at first unnecessary, it anticipates questions that emerge commonly in these cases, such as, how does one control for possible changes within a given period, or how does one know that the time scales designed by archaeologists on the basis of material culture changes constitute meaningful time scales for the analysis of social change. The answer to the first question is very easy: changes within a period cannot be tracked, but it is assumed that—and in response to the second question—major social and political changes must have an obvious material manifestation in the most widespread item of material culture in most ancient societies (pottery). Thus, changes that do not correlate with a transformation of material culture must not have been drastic and equally meaningful as compared to changes that led to such transformations. In pretty much any long term trend in the social and physical world, change, even if directional (instead of cyclical, for example), occurs in an oscillating fashion, sometimes leaning towards what will be later identified as a trend, sometimes retreating from it, yet the overall effect is distinguishable and unequivocal when enough of the fluctuation is observed at once. Detailed consideration of peaks, valleys, retreats or advances at fine grained time scales is intrinsically interesting to witness as an expression of the oscillating nature of many processes of change, but does not necessarily speak better of trends that are instead defined by reference to long spans of time. In a similar fashion, periods of time defined on the basis of limited change in material culture can also be seen as intrinsically stable periods, during which, despite oscillations, fluctuation is the exception rather than the norm. Adhering to this conception of change and material culture does not call for control of oscillations within a given time span and should not pose doubts as of the appropriateness of tracking broad patterns of social change by looking at changes in material culture that occur in the span of many years or centuries.

PRE-HISPANIC TEMPORAL FRAMEWORKS FOR THE ANALYSIS OF SOCIAL CHANGE IN ECUADOR AND IN THE VALLE DE QUIJOS

The archaeological information for Ecuador has been organized according to the scheme proposed by Meggers and Evans since the 50's: Pre-ceramic, Formative, Regional Development and Integration periods. Meggers and Evans and subsequent researchers have applied this scheme to virtually all regions of Ecuador, from the coast to the highlands, to the Amazon. The association of local ceramic chronologies to these major periods, which represent spans of time that are commonly thought of as a set of distinctive traits of social, political, and economic organization, has been done in a rather automatic fashion, privileging correspondence of absolute dates instead of correspondence of actual socio-political change. Typically, when dates associated with certain ceramic types fall within the span of time believed to correspond to, say, the Integration Period, then it is assumed that the society in question at that time should have been a typical "Integration Period society." The characterization of such periods and their transitions suggests a unilineal and uniform path of social change. The Formative Period (1000 to 300 B.C.) is characterized by sedentary communities but without signs of permanent authority or political centralization. The period of Regional Developments (300 B.C. to 800 A.D.) is supposedly characterized by the development of regional political centers and growth and settlement expansion. The Integration Period (800-1500 A.D.) is seen as the one in which regional centers consolidate (Almeida 2000). These characterizations rarely have a solid empirical basis, and more often than not lead to uniform and hyper-coherent assumptions about social and political change, in which the attributes of certain societal types are believed to change in unison. In this scheme, when there is evidence of a large system of raised fields, for example, the society that constructed them is believed to have had regional political centers and coercive system of authority. For the case of the Quijos region in particular, it has been assumed that the social and political configuration of pre-Hispanic societies corresponds to the traits of the Regional Development and Integration periods, based on the dates available for the region (Arellano 1989).

Porras (1975) made the first attempt to establish a ceramic chronology for the Quijos region based on sherds collected during his fieldwork in the 50's and 60's. He proposed that only one major block of time could be distinguished, one in which Cosanga pottery was predominant, and that despite the existence of other ceramic types whose frequencies varied through the stratigraphic sequences, none of them had ever been dominant types so as to represent a different phase. The observations that led him to this conclusion are that Cosanga sherds appeared in all but one of the levels in the 16 stratigraphic tests he excavated. Porras paid attention to the changing frequencies of the ceramic types he defined (Papallacta Ordinario, Cosanga Ordinario and Borja Ordinario in chronological order from early to late, plus 13 types of decorated Cosanga sub-types) as they related to the stratigraphy. He identified some trends (that the size of the temper particles tended to diminish through time, that certain decorations were common at the lower or upper ends of the stratigraphic sequences), but concluded that because the quantities of Cosanga pottery were so overwhelming in comparison to the other types and did not give way to other types to stand by themselves in the stratigraphic sequences, the use of this ceramic type must have been common from the beginning of ceramic occupation in the region. He assumed that Cosanga must have coexisted with the other types, otherwise Papallacta Ordinario and Borja Ordinario should have occurred alone in at least some strata.

The 11 carbon dates provided by Porras range from 665 B.C. to 1810 A.D. (a date of 1495 B.C seems too early and therefore is not considered here, and another date is modern). All of these dates come from strata in which Cosanga pottery was present, explaining why he took the whole range of dates to define the Cosanga Phase (discussion of these and other dates is found below in this chapter), yet he averaged them in a way that produced a range between 400 B.C. and 700 A.D. as the span of time of the Cosanga Phase. Specifically, he called this phase Cosanga-Píllaro I and II for the piedmont, and Cosanga Píllaro III and IV to the span of time in which Cosanga pottery is present in several parts of the northern and central sierra (700 to 1500 A.D.), but supposedly not in the piedmont. This fit nicely with his assertion that the Quijos had been expelled from the piedmont by hunter-gatherer groups from the Amazon and forced to migrate to the sierra.

The association of a number of late dates with Cosanga pottery in the northern highlands constituted for some researchers solid proof of Porras' hypothesis regarding the expulsion of the inhabitants of the Quijos region (e.g. Athens 1995). This has been based on a reading of Porras that overlooks the fact that he averaged the radiocarbon dates, as some other researches have already noted (Lumbreras 1990). Regardless, at least since the 70´s, recurring discussion of archaeology in the Quijos region of Ecuador, has centered for the most part on the origins of

Cosanga pottery found in the highlands, the reasons why it is present there, whether it was locally manufactured or imported from the Quijos region, and revisions of Porras' work and conclusions (Arellano 1989; Bray 1995a; Buys 1995; Lumbreras 1990; Oberem 1981). This discussion has now even been named "the Panzaleo puzzle" after the name Jijón y Caamaño gave this pottery in 1952 and it continues to be a hot issue of debate today (see Ontaneda 2002). Apart from Panzaleo, Cosanga, and Cosanga-Píllaro, this ceramic type also appears in the literature as *Cerámica Fina* or *Cerámica Delgada.* For the sake of avoiding confusion we will consistently refer to it here as Cosanga. This type of ceramics has appeared consistently in the northern highlands in burials and mounded sites, which has been interpreted as evidence that Cosanga pottery outside the Quijos region was mainly an elite prerogative and had ceremonial usages (Bray 1995a). The forms, mainly decorated bowls with pedestals known in the literature as *compoteras* and large round jars with anthropomorphic decoration, are indistinguishable from the ones found in the Valle de Quijos, and the results of several mineralogical analysis (Arellano 1989; Bray 1995a; De Paepe and Buys 1990) agree that the specimens found in the highlands must have been brought from the eastern slopes of the Andes. Despite intensive study of the distribution of this ceramic type outside of the eastern piedmont, the gaps that Porras´ work in the region does not fill have not been re-addressed by other scholars through the collection of new data. Complaints about the inadequacy of his work are very common, but the tendency has been to use the same set of data that most scholars consider inadequate. Revisions based on re-analyzing his materials are complicated by the fact that a good portion of this ceramic collection is in Washington or else dispersed throughout several museums and monasteries. In this section I re-address Porras´ work with the use of new local data, in an attempt to establish a ceramic typology that, although not substantially refined, helps to identify temporal differences among types and therefore reconstruct a trajectory of occupation in the region through the analysis of settlement patterns.

CERAMIC CLASSIFICATION

The ceramic classification used in this project serves the main purpose of allowing the chronological placement of the settlements identified in the regional survey. It was created to allow the chronological identification of sherds collected without a stratigraphic context and without association with absolute dates, and is based on the excavation of stratigraphic tests. The vast majority of materials collected in the regional survey are small non-diagnostic sherds without decoration. In the eyes of some people these are worthless, because classification should focus on the more reliable diagnostic and decorated sherds (yet considered a poor substitute for complete ceramic pieces). Although it is certainly the case that form and decoration are very important chronological markers, using them alone in this case would have implied ignoring the bulk of the ceramics collected, and therefore, most of the sites in the regional survey could have not been assigned to a chronological period. This would have been a very unfortunate outcome, equivalent to treating only large sites with architecture as informative and worth the effort of archaeologists. In fact, none of the publications that review the work of Porras mention the presence of *Papallacta Ordinario* and *Borja Ordinario* in the excavations. Despite extensive attention to the ceramics of the region (in reality only to the Cosanga pottery), no one has ever questioned how Porras arrived at the conclusion that there had been only one occupation in the region, or why he did not make much of any of the different types that accompanied Cosanga. Thus, undecorated sherds different from Cosanga have simply not been dealt with, apparently because they are not "fancy" in the eyes of many archaeologists or because the quantities are comparatively so low that they are not perceived as worth the effort. In this project they will receive equal treatment.

The process of classifying ceramics is always guided by the goals of a project. From the infinite factors that can enter a matrix of classification criteria, one generally chooses those that are most likely to provide the necessary information to answer specific research questions. In that sense, a classification that accounts for all of the possible dimensions of ceramic variability is never possible, and no classification is ever "complete" in this sense (Sinopoli 1991:44). The dimensions of variation used in this project are surface, paste, temper, form, and decoration. When the attributes of more than one ceramic type were present on a single sherd, the tendency was to favor attributes related to general appearance to classify it. Drennan (1993) has suggested that because people are ultimately concerned with appearance when making and using pottery, attributes that relate to it are more useful than others such as temper—which may reflect just variations in the distribution of minerals in a region.

The types proposed below, as types that predominated during different time spans, were defined through the analysis of materials from 46 stratigraphic tests spread throughout much of the region that was surveyed. Of these 46 tests, 15 2x1 m tests were excavated with the specific aim of establishing a ceramic chronology that could be used to analyze the materials of the entire region. The remaining 31 1x1 m tests were excavated as part of a program focused on the recovery of botanical remains, yet many of them were informative in terms of chrnology, as they strengthened observations derived from the former set of tests. The methods and rationale for selecting sites for excavation of the 2x1 m tests are explained below in this section (detail about the selection of the locations of 1x1 m tests excavated with the main purpose of recovering botanical samples is provided in Chapter 6). In the process of analyzing ceramics and sorting them out into types with chronological significance, survey materials were used as referents against which to compare what appeared in the excavations and test the utility of the typology in terms of accounting for the vast majority of ceramics collected in the survey. This process of defining types based on materials collected with a stratigraphic context, and then using the typology to classify survey materials was repeated, back and forth, until the process of classifying survey materials ran more or less smoothly. The types presented here were initially subdivided into more types, as explained below, and finally grouped together again in the way that seemed most appropriate in terms of accounting for temporal variation. Future research may lead to the conclusion that some of those sub-types are chronologically distinctive, but for the moment the evidence does not seem strong enough to make that assertion. The schema utilized here seemed the most unproblematic and straightforward in terms of allowing the classification of survey materials, and has strong support in the analysis of excavated ceramics.

The 46 stratigraphic tests yielded 9,506 sherds. 2,121 of the 2,256 lots of the survey (133 lots contained only lithic material) were classified using this typology (23,585 sherds). Some sherds did not seem to fit any of the type definitions and therefore were not classified. These comprise less than 1% of the survey materials, and could only have negligible impact on the interpretation of regional settlement patterns. All of the sherds from excavations and regional survey were classified by the author and one research assistant.

CERAMIC TYPOLOGY AND CHRONOLOGY

Bermejo Thick (Early 1 Period)

The main characteristic of this type is a coarse paste with very large temper particles, covered by a thick slip that seems smoothed but not polished. Porras' description of Papallacta Ordinario resembles this type in many respects, and also has a tendency to predominate in the lower portion of the stratigraphic sequences that he presents (Porras 1975: 117, 145). This type was named after Santa Lucía del Bermejo, the first site that provided the clearest indications of its chronological position in a neat stratigraphic context. It is very possible that this ceramic type is the same that Porras called Papallacta Ordinario, but I decided not to use this name without having examined Porras' materials.

Surface: Smoothed but not polished, with a technique that sometimes leaves tracks. It is opaque or has a very slight burnish and occasionally traces of red or purple paint can be seen. Large temper particles occasionally erupt through the surface despite a thick, hard slip that does not separate from the paste with ease. The slip is normally thicker (sometimes 1 mm thick) on the outer surface and well preserved for the most part. It contrasts with a generally dark and coarse paste. The color is uniform, grayish beige, grayish brown, and sometimes slightly orange or creme. The general appearance is of a slightly bumpy but smooth surface, but when this is not preserved it looks porous and irregular and feels rough to the touch.

Paste: Coarse, very porous, and crumbly. It easily disintegrates into large temper particles and chunks of clay producing a low pitch sound when one breaks a sherd. The color is dark brown to black, consistently dark, probably owing to an incomplete oxidation. The few sherds of this type that have thin walls generally have a more compact and uniform paste, with much smaller temper particles. These specimens were initially sorted out as a different type, before recognizing that it was a variation related to thickness and probably to vessel size that is not chronologically meaningful.

Temper: Large particles with sharp angles, black, gray, or white (dark particles are more usual). The size varies but the most abundant that can be observed by eye inspection measure between 2 and 5 mm across.

Walls: Generally thick, between 4 and 10 mm.

Rims: Everted and simple pot rims are the most common. These are thickened and generally short and in sharp angle producing a contrasting narrow neck. Direct rims of neckless pots and bowls occur less frequently.

Decoration: Shallow incised bands, around 3 mm thick, at a 45 degree angle on the rims or shoulder, but also on body sherds.

Pituro Dark Polished (Early 2 Period)

This type is characterized by a dark color and a polished, shiny surface. Porras' descriptions of Papallacta Ordinario and Cosanga Pulida, in different ways, resemble this type to a certain extent. When the surface is not well preserved it may be hard to distinguish from Bermejo, except that the paste is not as coarse, the temper particles are smaller, and the walls tend to be thinner. If the surface is well preserved, the polished and dark surface are distinctive when compared to Bermejo. It follows Bermejo in some of the most reliable stratigraphic sequences, but the assertion that this is a more recent type remains tentative. In many of the excavated tests the two types overlap substantially in occurrence and frequency, or appear intermingled in a way that makes it very hard to determine which one comes first. Nevertheless, Pituro clearly precedes Cosanga.

Surface: Well polished and shiny, it feels very soft to the touch. This generally appears to be the result of the application of a thin, hard and resistant slip that was polished and whose color is darker than the paste. The appearance can be very even or crackled. It can be flaked with a knife, exposing a less smooth surface. Sometimes the surface has the same color as the paste and does not appear to have a slip even though it is very well polished. The color is almost invariably dark, dark brown or even black, and occasionally dark orange (although it is sometimes lighter on the inside, light brown or orange). Small micaceous particles are visible on the surface, and red or purple paint is sporadically seen.

Paste: Compact, of medium texture and hardness, with many visible small temper particles. The color varies from dark gray to dark brown or orange, generally consistent or only slightly oxidized towards one of the surfaces.

Temper: Many small particles are visible. On a dark paste, the most visible are white, which measure less than 1 mm. Gray, black, red and vitreous looking particles (which appear to be crushed obsidian) are also common. Occasionally the particles can be larger than 1 mm, between 1 and 3 mm across, but for the most part they are very small.

Walls: Commonly between 3 and 6 mm.

Rims: Direct bowl rims are the most common, followed by everted pot rims.

Decoration: Series of incised bands a few millimeters wide. Sharp and deep incised narrow horizontal lines on an applied band on the body of bowls are less common.

Cosanga (Late Period)

The main characteristics of this type are a light color (orange, pink, light gray, light brown, or brownish yellow most of the time), a very even surface that has not been polished (with some exceptions), and a sandy and uniform paste. This type was described by Porras (1975) as *Cosanga Ordinario*, and our general observations coincide with his. However, we do not see much of a distinction between his definition of this type and another type he defined as *Borja Ordinario,* and we did not find in our samples sherds that matched the characteristics of the latter that we would not classify as Cosanga. There is no chronological distinction between *Cosanga Oridinario* and *Borja Ordinario* according to Porras, although he argues that the latter may predominate in the uppermost part of his sequence (while the rest of the time simply accompanying Cosanga).

Cosanga is a variable type, but most of the cases conform to the general definition of the type. These apply to Cosanga Fine too, except that in this case we refer to very fine ceramics with extremely thin walls, and often painted in white or red. Cosanga unequivocally dominates in the uppermost levels of the stratigraphic sequences and composes the bulk of the ceramics collected in the survey and excavations as a whole. Attempts to break it down into chronologically significant types on the basis of slight variations in surface treatment (it can be polished sometimes), color, thickness or paste (sometimes rough but most of the time uniform) were not successful. With the information at hand, it seems most sensible to argue that this variability has no chronological significance. On the other hand, it is not really marked enough to define other types fundamentally distinct from Cosanga. Neither of the types defined initially (Fine, Orange/Red, Gray, Polished, Sandy, Sandy Thick, Fine White, "Brick"), shows a special regional distribution suggestive of variations due to location.

Surface: Very smooth in the exterior but only occasionally polished. The color is frequently orange, light orange, yellowish brown, light or bluish gray, or light brown; and micaceous elements are always visible in both matte and polished surfaces. Occasionally it can be almost white or very light pink, or red. Very frequently it is orange on the exterior and gray on the interior. Cooking clouds are common too. The finishing technique is different on the exterior, where traces of the smoothing process are rarely visible, while on the interior, bands of striations in various angles are common. These look very similar to those left by certain thinning techniques. When the surface has been polished it can be darker, brown or almost black, with a crackled appearance that appears to be the result of a very thin slip, and shallow grooves resulting from polishing are sometimes visible. It feels a little abrasive when the original surface is not preserved. The surface characteristics of Cosanga Fine are the same, except that it is never polished and sometimes appears to have a thin red slip. Cosanga may have white, red, black, purple or red painting, while Cosanga Fine may have red or white painting or slip. Cosanga was initially divided into Cosanga Gray (later on we realized that Cosanga sherds could just be orange in one side and gray in the other one, or have gray cooking clouds), Cosanga White, Cosanga Red, and Cosanga Polished on the basis of color and surface treatment, but no chronological differences appear to exist among them. As we familiarized ourselves more with the ceramic materials, it was apparent that these distinctions were not really sharp or worth making (this was especially clear, for example, when some of the different colors appeared in the same sherd), yet to be consistent we continued to sort out sherds into these different groups in the ceramic classification of survey and excavation materials. In the end, the number of sherds that fell into these categories turned out to be tiny (generally less than 1% in both survey and excavations), which may just indicate variations related to the manufacture process.

Paste: Sandy, usually fine, and compact. The color can be the same color of the surface, uniform throughout, or else gray in the core or half gray and half orange (the half gray usually corresponds to the interior surface). Some thicker sherds tend to have a more coarse and crumbly paste. These were initially classified as Sandy Thick, but this distinction does not appear to have chronological significance. In Cosanga Fine sherds the paste is extremely fine and feels powdery when one breaks a sherd.

Temper: Very small particles, white and black are the most visible. Particles larger than 1 mm are rare and found mostly in thicker sherds. In Cosanga Fine sherds, temper particles are not even distinguishable from the rest of the paste.

Walls: Between 2 and 5 mm are the most common. Thick sherds, about 8 to 10 mm, are out of the normal range and were initially classified as Sandy Thick. Because this is very rare (it appeared in only 4 stratigraphic tests) it was difficult to establish its chronological position with certainty, but it has a tendency to be associated with Cosanga pottery in survey collections and for now we are treating it as a variety of Cosanga because of its similar appearance. It represents only 0.54% of the sherds collected in the survey, and appears in only 80 collections. Other than that, the walls of Cosanga sherds are consistently thinner when compared to those of Bermejo sherds.

Rims: Everted rims of restricted pots (straight or curved), direct rims of globular unrestricted pots, long and thickened slightly everted rims of jars, direct rims of bowls. Some variations in edges are common (thickened, doubled onto itself, or flattened). Also very common are bases of *compoteras* (bowls with anular bases, curved or straight, of different heights). Rims of dishes are less common. Cosanga Fine rims include only occasionally everted and curved rims of tiny pots, and in general just bowl rims and *compotera* bases.

Decoration: Painted (both negative and positive), modeled, applied, and incised decoration is common. Painted decoration has various designs, commonly painted in black, red, white, or purple parallel bands or crossed bands in body sherds or in the interior of everted rims. Series of short parallel white lines appear in the bodies and rims of *compoteras.* Painted designs may include perpendicular bands too, in several angles and with negative circles inside the bands. Others similar to a chess-board pattern and curvilinear designs appear as well. Common incised decorations appear in the form of two parallel rows of dots on a rim doubled onto itself, or on a flat direct rim (called *Cosanga Ribete Punteado* by Porras). Bands of hollow circles are common too (called *Cosanga Estampado en Anillos* by Porras). Less common are shallow incised parallel bands. Modeled decoration in anthropomorphic designs appears in the bodies of large pots. Applied decoration includes series or couples of buttons on the rim of *compoteras* (called *Cosanga Bordes con Nudos* by Porras). Sometimes these appear to be modeled instead of applied. Cosanga Fine decoration is restricted to painting. No incised, modeled, or applied decoration patterns are associated with this type.

Jijón y Caamaño (1952) as well as Porras (1975) established some chronological distinctions among decoration types (negative preceding positive and incised for Jijón y Caamaño, positive preceding negative and incised for Porras). Lumbreras (1990) also suggests a division of Cosanga (Early, Middle, and Late) based on the same decorative characteristics defined by Jijón y Caamaño and Porras, contradicting the chronological order that they proposed (Lumbreras argues that incised decoration and negative painting, not positive painting and slip, serve as chronological markers to characterize the early and late manifestation of Cosanga respectively). In contrast, Athens (1980) and Schoenfelder (1981) argue, agreeing with Jijón y Caamaño and Porras, that changes in the type of painting actually serve as chronological indicators. I did not find any consistent trend in the succession of decoration types in the ceramic analysis of excavated materials, nor did I perceive any difference other than decoration between Cosanga sherds with different types of painting or decoration, but the sample of decorated sherds is small and therefore these observations could change if a larger sample of decorated sherds was analyzed.

STRATIGRAPHIC TESTS

Choosing sites for excavation of 2x1 m tests followed observations of the survey materials after this had yielded a reasonable number of collections with which we started to sort out different ceramic types. I chose sites based on collections that appeared to have only one ceramic type and collections that appeared to have more than one. As the materials of the initial tests were analyzed and more collections were available from the survey, we continued to choose more sites, every time narrowing down the specific questions that we wanted to answer with the excavation of each set of tests. This process of narrowing down the questions became more productive as we gained more familiarity with the ceramic materials, and felt more comfortable sorting them out in groups that appeared to be relevant in terms of chronology.

Apart from observations about the ceramic materials of survey collections, observations of the landscape were also important in deciding where to excavate the 2x1 stratigraphic tests. This involved visiting sites that could potentially answer the questions we had in mind (based on survey collections), and choosing one or two that appeared to present acceptable conditions for stratigraphic excavations. We tended to choose sites on top of hills or in flat areas that were less likely to be subject to depositional processes that would complicate the interpretation of stratigraphic sequences. This approach to choosing sites for chronological reconstruction differs from what is more common in the archaeology of Ecuador and other places, in which the tendency is to choose the largest site, the tallest mound, the deepest deposit, or the one with more ceramics and invest a substantial amount of time and effort in one large excavation. The idea is that this single site will provide the best answers to chronological reconstruction. This has not always been the case, yet the excavation of small tests in "unattractive" sites is still looked upon with suspicion arising from the perception that more "attractive" sites will inevitably produce "more" or "better" material. The fact is that "unattractive" sites can actually yield valuable information for chronological reconstruction. Very often small sites without surface features have the advantage of being less disturbed since they do not attract the attention of looters, and because they generally do not yield overwhelming quantities of material, they can be analyzed within much less than one's lifetime, making results available more quickly to the scholarly community. Reducing excavations to a small size also contributes to this end. The efficiency of this approach allows extending observations to many sites (even if "unattractive" ones), which strengthens the interpretation of each one individually. The rationale for this approach is persuasively and extensively presented by Drennan (1993), and this is the one that guided the design of our plan for chronological reconstruction.

Stratigraphic tests were oriented North-South (long axis), and the vegetation cover was removed with shovels. Once the excavation of soil started, shovel and trowel were used alternately and the soil removed was placed in buckets to be examined manually or passed through a 15 mm screen. Excavation layers were defined on the basis of changes in the characteristics of soils, trying to follow the particular stratigraphy in each case, but the generally wet condition of sediments made this goal frequently unattainable. If more than 10 cm had been excavated without evidence of soil change, we started a new level anyway, to be finished either when 10 cm more had been excavated or when soil changes were observed; this was repeated until culturally sterile soil was reached. Often we excavated one more 5 or 10 cm level to ensure that we had exhausted the possibility of finding more cultural materials. For each stratigraphic test we filled out a form that includes observations about the site and its surrounding landscape and vegetation, and details of the excavation. For each level we filled out level number and depth, took notes about the soil and features if these were present, materials collected and number of bags of each type, method of recovering materials from the soil removed (screening, manual inspection), whether samples for radiocarbon dating had been collected, and references to photographs if these were taken. The bags of materials collected in each excavated level were marked with the name of the site, the excavation number, the level, depth, and type of material collected. Drawings of profiles were made on graph paper after each excavation was finished, and sketches or other drawings (of features, for example) were placed on the back of the form that corresponds to each test or in additional graph paper.

Below is a description of each stratigraphic excavation by site, accompanied by a battleship curve graph that depicts variations in the proportions of different ceramic types. Dates are expressed in years B.C. and A.D., and references to enumerated "levels" of excavation are made, counting such levels from the top down ("second level" of excavation, then, means the second level that was excavated). Information on depth will be provided in the descriptions below if it helps to better envision the position of a certain feature or finding.

La Palma

Three 2x1 m tests were excavated here in May of 2002. This site is located 1 km southwest of the town of Baeza Vieja, on the western margin of the Machángara River, and can be reached by walking a trail that departs from the town and runs parallel to this river. The site lies at about 2,100 m above sea level and has been used as pasture for cows in the last few decades. A few artificial terraces can be observed on the western slope below the leveled top of a gentle hill, as well as several *metates* and sherds in the exposed surfaces. This slope descends gently and forms a narrow and small natural terrace before it drops again in a sharp fall. The excavation of these tests and the large samples of Cosanga ceramics that they yielded was productive in that it allowed us to better understand variations in color, thickness, rims, and decoration within the Cosanga type.

La Palma, Unit 1: (VQ001-176821,9948444). This test was excavated on the north edge of the natural terrace below the slope where the artificial terraces are located, in a small elevated area (approximately 4x2 m) where many sherds were observed in the surface and falling towards the slope. This was a shallow deposit (although very dense), only 36 cm deep, and at the bottom we found a hard clayey soil with abundant rocks and no ceramics. The stratigraphy was straightforward (Figure A.1). This test yielded 422 sherds, 409 of which are Cosanga and 13 that we could not identify either because they were too small or too deteriorated. This large sample of Cosanga sherds was very useful for understanding the range of variation within the type.

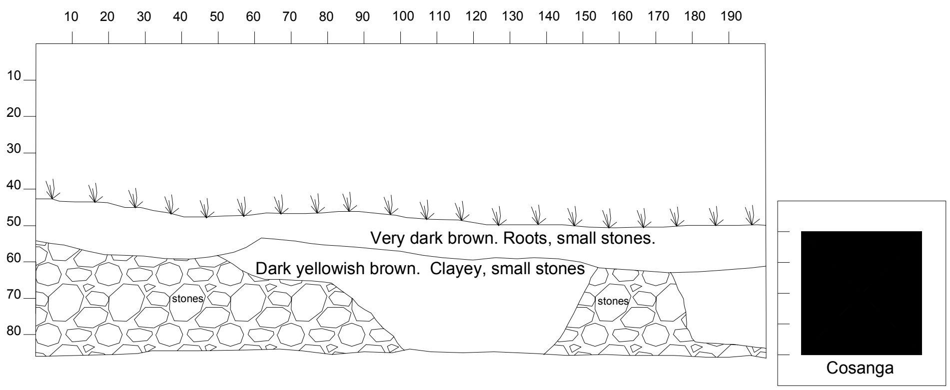


Figure A.1. VQ001 Stratigraphy (NW Profile).

La Palma, Unit 2: (VQ002-176894,9948349). This test, excavated at the edge of one of the artificial terraces in the slope, yielded only Cosanga sherds. This was not as dense a deposit as VQ001 and was excavated until no more ceramics were found (at approximately 65 cm depth from the surface) (Figure A.2).

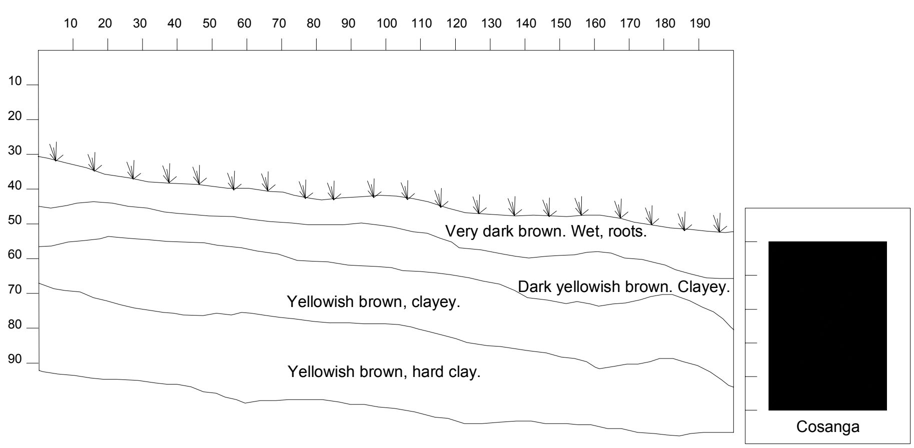


Figure A.2. VQ002 Stratigraphy (S Profile).

La Palma, Unit 3: (VQ003-176931,9948290). Located at the edge of the largest of the artificial terraces on the slope. It yielded 522 sherds, mostly Cosanga, and 3 Bermejo Thick sherds. One of them appeared alone in the bottommost level with cultural materials, and the other two in one of the middle levels. Two more levels were excavated after this one but did not yield any ceramics. The stratigraphy was simple, and this test suggests that Bermejo Thick is earlier than Cosanga (Figure A.3).

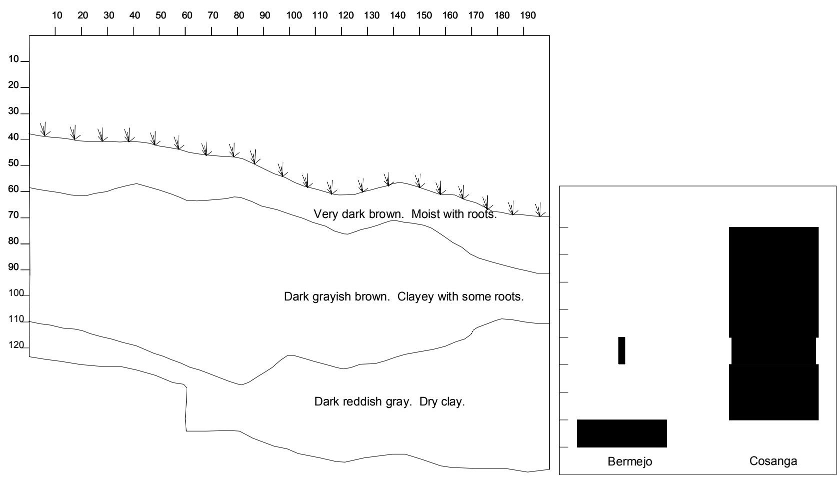


Figure A.3. VQ003 Stratigraphy (NW Profile).

Santa Lucía del Bermejo

This site is located north of the Bermejo River, and can be accessed from the end of the secondary road that leads to the Antisana Reserve from the main Baeza-Cosanga road. A number of small semi-circular or rectangular terraces for housing and long terraces for agriculture can be observed all around in this area. Two of the sets of agricultural terraces are separated by a deep canal. The owner of the farm pointed out to us that some of the terraces have stone foundations, composed of a several layers of stone, but are covered by overgrown grass, and he also showed us many *metates* and *manos* that he had encountered while working on the farm. We only saw terraces with stone foundations on a couple occasions, but we encountered worked stone scattered throughout the site. The area is at about 2,200 m above sea level and is currently used for pasture. We excavated 3 1x1 m tests here during Gaspar Morcorte's visit, with the purpose of learning about the domestic deposits in the region, and experimenting with a strategy for the collection of macrobotanical remains precisely with the specialist that was going to analyze them. This site seemed appropriate for that purpose since it was easy to target domestic areas and seemed very well preserved.

Santa Lucía del Bermejo, Unit 1: (VQ004-175823,9942916). This test was excavated on an artificially leveled ridge on the top of a hill and just above two sets of agricultural terraces separated from each-other by a deep canal that traverses the entire side of the mountain. The terrace was 4x6 m, and it was surrounded by several other small terraces that also appeared to be residential. The stratigraphic sequence was straightforward and culturally sterile soil was reached very quickly, at about 60cm (Figure A.4). This test yielded 33 sherds, all Cosanga.

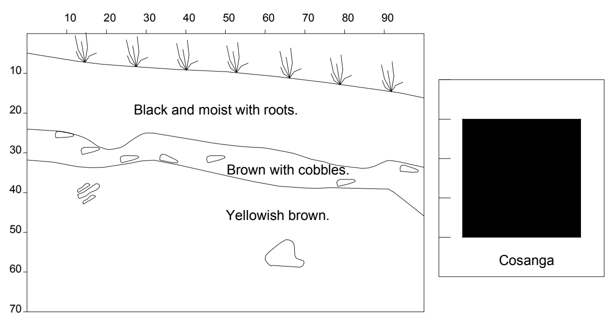


Figure A.4. VQ004 Stratigraphy (N Profile).

Santa Lucía del Bermejo, Unit 2: (VQ005-175837,9942821). This was excavated in a semi-circular terrace that was likely used for residential purposes. The owner of the farm cleared the grass from the edges of the terrace to show us a foundation that surrounded the front and sides of the terrace, composed of six layers of slabs and measuring about 1 meter in height. The unit was excavated approximately in the center of the terrace, which was most likely a covered area. This was a deep deposit, with abundant ceramics and carbonized botanical material. In the southeast corner of the test, starting at about 40 cm from the surface we observed an unusual concentration of carbonized material on an area where the soil was darker, loose, and ashy. This material was present until the excavation reached 1 meter in depth. We took several carbon and soil samples when this feature was excavated. Other than this deposit of carbon material, the stratigraphy was straightforward (Figure A.5). This test yielded mostly Cosanga pottery with only two small Bermejo Thick sherds in Level 4, accounting for an insignificant percentage of the total ceramics in this excavation.

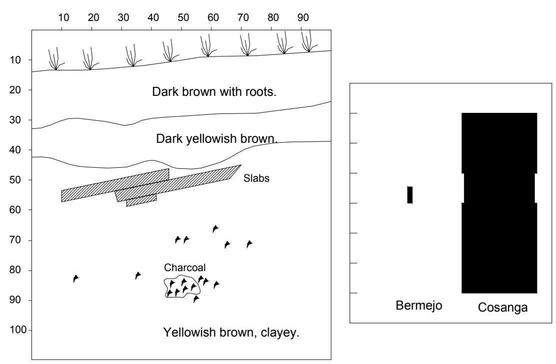


Figure A.5. VQ005 Stratigraphy (W Profile).

Santa Lucía del Bermejo, Unit 3: (VQ006-175843,9942815). This was excavated a couple of meters below the stone foundation at VQ005, outside of the terraced area, on the slope. This test yielded abundant ceramics and carbonized materials, and the stratigraphy was very neat (Figure A.6). The stratigraphic sequence and its associated materials show a predominance of Bermejo Thick pottery in the bottommost levels with Pituro Dark Polished peaking in the middle levels and Cosanga in the uppermost levels. This was a very informative test for understanding the chronological relationship between types. We obtained the first large sample of Bermejo Thick sherds here, which was crucial for the definition of the type at this early stage of the project. The intention was to compare the abundance and type of carbonized material present inside and outside what appeared to be a residence. This makes it problematic for the interpretation of botanical remains, because the survey materials had indicated that the site was predominantly Late (see Chapter 2). Therefore, we did tests at this site assuming that we would find little or no Early Period material, which ended up not being the case.

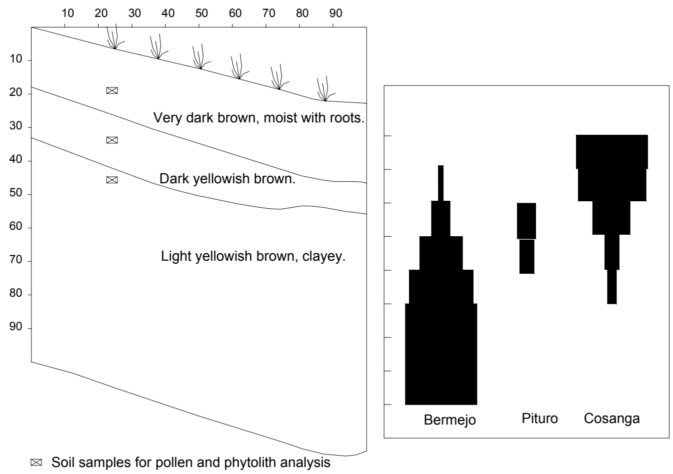


Figure A.6. VQ006 Stratigraphy (E Profile).

Borja

This site is located less than 1 km from the town of Borja, between the San José and Sardinas Chico rivers, and can be easily accessed by foot from the main Baeza-Chaco road or from a narrow gravel side road that gives access to some of the farms of the area. This is a relatively flat area, at approximately 1,700 m above sea level. It is used mainly for cattle ranching, and only occasionally to cultivate corn and tomatoes. At the time we were there, less than 1 ha was being used for the latter and the rest was grass. Three 2x1 m tests were excavated, with the hope of understanding the relationship between the different types that appeared in the survey collections performed in the area.

Borja, Unit 1: (VQ007-183135,9953139). Located on a naturally elevated area on a swampy lot where several canals have been opened to help direct the excess of water on the ground. This test yielded only Cosanga pottery, and culturally sterile soil was reached quickly (Figure A.7). In the second level of excavation, on the northeast portion, a few very small fragments of bone were collected (not yet identified) as well as some carbonized material associated with it.

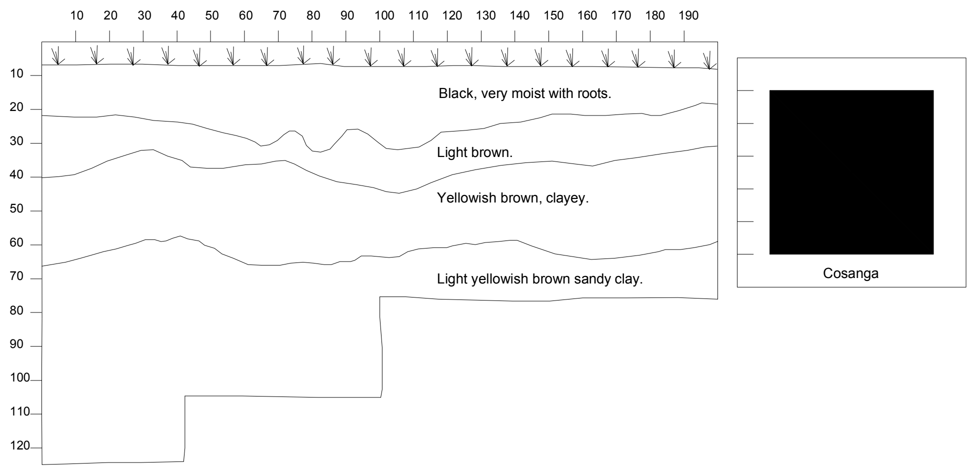


Figure A.7. VQ007 Stratigraphy (E Profile).

Borja, Unit 2: (VQ008-183315,9953153). This was excavated just a few hundred meters south of the population of Borja, and less than 1 km west of the Quijos River, on a naturally elevated area as well. The neat stratigraphy and its association to ceramic materials was very informative for understanding the relation between Cosanga and the other two types (Figure A.8). Bermejo Thick and Pituro Dark Polished are more frequent in the lower levels while Cosanga peaks in the uppermost levels. This test suggests that Pituro Dark Polished precedes Bermejo Thick.

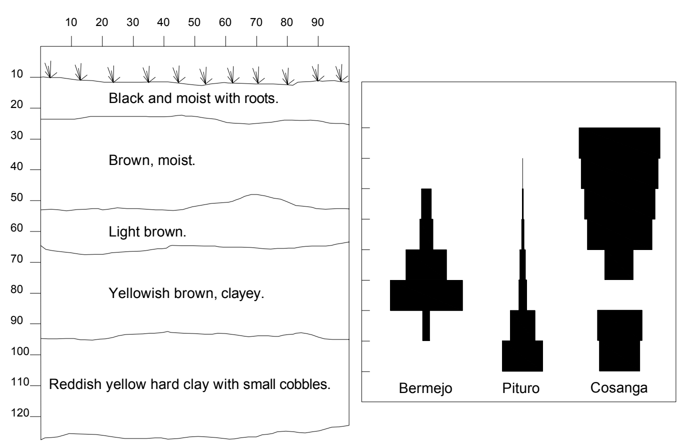


Figure A.8. VQ008 Stratigraphy (N Profile).

Borja, Unit 3: (VQ009-183446,9953173). Just a few meters east of VQ008, this test was also for understanding the chronological relations between types (Figure A.9). Bermejo Thick is the most frequent type in the lowest levels and Cosanga in the uppermost levels. Pituro Dark Polished appears only in one of the bottommost levels (one sherd only). It is hard to determine its relation to Bermejo Thick in this test, but it seems consistent with the observation that these two types precede Cosanga.

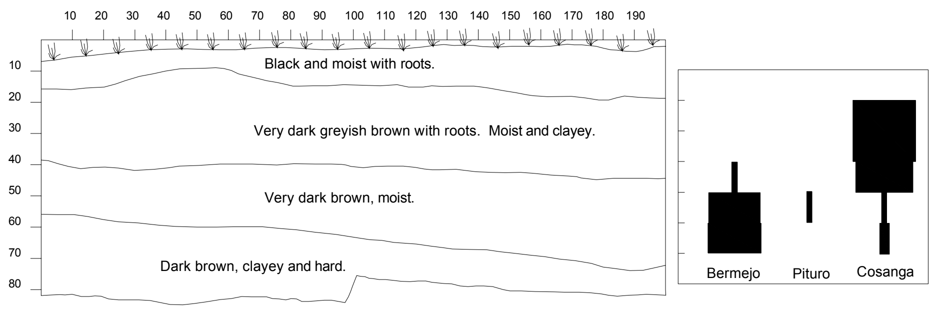


Figure A.9. VQ009 Stratigraphy (E Profile).

Pituro

This site is located on a gentle slope that descends very gradually to the conjunction of the Quijos and Cosanga rivers, at approximately 1,900 m above sea level. The survey collections in this area yielded Bermejo Thick and Pituro Dark Polished sherds, as well as a majority of Cosanga sherds, so this seemed like a good opportunity to further explore the chronological relations between these types. We excavated three 2x1 m tests at this site in September of 2003. The site is covered by secondary forest for the most part, sometimes extremely thick, with a few cleared areas used for pasture or covered by overgrown bushes. This made it very difficult to navigate and identify landscape features, but nevertheless the survey yielded a good number of ceramic collections here. This site can be reached from the side road (known locally as the "bypass") that was recently constructed to connect Borja directly from the Baeza-Cosanga road.

Pituro, Unit 1: (VQ010-181692,9949540). This was excavated on a naturally leveled area, close to a few small artificial terraces on one of a few grassy areas that can be seen from the "bypass," on the north side of it. The stratigraphy was straightforward. It yielded Cosanga sherds only (Figure A.10).

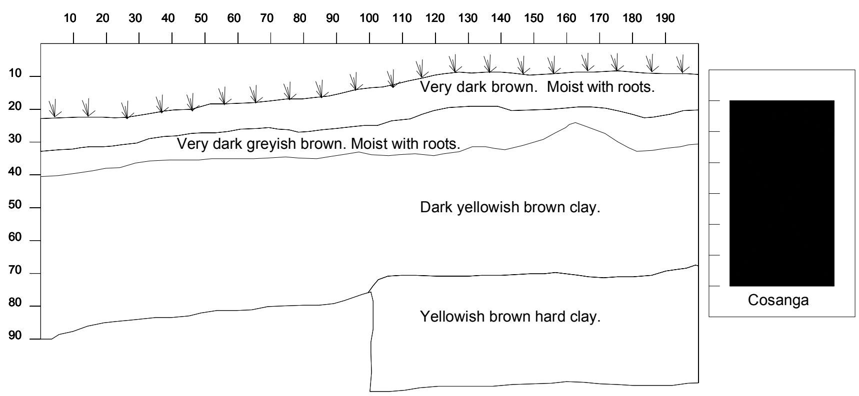


Figure A.10. VQ010 Stratigraphy (E Profile).

Pituro, Unit 2: (VQ011-181879,9949376). Located on the top of a small hill, one of the few spots that is not constantly saturated with water, on the east side of the "bypass." On the side of this small hill there are a few short and narrow terraces perhaps used for cultivation. The high density of vegetation, however, makes it difficult to estimate their extent. This test produced a very large sample of Cosanga sherds, with a few Bermejo Thick and Pituro Dark Polished sherds, both of which are more abundant in the bottom and medium levels—yet their proportions are minimal compared to Cosanga. This sequence would seem to suggest that Pituro Dark Polished precedes both Bermejo Thick and Cosanga (Figure A.11).

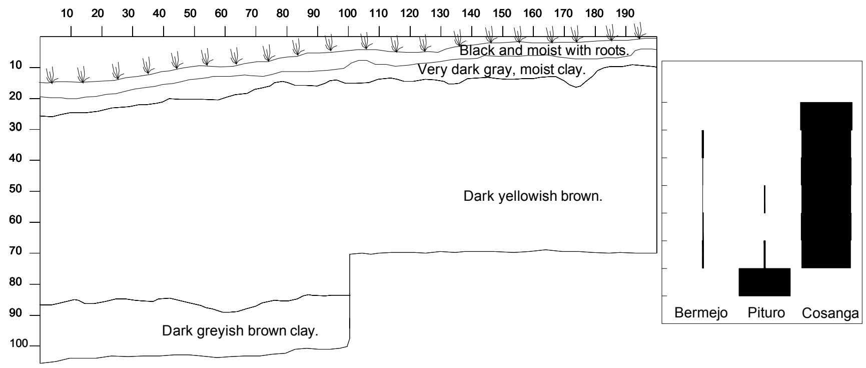


Figure A.11. VQ011 Stratigraphy (W Profile).

Pituro, Unit 3: (VQ012-181935,9949374). Just a few meters from VQ010, this was excavated on top of a naturally elevated area that does not accumulate as much water as in the vicinity. The stratigraphy of this test was disturbed due to the presence of abundant and thick roots, present from the first until the sixth level of excavation. This was a very deep deposit but complicated during excavation by a very intricate stratigraphy and by the abundant filtrations of water. It yielded a large sample of Cosanga sherds, and a very small sample of Bermejo Thick sherds. No patterns seem clear here (Figure A.12).

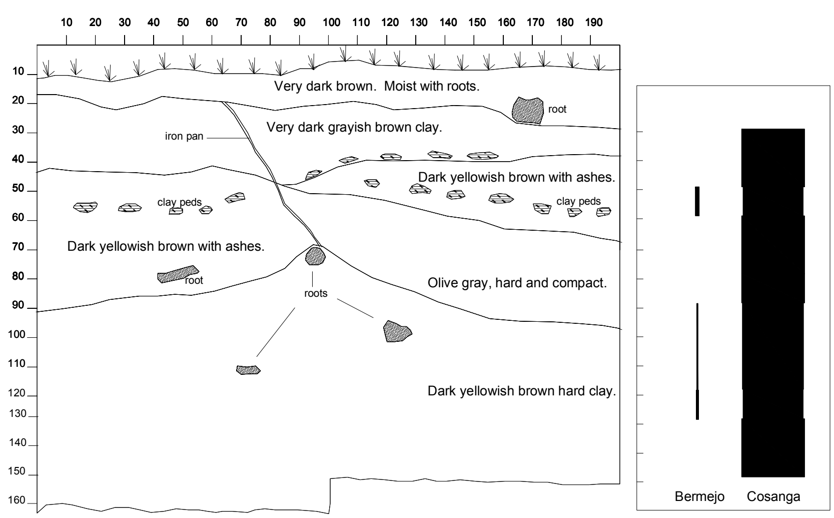


Figure A.12. VQ012 Stratigraphy (E Profile).

Oritoyacu

This is a large site on a mountain facing the intersection of the Oritoyacu and Cosanga rivers. There are numerous artificial terraces visible on the slopes. The site can be accessed by foot from the Baeza-Cosanga road. We excavated one 1x1 m test here, at about 2,000 m above sea level. The site is currently used for pasture. Survey collections yielded Cosanga, Bermejo Thick and Pituro Dark Polished sherds, and we intended to further clarify their chronological relation with the excavation of stratigraphic tests here. Unfortunately, intense rainfall at the time led to landslides on the road that restricted our access to the area and consequently we were unable to excavate more than one test at this site.

Oritoyacu, Unit 1:(VQ013-179487,9944776).This test was excavated in a small artificial terrace (7x4 m), close to the top of the mountain. The stratigraphy was uncomplicated. The test yielded a majority of Cosanga sherds and only one Bermejo Thick sherd, which appeared in the fourth level of excavation, exactly when the quantity of Cosanga sherds drops. While this is scant evidence, it suggests that Bermejo Thick precedes Cosanga. A charcoal sample collected in the third level of excavation, associated with Cosanga sherds, yielded a radiocarbon date of 1,613 ± 32 A.D. This would correspond to the Colonial Period, which seems plausible as a time when Cosanga pottery could well have been still in use (Figure A.13).

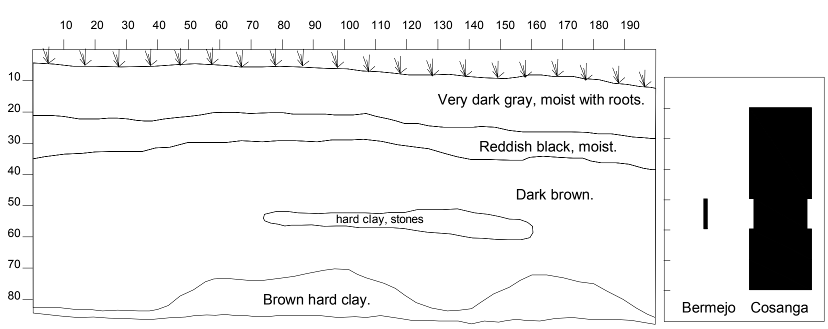


Figure A.13. VQ013 Stratigraphy (E Profile).

Vega

This site occupies a gentle slope, north of the Quijos River and east of the Paradalarca River, just above the new oil pipeline. There are four terraces in the lower part, with semi-circular edges and looking down towards the Quijos River, that appear to be residential terraces. About 100 meters above these terraces, there are a group of four or five long, narrow, rectangular terraces, that appear to have been agricultural terraces. There are two canals, one east of the first group of terraces that eventually joins a spring that descends towards the Quijos River, and another one in between the small group of agricultural terraces in the upper part of the site. We excavated six 1x1 m tests here in October of 2002. The altitude of this site is between 1,950 and 2,000 m above sea level. The site is currently used for pasture and can be accessed by foot from the Baeza-Borja road. We selected this site because the survey materials indicated that this was a predominantly Late Period site, and it seemed like a good opportunity to compare the materials coming from what appeared to be agricultural and residential terraces at the same site. However, this site was the other site (with Santa Lucia de Bermejo) where the excavation materials and the survey materials did not neatly match (see Chapter 2 for further discussion). As a result, the analysis of botanical materials from this site are problematic, given the mixed occupation of the area. These tests did prove useful for the determination of ceramic chronology.

Vega, Unit 1: (VQ014-178995,9950812). This was excavated in one of the terraces located in the lower part of the site. It was the upper terrace of a double terrace, with dimensions of 13.5 m wide by 7.3 m deep. It has a semi-circular front edge that drops into a larger terrace below. Its size and shape suggest that it could have been used for housing. The test was placed towards the south-east area of the terrace, close to the front edge. The stratigraphy was very clear and uncomplicated (Figure A.14). Only 21 sherds were recovered; Bermejo Thick is clearly more popular in the bottommost levels while Cosanga peaks in the uppermost levels.

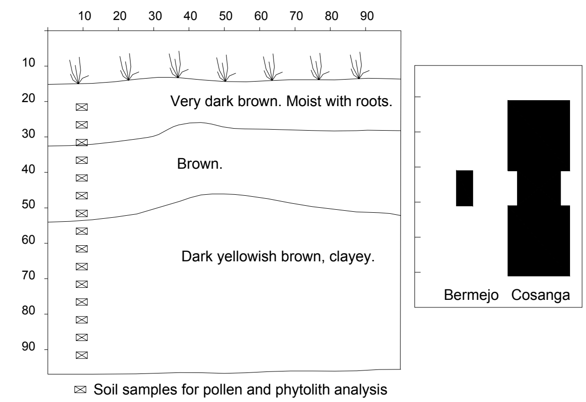


Figure A.14. VQ014 Stratigraphy (S Profile).

Vega, Unit 2: (VQ015-179004,9950796) In the terrace just below VQ014, which measures 18.3 by 12.7 m. This terrace may have also been a residential terrace or another kind of structure, or perhaps an open-air activity area. The test was placed towards the south-east edge of the terrace. The stratigraphy was straightforward. Here Cosanga tends to predominate in upper levels, while Bermejo Thick does so in the middle levels and Pituro Dark Polished in the lowest levels (Figure A.15).

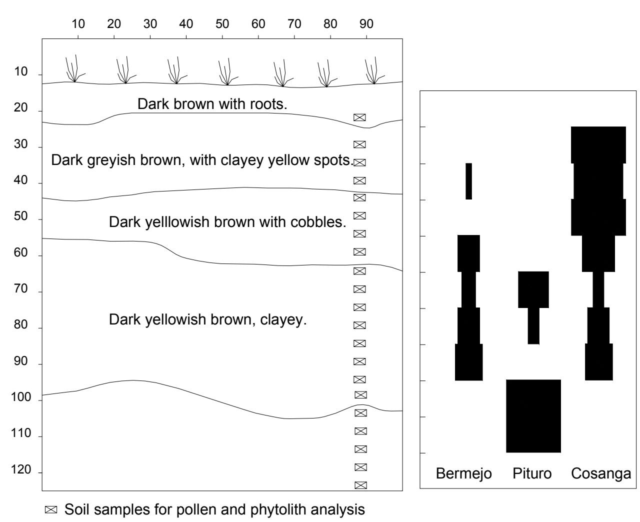


Figure A.15. VQ015 Stratigraphy (S Profile).

Vega, Unit 3: (VQ016-179095,9950816). Excavated outside of the artificial terraces, in a narrow leveled area near the stream that runs east of them. It is a long and narrow area, parallel to the stream, and we felt that this area may have been either a garden or an off-site area. This was a very shallow deposit (only 65 cm) before reaching culturally sterile soil of a clayey consistency with an orange color, and it yielded only a few sherds in the two lowest levels of excavation (the upper two did not have any cultural materials). The stratigraphy was uncomplicated (Figure A.16). In the upper level with cultural material (Level 3) there are only 5 Cosanga sherds; in Level 4, there are 10 Cosanga sherds and 2 Bermejo Thick sherds.

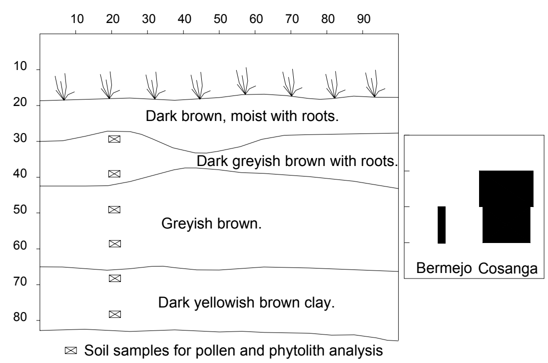


Figure A.16. VQ016 Stratigraphy (N Profile).

Vega, Unit 4: (VQ017-178973,9950812). This was placed on a small terrace above VQ015 and VQ016, whose dimensions are 9 by 4.2 m. This one also has a semicircular edge, that may have been residential given its shape, or may have been used for other activities. The stratigraphy is easy to understand, but we did encounter a layer of white ash in the southern profile at a depth of 30 cm. Also there was a cylindrical deposit of very loose and dark sediment that may have been a post hole in the western profile between 36 and 74 cm in depth (Figure A.17). Here Cosanga also predominates in uppermost levels, while Bermejo Thick with Pituro Dark Polished predominate in the lowest ones.

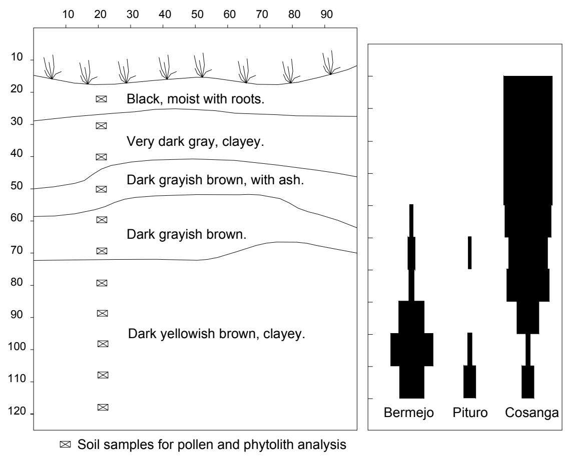


Figure A.17. VQ017 Stratigraphy (W Profile).

Vega, Unit 5: (VQ018-178893,9950873). Located on an agricultural terrace (19.8 by 6.5 m), we excavated on the middle terrace of a set of three that were practically identical in shape and size. The canal runs along the right side of these terraces, which face south towards the Quijos River, and separates these terraces from the other small group of what appeared to be agricultural terraces that were in a poor state of preservation. The test was placed in the middle of the terrace. The stratigraphy was straightforward, and approximately between 15 and 20 cm from the surface there is a very dark and homogeneous layer of soil. This could have been a cultivation surface. It yielded Cosanga and Bermejo Thick sherds, with Bermejo Thick predominantly found at the lower levels (Figure A.18).

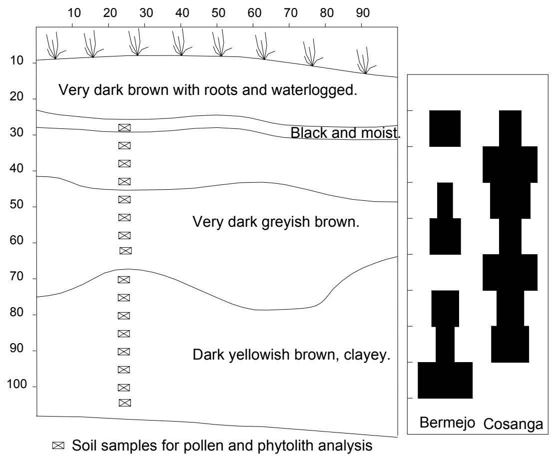


Figure A.18. VQ018 Stratigraphy (E Profile).

Vega, Unit 6: (VQ019-178907,9950862). Placed in the terrace just below VQ018. Adjacent to this terrace there was a semi-circular/triangular terrace facing the side of the mountain. The excavation was located very near the back and on the west side of the agricultural terrace, near where we believe a small drainage ditch may have passed. This one had a very similar stratigraphy to VQ018, with the dark layer at about the same depth from the surface. Towards the bottom part of the terrace, there is a minor disturbance in the stratigraphy. Cosanga predominates in all levels, and the early ceramics predominate in the lower levels (Figure A.19).

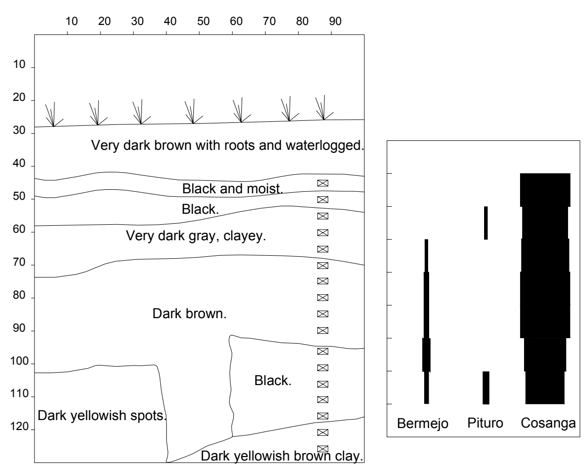


Figure A.19. VQ019 Stratigraphy (E Profile).

Sardinas Chico

This site spreads along the ascending ridge of a hill parallel to the south side of the Sardinas Chico River. The site can be accessed by foot from a small side road that leads to the *finca* La Bretaña. Its altitude of the site is between 1,900 and 1,950 m. Small groups of a few terraces can be observed along the ridge. We excavated three 1x1 m tests in a small group of four artificial terraces towards the top of the hill in October of 2002. At some of their edges, a few stones seemed to indicate the existence of stone foundations, but the grass was too tall and thick to be certain of this. There were three terraces, a single terrace and a double-terrace, that may have been residential, given their small size and shape, and below and connecting them is a large leveled area. The south slope drops sharply into a cliff with very thick vegetation and a stream that runs at the bottom of the cliff. There are no agricultural terraces observed in the area around these terraces, although it is possible that there is a canal running along the north-east edge that may have served terraces located above and below this group of three. In the survey, the materials recovered from this site were predominantly from the Late Period. The area is currently used for pasture.

Sardinas Chico, Unit 1: (VQ020-181254,9952497). We placed this test in on the east side and towards the edge of the small terrace facing the Sardinas Chico River. This is approximately 8.5 by 6.4 m, with a curved front. It has a semi-circular front, although the side borders were straight lines. The stratigraphy was uncomplicated until the third level of excavation, when an irregular layer of looser and darker soil started to appear (Figure A.20). Only four sherds appeared associated with this feature (and they are all Cosanga). At the bottom of the last excavation level (which did not yield ceramics) we noted the presence of two shallow circular features composed of loose soil, which resembled post molds. A total of 35 sherds were recovered in this test, of which 32 are Cosanga. The remaining three are Bermejo Thick, which appeared in the second level of excavation.

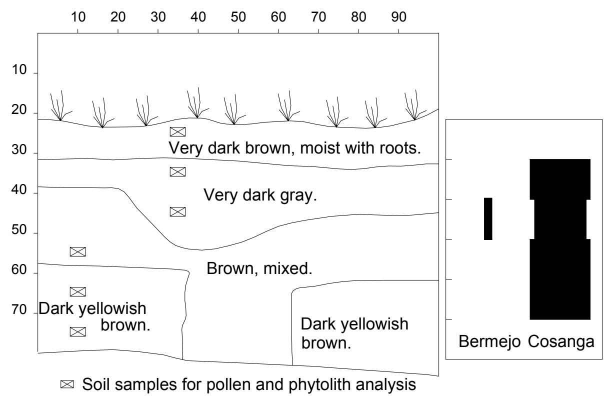


Figure A.20. VQ020 Stratigraphy (E Profile).

Sardinas Chico, Unit 2: (VQ021-181262,9952484). This test was placed in the large flat area connecting the two terraces that faces the Quijos River, close to its front edge. It has an irregular shape; its north edge is well defined but its south edge is not as sharp and extends 22 m until the edge of the terrace where VQ022 was excavated (the north edge and front measure 11.9 and 12 m respectively). The stratigraphy of this test was very straightforward (Figure A.21). This excavation recovered predominantly Cosanga materials. The overall behavior of ceramic types suggests a gradual increase of Bermejo Thick as depth increases, and Cosanga remains practically constant throughout the stratigraphic sequence. However, the appearance of early pottery was miniscule. With the excavation of this test, we wanted to compare the materials collected inside and outside of the terraces.

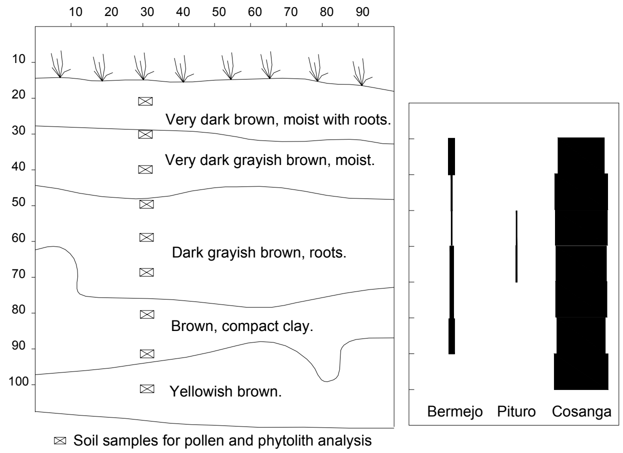


Figure A.21. VQ021 Stratigraphy (N Profile).

Sardinas Chico, Unit 3: VQ022-181154,9952480). This was located in the south terrace, very close to the cliff. This is a small terrace, only 9.6 by 5.7 m, and has a relatively round front in which a few shallow stones were partially set into the ground upright. The tall grass would not normally let them be seen, and in fact they cannot be seen if one just takes a quick glance. One of them appeared to have fallen recently. It was less than one m tall and had five shallow circle hollows in one of its ends. This type of carving was described more than once by Porras (1975), who proposed that they are anthropomorphic sculptures. This test turned out a to be a complicated deposit due to the fact that a tomb may have been located right below. The succession of stratigraphic layers was hard to understand and as we were advancing we noted that the soil appeared to be mixed, but could not recognize any feature in particular. Beginning with level four, we observed areas of burnt clay, but it was not accompanied by other indications of a hearth. By the eighth level of excavation a series of large slabs started to appear, and upon their removal, two complete ceramic pieces and two more that were almost intact were found. Underneath these, more slabs continued to appear and the bottom soil turned extremely crumbly. We decided to stop the excavation of this test at this point and carefully put back the slabs that had been removed with the intention of protecting a possible tomb that someone else may be prepared to excavate in the future. This was located in the south terrace, very close to the cliff. This is a small terrace, only 9.6 by 5.7 m, and has a relatively round front in which a few shallow stones were partially set into the ground upright. The tall grass would not normally let them be seen, and in fact they cannot be seen if one just takes a quick glance. One of them appeared to have fallen recently, it was less than one m tall and had five shallow circle hollows in one of its ends. This type of carving was described more than once by Porras (1975), who proposed that they are anthropomorphic sculptures. This test turned out a to be a complicated deposit due to the fact that a tomb may have been located right below. The succession of stratigraphic layers was hard to understand and as we were advancing we noted that the soil appeared to be mixed, but could not recognize any feature in particular. By the eighth level of excavation a series of large slabs started to appear, and upon their removal, two complete ceramic pieces and two more that were almost intact were found. Underneath these, more slabs continued to appear and the bottom soil turned extremely crumbly. We decided to stop the excavation of this test at this point and carefully put back the slabs that had been removed with the intention of protecting a possible tomb that someone else may be prepared to excavate in the future. This clearly disturbed context is not appropriate for interpreting the proportions of different ceramic types through the stratigraphic sequence; in fact, this is among the least informative tests excavated (Figure A.22).

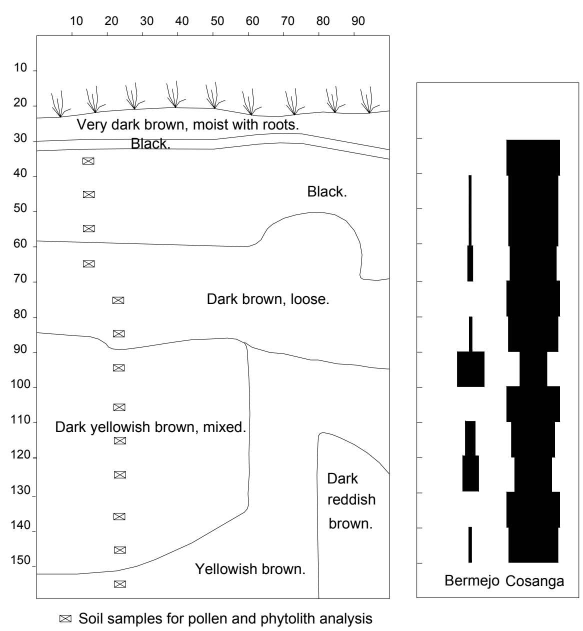


Figure A.22. VQ022 Stratigraphy (S Profile).

Sardinas Grande

This site is located on top of a gentle hill, about 1,660 m above sea level, less than 1 km southwest of the intersection of the Sardinas Grande and Quijos rivers, close to the northernmost limit of the surveyed area. It can be accessed by foot from the side road that leads to the community of Sardinas. This area is currently used for pasture, but parts of the slopes have overgrown bushes. Since the grass was short at the moment we worked there, rows of stone were easily observable on the surface, probably delimiting the terraces. On two sides of one of the terraces, three to five layers of stone corresponded to the edges of the terrace. On two other terraces, there were stones aligned on the surface that likewise delimited the edges of the terraces, leading us to believe that they may have been the uppermost layer of stone foundations. All three terraces are rectangular. On the slope that faces the Quijos River there appears to be a small set of agricultural terraces, but the tall grass and bushes here make recognition very difficult. A canal that descends from the top of the hill through this slope is easily recognizable, however. Abundant worked stones are visible on the slopes, which appeared to have rolled down from the top of the hill. We excavated three 1x1 m tests here.

Sardinas Grande, Unit 1: (VQ023-185715,9957450). This was placed inside the area delimited by the stone foundation of the smallest terrace, which measures 6.7 by 5.1 m. It may have been a residential terrace or another kind of covered structure. The stratigraphy was straightforward (Figure A.23). Most of the ceramic material is Cosanga; Bermejo Thick accounts for less than 3% of the total. A complete *compotera* Cosanga appeared in the last level of excavation, and the sediment inside of this cup was collected and stored separately for botanical analysis.

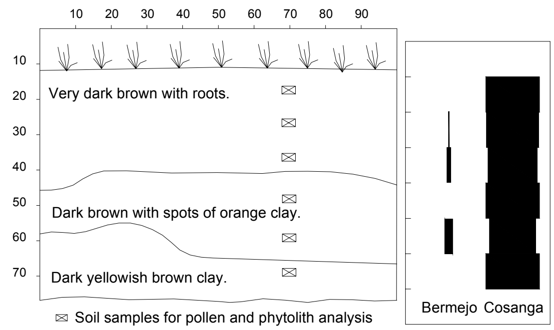


Figure A.23. VQ023 Stratigraphy (N Profile).

Sardinas Grande, Unit 2: (VQ024-185703,9957444). We excavated this test in the structure adjacent to where VQ023 was located. This is a larger structure (16.1 x 11 m), distinguishable from the first one by a short incline in between the two. The succession of stratigraphic layers was easy to follow (Figure A.24). Here too, non-Cosanga ceramics appeared only a very small proportion (5.6%).

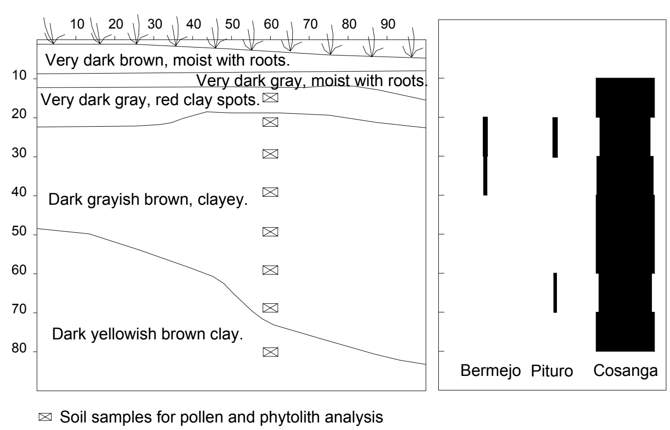


Figure A.24. VQ024 Stratigraphy (W Profile).

Sardinas Grande, Unit 3: (VQ025-185720,9957423). This was excavated in a leveled area just outside of the third terrace, which is separated from the other two by a three meter wide and shallow canal. Its dimensions are 7 x 4.9 m. This level area did not have a stone foundation, but the terrace directly above it did, which lead us to believe that this may have been an outdoor area. It yielded abundant ceramic material. The stratigraphy was hard to follow after the sixth level of excavation, when we started to encounter some stones that appeared in a random fashion from that point through the tenth level of excavation, where we reached culturally sterile soil. After we had finished and cleaned the profiles for drawing we noted that the presence of these stones coincided with a slightly darker deposit where carbonized material and ashes were abundant. Because of the small size of this test, interpretation of this feature is difficult. Most of the material was Cosanga, with a tiny proportion of other types. The varying proportions of ceramic types through this test are consistent with others, in which Bermejo Thick and Pituro Dark Polished precede Cosanga (Figure A.25).

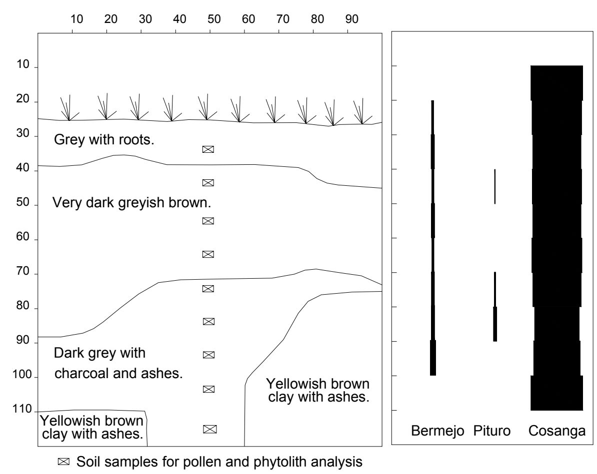


Figure A.25. VQ025 Stratigraphy (W Profile).

Bermejo

This site is located on a steep mountain right at the juncture of the Bermejo and Cosanga rivers. Terracing that may have been housing and terraces for agriculture can be seen throughout the terrain of the Hacienda Bermejo. We excavated five 1x1 m tests here in October of 2003. The side of the mountain towards the Bermejo River has the largest concentration of agricultural terraces observed during the survey. Most survey collections (both shovel probes and superficial collections) consistently yielded an unusually high number of sherds, of which the majority were Cosanga. The site elevation is between 2,000 and 2,050 m above sea level. There are numerous worked stones distributed throughout this area, especially towards the north drop-off, and the owner of the site suggested that they once formed some kind of a construction, but that the cows had destroyed it. This site was chosen to collect soil samples for the analysis of botanical remains of the Late Period.

Bermejo, Unit 1:(VQ026-178972,9942378). This was placed on the north slope, where two long sets of agricultural terraces were constructed from the edge of the mountain almost reaching down to the Bermejo River. The cuts of these terraces are fairly tall, between 2 and 4 m each, and the two sets of terraces are separated in the middle by a shallow canal, about 4 m wide. This one measured 30 m long by 5 m wide and was one of the very few that had not been partially destroyed by intensive cattle walking. This turned out to be a very deep deposit; we excavated fifteen levels before reaching culturally sterile soil in level sixteen. The stratigraphy was unproblematic, and we noted two areas where some ash had accumulated patchily in the third and ninth levels of excavation. These do not mark any stratigraphic transition though. About 85% of the material collected was Cosanga, but Bermejo Thick sherds were present, albeit in very small quantities and only predominating towards the very bottom of the test (Figure A.26).

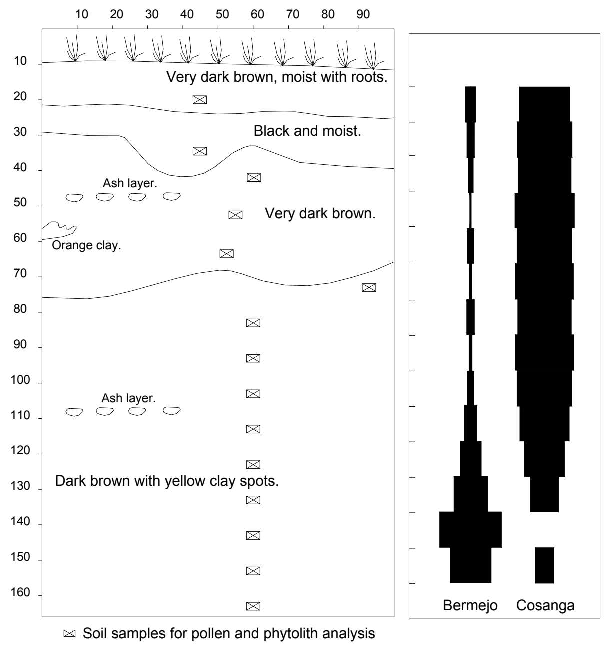


Figure A.26. VQ026 Stratigraphy (NW Profile).

Bermejo, Unit 2: (VQ027-178965,9942372). This was excavated on the same terrace, very close close to VQ026, towards the center of the terrace. This was a deep deposit too (1.80m), with a clear stratigraphy. At approximately 20 cm from the surface we reached a distinctive layer of very dark soil that could have been a cultivated surface. In the eighth level we encountered large quantities of carbon, dark ash features, and a carbonized maize cob. Most sherds encountered in this test were Cosanga too, and Bermejo Thick and Pituro Dark Polished appeared in only very small proportions. Bermejo Thick shows the same tendency seen in other tests, peaking towards the bottommost levels. Only one sherd of Pituro Dark Polished appeared in the second level of excavation. This scant evidence does not really help much to clarify its position (Figure A.27).

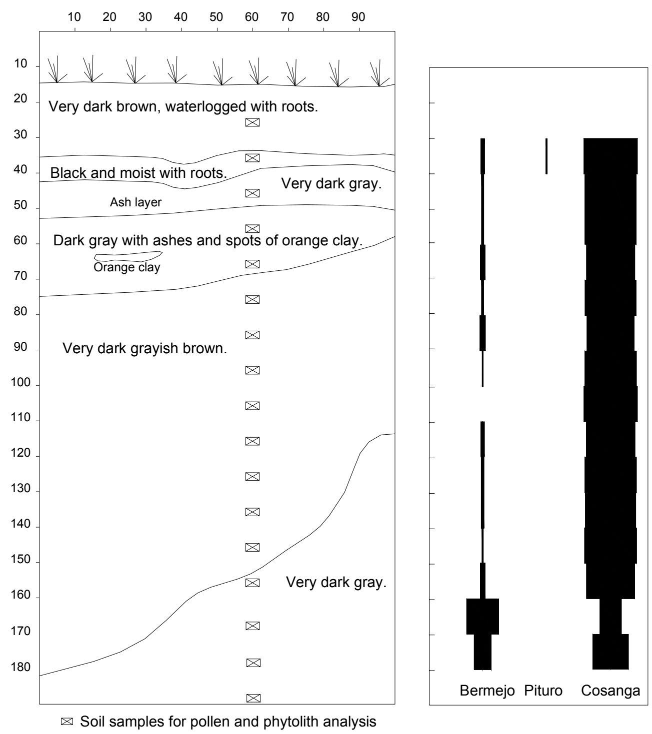


Figure A.27. VQ027 Stratigraphy (E Profile).

Bermejo, Unit 3: (VQ028-178964,9942365). This test was excavated on the western edge of the same agricultural terrace. Its stratigraphy was hard to understand during excavation, because the soil was extremely saturated with water, especially in the upper layers. We found the same layer of very dark soil here too, at about the same depth from the surface as the one found in VQ027. In the third level, at about 30cm, a flat, worked stone appeared, limiting the area of excavation. Cosanga was predominant among the materials collected and was present throughout all of the levels excavated. There was a very small proportion of Bermejo Thick sherds (Figure A.28).

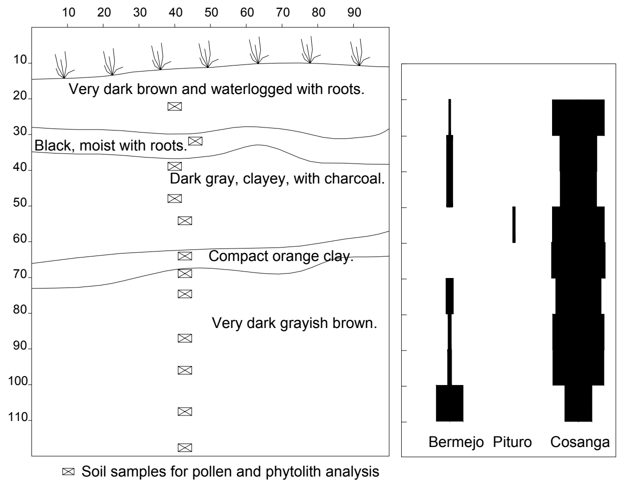


Figure A.28. VQ028 Stratigraphy (SE Profile).

Bermejo, Unit 4: (VQ029-179094,9942328). This test was excavated on top of the mountain, towards the south, on a very well leveled area whose dimensions are 10.8 by 7.7 m. We chose it thinking that it could correspond to a residential area associated with the complex of agricultural terraces found in the north slope of this mountain. The flat area looks out over the Cosanga River, and next to it there is a depression that now forms a swamp. Around the edges of this swampy area are numerous worked stones that likely formed parts of walls or other structures, and some of these stones have small round depressions that do not seem to have been formed naturally. Surrounding this swamp, we found large quantities of ceramics and obsidian. The stratigraphy of this test was difficult to understand due to soil mixing that obscured the nature of the transitions as we were excavating the upper levels, and obviously, the small size of this excavation contributes little to understanding cases like this one. This test yielded a majority of Cosanga sherds, with only two Bermejo Thick sherds (Figure A.29).

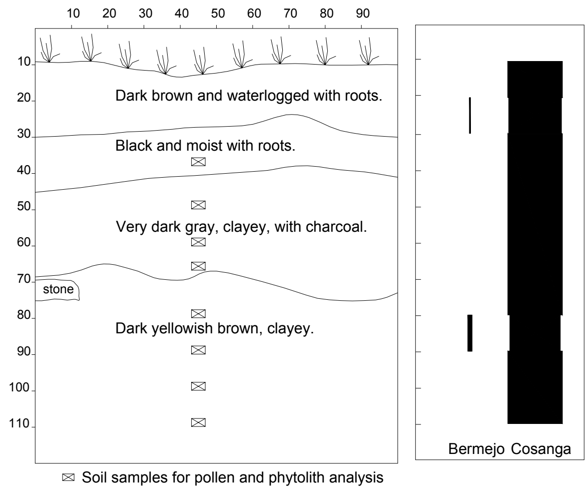


Figure A.29. VQ029 Stratigraphy (E Profile).

Bermejo, Unit 5: (VQ030-179078,9942317). This was located on another well leveled area right below the one where VQ029 was placed, and we also believe this to be a residential area. Its dimensions are 11.4 by 6.7 m. The incline that divides the two is very gentle and is covered by thick and tall grasses, but nevertheless seems to be an artificial one. The stratigraphy of this test was easy to understand. A charcoal sample collected in the ninth level of excavation, in association with Cosanga sherds, produced a radiocarbon date of 1,226 ± 24 A.D. This was part of an accumulation of carbonized material and ashes that started to appear in the eighth level of excavation, forming a dark and almost round spot where the soil was very loose. After this feature was completely excavated we concluded that it could have corresponded to a burned post mold. The radiocarbon date seems reasonable and well within the range in which we expect dates associated with Cosanga to fall. Most of the materials corresponded to Cosanga and only four Bermejo Thick sherds were recovered (Figure A.30).

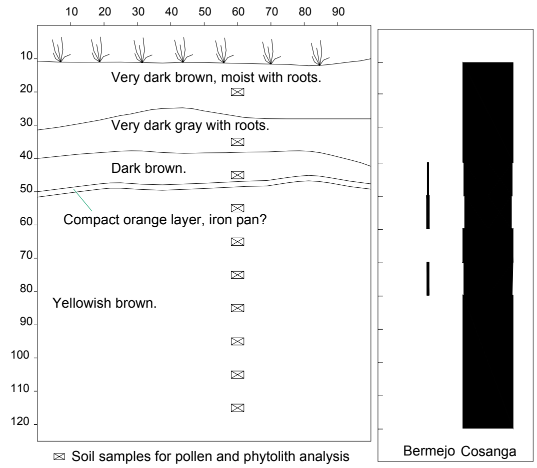


Figure A.30. VQ030 Stratigraphy (E Profile).

Logmapampa

This site is located approximately 1 km to the southwest of the town of Baeza Vieja along a path that runs parallel to the Machángara River. It was selected as part of the testing program aimed at collecting soil samples for the analysis of botanical remains of the Late Period. It is a large site, although quite dispersed, and it has very steep slopes. Ceramic materials were abundant, and three *metates* were also recovered in superficial recollection; terraces of various sizes are visible on the landscape. Four 1x1 m tests were excavated here in November of 2002. It is currently used for grazing, and lies at an altitude of about 2,100 meters above sea level. This site can be reached by foot from the town of Baeza Vieja.

Logmapampa, Unit 1: (VQ031-176813,9948377). Excavated in what appears to be a natural wide terrace, where a series of rows of stones of similar shape appear to define a few structures. The overgrown grass and bushes make it difficult to delineate their forms with much precision. The center of the terrace had accumulated a lot of water and therefore we placed this test towards its front edge, right outside a possible stone foundation. This was a very shallow deposit, and after only four levels of excavation we reached very hard clayey soil with abundant stones and few sherds compared to the other levels excavated. Abundant ceramics were recovered at this site. All of the material collected was Cosanga (Figure A.31).

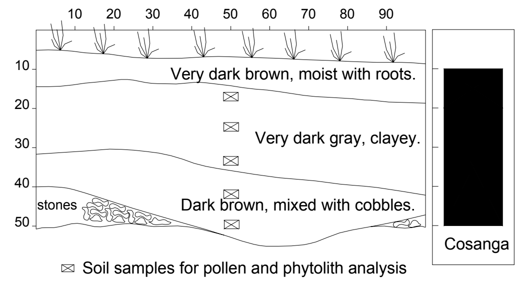


Figure A.31. VQ031 Stratigraphy (E Profile).

Logmapampa, Unit 2: (VQ032-176836,9948369). We placed the test towards the west edge of the wide terrace described above, outside of the possible structures delineated by stones. Above this terrace there was a round terrace traced by a wall of rocks on all sides that had been thoroughly looted. It turned out to be a complicated deposit, with zones of mixed soil and roots that were difficult to isolate as we were excavating. Of course the small size of the test makes it difficult to provide interpretations about the possible origins of these disturbances, but they appear to be the product of root intrusions. All sherds collected were Cosanga (Figure A.32).

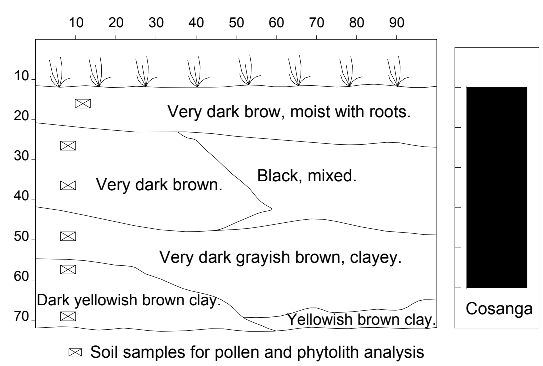


Figure A.32. VQ032 Stratigraphy (N Profile).

Logmapampa, Unit 3: (VQ033-176963,9948017).This was excavated right below the top of the hill, looking towards the Machángara River, this test was excavated in the upper terrace of a double terrace, towards its front edge. This type of double terrace is very common throughout the survey area. This terrace is 31x9 m, and only another couple of small terraces for agriculture can be detected in its immediate surroundings, but these have been partially destroyed by cattle. This could have been a residential area, judging from its size and shape. The stratigraphy was clear and easy to understand. The vast majority of sherds were Cosanga (98.7%), and only three Bermejo Thick sherds appeared in the sixth and eighth levels of excavation, but none in higher levels. This is consistent with the idea that Bermejo Thick precedes Cosanga (Figure A.33).

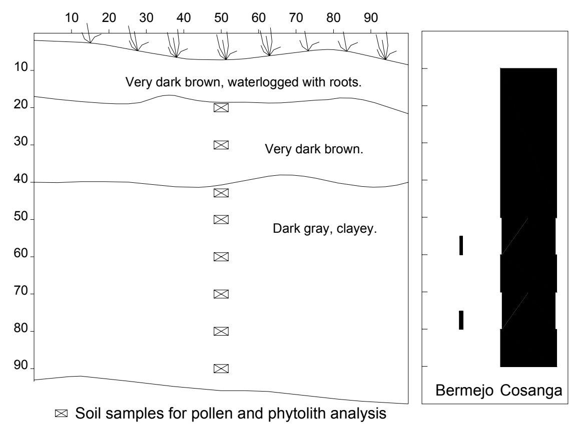


Figure A.33. VQ033 Stratigraphy (N Profile).

Logmapampa, Unit 4: (VQ034-176965,9948021). We excavated this test in the terrace just below VQ033. This one was 18 m long by 5 m wide, and the test was placed towards the back of the terrace. The stratigraphy was straightforward. This test yielded mostly Cosanga sherds, with a few Bermejo Thick sherds concentrated in the bottom layers of excavation that represented a minuscule proportion of the total sherds. This supports the idea that the latter precedes Cosanga (Figure A.34).

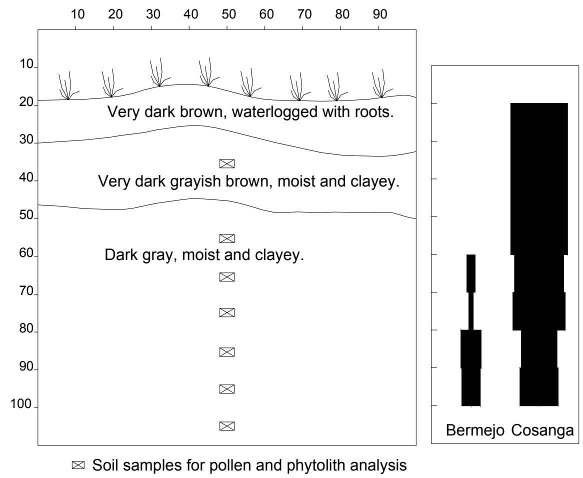


Figure A.34. VQ034 Stratigraphy (E Profile).

Pucalpa

We chose this site with the purpose of recovering soil samples for the analysis of botanical remains from the Late Period through the excavation of four 4 1x1 m tests during November of 2003. The survey collections consistently yielded predominantly or only Cosanga pottery in this area. The site is on an unusually wide and gently inclined plateau at approximately 2,320 m above sea level that ends abruptly at a cliff that drops to the Quijos River approximately 400 m below. There are numerous artificial terraces throughout the area, and they are very well preserved. Terraces for housing and agriculture as well as shallow canals are very easily identifiable in the landscape. The agricultural terraces are smaller, shorter, and narrower than other agricultural terraces observed in other sites in the region, and they are not very pronounced, due to the gradual nature of the slope. The plateau is cut by various streams, and the landscape is dominated by pasture with a few isolated trees, although there are remnants of what may have been a larger forest along streams and on steep slopes at the edges of this plateau. The site can be reached by foot from the road Baeza-Papallacta, descending to the Quijos River, crossing it through a suspension bridge, and ascending to the plateau through a path maintained by the local landowners. It is currently used for pasture.

Pucalpa, Unit 1: (VQO35-169843,9950434). This was excavated on a large artificial terrace (28.4 x 9.8 m), on the east side towards the edge. Given the size and shape of this terrace, it is difficult to ascertain its possible use, although it does not seem to resemble agricultural terraces that we found in other sites in the region. Given its unusually large size, it is difficult to assess the use of the terrace, as it could have either part of a residential complex, an open-air activity area, or a ceremonial site. This was a deep deposit (1.04m) that yielded only Cosanga sherds. The different stratigraphic layers were easily distinguishable. A carbon sample from the ninth level of excavation provided a date of 1,555 ± 32 A.D. It was collected from the southwest portion of the test, where abundant carbonized materials, ash, and sherds were found. This date falls right into the beginning of the contact period and therefore seems a plausible date for Cosanga ceramics (Figure A.35).

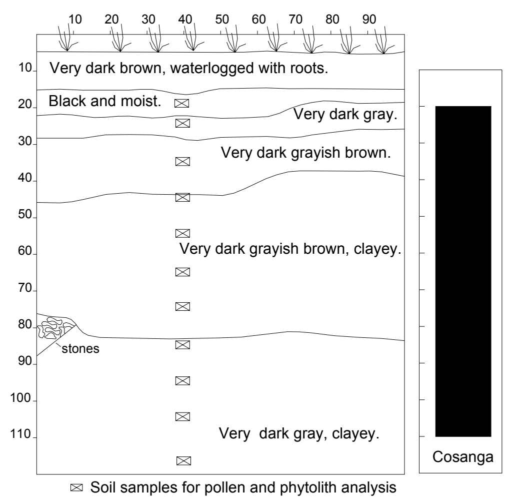


Figure A.35. VQ035 Stratigraphy (E Profile).

Pucalpa, Unit 2: (VQ036-169831,9950451). Placed on a small adjacent leveled area to where VQ035 was excavated, right below its front edge (its dimensions are 5.4 x 2.5 m). The vast majority of sherds are Cosanga (96%). Again it is difficult to determine the function of the site, but it may have been an activity area associated with the large terrace. Only two early sherds, a minimal proportion of the total sherds collected, were recovered in this excavation. The stratigraphy was uncomplicated but we noted an unusually thin (less than 2 cm), hard, orange and irregular clayey layer just as we were finishing the third level of excavation. A carbon sample associated with Cosanga sherds collected in the eighth level of excavation towards the center of the test provided a date of 1795 ± 33 B.C. The sample was collected from a zone of dense accumulation of small fragments of carbon, but it did not seem to correspond to a hearth. The date it yielded seems too early for this region and therefore cannot be used to delineate the absolute dating of the different chronological periods proposed in this research (Figure A.36).

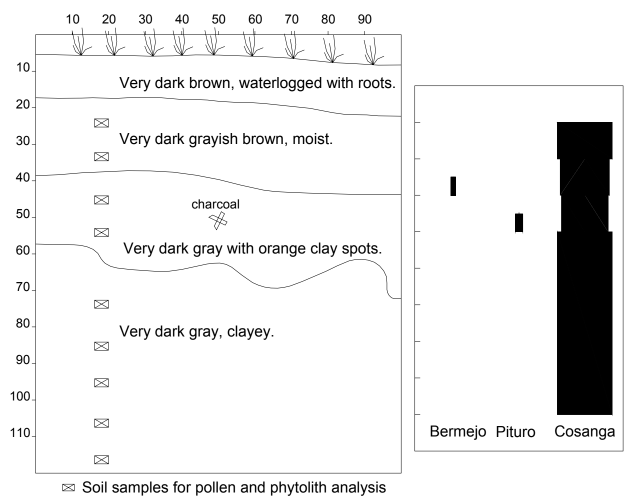


Figure A.36. VQ036 Stratigraphy (N Profile).

Pucalpa, Unit 3: (VQ037-169785,9950449). This test was excavated on an agricultural terrace (13.8 x 3.7 m), the highest of a set of five similar terraces located less than 100 m west of VQ035 and VQ036, and located near a deep canal that runs along the eastern edge. Given its shape and association with a group of similar terraces, there is little doubt that this was an agricultural terrace. It yielded only 15 sherds, yet the three ceramic types peak at different points of the stratigraphic sequence. The stratigraphy is unambiguous (Figure A.37).

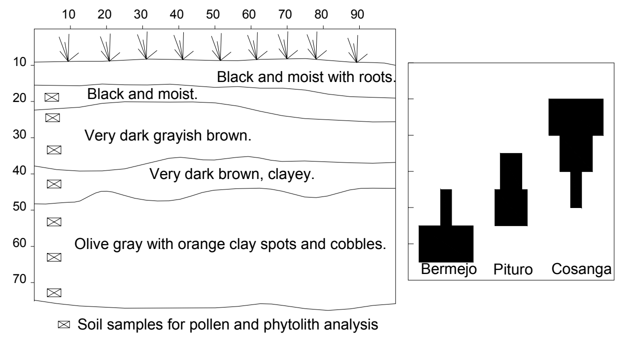


Figure A.37. VQ037 Stratigraphy (SProfile).

Pucalpa Unit 4: (VQ038-169810,9950484). Less than 50 m north of VQ037, we excavated this test on another agricultural terrace (12.7 x 4.6 m), which was part of a group of three terraces of this kind. The stratigraphy was uncomplicated. Only 23 sherds were recovered in this test, 22 of which are Cosanga and one Bermejo Thick sherd found in the last level of excavation. This is consistent with the idea that Bermejo Thick is earlier than Cosanga (Figure A.38).

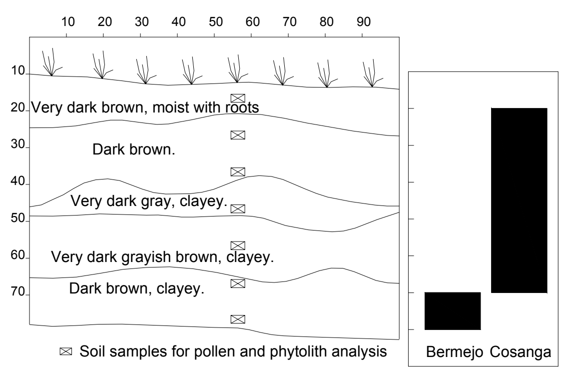


Figure A.38. VQ038 Stratigraphy (E Profile).

San José

We excavated three 1x1 m tests here in November of 2002. The site is on a gently inclined slope, between the San José and Sardinas Grande rivers, and lies at approximately 1,720 m above sea level. Visible on the landscape is a double terrace, one smaller terrace, and a drainage ditch approximately three meters wide. The area is currently used for pasture. It can be accessed by foot from the main Borja-Chaco road or from a side road that runs parallel to the San José River, which leads to a few scattered farms. The survey collections here produced only Cosanga sherds.

San Jose, Unit 1: (VQ039-183929,9955745). Test excavated on a small level area (3 x 4 m) adjacent to an isolated double terrace and separated from it by a 3 m wide canal that descends all along the slope. We thought this could have been an activity area (perhaps a garden) adjacent to what appears to be a residential area. Alternately, this may have been an off-site location. The excavation was shallow, as we reached culturally-sterile soil at 50 cm. The stratigraphy was straightforward and the test produced only Cosanga sherds (Figure A.39).

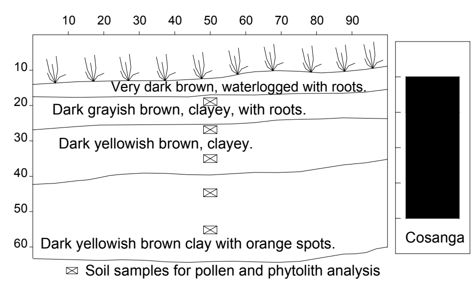


Figure A.39. VQ039 Stratigraphy (S Profile).

San Jose, Unit 2: (VQ040-183945,9955758). Excavated in the bottom terrace of the double terrace adjacent to the one in which VQ039 was excavated. The dimensions of this terrace are 16 meters wide by 6 meters deep. Either of the terraces comprising the double terrace could have been a residential terrace, although it is difficult to assess which one, if either, was a household terrace. The test was placed towards the center of the terrace. The stratigraphy was relatively uncomplicated, with a simple succession of layers until the fifth level of excavation, when zones of mixed soil started to appear. Due to the very small size of this test it is hard to interpret the origin of this disturbance. Only Cosanga sherds were recovered here (Figure A.40).

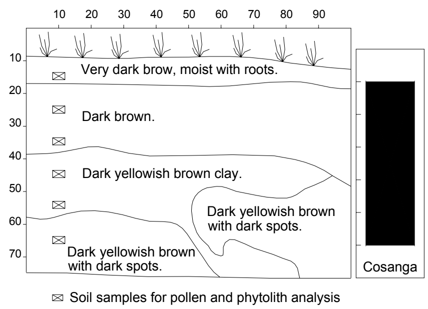


Figure A.40. VQ040 Stratigraphy (E Profile).

San Jose, Unit 3: (VQ041-183940,9955760). Excavated in the front edge of the upper terrace (whose measurement is 14 meters wide by 7 meters deep), just a few meters from VQ040. This terrace was likely a residential terrace. All sherds collected in this test were Cosanga (Figure A.41). The stratigraphy was straightforward. A carbon sample from level three yielded a date of 1,151 ± 32 A.D. This seems a coherent date for association with Cosanga pottery.

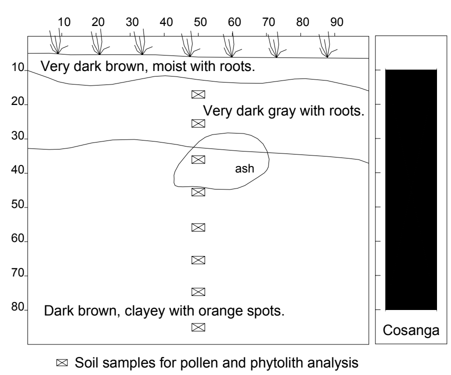


Figure A.41. VQ041 Stratigraphy (E Profile).

Cumandá

This site was chosen at the end of the field season with the hope of collecting carbon samples associated with early pottery types. In this area a few consecutive survey lots produced either predominantly or exclusively early pottery. The site is located on a slope at aproximately 1,980 m above sea level, approximately 1 km north of the Quijos river and 1.5 km east of the Paradalarca River, within the terrain of the Hacienda Cumandá. The area has been cleared for pasture in the past but the owners want forest to grow again, so the predominant vegetation is composed of brush of medium height and tall grasses. It can be reached by foot, from the main Baeza-Borja road. We excavated two 2x1 m tests here in November of 2003.

Cumandá, Unit 1: (VQ042-179708,9950909). This test produced few sherds, most of which are Pituro Dark Polished and Bermejo Thick. Cosanga appears only in the uppermost two layers. Pituro Dark Polished peaks in the lowest excavated levels, suggesting that it may preceed Bermejo Thick. A carbon sample from level 3, associated with Pituro Dark Polished ceramics produced a date of 1,613 ± 32 A.D. This is later than what we expect for this ceramic type (Figure A.42).

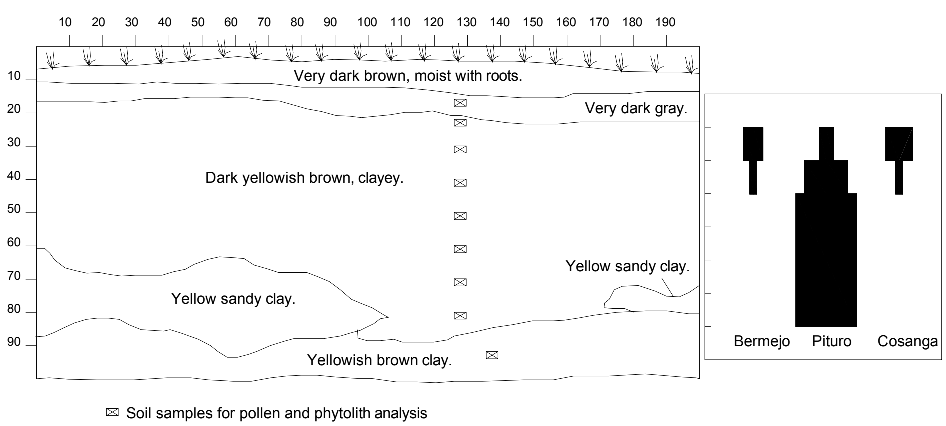


Figure A.42. VQ042 Stratigraphy (E Profile).

Cumandá, Unit 2: (VQ043-179746,9950902). The ceramics recovered here were predominately Pituro Dark Polished, which reach their higher frequencies in the lowest levels. Only three Bermejo Thick sherds appeared, in the second layer, and Cosanga shows slow decrease towards the bottommost layers. This places Pituro Dark Polished as an earlier type than Bermejo Thick (Figure A.43).

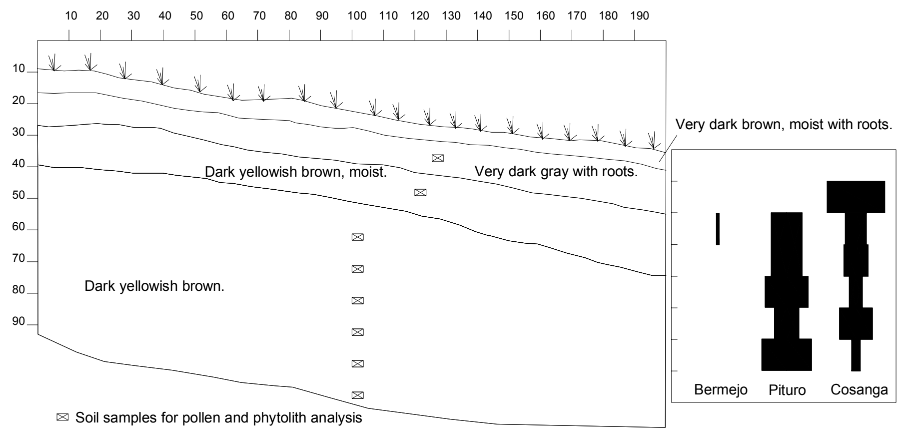


Figure A.43. VQ043 Stratigraphy (E Profile).

Vinueza

The excavation of three 2x1 m tests here was the last attempt in the first season of this project to recover carbon samples associated with early ceramic types and to clarify their mutual chronological relations. We conducted these excavations in November of 2003. The specific area in which we wanted to excavate, where a number of consecutive survey lots had consistently yielded early ceramics, was very swampy after three weeks of unusually intense rainfall that followed the eruption of the Reventador volcano, so we moved north towards a slightly more elevated area that was not inundated. This is still within the area of most occupational density during the Early 1 Period, yet the three tests yielded only Cosanga sherds and in very low quantities. The three tests were located on a relatively large natural terrace, approximately one kilometer east from the population of Borja. This site lies at about 1,750 m above sea level and can be reached by foot from the main road Borja-Chaco or from a side road that leads to a few small farms.

Vinueza, Unit 1: (VQ044-182925,9954135). This was a very shallow deposit that yielded only 16 Cosanga sherds (Figure A.44).

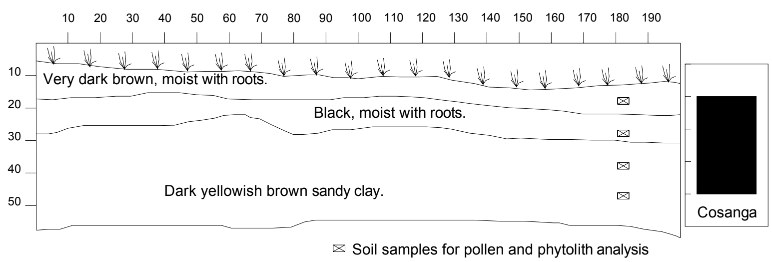


Figure A.44. VQ044 Stratigraphy (E Profile).

Vinueza, Unit 2: (VQ045-182958,9954057). Cosanga was the only ceramic type represented in this test. Culturally sterile soil was reached at less than 50 cm from the surface (Figure A.45).

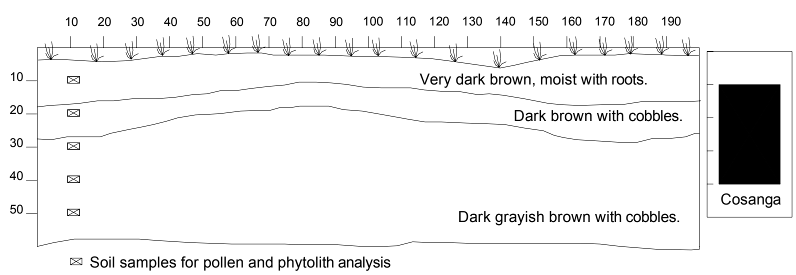


Figure A.45. VQ045 Stratigraphy (E Profile).

Vinueza, Unit 3: (VQ046-182937,9954069). This test yielded only one Cosanga sherd, a hard clayey layer with abundant stones was reached very close to the surface (Figure A.46).

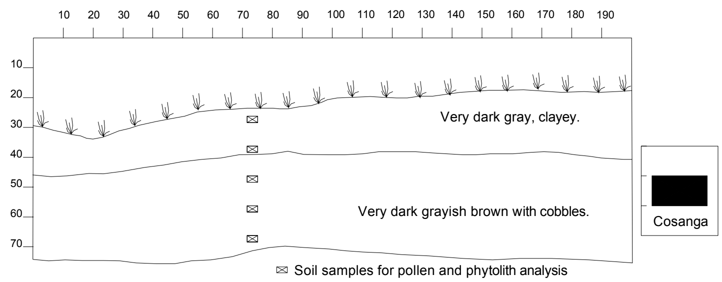


Figure A.46. VQ046 Stratigraphy (W Profile).

ABSOLUTE DATING

Despite the small quantity of radiocarbon dates available for the Quijos region, it is possible to make some observations about the probable duration of the different periods of occupation proposed through the analysis of ceramic materials from stratigraphic tests. Table A.1. summarizes the dates known at present obtained through this research and Porras' research (none of the dates are calibrated). They are listed with their ceramic associations. Four of Porras' dates (Porras 1975:147) are not included here, one that turned out to be modern, one that is too early (1495 ±140 B.C), and two whose ceramic associations are not known because the level and excavation number provided in the list of radiocarbon dates do not match the chart in which the frequencies of ceramic types by level by excavation are provided. One of the dates produced by this research is not included either because it is also too early (1795 ± 33 B.C).

Unfortunately, all of Porras' dates are associated with more than one ceramic type, and he does not provide enough detail in terms of stratigraphy or specific association of carbon samples with particular types. However, it is worth noting possible patterns related to the different percentages of sherds of different types that are associated with each one of the dates.

Table A.1. Radiocarbon Dates (from Late to Early) and their Ceramic Associations.

Cuéllar	1613	± 32	A.D.	Cosanga	100 %				
Cuéllar	1604	± 32	A.D.	Cosanga	12.5 %	Pituro	75.0%	Bermejo	12.5%
Cuéllar	1555	± 32	A.D.	Cosanga	100 %				
Porras	1260	± 80	A.D.	Cosanga	75.5 %	Papallacta	23.8%		
Cuéllar	1226	± 32	A.D.	Cosanga	100 %				
Cuéllar	1151	± 32	A.D.	Cosanga	100 %				
Porras	1090	± 100	A.D.	Cosanga	71.6 %	Papallacta	25.2%	Borja	3.1%
Porras	495	± 170	A.D.	Cosanga	72.5 %	Papallacta	26.8%	Borja	0.7%
Porras	35	± 170	B.C.	Cosanga	53.1 %	Papallacta	46.9%		
Porras	190	± 120	B.C.	Cosanga	46.6 %	Papallacta	53.0%		
Porras	440	± 165	B.C.	Cosanga	58.4 %	Papallacta	41.6%		
Porras	650	± 100	B.C.	Cosanga	51.5 %	Papallacta	48.3%		
Porras	665	± 100	B.C.	Cosanga	53.0 %	Papallacta	46.8%		

All dates associated only or strongly with Cosanga pottery are later than the ones from contexts in which Cosanga was not the dominant type by at least 70% (with the exception of the second one, in which Cosanga constitutes only a minority and yet the date is late). This makes a strong case for arguing that Cosanga was the ceramic type in use by the time of the Spanish conquest, an observation that contradicts Porras' argument (that the region had been abandoned by approximately 700 A.D) and that Lumbreras (1990), Delgado (2000) and Ontaneda (2002) have proposed more recently. Placing a date in terms of when Cosanga became the predominant type in the region is less straightforward. The earliest date associated exclusively with Cosanga sherds is 1151± 32 A.D. following this date, there are two dates associated with at least 70% Cosanga sherds, of which the earliest is 495 ± 170 A.D. The latter two appeared with Borja sherds (we mentioned above how we believe that this type, which Porras believed dominant in the later portion of his sequence, is indistinguishable from Cosanga), and with Papallacta sherds. The general trend, as far as Porras' dates are concerned, shows that the earliest dates are associated with higher percentages of Papallacta sherds. If this evidence is used to assign beginning and ending points to the early occupation of the region, one could conceivably argue that this started by roughly 600 B.C. and gave way to a late occupation, in which Cosanga was the predominant type, by roughly 500 A.D. This is by no means a rigorous way of assigning tentative dates to the early occupation of the region, and it should be considered only as a tentative proposition that needs more investigation. Even more questionable is to propose that the Early 1 and 2, if in fact they represent different periods, have a similar length of approximately 500 years just by splitting the earliest and latest hypothetical range of the early occupation in two. This is proposed here with a great deal of hesitation. Alternatively, the Early 1 and 2 can be considered as a single period.

The scheme proposed matches well the set of dates associated to Cosanga pottery available in the northern and central highlands. A general look at all of the highland sites that have produced Cosanga ceramics, and their associated dates, indicates a late time range for the use of that pottery extends to the Colonial Period, within what is called the Integration Period. The most reliable contexts with Cosanga pottery in the northern highlands, at the site of Cochasquí, yielded dates between 900 A.D. and 1300 A.D. (Oberem 1981). Further north, in the Chota-Mira Valley, Echeverria (1995) draws the association of Cosanga pottery with other local types between 700 A.D. and 1600 A.D. Likewise, Buys et al. (1994) place it in a range of 500 A.D. to 1500 A.D. based on samples from Cumbayá; where Uhle (1926) also found it associated with materials that more recently have been dated between 400 A.D. and 1000 A.D. Reliable dates associated with Cosanga pottery in the central highlands fall within similar ranges; Rodríguez (1991) reports three dates between 565 and 725 A.D. Other dates in the highlands point to earlier time ranges, for example, in excavations at La Chimba Athens (1995), dates the levels where Cosanga sherds are more popular between 40 B.C. and 120 A.D. Regardless, it seems like the majority of reliable dates associated to Cosanga pottery in the highlands falls in a range similar to the one proposed here based on the dates obtained from the Quijos region.

Once again, this is offered as a provisional frame of reference that will serve as a starting point for further investigation in the future. The early occupation is so small and hard to detect in the region, that it was extremely difficult during the first field season of this project to target sites for absolute dating that did not have a late component. Obviously, one of the aims of future fieldwork has to be to find more deposits in which early ceramic types are predominant so that we can provide a good number of absolute dates for this occupation.

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