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Reimagining Ancient Agricultural Strategies and Gendered Labor in the Prehispanic Moche Valley of North Coastal Peru

A dissertation submitted in partial satisfaction of the
requirements for the degree Doctor of Philosophy
in Anthropology

by

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June 2017

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DEDICATION

This dissertation is dedicated to twin sister Paige, who shares my love for all things curious and far away.

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PUBLICATIONS (PEER-REVIEWED JOURNAL ARTICLES)

2016 Sociopolitics in Southeastern Archaeology: The Role of Gender in Scholarly Authorship. *Southeastern Archaeology* 35(3):175–193. (D.N. Bardolph and A.M. VanDerwarker)

2016 New World Paleoethnobotany in the New Millennium (2000–2013). *Journal of Archaeological Research* 24(2):125–177. (A.M. VanDerwarker, D.N. Bardolph, K.M. Hoppa, H.B. Thakar, L.S. Martin, A. Jaqua, M.E. Biwer, and K.M. Gill)

2015 Lamb Site Archaeobotanical Remains: Reconstructing Early Mississippian Plant Collection and Cultivation in the Central Illinois River Valley. *Illinois Archaeology* 27:151–172. (D.N. Bardolph and A.M. VanDerwarker)

2015 Lamb Site Features: Clues to Cooking and Community Organization. *Illinois Archaeology* 27:150–173.

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2014 A Critical Evaluation of Recent Gendered Publishing Trends in American Archaeology. *American Antiquity* 79(3):522–540.

2014 Evaluating Cahokian Contact and Mississippian Identity Politics in the Late Prehistoric Central Illinois River Valley. *American Antiquity* 79(1):69–89.

2013 Maize Adoption and Intensification in the Central Illinois River Valley: An Analysis of Archaeobotanical Data from the Late Woodland through Early Mississippian Periods (A.D. 400-1200). *Southeastern Archaeology* 32:147-168. (A.M. VanDerwarker, G.D. Wilson, and D.N. Bardolph)

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2015 Sexuality: Ancient North America. In *The International Encyclopedia of Human Sexuality*, edited by Patricia Whelehan and Anne Bolin, pp. 1–6. Wiley-Blackwell, Malden, Massachusetts. (D.N. Bardolph and L. Gamble)

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2017 La Poza Archaeobotanical Remains: Salinar/Gallinazo Phase Plant Collection and Cultivation in Huanchaco, La Libertad, Peru. Report prepared for Gabriel Prieto (National University of Trujillo) and the Ministry of Culture (Peru).

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2017 Hearing and Reading California Archaeology: Gender, Publishing, and Narrative Construction at the SCAs. Paper presented at the 51st annual meeting of the Society for California Archaeology, Fish Camp, California.

2016 Food in the Contact Zone: Reimagining Highland-Coastal Contact in the Prehispanic Moche Valley. Paper presented at the 81st annual Society for American Archaeology meeting, Orlando, FL. (Bardolph, Billman, and Briceño)

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2015 Reconsiderando el cultivo de maíz en la época Pre-Moche. Paper presented at the Mesa Redonda de Trujillo 2015, Trujillo, Peru.

2015 Culinary Encounters and Cahokian Contact. Paper presented at the American Indian and Indigenous Collective Symposium on Native Foodways, Environmentalism, and Bio-Colonialism, UC Santa Barbara.

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2015 Paleoethnobotany at Cerro la Virgen: Exploring the Lives of People and Plants at a Chimú Town in the Hinterland of Chan Chan. Paper presented at the 80th annual Society for American Archaeology meeting, San Francisco.

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2014 Evaluating Food, Identity, and Moche Valley Society through Archaeobotany. Paper presented at the 79th Society for American Archaeology annual meeting, Austin.

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2013 Sociopolitics in Southeastern Archaeology: The Role of Gender in Scholarly Authorship. Paper presented at the 70th annual Southeastern Archaeological Conference, Tampa. (Bardolph and VanDerwarker)

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2012 Maize Adoption and Intensification in the Central Illinois River Valley. Paper presented at the 69th annual Southeastern Archaeological Conference, Baton Rouge. (VanDerwarker, Wilson, and Bardolph)

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2010 Cooking in Contact: Changes in Foodways at the Lamb Site. Paper presented at the 67th annual Southeastern Archaeology meeting, Lexington, Kentucky.

2010 Cultivating the Countryside: Diachronic Trends in Mississippian Plant Foodways. Paper presented at the 67th annual Southeastern Archaeology meeting, Lexington, Kentucky. (VanDerwarker and Bardolph)

2010 Finding Food in Features: A Spatial Analysis of the Lamb Site. Paper presented at the 75th annual Society for American Archaeology meeting, St. Louis.

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2009 Personhood in Pottery? An Analysis of Lamb Ceramics. Paper presented at the 66th annual Southeastern Archaeology meeting, Mobile, Alabama.

TEACHING EXPERIENCE

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ABSTRACT

Reimagining Ancient Agricultural Strategies and Gendered Labor in the Prehispanic Moche Valley of North Coastal Peru

by

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Understanding the relationship between agricultural intensification and ancient sociopolitical complexity is a question that has long resonated with archaeological research interests. This dissertation explores the dynamics of food production, migration, and sociopolitical change in relation to the consolidation of the complex, hierarchically organized Southern Moche polity of north coastal Peru during the Early Intermediate Period, or EIP (400 B.C. – A.D. 800). I incorporate archaeobotanical, environmental, and ethnohistorical evidence to address changes in food production, processing, and consumption over five cultural horizons to critically re-evaluate existing models of Moche sociopolitical development, with a bottom-up perspective of the laborers in rural households whose agricultural production supported the growth and florescence of this complex society.

A diachronic comparison of paleoethnobotanical data sampled from five EIP habitation sites in the Moche Valley reveals that dramatic increases in agricultural production by coastal (*costeño*) and highland (*serrano*) groups occurred *prior* to the expansion of the Moche state in the A.D. 300s. The plant data suggest that complex political

dynamics involving tribute relationships and suprahousehold commensal events were already in place during the Gallinazo phase (A.D. 1-200). Highland and coastal peoples likely established mutually beneficial relationships that revolved around food and farming during this period, including fiestas, religious gatherings, and work parties (*masa*). I argue that Moche leaders built upon existing political institutions in which rural households were already engaged in intensive agricultural production, which included maize but also other field cultigens and tree crops.

The intensification of food-processing demands over time also suggests that changes in women's social status may have been tied to increases in processing demands, as women were subjected to new labor increases, time constraints, and scheduling conflicts. Detailed intrasite spatial analysis of a highland colony site reveals that women prepared food in private, behind-the-scenes contexts for supra-household events and public displays that were performed on patio terraces at high status compounds. These women may have prepared food for these public events totally apart from, and without being included, in such events. I interpret the restriction of visibility, with women processing maize and other foodstuffs out of view behind kitchen walls, as part of increased gender segregation that often accompanies processes like agricultural intensification.

The micro-scale approach employed in this study departs from the current, prevailing studies of political, economic, and ideological phenomena at larger ceremonial centers on the Peruvian north coast. This project reveals how a seemingly mundane category of archaeological data (archaeobotanical data) can shed light on myriad social processes related to the negotiation of ethnic identities, gender relations, and domestic labor more broadly, and reframe our understandings of Moche sociopolitical development specifically.

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CHAPTER 1

EVALUATING FOOD, IDENTITY, AND MOCHE VALLEY SOCIETY: AN INTRODUCTION

How can studies of agricultural systems and the ways that people interact with foods they produce, eat, and discard lead us to new understandings about social relations in the past? How do labor roles, gender relations, and status-based inequalities relate to these types of interactions? This dissertation addresses these themes through the lens of foodways in the prehispanic Moche Valley of north coastal Peru. The Peruvian north coast witnessed a profound series of social and political changes during a time period that archaeologists refer to as the Early Intermediate Period, or EIP (400 B.C. – A.D. 800), with far-flung consequences for members of various social standing, from rural households to political centers. The EIP was marked by an increase in political complexity, with clear shifts in settlement and site reorganization accompanied by an increase in social stratification (e.g., Bawden 1996; Billman 1996, 2010; Pozorski and Pozorski 1979; Topic 1977, 1982). These cultural and political changes occurred in a vertically compressed environment that also witnessed periodic El Niño events, which had significant and varied impacts on people's subsistence practices. Indeed, substantial changes in elevation over the relatively short distance from the coast to the highlands, in the Moche and neighboring river valleys, create different microenvironments within close proximity to one another. Fertile interandean valleys have constituted a prime interaction zone between people of the highlands and the densely populated Peruvian coast, a contact dynamic that initiated in prehistory and continues today.

The beginning of the EIP, which includes the Salinar (400 B.C. – A.D. 1) and Gallinazo (A.D. 1–200) phases, witnessed the abandonment of earlier ceremonial centers; population increases and expansion of irrigation systems; political fragmentation and the appearance of formal fortifications and settlements in defensive locations; and cooperation and conflict between coastal and highland groups and among polities of various coastal valleys (Billman 1996, 1999, 2002; Brennan 1978, 1980, 1982; Carcelén 1995; Gagnon 2006, 2008; Gagnon and Wiesen 2013; Gagnon et al. 2013; Leonard 1995; Leonard and Russell 1994; Mujica 1975). Between approximately 300 and 800 A.D., the iconic Moche culture flourished on the Peruvian north coast. The large adobe pyramid complex of the Huacas de Moche was constructed, accompanied by the emergence of a new regional political economy in which Moche rulers exercised significant economic, military, and ideological power over the population of the Moche and adjacent valleys. How did these periods of profound social change affect the prehispanic residents of the Moche Valley in terms of gender relations, status, and the organization of labor in ancient rural households?

Foodways data provide a critical lens for examining these issues. Foodways represent a fundamental axis along which identity is constructed and maintained, and are increasingly recognized as having played a prominent role in the emergence of social hierarchies and the negotiation of status and power (e.g., Bray 2003; Dietler 1996; Gero 1992; Hastorf 1990, 1991; Hayden 1995; Klarich 2010; Weissner and Schieffenhovel 1996). In this dissertation, I incorporate archaeobotanical, environmental, and ethnohistorical evidence to address changes in food production, processing, and consumption during the EIP, a period that included the consolidation of the Southern Moche polity, one of the largest and most complex pre-Columbian political systems in the New World. Conducted in conjunction with MOCHE, Inc., a 501c3 nonprofit dedicated to protecting archaeological sites through community heritage empowerment, this project involved a large-scale comparative analysis of paleoethnobotanical data sampled from five EIP habitation sites that span the period of political transformation and state formation in the Moche Valley.

The data presented in this dissertation derive from three major projects conducted in the Moche Valley in collaboration between North American and Peruvian archaeologists since 2000: (1) the Moche Origins Project (MOP), directed by Brian Billman (University of North Carolina, Chapel Hill) and Jesus Briceño Rosario (Ministry of Culture, Peru) (Billman et al. 2000, 2001, 2004, Briceño and Billman 2007, 2008, 2009; Briceño et al. 2006); (2) el Proyecto de Evaluación Arqueológico con Excavaciones en las Lomas de Huanchaco (PEALLO), directed by Gabriel Prieto (National University of Trujillo) and Victor Campaña (Ministry of Culture, Peru) (Prieto and Campaña 2013); and (3) the Galindo Archaeological Project (GAP), directed by Gregory Lockard (University of New Mexico) and Francisco Luis Valle (Ministry of Culture, Peru) (Lockard 2001, 2002, 2003, 2005). I employ diachronic and spatial analyses of archaeobotanical data from 225 soil samples recovered from five domestic habitation sites excavated within the contexts of these projects to address key issues that have largely remained untested with direct subsistence data. Through these analyses, I trace changes in food production and wild plant food collection during the EIP, considering issues of agricultural intensification and the resulting impacts on labor relations, gender roles, and social inequality for the pre-Columbian inhabitants of rural households in the Moche Valley.

The question of scale looms large in this dissertation. The Moche civilization of northern Peru is one of the best-known and most intensely studied archaeological cultures of the ancient New World. The ancient Moche have captured the imagination of scholars and the public alike, characterized by a series of elaborately decorated temple complexes, wealthy elite burials, and exquisite ceramics found over ten river valleys on the desert coast. A wealth of research by Peruvian, North American, and other international scholars (e.g., Bawden 1995, 1996; Billman 1996; Bourget 2016; Castillo et al. 2008; Donnan and Mackey 2011; Donnan and MacClelland 2002; Pillsbury 2001; Quilter and Castillo 2010; Shimada 1994; Uceda 2001) has revolutionized our understandings of the form, function, and decoration of civic/ceremonial platform mounds; the potential meaning of many Moche artistic themes and figures in iconography; and the nature and purpose of Moche rulers, whose political power appears to have been largely legitimated by the role they played in the performance of religious rituals.

Often overlooked, however, is the labor of men, women, and children in rural households that supported the growth and florescence of this complex society. This topic is emerging recently as a focus of archaeological inquiry in the Moche world (e.g., Briceño and Billman 2008; Bawden 1982b; Chapdelaine 2002; Cruz et al. 1996; Dillehay 2001; Jáuregui et al. 1995; Johnson 2010; Ringberg 2012; van Gijseghem 2001). How do we write the histories of the indigenous peoples that occupied the north coast region for thousands of years before Spanish conquest? At what scale do we write those histories? And what role can archaeology play in the process?

In his discussion of long-term change and continuity in Native North America, Silliman (2010a) charts the ways in which recent scholarship has attempted to bridge some "great divides"—disciplinary, interpretive, cultural, scalar, and political—in a number of ways. These attempts include giving greater consideration to issues of agency, practice, memory, and gender; devising ways to talk about artifacts that tell history rather than those that just tell time; moving away from preconceived and typological ideas about material culture or food items; and paying closer attention to microscale contexts like households in our examinations of social and political change. It is my goal in this dissertation to shift the focus away from large monumental centers and mortuary complexes, the focus of much of the extant research in this region, towards an archaeology of the rural households of the Moche Valley whose labor, particularly as related to plant food production, created, transformed, and sustained the population that we understand as Moche.

Recent advances in Andean scholarship have elevated culinary concerns beyond the realm of the domestic, which is often considered to be outside the domain of the active and political (Bray 2003:5), in works focusing, for example, on the significance of plant remains for understanding sociopolitical change and social memory (Hastorf 1990, 1993; Hastorf and Johannessen 1993; Hastorf and Weismantel 2007; Roddick and Hastorf 2010); the powers women exercise as purveyors of culinary and agricultural knowledge (Krögel 2009; Skar 1981; Zimmerer 1996); and the centrality of the kitchen in modern Andean contexts (Weismantel 1988). The material remains of foodways have great potential for investigations of social, economic, political, and ideological negotiations between diverse groups, within the household and beyond. This type of micro-scale approach both departs from and complements the current, prevailing studies of political, economic, and ideological phenomena at larger ceremonial centers such as the Huacas de Moche, the Complejo El Brujo, San José de Moro, and Pampa Grande on the Peruvian north coast (e.g., Castillo 2001; Franco 1998; Franco et al. 1996; Galvez and Briceno 2001; Quilter 2002; Shimada 1994; Uceda and Armas 1997, 1998; Uceda and Mujica 1994) (Figure 1.1).

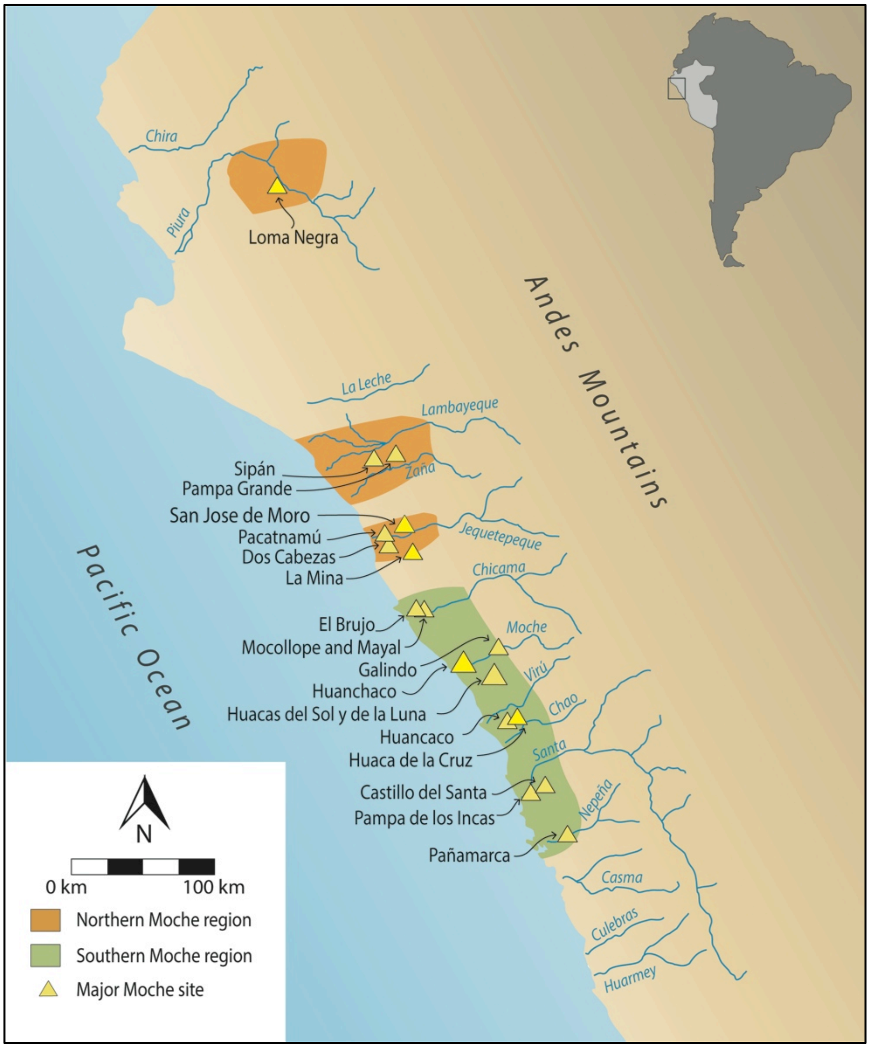

Figure 1.1 Map of north coastal Peru with major Moche centers (adapted from Castillo 2012: Figure 1.1).

Project Goals

My goal in this dissertation is to situate paleoethnobotany within the perspective of a social archaeology, in the ancient Andes more broadly, and on the Peruvian north coast specifically. Within the past few decades, paleoethnobotany, the study of human–plant interactions in the past, has significantly increased its presence in archaeology. A growing number of scholars are focusing their research efforts on untangling how people used plants to negotiate their past social, political, and economic relationships, and those researchers are going far beyond descriptions of subsistence economies, reconstructions of ecological systems, or static lists of identified plant remains (for a recent review, see VanDerwarker et al. 2016). Over the past few decades, we have seen a shift in the issues that scholars attempt to address using plant data. Paleoethnobotanists now routinely employ archaeobotanical data to elucidate as many aspects of past social life as any other form of archaeological data. It is common for plants to be used like ceramics, lithics, spindle whorls, grinding stones, or other artifacts archaeologists commonly encounter to address questions of power, identity, status, gender, ideology, exchange, conquest, and so forth. Paleoethnobotanists can examine plant remains as connected to social practices situated in time and space, rather than only as broad trends that generalize a people's economy or ecology.

Using archaeobotanical data, I seek to redefine ideas about the relationship between the Moche and food production that have long been grounded in proxy features such as irrigation canals, or on more general aspects of production. To date, most scholars continue to rely on Shelia Pozorski's (1979) reconstruction of Moche Valley subsistence, the most substantial contribution to our knowledge of foodways on the North Coast. Pozorski (1979:181-182) envisioned incremental changes in provisioning strategies through time, which culminated in the centralized, redistributive system of the Chimu empire during the Late Intermediate through Late Horizon periods in the Moche Valley (A.D. 1000–1460), based on specialization of agricultural production and emphasis on camelids and cultivated crops over marine fauna and wild plants. However, more robust sampling and analytical methods have developed in the past 40 years since her subsistence data were collected, and Pozorski's EIP data derive specifically from Moche III and Moche IV midden contexts from the Huacas de Moche—lacking are data from Gallinazo-phase contexts, *before* the Moche polity consolidated, or from food-producing households outside of the polity's capital. It is my goal in this study to critically examine the role(s) of agricultural food systems, including maize (*Zea mays*) agriculture, in relation to the emergence of the Southern Moche polity ca. A.D. 300.

Identifying the ways in which political power was mobilized and employed is key to understanding Moche, and direct subsistence data have much to bear on this issue. Billman (2010) proposes that a regional political economy emerged in the Moche Valley during the EIP that was based primarily on the extraction of tribute from farming households in exchange for access to land and water via irrigation canals. In addition to expansion of irrigation systems, farmers would have had to (1) make changes in the types and proportions of cultigens grown and (2) reduced crop fallowing time. As Gagnon (2006, 2008; Gagnon and Wiesen 2013; Lambert et al. 2012) argues, these economic shifts would have resulted in changing patterns of labor, gender roles, and diet.

But how and when did these changes occur? Did intensified agricultural production pre-date or post-date Moche political consolidation, ca. A.D. 300? To evaluate this issue, I employ a diachronic analysis of archaeobotanical data from five EIP Moche Valley sites that span the Salinar (400 B.C. – A.D. 1) through Late Moche (A.D. 700–800) phases. I conclude that maize, along with other storable and productive field cultigens and tree crops, likely served as important precursors to the development of the complex, hierarchically organized Southern Moche polity. I also rethink how different the Southern Moche polity was compared to its predecessors, including the Gallinazo group in the Virú Valley. Indeed, recent research on expansionary dynamics and statecraft in the Virú Valley suggests that a state-level polity may have emerged at the Gallinazo group site, an idea that is currently a topic of hot debate in Peruvian north coast archaeology (e.g., Downey 2015; Fogel 1993; Millaire 2010; Millaire et al. 2016).

I argue that Moche leaders likely built upon existing political institutions in which rural households were already engaged in intensive agricultural production, including maize but also other field cultigens and tree crops. Key changes appear to have occurred in the local domestic and political economies of the middle Moche Valley *in advance* of the dramatic expansion of the Moche polity in the A.D. 300s. The data in this study reveal that rural farmers transitioned to intensive agricultural production in the Gallinazo and Early Moche phases (A.D. 1–300), potentially in response to demands of coastal polities that predated the Huacas de Moche. The extraction of agricultural products witnessed during the peak of Moche power can thus be considered a continuation of patterns to which households had already long become accustomed, which may have been organized at the kin-level rather than by the state. Countering the claim that plant food intensification was orchestrated by those aspiring to *create* political hierarchies, I argue that it may have occurred in the context of larger social/religious negotiations initiated among interallied and intermarried kin groups that ultimately reached an exaggerated scale during the Moche period.

Furthermore, intensive agricultural production was witnessed in both local coastal and migrant highland households of the Moche Valley during the EIP. During the preceding Gallinazo and Early Moche phases (A.D. 1–300), groups from the neighboring highlands colonized many principal river valleys along the Peruvian north coast, just prior to the consolidation of the complex, highly centralized Southern Moche polity (Billman 1996:264, 1997:301; see also Topic and Topic 1982). Billman's (1996) pedestrian surveys located a large number of sites in the middle Moche Valley that were likely occupied by highlanders moving down from the neighboring La Libertad highlands, the Otuzco Basin and the Carabamba Plateau, presumably to take advantage of better resources and farming opportunities. Scholars have envisioned diverse interactions between locals and nonlocals, from trade and exchange, alliance and marriage, to warfare, coercion, and slavery. These dynamics primarily have been interpreted and imagined using survey data; only recently have scholars begun to test these hypotheses with more microscale data, including household excavation data. Recent analyses of ceramic and architectural data from MV-225, a highland colony site in the Moche Valley, indicate that highland and coastal groups may have established mutually beneficial relationships during the Gallinazo/Early Moche phases (A.D. 1–300) to exchange food and farming techniques, along with pottery, labor, and possibly marriage partners (Billman et al. 2000, 2001, 2004, Briceño and Billman 2007, 2008, 2009; Briceño et al. 2006; Fariss 2012; Ringberg 2012). I compare archaeobotanical data from both local coastal and highland colony sites to gain a better understanding of what resources highland migrants were actually targeting, and to evaluate the nature of interaction between these groups.

As a result, a secondary goal of this dissertation is to question longstanding taxonomic classifications about highland-coastal interaction specifically pertaining to foodways. Andean scholarship has long witnessed a wide geographic and conceptual divide between people of the coast and highlands (e.g., Ackerman 1991; Covey 2000; Gelles 1996, 2000; Goldstein 2005; Lau 2004; Mannheim 1991; Orlove 1991; Weismantel 1988). This dichotomy has repercussions not only for our understandings of the Andean past but also for contemporary societies throughout Peru. The inhabitants of these two areas often are referred to as *costeños* (coastal-dwellers) and *serranos* (highlanders), respectively. Although there is constant and dynamic interaction, melding, and movement between these two areas, they are spoken of and conceptualized by academics and laypersons alike as iconic of two different cultures with vastly different economic, material, and political strategies.

Certainly, the inhabitants of north coastal villages 2,000 years ago cannot directly be compared to coastal urban *criollos* (a term originally used to designate people of Spanish descent born in the Americas), nor can ancient highlanders be said to directly resemble the inhabitants of contemporary *serrano* communities. However, this rigid distinction between 'coast' and 'highland' has implications for the way archaeologists interpret their datasets and the patterns that we look for when tracing ancient migration events. The western slope of the Peruvian Andes is a series of vertical environmental zones that support different resources. John Murra's (1975) famous vertical archipelago model, though widely critiqued as universalizing (e.g., Van Buren 1996), still conditions expectations about what 'coastal' and 'highland' dietary assemblages should look like—foods like chili peppers (*Capsicum* spp.), fruits, cotton (*Gossypium barbadense*), and shellfish are 'coastal;' potatoes (*Solanum tuberosum*), other tubers, quinoa (*Chenopodium quinoa*), and camelids are 'highland;' and other prime economic cultigens, including maize and coca (*Erythroxylum coca*), fall in between. Indeed, the interstice of 'coast' and 'highland,' known as the fertile midvalley *chaupiyunga* zone (500-2,300 masl), is a prime maize-growing zone (Fariss 2012:149) and the only zone on the western slope of the Andes that produces coca, a highly valued resource important for ritual and other traditional Andean political-economic strategies (e.g., Allen 1988; Plowman 1984; Rostworowski 1988).

But what happens when *costeños* and *serranos* intersect and overlap in the *chaupiyunga*? What do food and foodways in those contact zones (to use Mary Pratt's [1991, 1996] term) actually look like, at sites where *costeños* and *serranos* intersected and possibly lived together in households? As Sammells (2010) illuminates, what we label as various ethnic cuisines (e.g., "French," "Mexican") actually are collections of diverse ingredients, cooking techniques, labor practices, dining etiquettes, and cultural knowledge, many of which have associations with class, regional identity, and other social markers. I argue that middle valley *chaupiyunga* cuisine during the EIP emerged as a blend of highland-coastal interaction and influence, and that food items at highland and coastal middle valley sites do not necessarily fall into rigid typological categories purely related to predefined assumptions about ecological growing zones.

Shimada and Shimada (1985) identified this issue with respect to camelids (alpacas and llamas) on the north coast of Peru, long considered only to suitable for breeding in highland locales a result of their highland-dominated distribution after the Spanish conquest. Following the period of conquest, camelids were much reduced in economic significance, number, and geographical distribution (indeed, they are not herded on the north coast today), as introduced European domesticates (e.g., sheep, pigs, donkeys) usurped traditional camelid use (Shimada and Shimada 1985:3). However, Shimada and Shimada argue that llamas were bred and herded on the prehistoric North Coast of Peru (rather than periodically imported from the highlands) during the EIP or potentially earlier, based on multiple lines of evidence (ethnographic, ethnohistoric, and zooarchaeological). By not solely relying on typological distinctions witnessed in the present, largely an effect of colonial efforts conducted over the last 500 years (see Silliman 2009), we can more fruitfully reimagine ancient culture contact scenarios, which often involved the exchange of foodstuffs, as well as the technologies needed to process and serve them.

A final goal of this project is to understand the staging of foodways during the transition to intensive agricultural production in the Gallinazo/Early Moche phases. Detailed architectural analyses from MV-225, an EIP highland colony site (Ringberg 2012; see also Billman et al. 2000, 2001, 2004, Briceño and Billman 2007, 2008, 2009; Briceño et al. 2006) afford the opportunity to examine where certain plant foods were processed and prepared (and ultimately discarded), and permit me to make inferences out possible gender- and status-based segregation at the site. In addition to the types and amounts of foods consumed, socially-constructed cuisine preferences can be archaeologically evident from distribution patterns across space. As Hastorf (1991:137; see Bourdieu 1977) highlights, ethnographic studies have shown that we can see differential spatial patterning of artifacts in storage contexts, food preparation loci, refuse disposal areas, and in or near domestic structures; such patterns are the result of habitual domestic practices.

I compare the distribution of plant food remains from specific functional spaces (kitchens, patios, and storage rooms, among others) at MV-225, as well as their distribution in higher and lower status compounds, drawing primarily on Ringberg's (2012) functional classifications but also independently testing her classifications with a Principal Component Analysis. I draw on a range of ethnohistoric, ethnographic, and ethnoarchaeological accounts, from studies of rural farmers in the town of Moche in the 1920s to present day smallholders in the Ecuadorian and Bolivian Andes, to contextualize my interpretations about gender, space, and the organization of foodways (e.g., Bruno 2008; Gillin 1947; Guaman Poma de Ayala 1980[1615]; Sikkink 1998; Silverblatt 1987, 1991; Skar 1981;Weismantel 1988). My intrasite spatial analysis reveals that a significant amount of food processing, including of maize, occurred in enclosed (private) kitchen spaces. Women likely were responsible for this food processing, for daily meals as well as for supra-household events on terraces and patios in which they may not have participated in the consumption of foodstuffs prepared. While data are needed from other sites to make diachronic comparisons about the spatial organization of foodways in the Moche Valley, the spatial data from MV-225 offer an intriguing glimpse into lifeways and labor at a highland colony during the EIP.

Three final points emerge from this study. First, the diachronic comparison of the five Moche Valley datasets highlights the importance of evaluating *both* change *and* continuity in foodways in light of the existing social, political, economic, and ideological systems in which they played a variety of important roles. The consideration of contexts both pre- and post-political consolidation is crucial for understanding changes in agricultural strategies, along with associated changes in domestic labor, gender relations, and social status. In this study, I consider long-term change by tracing shifts in plant cultivation and collection, agricultural intensification, and gender and status relations as tied to labor at the household level over five cultural horizons during the EIP (400 B.C. – 800 A.D.).

A second point to consider is that the ways in which food was used was highly dependent on the political dimensions of the Moche Valley at the time these sites were occupied. The significance of political economies as a factor influencing food choice cannot be underestimated. The food practices discussed here were embedded within increasingly socially hierarchical and economically stratified societies, and thus are inextricably tied to notions of status, including status defined along gendered lines. Reconstructing the routine intimacies of household contexts can be a productive means of investigating subject formation and the inscription and contestation of power through daily social practices, in addition to larger social and political events.

Finally, it is important to note that my discussion of Moche Valley foodways, while considered through the lens of archaeological data, has been shaped by and has implications for people in the political present. As discussed above, our understandings of highland/coastal interaction in the past have largely been shaped by modern notions of difference. Indigenous food choice today echoes the political and ideological impacts of colonialism and continues to play an active role in how people respond, react to, and situate themselves within changing power structures. The interplay of food, politics, and identity underscores the idea that colonialism (or neocolonialism) is an ongoing project, and that the negotiation of foodways must be regarded as an active and agentive process rather than a foregone event (see Thomas 1991).

Throughout the course of conducting research for this dissertation from 2010-2015, I walked through fields tended by smallholding farmers, chatted with women tending plants in house gardens, and shared meals with rural families in their homes, sitting on packed earthen floors, consuming soups and stews cooked over open hearths (including from Chimu pots that farmers recovered in their fields). I do not suggest that traditions of food preparation and serving in Moche Valley households have remained static for millennia, but these instances remind us of the deep antiquity of traditional Andean cuisine and the ties of contemporary residents to their prehispanic past. Indeed, it is archaeology's perspective on the *longue durée* that can grant primacy to Indigenous agency and traditions that pre-date European colonialism (see Joyce and Lopiparo 2005; Silliman 2012).

Emphasizing the many stages of decision-making in food use, I incorporate various bodies of theory, including ecological and practice-oriented perspectives, to discuss shifts in agricultural production, gender dynamics, labor relations, and migrations during this complementary and coterminous period of complex polity formation and diaspora. Ultimately, the case study of this dissertation speaks to the power of plant data for evaluating a key political dynamic that has previously remained untested. By not solely relying on indirect proxies for food production and instead examining direct subsistence evidence, we can more fruitfully reimagine ancient economies and the resulting implications for understanding complex sociopolitical dynamics in the more recent and distant past.

Dissertation Outline

In the chapters to follow, I expand upon the themes and questions that I have raised above. Chapter 2 situates my theoretical perspective on gender, foodways, and labor, in the Andes and more broadly. I discuss anthropological approaches to the study of foodways and labor that use data from the archaeological record, and then I provide a review of recent literature that pushes paleoethnobotany into the realm of social archaeology in the Andes. Chapter 3 provides background information on the ecology and geography of the Moche Valley, along with an overview of current research on cultural developments in the EIP (400 B.C. – A.D. 800). I conclude this chapter with a specific discussion of what is known about Moche foodways to date, based on data from limited earlier studies. This chapter sets the stage (or the table, if you will), for the diachronic comparison of Moche Valley subsistence that follows.

Chapter 4 discusses the plant remains recovered from the five EIP Moche Valley sites in detail. In this chapter, I summarize sampling strategies, methods, preservation issues, and other factors that impacted the ways in which I collected and analyzed the paleoethnobotanical data, and I employ quantitative analysis to explore changes in patterns of plant food use through time. Chapter 5 zooms in on one of the study sites, MV-225, a highland colony occupied during the Gallinazo/Early Moche phases (A.D. 1–300) and presents an intrasite spatial analysis. My goal in this chapter is to explore the staging of foodways, in order to evaluate how migrant subsistence practices were organized with respect to gender and status groups in the context of intensive agricultural production. Chapter 6 summarizes the results of my case study and attempts to retie the threads of Moche Valley EIP food history back to the theoretical issues and questions raised in this introductory chapter. I conclude with directions for future research.

A note on chronology

I use the dating conventions of BC/AD in this dissertation. While it has become increasingly more common for archaeologists to use the secular abbreviations of BCE and CE (or revise dates to report them as BP), the BC/AD convention is still widely used in North Coast and Moche studies, and thus I follow chronologies developed by other scholars.

A note on terminology

Following Hastorf and Popper (1988:2; Hastorf 1999), I define paleoethnobotany as ‘‘the analysis and interpretation of archaeological remains to provide information on the interactions of human populations and plants.’’ While the term ‘paleoethnobotany’ is more commonly used in the New World, the term ‘archaeobotany’ often appears in Old World literature. I use these two terms interchangeably, as do many plant analysts, to refer to the connection between ancient humans and ancient plants.

CHAPTER 2

FOOD FOR THOUGHT: THEORIZING FOODWAYS, LABOR, AND GENDER IN THE ANDES AND BEYOND

The goal of this chapter is to provide a theoretical framework for understanding foodways and labor through the lens of paleoethnobotanical data, in the Early Intermediate Period, or EIP (400 B.C. – A.D. 800) Moche Valley specifically and in the ancient Andes more broadly. I discuss anthropological approaches to the study of foodways and labor that use data from the archaeological record, and then I provide a review of recent literature that pushes paleoethnobotany into the realm of social archaeology in the Andes. A focus on foodways and labor departs from traditional top-down approaches of how elites manifested and wielded political, economic, and ideological power in the Moche Valley. If we accept the idea that foods are “good to think” as well as “good to eat” (*sensu* Levi-Strauss 1964), then the social relations of food and eating should be considered a productive realm for investigating themes such as identity, tradition, gender, labor, and power, in the EIP Moche Valley and beyond.

In the Andes today, *comuneros* (commoners), a peasant class, make up 95 percent or more of the population in rural towns. Their lives are oriented around agrarian pursuits, with a sense of spiritual community engendered by cooperative work in fields (see Gose 1991:42). During my six summer seasons of research in the Moche Valley for this dissertation, I chatted with local farmers in their fields, and often was invited into homes to share meals cooked in ceramic pots over wood hearths, with food debris swept into corners of packed earthen floors. Though not static, these traditions related to foodways can be witnessed in an archaeological record that spans over two millennia. The tasks related to planting, tending, and harvesting, along with processing, cooking, serving, and sharing, condition the rhythms of every day life on the north coast, in the Andes, and beyond, and also have consequences for gender stratification and social inequality. These themes guide my analysis detailed in the chapters that follow.

Theorizing Foodways

In everyday household and community life, foodways are highly visible and pervasive reminders of individual and collective identity, ideology, and social status. *Foodways*, a term that refers to a broad range of practices associated with food, may be conceptualized in terms of diet (actual foods consumed) as well as cuisine (cultural beliefs and practices concerning food) (Crown 2000; Voss 2008a:233). Food is produced/procured, prepared, shared, and consumed multiple times a day, in public and private settings, amongst families and during larger community gatherings, and often is at the heart of social interaction and cultural expression. It is perhaps unsurprising that even in the midst of immense cultural change, including periods of intensive contact with outsiders, food practices are one of the most enduring aspects of traditional lifeways among indigenous peoples (e.g., Graesch et al. 2010; McKee 1987; Sanders 1980). Such persistence is not only explained by environmental or ecological realities, but also by the symbolic importance of historically situated practices embodied in all facets of daily food production and consumption (*sensu* Bourdieu 1977).

The value of exploring past social and political change through the lens of foodways is apparent in a broad range of anthropological literature. It has become axiomatic within anthropology that social relationships are constructed through food-related practices and embodied in food (e.g., Appadurai 1981; Carsten 1997; Douglas 1984; Counihan and Van Esterik 2008; Mintz 2001; Strathern 1988; Sutton 2001; Weismantel 1988). Within the past few decades, archaeologists have increasingly engaged in the study of past commensal relations through the material remains of foodways. Archaeological subsistence studies have moved far beyond dietary reconstructions to examine cooking and cuisine as related to political and ideological discourse (Atalay and Hastorf 2006; Bray 2003; Counihan 1999; Dietler 1996; Hastorf 2012; Potter and Ortman 2004; Spielmann 2002; VanDerwarker et al. 2007; Weismantel 1988), revealing that foodways can serve as strong markers of gender, ethnicity, status, and class, and often are deeply rooted in tradition. However, as Pollock (2012:1, see also Gumerman 1997; Hastorf 2003) notes, the recent focus in archaeology and related disciplines on feasting and other special commensal occasions (e.g., Bray 2003; Dietler 1996; Dietler and Hayden 2001; Gero 1992) should be balanced by attention to daily commensality, in which crucial elements of social reproduction take place. A primary focus on feasting diverts attention from the everyday negotiations of class, gender, status, and ethnicity that are implicated in everyday household tasks related to food (Pollock 2012:5).

In many cultures, staple foods are “loaded with meanings of home, family, hospitality, nourishing, and sharing with the community” (Robb 2010:510). The loci of food preparation, whether within households or in communal facilities, are places where children (often girls) are enmeshed in group norms and ideologies (Crown 2000; Meigs 1988). Indeed, in domestic household kitchens, food usually is prepared by unpaid family members (or underpaid domestic workers), many of whom are often women. While labor related to foodways historically has been characterized as “women’s work” and often has been viewed as drudgery (Janowski 2012:180; Rodriguez-Alegria and Graff 2012:1), possessing culinary or agricultural knowledge can also give women a good deal of power (e.g., Krogel 2009; Skar 1981; Zimmerer 1996). Food and eating are central to conceptions of social relationships, power, status, reproduction, economy, ideology, and sex, all of which are fundamental to constructions of identity (Wilson 1997:129). As a result, choices of foods consumed, as well as organization of food production activities, often can be attributed to individual identity, group definition and solidarity, or hierarchical position (Hastorf and Johannessen 1994:427; see Graesch et al. 2010).

In this dissertation, I focus my discussion on plant foodways, and explore a range of field cultigens, tree crops, other fruits, and miscellaneous wild resources exploited by ancient residents of the Moche Valley of north coastal Peru (see Chapter 4). Throughout history, humans have obtained much of their food, fuel, and technological needs from the gathering of wild plants, horticulture, agriculture, and arboriculture. Certainly, animal products also have been important components of diet and cuisine (past and present), and there has been a recent push to integrate archaeobotanical and faunal datasets to gain fully robust understandings of past foodways (VanDerwarker and Peres 2010; see Crane and Carr 1994; Miller et al. 2009; Smith and Egan 1990; Spielmann and Angstadt-Leto 1996; Twiss et al. 2009). Prehispanic residents of north coastal Peru relied on two main domesticates, camelids (*Lama* sp. and *Vicugna* sp.) and guinea pig, or *cuy* (*Cavia* sp.), and they also exploited white-tailed deer (*Odocoileus* sp.), rodents, small snakes, and lizards, as well as marine resources including marine otter (*Lontra felina*), various near and off shore pelagic fish, sharks, rays, molluscs, and coastal seabirds such as cormorant (*Palacrocorax* sp.) and pelican (*Pelicanus* sp.), on the coast as well as in middle valley sites (e.g., Pozorski 1979;

Reitz 1988; Sandweiss et al. 1996; Shimada and Shimada 1985; Szpak et al. 2015, 2016; Venet-Rogers 2013)[1].

Regardless, the contribution of plant foods to Moche Valley diet (along with ritual, medicinal, and technological needs) was and remains substantial. While the abundance of certain plants in the archaeological record may be the result of differential preservation (Miksicek 1987; Munson et al. 1971) or ecological constraints, evidence of differential plant use between communities is often conditioned by cultural choices (Hastorf 1999:37; Pearsall and Hastorf 2011). For example, Morehart and Helmke's (2008) comparison of archaeobotanical data from two Late Classic period Maya sites in the upper Belize Valley, an affluent *plazuela* group and a commoner farmstead, demonstrated that wood procurement and craft production were socially contingent—some households procured wood from the local environment while others obtained higher quality materials through trade, gifts, or tribute. These practices in turn impacted the organization of household labor, including gendered household tasks such as firewood collection. In addition to status, food selection is often enacted to preserve identity and tradition. In her ethnographic study of Salasacan foodways in the Ecuadorian Andes, Corr (2002) found that food informed local construction of personhood and Salasacan identity, in contrast to White/Mestizo identity. Contrasts between local/non-local, processed/natural, cultivated/store-bought, and Spanish/Indian foods served to strengthen individual as well as collective identities (Corr 2002:6).

In addition to the types and amounts of foods consumed, socially-constructed cuisine preferences can be archaeologically evident from distribution patterns across space. As

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[1] It is my goal in future research to incorporate a comparative faunal analysis from the Moche Valley sites included in this study once such data become available; however, at this point a consideration of faunal contributions to EIP foodways falls outside of the scope of this dissertation.

[2] In the literature review in this section, I omit studies that are more paleoecological in

Hastorf (1991:137; see Bourdieu 1977) highlights, ethnographic studies have shown that we can see differential spatial patterning of artifacts in storage contexts, food preparation loci, refuse disposal areas, and in or near domestic structures; such patterns are the result of habitual domestic practices. Archaeologists have successfully used spatial analysis of different contexts (elite/non-elite, monumental/domestic, etc.) to examine the intersection of a variety of food-related activities with status, political economy, gender, ritual, and the public/private division (e.g., Cutright 2009; Gero and Scattolin 2002; Gumerman 1991, 1994a; Hastorf 1990, 1991; Marston 2010; Twiss 2012; VanDerwarker and Detwiler 2002; VanDerwarker and Idol 2008; VanDerwarker et al. 2014; Welch and Scarry 1995; Wright 2000).

VanDerwarker and Detwiler's (2002) analysis of Cherokee foodways from the Coweeta Creek site revealed that plant food processing took place near townhouses (typically considered to be a 'male' domain), complicating assumptions about gendered segregation of space in protohistoric Cherokee communities. Based on her analysis of faunal data from Neolithic Çatalhöyük in central Anatolia, Twiss (2012; see also Bogaard et al. 2009) suggests that each household had separate private and communally advertised identities; whereas certain feast foods were placed publically to announce particular identities to others (likely as claims of power and prestige), quotidian food stores were placed out of sight in private storage rooms on the sides of individual houses. I discuss the intersection of food and social space further in Chapter 5.

Theorizing Labor

Inseparable from a consideration of foodways is a consideration of labor. Silliman (2001, 2010b) explicitly problematizes anthropological conceptions of labor, asserting that a useful definition places it in an economic framework encapsulated within social relations. Citing Wolf (1982:74), Silliman (2001:380) draws on Marx's distinction between work and labor: work represents the activities of individuals or groups expending energy to produce, but labor represents a social phenomenon, carried out by human beings bonded to one another in society. Labor's significance for the anthropology of power and social relations is its ability to be appropriated and enforced (see Arnold 1993, 1995) as well as its varying impacts on men, women, and children in households and communities.

Within prehistoric archaeology, labor primarily has been approached through studies of political economy (e.g., D'Altroy and Hastorf 2001; Saitta 1997), elite control of labor and surplus (e.g., Ames 1995; Arnold 1993, 1995; Hayden 1995; Schortman and Urban 1998; Webster 1990), and craft specialization (e.g., Arnold and Munns 1994; Costin and Hagstrum 1995; Kelly and Ardren 2016). Studies in historic archaeology have addressed the relationships between conscripted labor and tribute, material life, and social relations in colonial households, missions, rancherias, and plantation settings (e.g., Deagan 2001; Silliman 2001, 2004; Singleton 1985; Voss 2008b; Young 1997). Many traditional Andean societies considered the control of labor to be the foundation of social power, rather than possession of material wealth or commodities (Murra 1980; Ramírez 1996). With respect to the Inka, all categories of people (infants, children, men, women, the elderly, and the disabled) were categorized into different classes on the basis of their productive capabilities. As described by chronicler Guaman Poma de Ayala (1980[1615]:137, translated from Spanish), the Inka empire "separated the Indians into ten classes to be able to count them, in order that they were employed in work according to their capacity and that there were no idle people in this reign." Given the emphasis on labor relations noted in the ethnographic and ethnohistoric literature in the Andes (see Murra 1980), a deeper consideration of ancient labor dynamics seems critical to understanding Andean political economies and shifts toward increasing sociopolitical complexity and inequality.

In his studies of laborers in Franciscan mission contexts and Mexican California ranchos in Alta California, Silliman (2001, 2004) employs explicit practice-based approaches to labor (see Bourdieu 1977; Giddens 1984). According to Silliman (2001:381), labor is more than simply an economic or material activity; rather, it should be conceived of "as social action and as a mechanism, outcome, or medium of social control and domination." As Hastorf (2009:52) illuminates, the "places where people complete daily tasks are the nexus of grumbling, confrontation, as well as celebration and awe." Highlighting labor as practice considers how labor regimes are implemented and then carried out on a daily basis; how labor can be a highly routinized set of practices; and how labor tasks and scheduling are experienced bodily and socially. The procurement, production, processing, and consumption of plant foods in households and for larger community events certainly require a unique set of social practices that leave archaeological signatures. Hastorf (1988) outlines a range of labor activities related to these three elements of foodways, from production to processing to consumption.

Production requires preparing soil, planting, fertilizing, mulching, recultivating, watering, weeding, and collecting/harvesting, all of which may require reaping, beating, plucking, uprooting, or furrowing, which often occurs more than once during a single-growth cycle. Production activities require careful attention to seasonality and scheduling, with regards to planting, crop management/maintenance, and harvesting. With the exception of seed storage, tool production, and the generation of domestic compost, activities related to production take place in fields or home gardens where crops are grown. Archaeologists rarely investigate fields themselves to find evidence of crop production (but see Hayashida 2006; Kus 1975; Miksicek 1983; Miller and Gleason 1994; Morehart 2012; Nordt et al. 2004); rather, they make inferences about production activities based on patterns of field crops, tree crops/other fruits, and wild weed seeds that make their way back to domestic habitation sites.

The issue of agricultural intensification looms large in this dissertation. Prehistoric agricultural intensification would have involved increased labor investment along the entire set of tasks associated with farming: canal construction and maintenance, terracing, fertilizing, weeding, mulching, harvesting, processing, etc. Ancient farmers would have paid strict attention to seasonality and scheduling of planting, tending, and harvesting; as a result, changes in agricultural rhythms associated with intensification would have conditioned daily practices related to crop production and processing.

Processing relates to a range of activities associated with preparation for immediate consumption or storage, in addition to preparing plant parts for their use as shelter, containers, tools, clothing, and so forth (Hastorf 1988:125). These activities include threshing, winnowing, milling, leaching, grinding, etc., along with cooking activities such as parching, roasting, toasting, boiling, baking, etc. Most of these activities take place within habitation areas and require the use of various material media (ceramics, processing implements, foodstuffs) as well as movement through various spaces, public and private, that provide opportunities for social interaction or restrictions on visibility and community integration (Bardolph 2014; Gifford-Gonzalez and Sunseri 2007; Twiss 2012; Wright 2000). Archaeobotanical data can be used to indicate the spatial location of on-site processing activities (e.g., in enclosed rooms or single-house structures, open patios, communal outdoor spaces), and can also inform on processing that occurs off-site, near fields at times of harvest.

Consumption, the actual intake of foodstuffs, can be reflected in food preparation and cooking strategies (Hastorf 1988:135). In the absence of direct evidence of consumption in the form of dental calculus, coprolites, or bone chemistry data, consumption practices can be inferred via food remains within hearths, types of cooking and serving vessels, heating techniques (e.g., *comales* for grilling, pots for boiling), starch grain residues and phytoliths on cooking vessels, and scatterings around hearths and middens where food was prepared and leftovers were discarded.

Some of the literature focused on the political economy of expansionist states considers the role of food (and resulting implications for sociopolitical change) in terms of household labor organization and gender hierarchies. Andean researchers have questioned whether state development implied increases in women's labor and changes in women's social status (e.g., Costin 1998, 2016; Costin and Earle 1989; Gero 1992; Hastorf 1991; Silverblatt 1987, 1991). Important approaches also have been developed in Mesoamerican scholarship for considering these issues (e.g., Brumfiel 1991; Hendon 1996, 1997; McCafferty and McCafferty 1996). For example, Brumfiel (1991) argued that the Aztec state increased tribute demands on households, requiring family members (usually men) to spend more timing engaging in labor away from the household. She argues that women's labor investment in food processing increased with the shift from the cooking of stews and porridge to the preparation of portable but more time-consuming tortillas.

Food, Labor, and Gender in the Andes

In the Andes, questions of state expansion, gender, and labor have revolved mostly around *chicha* (*k'usa* in Aymara; *aqha* in Quecha)*,* or beer production (typically maize beer, although chicha is manufactured from other fruits and grains including manioc [*Manihot esculenta*], mesquite [*Prosopis pallida*], molle berries [*Schinus molle*], peanuts [*Arachis hypogeae*], and quinoa [*Chenopodium quinoa.*], see Biwer and VanDerwarker 2015; Logan et al. 2012; Sayre et al. 2012). Throughout the Andes, large quantities of chicha are prepared to supply *masa*, or work parties, in which laborers (men) are provisioned with alcohol in exchange for their participation in agricultural production or monumental construction (Cavero Carrasco 1986; Gose 1991; Bray 2003, 2009; Costin and Earle 1989; Morris 1982). Chicha is also offered as libations after harvest ceremonies, during feasts, and at the end of the life cycle. A practice documented in ethnohistoric times involved the use of chicha in ancestor veneration (Cook and Glowacki 2003; Cummins 2002; Hastorf and Johannessen 1993; Staller 2006); during imperial celebrations, mummified ancestors were brought out in their finery and offered toasts of chicha (Cobo 1979:218; Cummins 2002; Hastorf and Johannessen 1993; Pizarro 1965[1571]:192; Staller 2006; Valdez 2006:57).

Bray (2003) and Jennings (2005) outline the enormous labor input for chicha brewing, concluding that labor investment in chicha production would have been central to Andean leaders' ability to organize large-scale feasts. Gero (1992) and Jennings and Chatfield (2009) suggest that large-scale feasting impacted women's status, arguing that as feasting became more centralized and production more specialized, women lost control and influence formerly held through domestic production and distribution within a household's social network. This labor endeavor had different consequences with respect to gender and status is terms of consumption as well. In several cases, including the Inka occupation of the Upper Mantaro Valley of central Peru (Hastorf 1991), the Tiwanaku occupation of Moquegua in southern Peru (Goldstein 2003, 2005), and the Gallinazo occupation of Cerro Oreja in the Moche Valley (Gagnon 2006, 2008; Gagnon and Wiesen 2013), bone chemistry studies and oral health indicators suggest that men had higher maize intakes, likely a result of participation in public commensal events involving chicha.

In contrast, these differential consumption patterns led to poorer dental health for women; Andean scholars have reported gendered divisions of labor in which females are responsible for masticating maize kernels for *chicha* production, resulting in higher dental caries rates among women (Berryman 2010:281). In certain parts of the Andes and Amazon it has been documented ethnographically that to sweeten chicha, women chew the maize (which breaks down the complex starches into simple sugars) and spit the masticated mixture into the pot where the chicha is then boiled (e.g., Conklin 2001). These differences would not result in differences in male and female stable isotope ratios, as women were not necessarily consuming the maize; depending on the location in the Andes, chicha can be made from a variety of products, and chewing and spitting is not always part of the preparation. Based on her analysis of bioarchaeological data from the Salinar (400–1 B.C.) and Gallinazo (A.D. 1–200) burials from the site of Cerro Oreja in the Moche Valley, Gagnon (2006, 2008; Gagnon and Wiesen 2013) suggests that the men of Cerro Oreja were increasingly drafted by elite into work parties where they were provisioned with meat or marine resources, whereas women and children tended agirucltural fields and consumed the staple crops they produced and processed, resulting in different gendered diets and dental health.

Hastorf (1991) documents similar patterns in for the Sausa people under Inka hegemony in the Upper Mantaro Valley; stable carbon and nitrogen isotopic values suggest that while women were producing more chicha, only certain men in the Sausa community consumed maize in suprahousehold community events, and men also had greater access to meat. While women increased their labor in terms of chicha preparation, they did not participate in suprahousehold consumption. In the Andes, chicha drinking reinforces social hierarchies; social status is marked by the order in which one is served chicha, and whether one acts as giver or receiver (Bolin 1998; Chávez 2006; Cutler and Cárdenas 1947; Hastorf 2003; Hastorf and Johannessen 1993; Jennings 2005; Jennings and Bowser 2009; Staller 2006; Weismantel 1991). Dynamics in which women prepared and served chicha that was then consumed by men thus has implications for status as well as traditional gender roles in Andean societies.

While a wealth of literature has been devoted to feasting, work parties, etc., less often considered in discussions of political expansion, gender, and labor is a consideration of everyday labor associated with farming, foraging, and processing of foodstuffs for daily household needs in addition to suprahousehold community. Feasts and daily meals are not necessarily mutually exclusive (Gumerman 1997; Hastorf 2003; Hastorf and Weismantel 2007; VanDerwarker et al. 2007)—when distinguishing between feasts and daily meals, often it is not the type of plant that differs but the way(s) in which it was prepared, presented, or combined with other foods, or in terms of the sheer quantity in which it was used and/or deposited.

We can consider chicha production as an example of the difficulty of distinguishing between the production of feasts and daily meals: the steps of chicha production have been documented ethnographically and through experimental archaeology in the Andes (e.g., Goette et al. 1994; Jennings 2005; Jennings and Bowser 2009; Marcus 2009; Morris 1979; Moseley 2005; Ringberg 2012; for summaries see Biwer and VanDerwarker 2015; Dietler 2006), including on the north coast of Peru (e.g., Hayashida 2008; Moore 1989; Prieto 2011). These studies point to three broad contexts of production: (1) large-scale chicha production within permanent facilities; (2) small-scale household production; and (3) production for feasts by attached households. Although state-sponsored chicha breweries have been documented at several Prehispanic sites, Hayashida (2008) points out that household production is difficult to identify in the archaeological record, because chicha is usually made in kitchens where food is also prepared, and these foods also comprise the same ingredients used in chicha (e.g., maize, or other fruits or grains). Within Andean households, daily plant food processing may have been conducted for a variety of purposes: to prepare for community events such as feasts or work parties; to meet tribute demands; and to prepare and store foods to meet daily household needs.

If we consider the distribution of labor associated with household and suprahousehold tasks related to food and farming, Andean ethnographies and ethnohistories overwhelmingly indicate that labor is highly gendered (e.g., Guaman Poma de Ayala 1980[1615]; Hamilton 1998; Krögel 2009; Mayer 2002; Skar 1981; Weismantel 1988; Zimmermer 1996). Guaman Poma de Ayala (1980[1615]) describes how each age/gender were assigned a specific role amongst the Inka and were required to participate in the maintenance of the household. Men engaged in seasonal agriculture, as well as lithic production and some herding; women also played a role in seasonal agricultural work (primarily through planting), as well as spinning, weaving, and herding; children were responsible for many small tasks, such as gathering fuel wood, plants for dyes, or herbs, as well as herding (Guamán Poma 1956 [1613]). Guaman Poma de Ayala (1980[1615]) further described *aqllakuna*, a group of select women from regions conquered by the Inka who were sequestered at state facilities known as *aqllawasis* (see Costin 1996, 1998). Referred to as *monjas* (nuns), these women "made textiles, chicha, and food and did not sin" (Guaman Poma de Ayala (1980[1615]:310, translated from Spanish). Separating the *aqllakuna* from their own kin (Guaman Poma de Ayala (1980[1615]:302-303), the Inka created fictive kinship networks and heralded these women as virgins of the sun (and indeed wives of the sun god himself, see Silverblatt 1987:85), whose primary purpose was to serve the state, including as food producers.

On a broader scale, the typical view in the Andes is a gender-divided dynamic of men working in fields and women processing harvests, linked to the basic economic unit of the household. These cultural ideals are likely flexible (in the present and past), as the realities of work on a day-to-day or seasonal basis are/were negotiated. Indeed, women in Andean societies often are responsible for storing seed and planting, whereas men plow, harvest, load pack animals, and organize transport of crops to the house (Hastorf 1991:138). Overall, however, women primarily are considered responsible for the preparation of daily meals in traditional Andean households (Hamilton 1998; Mayer 2002), and they manage food preparation and serving for supra-household events including feasts. Rather than seeing household labor related to food and farming as drudgery, scholars including Skar (1981), Krögel (2009), and Zimmerer (1996) examine the powers women exercise as purveyors of culinary and agricultural knowledge. According to Skar (1981:41), Andean women are widely reported to exert exclusive control over storage and distribution of agricultural products. As the movement of agricultural products shifts outside of the household to larger community events or to meet tribute demands, however, this exclusive control of agricultural products may change.

Kelly and Heidke (2016) summarize a range of anthropological and economic scholarship that suggests a correlation between increasing rigidity between gendered tasks and increasing dependence on agriculture (Aaby 1977; Chevillard and LeConte 1986; Divale and Harris 1976; Ehrenberg 1989; Lerner 1986; Meillassoux 1981; Peterson 2002). Ethnographic data suggest that women's participation in intensive agriculture decreases relative to men's participation as women increase tasks related to food processing and domestic production (Burton and White 1984; Ember 1983). The process of agricultural intensification in the Andes, whether through canal irrigation (witnessed on the coast) or agricultural terracing (witnessed in the highlands), or through shortening fallow sytems more generally, likely impacted the spatial distribution of domestic labor. When interpreting gender relations through the lens of archaeological data, scholars run the risk of uncritically relying on ethnographic analogy to project gender ideologies and practices onto the past. This research tradition is problematic in the Andes, where pan-Andean concepts of "lo andino" (a catchphrase for all things culturally Andean; see Jamieson 2005; Van Buren 1996) prevail, positing that Andean traditions and cultural identities experience continuity across time and space (e.g., Janusek 2004). Scholars also disproportionately rely on models derived from knowledge of the Inka, in the absence of an ethnohistoric record (or written record) for more ancient polities.

The Inka Empire was largely organized as a means of extracting *mita* (corvée labor) and tribute from its populace (D'Altroy and Earle 1985; Earle 1994; Murra 1980). Drawing on Goody (1982) and Mayer (1977), Murra (1980) suggests that during this era, the basic tax unit was the "traditional household," a married couple and their children, who worked together as a unit to provide tribute, with laborers (men) tilling state fields and women processing agricultural produce (see also Stanish 1992:27). On the Peruvian north coast, ethnohistoric documents provide excellent sources for understanding Chimu communities in addition to Inka lifeways. Many of these sources indicate that a network of patron-client relationships existed between leaders and commoners during the reign of the Chimu Empire (Cock 1986; Netherly 1977, 1984, 1990; Ramírez 1996:42–97; Rostworowski 1975, 1977; see also Billman et al. 2017). Known as *señores*, *curacas*, *caciques*, or *principales* in ethnohistoric documents, these leaders were arrayed in a political hierarchy ranging from local lords to the king of the Chimu Empire and his kin. Each *curaca* controlled groups of families, known as *parcialidades*, as well as specific resources (such as agricultural land and water, raw material sources, or fisheries). In exchange for protection and access to those resources, each *parcialidad* of farmers, fishermen, or crafting households provided annual tribute payments in the form of goods and labor to the local lord. Thus, occupational specialization largely dictated the gendered division of labor witnessed in north coast households, as each *parcialidad* focused on a particular productive activity, such as farming, fishing, or crafting.

As a result, we must carefully interrogate the limits of our data when reimagining ancient labor relations and gender dynamics tied to foodways in the more distant past. In her study of Wari households in southern Peru, Nash (2002) suggests that independent domestic units (i.e., residences) were not necessarily economically independent, and that labor associated with foodways tacks back and forth between the household and larger community events. According to Nash (2002:51):

> Mothers, associated with cooking fires, define the simplest family group—a woman and those to whom she serves food. Nevertheless these food preparation divisions do not necessarily carry over into other productive tasks that benefit the larger group spread out in several structures. Meals may be cooked in separate rooms, but prepared food may be sent between structures to maintain ties that coordinate larger labor activities.

In this dissertation, I attempt to redefine ideas about the complexity of the Moche and food production that have long been grounded in proxy features such as irrigation canals, or on more general aspects of production. I draw on ethnographic and ethnohistoric models to conceptualize ancient gender and labor relations during the EIP, and posit that men, women, and children likely participated in various tasks on an everyday basis to provide the basic economic requirements that sustained a household, as well as to meet the requirements for supra-household events and tribute demands. It is likely that individuals from multiple houses pooled labor on a daily basis to meet those requirements; thus, my consideration of ancient labor and gender relations is inherently collaborative. Theorizing foodways and labor, including through the lens of paleoethnobotany, represents a relatively new endeavor, particularly in the Moche Valley but also in the Andes more broadly. I now turn to a review of recent literature that attempts to push plant data into the realm of social archaeology and that serves as a framework for this study.

Social Paleoethnobotany in the Andes

How have Andean scholars addressed issues related to the theoretical frameworks of foodways, labor, and gender outlined above? A host of issues, from agricultural intensification to feasting, have been discussed in the Andes largely in the absence of systematically collected paleoethnobotanical data; rather, these discussions revolve around proxy measures such as irrigation canals, terraces, lithic tools for agricultural intensification, ceramic vessels and other serving implements, and the analysis of functional spaces (e.g., breweries) for feasting. In recent decades, however, the Andean region has witnessed a growth in the number of practicing paleoethnobotanists, with pioneering groundwork laid by scholars such as Christine Hastorf (e.g., Hastorf 1983, 1990, 1991, 2001), Deborah Pearsall (e.g., Pearsall 1989, 1999, 2002, 2003, 2004), and Shelia Pozorski (1976, 1979, 1982) among others.

Paleoethnobotany has been somewhat limited on the Peruvian north coast, with the exception of important works by Shelia Pozorski (1976, 1979, 1982; Pozorski and Pozorski 2006) and George Gumerman (1991, 1994a, 1997), discussed below. In a region where academic and popular imaginations have historically been focused on monumental architecture, large mortuary contexts, and power-wielding elites, paleoethnobotany's contribution to reconstructing the Andean past is not particularly well known. The fact that both professional discourse and popular imaginations of the ancient Moche overwhelmingly have centered on the more romantic and macro-scale aspects of past societies makes the pursuit of more micro-scale research significant.

As discussed above, a major shift that we have witnessed in the past few decades is a movement away from pure subsistence reconstruction towards examinations of foodways. A consideration of foodways is not just a concern with what foods people eat—that is, not just lists of foodstuffs or caloric intakes—but how people procure, prepare, and serve different combinations of foods, and what meanings meals might have in varied contexts. Are the plants we recover in archaeological assemblages representative of every day foods, and/or did they serve medicinal or technological purposes? Could the plants represent special purpose ritual foods (which may or may not have actually been consumed), or luxury foods that are difficult to procure or restricted to certain contexts (*sensu* Hastorf 2003)? Are they partitioned in various communities along class, status, gendered, or ethnic lines? Are the uses of certain plant foods structured by power and inequality? Several recent case studies in the Andes use paleoethnobotanical data to evaluate these issues. In my review of these cases below, I highlight several key themes, including ritual, hierarchy, political economy, and daily practice (as well as their intersection)—it is within these theoretical areas that paleoethnobotany in the Andes has meshed most with social archaeology[2].

Plants and Ritual

A number of recent paleoethnobotanical investigations have focused on ritual, in that scholars have examined plant remains to identify, characterize, and understand past ritual practices. A focus on ritual diverges from earlier utilitarian emphases in paleoethnobotany that viewed plant remains solely as indicators of ecological settings, subsistence patterns, or utilitarian resources (Morehart and Morell-Hart 2013; see Morehart 2011; Morehart and Helmke 2008). Plants can serve as artifacts of ritual experience and are often key components in the physical materialization of religious beliefs. Researchers focusing on ritual in the Andes tend to identify plants in the archaeological record that have recorded ritual uses in ethnographic records, or they tend to examine ritual contexts where plants were used, such as funerary contexts or feasts. Often in the latter cases, spatial contexts are identified prior to conducting analysis of plant data (see Chapter 5).

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[2] In the literature review in this section, I omit studies that are more paleoecological in nature, as well as studies focused exclusively on documenting the origins of particular taxa, the domestication of crops, and the introduction of agriculture.

Attempts to identify ritual plants in Andean contexts include Belmonte and colleagues' (2001) examination of coca leaves (*Erythroxylum coca*) recovered from offering bags in funerary contexts from three Tiwanaku period cemeteries in Northern Chile. Their analysis of coca varieties indicates that it was locally grown in the Arica/Bolivia area, and they infer that the individuals interred with the coca offering bags were likely in positions of power/higher status, due to the ritual/ceremonial importance of coca that has long been recognized in Andean communities from prehispanic to modern times (e.g., Allen 1988; Plowman 1984; Rostworowski 1988). Muñoz Ovalle (2001) provides new archaeobotanical evidence of early interment of people with coca in the Formative Period in Arica, Chile; he also describes the importance of vegetable fibers in burials, identifying local water plants and reeds that would have been used to make mats for the interred. Morcote-Riós (2006) discusses plant remains from funerary contexts in Southwestern Columbia spanning 650 to 1250 A.D. He identified a range of fruits and seeds associated with burial contexts, including varieties of cotton (*Gossypium* spp.), mosses, bamboos or reeds, and achiote (*Bixa orellana*), the oils of which may have been used to anoint the heads of deceased interred in tree trunk sarcophagi.

In addition to inventorying the types of plants used by ancient Andean peoples to inter their dead, it is important to understand how this inventory differs from plants that people ate or used in their daily lives. Cutright (2011) analyzed plant remains from Lambayeque period burials at the site of Farfán in the Jequetepeque Valley of northern Peru, comparing her data to the Moche mortuary offerings at Pacatnamu analyzed by George Gumerman (1994b, 2010). She contrasts food remains recovered in mortuary contexts with domestic contexts at Farfán, arguing that food used in ritual contexts, including funerary food offerings, was used in domestic culinary traditions as well as in ceremonial practices. Interestingly, the high amounts of maize recovered in mortuary contexts do not appear to reflect quotidian diet, as domestic contexts included a wider variety of resources, including fruits. A ritual/quotidian distinction was also noted by Capparelli et al. (2005, 2007) at the site of El Shincal, a colonial-Inka administrative center in Northwest Argentina. They documented Old World cultigens, including wheat (*Triticum* spp.), barley (*Hordeum vulgare*), and peach (*Prunus persica*), in a hearth associated with an *usnu*, or ceremonial platform, and suggest that those items were incorporated into changing ritual practices of the Hispanic-Indigenous period, although those foods were not recovered in other domestic contexts.

Throughout the period of Spanish conquest, a common cultural exchange that occurred between Europeans and Indigenous peoples involved food, especially cultigens. Jamieson and Sayre's (2010) recovery of barley and quinoa from eighteenth century artisan households from a marginal neighborhood in Riobamba in highland Ecuador suggests that lower-class households consumed both Old World and New World domesticates. They argue that indigenous highlanders may have readily adopted barley, an Old World cultigen, as the grain would have fit well into existing food-processing systems and grain-based cuisine that included quinoa (Jamieson and Sayre 2010:209). While the impact of European contact on native subsistence systems has been a prominent theme in historic archaeology in North America (e.g., Bonhage-Freund et al. 2002; Lightfoot et al 2008; Gremillion 2002; Voss 2008a; Martindale and Jurakic 2004; VanDerwarker, Marcoux, and Hollenbach 2013), historic archaeology in the Andes has been more limited (see Jamieson 2005).

Rethinking the Role of Feasts

Aside from ritual offerings themselves, paleoethnobotanists have examined the settings in which ritual events took place—namely, feasting, including memorial feasting as well as feasting that was more explicitly tied to the political economy (e.g., Chicoine 2011; Goldstein et al. 2009; Iriarte et al. 2008; Sayre and Whitehead 2017; see Dietler and Hayden 2001; Hastorf and Johannessen 1993). Many scholars have emphasized the political and economic roles of prominent types of ritual negotiation—feasts—in creating and reinforcing power and status differences. However, scholars are now questioning the simple association between the emergence of social hierarchies and food production linked to status competition occurring in the context of feasting. Rather than having a causal role in the emergence of social hierarchies, changes in plant food cultivation likely were embedded in the changing social relations that eventually led to the development of those hierarchies.

Across the world and through time, while many groups certainly engaged in hierarchical negotiations involving foodways (including large-scale feasting events) to emphasize power or status differences, others likely participated in commensal events that reinforced shared group identities and traditions (see Pollock 2012; Potter 2000; Potter and Ortman 2004; Wilson et al. 2017). Neither scenario is mutually exclusive; attempts at increasing solidarity within communities and emphasizing differences among its members through commensal activities likely happened simultaneously in the formation of early complex societies, including early Andean polities.

Some recent scholarship in the Andes has moved away from ideas of food production as an economic foundation for accumulation on the part of leaders (necessary for financing feasting events), and instead favors views of community events and the ritual significance of food in the formation of sociopolitical inequalities. At the site of Buena Vista in the Chillón Valley of central Peru, Duncan et al. (2009) discuss macro and microbotanical remains from the Fox Temple, a special purpose ritual feature that dates to ca. 2200 B.C. In addition to a diverse suite of macrobotanical remains, gourd and squash artifacts yielded starch grains of manioc (*Manihot esculenta*), potato (*Solanum tuberosum*), chili pepper (*Capsicum* spp.), arrowroot (*Maranta arundinacea*), and mesquite, or *algarrobo* (*Prosopis pallida*). The authors argue that these remains likely represent refuse from small feasting events. In the Preceramic period (2500–1800 B.C.), multiple small-scale construction events appear to have been preceded by feasting rituals hosted by informal leaders who lacked the social power to organize large amounts of labor for more massive building events. Drawing on work by Vega-Centeno (2007), they argue that the limited and weakly formalized leadership of this time needed to be constantly reinforced through ritual practices or events.

For the Tiwanaku polity of western Bolivia and southern Peru, Goldstein (2003) argues that there were no specialized chicha brewing facilities (for a counterargument, see Janusek 2003), and that the distribution of *keros*, the emblematic Tiwanaku serving vessel, indicates that feasting was organized at an *ayllu*-like level (i.e., extended kin groups) and not at the grandiose large scale of Inka state feasting. In this view, chicha consumption, including amongst Tiwanaku colonies, contributed to the development of community cohesion and a panregional identity across areas that had previous lacked unifying features, including the Atacama region, the Azapa Valley, Cochabamba, and Moquegua. In all of these areas, ceramic assemblages for making and consuming chicha are associated with Tiwanaku expansion and came to predominate over open-mouth pots more suited for the preparation of stews. The adoption of chicha at the household level, using Tiwanaku drinking vessels and designs, signals the depth of Tiwanaku influence as it affected commoners’ daily practices instead of being restricted to feasting or elite contexts (Anderson 2009:191).

Recent research also questions assumptions about the role of maize (*Zea mays*) as an important element of ritual practice within emerging political institutions. Microbotanical analyses by Zarillo et al. (2008) suggest that maize was initially used as ritual beverage, rather than a quickly-intensified staple, at the Early Formative/Valdivia period Real Alto site on the Santa Elena Peninsula of coastal Ecuador as early as 3350 B.C. They argue that subsistence change was slow and gradual, rejecting the idea that political competition framed early food production. Recent macro and microbotanical analyses of early maize remains from Paredones and Huaca Prieta, Peru by Grobman and colleagues (2012) also lend support to the argument that maize was not a staple food in the Preceramic period (2500–1800 B.C.). These new findings are significant in that they cast doubt on previous scenarios that consider food production to always be orchestrated by politically savvy elites—rather, political consolidations and social inequalities may have emerged from rituals (including feasts) practiced within traditionally accepted parameters that eventually reached exaggerated scales.

Political Economy Approaches

Moving beyond the emergence of social hierarchies, other studies continue to draw more explicitly on political economy approaches for understanding changes in plant foodways and social differentiation. Archaeologists typically have examined political economies in terms of class relations, surplus production, and the financing of political institutions. Some Andean models of political economy posit that inequalities resulted as differential control of canals and irrigated land was exploited by elites as a means to co-opt the labor of others, generating agricultural surpluses to achieve power and participate in exchange networks with other communities and ethnic groups (e.g., Bawden 1996; Billman 1996; Moseley 1992; see also Carneiro 1970; Haas 1987; D'Altroy and Earle 1985; Earle 1997); however, these assumptions largely remain untested with direct subsistence data.

One of the most important contributions of paleoethnobotanical data to understanding shifts in political economy in the Andes is Hastorf's (1990, 2001) classic case of how the Inka interfered with the local political economy of the Sausa people of the Upper Mantaro River Valley of central Peru. Hastorf's analysis of plant data from Sausa house floors dating both prior and subsequent to Inka control revealed a shift in plant diet for local elites and non-elites. Prior to Inka domination, elite and non-elite status was clearly marked in plant foodways; the shift to imperial control, however, led to a leveling of local status differences. Hastorf and colleagues (2005) extend their analysis to wood use as well, noting a change in wood use (including a reduction of imported varieties) that indicates restriction in access, tending, or trade of fuel resources by the local indigenous inhabitants under Inka rule.

Goldstein et al. (2009; see Sayre et al. 2012) discuss labor extraction in relation to molle (*Schinus molle*) chicha production at the Wari site of Cerro Baul in Moquegua (southern Peru). They argue that outside of Wari elite contexts, the local population was not engaged in producing chicha for their own consumption, but that chicha primarily played a role in organizing and legitimizing elite activities, perhaps including the extraction of labor from nonelite households. Their examination of molle remains departs from the traditional emphasis on maize chicha that has dominated the Andean literature for decades (e.g., Johannessen and Hastorf 1994; Staller et al. 2006). Indeed, no other staple food has been as thoroughly investigated as maize in terms of its political role. Regardless of its role as a subsistence crop across time and space, maize has salience in debates about social inequality in the Andes (including in the case study of this dissertation, which I discuss in Chapter 4).

Billman and colleagues (2017) consider labor extraction during the realm of the Chimu empire (A.D. 1000-1460) on the Peruvian north coast through an analysis of materials recovered from household excavations at Cerro la Virgen, a Chimu town located in the rural sustaining area of Chan Chan. I analyzed the paleoethnobotanical data for that project, which we used to reinterpret existing models about the site's role in the provisioning of Chan Chan. Earlier scholars (Griffis 1971; Keatinge 1974, 1975; Pozorski 1976, 1979, 1982) argued that Cerro la Virgen was a state-sponsored settlement, and that the site was the product of a community that was forcibly relocated to Cerro la Virgen in order to farm plots adjacent to the Chimu center. Systematic recovery and analysis of the Cerro la Virgen botanical remains, however, revealed that site residents practiced broad-based strategies of field cultivation, arboriculture, and wild plant collection. These data suggest that aside from fulfilling potential tribute demands, households appear to have been relatively autonomous, although they were dependent on higher authorities for irrigation water. Rather than specialists, households largely were self-sufficient with regards to food production.

This brief review highlights the exciting directions that social paleoethnobotany has taken in the Andes in recent years. An updated picture has emerged of plant use in Andean prehistory—plant remains are no longer examined solely for their economic uses, and scholars have used plants to interrogate the diverse pathways in which belief systems articulated with economic systems to fashion and fix structural inequalities. We have also witnessed a movement away from purely elite motivations to considerations of community-based foodways. The convergence of a new social paleoethnobotany in the Andes has important implications for the study of the ancient Moche and their predecessors. As one of the earliest polities to develop hierarchical political organization and vast differences in wealth and power, the Southern Moche polity has long been investigated by researchers interested in social inequality. However, little is known about life in the Moche Valley during the Salinar and Gallinazo phases that immediately preceded the consolidated of the polity, and even less well known are specifics on foodways. I discuss these issues further in Chapter 3.

Merging Theory and Methods

With the goal of pushing plant data from Moche Valley habitation sites into the realm of social archaeology that includes an analysis of gender, labor, and sociopolitical change, I end this chapter on a methodological note. Social paleoethnobotany depends on methodological rigor regarding sampling and data analysis to fully realize its potential. As VanDerwarker et al. (2016:155) note, "paleoethnobotanists excel at diachronic analyses of plant data, synchronic comparisons of different sites/regions, and (increasingly) the use of diverse quantitative techniques, from basic standardizing measures to complex multivariate statistics." It is still the rare study, however, that examines variability in plant remains from different contexts within a single site (see VanDerwarker et al. 2014), although such an approach has the potential to inform about the organization of food preparation, processing, storage, and disposal, as well as issues of site formation and feature function. Hastorf's (1991) study of Inka conquest, foodways, and gender represents a seminal case of the spatial distribution of plant remains and gender, and is also a key paper that pushed paleoethnobotany toward social archaeology in the first place—drawing on such approaches has good potential for evaluating the organization of Moche Valley society.

Understandings of domestic labor, including food preparation and consumption, can shed light on elements of social reproduction and inequalities in daily life that are often downplayed in large-scale, structural histories (Pollock 2012:5). By studying the material remains of foodways, this dissertation contributes to further understandings of the diverse social strategies enacted by both highland and coastal groups that profoundly influenced ancient sociopolitical development along the Peruvian north coast.

CHAPTER 3

SETTING THE TABLE: A PREHISTORY OF THE MOCHE VALLEY, PERU

In this chapter, I broadly sketch varying perspectives on the archaeology of the Moche, and then discuss social and political developments in the Early Intermediate Period, or EIP (400 B.C. – A.D. 800), on the North Coast more broadly and in the Moche Valley specifically as they relate to the research questions of this project. My goal here is not to summarize an entire history of Moche studies (for recent volumes, see Castillo et al. 2008; Quilter and Castillo 2010; see also Chapdelaine 2011). Indeed, key arguments in this dissertation (1) stem from looking at the cultural developments that predated this complex state polity, and (2) shift the lens away from the topics of Moche elite power and the control of ritual ideology (along with artistic themes and figures in iconography) that typically fall under the umbrella of Moche studies. I instead consider the cultural, historical, and ecological shifts during the EIP that impacted rural households away from the Moche polity's capital, and I consider the Salinar (400 B.C. – A.D. 1) and Gallinazo (A.D. 1–200) phases that predated Moche political consolidation in critical detail. I also discuss the ecology and geography of the Moche Valley, along with current understandings of food systems in the region, and provide background information on the study sites that generated archaeobotanical data for this dissertation.

The north coast of Peru, extending from the Piura River Valley to the Nepeña Valley nearly 400 km to the south, has a long history of occupation, with the earliest human occupation nearly 15,000 years ago at Huaca Prieta in the Chicama Valley (Dillehay et al.

2017). Cultivation of land adjacent to north coast river valleys, including the Moche Valley, and exploitation of rich cold-water fisheries formed the subsistence base for sedentary seaside villages beginning in the Cotton Preceramic Period ca. 2500 B.C. (Pozorski 1979), although the manipulation and early domestication of various plants, including chili pepper (Capsicum spp.), squash (Cucurbita spp.), bean (Phaseolus vulgaris), and avocado (Persea americana) may have begun as early as 8650 B.C. (Dillehay et al. 2017). Archaeological evidence from a number of ancient polities indicates that political centralization occurred very early along the north coast, from the occupation of Initial Period ceremonial centers from 1800–900 B.C. (Burger 1992; Pozorski and Pozorski 2008; Nesbitt 2012; Vega-Centeno et al. 1998; Williams 1985) to the later florescence of the Moche and Chimú polities that controlled the north coast from around A.D. 300 until the Inka conquest ca. A.D. 1470, respectively (Bawden 1996; Moore 1996; Moseley and Day 1982). The origin and development of this early north coastal tradition of social complexity has become a subject of systematic study over the past few decades (e.g., Billman 1996, 1997, 1999; Brennan 1978, 1980, 1982; Donnan and Castillo 1994; Millaire 2010; Millaire and Morlion 2009; Quilter and Stocker 1983; Shimada and Maguiña 1994; Topic 1982; Uceda and Mujica 1994).

Of the archaeological cultures that fluoresced along with north coast of Peru, the Moche is one of the best known and most intensely studied. A watershed of increased fascination with the Moche occurred in 1987 with the discovery of the royal tombs of Sipán in the Lambayeque Valley (Alva 1988, 1994, 2001, 2008; Alva and Donnan 1993). Indeed, few ancient cultures have evoked as much fascination, speculation, and imagination as the Moche, by academics and the public alike, as a result of a charismatic series of elaborately decorated temple complexes, wealthy elite burials, exquisite fineware ceramics including stirrup spout bottles and *floreros* (flower pot shaped vessels), and well-crafted metal jewelry and regalia found over ten river valleys on the desert north coast (e.g., Bawden 1995, 1996; Billman 1996, 2010; Bourget 2016; Castillo et al. 2008; Donnan and Mackey 1978; Donnan and MacClelland 2002; Pillsbury 2001; Quilter 1997, 2002; Quilter and Castillo 2010) (see Figure 1.1). Today scholars use the terms "Moche" and "Mochica" interchangeably to refer to the archaeological culture. Since Larcos' (1938) seminal publication, *Los Mochicas*, the term "Moche" became popular with the Chan Chan Moche Valley Project of 1969-1974, sponsored by the Peabody Museum at Harvard and directed by Michael Moseley and Carol Mackey (e.g., Moseley and Day 1982), which attempted to separate a linguistic and cultural reference, "Mochica," from the archaeological culture. "Moche" refers to the river valley of the same name and thus conforms to widely accepted method of archaeological nomenclature (for a counterargument to return to the use of "Mochica," see Shimada [1994:xiii–xiv]).

For archaeologists and other scholars, the Moche culture is of great interest because it represents a high degree of social complexity with a rich and remarkable archaeological record of sites and artifacts. The most dramatic advances in our knowledge of the Moche concern the form, function, and decoration of civic/ceremonial platform mounds; the potential meaning of Moche artistic themes and figures in iconography; and the nature and purpose of Moche rulers, whose political power appears to have been largely legitimated by the role they played in the performance of religious rituals. One of the most controversial questions in Moche studies over the past few decades has been the nature of Moche political organization. The archaeological culture of Moche is often cited as the first (or one of the first) state-level societies in the New World, in specialist Andean literature (e.g., Atwood 2010; Billman 1996, 2002, 2010; Chapdelaine 2010; Haas 1982, 1987; Stanish 2001) as well as more broadly in the literature of ancient states (e.g., Fagan 2008; Maisels 2010).

Neo-evolutionary views of Moche statehood have not escaped criticism by other Andean scholars (e.g., Bawden 1996, 2004; Isbell and Schreiber 1978, Quilter and Koons 2012; Schaedel 1985)[3], leading some researchers to suggest that there were two distinct Northern and Southern Moche states, separated by the large Pampa de Paiján desert (e.g., Castillo and Donnan 1994; Kaulicke 1991; Shimada 1994), and others to contend that the region was divided into many small autonomous polities that shared an elite iconography and ideology (Donnan 2010; Moseley 2001). Further still, some view Moche exclusively as a religious phenomenon that aligned the political economies and social relations of North Coast societies (Koons and Alex 2014; Quilter and Koons 2012), and that sites from the same time period that did not use the set of shared symbols and messages presented on portable media (e.g., ceramics) cannot be considered Moche (Bourget 2010).

In my work it is less critical to determine whether or not Moche was a state; rather, I recognize Moche as one of the largest and most complex prehistoric political systems to have developed in the New World, and that its consolidation had far-flung consequences for ancient people, elite and commoner alike, that lived in the Moche Valley and other river valleys along the North Coast during the EIP. States are rarely monolithic entities; rather, they are often complex and have multiple and competing agendas (Schreiber 2005:237). To avoid the pitfalls of rigid categorical schemes, many researchers (including those working

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[3] Gagnon et al. (2013:195) highlight a possible source of misunderstanding in this debate; they point out that while scholars (e.g., Quilter and Koons 2012) criticize the term “state” in the Neo-evolutionary sense of Fried (1967) and Service (1975), rarely have the latter studies been cited in discussions of Moche political economy.

outside of the Andes) stress the importance of understanding how the practices of individuals and social groups actually reproduce social hierarchies (e.g., Pauketat 2007; Marcoux and Wilson 2010; Wilson et al. 2006; Yoffee 2005). My goal in this study is to investigate the changing use of socially and economically important resources to understand how power was manifested and embodied in shifting practices of foodways and agricultural labor, and to investigate the timing of those shifts. Rather than refer to the Moche state (or the Southern Moche state), I henceforth refer to the Southern Moche polity, a phrase that I use primarily as a heuristic device that relates to the region of study (the Moche River Valley, which lies south of the Pampa de Paiján). I also note that the past decade has witnessed major changes in the accepted chronology of the Peruvian north coast EIP (400 B.C – A.D. 800). In this dissertation, I follow the chronology outlined by Billman (2002:378; see also Ringberg 2012:35) (Table 3.1), which departs slightly from the Ica Valley sequence reported by Moseley (2001:173) that dates the EIP from 200 B.C. to A.D. 600[4].

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[4] The Ica Valley sequence places the Salinar phase in the Early Horizon; in this study I follow other North Coast researchers that place the Salinar phase in the Early Intermediate Period.

Table 3.1 Current Moche Valley chronologies.

Huacas de Moche sequence[1]		**Local Moche Valley sequence**[2]	
Early Chimu	A.D. 800–?	Early Chimu phase	A.D. 900–1000
Phase V	A.D. 650–800	Late Moche phase	A.D. 700–900
Phase IV	A.D. 450–700	Middle Moche phase	A.D. 400–700
Phase III	A.D. 300–450	Early Moche phase	A.D. 200–400
Phase I/II/Gallinazo	A.D. 100–30	Gallinazo phase	A.D. 1–200
Gallinazo phase	100 B.C. – A.D. 100	Late Salinar phase	200–1 B.C.
Salinar phase	? –100 B.C.	Early Salinar phase	400–200 B.C.

[1] Adapted from Chadelaine 2003:279, Cuadro 22.3
[2] Adapted from Billman 2002:378, Table 1

Despite a wealth of research on the Moche period (A.D. 300–800), the period of transition between the decline of the Early Horizon Chavín-influenced polities of the Cupisnique phase ca. 400 B.C. and the expansion of the Moche political system ca. A.D. 300 remains poorly understood. The EIP (400 B.C. – A.D. 800) was marked by an increase in political complexity along the north coast, with clear shifts in settlement and site reorganization accompanied by an increase in social stratification (Bawden 1996; Billman 2010; Pozorski and Pozorski 1979; Topic 1977, 1982). With most archaeological research devoted to the apogee of Moche political power, relatively little focus has been given to the antecedent Salinar and Gallinazo phases (but see Billman 1996, 2002; Brennan 1978, 1980, 1982; Fariss 2012; Fogel 1993; Gagnon 2006, 2008; Lambert et al. 2012; Millaire and Morlion 2009; Ringberg 2012; Shimada and Maguiña 1994). These periods are particularly interesting as they are linked to a variety of cultural issues, including a complex set of interactions that accompanied the population movements, subsistence trends, and changes in architecture and ceramics apparent in the archaeological record prior to the consolidation of the Southern Moche polity. Indeed, it is the antecedent phases of Salinar (400 B.C. – A.D. 1) and Gallinazo (A.D. 1–200) that receive primary attention in this dissertation, as data from these periods prove to have key insights into the timing of agricultural intensification and accompanying shifts in domestic labor, gender roles, and social inequality that occurred prior to the consolidation of Moche.

The Salinar phase, which marks the beginning of the EIP, witnessed the abandonment of earlier Guañape phase (1800–400 B.C.) ceremonial centers on the north coast; population increase and expansion of irrigation systems; as well as political fragmentation, the appearance of formal fortifications and settlement in defensive locations, and raiding and warfare between coastal and highland groups and among polities of various coastal valleys (Billman 1996, 1999, 2002; Brennan 1978, 1980, 1982; Mujica 1975). In the Moche Valley, discussed further below, the valley's population was aggregated into eight discrete site clusters, and the site of Cerro Arena was likely the dominant political power in the valley.

The Gallinazo phase has been the subject of more intensive investigation on the north coast, primarily at the system of large residential complexes and ceremonial centers known as the Gallinazo Group in the Virú Valley. Early work was carried out on the seminal Virú Valley Project in the 1940s and 1950s by pioneering scholars Gordon Willey (1953), Wendell Bennett (1939, 1950), among others (Collier 1955; Ford 1949; Strong and Evans 1952), with more recent work conducted by Jean Francois Millaire (Millaire 2010; Millaire and Morlion 2009; Millaire et al. 2016). Many scholars view the Gallinazo culture as a complex pre-state phenomenon with a distinctive ceramic style, large canals, and varied, hierarchically organized settlements. After the Gallinazo phase, scholars contend that a “more centralized and consolidated rule arose” (Moseley 1992:166) when the Moche Valley polity was linked to the Chicama Valley polity during the Moche period (ca. A.D. 300-800). According to Billman (2010:178), not only did Moche rulers control more labor than did rulers in previous periods, but they also developed new religious beliefs and practices that displayed and legitimized their wealth, power, and use of violence. These new beliefs were materialized through a variety of practices, from the collection of tribute from commoner households, the mandate of participation in *huaca* (pyramid) construction, and the performance of public rituals of violence and death.

However, recent research is beginning to refine sociopolitical developments during the Gallinazo phase and question its antecedent status to Moche. Scholars have recognized instances in which Gallinazo and Moche ceramic styles intersect (Millaire and Morlion 2009; see also Quilter and Castillo 2010). Recent research in the Virú Valley has opened up the debate on the expansive state paradigm that was built on ceramic style; research by Millaire (2010) and Bourget (2010) has shown that sites that were once considered definitively Moche may actually be local variants or not Moche at all, which complicates our understanding of the Moche political landscape. Millaire’s (2010) recent reevaluation of data from Huaca Santa Clara in the Virú Valley suggests that there is very little, if any, true Moche architecture or ceramics at the site (some of the ceramics have Moche-like characteristics, but he contends that they are local phenomena). Bourget (2010) also concluded from investigations at the site of Huancaco in the Virú Valley that Huancaco should be considered a local cultural variation and ceramic style. From a religious iconographic perspective, Uceda (2010) notes that the deities who decorate Moche murals and portable art during the early phases of Moche are direct antecedents of Cupisnique deities (1000–200 B.C.), arguing for long continuity of some aspects of religious tradition on the north coast of Peru rather than emergence of strictly new traditions during the Moche era.

Some North Coast scholars argue that Moche leaders had built upon existing political institutions, and that the emergence of an Andean state had taken place at an earlier point in time in the Virú Valley (e.g., Fogel 1993; Millaire 2010; Downey 2015). They suggest that the Gallinazo culture, rather than the Moche culture, pioneered large-scale statecraft on the north coast, and that with the collapse of the Gallinazo state centered in Virú that the focus of power shifted to the Moche Valley ca. A.D. 400. Millaire (2010) posits that the Virú (Gallinazo) polity had developed a number of institutions typical of functioning states (see for example Billman 2002; Haas 1982; Stanish 2001), including a four-tiered settlement systems, a complex valley-wide administrative system with an urban capital at the Gallinazo Group site in Virú, and large mound construction that clearly required immense coordination and labor (see also Fogel 1993), presenting recent radiocarbon dates that support the formation of what Millaire considers to be a regional state in Virú ca. 200 B.C.

Koons and Alex (2014) highlight the problem that our understandings of the emergence, spread, and decline of Moche society has been based almost entirely on relative ceramic phases, rather than absolute dates. Their Bayesian analyses of the Moche ^{14}C record demonstrate that ceramic phases are insufficient for understanding Moche chronology. While the authors do not discuss phases considered antecedent to Moche (e.g., Gallinazo), their work gives pause to reconsider exclusive reliance on ceramic sequences when thinking about cultural developments, in this region and others. Downey (2015, 2017) also reconsiders the centralization of Gallinazo authority; in his reanalysis of Ford's (1949) ceramic seriation in his dissertation, Downey (2015) concludes that the Virú valley was unified into a single polity with its capital at the Gallinazo Group during the Middle Virú Period (200 B.C. – A.D. 600), and that this polity sponsored a program of infrastructure building to materialize its power and to develop political authority over the valley.

In short, it is my goal in this dissertation to critically re-evaluate the role of cultural developments long considered antecedent to or less complex than Moche. I argue that key transformations in political economy and household labor occurred in the Gallinazo phase (A.D. 1–200) in the Moche Valley, prior to the consolidation of the hierarchically organized southern Moche polity. I make this argument primarily through an examination of agricultural intensification, witnessed through diachronic changes in plant foods exploited throughout the EIP and detailed in Chapter 4. Numerous studies of agricultural intensification in the focus on the *effects* of political economies; fewer studies highlight the fundamental importance of plants (from agricultural crops to weeds) in the formation of these networks (but see Hastorf 1993; Hastorf and Johanssen 1993; VanDerwarker 2006; VanDerwarker et al. 2017). Plants played a critical role in many of the institutions that relied on or precipitated the intensification of agricultural goods, plants which were in turn redistributed as food, currency, and tribute (Hastorf 1990, 1999; Smith and Montiel 2001:249). As I will demonstrate in the following chapters, dramatic increases in agricultural production occurred *prior* to the expansion of the Southern Moche polity in the A.D. 300s, and shifts in gendered labor, seasonality, and scheduling occurred in advance of the zenith of Moche political power.

To set the stage for the evaluation of these dynamics, I turn to a discussion of ecology, geography, and social and political developments in the Moche Valley. The Moche Valley has been researched extensively over the past century, from the early 20th century work of Max Uhle (1913) and Alfred Kroeber (1925, 1930) to the present (e.g., Bawden 1977; Billman 1996, 1999, 2002, 2010; Boswell 2016; Brennan 1978, 1980, 1982; Donnan and Mackey 1978; Moseley and Cordy-Collins 1990; Lockard 2009; Moseley and Day 1982; Moseley and Mackey 1974; Mullins 2016; Pozorski 1976, 1979, 1982; Topic 1977; Uceda et al. 1997, 1998, 2000). This research has included surveys of the lower, middle, and upper valleys, along with numerous site-specific projects, many of which have encompasses intensive excavations (discussed further below).

Ecology of the Moche Valley

The Moche Valley watershed is located in the La Libertad region of Peru and is drained by three rivers from the Peruvian Andes: the Moche, Sinsicap, and Cuesta rivers. This watershed comprises a catchment area of 2,708 km^2 (ONERN 1973:32; see Ringberg 2012: Figure 2.2.2). At 102 km in length, the Moche River is relatively short compared to its neighbors to the north (the Chicama River, 150 km in length) and south (the Santa River, 347 km in length). The Moche river floodplain supports riparian vegetation catchments, which have been substantially extended by the construction of large networks for irrigation canals, beginning in prehistory (Billman 1996). Although the Moche River basin is not large, significant changes in elevation over the relatively short distance from the coast to the highlands create different microenvironments within close proximity to one another. One can cover a range of elevation along the Moche River drainage and encounter a wide variety of ecozones from sea level to 4,000 masl in less than 50 km Euclidian distance (Fariss 2008:8; ONERN 1973:54-67).

The diverse ecological zones of the Moche Valley, as witnessed in other north coast valleys, have significant and varied impacts on people's subsistence practices. At 1,600 masl and below, agriculture is limited to irrigation agriculture because of arid and semi-arid conditions. A relatively stable climate with warm weather year-round allows for the cultivation of at least two crops a year of a wide variety of cultigens, and marine exploitation of fish, mollusks, sea mammals, and sea birds is practiced near the coast. Above 1,600 masl, rainfall agriculture is possible, but cultivation and the types of crops are limited by cold temperatures and extreme topography (Billman 1996:27). People living in highland environments in the upper Moche watershed thus practice extensive rainfall agriculture alongside pastoralism. The highlands of the La Libertad region consist of diverse topography that includes steep river valleys, highland basins including the Otuzco Basin, as well as the large Carabamba Plateau.

Paleoclimate and El Niño Flooding

The Humboldt Current, which runs along the Pacific coast of South America, creates a rain shadow along the coast, creating a desert environment. As a result of this rain shadow, little precipitation falls on the coast and lower valley regions of the Central Andes. This precipitation is sustained in part by a layer of low hanging cloud fog that is created when dry winds hit the lower western slope of the Andes. In the Moche Valley, annual temperatures average 20° Celsius, with approximately 4 mm of precipitation near the ocean to approximately 30 mm near the Andean foothills (ONERN 1973:65). The highlands at 3,700 masl in the upper Moche watershed have a more extreme temperature range, averaging 7° Celsius and 4,000 mm of annual precipitation (ONERN 1973:65). Sandweiss and Richardson (2008:99) suggest that beginning about 3,000 years ago, weather and climate in the Andes have been fairly similar to today's conditions.

Water is one of the most important resources for people living in the rain shadow of the Andes. Seasonal rains from October through April in the highlands feed irrigation in the middle and lower valleys, enabling two planting seasons: December–May, a period that typically witnesses sufficient river discharge to irrigate fields, and June–November, the dry period of the year, when low river levels do not permit all fields in the lower and middle valleys to be planted. Modern Moche Valley farmers only plant one-fifth of lower valley fields in this second season (Billman 1996:41). Boswell (2016:37) discusses the coordination and cooperation required for irrigation agriculture amongst modern communities in the lower through upper Moche valleys. She describes community water committees that (1) delegate how many hours each week that each community member's fields will receive water, and (2) negotiate water access with other local committees. This concerted effort to negotiate water rights suggests that tensions surrounding access to water to irrigate arable land may have existed in the past, but that relationships between groups may have been more cooperative than bellicose.

Impactful environmental phenomena in the modern day and throughout the prehispanic era include El Niño Southern Oscillation (ENSO), or El Niño events. El Niño events are characterized by warm currents and extensive heavy rains (whereas La Niña events witness unusually cold ocean waters and low inland precipitation). These weather phenomena have varied interims and effects in north coast valleys (Waylan and Caviedes 1986). Changes in sea surface temperatures during these events, including rising temperatures during El Niños, result in die-offs of pelagic fish and affect entire maritime food chains. Torrential rains that rush through coastal valleys destroy crops, flood dry *quebradas* (washes), and causes landslides on the coast, whereas drought occurs in the highlands. Low to moderate El Niño events occur every 2–8.5 years (Rodbell et al. 1999), whereas more extreme events occur approximately every 15 years. In the twentieth century, the most recent severe El Niño events occurred in 1925–1926, 1982–83 and 1998–99[5]. It bears noting that with the exception of extreme events, El Niño flooding generally are less severe in the Moche Valley than in the majority of other coastal valleys. As the majority of the Moche Valley's watershed is above 1,000 masl (and 50 percent of the watershed is above 3,000 masl) the impact of El Niños events traditionally have been less than the impact in other coastal valleys with lower watersheds (Billman 1996:26–27; Billman and Huckleberry 2008; Waylan and Caviedes 1986, 1987).

Severe El Niño events certainly impacted prehispanic populations in the Andes (Moore 1991; Moseley 2001), with effects ranging from small-scale abandonments of sites and communities to larger depopulation movements and 'collapse' of large polities such as the Moche and Tiwanaku, whom scholars argue 'collapsed'[6] in the ninth century A.D. when a large El Niño event occurred (e.g., Kolata et al. 2000; Moseley et al. 2008). Bourget (2016:196) argues that El Niño events shaped Moche cosmologies and rituals, identifying themes in Moche iconography related to human sacrifice and death as well as animals and plants that he claims are indicative of El Nino-Southern Oscillation (ENSO) conditions. El

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[5] As I write this dissertation in Spring of 2017, north coastal Peru is currently witnessing a severe delayed El Niño event, which has resulted in the displacement of many communities whose villages have flooded.

[6] Although outside of the scope of this dissertation to consider in depth, I question the overall utility of the concept of 'collapse,' as cultural traditions often survive political decentralization. I concur with other scholars (e.g., Eisenstadt 1988; Graffam 1992; McNeill 2010; McAnany and Yoffee 2010) who emphasize that while crises existed, political forms changed, and landscapes were altered, rarely did societies collapse in an absolute and apocalyptic sense.

Niño events also appear to have damaged later Chimu irrigation systems on the north coast (Pozorski 1987; Pozorski and Pozorski 1982, 2003). Billman and Huckleberry (2008) use proxy records to reconstruct flooding events over a period of 600 years between 345 B.C. and A.D. 220. Their data reveal an increase in relative frequency of flooding events, indicating that this period of the EIP (i.e., the Salinar and Gallinazo phases) in the Moche Valley likely experienced wetter conditions due to increased co-occurrence of near-moderate to moderate El Niño phenomena. Paulson (1976) and Shimada et al. (1991) posit that during these periods of increased precipitation, highland and lowland groups engaged in various strategies to gain access to irrigation-fed agricultural lands in many valleys on the Peruvian north coast. The periods of increased frequency and magnitude of El Niño events would have resulted in a reduction of available farmland on the north coast, and suggest "a concomitant increase in conflict over arable land as well as an increase in landless farmers" (Billman and Huckleberry 2008:116).

Irrigation Requirements

Aside from periodic El Niño events, rainfall is limited on the Peruvian north coast, and irrigation of interandean river valleys is necessary for growing crops. If adequate water can be supplied, then crops will grow year-round, but flow is dictated by the amount of rainfall in the highlands (Netherly 1984:237). Between the months of December and April, irrigation canals are inundated with water; however, this is often not the case during the dry season from June to November. North of the Moche Valley in the Lambayeque Valley, studies of ancient agricultural fields have revealed that fields were fertilized and that soils were high in phosphorus, potassium, calcium, magnesium, and sulfur, but low in nitrogen (Nordt et al. 2004). Low levels of nitrogen are likely the result of leaching into irrigation canals and from normal uptake into crops (Nordt et al. 2004:36). Legumes (e.g., beans [*Phaseolus* spp.], peanuts [*Arachis hypogeae*], lupines [*Lupinus* spp.]) may have been able to fix some amounts of atmospheric nitrogen (discussed further in Chapter 4), but other external inputs (e.g., manure, ash) likely would have been necessary to fertilize soils.

Ethnohistoric documents (e.g., Garcilaso de la Vega 1966:246-7) describe the use of bird guano from offshore guano islands as manure in coastal areas, and in some cases, the heads of small marine fish were also applied to the soil. However, recent studies indicate that EIP farmers likely did not use bird guano on their fields (Szpak et al. 2012). Other possibilities for fertilizer include llama dung, as well as leaf litter from leguminous trees (e.g., mesquite [*Prosopis pallida*], pacay [*Inga feuillei*]), which would have aided in replenishing nitrogen (Nordt et al. 2004:36).

Environmental Zones and Diversity

The unique environmental and topographic conditions played a significant role in cultural developments in the coastal river valleys of Peru. As discussed above, significant changes in elevation over a relatively short distance from coast to highlands create different environments within close proximity to one another. Although gradients are steep, in compressed zones modern smallholders can move between multiple ecological zones on almost a daily basis and seasonal movement suffices in lieu of permanent migration (Brush 1977:11). The Moche River basin can be divided into five environmental zones based on differences in climate and natural vegetation. Billman (1996:29) divides the Moche Valley into lower, middle, and upper valley zones, based on designations from the National Office for the Evaluation of Natural Resources (ONERN 1973; see also Vidal 1972) (Table 3.2).

Table 3.2 Ecological zones for the Andes and the Moche Valley.

Ecological Zonation (Andes)[1]		Ecological Zonation (Moche Valley)[2]	
0-500 masl	*Chala*	Lower Valley	0-300 masl
500-2,300 masl	*Yunga*	Middle Valley	300-800 masl
		Upper Valley	800-4,200 masl
2,300-3,500 masl	*Quechua*		
3,500-4,000 masl	*Jalca*		
4,000-4,800 masl	*Puna*		

[1] Vidal 1972
[2] Billman 1996:29, based on ONERN 1973

The *chala* zone, Vidal's (1972) term for the zone from the Pacific coast to 500 masl, is characterized as a coastal desert found along the Pacific shore into lower river valleys. The zone extends from the coast and lower Moche Valley nearly 30 km inland. As mentioned above, little rainfall occurs in this region, due to the rain shadow created from the high Andes and Humboldt Current. In prehistory (as well as in the present), people living here had direct access to marine resources and the greatest amount of arable land, made possible by the construction of long irrigation canals with headgates in the middle valley (Billman 2002; Sandweiss and Richardson 2008).

The next inland zones, the *yunga* (Vidal 1972), but some scholars refer to the 300 to 1,800 masl range as the *chaupiyunga* zone (Dillehay 1976; Netherly 1988; Rostworowski 1988), ranges from 500-2300 masl. The middle Moche Valley is located at the intersection of the chala and the chaupiyunga zones. A greater variety of plants can be grown here under irrigation than in both the lower and upper valleys, and agroecological zonation models indicate this zone to the most productive zone for growing maize (*Zea mays*) and coca

(*Erythroxylum novogranatense* var. *truxillense)* in the Moche Valley (Fariss (2012:149; Plowman 1986). It bears noting that coca can be cultivated throughout the valley, from sea level up to 2000 masl (Brack Egg 1999:201-202). Indeed, I have witnessed coca growing in kitchen gardens throughout the Moche Valley, from lower elevations to Collambay in the Upper Moche Valley (see also Boswell 2016).

The *quechua* zone (2,300 to 3,500 masl) witnesses the upper limits of maize production. Unlike southern Peru, where agricultural terracing is common, northern Peruvian quechua zone farmers do not terrace hillslopes (Sandweiss and Richardson 2008:96); rather, they rely on spring-fed canal irrigation (Ringberg 2012:18). In the quechua zone, significant diurnal temperature variation limits the variety of agricultural crops that can be grown.

The eastern limits of the Moche watershed include the *jalca* (3500-4000 masl) and *puna* (4000-4250 masl) zones. In the jalca zone, camelid herding is common, and cultigens such as quinoa (*Chenopodium quinoa*), *tarwi* (*Lupinus mutabilis*, an edible legume), fava beans (*Vicia faba*), and tubers including *oca* (*Oxalis tuberosa*) and *ulluco* (*Ullucus tuberosus*) are grown. The *puna* represents the highest part of the Moche watershed, with wild grasslands suitable for grazing camelids. Camelids were present in the puna zone in prehistory and at the point of Spanish contact (Bonavia 2008), and there is a large vicuña (*Vicugna* sp.) reserve in the highlands between the Santa and Virú Valleys today. Because of cold average annual temperatures, ranging from 0 to 7° Celsius, crops that can be grown in the puna zone are limited to certain varieties of potatoes (*Solanum tuberosum*), maca (*Lepidium* spp.) and quinoa.

As discussed above, the vertical compression of the Moche Valley facilitates movement throughout these diverse ecological zones, movement that is commonly practiced today and was likely practiced throughout prehistory. As Ringberg (2012:19; see also Brush 1977; Topic and Topic 1983:239) notes, at a travel pace of 15 to 20 miles, or 24 to 32 kilometers in a full day (eight to 12 hours of walking), people in the middle valley can travel to the ocean or deep into the chaupiyunga zone within a day's walk. Modern rural residents of the Moche Valley often conceptualize the day's walk not in terms of miles or kilometers, but in terms of the number of *bolas* (wads of leaves) of coca chewed (Briceño personal communication 2013). Intra- and inter-valley movement was likely a common element of daily existence in prehistory for rural Moche Valley residents exchanging resources and information. During the EIP in particular, there was frequent interaction between highland and coastal groups, discussed further below.

Cultural Developments in the Moche Valley

One of the most substantial contributions to understandings of diachronic cultural developments in the Moche Valley is Billman's (1996) dissertation, which details his systematic pedestrian survey of the middle Moche Valley conducted in 1990-1991. He integrates his survey data with extant survey data of the lower Moche Valley from the Chan Chan Moche Valley project; together these surveys cover the entire coastal section of the Moche Valley and provide information on over 910 archaeological sites. Billman (1996) reconstructs a sequence of political development from the formation of the first autonomous villages in the Late Preceramic Period (2700–1800 B.C.) to the zenith of the Southern Moche polity (ca. A.D. 400–800). In his study, Billman (1996, see also Billman 2002) set out to test Wittfogel's "hydraulic hypothesis," framed as Oriental Despotism (Wittfogel 1956, 1971), which asserted that irrigation necessarily leads to social stratification and a centralization of power. Billman specifically charted the expansion of canal systems to examine changes in the organizational requirements of the construction and maintenance of irrigation from the start of small-scale irrigation in the middle valley ca. 1800 B.C. to the construction of large-scale irrigation projects on the north side of the lower valley in the Middle Moche phase (A.D. 400–700). Refuting Wittfogel's (1956, 1971) hydraulic hypothesis, Billman's (1996, 2002) study indicated that the managerial requirements of irrigation were relatively minimal; rather, he argues that warfare, highland-coastal interaction, and political control of irrigation systems created opportunities for leaders to form the highly centralized Southern Moche polity beginning around A.D. 300.

We can trace ideas about agricultural trajectories in the Moche Valley beginning with the Late Preceramic Period (2700–1800 B.C.), when economies were based on marine resources and small-scale farming was established (Pozorski 1979). Marine resources including sea mammals, mollusks, near-shore birds, and marine fish were exploited, and various cultigens were grown, including beans, cotton, gourds, peanuts, peppers, and squash, along with various fruits. Cultigens were likely grown in small plots in sunken fields and on river floodplains. Current ideas about agricultural development in the region place the advent of irrigation systems on the north coast in the Guañape phase (1800– 400 B.C.). The start of the Guañape phase witnessed a population movement away from coastal settlements into the middle Moche Valley, and the first mounds were constructed in the valley between 1800–1300 B.C., including at the paramount site of Caballo Muerto along with other smaller sites (Billman 1996, 2002; Chauchat et al. 2006; Nesbitt 2012; Pozorski and Pozorski 1979). According to Billman (1996, 2002:380), by the end of the Guañape phase over 4,000 ha of land was under irrigation.

At the start of the EIP in the Salinar phase (400–1 B.C.), the political landscape of the Moche Valley changed dramatically (Billman 1996, 1999). All of the Guañape phase ceremonial centers (including Caballo Muerto) were abandoned, and the lower valley witnessed substantial settlement expansion. According to Billman (1996:234), the first formal fortifications in the Moche Valley were constructed and the valley's population aggregated into eight discrete site clusters. The eight site clusters likely were autonomous polities, although Cerro Arena appears to have represented the dominant political power in the valley as a result of its demographic advantage over the other, smaller site clusters (Billman 1996, 1999; Brennan 1978, 1980, 1982; Mujica 1975).

At the site of Cerro Arena, a 200 ha site with one of the largest concentration of residential areas on the north coast at during the Salinar phase, high status residences were located close to passes with roads leading to the Virú Valley, privileging access to trade routes (Brennan 1980). Billman (1996, 1999, 2002) argues that political fragmentation of the valley, the abandonment of Guañape phase centers, and resulting shifts in population were probably the result of the onset of armed conflict between coastal and highland groups, and among polities of various coastal valleys. Billman (1996:223) also suggests that an elite social stratum developed in the Moche Valley by the end of the Salinar phase, indicated by the amount of labor investment in elite dwellings and a restricted distribution of fineware ceramics. During the Salinar phase, irrigation in the Moche Valley expanded, increasing productive land to between 6,750 and 7,300 ha, a 73 percent increase over the preceding period (Billman 1996, 2002:382; Moseley and Deeds 1982).

At the start of the Gallinazo phase (A.D. 1–200), populations aggregated in the lower part of the middle Moche valley, investment in public architecture expanded, and the site of

Cerro Oreja developed into the paramount center of a centralized polity that controlled much of the valley (Billman 1996:236, 1999; see Carcelén 1995; Gagnon 2006, 2008; Gagnon and Wiesen 2013; Gagnon et al. 2013). Second in population to Cerro Oreja, Pampa La Cruz grew into another large and politically autonomous center on the coast. Further up the valley from Cerro Oreja, the population was concentrated at a series of fortified hilltop towns. During that time, virtually all available land in the middle valley and large areas of the lower valley were under cultivation; Billman (2010:181, see Lambert et al. 2012) argues that through the manipulation of intensifiable agricultural resources, larger and more complex political organizations were able to develop. Leaders of the Cerro Oreja polity apparently controlled more labor than the earlier Salinar phase polities of the Moche Valley, mobilizing large groups for extended periods for construction projects. According to Billman (2002:383), while irrigation systems did not expand significantly during the Gallinazo phase, the control of agricultural resources was essential to the power structure of the Cerro Oreja polity.

Despite a lack of major canal expansion, food production could have intensified during this period through shifts in crop production (Gagnon 2006; Gagnon and Wiesen 2013), the use of manure as fertilizer, decreases in the length of fallowing, and the development of new and more productive varieties of cultigens, including maize (Lambert et al. 2012:149). Bird and Bird (1980) argue from their analysis of desiccated maize cobs recovered from early excavations at Huaca Prieta in the Chicama Valley that new varieties of maize were introduced to the north coast during the Gallinazo phase. The intensification of agricultural resources and resulting implications for labor investment are key aspects of this dissertation and are discussed further in Chapter 4.

Another important cultural phenomenon that occurred during the Gallinazo phase was an influx of migrants from the adjacent Andean highlands, who established settlements in many principal north coast river valleys, including the middle Moche Valley and the adjacent Virú Valley (Billman 1996:264, 1997:301; Topic and Topic 1982). In his 1990-1991 pedestrian survey project, Billman located a large number of sites in the middle Moche Valley clustered in three principal areas: the (lower) Sinsicap, Cruz Blanca, and Quebrada del León, interspersed amongst local coastal settlements. These sites, defined as highland in nature by their distinct ceramic, architectural, and burial styles (Ringberg 2012; see also Gagnon et al. 2013:195), likely were occupied by highlanders moving down from the neighboring Otuzco Basin and the Carabamba Plateau, part of the La Libertad highlands.

Some regions of the La Libertad highlands have undergone archaeological investigation, including the Otuzco/Upper Moche area (Topic and Topic 1983, 1985), the Carabamba Plateau (Topic and Topic 1979; Haley 1979), the Alto Chicama Valley (Krzanowski 2006), and the Huamachuco Region (J. Topic 1986, 1998, 2009; T. Topic 2009; Topic and Topic 1987). However, the majority of this research has been survey-based (and largely remains unpublished), and limited excavation data are available from household sites. No plant data are currently available from EIP habitation sites in the La Libertad highlands, an issue to be addressed in future research.

Various researchers have discussed economic incentives for highland colonization of middle valleys on the north coast during the EIP (e.g., Billman 1996; Netherly 1988; Towle 1961; Quilter and Stocker 1983), proposing that highlanders entered fertile chaupiyunga zones to take advantage of better resources and farming opportunities. Highland agriculture is based on rainfall rather than irrigation; while it requires less technological and organizational sophistication (e.g., construction and maintenance of canals) (Billman 1996:45-46), a more limited range of cultigens can be grown. EIP highlanders would have been unable to grow crops such as coca, chili peppers (*Capsicum* spp.), cotton (*Gossypium barbadense*), and certain fruits, and they would have lacked access to marine resources, including various species of fish, mollusks, sea mammals, and coastal birds.

Fertile middle valleys thus constituted a prime interaction zone between the highlands and densely populated coast during the EIP. Scholars, including Billman (1996, 2002), Dillehay (1976), Fariss (2012), Ringberg (2012), Rostworowski (1988), and John and Teresa Topic (1983; 1987), have proposed/evaluated different models for highland-coastal interaction, with regards to how different groups related to one another in controlling or sharing resources. Billman's (1996) total coverage survey of the middle Moche valley, as well as Topic and Topic's (1983, 1987; T. Topic 1982) fortification survey of the Chicama and Moche highlands and coast, emphasize the defensive nature of highland and coastal settlements. Billman (2002) argues that the consolidation of the Cerro Oreja polity, with a location in the middle valley at the valley neck (a key defensive location), may have been a result of a need to resist invasion from the highlands.

Billman (2002) also discusses other potential scenarios for the highland occupation of the middle valley, including more peaceful migration and colonization, whereas Topic and Topic (1987) view interaction primarily as the result of intensive trade networks. Throughout the Andean region, exchange of animal products for lowland crops is a well-known strategy for mitigating the effects of unpredictable agricultural yields at high elevations (Julien 1985:196); however, recent excavation data from the middle Moche Valley favor colonization rather than trade arguments (discussed below). Dillehay (1976) and Rostworowski (1988) depict highland presence in the middle Chillón valley on the central coast as involving both conquest and multi-ethnic settlement (see also Marcus and Silva 1988).

Based on site clustering and the presence of a three-tier settlement hierarchy, Billman (1996:250-253) suggests that groups of highlanders were divided into three centralized polities seeking to co-opt existing coastal irrigation networks. In this scenario, control over irrigation agriculture is cited as central to the development of the Southern Moche polity—models of regional political economy, in this region and others, posit that inequalities resulted as differential control of floodplain agriculture was exploited by elites as a means to co-opt the labor of others, generating agricultural surpluses to achieve power and participate in exchange networks with other communities and ethnic groups (Bawden 1996; Billman 1996; Moseley 1992; see also Carneiro 1970; D'Altroy and Earle 1985; Earle 1997; Haas 1987). Surridge (2010) submits that during the Gallinazo/Early Moche (A.D. 1–300) occupation of the middle Moche valley by highland colonists, highlanders were intensely involved in agricultural labor, as evidenced by high discard rates of stone hoes. He suggests that elite households produced surplus stone hoes as a means to achieve power and participate in exchange networks with other communities and ethnic groups.

However, recent research has questioned aggressive warfare arguments, suggesting that highland-coastal relations may have been complementary rather than strictly conflicting (Fariss 2012; Ringberg 2012; see also Topic and Topic 1987). Based on analysis of ceramics recovered from recent large-scale household excavations, Ringberg (2012:271; see also Briceño and Billman 2007) suggests that highland and coastal groups may have established mutually beneficial relationships to exchange food, pottery, labor, and possibly marriage partners. Moreover, Fariss (2012:12) submits that migrant highland settlement decisions likely were based on a desire to maximize agricultural productivity and mitigate environmental risk, rather than made with strictly defensive purposes in mind. However, such assumptions remain untested with direct subsistence data. Thus, a detailed paleoethnobotanical study is well positioned to shed light on the roles of food in highland migrant lifeways, in terms of which resources highland migrants and local coastal dwellers were actually targeting (discussed in Chapter 4), as well as how food processing was spatially organized, with implications for gendered divisions of labor (discussed in Chapter 5) in a period characterized by increased political complexity and social stratification.

By the end of the Early Moche phase (A.D. 200–300), the center of power in the Moche Valley shifted away from Cerro Oreja, and a new political and ceremonial center was founded at the Huacas de Moche, and the construction of Huaca de la Luna and Huaca del Sol began (Bawden 1996; Billman 1996, 2010; Topic 1977, 1982; Uceda 2001; Uceda et al. 1997, 1998, 2000). These adobe monuments were dramatically different in form and function than the antecedent monuments of the Salinar and Gallinazo phases (Billman 1996; 2010), and new public rituals emerged that included human sacrifice along with lavish elite burials ((Billman 2010; Bourget 2001; Uceda 2001; Verano 2001a, 2001b). Beyond the Huacas de Moche, a major settlement expansion and reorganization occurred in the valley, which included the construction of large numbers of new settlements, monumental centers, and three massive canals (Billman 1996, 2002, 2010; Moseley and Deeds 1982).

Billman (2010) argues that during this period, rulers were able to harness labor and collect large quantities of goods on a regular basis from commoner households, which they used to finance a broad range of political activities, including monumental construction, craft production, land reclamation, and possibly military actions. These transformations were manifestations of the emergence of a new regional political economy in which Moche rulers exercised significant economic, military, and ideological power over the population of the Moche and adjacent valleys. The dramatic expansion of the Southern Moche political economy would have required the mobilization of large quantities of foodstuffs to support public work projects, craft specialists, elite families, and massive public gatherings at Huaca de la Luna.

An important question in this dissertation is whether shifts in agricultural production occurred prior to or during the dramatic expansion of the Middle Moche phase, after the polity consolidated. Lambert et al. (2012; see also Gagnon 2006, 2008; Gagnon and Weisen 2013) use bone chemistry data and dental markers from coastal skeletal populations at Cerro Oreja to suggest that maize production intensified during the Gallinazo phase. They compare data from Guañape, Salinar, and Gallinazo phase burials from Cerro Oreja and reveal a significant increase in the $\delta^{13}C$ signature from the Salinar to the Gallinazo phase (see Lambert et al. 2012:158, Figure 3). They interpret this increase as evidence of increased maize consumption in the Gallinazo phase, in advance of the Moche political expansion; however, as they do not include any Moche phase samples in their comparison, they are not able to document whether this increase in maize consumption during the Gallinazo phase was accompanied by a second wave of increased consumption (or intensification) during the Moche era. I evaluate this issue in Chapter 4 and conclude that maize intensification does appear to have pre-dated Moche political expansion ca. 300 A.D. in the Moche Valley, and was not followed by a secondary wave of intensification.

By the start of the Middle Moche phase (ca. A.D. 400), highland groups had left the Moche Valley, but it is not clear what became of these groups after the abandonment of highland EIP sites. Billman (1996:290) has proposed a conquest scenario in which the centralized coastal polity of Cerro Oreja forced highland invaders out of the middle Moche Valley, and that "out of this crucible of warfare and reconquest the Moche State emerged." Billman (1999, 2002) presents other possible scenarios for the abandonment of highland EIP sites, hypothesizing that they either left, were driven out to resettle elsewhere (possibly returning to the highland locales from where their ancestors had originally migrated), or that they assimilated into Moche culture. Given the current revision in thoughts about the bellicose nature of highland/coastal interaction during the EIP and a shift towards thinking that these relationships may have been more cooperative and collaborative, it is possible that highlanders did intermarry and assimilate with the local coastal groups that ultimately manifested the artifactual and architectural traditions associated with Moche. I imagine a return to ancestral homelands also likely occurred as well. Whatever the case, most, if not all highland sites occupied during the Gallinazo/Early Moche phases were abandoned by the Middle to Late Moche phases, although this aspect of north coast prehistory remains poorly understood.

The Middle Moche phase (A.D. 400–700) witnessed a variety of other important social and political changes. The volume of ceremonial architecture in the Moche Valley increased to nearly twenty times that of the preceding Gallinazo and Early Moche phases (Billman 1996:317-218; Billman 2002:392). At the Huacas de Moche, laborers constructed elaborate residences for elites (Chapdelaine 2009; Uceda and Armas 1998; Van Gijseghem 2001), and specialists engaged in adobe brick production, ceramic production, metallurgy, chicha brewing, and camelid herding. It is unclear the degree to which residents at the Huacas de Moche engaged in agricultural production. While excavations have been undertaken in the residential sector (e.g., Chapdelaine 2002; Uceda and Chapdelaine 1998), and Pozorski (1979) analyzed botanical remains recovered from midden excavations, no studies have been conducted using modern/systematic recovery and analytical techniques (an issue I discuss further below). Furthermore, the majority of excavations at the Huacas de Moche have been conducted without screening, which limits our potential for understanding issues such as agricultural production.

In the context of broader Moche studies, archaeological studies of everyday domestic life often are neglected in favor of more elaborate mortuary and ceremonial contexts. While there are growing numbers of Moche scholars engaged in studies of the household (e.g., Briceño and Billman 2003; Bawden 1982b; Chapdelaine 2002; Cruz et al. 1996; Dillehay 2001; Jáuregui et al. 1995; Johnson 2010; Ringberg 2012; van Gijseghem 2001), there continues to be a need for studies focusing on households within hinterland communities in addition to primary centers (Chapdelaine 2011:214), and in particular studies of households that encompass the Gallinazo and Early Moche phases. The Moche Origins Project, directed by Brian Billman (University of North Carolina, Chapel Hill) and Jesús Briceño Rosario (Ministry of Culture, Peru) is one project advancing research in this direction.

Surridge's (2010) lithic analysis (part of the Moche Origins Project) indicates declining hoe consumption in elite households by the Middle Moche phase (ca. AD 400–600), suggesting a shift in high-status domestic economies to ascribed positions that focused on mobilizing the labor of others, in order to redistribute crafts and foodstuffs such as chicha. Billman (2010:192) suggests that Moche rulers may have played a central role in financing the production of an intermediate class of ceramic wares and their distribution in the Moche and Chicama Valleys. Russell and Jackson (2001) propose that Moche rulers provided potters at the ceramic workshop of Cerro Mayal in the Chicama Valley with food and access to raw materials, and then collected and redistributed finished ceramic vessels. In their model, rulers placed themselves between producers and consumers by directly financing craft activities. Pottery would have flowed through a network of hierarchically ordered Moche rulers down to farming, fishing, and other types of crafting households.

In an unpublished Master's Thesis, Attarian (1996) argues that potters at Cerro Mayal were dependent on stored foods for their sustenance rather than fresh fruits and vegetables, and that those stored foods were a result of provisioning by Moche rulers. This interpretation is questionable, however, as seeds from fresh fruits and vegetables are less likely to preserve in charred macrobotanical assemblages (as these foods are often consumed in their entirety). The patterns Attarian describes may be a result of preservation issues rather than actual past provisioning strategies. In short, current understandings of the Middle Moche phase political economy include elite redistribution of ceramic wares, chicha, coca, and other consumables, and the elite sponsorship of *masa*, or work parties in which laborers were provisioned with alcohol in exchange for their participation in agricultural production or monument construction.

The Late Moche phase (A.D. 700–800) witnessed a series of droughts and strong El Niño events (Bawden 2001; Dillehay and Kolata 2004; Moseley and Deeds 1982; Moseley et al. 2008; Shimada 1994). Scholars, including Bawden (1996, 2001) and Shimada (1994) suggest that these climatic events weakened the power and authority of the Moche ruling class(es) and caused major reorganization throughout parts of the north coast, including abandonment of major centers and population decline. Other factors such as internal class struggle; changes in elite ideology; and conflict with external polities have been proposed for the decline of Moche polities as well (Castillo 2000, 2001; McClelland 1990; Shimada et al. 1991). Swenson (2006:113) argues that feasting was implicated in localized strategies of political empowerment in the Jequetepeque Valley in the Late Moche period, and that these strategies, directed by lower level kin groups, "subverted elite authority and urban-based social control in the region." Overall, the decline of the Moche polities is the subject of active debate, one that is linked to how different scholars interpret Moche politics with different trajectories proposed for the Southern and Northern Moche polities.

The site of Galindo in the middle Moche Valley is one of the most important Late Moche centers on the north coast. The site was once thought to have been occupied after the Huacas de Moche were abandoned; however, recent radiocarbon dates presented by Lockard (2009) revise this interpretation. Lockard (2009) suggests that Galindo and the Huacas de Moche were in fact contemporaneous, and that the occupation of the Huacas de Moche extended well into the eighth century A.D. The social and political relationship between these two presumably coeval centers, Galindo and the Huacas de Moche, is not particularly well understood. Regardless, Galindo appears to have been abandoned by A.D. 800, along with the Moche Huacas and other major Moche sites. Moche Valley residents that abandoned these sites likely lived with fellow kin groups in the absence of centralized political organization (Lockard 2009).

There is an approximately one hundred year gap between the abandonment of Galindo and the founding of Chan Chan in A.D. 900, the capital of the Chimu Empire that dominated the north coast during the Late Intermediate Period (AD 1000–1460) (Campana

2006; Keatinge and Day 1973; Moseley and Day 1982; Moore and Mackey 2008; Ravines 1980). During the Middle Horizon (A.D. 600–1000; in certain regional chronologies this period overlaps with the EIP), two expansive polities emerged, including the Wari of the central highlands and the Tiwanaku of the south-central highlands. The encounters and interactions between Wari and Tiwanaku polities with groups outside their homelands is a lively topic of debate in the Andes (e.g., Castillo and Jennings 2012; Isbell and McEwan 1991; Jennings 2010; Nash and Williams 2004; Schreiber 1992, 2001; Topic and Topic 2010; Vranich and Stanish 2013). Of these two polities, the Wari appears to have been the only group to interact with populations of north coastal Peru, evidenced primarily by Wari material culture in elite funerary contexts in the Huarmey Valley, the Jequetepeque Valley, and the Moche Valley at Huaca de la Luna (Castillo et al. 2012; Rucabado and Castillo 2003; Shimada 1990; Uceda and Morales 2013).[7]

Ultimately, the north coast of Peru witnessed a series of profound social and political changes during the EIP. Shifting the focus away from large monumental centers and mortuary contexts, we can use the household as a basic analytic unit (*sensu* Wilk and Rathje 1982; see Aldenderfer and Stanish 1993; Bawden 1982b; Bermann 1994; Moore 2012; Robin 2003; Wilk and Ashmore 1988; Wilk and Netting 1984) to examine how women, men, and children produced and reproduced status-based, gendered, and cultural identities during this period of immense cultural change through the practices of their daily lives. An analysis of foodways provides a critical lens for understanding these issues. I now discuss current understandings of food systems, in the north coast more broadly and in the Moche

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[7] Neither Billman (1996) nor Boswell (2016) encountered any Wari ceramics in their pedestrian surveys of the lower/middle and upper Sinsicap valleys, respectively. Outside of elite mortuary contexts, current understandings of Wari interaction with local north coastal populations are not well understood.

Valley specifically, and discuss the limited paleoethnobotanical data that are available for the Moche Valley.

Current Understandings of South American Food Systems

Within the diverse South American continent, three well-developed agricultural systems were documented at the time of European contact: (1) low-altitude farming in the eastern lowlands and western coast, based on the cultivation of root crops and maize; (2) mid-elevation Andean systems dominated by maize, beans, and tubers; and (3) high-altitude systems based on potato and other root crops, quinoa, and camelid herding (llamas and alpacas). Scholars continue to debate when food production began and how these agricultural systems developed (e.g., Lentz 1999; Parsons 1970; Pearsall 1992, 2007, 2008; Piperno 1991, 2011; Rossen 2011).

Evidence suggests that by 5,000 B.C., a number of plants were being cultivated in South America, with evidence for use of cultivated plants becoming increasingly abundant from 4,000 to 1200 B.C. These plants include maize (*Zea mays*) introduced from Mesoamerica, gourd (*Lagenaria siceraria*), cultivated legumes (*Arachis hypogeae*, *Canavalia plagiosperma, Phaseolus vulgaris*, *Phaseolus lunatus*), squashes (*Cucurbita* spp.), chili peppers (*Capsicum* spp.), cotton (*Gossypium barbadense*), quinoa (*Chenopodium quinoa*), potato (*Solanum tuberosum*), sweet potato (*Ipomoea batata*), avocado (Persea americana), guava (*Psidium guajava*), lucuma (*Pouteria lucuma*), and the stimulant coca (*Erythroxylon novogranatense*) (e.g., Bryant 2003; Chiou et al. 2014; Duncan et al. 2009; Perry et al. 2007; Piperno 2011; Pipernot and Dillehay 2008; Piperno and Smith 2012; Piperno and Stothert 2003; Piperno et al. 2000; Zarillo et al. 2008), along with other indigenous root crops such as arrowroot (*Maranta arundinaceae*), jícama (*Pachyrrhizus* spp.), lerén (*Calathea* spp.), manioc (*Manihot esculenta*), oca (*Oxalis tuberosa*), and yam (*Dioscorea* spp.) (e.g., Chandler-Ezell et al. 2006; Dickau et al. 2007; Iriarte 2007; Piperno 2006:47; 2011).

Piperno and Dillehay (2008:19) also have established the South American domestication of pacay (*Inga feuillei*) by 6850–5650 B.C., indicating that people domesticated both tree crops and root crops prior to the domestication of weedy annuals in South America. These data have led researchers to suggest that societies developed significant food production systems in South America by 7250 B.C. (Dillehay et al. 2007; Piperno and Dillehay 2008). The documentation of plant cultivation from early sites is not without interpretive problems, and scholars are continually revising chronologies for the origins of domestication for certain taxa, often in light of new data from high-precision direct AMS dating of macroremains, along with advances in microbotanical, isotopic, chemical, and genetic studies.

Margaret Towle's seminal work, *The Ethnobotany of Pre-Columbian Peru* (1961), drew together all of the plant data available at the time from early excavations on the desert coast of Peru (although she herself never visited Peru). Today the Peruvian coast remains a primary source of data on the origins and evolution of agriculture in South America. Though few South American crops are native to the coast, many were eventually introduced and grown there under irrigation, and desiccated remains have preserved in exceptional form at some sites in hyper-arid desert conditions. Of all cultigens grown in coastal Peru, maize has received the most attention; indeed, preoccupation with the domestication, spread, and intensification of maize throughout the New World remains an overarching theme and a subject of lively debate within and outside the field of paleoethnobotany. A highly productive and storable crop, maize underwrote the expansion of the Late Horizon Inka empire (A.D. 1450–1540) (Bray 2009; Cobo 1979; Morris 1979; Murra 1980, 1986; Pizarro 1965[1571]; Poma de Ayala 1987[1615]; Staller 2006) and by inference other earlier polities (e.g., Gagnon 2006:253; Goldstein et al. 2009; Finucane et al. 2006; Hastorf 1990; Hastorf and Johannessen 1993; Hayashida 2009; Moore 1989; Ramirez 1996; Sayre et al. 2012; Schreiber 1992; Valdez 2006; Valdez et al. 2010; Wright et al. 2003). Maize continues to be a valuable agricultural product and subsistence commodity in the Andes today, with hundreds of varieties adapted to local environmental conditions and culinary preferences (Hastorf et al. 2006:431), as well as through its central role in ceremonies and religious rituals, particularly in the form of chicha (Hastorf and Johannessen 1993; Jennings 2005; Jennings and Bowser 2009; Logan et al. 2012; Morris 1979; Weismantel 1991).

Recent genetic studies confirm that maize domestication occurred only once (ca. 7150 B.C.), most likely from a population of wild teosinte (*Zea mays* ssp. *parviglumis*) that grew in the lower Balsas River valley of Guerrero, Mexico (Bennetzen et al. 2001; Matsuoka et al. 2002). Maize was introduced into South America as early as 4050–3050 B.C., evidenced by starch grains from food residues in early ceramics from sites in Ecuador (Zarillo et al. 2008; see Pearsall 2002, 2003, 2004; Piperno 2003). Local Peruvian maize varieties (identified from macrobotanical and microbotanical remains) arose as early as 4750 B.C. in northern Peru (Grobman et al. 2012) and no later than 2050 B.C. in Peru's southern highlands (Perry et al. 2007). Piperno (2011) argues that interandean valleys were major routes for the rapid dispersal of maize after it entered South America, citing the high number of sites with early maize in the Cauca Valley of southwestern Colombia.

Paleoethnobotanical research in North Coastal Peru

Shelia Pozorski's (1976, 1979, 1982) research on Moche Valley subsistence, which includes archaeobotanical data from the Preceramic period (2500–1800 B.C.) through the Late Intermediate and Late Horizon periods (A.D. 1000–1532), is one of the major contributions to our knowledge of subsistence practices for the Peruvian north coast. Pozorski's study evaluated archaeobotanical and faunal data from 11 Moche Valley sites spanning that timeframe. She argued that a shift away from consumption of marine resources towards a focus on irrigation agriculture occurred during the Initial Period ca. 1800 B.C., and that over time, maize began to dominate species inventories. Pozorski (1979:181-182) envisioned incremental changes in provisioning strategies through time, which culminated in the centralized, redistributive system of the Chimu empire during the Late Intermediate and Late Horizon periods (A.D. 1000–1532) in the Moche Valley, based on specialization of agricultural production and emphasis on camelids and cultivated crops over marine fauna and wild plants.

Pozorski (1976, 1979, 1982) presents compelling arguments for her interpretations of north coast subsistence change that have been widely accepted by regional scholars. However, more robust sampling and analytical methods have developed in the past 40 years since those subsistence data were collected. The main weakness of Pozorski's study is that not all the excavations were screened, and the midden excavation was screened through ¼-inch mesh, biasing her recovery toward large desiccated plant remains. Furthermore, she used a unique method of quantitative analysis of food remains that estimated the volume of plant foods based on plant part (e.g., stems, seeds) for dietary reconstruction, rendering comparative use of her data problematic.

Analysis of bulk soil samples and the use of quantitative measures including ubiquity (Godwin 1956; Hubbard 1975, 1976, 1980; Popper 1988; Willcox 1974), density (Miller 1988; Scarry 1986), and other abundance measures can be used to more rigorously assess diachronic change in plant assemblages, discussed further in Chapter 4. Moreover, Pozorski's EIP data derive specifically from Moche III and Moche IV (i.e., Early/Middle Moche) midden contexts from the Huacas de Moche in the lower Moche Valley—lacking are data from Gallinazo-phase (A.D. 1–200) contexts, *before* the Moche polity consolidated, or from food-producing households outside of the polity's capital. Pozorski analyzed data from the Salinar-phase (400–1 B.C.) Cerro Arena site discussed above; however, according to Pozorski (1979:175), almost no plant remains were preserved at Cerro Arena. This issue is likely related to a couple of factors: (1) Pozorski only examined desiccated plant material, which would be unlikely to preserve at a middle valley site often engulfed in garua (low hanging cloud fog); and (2) Pozorski and colleagues used ¼ inch screens in their excavations and therefore were unlikely to recover any small plant parts or seeds.

Pozorski (1979:176) argues that the plant data from the Moche Huacas indicate efforts to increase agricultural production, citing the emergence of common beans, cotton, gourd, maize, peanuts, and squash as major crop plants that were cultivated as new and larger areas were opened to irrigation. She also suggests that fruits decreased in importance; I revisit this interpretation in this dissertation and present data that refute that assertion in Chapter 4, through a comparison of data from the preceding Salinar and Gallinazo/Early Moche phases. She also presents data from Galindo and suggests that "Moche concern with increased production of storable plant products was essentially maintained," (Pozorski 1979:177) but that unequal cultigen frequencies and decreases in seed size suggest that agricultural outlook had narrowed and that maize and common bean production was emphasized at the expense of other cultigens, especially gourd and squash. I revisit this interpretation in Chapter 4 as well.

As discussed in Chapter 2, Billman et al. (2017) revise Pozorski's (1976, 1979, 1982) interpretations of Chimu provisioning strategies based on the analysis of plant remains from the hinterland site of Cerro la Virgen. I analyzed the paleoethnobotanical data for that project, which we used to update interpretations about forced resettlement and farming of Chimu state fields. We document broad-based strategies of field cultivation, arboriculture, and wild plant collection in the rural sustaining area of Chan Chan, and argue that aside from fulfilling potential tribute demands, Cerro la Virgen households appear to have been relatively autonomous. Rather than specialists, households appear to have been largely self-sufficient with regards to food production, combining farming with fishing and shellfishing, although they did depend on higher authorities for access to irrigation water.

Cutright (2009, 2011, 2015) addresses similar questions of Chimu expansion and the impact on food practices of incorporated populations that supplied urban settlements. She considers plant data from Pedregal, a rural settlement in the Jequetepeque Valley, before and during Chimu expansion, and discusses both change and continuity in food production and consumption. Her data indicate that the production of agricultural staples such as corn and cotton intensified during the Chimu occupation of Pedregal; however, culinary equipment (including ceramics) and the overall range of household activities remained the same. Broadly, Cutright's arguments support Pozorski's in that the Chimu appear to have been able to establish political control and solicit the mobilization of agricultural products from conquered rural settlements in to urban centers. However, according to Cutright (2015:64), this establishment of political control occurred without a radical reorganization of rural domestic economies (*sensu* Billman et al. 2017). Long-standing interpretations based on faunal data are being revised in light of advances in sampling and recovery techniques as well; for example, in her analysis of household excavation data from the site of Pampa Grande in the Lambayeque Valley, Johnson (2010:250) found no relationship between status and consumption of camelid meat (or of any other food item) and no indication of centralized management of herds, as proposed by Shimada (1994:189) and Pozorski (1979) for other Moche sites.

Aside from Pozorski's seminal work, paleoethnobotany in the Moche Valley and in neighboring north coast valleys has been extremely limited. Gumerman's (1991, 1994a, 2002) classic case study of status delineation in foodways during the Lambayeque (A.D. 1000–1370) occupation of Pacatnamu in the Jequetepeque Valley is the most widely cited. His study revealed that commoners relied more heavily on wild plants and marine resources, whereas elites consumed more camelid meat and had greater access to chili peppers and coca (Gumerman 1991; 2002:244-245) [8]. Gumerman (1994b, 2002) also considers food practices in Moche burial offerings, through an analysis of plant remains from burials from the Moche occupation at Pacatnamu that began ca. A.D. 300. His study revealed that maize and seaweed (*Gigartina chamissoi*) were the most common plants in Moche burial offerings, and that there was an even distribution of taxa in burials regardless of social standing.

Food for the living appeared to have been different, as data recovered from middens indicated a heavy reliance on marine food, and maize with higher row numbers appears to

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[8] These markers of elite status clearly are socially contingent; at the Wari site of Cerro Baul in southern Peru, plants that mark elite status are coca, tobacco (*Nicotiana tabacum*), and cactus fruit (*Opuntia* spp.), whereas maize, beans, peanuts, chenopods, and chili peppers were accessible across the social spectrum (Moseley et al. 2005:17270).

have been selected as food for the dead (Gumerman 1994b:406). Cutright (2011) documented higher amounts of maize in Moche burial offerings than in domestic contexts at the site of Farfán in the Jequetepeque Valley, reporting that domestic contexts included a wider variety of resources than burials, including fruits. With regards to the organization of mortuary rituals, Gumerman (2010:124) argues that the intensity of mortuary feasting at the Moche center of El Brujo in the Chicama Valley attests to the importance of food in these types of rituals among the Moche, but that the types of foods used indicate kin-level instead of state-centered organization of feasts.

Data from earlier EIP sites, particularly related to the development of the Southern Moche polity and from domestic habitation sites, are lacking. To date, there are no published studies on Gallinazo phase subsistence, with the exception of early work by Junius Bird (1948, see Bird and Bird 1980) and Margaret Towle (1952), who described desiccated plant remains from Huaca Prieta in the Chicama Valley and Castillo de Tomoval and Huaca de la Cruz in the Virú Valley, respectively. Bird and Bird (1980) discuss the morphological characteristics of maize from the Gallinazo phase midden deposits excavated by Bird (1948) at Huaca Prieta, and Towle (1952) lists the inventory of plant remains recovered from middens at Castillo de Tomoval and Huaca de la Cruz, which yielded desiccated maize cobs, peanuts, varieties of beans, squashes, and various fleshy fruits. Other than identifying the plants recovered, no inferences or conclusions were made about how these plants were used or processed.

Proxy measures have been employed by Moche Valley researchers to examine agricultural strategies during the Gallinazo/Early Moche phases, including the analysis of chipped stone hoes (Surridge 2010), agro-ecological zonation modeling with GIS (Fariss

2012), and canal irrigation requirements (Billman 1996, 2002). A limited number of Master's theses were produced under the Moche Foodways Archaeological Project directed by George (Wolf) Gumerman IV from 1997-2000 in the Moche Valley (Ryser 1998; Tate 1998; see Gumerman and Briceño 2003), along with a few other studies in the Chicama (Attarian 1996; Hough 1999), Jequetepeque (Mort 2010), and Virú Valleys (Dionne 2002; Masur 2012). However, these theses either focused on a single plant food category, such as maize (Tate 1998), beans (Ryser 1998, see also Ryser 2008), or peanuts (Masur 2012), or do not report sufficient raw data to permit quantitative comparisons (Attarian 1996; Dionne 2002; Hough 1999; Mort 2010). Furthermore, none of these paleoethnobotanical studies have been published, with the exception of Ryser's bean study, which does not report raw data and focuses primarily on the significance of beans in Moche iconography (Ryser 2008), and none of these scholars continued to conduct paleoethnobotanical research in Peru *after* the completion of their M.A. projects.

The time therefore is ripe to reconsider changes in foodways during the EIP, and resulting implications for labor, gender, and status-based inequalities, through a detailed paleoethnobotanical study that uses modern and systematic recovery and analytical techniques. I now turn to a discussion of the five domestic habitation sites whose excavations yielded the paleoethnobotanical data considered in this dissertation.

Study Sites

All of the sites considered had EIP domestic occupations, evidenced by the presence of masonry hearth compounds, patios, hearths, storage rooms, and large *batanes* (grinding stones). With the exception of Galindo, these sites do not have civic/ceremonial architecture. For the three sites investigated by the Moche Origins Project (discussed below), I refer to site numbers rather than longer site names throughout this dissertation, primarily to maintain consistency with graphical displays of data that include the shorter site numbers (Figure 3.1).

Figure 3.1 Map of the Moche Valley, Peru, with relevant sites labeled.

La Poza

La Poza represents the only excavated habitation site with Salinar components in the Moche Valley other than the site of Cerro Arena, where Brennan (1978, 1980, 1982) conducted excavations of elite residences, public ceremonial architecture, possible specialized administrative facilities, and non-elite domestic architecture. As discussed above, Pozorski (1979:175) analyzed plant data from the site, but reports that almost no plant remains were preserved, likely a result of sampling and analytical strategies. Bulk soil samples were collected from the La Poza site in 2012 (discussed in detail in Chapter 4), presenting an opportunity to reevaluate plant subsistence practices during this period.

La Poza, also known as Pampa La Cruz, is located on a marine terrace on the coast, towards the southern end of Huanchaco Bay (see Figure 3.1). Excavations at this site were conducted by various researchers in the twentieth century, including Iriarte (1965); Donnan, as part of the Chan Chan Moche Valley Project (Donnan and Mackey 1978); and Barr (1991; Barr et al. 1986), although these researchers did not collect soil samples. The site was excavated more recently by Gabriel Prieto and Victor Campaña as a salvage project, el Proyecto de Evaluación Arqueológico con Excavaciones en las Lomas de Huanchaco (PEALLO) in 2012 (Prieto and Campaña 2013; see Millaire et al. 2016). The site had suffered from heavy looting, and previous municipal authorities of the District of Huanchaco had sold hundreds of lots in the archaeological zone (Prieto and Campaña 2013:17). Currently, the area that the site occupies is known as "Las Lomas de Huanchaco." Prieto and Campaña (2013:4) estimate that there are approximately 200 houses within the perimeter of the archaeological zone, representing a population of 5,000 people.

Prieto and Campaña placed a series of 2-X-2 meter units across the site in areas that they could access (including in streets and public parks). In some cases these units were expanded if features were documented. Excavations revealed that La Poza was initially occupied by people who used Salinar-style pottery (ca. 400–1 B.C.) and built one of mounds at the site, designated Montículo II. Houses featured masonry stone walls, and the ceramic chronology places domestic occupation in the Salinar and Gallinazo phases, with later Moche and Chimu cemetery occupations. The Salinar domestic occupation was the most extensive of the residential areas exposed at the site. Some occupation layers evince a coexistence of Salinar style with Gallinazo style ceramics (i.e., Virú style, see Millaire and Morlion 2009), primarily in the area to the southeast of Montículo I, a second platform built during the EIP. Prieto and Campaña (2013:4) suggest that these ceramics considered to be

Gallinazo style are actually a continuation of Salinar. The lower area of the site also has Middle Moche phase households and burials (Donnan and Mackey 1978).

Radiocarbon dates from wood charcoal recovered from excavations by Prieto and Campaña of the Salinar component range from 390–116 B.C., consistent with date ranges for the period. I selected three carbonized specimens from annual plants (maize [*Zea mays*], avocado [*Persea americana*] and tillandsia [*Tillandsia* spp.]) for three additional AMS dates, discussed below. Analysis of materials recovered from the 2013 excavations is still ongoing; thus, the specific nature of daily life for Salinar phase residents at La Poza currently is poorly understood. As a result, I include La Poza in my broader diachronic comparison, but I am unable to tease out patterns of plant use within different households or social spaces based on the limited data available for this site and time period.

Table 3.3 Radiocarbon dates from the Salinar phase component at La Poza (adapted from Millaire et al. 2016:Table S8).

Lab ID	Context	Material	^{14}C y BP	Calibrated 2-σ range
PSU-5538	Test pit 18	Wood charcoal	2195 ± 30 BP	363–183 B.C.
BETA 433940	Test pit 51	Wood charcoal	2170 ± 30 BP	360–116 B.C.
BETA 433941	Test pit 50	Wood charcoal	2240 ± 30 BP	390–205 B.C.

MV-224

MV-224, also known as West Cerro-León, initially was recorded by Brian Billman during his 1990-1991 surface survey of the middle Moche Valley. Billman (1996:244-245) identified the site as one of two fortified settlements dating to the Gallinazo phase (A.D. 1-200) in the middle valley. As discussed above, during this time period, large areas of the Moche Valley were abandoned by coastal groups, and the population aggregated in the lower middle valley. Cerro Oreja appears to have developed into the paramount center of a centralized polity that controlled much of the valley (Billman 1996; Carcelén 1995; see Gagnon 2006, 2008; Gagnon and Wiesen 2013). Information on the Gallinazo Phase in the Moche Valley is primarily drawn from survey data; three large Gallinazo phase sites (Cruz Blanca, Cerro Oreja, and MV-74) were excavated during the Chan Chan Moche Valley Project (Billman 1996:242), but none of these excavations have been published or sampled with contemporary recovery methods. Excavations at MV-224 were conducted in 2009 by the Moche Origins Project, directed by Brian Billman and Jesús Briceño Rosario. This project has produced the only coastal Gallinazo phase household excavation data in the Moche Valley available for study to date.

MV-224 is a located on the south side of the middle Moche Valley on a hill between Quebradas del León and Alto de las Guitarras (see Figure 3.1). The site features between 25 and 50 residential compounds spread over a 1.1 ha area, along a hill slope between two large *quebradas*, or dry drainages. Habitation terraces extend from the summit down to the base of the hill and are densely packed between two ridges that run off the hill. The site is fortified by a substantial wall, approximately 1-m thick and between 1.5 and 2 m high, which runs along the northern base of the hill (Billman 1996:245). Based on artifact concentration in the construction and terrace fill, initial occupations may have been located at the base and then moved farther up slope. Excavations yielded relatively high quantities of Castillo Incised and Modeled sherds, diagnostic of the Gallinazo phase, while Moche sherds were rare or absent. Billman's (1996) analysis of ceramics collected from his pedestrian survey concluded that Gallinazo-phase ceramics from the middle Moche Valley are essentially identical to the Gallinazo-phase types defined in the neighboring Virú Valley (see Millaire and Morlion 2009). These ceramics evince clear similarities with ceramics recovered from the Santa Valley as well, including from the San Juanito, San Nicolas, and El Castillo sites excavated by the Santa Valley Project of the Université de Montréal (Chapdelaine et al. 2009). To provide further chronological control, I selected four carbonized maize specimens from MV-224 for direct AMS dates, discussed below.

An important question regarding MV-224 is whether its residents had hostile or cooperative relations with nearby highland-occupied communities, including at MV-225 (discussed below). While fortifications suggest an interest in defense, the presence of fortifications does not directly indicate that violence occurred. Rather than purely bellicose relations between highland and coastal occupants of the Moche Valley, valley residents may have been allies, banding together against threats from people inhabiting nearby valleys. In the neighboring Santa Valley, researchers suggest that the positioning of defensive sites relates more to threats from nearby valleys than from highland colonists during the Gallinazo phase (Wilson 1988:193; see Hubert 2014:60). More fine-grained analyses of architecture and materials from MV-224 are necessary to clarify the nature of this dynamic.

Besides the initial survey and subsequent mapping of visible architecture (Farris 2012), only one season of excavation has been carried out at MV-224, and analysis of artifacts has been preliminary. While Surridge (2010) has documented the lithic material from the site (primarily stone hoes), overall the residential occupation at MV-224 is not particularly well understood. Furthermore, the site habitations have been subjected to colluvial erosion and looting, resulting in mixed deposits and some difficulty in associating deposits with particular structures and their corresponding social/domestic groups. Like La Poza, I include MV-224 in my broader diachronic comparison, but I am unable to tease out intra-site patterns plant use based on the limited data available for this site.

MV-225

In contrast, MV-225, also known as Cerro León, was the focus of six seasons of excavation and mapping from 2002 to 2008 by the Moche Origins Project (Billman et al. 2000, 2001, 2004, Briceño and Billman 2007, 2008, 2009; Briceño et al. 2006; Fariss 2008, 2012; Ringberg 2012; Surridge 2010). The site was initially recorded by Billman in his pedestrian survey in 1990-1991 as one of 113 sites in the middle Moche valley with large quantities of nonlocal ceramics, similar in paste, vessel form, and decoration to the EIP ceramics from the highland areas of the Moche, Virú, and Chicama drainages (Topic and Topic 1982). Architecture at the site covers 8.64 ha on a hill east of MV-224 and has been divided into ten areas that feature various levels of defensibility and investment of labor. The bulk of excavations at MV-225 focused on three domestic compounds in Area 1 of the site, designated Compounds 1, 3, and 6.

Compound 1 represents the largest known residence dating to the highland occupation of the middle valley, and may have been the home of the paramount elite of the largest polity of highland colonists (Billman et al. 2004; Briceño and Billman 2007, 2008, 2009; Ringberg 2012). The other two compounds, Compounds 3 and 6, represent an intermediate status of residential architecture. Radiocarbon dates from maize kernel and cob fragments reported by Huckleberry and Billman (2003) and Ringberg (2012) place the highland occupation of MV-225 during the Gallinazo/Early Moche phases (A.D. 1–300), an occupation that predates the occupation of the urban sector of the Huacas de Moche reported by Uceda et al. (2008). The MV-225 dates also fall within the range of Millaire’s (2010) dates from the residential sector at the Gallinazo Group.

Table 3.4 Radiocarbon dates from MV-225 (adapted from Ringberg 2012 and Huckleberry and Billman 2003).

Lab ID	Context	Material	^{14}C y BP	Calibrated 2-σ range
BETA 294056[1]	Feature 32	Maize	1830 ± 30 BP	A.D. 134-346
BETA 294055[1]	Feature 32	Maize	1890 ± 30 BP	A.D. 81-254
BETA 294054[1]	Feature 44.01	Maize	1780 ± 30 BP	A.D. 240-402
CAMS-74945[2]	Room block beneath Wall 1	Wood Charcoal	1910 ± 40 BP	A.D. 59-254
CAMS-74946[2]	Room block beneath Wall 1	Wood Charcoal	1780 ± 50 BP	A.D. 209-425
CAMS-74947[2]	Room block beneath Wall 1	Wood Charcoal	1940 ± 30 BP	A.D. 48-237

[1] Ringberg 2012:Table 5.7.1
[2] Huckleberry and Billman 2003:Table 3

Detailed analyses of ceramics (Ringberg 2012) and architectural data (Farriss 2012; Ringberg 2012), and preliminary analyses of lithic data (Surridge 2010) have been completed for MV-225 and reported in various dissertations and Master's theses. Excavation data indicate that highland colonists from the Otuzco Basin and Carabamba Plateau occupied the site (as opposed to an indication of trade or exchange networks). Exchanges likely took place between the migrant community that occupied MV-225 and local coastal communities (including MV-224), but highland settlers appeared to have lived at MV-225, while maintaining relationships with their communities of origin in the highlands. Highland ceramics identified at MV-225 by Ringberg (2012) have different vessel forms and pastes than local coastal wares, and are consistent with descriptions of ceramics from Otuzco Basin and Carabamba Plateau by Topic and Topic (1982). A highland presence has been recorded in neighboring valleys as well; for example, at the site of San Nicolas in the Santa Valley, over a third of decorated ceramics were Recuay imports from the highlands (Choronzey 2009:13; Hubert 2016). Highland-style material culture is present in the middle Chillón valley on the central coast as well, which Dillehay (1976) argues involved both conquest as well as multi-ethnic settlement. Highland-coastal interactions on the EIP north coast have been documented in regional settlement surveys for the Casma, Chao, Virú, Nepeña, and Lurín Valleys as well (Daggett 1983; Patterson et al. 1982; Topic and Topic 1982, 1983; Wilson 1988). However, the highland presence in the Moche Valley at MV-225 is the first to be explored through intensive excavations supported by AMS dates.

Fariss (2012) argues that highland settlement patterns in the middle Moche Valley, initially interpreted as defensive in nature, may not have been for defensive purposes; rather, the irrigation expansion witnessed during this phase lessened competition between groups and supported a larger population that co-existed peacefully. According to Ringberg (2012:108), daily life at MV-225 "centered around daily subsistence and craft production, ancestor-centered ritual, and hosting public, large-scale events," citing the evidence of large patio/terrace spaces for public gatherings, and ceramic assemblages that include fineware serving vessels and jars for chicha production. With a large sample of excavation data available from MV-225, I examine (1) which resources highland migrants were actually targeting upon their colonization of the valley, and (2) how foodways were spatially organized at MV-225 with respect to gender and status-based divisions of labor.

MV-83

MV-83, also known as Ciudad de Dios, is located on the north side of the middle Moche Valley (see Figure 3.1), directly above the modern rural village of Ciudad de Dios and approximately 18 km from the coast. The site covers approximately 3.3 ha and consists of five ridges about 50 m above the valley floor designated as site areas (Areas 1-5). During his 1990-1991 pedestrian survey of the middle Moche Valley, Billman (1996) mapped visible surface architecture and dated the site to the Middle Moche phase (A.D. 400–700) based on his ceramic analysis. I selected three carbonized maize specimens from MV-83 for direct AMS dates, discussed below.

Within the site boundaries there are two ridges, or site areas, containing large, well-constructed masonry domestic compounds (Areas 2 and 3), surrounded by the remains of smaller *quincha* (wattle and daub) and masonry domestic structures (Areas 1, 4, and 5). Structures are interpreted as domestic based on the presence of batanes (grinding stones), plainware sherds, debitage, lithics, and midden deposits; furthermore, there is no ceremonial or public architecture at the site. This site was excavated by the Moche Origins Project from 1998 to 2000.

The residences located in Area 2 of the site represent some of the largest known Moche phase habitations in the valley; Billman (1996; Billman et al. 1999, 2000, 2002) suggests that they may represent the homes of paramount elites in the middle Moche Valley. Area 3 displays intermediate-sized architecture, while Areas 1, 4, and 5 contain smaller and less elaborate structures, interpreted to have housed retainers and craft specialists, including metalworkers and *chicha* brewers (Billman et al. 1999, 2000, 2002). High quantities of fineware serving vessels, including *floreros*, *cantaros*, neckless jars, and metal objects have led researchers (Billman et al. 1999, 2000, 2002; Gumerman and Briceño 2000) to suggest that the MV-83 residents were relatively wealthy and enjoyed a high social status. The association between the neckless jar form and chicha production has been documented elsewhere on the North Coast (Moore 1989), suggesting that Ciudad de Dios households were engaged in mobilizing masa (work parties) through the redistribution of chicha, coca, and other consumables. Billman (2010) argues that by sponsoring masa, MV-83 residents could have functioned as an intermediate node in the Moche administrative network, providing a connection between the rural populations for the middle Moche valley and paramount elites at the Huacas de Moche.

As a Middle Moche phase site, MV-83 dates to one of the most prosperous periods of expansion for the Southern Moche polity, as construction of public works, including roads, monuments, and irrigation canals, occurred on an unprecedented scale, particularly in the Moche and Santa Valleys (Billman 1996:310). Large-scale construction continued at the Huacas de Moche, the largest site in the valley at this time, and a new settlement hierarchy ensured that no site in the valley was more than approximately 5.5 km away from an administrative center (Billman 1996:313). Paramount centers were established as part of a three-tiered hierarchy of sites, and settlement shifted closer to the coast (Billman 1996:331, 2002:392)

Excavation of Middle Moche households from the urban sector of the Huacas de Moche (Chapdelaine 2001; Montoya et al. 2004:215-223; Tello et al. 2004a:250-256; Tello et al. 2004b: 277-289) and MV-83 (Billman et al. 1999, 2000, 2001; Gumerman and Briceño 2003) reveal that painted ceramic servingwares (*floreros*, *cantaros*, and bottles) were used in homes along with musical instruments (rattles, whistles, and trumpets) and ceramic figurines (see Ringberg 2008). As described by Billman (2010:190), these types of ceramic artifacts were found on the floors of patios and rooms in domestic structures, in formal kitchens, and in every domestic refuse deposit excavated at the site. This suite of artifacts including painted servingwares, musical instruments, and figurines is found at Middle Moche phase domestic habitation sites throughout the Moche Valley, "from the fishing village at Pampa Cruz, to agricultural settlements near Milagro, to the upper reaches of the middle valley above Simbal and Poroto" (Billman 2010:190; see also Billman 1996). Billman argues that this assemblage is suggestive of households involved in the serving of food and drink in special vessels.

In contrast, surface surveys in the Moche Valley (Billman 1996) and household excavations at Santa-Rosa Quirihuac, an Early Moche phase domestic site, indicate that these types of ceramic items may not have been used in domestic contexts during the Gallinazo and Early Moche phases (Gumerman and Briceño 2003; Mehaffey 1998). These types of ceramics, including serving vessels (e.g., bowls, plates), figurines, and musical instruments, are rare in Gallinazo and Early Moche phase sites (e.g., Bennett 1950; Billman 1996; Ford and Willey 1949; Strong and Evans 1952). Archaeobotanical data recovered from MV-83 households therefore have the potential to contribute to discussions of the ways in which foods (particularly maize) were prepared and served, in addition to agricultural strategies. I include MV-83 in my broader diachronic comparison to explore both issues. Soil samples from MV-83 were preliminarily analyzed by Celeste Gagnon and Kimberly Schaeffer (Gagnon and Schaeffer 2002); I reanalyzed these samples and updated their identifications for this dissertation (discussed in Chapter 4).

Galindo

The site of Galindo is located at the base of Cerro Galindo, which marks the north bank of the valley neck of the middle Moche Valley, across the Moche River from Cerro Oreja (see Figure 3.1). The site of Galindo has been the subject of intensive investigation since the 1970s, with studies by Geoffrey Conrad (1974), Garth Bawden (1977, 1978, 1982a, 1982b) and Shelia Pozorski (1976, 1979), in association with the Chan Chan Moche Valley project (Moseley and Day 1982; Moseley and Mackey 1974). The associated projects at Galindo, along with the projects at the site of Moche (Pozorski 1976, 1979; Topic 1977, 1982), were important contributions to Moche studies in that they included the first in-depth examinations of residential patterns and the subsistence economies of Moche political centers. More recent excavations took place at Galindo during the Galindo Archaeological Project (GAP), directed by Gregory Lockard and Francisco Luis Valle (Lockard 2001, 2002, 2003, 2005). As previous researchers that worked at the site in the 1970s and 1980s did not collect soil samples, I discuss data only from the GAP excavations in this dissertation.

Excavations took place over the course of three field seasons from 2000-2002. Excavations were divided into areas, subareas, and units; areas and subareas were later reclassified into architectural units (e.g., structures, rooms, terraces). Excavations took place in natural or culturally meaningful units. According to Lockard (2009:283), the primary goal of this project was to excavate residences of different status groups in order to examine the political and economic power of Galindo's Late Moche rulers, and to compare it to that of rulers at antecedent and contemporary north coast centers. Fieldwork included the excavation of a stratigraphic cut across a large defensive wall that extends along the base of Cerro Galindo, along with excavations in residential and civic/ceremonial contexts. The residential excavations included: three low-status Moche residences (Structures 39, 40, 50); a low-status Moche storage structure (Structure 46); two intermediate-status Moche residences (Structures 51 and 52); and two high- status Moche residential structures (Structures 41 and 42). The civic ceremonial contexts included: Platform B and Terrace 2 of the Huaca de las Lagartijas; Platform A and Plazas 1 and 3 of the Huaca de las Abejas; and three residential structures (Structures 43, 44, 45) within the plazas of the Huaca de las Abejas. The GAP also excavated three Chimu residences (structures 47, 48, and 49), which I do not consider in this dissertation.

The most substantial contribution of Lockard's project was the revision of Galindo's placement in Moche Valley chronology relative to the Huacas de Moche (Lockard 2009). It was previously assumed that the Huacas de Moche were abandoned ca. A.D. 600 (marked by the end of production of the Moche IV ceramic style), and that people residing at the Moche Huacas moved to Galindo and adopted Moche V ceramic wares (Bawden 1996; Moseley and Deeds 1982). However, based on the presentation of new AMS dates from the GAP excavations, along with a comparison of recalibrated radiocarbon dates from the Huacas de Moche (see Chapdelaine 2003:Table 22.2) and the site of Cerro Maya in the Chicama Valley (see Russell 1998:Table 1), Lockard (2009) demonstrates that the site of Galindo was occupied at the same time as the Huacas de Moche (see also Chapdelaine 2001).

Lockard (2009:293-294) discusses 17 AMS date from the GAP, 13 of which date to the Moche occupation (Table 3.5). Six dates were taken from wood charcoal samples from Moche civic/ceremonial contexts (four from Platform A of the Huaca de las Abejas and two from Platform B of the Huacas de las Lagartijas, respectively). The dates from these samples range from 1441 to 1285 B.P.; Lockard's calibration of these dates produced two-sigma ranges of A.D. 572-884 and median probabilities of 647-792 (see McCormac et al. 2004). Lockard (2009:293) argues that Platforms A and B were likely built during the eighth century, as only one date had a mean probability outside of the eighth century A.D. Five AMS radiocarbon dates were taken from annuals collected from hearths in Moche residential structures, including maize cob fragments, maize kernels, and one reed (*Phragmites* spp.) fragment. The dates of these five samples also were consistent, ranging from 1373 to 1335 B.P.; Lockard's calibration produced two sigma ranges of A.D. 641-860 and median probabilities of A.D. 703-730, likely confining the residential occupation to the eighth century A.D. (for a full list of the Galindo AMS samples, see Lockard 2009:Table 4).

Table 3.5 Radiocarbon dates from Galindo (adapted from Lockard 2009:Table 4).

Lab ID	Context	Material	^{14}C y BP	Calibrated 2σ Range
AA56787	Huaca de las Abejas, Platform A	Wood charcoal	1285 ± 32	A.D. 688-753
AA56783	Area 103, Unit 1	Maize	1290 ± 34	A.D. 687-882
AA56793	Huaca de las Lagartijas, Platform B	Wood charcoal	1319 ± 29	A.D. 669-784
AA56784	Huaca de las Abejas, Platform A	Wood charcoal	1322 ± 35	A.D. 665-828
AA56786	Huaca de las Abejas, Platform A	Wood charcoal	1327 ± 40	A.D. 662-830
AA61598	Structure 39, Feature 1	Maize	1335 ± 36	A.D. 659-783
AA61599	Stucture 41, Feature 1	Reed	1341 ± 36	A.D. 659-783
AA56792	Huaca de las Artijas, Platform B	Wood charcoal	1349 ± 30	A.D. 659-777
AA61601	Structure 42, Feature 3	Maize	1358 ± 36	A.D. 651-779
AA61600	Structure 42, Feature 2	Maize	1360 ± 36	A.D. 650-779
AA56782	Area 103, Unit 1	Maize	1372 ± 37	A.D. 649-775
AA61597	Structure 40, Feature 2	Maize	1373 ± 41	A.D. 641-779
AA56785	Huaca de las Abejas, Platform A	Wood charcoal	1141 ± 40	A.D. 572-694

The Huacas de Moche thus were not abandoned prior to Galindo, with a transfer of the residential population; the sites in fact appear to be contemporaneous, with an abandonment some time around A.D. 700-800. Galindo also had a small later Chimu occupation during the late thirteenth and/or early fourteenth centuries (which post-dates the abandonment of the Huacas de Moche by nearly 500 years). While the sample size of soil samples from the Moche occupation of Galindo is too small to conduct an intra-site spatial analysis (n = 10), I incorporate Moche-phase archaeobotanical data from Galindo in my broader diachronic comparison. Soil samples from Galindo were analyzed by George (Wolf) Gumerman IV and students and are reported in Lockard's dissertation (Lockard 2005; see also Lockard 2013). I reanalyze these reported data using updated quantitative measures to explore changes in foodways and agricultural strategies during the Late Moche phase, in comparison to earlier time periods.

AMS Dates

Ten new AMS dates were generated for this dissertation from annual plants (maize, avocado, and tillandsia) from three of the Moche Valley sites, La Poza, MV-224, and MV-83 that lacked or had minimal radiocarbon dates available. All of the carbonized plant remains submitted for AMS dating were identified in flotation samples; annual plants were selected over wood charcoal to avoid “old wood effects” (Millaire 2010:6191; Schiffer 1996). As summarized by Koons and Alex (2014):

> “Good” ^{14}C samples come from secure stratigraphic contexts and have a demonstrated association with an archaeological event (Boaretto 2009). Specifically, the measured carbon must have been incorporated into the material from atmospheric CO2 when the event we wish to date occurred (Bronk Ramsey 2008). Marine resources and wood do not meet this criterion, and will often give a date decades to centuries older than the time of their archaeological use (Kennett et al. 2002).

The samples were submitted to the Keck-Carbon Cycle AMS facility at the University of California, Irvine (UCIAMS) in 2017. Following Stuiver and Polach (1977:355), radiocarbon concentrations are reported as fractions of the Modern standard, D^{14}C, and conventional radiocarbon age, with results corrected for isotopic fractionation (Table 3.6).

Table 3.6 Uncalibrated AMS dates from La Poza, MV-224, and MV-83 (report provided by UCIAMS).

UCIAMS#	Site	Material	Context	Fraction Modern	$D^{14}C$ (%)	^{14}C age (BP)
187548	La Poza	Avocado	CT-36 RC-3-H	0.7571 ± 0.0012	-242.9 ± 1.2	2235 ± 15
187549	La Poza	Tillandsia	CT-36 RC-3-P	0.7531 ± 0.0012	-246.9 ± 1.2	2280 ± 15
187550	La Poza	Maize	CT-38 RC-6	0.7618 ± 0.0013	-238.2 ± 1.3	2185 ± 15
187551	MV-224	Maize	PD 2018 FS 9	0.8002 ± 0.0012	-199.8 ± 1.2	1790 ± 15
187552	MV-224	Maize	PD 2023 FS 1	0.8068 ± 0.0014	-193.2 ± 1.4	1725 ± 15
187553	MV-224	Maize	PD 2024 FS 1	0.8017 ± 0.0015	-198.3 ± 1.5	1775 ± 20
187554	MV-224	Maize	PD 2135 FS 1	0.8017 ± 0.0013	-198.3 ± 1.3	1775 ± 15
187555	MV-83	Maize	PD 286 FS 9	0.8300 ± 0.0014	-170.0 ± 1.4	1495 ± 15
187556	MV-83	Maize	PD 293 FS 1	0.8286 ± 0.0013	-171.4 ± 1.3	1510 ± 15
187557	MV-83	Maize	PD 321 FS 1	0.8300 ± 0.0014	-170.0 ± 1.4	1495 ± 15

I calibrated these dates using the online software application OxCal (Table 3.7, Figure 3.2). In this calibration, I also included some of the previously reported dates from MV-225 (Huckleberry and Billman 2003; Ringberg 2012) as well as some of the Galindo dates (Lockard 2009). When selecting samples from MV-225 and Galindo to include in the OxCal calibration, I excluded wood charcoal to avoid the “old wood effects” discussed above. For this reason, I did not include the previously reported dates from La Poza (Millaire et al. 2010) in my calibration, as these samples also were all wood charcoal.

Table 3.7 Calibrated AMS dates from La Poza, MV-224, MV-225, MV-83, and Galindo.

Site	Sample No	Lab ID	Calibrated 2σ Range	%	1σ	Median
Galindo	GAL-1	AA56783[1]	A.D. 658-774	95.4	38	A.D. 715
Galindo	GAL-2	AA61598[1]	A.D. 639-768	95.4	36	A.D. 674
Galindo	GAL-3	AA61599[1]	A.D. 639-768	95.4	36	A.D. 674
Galindo	GAL-4	AA61601[1]	A.D. 611-765	95.4	32	A.D. 663
Galindo	GAL-5	AA61600[1]	A.D. 610-765	95.4	32	A.D. 662
Galindo	GAL-6	AA56782[1]	A.D. 598-764	95.4	30	A.D. 655
Galindo	GAL-7	AA61597[1]	A.D. 595-765	95.4	34	A.D. 655
MV-83	83-1	UCI 187555	A.D. 544-605	95.4	18	A.D. 576
MV-83	83-2	UCI 187557	A.D. 544-605	95.4	18	A.D. 576
MV-83	83-3	UCI 187556	A.D. 479-604	95.4	25	A.D. 563
MV-224	224-1	UCI 187552	A.D. 254-382	95.4	38	A.D. 314
MV-224	224-2	UCI 187554	A.D. 217-331	95.4	36	A.D. 280
MV-224	224-3	UCI 187553	A.D. 170-336	95.4	41	A.D. 275
MV-224	224-4	UCI 187551	A.D. 141-323	95.4	44	A.D. 239
MV-225	225-1	BETA 294054[2]	A.D. 137-335	95.4	54	A.D. 252
MV-225	225-2	BETA 294056[2]	A.D. 129-381	95.4	69	A.D. 250
MV-225	225-3	BETA 294055[2]	A.D. 86-311	95.5	43	A.D. 183
La Poza	LP-1	UCI 187550	358-185 B.C.	95.5	54	309 B.C.
La Poza	LP-2	UCI 187548	378-209 B.C.	95.4	47	270 B.C.
La Poza	LP-3	UCI 187549	400-257 B.C.	95.4	38	379 B.C.

[1] Lockard 2009
[2] Ringberg 2012

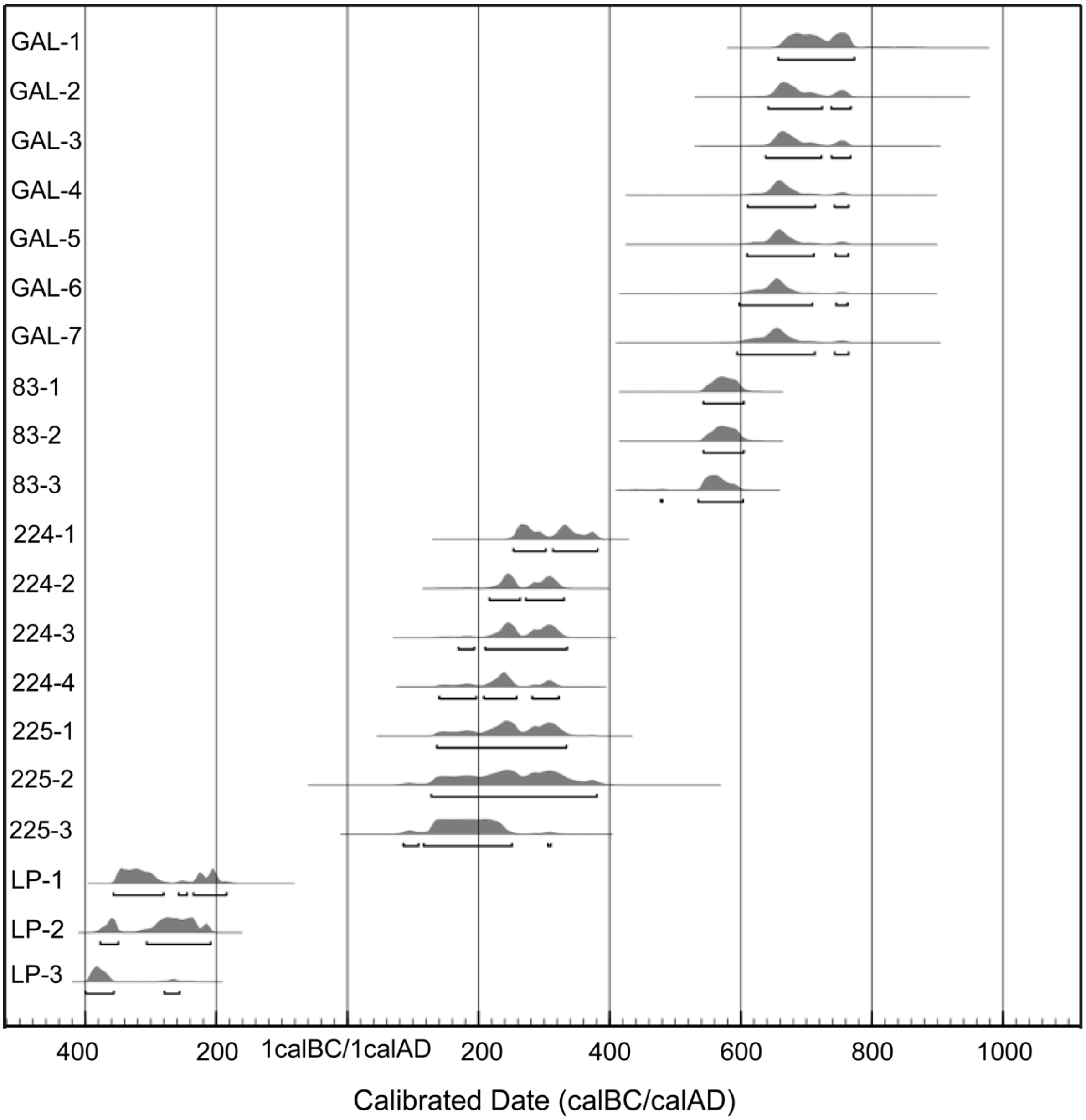

Figure 2.2 Calibrated AMS Dates from La Poza, MV-224, MV-225, MV-83, and Galindo.

Overall, the dates cluster tightly and support the ceramic chronologies for the five sites discussed above. The La Poza dates fall within the expected range for the Salinar phase (400 B.C. – A.D. 1). The MV-224 dates range from 141 and 382 A.D., indicating that MV-224's occupation extended into the Early Moche phase. The MV-224 dates overlap with the dates from MV-225, also identified as Gallinazo/Early Moche (see Ringberg 2012:121); however, it appears that MV-224 may have been occupied later into the third century A.D. than MV-225. The MV-83 dates fall within the expected range for the Middle Moche phase; indeed, the three dates cluster tightly with a median age in the late sixth century. Confirming what Lockard (2009) had already tested, the Galindo dates cluster tightly and are confined to the Late Moche phase, post-dating MV-83.

With those considerations of Moche Valley ecology, geography, cultural history, and chronology in mind, I turn to a detailed examination of the plant data recovered from the five EIP Moche Valley sites discussed above.

CHAPTER 4

RECONSIDERING PRE-MOCHE FARMING: A DIACHRONIC ANALYSIS OF THE PLANT DATA

This chapter discusses the plant remains recovered from the five Moche Valley sites in detail, and presents a diachronic analysis of changes in plant foodways during the Early Intermediate Period, or EIP (400 B.C. – A.D 800). I begin with a discussion of methods, including procedures for recovery, laboratory analysis, and quantification. I then present the plants identified in the La Poza, MV-224, MV-225, MV-83, and Galindo assemblages to set the stage for my quantitative analysis. This section also includes ecological descriptions and ethnobotanical uses of the plants themselves, as a background for reconstructing the organization of foodways in the Moche Valley. Next, I present my quantitative analysis as a means to explore changes in the patterns of plant food use through time. My diachronic comparison suggests that key changes occurred in the local domestic and political economies of the middle Moche Valley *in advance* of the dramatic expansion of the Moche polity in the A.D. 300s. Rural farmers appear to have transitioned to intensive agricultural production (including maize production) in the Gallinazo and Early Moche phases (A.D. 1-300), potentially in response to demands of coastal polities that predated the Huacas de Moche. Countering the claim that plant food intensification was orchestrated by those aspiring to *create* political hierarchies, I argue that it may have occurred in the context of larger social/religious negotiations initiated among interallied and intermarried kin groups that ultimately reached an exaggerated scale during the Moche period.

The paleoethnobotanical analysis that follows includes the identification and discussion of botanical use based on remains retrieved from 225 soil samples from the five Moche Valley sites. This project also involved the sampling of 14 ceramic sherds and three groundstone *chunga* (mano) fragments from two of the study sites, MV-224 and MV-225, for starch grain residues. While the residue data cannot be quantitatively integrated with the macrobotanical data, I discuss the identification of starch granules with respect to overall taxa inventories. Paleoethnobotanists recognize that while some assemblages can seem incredibly rich, archaeological plant assemblages represent only a fraction of what was used and deposited by humans (Wright 2014). From production/procurement to processing, consumption, discard, and recovery by archaeologists, plant remains undergo a series of natural and cultural processes that can significantly modify organic remains, resulting in assemblages that differ from original deposits. Nevertheless, scholars have developed a suite of standardized data collection and quantitative techniques that address potential depositional and recovery biases (e.g., Hastorf and Popper 1988; Marston et al. 2014; Pearsall 1989, 2000, 2015), which I discuss further below.

Field Recovery Procedures

La Poza

As discussed in Chapter 3, the samples from La Poza considered in this dissertation were excavated as a part of a salvage recovery project, el Proyecto de Evaluación Arqueológico con Excavaciones en las Lomas de Huanchaco (PEALLO), directed by Gabriel Prieto and Victor Campaña (Prieto and Campaña 2013). A series of 2 X 2 m units were placed to incorporate distinctions in architecture and deposits visible from the surface (rather than in an arbitrary grid). Excavations took place in culturally determined levels and units, defined by soil changes, location, and spatially distinct features. In some cases these units were expanded upon exposure of features. Soil was not regularly screened, but a total of 23 flotation samples were judgmentally collected within features and units. Soil samples were curated at Huaca del Dragón (also referred to as Huaca Arco Iris) in La Esperanza, Trujillo and then exported to the University of California, Santa Barbara Integrative Subsistence Laboratory (UCSB ISL) in December 2015. Soil volume was not standardized during field collection but I measured and recorded volume prior to processing. As La Poza is a coastal site characterized by dry, sandy soils, I elected to dry-sieve the soil samples (Pearsall 2000:117, see Chiou et al. 2013), rather than subject them to water flotation. With no prior analyses conducted on samples from La Poza, I did not want to subject potential desiccated remains to damage from water flotation (some plant remains can expand and "explode" upon contact with water, see Pearsall 2000:81-83). Ultimately, no desiccated plant remains were recovered in my analyses (discussed below). As all of the La Poza remains were carbonized, they are quantitatively comparable to the other datasets included in this dissertation.

MV-224, MV-225, and MV-83

MV-224, MV-225, and MV-83 were excavated by the Moche Origins Project, directed by Brian Billman and Jesus Briceño Rosario (Billman et al. 1999, 2000, 2002, 2004; Briceño and Billman 2007, 2008, 2009; Briceño et al. 2006; Fariss 2012; Ringberg 2012; Surridge 2010). MV-83 was excavated between 1998-2000; MV-225 was excavated between 2002-2008; and MV-224 was excavated in 2004. Excavation goals were centered on exploring a variety of contexts, including sampling within different types of architectural features and other domestic features such as patios and middens. These methods were used to determine which types of functional and status-related differences were visible across the sites, and to establish the durations of occupation and modes of abandonment.

Excavations at each of these sites followed the same field protocols. Units were placed to incorporate distinctions in architecture and deposits visible from the surface, rather than in an arbitrary grid. Excavations took place in culturally determined levels and units, defined by soil changes, location, and spatially distinct features. Features (e.g., rooms, hearths) were excavated in bisects or quarter-sections to ensure maximum recovery of material in stratigraphic context. Each deposit was assigned a Provenience Designation (PD) number, with associated information including structure number, context type (e.g., architectural fill, floor fill), and integrity. Excavated soil from each provenience was screened using 1/8-inch mesh and 100% of material was collected.

Standard 5-liter flotation samples were taken systematically from each level of every provenience excavated (unless otherwise noted, e.g., if a feature was too small to permit collection of a sample that was that large) and assigned a Field Specimen (FS) number. When encountered, floors were systematically sampled as well. The soil was collected in bulk without separation of any artifacts. This bulk sampling method of recovering soil samples systematically, rather than only sampling features with dense organic remains, has shown to better represent plant distribution across different household contexts (Lennstrom and Hastorf 1992, 1995; Pearsall 2000; Popper 1988). It bears noting that the Moche Origins Project follows standard North American excavation and sampling procedures; while paleoethnobotanists are increasingly contributing to data collection protocols in the field in South America, the majority of excavations that take place in the Moche Valley, on the Peruvian north coast, and in the Andes more broadly do not systematically collect soil samples (and often do not screen excavated material), rendering limited potential for comparative analyses across sites within and between regions.

A total of 69 flotation samples were recovered from MV-224 and 451 from MV-225, which were stored in the Moche Origins Project repository at Huaca del Dragón. Some of these samples had been processed from earlier excavation seasons at MV-225; however, the majority of these soil samples had not been floated prior to 2012. In the 2012 and 2013 summer field seasons I processed most of the remaining soil samples from the MV-224 and MV-225 excavations via water flotation, with the aid of Moche Origins Project field school students and local Peruvian workers in Huanchaco, Peru. Provenience data and flotation personnel were recorded on a flotation log, along with other notes (e.g., whether soaking and re-floating heavy fraction was necessary, if there was an unusual abundance of charcoal or animal dung, etc.). I re-measured the volume of each sample before water flotation and found some deviations from the general 5 L sampling strategy (e.g., some samples were actually 4.5 or 5.5 L rather than the expected 5 L based on field protocol). Soil samples floated prior to 2012 by other Moche Origins Personnel had volume data recorded on provenience tags.

Soil samples were floated without the aid of a machine-assisted system; samples were floated in a bucket of water and agitated by hand (see Pearsall 2000:35-39). The bucket method proved effective for processing these samples, which were generally 5 L or less, and because water was not recycled between samples, there was no possibility of cross-sample contamination. The manual bucket technique also proved to be more time efficient than a machine-assisted system, as multiple flotation teams could process multiple samples simultaneously. The light fraction was captured in a fine-weave chiffon cloth that was laid over a fine-mesh sieve placed on top of a large plastic bucket that was used to catch the floating material as water was decanted from the bucket in which the soil sample had been immersed and agitated. The heavy fraction was then collected and dried on 16th-inch fine-mesh window screens. The light-fraction chiffon bags were tied up with provenience tags and hung on a drying line.

A small number of soil samples from MV-224 and MV-225 were not floated due to time constraints during the 2013 field season; however, these unfloated samples proved beneficial as a source for artifacts for starch grain residue analysis. As soil samples were collected in bulk during the excavations at MV-224 and MV-225 without separation of artifacts, many ceramic sherds and some groundstone fragments were present in soil samples. All other sherds and lithic materials from these sites had been washed in the project laboratory during the excavation seasons in preparation for ceramic analysis by Ringberg (2012) and lithic analysis by Surridge (2010). As such, unwashed sherds from unfloated soil samples could be used to test for starch grain residues, so I judgmentally selected 20 plainware ceramic sherds and four groundstone fragments from the two sites for starch grain analysis, discussed further below. Unwashed ceramic or groundstone artifacts were not available for residue testing from the other site considered in this dissertation, a research possibility I hope to pursue in future work on this project.

Flotation samples were recovered from every provenience excavated at MV-83 in the 1998 and 1999 excavations, and a subsample (n = 18) was selected for analysis by Moche Origins Project personnel and is reported in this dissertation. The MV-83 samples were processed in Huanchaco, Peru, using a similar method of bucket flotation during the 1999 and 2000 field seasons, with volume recorded by those personnel on field forms and/or sample tags. Light fractions from the 1998 season were exported for analysis in 2000 to the University of North Carolina-Chapel Hill, and heavy fractions were screened and sorted in Peru (Billman et al. 2000).

Galindo

The Galindo samples considered in this dissertation were excavated by the Galindo Archaeological Project (GAP), directed by Gregory Lockard and Francisco Luis Valle (Lockard 2001, 2002, 2003, 2005). Excavations took place over the course of three field seasons from 2000-2002. Excavations were divided into areas, subareas, and units; areas and subareas were later reclassified into architectural units (e.g., structures, rooms, terraces). Excavations took place in naturally or culturally meaningful units, similar to the Moche Origins Project field protocols described above. Excavated soil from each provenience was screened using 1/8-inch mesh, and certain contexts were judgmentally targeted for soil sample collection. As described by Lockard (2005:133):

> Excavation in residential zones focused on the recovery of faunal and botanical remains from primary contexts, particularly hearths. Some areas where extensively excavated, while others were only sampled. The benefit of this strategy was that a wide range of contexts was sampled, including hearths. A disadvantage of this strategy, however, was that the function and association (i.e., whether they were part of the same room or structure) or lightly sampled areas often could not be determined.

A total of 108 soil samples was collected over the course of the three excavation seasons. Samples were floated by GAP personnel, although the method (i.e., bucket flotation vs. machine-assisted flotation) is not reported in Lockard's (2005) dissertation. Soil volume was not standardized during field collection but was recorded and reported by Lockard (2005:Table 7.2). Samples selected for analysis were rough-sorted in Peru; all botanical remains recovered from the samples were exported for analysis at Northern Arizona University some time after the completion of 2002 field season (Lockard 2005:188).

Recovery and Preservation Biases

Plant distributions can be affected by a number of planned and unplanned cultural activities, in addition to non-cultural processes. The circumstances under which plants preserve best archaeologically involve extreme conditions (e.g., exceptionally wet, dry, or cold environments) that prohibit decomposition of organic matter (Miksicek 1987). The hyper-arid Peruvian desert represents one region of the world with exceptional botanical preservation. Indeed, organic materials are found in large quantities and in excellent conditions along Peruvian coastal plains (e.g., Billman et al. 2017; Bird and Bird 1980; Chiou et al. 2013; Cohen 1978; Pearsall and Ojeda 1988; Towle 1952). Plants can also preserve as a result of carbonization, in which organic material is transformed into carbon through exposure to fire (Miksicek 1987). Different classes of plant remains have different chances of being preserved through charring (Miksicek 1987; Munson et al. 1971); denser, more durable structures such as avocado pits are more likely to preserve than foods like fruits with small seeds or soft, fleshy tubers. These preservation effects create different counts and densities among taxa and therefore should be controlled for with measures of standardization, discussed further below.

The issue of source must be considered as well; abundance of plant taxa may have a different meaning depending on the source of the remains. Pearsall (1988; see Popper 1988; White and Shelton 2014) identifies two aspects related to the issue of source: (1) how raw materials are deposited into a site, and (2) how these materials are charred so that they end up in paleoethnobotanical assemblages. Plant remains may reflect parts of plants brought in for food or other economic uses. However, they may also reflect incidental inclusions in assemblages, including as a result of people working in fields and bringing invasive species back to their homes attached to clothing or livestock. Miller and Smart (1984) present an additional alternative explanation of indirect resource use: some seeds may reflect components of animal fodder preserved in dung intentionally burned as fuel (discussed further below). An examination of context of deposit is therefore essential to aid our understanding of depositional bias.

With respect to food taxa, plant parts that require the removal of inedible portions (e.g., avocado pits, maize cobs) are more likely to find their way into a fire, including as inedible discard that is burned as fuel (Minnis 1981). Furthermore, as inedible plant parts tend to be dense and fibrous, they are more likely to survive processes of carbonization than edible part. Plant parts that are eaten whole (e.g., beans) are less likely to make their way into a fire, although the process of cooking provides the opportunity for carbonization through cooking accidents, with remains accidentally charred during cooking, parching, or other food preparation activities. Foods that are conventionally eaten raw (e.g., fruits) are less likely to be deposited, either as a result of intentional burning of refuse or accidental burning. As Yarnell (1982; see also Johannessen 1984) argues, however, carbonized material that ends up in archaeological sites will generally be the result of accidents repeated with some degree of frequency and regularity through time, and therefore have high interpretive value.

Fleshy roots and tubers that may have been eaten raw or cooked, especially those that are high in water content, are extremely fragile in a carbonized state and are even less likely to survive most post-depositional environments (Chandler-Ezell et al. 2006; Piperno and Holst 1998; Piperno et al. 2000). Indeed, root and tuber foods typically are underrepresented or absent in carbonized macrobotanical assemblages; as a result, pollen, phytoliths (microscopic siliceous remains of plants), or starch grains can present better direct sources of evidence for these categories of plant foods. Indeed, residue analyses have the potential to identify food preparation methods (Henry et al. 2009; Raviele 2011), and increasingly are used to identify vessel contents in the Andes (e.g., Ikehara and Shibata 2008) as well as plant remains processed with groundstone artifacts (e.g., Louderback et al. 2015).

To maximize recovery of plant remains, paleoethnobotanists working in dry, sandy conditions may choose to adopt a recovery strategy that favors dry sieving, where others may use flotation to recover carbonized plant material. Located less than 1000 masl, the four middle Moche Valley sites considered in this dissertation (MV-224, MV-225, MV-83, and Galindo) are located in areas constantly subjected to a layer of low hanging cloud fog that is created when dry winds hit the lower western slope of the Andes (Figure 4.1).

Figure 3.1 A fog layer blanketing the lower and middle Moche Valleys, with a view from MV-900 in the upper valley at 1000 masl (photo by D. Bardolph August 2011).

In a similar manner, La Poza, while adjacent to the coast, is situated in proximity to *lomas*—low coastal mountain areas where heavy fog provides moisture for vegetation. These conditions generate enough moisture that plant remains do not desiccate and preserve in the same manner that they do on the hyper-arid coastal plain that covers much of the central coast of Peru. As a result, the plant data that I present here are nearly all carbonized. A small amount of desiccated plant remains were recovered in excavations at MV-224 and MV-225 (Appendix 1)[9]; however, I do not include these data in my quantitative

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[9] I did not have access to collections aside from soil samples at the other Moche Valley sites discussed in this dissertation besides MV-225. Moche Origins Project excavators also collected charcoal during field screening, which likely included charred plant remains in addition to wood; however, field-screened charcoal was not analyzed for this project as it has limited utility in unstandardized form. According to Amber VanDerwarker, a very small amount of desiccated plant material was present in the MV-83 soil samples, which exploded during flotation (VanDerwarker personal communication 2017). While some desiccated material may have been collected during field screening, I did not have access to those collections to determine if that was in fact the case.

comparisons. All of the desiccated remains represent taxa also identified in carbonized assemblages. The carbonized plant remains likely were incorporated into the record in a variety of ways as a result of intentional or accidental burning, including cooking accidents, storage pit clearing, discard of plant parts in hearth fires (e.g., avocado, lucuma pits), use of plant parts as fuel (e.g., maize cobs), dung-burning, etc.

Starch grains present different recovery issues that are outside of the scope of this dissertation to discuss in detail (for a recent volume, see Torrence and Barton 2016). Starches used for archaeological studies often are extracted from residue adhering to the edges of flaked stone tools; as material that has accumulated in groundstone; from inside ceramic vessels; and from sediments (e.g., Gott et al. 2006; Hardy et al. 2009; Iriarte et al. 2004; Perry et al. 2006; Piperno et al. 2000, 2004). Different taphonomic processes affect whether starch grain residues survive in the archaeological record; current research indicates that starch is more likely to survive on artifact surfaces than phytoliths, though grains of different sizes may have different rates of survival archaeologically (Chandler-Ezell et al. 2006:103; Haslam 2004). Starch preservation in soils and sediments is less well understood (see Haslam 2004; Korstanje 2003; Lentfer et al. 2002; Lu 2003).

Soil Sample Selection

Twenty-three bulk soil samples were collected from La Poza in the 2012 season by Gabriel Prieto and Victor Campaña. I analyzed 17 samples for this project, excluding samples that I deemed inappropriate for comparison with other datasets (i.e., two samples of soil collected from inside of ceramic vessels) or samples unlikely to produce macrobotanicals (i.e., one sample of adobe plaster and three samples of burned clay that were collected by the excavators and included with the other soil samples). Much larger flotation sample collections existed for MV-224 (n=69) and MV-225 (n=451), collected by the Moche Origins Project; as a result, I decided to subsample those collections. Judgmental sampling was employed to select 43 flotation samples from MV-224 and 137 flotation samples from MV-225, using the selection criteria described below.

I began by categorizing each sample by archaeological context, using information from the Moche Origins Project's extensive database of Provenience Designation (PD) forms archived digitally in Microsoft Access. The categories include: (1) features such as hearths, ash pits, and burials; (2) surface and activity areas such as floors and occupation surfaces; (3) accretional deposits such as middens and fill episodes; (4) architectural features and materials such as walls, pot rests, and adobe; (5) disturbed contexts such as looters' pits; and (6) contexts that fell outside of this project's scope, such as a short, later Chimu phase occupation that was documented at MV-225. In my sample selection, I prioritized discrete contexts (hearths, ash pits), floors/activity surfaces (from patios and enclosed masonry rooms of different functional categories) and midden fill, as these contexts should represent a range of activities including those related to food processing and consumption. I did not analyze any proveniences characterized as looter's pits or other contexts noted on PD forms to be exceptionally disturbed.

I further reduced my sample for MV-225 by considering the detailed architectural analyses conducted by Jennifer Ringberg and reported in her dissertation (Ringberg 2012). Her analyses generated specific functional assignments of different rooms, including patios, kitchen areas, storage rooms, and other living/activity areas, and revealed variation among compounds in terms of size, room layout, and architectural construction techniques, likely due to status differences and ritual vs. domestic uses (Ringberg 2012:106-113). I selected a range of these different activity spaces to sample from each of the compounds at MV-225; I return to this issue via spatial analysis of the MV-225 plant remains in Chapter 5.

The MV-83 samples considered in this dissertation were collected and processed during the 1999 Moche Origins Project field season. During that season, the Moche Origins Project conducted excavation in two areas at the site, designated Areas 3 and 4, an area with several occupational terraces. These terraces represent residential areas with patios, kitchen areas, masonry storage rooms, and other small rooms. From these excavations, a number of samples were exported to Margaret Scarry's lab at the University of North Carolina-Chapel Hill in 2000. Celeste Gagnon and Kimberly Schaeffer conducted a preliminary analysis on 18 samples from MV-83 under the direction of Margaret Scarry (Gagnon and Schaeffer 2002). Due to the lack of a robust Andean comparative collection, Gagnon and Schaeffer were unable to identify many of the botanical remains from these samples, particularly small seeds. As a result, I reanalyzed these samples in 2016 and report those data in this dissertation.

The Galindo samples considered in this dissertation were collected and analyzed by the Galindo Archaeological Project (GAP) directed by Gregory Lockard. Of a total of 108 samples collected in three seasons of GAP excavations, 26 were fully analyzed by George (Wolf) Gumerman IV and students at Northern Arizona University. Of those 26 samples, 10 derive from Late Moche contexts at Galindo and 16 derive from Chimu contexts. I only consider the 10 Late Moche samples in this dissertation, as the Chimu contexts fall outside of the scope of this project. The Moche samples are from five hearths[10] from residential contexts; an ash deposit associated with a hearth; two storage bins; and two ash deposits in civic/ceremonial contexts, including an ash deposit in the northeast corner of Plaza 3 of the Huaca de las Abejas and an ash deposit directly below the floor in the northeast corner of Structure 44 (a small storage structure located in Plaza 3 of the Huaca de las Abejas). Lockard (2005:211-219; 2013:154-157) uses specimen counts per 100 liters of excavated sediment of soil and species richness to compare botanical remains from Moche and Chimu contexts at Galindo. I reanalyze the Galindo data in this dissertation; as provenience information, plant specimen counts, weights, and soil volume are reported in Appendix 8 of Lockard's dissertation (Lockard 2005:525-536), the Galindo paleoethnobotanical data are quantitatively comparable to the other datasets reported in this dissertation.

Unlike La Poza, MV224, MV225, and MV83, which primarily represent domestic habitation sites, Galindo is a large political center with ritual/ceremonial as well as residential areas, and researchers argue that there is clear segregation between status groups (Bawden 1977, 1978, 1982a, 1982b; Lockard 2005, 2009, 2013; Pozorski 1976, 1979). Lockard (2005, 2013) assigned categories of low status, intermediate status[11], or high status to residential areas encountered in his excavation blocks, along with a classification of civic/ceremonial contexts separate from residential contexts. These contexts were defined

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[10] It is important to note that hearths are not ideal contexts to sample for paleoethnobotanical remains; they often are too small to have served as ancient refuse deposits and repeated exposure of plant remains to fires can result in distortion or incineration (e.g., Wright 2003). A greater sample of plant remains from other contexts (including trash pits) would enhance the interpretive value of the Galindo archaeobotanical record.

[11] Lockard (2005, 2013) uses the phrase "moderate status," which I interpret as intermediate status.

based on the spatial location of the deposit relative to monumental architecture or the distribution of other artifact categories known to signal elite and/or ceremonial activities.

As a result, Lockard (2005:189, 2013:141) assigns the following categories and functional assignments to the Moche contexts from which soil samples were taken: two "low status" hearths, one "low status" storage bin, three "high status" hearths, one "high status" ash deposit, two "high status" storage bins, and two "civic/ceremonial" ash deposits. In his dissertation, Lockard (2005:209-219) presents two analyses of the archaeobotanical data: (1) a comparison between Moche and Chimu contexts, and (2) a comparison of the different Moche contexts, using specimen count[12] and species richness. In the latter analysis, he attempts to distinguish patterns between high status and low status contexts, and argues that Moche elites at Galindo had increased access to all plant types identified in the assemblage, with the exception of legumes, and he notes in particular that elites had an apparent increased access to maize and cotton and sole access to coca (see also Lockard 2013:157). Lockard (2005:220; 2013:157) acknowledges the issue of small sample size bias; I concur and argue that the sample size (three "low status" contexts, five "high status" contexts, and two "civic/ceremonial contexts) precludes detailed intra-site spatial analysis and that more data are needed to support his conclusions about elite/non-elite access to resources. In this dissertation, I reanalyze the Galindo Moche context data, but only use these data for inter-site diachronic comparisons.

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[12] Lockard (2005, 2013) uses the term "NISP" in his analysis of the Galindo archaeobotanical remains; however, this measure typically only applies to faunal analysis (Grayson 1984; Reitz and Wing 2008).

Sorting Protocol

I sorted samples from La Poza, MV-224, and MV-225 using the same protocol based on standard sorting procedures for paleoethnobotanical assemblages in the Andes (e.g., Bruno 2008; Chiou 2017; Gumerman 1991; Hastorf 1983, 1990, 1993; Sayre 2010; Whitehead 2007). The sorting and identification of plant materials was conducted using a low power stereoscopic microscope (10-40x magnification). All flotation samples include a light and heavy fraction component. I sorted the heavy fractions from MV-224 and MV-225 in the Moche Origins Project laboratory in Huanchaco, Peru in 2014. Many of the heavy fractions were quite large (i.e., > 500 g), so I subsampled these heavy fractions and extrapolated counts for analysis. Samples were either half or quarter subsampled via a grid method, in which I passed samples back and forth over a series of small boxes paper-clipped into a grid. Extrapolated counts (X) were calculated by dividing the subsample weight (n) by the sample weight (N) using the following formula:

$$X = \frac{\textit{weight } N * \textit{count}}{\textit{weight } n}$$

Light fractions were exported to the UCSB ISL in March 2015 and analyzed from 2015-2016. Although the material from the light and heavy fractions were processed and sorted separately, data from the two fractions were combined for analysis. Samples from La Poza were exported to the UCSB ISL in December 2015 and analyzed in 2016. As these samples were not subjected to flotation they did not contain a light and heavy fraction component. I subsampled all of the material from La Poza using a riffle box and extrapolated counts for analysis.

All samples were weighed and sifted through 2.0 mm, 1.4 mm, and 0.7 mm standard geologic sieves. All carbonized plant remains, including wood charcoal, were removed and sorted from the 2.0 mm sieve. I trained two undergraduate laboratory assistants in the UCSB ISL to assist with separating carbonized plant material that was greater than 2.0 mm, and I completed all identifications of charcoal from that sieve level as well as the sorting and identification of materials from the 1.4 mm, 0.7 mm, and pan levels. All taxa not identified in the 2.0 mm sieve, with the exception of maize cupules, were removed and sorted from the 1.4 mm sieve. Only seeds were removed from the <1.4 mm sieve sizes.

Botanical remains were identified with reference to seed identification manuals and botanical reference guides (Brako and Zarucchi 1993; Martin and Barkley 1961; Weberbauer 1945); seed identification websites (e.g., USDA PLANTS database); and the modern comparative collections housed in the UCSB ISL, the McCown Archaeobotany Laboratory at UC Berkeley, and my personal comparative collection amassed in Trujillo in 2011. I collected about 20 specimens in the Moche Valley informally during my 2011 field season, in consultation with local residents with whom I identified various fruits and flowering plants in the field as well as through purchase of various cultigens at local markets. All plant specimens were identified to the lowest possible taxonomic level. If identification was probable but not definite, then specimens were recorded as cf. (e.g., "maize cupule cf.")[13]. If taxonomic identification was not possible (some remains lacked diagnostic features or were too highly fragmented), then the specimens were recorded as generally unidentifiable, unidentifiable seeds, and unidentifiable seed fragments. While included in the overall

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[13] Departing from its use in writing to refer the reader to other material to make a comparison with the topic being discussed, in biological naming conventions, cf. is used to express a possible identity if identification is probable but not definite.

assemblage counts as unidentified (UID), these remains were excluded from further analysis. Once sorted and identified, analysis of plant specimens included the recording of counts, weights (in grams), portion of plant (e.g., maize kernel vs. cupule), provenience, and volume of soil floated. Wood was weighed but not counted, and no wood analysis was conducted. Generally, seeds were counted but not weighed, as weights of singular specimens were usually below 0.01 g.

For the MV-83, samples, I re-examined each botanical specimen identified by Gagnon and Schaeffer (2002) to either confirm or revise existing identifications, and I updated specimens listed as unidentified that I was successfully able to identify. As only light fractions were exported and available for my reanalysis, I rely on previous researchers' identifications in the heavy fractions reported in Billman et al. (2000) and Gagnon and Schaeffer (2002). The Galindo samples were analyzed by George (Wolf) Gumerman IV and students at Northern Arizona University and reported in Lockard (2005)'s dissertation; thus, I rely on their identifications in this study. Lockard does not provide a detailed description of Gumerman's laboratory sorting methods; however, in earlier studies (e.g., Gumerman 1991), Gumerman followed standard sorting methods developed by Hastorf (1983, 1990), and I assume that his data collection procedures are comparable to mine. Fortunately, Lockard (2005) reports all information necessary to make quantitative comparisons in his dissertation appendices (raw counts, weights, soil volume, provenience information, etc., see discussion of methods of quantification below)[14].

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[14] Lockard's (2005) reporting of raw data in a manner that permits quantitative comparison to other assemblages is the only example of such a study in the Moche Valley (and neighboring regions with EIP assemblages). The handful of north coast MA theses discussed in Chapter 3 do not report enough information about the assemblages analyzed to permit quantitative comparisons (nor have these studies been published).

Starch Grain Analysis Protocol

Starch grain residue analysis was performed by Victor Vasquez and Teresa Rosales at the Arqueobios laboratory in Trujillo, Peru (Vasquez and Rosales 2015). As discussed above, 20 plainware ceramic sherds and 10 groundstone artifacts from MV-224 and MV-225 were judgmentally sampled from unfloated soil samples (10 sherds and two groundstone artifacts from each site, respectively). Of these, 17 artifacts yielded starch grains, including 14 ceramic sherds (8 sherds from MV-225 and 6 sherds from MV-224), and three groundstone chunga (mano) fragments (all from MV-225).

Vasquez and Rosales followed standard protocols for starch extraction for unwashed artifacts (see Loy 1994; Pearsall et al. 2004; Perry 2001; Torrence and Barton 2016). Samples were gently brushed and examined under a dissecting microscope; sediments were identified and transferred onto a microscope slide with an air displacement pipette; and starches were observed, measured, and photographed with contrast from polarized light (for a full description of starch grain extraction methods by the lab analysts, see Vasquez and Rosales 2015). Starch grains were identified with reference to a modern comparative collection of edible plants, including tubers, roots, grains, beans, and native fruits of Peruvian coastal and broader Andean origin. Diagnostic starch grains retained sufficient shape and surface characteristics to permit identification; Vasquez and Rosales also consulted various published studies to confirm identifications (Guevara 1973; Loy 1994; Piperno 2006; Reichert 1913; Torrence and Barton 2006).

Methods of Quantification

Quantification methods in paleoethnobotany have developed significantly over the past several decades, and it is now increasingly common to see rigorous applications of robust quantitative techniques in paleoethnobotanical analyses. Because of problems with comparability between different types of plant taxa, raw (or absolute) counts and weights are not appropriate comparative measures (Marston 2014; Popper 1988; Scarry 1986). Counts and weights may reflect differential preservation, sampling, soil conditions, or various other factors. As discussed above, denser plants will yield higher weights, and some plants will yield higher counts by nature of producing more seeds. Standardizing counts can correct for these biases and be used to assess the relative abundance of plants at sites.

A useful method that disregards absolute counts is *ubiquity*, which considers the number of samples in which a taxon appears within a group of samples (Popper 1988:60-64; see also Godwin 1956; Hubbard 1975, 1976, 1980; Willcox 1974). Ubiquity uses presence/absence data rather than counts; the researcher first records the presence of a specific taxon in each sample, and then calculates the percentage of all samples in which a taxon is present (Popper 1988). As a result, the same ubiquity value applies whether the sample contains one specimen of a particular taxon or 100. However, a sufficient number of samples is needed to provide meaningful results, as having too few samples can inflate frequency scores. Hubbard (1976) suggests using a minimum of 10 samples when calculating this measure. This form of data presentation avoids the differential preservation of plant matter by making each taxon ubiquity independent of all others, thus allowing for intersite comparisons. While this method of standardization reduces biases due to differential preservation and sampling, a limitation is that it does not allow us to examine changes in abundance, either across space or through time (Scarry 1986:193). Ubiquity can obscure cultural patterns of plant use where the frequency of use remains the same, but abundance varies. Ubiquity can be a useful measure to examine special plant use; plants with a restricted or specific type of use may have low ubiquity values. When combined with other measures, ubiquity is often a good starting point for analysis, particularly to track changes in the use of plant taxa over time (see e.g., Hastorf 1983, 1990, 1993).

Density measures can be used to assess the relative abundance of plants at the site (Miller 1988:73-75; Scarry 1986). Standardizing by soil volume to calculate density measures allows for comparison of samples of unequal size. The absolute count (or weight) of plant material for individual taxa is divided by total soil volume for the site as a whole. As density measures calculate the abundance of plants per liter of soil, we can assume that in general larger volumes of soil will yield more plant remains. However, differences in context of deposition may affect this relationship; for example, a 10-L soil sample from an intact house floor that had been swept clean by its prehistoric occupants would probably yield a smaller sample of carbonized plant remains than a 10-L soil sample from a refuse midden (VanDerwarker 2006:73). Density measures tend to reflect all of the activities that are represented in a deposit, including spatial patterns regarding the organization and layout of site activities, particular burning episodes, seasonal nature of plant collection/discard activities, differences in stratigraphy, etc. (Miller 1988:73-74).

Standardized counts that divide absolute counts by plant weight (the sum of weights recorded for all carbonized plant specimens per sample) present an alternative to density measures (Scarry 1986). Standardizing by plant weight considers the contribution of a specific plant (or category of plants) solely in terms of plant-related activities, and more accurately reflects spatial and temporal differences in plant use. Other independent ratios can be used to determine how two variables vary relative to each other (see Miller 1988); in this study I calculate ratios of tree crops: field crops to explore patterns of tree fruit exploitation alongside the growing of field cultigens (see VanDerwarker 2006:107).

Regardless of quantitative measures employed, it is important to summarize and display data in ways that produce meaningful results and can be clearly interpreted. Following other paleoethnobotanical researchers (e.g., Scarry 1986; Scarry and Steponaitis 1997; VanDerwarker 2006), I use box plots throughout this dissertation to convey differences between samples and sites (see Cleveland 1994; McGill et al. 1978; Wilkinson et al. 1992). Although the use of box plots is increasingly common in archaeology, a description of this type of visual aid nevertheless bears repeating. Box plots display distributions of data using several key features (Figure 4.2).

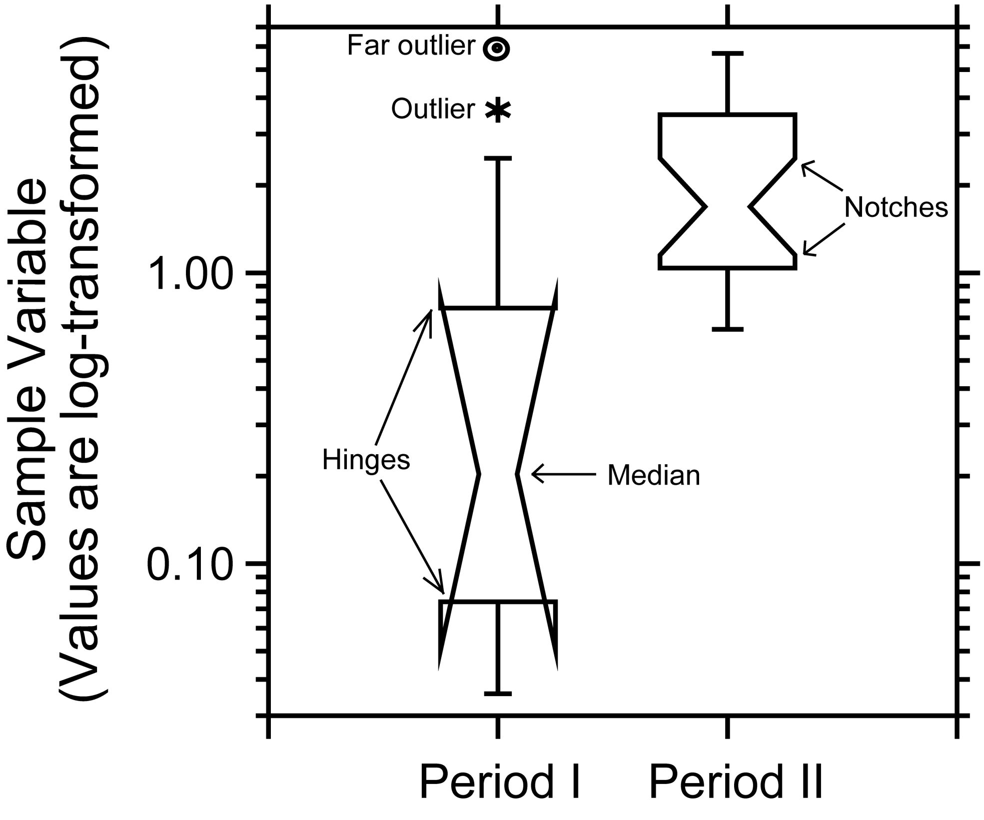

Figure 4.2 Sample notched box plot displaying a statistically significant difference in the two data distributions.

The hinges of the box represent the middle 50 percent of the data, while lines, or whiskers, extending from the box on either end represent the remaining top and bottom 25 percent of the distribution (outliers are depicted as asterisks and far outliers as open circles). Notched box plots allow for significance testing; if the notched areas of any two boxes do not overlap, then the two distributions are statistically different at the 0.05 level. In some cases, a smaller sample size will produce longer boxes, or cause a notched box to overextend and then fold back on itself. The plant data analyzed and summarized in box plots in this dissertation are logarithmically-transformed in order to normalize skewed distributions; while the original scale often can be easier to interpret in non-transformed plots, log transformation produces more symmetric plots.

Another useful tool for analyzing and displaying plant data is *diversity analysis*. A comparison of species diversity, particularly among different archaeological temporal units, can aid in identifying fundamental changes in subsistence practices. Scarry (1993a) found that diversity in maize types declined over time in different valleys of the Moundville polity, indicating that farmers were increasingly standardized in their production. Wymer (1993) found a similar result during the Middle to Late Woodland transition in the central Illinois River Valley, indicating agricultural intensification. A consideration of agricultural intensification is central to this analysis; thus, a consideration of diversity can indicate how intensification of key cultigens, including maize, affects the procurement/production of other plant taxa at different sites through time. Species diversity can be examined along two key variables: richness, or the number of taxa in a given assemblage, and evenness, or the uniformity of distribution of taxa in an assemblage (Kintigh 1984, 1989).

To calculate diversity, some scholars rely on the Shannon-Weaver diversity and equitability index, which produces H’ and V’ values (e.g., Scarry 1993a). H’ values represent diversity, or number of categories. When assessing H’ values, we consider high values to represent higher relative diversity and lower values to represent lower relative diversity. V’, the equitability value, represents how a sample is distributed amongst categories. The value of V ranges from 0-1; values closer to 1 represent a more even distribution of categories. A problem with this measure is that Shannon-Weaver does not account for sample size bias. In this dissertation I compare datasets of widely different sample sizes; to account for this issue I use DIVERS, a statistical program designed to measure the diversity of assemblages of different sample sizes (Kintigh 1984, 1989, 1991).

The DIVERS program simulates a large number of assemblages based on the categories and sample size of a given archaebotanical assemblage and produces expectations that can be compared with actual data. Archaeological assemblages are not directly compared to each other; rather actual diversity values are compared with expected values for the sample, and are plotted against a sample size with a 90% confidence interval. If a value falls above the confidence interval, then it is more diverse than expected, and if a value falls below the confidence interval, then it is less diverse than expected (VanDerwarker 2006:78).

The Study Assemblages in Ecological and Ethnobotanical Perspective

A total of 7,653 carbonized macrobotanical remains representing at least 49 taxa were identified at least to the family level across the five Moche Valley sites considered in this dissertation. Starch grain residue analysis indicates the presence of an additional taxon, potato (*Solanum tuberosum*), on ceramic and groundstone artifacts from MV-224 and MV-225, a taxon that was not present in the macrobotanical assemblages. The plants cultivated and collected by Moche Valley residents include a range of cultigens, fruits, and other miscellaneous wild plants, some with known economic uses, including as comestibles, fuels, construction materials, medicines, and fodder. While most plants could be identified to the genus or species level, some botanical remains only could be assigned to a particular botanical family. I have grouped the plant remains into categories of cultigens, tree fruits, other fruits, and miscellaneous/wild resources. In the discussion that follows, I provide descriptions of the plants identified in the assemblages, including information about growing requirements, timing and method of harvest, food vs. non-food uses, and potential cropping methods (for detailed summaries of individual taxa, see Brack Egg 1999; Soukup 1970)

Along with scientific taxonomic names, I list English common names and Spanish common names used in Peru if available. Spanish common names used in Peru were determined in consultation with local Moche Valley residents, according to signage at the Jardín Botánico de Trujillo (Trujillo botanical gardens), or following Soukup's [1970] and Brack Egg's (1999) dictionaries of *nombres vulgares*, or common names. Common names of plants used in Peru are quite variable, and stem from Spanish, Quechua, and Aymara linguistic roots, along with twelve other languages and 42 Amazonian dialects (Brack Egg 1999:10).

Maize

As discussed in Chapter 3, no other taxon has received as much attention as maize in the Andean literature, by paleoethnobotanists as well as other scholars, likely as a result of the centrality of maize and chicha to notions of a pan-Andean identity. Maize also is prominent in the Moche sculptural ceramic canon (Eubanks 1999; Museo Larco 2017). Productive, storable with minimal processing, and rich in carbohydrates, maize was adopted for different reasons and at different times across the Andes, as a subsistence crop (e.g., Pearsall 1999, 2002) and/or for ceremonial uses (e.g., Burger and van der Merwe 1990; Hastorf 1999; Logan et al. 2012; Staller and Thompson 2002). Cultivated from the tropical lowlands to high altitudes in the Andes, maize is adapted to a broad range of habitats, and numerous varieties are grown with many hybridizations. Highly productive, maize is also very storable, especially if stored un-shucked on the cob. Unlike central and southern Peru, where agricultural terracing is common (Sandweiss and Richardson 2008:96), Moche Valley farmers do not terrace hillslopes and instead rely on canal irrigation. Modern maize farming in the Andes generally is conducted in long-fallow shrub-covered fields, and ashes are often used to enrich soils. Maize is often intercropped with beans for purposes of nitrogen-fixation (Giller 2001; Lentz 2000; Smartt 1988) (discussed further below); Andean tubers (e.g., potatoes, *oca*, *ulluco*) have been documented in crop rotation systems as well (Dollfus 1982:40).

As discussed in Chapter 3, Fariss (2012:149) considers the *chaupiyunga* zone (500-2300 masl) to be the best maize growing zone in the Moche Valley; however, maize can be successfully cultivated from 0-3300 masl (Brack Egg 1999:537; Tapia and de la Torre 1998). Seasonal rains from October to April in the highlands feed irrigation in the middle and lower valleys, enabling two planting seasons: (1) December–May, a period that typically witnesses sufficient river discharge to irrigate fields, and (2) June–November, the dry period of the year, when low river levels do not permit all fields in the lower and middle valleys to be planted (Billman 1996:41). Prehispanic Moche Valley maize farmers may have planted different maize seeds during the two seasons per year, as a means of achieving variability and ‘refreshing’ seed to enhance yield (see Panduro 1999). Farmers also may have saved seed for planting or obtained it from others who saved it; Morris and Lopez-

Pereira (1999; see also Stromberg et al. 2010) estimate that between two-thirds to three-quarters of maize growing areas in Peru may be planted with farmer-saved seed. Maize is a heavy feeder crop and will deplete soil if planted in the same place year after year; thus, with reduced crop fallowing times accompanying maize intensification, soil must constantly be replenished through the use of fertilizer (Akinyele and Adigun 2006). In the prehispanic Moche Valley, this fertilizer likely came in the form of camelid manure rather than guano (Spzak et al. 2012).

Other Field Cultigens

Chenopod/*quinoa* (*Chenopodium quinoa*) is an annual herb distributed throughout the Andes from Colombia to Chile and Argentina. Archaeological research suggests that domesticated chenopods were under cultivation in the Andes as early as 1500 B.C., based on direct AMS dates from charred chenopods at the site of Chiripa in the Southern Lake Titicaca Basin, Bolivia (Bruno 2006; Bruno and Whitehead 2003). Considered to be a quintessential highland Andean crop, chenopods typically are cultivated in high elevation, semi-arid regions with potato, other Andean tubers, and lupine (*tarwi*) (Pearsall 2008), but actually can be cultivated from sea level up to 4,000 masl. Typically grown in stands reaching 2 m tall, the growing period for quinoa is between 90 and 220 days, with modern production levels cited between 3,000-5,000 kg/ha (Brack Egg 1999:132).

While seeds need to be soaked to remove bitter saponins, quinoa grains are a popular ingredient in soups and stews (greens can be consumed in salads as well). The ashes of burned quinoa stalks, known as *ilucta*, also can be used as a catalyst to activate the alkaloids when chewing coca (Bruno 2008:211). High in both carbohydrate and protein content, quinoa has gained widespread popularity in cosmopolitan cuisine in recent years, touted as a ‘superfood’ for its nutritive properties. However, growing international demand for quinoa unfortunately has priced out its affordability for some contemporary Andean peasant communities that have traditionally subsisted on this grain for millennia (Walsh-Dilley 2013).

Chili pepper/*ají* (*Capsicum* spp.) originated in Brazil and Bolivia, and became dispersed widely throughout Central and South America, likely as a result of animal dispersal (including in the digestive tracts of birds) (Brack Egg 1999:102). Microbotanical studies indicate that people cultivated chili peppers and prepared them alongside native root and garden crops in South America as early as 4050 B.C. (Duncan et al. 2009; Perry et al. 2007; Zarrillo et al. 2008). From over 25 wild varieties, five species of Capsicum were domesticated independently by prehispanic peoples in different parts of Latin America (*C. annuum*, *C.* baccatum, C. *chinense, C. frutescens*, and *C. pubescens*); these varieties have a range of color, size, shape, and spice level (Chiou et al. 2014). Chili peppers identified to species level from the Moche Valley assemblages in this dissertation include *C. baccatum* and *C. chinense*[15]. *C. baccatum* was domesticated in Bolivia, Peru, Ecuador, and Chile, but remained in South America (other varieties, including *C. pubescens*, the rocoto pepper, were domesticated in South America but later introduced to Costa Rica, Honduras, Guatemala, and Mexico, where they remain a staple in those regional cuisines). *C. chinense* was domesticated in the Amazon region and introduced to coastal Peru (not in China as the name erroneously suggests) (Brack Egg 1999:102-104).

Conventionally considered to be a ‘coastal’ cultigen, *C. baccatum* and *C. chinense* varieties of chili pepper can be grown up to 1500 masl (other varieties including *C.*

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[15] Species-level *Capsicum* identifications were made by Katharine Chiou in the McCown Archaeobotany Laboratory at the University of California, Berkeley.

pubescens can be grown up to 2000 masl). Remains of these *Capsicum* varieties were documented in early excavations at the sites of Huaca Prieta in the Chicama Valley and Punta Grande in the Ancón district of coastal Peru (Cohen 1978; Heiser and Smith 1953; Pickersgill 1969). Chili peppers are used primarily as a spicy condiment (*ají*, a dipping sauce made from chili peppers blended with other ingredients, is served at nearly every Peruvian restaurant today, and is added as a condiment to nearly every dish). Chili peppers also have documented medicinal properties; pastes are applied to treat insect bites and psoriasis, to cure hemorrhoids, to relieve arthritis pains, and as an analgesic for dental work. The fruit also can be consumed with maize chicha to ward off colds and to clear the sinuses (Brack Egg 1999:102). Scholars have argued for a use of chili peppers in ritual contexts, as a result of their recovery in ritual features, e.g., the Fox Temple at the Preceramic site of Buena Vista in the Chillón Valley, Peru, ca. 2200 B.C. (Duncan et al. 2009), and from their presence in ceramic motifs (e.g., Joyce 1913; Vargas 1981). Gumerman (1991, 2002) categorizes chili pepper as an elite or luxury food (*sensu* Hastorf 2003); as discussed in Chapter 3, during the Lambayeque (Late Intermediate Period) occupation of Pacatnamu, greater densities of chili peppers and coca were recovered in elite contexts than in commoner contexts, which were dominated by wild plants and marine resources.

Coca (*Erythroxylum novogranatense var. truxillense*) is an important part of domestic and ritual life in the Andes (e.g., Allen 1981, 2012; Grisaffi 2010; Plowman 1984; Rostworowski 1988). Huánuco coca (*E. coca* var. *coca*) is the source of commercial coca today and is distributed along the eastern Andean slopes and wetter valleys from Ecuador to Bolivia and northwestern Argentina. Trujillo coca (*E. novogranatense* var. *truxillense*) is cultivated today on the Peruvian north coast and in the Marañon Basin on the Western slopes of the Andes (Pearsall 2008:109)[16]. Coca has widely documented shamanic use along with use in religious and ritual ceremonies, but is also an important part of daily routines and economic exchange. As discussed in Chapter 3, based on agro-ecological zonation modeling, Fariss (2012:149) considers the middle valley chaupiyunga zone (500-2,300 masl) to be the prime coca-growing zone of the Moche Valley for the cultivation of the Trujillo variety of coca; however, coca can be cultivated widely throughout the valley (and throughout the Peruvian coast and in the Amazon) up to 3,000 masl (Brack Egg 1999:201-202). A drought-resistant plant, Trujillo coca probably originated from the adaptation of Huánuco coca to drier habitats (Pearsall 2008:109). The best growing conditions include hill-slope planting in friable soil, good drainage, and ample shade; coca plants can be harvested 18 months from the time of planting (MacMillan 1935:512).

A mild stimulant and analgesic, coca is used to combat altitude sickness; assuage fatigue; stave off hunger and thirst; and relieve headaches, stomach aches, and joint pain. Dried coca leaves are chewed (but require a catalyst to activate the stimulant properties), or are steeped in water to make a tea. Coca tea is consumed commonly in the Andean highlands today as a means to prevent altitude sickness, but coca leaves are chewed broadly in coastal and middle valley communities, particularly by day laborers. While prehistoric remains of coca are rarely uncovered by archaeologists or positively identified by paleoethnobotanists because of their fragile nature (Hastorf 1987), Dillehay et al. (2010) provide evidence for coca chewing as early as 6050 B.C. in the Nanchoc Valley, Peru, and tie its use to emerging specialists who extracted and supplied calcite and lime to communities for coca chewing during the transition from mobile hunting and gathering to

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[16] The Trujillo variety of coca was used in early manufacture of Coca-Cola beverage, although the Coca-Cola company today uses a cocaine-free coca extract.

sedentary farming.

Common bean/*frijól* (*Phaseolus vulgaris*) was cultivated widely in the prehispanic era in Peru (e.g., Kaplan 1965, 1981; Pozorski 1979; Towle 1961). Indeed, fully domesticated common beans (along with lima beans, *P. lunatus*) were recovered from deposits in Guitarrero Cave in the Callejón de Huaylas, Ancash, Peru, dated to 6050 B.C. (Kaplan et al. 1973). Common beans were domesticated independently in Mexico as well as the Andes (Peru, Bolivia, and Argentina); Andean beans have larger seeds, but Mexican cultivars are better suited to hotter climates (Gepts 1991). According to Hastorf (1999:45-51), beans were the most common crop in coastal Preceramic sites from 6000 to 4200 B.C., eventually becoming widespread throughout the coastal region by the Initial Period (ca. 1800- 1000 B.C.). On the Peruvian north coast, beans have been recovered from the earliest levels at the Preceramic component of Huaca Prieta in the Chicama Valley (Bird and Hyslop 1985:233) and from the Initial Period site of Gramalote in the Moche Valley (Pozorski 1976:97). Because beans are highly susceptible to taphonomic processes and consumed in their entirety, the archaeological presence of beans is actually quite remarkable. Common beans are also prominent in the Moche artistic canon (Ryser 2008).

High in protein, common beans are well known comestibles, frequently added to soups and stews, but also have documented medicinal uses, as a diuretic, as an analgesic, to dissolve tumors, and to stabilize menstruation. After beans are harvested, stalks can be used as fodder. Beans tolerate most environmental conditions in tropical and temperate zones, and germinate rapidly at soil temperatures above 18°C. Seed rates are 20–115 kg/ha depending on seed size and row width (Brack Egg 1999:383). Beans are frequently cultivated with maize for their nitrogen-fixing properties; indeed, in Latin America today, ca. 70 percent of beans are interplanted with maize in commercial fields (Center for New Crops and Plant Resources 2017). With maize, beans are usually planted 5–8 cm deep, deep enough to give good coverage and sufficient moisture to promote fast germination and growth. Intercropping *Phaseolus* beans (*P. vulgaris* and *P. lunatus*) with maize provides benefits to both plants (Giller 2001; Lentz 2000; Smartt 1988). VanDerwarker (2006:81; see Bodwell 1987; Giller 2001) notes that in addition to enriching the growth and yield of maize plants, *Phaseolus* beans complement maize in terms of nutritional value; maize is deficient in essential amino acids lysine and isoleucine, which beans have in abundance. As a result, eating beans with maize together would have provided benefits as well as cropping beans and maize together.

Lima bean/*pallar* (*Phaseolus lunatus*) is another *Phaseolus* species broadly cultivated in the coast and highlands, with a great antiquity of domestication (see discussion of *P. vulgaris* above). Like the common bean, there were two independent centers of domestication of lima bean, with smaller varieties domesticated in Mesoamerica and larger varieties domesticated in coastal Peru. Although lima beans are primarily grown for consumption (in soups, stews, etc.), some medicinal uses include the treatment of styes and smallpox (Brack Egg 1999:382). Like the common bean, lima beans do not require much water for cultivation, and often are intercropped with maize for their nitrogen-fixing properties.

Ryser (1998; 2008:404) discusses lima bean use in the Moche and Chicama Valleys through a consideration of Moche iconography and paleoethnobotanical analysis of data from sites of Santa Rosa-Quirihuac (Early Moche), Ciudad de Dios (Middle Moche), and Galindo (Late Moche), arguing that the lima bean transitioned in status from a common comestible to a foodstuff restricted for use as a status symbol or in ceremonies. She links the lima bean to notions of Moche ideology, including the depiction of Moche warriors as lima beans on fineline vessels, and she argues that this resource was politically manipulated by Moche elites. In her study, however, Ryser (1998, 2008) only discusses bean data and does not consider other plant taxa; therefore, it is difficult to corroborate this claim or to evaluate the importance of lima beans relative to other taxa.

Another cultivated legume, peanut/*maní* (*Arachis hypogaea*), was domesticated in South America in the prehispanic era, likely in eastern Bolivia, northern Argentina, Paraguay, and Southern Brazil (Simpson 1991), where its cultivation then spread across South America. Peanuts are best suited to sandy, well-drained loamy soils; for optimal yields, peanuts require steady, warm temperatures and only a moderate amount of water, as well as a four to five month growing period (Woodroof 1966:29). The optimal growing ranges for peanuts in the Andes range from approximately 0 to 1,000 masl (Moseley 2001:31). Along with other members of the Fabaceae family, peanuts would have been beneficial for their nitrogen-fixing properties when planted in fields alongside other cultigens. High in protein, peanuts were prepared and consumed in a multitude of ways: roasted, fried, salted, boiled, and ground, used as additives in sauces and in some cases for chicha production (*chicha de maní*) (Bonavia 1991:131; Estrella 1990; Fernández and Rodríguez 2007; Gillin 1947; Nicholson 1960). While various scholars (Gumerman 1994; Hastorf 2003; Masur 2012) consider peanuts to be a luxury item primarily associated with elite contexts, the widespread nature of this practice is not particularly well understood. Milk also can be extracted from peanuts in a manner similar to almond milk; peanut milk, along with pressed peanut oil, was used for a variety of medicinal purposes, including to treat hemorrhoids, as a laxative, and to soothe colicky infants (Brack Egg 1999:44).

Cotton/*algodón* (*Gossypium barbadense*) was cultivated widely along the coast and in the Amazon in the prehispanic era, primarily for its vegetable seed fiber, the raw material for a large volume of textile products (e.g., Billman et al. 2017; Dillehay et al. 2007; Murra 1962; Pearsall 2008; Pozorski 1979). Domesticated in the Preceramic Period ca. 2600 B.C., cotton domestication, along with squashes/gourds and other root crops, was underway in northern Peru before maize arrived (Pearsall 2008:113). Aside from its primary economic use in textile production, oil from pressed cotton seeds also is consumed, and cotton seeds, leaves, and fibers possess a variety of medicinal uses, including as a diuretic, to treat hemorrhoids, dental abscesses, ear aches, coughs, and fevers (Brack Egg 1999:227). Irrigated fields in coastal yunga zones are ideal for growing cotton, as cottons are sun-loving plants, but cultivation requires an abundance of water. The highlands are too cold and the eastern slopes of the Andes generally are too humid for the plant to thrive (Dollfus 1982:40; McBride 1920; Pearsall 2008). Cotton is not planted anew each season but lives for several seasons (attaining a life as long as 20 years). Newly planted fields yield their first crops after approximately eight months growth; however, the best fibers are harvested from plants that are four or five years old (McBride 1920:39).

Gourd/*mate* (*Lagenaria siceraria*), along with cotton, was domesticated in the Preceramic Period and served primarily as an industrial plant. On the Peruvian coast, evidence for domesticated bottle gourd comes from the Middle Preceramic Siches Complex (6000-4000 B.C.), and from the La Paloma site in the Chilca Valley of central Peru (5700-3000 B.C.); squash, guava, and *Phaseolus* beans also were documented at La Paloma (Pearsall 2008:112). The flesh generally is too bitter to eat (although young gourds can be eaten raw, i.e., before the rind has hardened, and the oily seeds are edible), but gourds generally are used to make durable containers and floats. Although ubiquitous in the archaeological record, gourd is not a New World native. Rather, it is believed that African gourds were washed out to sea in the Atlantic and floated to coastal Brazil or northern South America (Erickson et al. 2005). Bottle gourds can be grown throughout the tropics, subtropics, and into the temperate zone.

Cultivated widely in the prehispanic era on the coast of Peru, gourd remains have been documented at several Preceramic cites including Huaca Prieta in the Chicama Valley and Guanape in the Virú Valley of northern Peru (Bird 1948) and at the Buena Vista site in the Chillón Valley of central Peru (Duncan et al. 2009). An artistic tradition that continues in Peru today is elaborate gourd carving. This practice has great antiquity; indeed, remains of *mates burilados* (carved gourds) were recovered from the Preceramic component at Huaca Prieta in the Chicama Valley in Junius Bird's 1946 excavations. Bird (1948) describes the remains of 15 gourds, some dated to 2,000 B.C., with Z-shaped and anthromorphic carvings (see Raphael and Villegas 1985).

Potato/*papa* (a Quecha word that simply means "tuber") (*Solanum tuberosum*) is cultivated in the Andes from sea level to 4,000 masl (Hawkes 1990). Andean potato crops are renowned for their immense diversity, with seven domesticated species and several thousand land races, as well numerous closely affiliated wild relatives. The potato complex is spread across the Andes in Peru, Bolivia, and Ecuador, with early potato cultivation beginning approximately 7,000 years ago (Pearsall 2008). Today, the diversity of potatoes is clustered in the eastern Andean valleys and uplands of south-central Peru and north-central

Bolivia, i.e., from the Huancayo and Ayacucho highlands southward to the Cochabamba and Potosí sierras.

In many parts of the Andes, growers rotate their potatoes and other crops among scattered field plots, typically sowing potato fields for 1-3 years before rotating the planting to another site (Zimmerer 1998:447).

As environmental factors including pests, diseases, weeds, climate hazards (e.g., frost, hail), and soil conditions (e.g., waterlogging or drought) are common, Andean farmers typically attempt to reduce crop losses by relying on potatoes with broad habitat tolerances (including resistance to blight and frost, Graves 2001:202). Sammells (2010:106) notes specifically that in highland Bolivia, women plant potatoes, but in rare instances, if no women are available, men will do so. Potatoes are prepared and consumed in a variety of ways, including roasted, boiled, steamed, or freeze-dried into *chuño* (left out during freezing temperatures in the night and early morning, dried chuño can be stored for years, see Bruno 2008:192). Potatoes are a common ingredient in soups and stews in Andean cuisine. Potatoes also have documented medicinal properties, from treating ulcers to insect bites (Brack Egg 1999:468). In addition to consuming the potato tuber for food, the leafy plant of the potato can be cut and fed to animals (Franquemont et al. 1990:100-101).

Several varieties of squash/*zapallo* (*Cucurbita* spp.) were cultivated during the prehispanic era in Peru, including pumpkin (*C. pepo*), butternut squash (*C. moschata*), and winter squash (*C. maxima*). The domesticated squashes were derived from separate ancestral species; *C. maxima* may be derived from a wild ancestor *C. andreana*, found today in Uruguay and Argentina (Brack Egg 1999:166; Pearsall 2008:108). Remains of squash seeds have been recovered from Peruvian coastal sites dating to ca. 1800 B.C., and *C. moschata* seeds have been documented in coastal burials dating to 1100 B.C. (West and Whitaker 1979). Squashes can be cultivated in a variety of climates, including the tropical desert, subtropics, temperate zones, and tropics, but require good soil fertility with abundant organic material (Brack Egg 1999:166). Aside from their technological uses, squash and gourd fruits are edible when eaten young (i.e., before the rind has hardened) and consumed in many forms, including stews, compotes, and purees; squash flesh is also pickled, and seeds are roasted or toasted. Squashes have a variety of other uses as well, including ornamental (squashes come in a variety of colors, from orange to red to marbled); medicinal (to relieve chest pain, bronchitis, earaches, and bladder and prostate infections); and as an antiparasitic agent for livestock. Studies have demonstrated that administering ground squash seeds to livestock has proven effective as a form of parasite control (Arevalo et al. 1989); it is possible that such a veterinary use could have been used in the prehispanic era as well.

Fruits

A number of fruits were recovered in the five archaeological assemblages; these fruits are actively managed in the Moche Valley today or grow wild in the local vegetation. There are many known uses for each, either as food, beverage, medicine, or dye, which I discuss below. Small seeds of fleshy fruits are less likely to be recovered in archaeological assemblages as they are often consumed in their entirety with the fruit; however, seeds from a fleshy fruits including opuntia (*Opuntia* spp.), elderberry/sauco (*Sambucus peruviana*), golden berry/*aguaymanto* (*Physalis peruviana*), passion fruit/*maracuyá* (*Passiflora* spp.), and a member of the genus *Prunus* (wild plum or cherry) are present in the assemblages. Other tree fruits are present in the assemblage as well, in the form of both seeds and rind fragments, including avocado/*palta* (Persea americana), guava/*guayaba* (*Psidium* spp.), lucuma/*lúcuma* (Pouteria lucuma), and pacay/pacae (*Inga feuillei*).

When Andean scholars refer to agriculture, they often discuss field cultivation, of maize, beans, cotton, etc.; however, the process of clearing, cultivating and fallowing fields is also tied to choices made with respect to tree management. Tree crop management was an important part of pre-Columbian farming systems; on-farm tree planting has been documented ethnographically in the Andes (Bluffstone et al. 2008; Farley 2007; Kattan and Alvarez-Lopez 1996; Reynel and Felipe-Morales 1987), and more broadly in tropical agricultural systems in the Americas (e.g., Peters 2000; VanDerwarker 2005). Indeed, fruit trees are cultivated along the edges of fields and along canals in the Moche Valley today, as well as in house gardens (Figure 4.3). Active tree management produces additional comestible resources for communities, and also can provide an alternative or addition to fuelwood and fodder collected from common forests. Certain fruit trees also had elevated importance in Andean cosmologies, as documented for the Inka (Hastorf and Johannessen 1991).

Figure 4.3 Trees lining agricultural fields in the middle Moche Valley (photo by D. Bardolph July 2014).

Tree Crops

Avocado/*palta* (*Persea americana*) is a cultivated tree with many varieties, distributed throughout the tropical and subtropical Americas, including along the coast, Amazon, and in interandean valleys. Avocado trees required well-drained sandy soils, and spacing is critical to ensure productive crops; avocados trees should be adequately spaced apart so that they are exposed to full sun. Production begins at 5-15 years, and some trees can produce up to 300 fruits (Brack Egg 1999:381; Davenport 1986). Cultivated primarily for their edible fruits; avocado fruits are very nutritious. They are high in fiber, antioxidants, and vitamins A, B, C, and E. Avocados have a wide variety of uses aside from their comestible use, from cosmetic to medicinal. The pulp of the fruit can be applied as a face mask, and both the fruit pulp and leaves have known medicinal properties from ranging from antidiarrheal, anti-diabetic, to analgesic. The ingestion of great quantities of avocado seeds also can serve as an abortive agent. Furthermore, avocado tree hardwoods can be used to make tools (Brack Egg 1999:381).

Guava/guayaba (*Psidium* spp.) is native to Mexico, Central America, and northern South America and are distributed throughout the tropical Americas. Cultivated in humid and dry climates, guavas can be grown up to 1,200 masl (Nakasone and Paull 1998). The fruits are consumed raw, but as guava fruits contain high levels of pectin, present day uses in Peru include preparing the fruit into marmalades, jams, and ice creams (the dehydrated fruit also can be prepared into a powder form) (Brack Egg 1999:418). Guavas are rich in dietary fiber, folic acid, and vitamin C; indeed, a single guava fruit contains four times the amount of vitamin C as an orange (Seshadri and Vasishta 1965). Guava also has some documented medical uses, often in the form of infusions prepared with leaves from the guava tree, to treat a range of maladies from gastritris to conjunctivitis to menstrual cramps (Brack Egg 1999:418). Guava tree hardwoods are also used to manufacture wooden tools (Moutarde 2008).

Lucuma/*Lúcuma* (*Pouteria lucuma*) trees are distributed throughout the Peruvian coast and highlands, as well as the highland Amazon; indeed, lucuma trees can be cultivated up to 3,000 masl. Adapted to various soils, lucuma trees are most productive when planted in rows spaced 4-5 m apart, and are suitable for mixed cultivation, as they are good shade trees. Production begins at 4-5 years; one tree can produce some 300 fruits and they produce for more than 60 years (Brack Egg 1999:411). Lucuma trees were cultivated in the prehispanic era (Hoelle and Risi 1993; Pearsall 2008; Pozorski 1979), with fruits consumed fresh or dried and ground into powder. Lucuma also possesses a range of medicinal properties, used to combat anemia, to treat skin infections, and as an antidiarrheal. Lucuma trees also produce good quality hardwoods used for tools and other artifacts (Moutarde 2008).

Pacay/Pacae (*Inga feuillei*) trees can be cultivated on the coast, in the highlands, and in the jungle up to 3,000 masl (Brack Egg 1999:261). Like other members of the Fabaceae family, including common beans and lima beans (discussed above), pacay trees produce abundant root nodules that fix nitrogen; thus, their cultivation benefits the land by increasing fertility levels. They require year round irrigation so are generally grown near river banks or canals, but they produce in abundance, are tolerant of diverse soils, and are resistant to disease and fire (National Research Council 1989). Referred to as “ice cream bean” for its sweet, edible white pulp, pacay fruit is eaten fresh, and also has known medicinal properties ranging from digestive relief to skin cancer treatment. Pacay hardwoods were also used to make wooden tools (Moutarde 2008). Pacay trees were cultivated widely in Peru during the prehispanic era (Beresford Jones et al. 2001; Perry 2007; Piacenza 2016; Rowe 1969), and pacay fruits are represented in in the Moche sculptural vessel canon (Museo Larco 2017).

Other Fruits

Elderberry/*Sauco* (*Sambucus peruviana*) is native to the Andes (likely Peru), and grows up to 3,000 masl. Requiring deep soil and a lot of water, elderberry plants thrive near irrigation canals. Aside from their comestible uses, elderberries have known magical and medicinal properties, including as an aphrodisiac, purgative, expectorant, antitussive, and diuretic. Juice from elderberry fruits also can be applied as an insecticide (Brack Egg 1999:44).

Golden berry/*aguaymanto* (*Physalis peruviana*) is native to Peru and is distributed throughout the coast, highlands, and Amazonian region up to 2,000 masl (Tapia and de la Torre 1998). Cultivated during the prehispanic era, golden berries can be eaten raw, pressed into juice, or dried, and possess many nutritive properties. Since the colonial era, it has been widely introduced into cultivation into other tropical, subtropical, and temperate areas, including China, India, and Malaysia (Morton 1987). Since its colonial introduction to the Old World, the golden berry also has been referred to as the cape gooseberry; however, *Physalis peruviana* from South America is marketed in the United States most commonly as golden berry and sometimes Picchu berry, named after Machu Picchu in order to associate the fruit with its origin in Peru and to address the fact that this fruit is not actually a gooseberry as the name cape gooseberry implies. As a member of the plant family Solanaceae, it is closely related to the tomatillo (*Physalis philadelphica*). High in Vitamins A, B, and C, as well as phosphorus and protein, golden berries also have a range of documented medicinal uses, including antitussive, antihelmintic, antidiabetic, and diuretic properites; they are also used to combat a range of maladies from eczema to conjunctivitis to gonorrhea (Brack Egg 1999:387; Wu et al. 2006). Recent studies have discovered 14 new compounds in various species of wild tomatillo (*Physalis* spp.) that have anti-cancer properties; these compounds, known as withanolides, are already showing promise in combating a number of different cancers and tumors without noticeable side effects or toxicity (Barot et al. 2013).

Passion fruit/*maracuyá* (*Passiflora* spp.) is a woody perennial climbing vine that originated in Brazil and then spread throughout South America. Cultivated in humid and dry climates, passion fruits can be grown up to 1,500 masl, but require non-flooded land with good drainage to produce successfully. Both the fruit pulp and seeds of this sweet fruit are consumed as desserts, and the fruits are also squeezed into juices and made into salsas. Similar to cotton, passion fruits can be pressed for oil, which is used to aid digestion. Passion fruits also possess magical and medicinal properties; they are used an as anaphrodisiac (i.e., to reduce sexual desire), as well as a muscle relaxer and sedative (Brack Egg 1999:369).

Cactus fruits of the genus *Opuntia* are abundant in the Moche Valley today; this plant grows between 500 and 3,000 masl in interandean valleys and survives in soil with low to medium soil fertility. The pulp of the cactus fruit is consumed also has a variety of other uses, including medicinal (to relieve colds, to treat abscesses, and to lower cholesterol); cosmetic (poultices are applied to remove skin spots and to wash hair); to attract cochineal insects used for dyes; and as fodder for livestock (non-spiny varieties) (Brack Egg 1999:352). In addition, various wild plum or wild cherry/*cerezo* (*Prunus* spp.) species are distributed throughout Peru, wild and cultivated up to 3,500 masl, with known comestible and medicinal uses (Brack Egg 1999:416).

Miscellaneous/Wild

A number of other miscellaneous/wild taxa were identified in the assemblages, including various weedy taxa found in agricultural fields and on habitation sites, many of which have known economic uses (discussed below). Others likely represent incidental inclusions, unintentionally transported to the site in the clothing of family members and fur of livestock returning from agricultural fields. In contrast to field cultigens and tree crops that produce large seeds or rind fragments, many of the miscellaneous/wild species discussed below have not received much treatment in the Andean archaeological literature. Only in the past few decades have paleoethnobotanists made attempts to systematically identify small weedy seeds from archaeological samples (some of which are less than 1.0 mm in size), in contrast to the recovery of larger taxa hand-picked during excavation or from larger mesh/screen sizes that characterize earlier excavation techniques.

Some specimens could only be identified to the family level (Asteraceae, Boraginaceae, Brassicaceae, Cactaceae, Fabaceae, Lamiaceae, Malvaceae, Poaceae, Papaveraceae, Rosaceae Solanaceae, and Sapotaceae). Some of these families are represented by multiple genera and hundreds of species, so it is difficult to make specific inferences about their economic uses by Moche Valley residents. Some of these families are well adapted to disturbed environments and occupy agricultural fields (e.g., members of the Asteraceae, Brassicaceae, Fabaceae, Malvaceae, Poaceae families), in open uncultivated areas (e.g., members of the grass family, Poaceae), or on rocky hill slopes or other relatively undisturbed areas (e.g., members of the Cactaceae, Lamiaceae, Rosaceae families). Other species identified to the species or genus level have well-documented economic uses, with data from ethnographic studies and some have longer histories of use evidenced archaeologically. Many of the taxa discussed below had multiple uses, including as food, medicine, fodder, fuel, or other purposes, with different portions of plants (e.g., leaves, flowers, stalks) used for different purposes, including with different preparation methods (e.g., eaten raw, cooked, ground, dried, infused, etc.). I draw primarily on ethnobotanical uses discussed by Brack Egg (1999), along with other scholars cited below.

Food taxa in the miscellaneous/wild category include amaranth/*kiwicha* (*Amaranthus* spp.)[17], lupine/*tarwi* (*Lupinus* spp.), mesquite/*algorrobo* (*Prosopis pallida*), plantain/*Plantago* spp., oregano (*Lippia* spp.), purslane/*verdolaga* (*Portulaca* spp.), rattlepod/*crotalaria* (*Crotalaria* spp.), saltbush/*orache* (*Atriplex* spp.), sow thistle (*Sonchus* spp.), trianthema (*Trianthema* spp.), vetch/*haba* (*Vicia* spp.), wildbean (*Strophostyles helvola*) and a member of the genus *Rubus.* Some of these comestibles are fairly well known; for example, amaranth is fairly cosmopolitan in cuisine, as a nutritious grain that can be toasted, popped, ground into flour, or boiled for gruel (the leaves also can be consumed as vegetables). Native to Peru, amaranth (known as *kiwicha* in highland Andean communities) is distributed throughout the Andes from Colombia to Argentina, on the on the coast, highlands (up to the Altiplano), and high jungle. Both wild and cultivated (grown in stands), different species of amaranths grow within different elevation zones, with coastal varieties that can be grown up to 500 masl and altiplano varieties up to 4000 masl (Brack Egg 1999:26-27). Brack Egg (1999) lists two wild species (*A. hybridus* and *A. peruvianus*) that can be grown in the north coast region (see also Weberbauer 1945). Amaranth has long been used as a food source in the Andes, including by the Inka (National Research Council 1989), with archaeological evidence of cultivation going back as far as 2,000 years, recovered in tombs in northwestern Argentina (Anon 1984). It is also used as livestock fodder and has medicinal uses, including to treat diarrhea, sore throats, menstrual cramps, and rashes. The green leaves also be can be eaten like vegetables (Brack Egg 1999:27).

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[17] I classify amaranth as a miscellaneous/wild resource in this study because it was unclear if the seeds in the assemblages were harvested from cultivated plants or collected from wild plants. Some specimens could only be classified as “cheno/am,” i.e., a member of either the Chenopod or Amaranth genus. Both genera are present in the region, and if seed coats are missing, it can be difficult to distinguish between the two based only on the endosperm. Furthermore, the specimens identified by George (Wolf) Gumerman and reported in Lockard (2005) are only listed as *Amaranthus* spp., and do not distinguish between wild or cultivated varieties.

Mesquite, or *algarrobo* (*Prosopis pallida*), is another well-known food; ripened seed-pods are often ground into flour and also used to make chicha. The seed pods also serve as camelid fodder. The sweet, molasses-like flavor of mesquite is incorporated into many beverages in Peru today, including *algarrobina*, a cocktail that uses mesquite syrup extract. Thriving in alluvial and rocky soils up to 1,500 masl, mesquite trees grow quickly and are long-lived (Brack Egg 1999:414). Their hardwoods are a source of long-burning firewood and charcoal as well as a raw material for wooden tools (although lucuma and pacay tree hardwoods likely were the preferred materials for domestic wooden tools, see Moutarde 2008). The leaves, greens, and seeds of many of the miscellaneous/wild taxa may have been eaten raw or cooked, including lupine, plantain, purslane, saltbush, rattlepod, *Rubus* spp., sow thistle, vetch, and wildbean, while others were used as seasoning or condiments, such as oregano or trianthema (Rico-Gray 1979:13). Some of these taxa have moderate to high degrees of toxicity and must be processed, e.g., lupine, which has a high alkaloid content. A member of the Fabaceae family, lupine, or *tarwi*, is typically considered to be a 'highland' food, as it grows up to 3,850 masl (above the range of *Phaseolus*).

A number of the miscellaneous/wild taxa have known medicinal uses as well, including acacia/*faique* (*Acacia macracantha*), amaranth, knotweed/smartweed (*Polygonum* spp.), milk thistle/*cardo* (*Silybum* spp.), oregano, purslane, ragweed/*ambrosía* (*Ambrosia* spp.), rattlepod, saltbush, sedge/*piri-piri* (*Cyperus farex*), spurge (*Euphorbia* spp.), tillandsia/*achupalla* (*Tillandsia* spp.), sage/*salvia* (*Salvia* spp.), shoreline purslane/*capin* (*Sesuvium* spp.), sida/*pichana* (*Sida* spp.), vervain/*verbena* (*Verbena* spp.) and violet/*violeta* (*Viola* spp.). These plants have known analgesic properties and been documented for the their use in treating a range of maladies, from coughs/colds, headaches/earaches/throat aches, gastrointestinal distress, rashes, and menstrual cramps, among others, and also have been used in fertility management as contraceptives or abortive agents (Brack Egg 1999; Soukup 1970). Certain taxa, e.g., vervain, have known uses in veterinary medicine as well; used to treat cattle hooves in the Andes today (Brack Egg 1999:521), it is possible that vervain could have been used to treat prehistoric ungulates (camelids). Certain spurges that have known purgative properties, along with sedges that have aphrodisiac properties have documented uses in shamanic rituals as well (Brack Egg 1999:206).

Some of the miscellaneous/wild taxa also have known fuel uses, including tillandsia, saltbush, mesquite, and acacia. A few archaeological studies have identified plant taxa and other organic materials including woods and other herbaceous plants used as prehistoric fuels on the north coast (Cleland and Shimada 1998; Goldstein 2011; Moutarde 2008; Shimada 1997; Tschauner et al. 1994; Wagner et al. 1998), for cooking, firing ceramics, and working metal. In Inka times, fuel was an important tribute item (Hastorf and Johannessen 1991:149; see Espinoza Soriano 1971; Murra 1975). Beyond potential inventories of north coast fuels, the social relations associated with fuel use remain poorly understood. Moche Valley residents likely burned dung as a source of fuel in addition to grasses and tree fuels (indeed, Gillin [1947] documented animal dung used as fuel in his ethnographic account of the town of Moche). In order to identify dung burning archaeologically, Wright (2014, see also Hastorf and Wright 1998; Wright Miller and Smart 1984) suggests that researchers consider the following: (1) if there is a basis for using dung such as a shortage of available wood, (2) the presence of suitable dung-producing animals in the archaeological context considered, (3) recognizable animal dung in the archaeological deposits, and (4) the recovery of such samples from hearth contexts (Charles 1998; Miller and Smart 1984).

No wood analysis was conducted in this dissertation, so it is difficult to say at this point if there was a shortage of any particular taxa in the Moche Valley that would have been used for fuel. As discussed further below, seeds of the potential fuel taxa (tillandsia, saltbush, mesquite, and acacia) only were recovered in small quantities, but future wood charcoal analyses may reveal a different pattern. The Moche Valley does not have the dense stands of algarrobo trees witnessed in the more northerly Jequetepeque Valley (see Goldstein 2011); I imagine that Moche Valley residents likely used a combination of gathered wild plant taxa and dung as fuel sources. Camelids would have served as suitable dung-producing animals; indeed, ample amounts of dung, from camelids (*Lama* sp.) as well as guinea pigs, or *cuy* (*Cavia* sp.), were recovered throughout the Moche Origins Project excavations at MV-224, MV-225, and MV-83, and was present in many flotation samples (although these amounts were not quantified). Hastorf and Wright (1998) and Miller and Smart (1984) argue that animal dung can serve as a vector for seeds from fodder plants, e.g., Poaceae, Chenopodiaceae, Verbenaceae, and Boraginaceae, taxa that were present in the Moche Valley assemblages.

A number of the miscellaneous/wild taxa were likely used for animal fodder as well, including amaranth, grasses including crown grass/*gramalote* (*Paspalum* spp.) and panic grass/*grama* (*Panicum* spp.), lupine, rattlepod, sandbur/*pega pega* (*Cenchrus echinatus*), sida, tillandsia, trianthema, vetch, and wildbean. All of these taxa have ethnographically documented cases of fodder use for livestock (Brack Egg 1999). Brack Egg (1999:456) lists sida in particular as a fodder used for guinea pigs. However, as Wright (2014) identifies, separating taxa used for fodder from taxa used for human consumption is complicated. Fodder can often be the same species as food used for human consumption and may also be processed and stored in a similar fashion (Charles 1998). Ethnographic data suggest that the boundary between food and fodder is flexible and often depends upon the success of the harvest. In other words, what might be fodder in one year, could be used for human consumption the next year if yields of more preferred foods are low. This distinction even relates to fodder and fuel; for example, the preferred economic use of tillandsia is as fuel, but it can also serve as a fallback fodder for animals (Brack Egg 1999:500).

Finally, some of the miscellaneous/wild taxa have other technological uses, as construction materials, for matting/thatching (e.g., sida), textile production, etc. Sage and field madder (*Sherardia arvensis*) have documented uses as green/yellow or red dyes, respectively (Brack Egg 1999:444; Georgia 1914). Other taxa may simply be the result of incidental inclusions in the archaeobotanical assemblages, and may not have been used by Moche Valley residents. The archaeobotanical assemblages from the five Moche Valley sites include a combination of wild and cultivated plants, with ecological requirements in many cases involving anthropogenic intervention. Moche Valley farmers had sustained access to water from irrigation canals, resulting in the creation of a landscape of cultivated fields, orchards, and fallow pastures. Aside from a wide range of field cultigens (chili pepper, coca, common bean, cotton, gourd, lima bean, peanut, quinoa, and squash) and tree crops (avocado, guava, lucuma, and pacay), other fruits (opuntia, elderberry, golden berry, passion fruit, wild plum or cherry) would have been actively managed, likely lining fields. A number of miscellaneous wild species thrive in areas disturbed by humans and likely existed and were harvested in gardens even if not intentionally grown. Certain economic weedy species thrive along irrigation canals (e.g., bulrush, pondweed, sedges); in disturbed areas (e.g., field madder, plantain, wildbean); and in fields under cultivation or recently fallowed (e.g., purslane, sida), presenting Moche Valley farmers with opportunities to collect them while managing farming tasks.

Ethnographic and Ethnohistoric Perspectives of Food Preparation and Processing

Some materials and techniques of processing and preparation of plant foods recorded in ethnohistoric documents and witnessed today may have some bearing on past practices. Many of the edible plants and animals listed in the inventories of prehistoric sites in Peru are still grown, purchased, or gathered today, and while I do not assume an unbroken continuity for two millennia regarding the ways in which foods were processed and prepared, ethnographic and ethnohistoric sources are a useful starting point for thinking about the organization of foodways. Throughout South America, the practices of baking in ovens or frying over fires were virtually unknown in prehispanic times (Gillin 1947:49; Olivas Weston 2001:13; Rowe 1946:220; Schaedel 1989:115). While much literature has focused on Inka or highland traditions rather than coastal valleys, a small amount of ethnographic and ethnohistoric information is available for the north coast region.

In Gillin's (1947) ethnographic account of the town of Moche, he observed that many dishes were cooked or boiled over an open flame, either in ceramic or metal containers placed on an adobe brick stove or on rock supports placed on the ground. Gillin (1947:48-49) lists a variety of one pot meals, including soups, stews, or gruels, which often contained meat, maize (on the cob or shelled), manioc, and/or beans. Typical kitchens contained ceramic cooking vessels, water storage jars, chicha fermentation jars, cooking hearths (located inside enclosed spaces and/or in outdoor patios), fuels (wood charcoal and animal dung), woven reed or cane fans for igniting or intensifying cooking fires, grinding stones (*batanes*) and pestles (*chungas*), wooden utensils, and various serving implements made from gourds including scoops, plates, and bowls.

Gillin (1947:49) also points out that essential ceramic (water storage jars and botijas) and groundstone (batanes and chungas) implements were commonly acquired from nearby archaeological sites, and praised by the local population at the town of Moche as being the best quality kitchen tools. In my research in the Moche Valley for this dissertation project, I have been invited into homes and served meals in kitchen setups mirroring those described above, including stews of meat (e.g., goat, guinea pig), maize, and beans cooked over open hearths in Chimu pots that smallholders recovered in their fields. It is likely that a variety of food preparation and processing techniques were implemented in the Moche Valley during the EIP, including boiling (in the form of soups, gruels, and stews), roasting, steaming, parching, toasting (of grains, legumes), drying, soaking, and grinding. Rowe (1946:222) describes how toasted maize, or *cancha*, was a popular food at the time of Spanish conquest in Peru (and is indeed still popular today).

Gillin (1947) provides interesting insight into the importance of water for the people of Moche. Water was considered important for irrigation, food preparation, and bathing, but not for drinking; distaste for drinking water has been documented widely in the Andes (e.g., Apffel-Marglin 2010:28; Rowe 1946:292). According to Gillin (1947:45), many families drank chicha rather than water, and many women also used chicha for boiling meats and vegetables. It is likely that chicha production occurred regularly at domestic habitation sites in the Moche Valley in the past, for quotidian uses in addition to feasting events. Indeed, chicha would have remained potable longer through the process of boiling, and also would have reduced sickness due to contamination of the water supply. Chicha production would have required a specific set of tasks associated preparation/processing; to brew maize chicha, germinated (i.e., sprouted) maize (*jora*) is dried, ground, mixed with water, and fermented, to create an alcoholic liquid (Cutler and Cardenas 1947; Logan et al. 2012; Nicholson 1960).

Basic Results of the Study Assemblages

This section presents the results of the identification of the carbonized plant remains from the study sites, which form the basis for the quantitative analysis. Each site yielded a range of cultigens, fruits, and other miscellaneous wild plants, some with known economic uses, including as comestibles, fuels, construction materials, medicines, and fodder. Raw counts are provided for each taxon, along with plant weight and wood weight. A list of provenience information for the flotation samples and basic sample measures (volume, plant weight, and wood weight) for each site are provided in Appendix 2. For a detailed reporting of taxon counts and weights for each provenience designation at La Poza, MV-224, MV-225, and MV-225, see Appendix 3-7 (for Galindo, see Lockard 2005:Appendix 8).

La Poza

The 17 La Poza samples total 51.5 L of soil and yielded a total carbonized plant weight of 9.5 g, 8.2 g of which are represented by wood charcoal (Table 4.1). Excluding wood, the La Poza assemblage contains 126 specimens representing 18 taxonomic categories. The archaeobotanical dataset from La Poza witnessed the lowest abundance of overall plant remains, as well as the fewest number of taxa present.

Table 4.1 Counts of plant taxa identified at La Poza.

Soil Volume = 51.5 L
Total Plant Weight = 9.5 g
Total Wood Weight = 8.2 g

Common Name (English)	**Common Name (Spanish)**	**Taxonomic Name**	**Count (n)**
Cultigens			
Chili pepper cf.	*Ají*	*Capsicum* spp. cf.	1
Gourd	*Mate*	*Lagenaria siceraria*	3
Maize cob frag	*Maíz*	*Zea mays*	1
Maize cob frag cf.	*Maíz*	*Zea mays* cf.	9
Maize cupule	*Maíz*	*Zea mays*	5
Maize cupule cf.	*Maíz*	*Zea mays* cf.	10
Maize kernel	*Maíz*	*Zea mays*	10
Maize kernel cf.	*Maíz*	*Zea mays* cf.	3
Fruits			
Avocado	*Palta*	*Persea americana*	2
Golden berry	*Aguaymanto*	*Physalis peruviana*	2
Guava	*Guayaba*	*Psidium* spp.	6
Lucuma	*Lúcuma*	*Pouteria lucuma*	7
Miscellaneous/Wild			
Barrel cactus		*Echinocactus* spp.	1
Grass family		Poaceae	4
Legume family		Fabaceae	4
Legume family cf.		Fabaceae	1
Nightshade family		Solanaceae	1
Shoreline purslane	*Capin*	*Sesuvium* spp.	4
Sunflower family		Asteraceae	1
Tillandsia	*Achupalla*	*Tillandsia* spp.	8
Trianthema	*Trianthema*	*Trianthema* spp.	1
UID			42
UID seed			7

MV-224

The 43 MV-224 samples total 195.3 L of soil and yielded a total carbonized plant weight of 136.5 g, 126.1 g of which are represented by wood charcoal (Table 4.2). Excluding wood, the MV-224 assemblage contains 2,886 specimens representing 36 taxonomic categories. Six ceramic sherds from MV-224 also produced starch grain residues of potato; one of these sherds also produced diagnostic maize starch (Figure 4.4). These sherds all came from different proveniences at the site (Table 4.3).

Table 4.2 Counts of plant taxa identified at MV-224.

Soil Volume = 195.3 L
Total Plant Weight = 135.6 g
Total Wood Weight = 121.6 g

Common Name (English)	Common Name (Spanish)	Taxonomic Name	Count (n)
Cultigens			
Chenopod	*Quinoa*	*Chenopodium quinoa*	27
Chenopod cf.	*Quinoa*	*Chenopodium quinoa* cf.	1
Chili pepper	*Ají*	*Capsicum* spp.	14
Chili pepper cf.	*Ají*	*Capsicum* spp. cf.	2
Common bean	*Frijól*	*Phaseolus vulgaris*	14
Common bean cf.	*Frijól*	*Phaseolus vulgaris* cf.	9
Gourd	*Mate*	*Lagenaria siceraria*	9
Gourd cf.	*Mate*	*Lagenaria siceraria* cf.	3
Legume family (possible domesticated bean)		Fabaceae	18
Lima bean	*Pallar*	*Phaseolus lunatus*	2
Lima bean cf.	*Pallar*	*Phaseolus lunatus* cf.	2
Maize cob frag	*Maíz*	*Zea mays*	86
Maize cob frag cf.	*Maíz*	*Zea mays* cf.	4
Maize cupule	*Maíz*	*Zea mays*	1510
Maize cupule cf.	*Maíz*	*Zea mays* cf.	34
Maize glume	*Maíz*	*Zea mays*	26
Maize glume cf.	*Maíz*	*Zea mays* cf.	7
Maize kernel	*Maíz*	*Zea mays*	493

Common Name (English)	**Common Name (Spanish)**	**Taxonomic Name**	**Count (n)**
Maize kernel cf.	*Maíz*	*Zea mays* cf.	57
Peanut	*Maní*	*Arachis hypogeae*	1
Squash	*Zapallo*	*Cucurbita* spp.	10
Squash cf.	*Zapallo*	*Cucurbita* spp. cf.	1
Fruits			
Avocado	*Palta*	*Persea americana*	11
Elderberry	*Sauco*	*Sambucus peruviana*	1
Golden berry	*Aguaymanto*	*Physalis peruviana*	97
Golden berry cf.	*Aguaymanto*	*Physalis peruviana* cf.	1
Guava	*Guayaba*	*Psidium* spp.	8
Lucuma	*Lúcuma*	*Pouteria lucuma*	19
Pacay	*Pacae*	*Inga feuillei*	11
Passion fruit	*Maracuyá*	*Passiflora* spp.	2
Opuntia	*Tuna*	*Opuntia* spp.	12
Opuntia cf.	*Tuna*	*Opuntia* spp. cf.	1
Miscellaneous/Wild			
Barrel cactus		*Echinocactus* spp.	28
Cactus family		Cactaceae	1
Cheno/am		Chenopodium/amaranthus spp.	7
Grass family		Poaceae	17
Grass family cf.		Poaceae cf.	2
Legume family (all)		Fabaceae	51
Legume family (weedy legume)		Fabaceae	9
Legume family cf.		Fabaceae cf.	2
Lippia	*Oregano*	*Lippia* spp.	2
Mallow family		Malvaceae	13
Mallow family cf.		Malvaceae cf.	1
Mesquite	*Algorrobo*	*Prosopis pallida*	4
Mesquite cf.	*Algorrobo*	*Prosopis pallida* cf.	1
Mesquite/acacia		*Prosopis/Acacia* spp.	1
Milk thistle cf.	*Cardo*	*Silybum* spp. cf.	1
Nightshade family		Solanaceae	2
Purslane	*Verdolago*	*Portulaca* spp.	56
Rattlepod	*Crotalaria*	*Crotalaria* spp.	23
Sapote family		Sapotaceae	1

Common Name (English)	**Common Name (Spanish)**	**Taxonomic Name**	**Count (n)**
Sedge family		Cyperaceae	3
Sedge family cf.		Cyperaceae cf.	1
Sunflower family		Asteraceae	3
Trianthema	*Trianthema*	*Trianthema* spp.	2
Vervain cf.	*Verbena*	*Verbena* spp. cf.	2
Vetch cf.	*Haba*	*Vicia* spp. cf.	2
Wildbean cf.		*Strophostyles helvola*	1
UID			107
UID seed			67

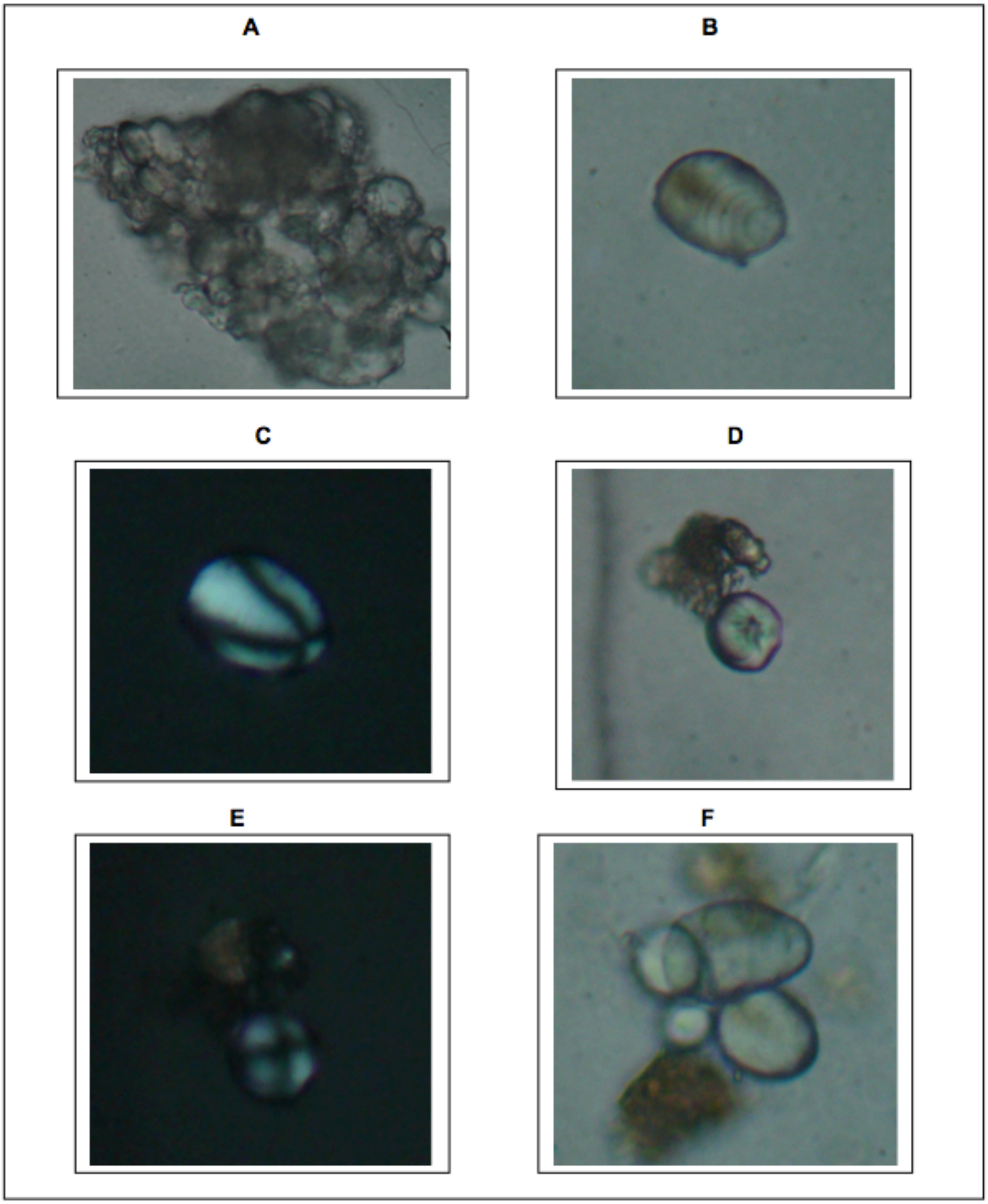

Figure 4.4 Starch grains recovered from ceramic and groundstone artifacts, MV-224 and MV-225.

(A) Gelatinized potato (*Solanum tuberosum*) starch grains from MV-225, Compound 1, Feature 8. Measures 28.6 X 18.2 µm. Image captured with a single-light optical microscope at 400X magnification. (B) Well-preserved potato *Solanum tuberosum* starch grain with visible lamellae from MV-224, Feature 1. Measures 28.6 X 20.8 microns wide µm. Image captured with a single-light optical microscope at 400X magnification. (C) The same grain of the previous potato starch with image captured with polarized light at 400X, displaying the diagnostic central position of the hilum in this species. (D) Maize (*Zea maize*) starch grain of polyhedral shape from MV-225, Compound 6. Feature 51. Measures 18.2 X 15.6 µm. Image captured with a single-light optical microscope at 400X magnification. (E) The same grain of the previous maize starch with image captured with polarized light at 400X, displaying the diagnostic central position of the hilum in this species (F) Potato (*Solanum tuberosum*) starch grains from MV-225, Compound 1, Feature 12. Measures 28.6 X 18.2 µm. Image captured with a single-light optical microscope at 400X magnification.

Table 4.3 Starch grains recovered from ceramic and groundstone materials from MV-224 and MV-225.

Material	Provenience	Taxa Identified	Measurements (µm)
Ceramic	MV-225, PD 1216, FS 1	*Solanum tuberosum*	28.6 x 18.2
			20.8 x 18.2
		Zea mays	18.2 x 18.2
		Unidentified	13.0 x 10.0
Ceramic	MV-225, PD 1751, FS 2	*Solanum tuberosum*	19.5 x 18.2
			28.6 x 23.4
Ceramic	MV-225, PD 1468, FS 10	*Zea mays*	18.2 x 16.9
		Unidentified	20.8 x 13.0
Ceramic	MV-225, PD 1458, FS 1	*Zea mays*	15.6 x 15.6
			18.2 x 15.6
		Solanum tuberosum	26.0 x 15.6
Ceramic	MV-225, PD 1783, FS 1	*Zea mays*	16.9 x 15.6
			18.2 x 15.6
Ceramic	MV-225, PD 1475, FS 1	*Solanum tuberosum*	28.6 x 18.2
			20.8 x 18.2
Ceramic	MV-225, PD 1168, FS 14	*Solanum tuberosum*	26.0 x 20.8
			23.4 x 20.8
		Zea mays	15.6 x 13.0

Material	Provenience	Taxa Identified	Measurements (µm)
Ceramic	MV-225, PD 1093, FS 1	*Solanum tuberosum*	18.2 x 15.6
Ceramic	MV-224, PD 2122, FS13	*Solanum tuberosum*	28.6 x 20.8
			26.0 x 23.4
Ceramic	MV-224, PD 2116, FS 17	*Solanum tuberosum*	20.8 x 15.6
			18.2 x 13.0
		Zea mays	16.9 x 16.9
Ceramic	MV-224, PD 2144, FS 1	*Solanum tuberosum*	18.2 x 15.6
			28.6 x 18.2
Ceramic	MV-224, PD 2123, FS 1	*Solanum tuberosum*	39.0 x 20.8
Ceramic	MV-224, PD 2108, FS 17	*Solanum tuberosum*	26.0 x 20.8
Ceramic	MV-224, PD 2006, FS 2	*Solanum tuberosum*	28.6 x 23.4
Groundstone Mano Fragment	MV225, PD 1211, FS 11	Unidentified	Not measured
		Solanum tuberosum	18.2 x 15.6
			23.4 x 18.2
			23.4 x 15.6
Groundstone Mano Fragment	MV225, PD 1122, FS 17	*Zea mays*	15.6 x 15.6
			16.9 x 14.3
Groundstone Mano Fragment	MV225, PD 1257, FS 19	*Zea mays*	15.6 x 15.6
			15.6 x 15.6
			18.2 x 18.2

MV-225

The 137 MV-225 samples total 654.3 L of soil and yielded a total carbonized plant weight of 548.9 g, 525.6 g of which are represented by wood charcoal (Table 4.4). Excluding wood, the MV-225 assemblage contains 3,980 specimens representing 49 taxonomic categories. The archaeobotanical dataset from MV-225 is the largest dataset examined for this project, in terms of number of samples analyzed as well as total soil volume. Eight ceramic sherds and three groundstone chunga (mano) fragments produced maize and potato starches (see Table 4.3). Six sherds and two chunga fragments had diagnostic maize starches, and six sherds and one chunga fragment had diagnostic potato starches. Two ceramic sherds produced starches that could not be identified. Like the artifacts at MV-224 submitted for residue analysis, these sherds all came from different proveniences at the site (see Table 4.3).

Table 4.4 Counts of plant taxa identified at MV-225.

Soil Volume = 654.3 L
Total Plant Weight = 548.9 g
Total Wood Weight = 526.6 g

Common Name (English)	**Common Name (Spanish)**	**Taxonomic Name**	**Count (n)**
Cultigens			
Chenopod	*Quinoa*	*Chenopodium quinoa*	11
Chenopod cf.	*Quinoa*	*Chenopodium quinoa* cf.	2
Chili pepper	*Ají*	*Capsicum* spp.	22
Chili pepper cf.	*Ají*	*Capsicum* spp. cf.	11
Coca	*Coca*	*Erythroxylum novogranatense* var. Truxillense	1
Common bean	*Frijól*	*Phaseolus vulgaris*	27
Common bean cf.	*Frijól*	*Phaseolus vulgaris* cf.	8
Gourd	*Mate*	*Lagenaria siceraria*	45
Legume family (possible domesticated bean)		Fabaceae	33
Lima bean	*Pallar*	*Phaseolus lunatus*	2
Lima bean cf.	*Pallar*	*Phaseolus lunatus* cf.	2
Maize cob frag	*Maíz*	*Zea mays*	355
Maize cob frag cf.	*Maíz*	*Zea mays* cf.	11
Maize cupule	*Maíz*	*Zea mays*	943
Maize cupule cf.	*Maíz*	*Zea mays* cf.	144

Common Name (English)	Common Name (Spanish)	Taxonomic Name	Count (n)
Maize glume	*Maíz*	*Zea mays*	53
Maize glume cf.	*Maíz*	*Zea mays* cf.	9
Maize kernel	*Maíz*	*Zea mays*	836
Maize kernel cf.	*Maíz*	*Zea mays* cf.	60
Peanut	*Maní*	*Arachis hypogeae*	6
Peanut cf.	*Maní*	*Arachis hypogeae* cf.	7
Squash	*Zapallo*	*Cucurbita* spp.	13
Squash cf.	*Zapallo*	*Cucurbita* spp. cf.	5
Fruits			
Avocado	*Palta*	*Persea americana*	102
Avocado cf.	*Palta*	*Persea americana* cf.	3
Elderberry	*Sauco*	*Sambucus peruviana*	1
Golden berry	*Aguaymanto*	*Physalis peruviana*	6
Golden berry cf.	*Aguaymanto*	*Physalis peruviana* cf.	1
Guava	*Guayaba*	*Psidium* spp.	58
Guava cf.	*Guayaba*	*Psidium* spp. cf.	6
Lucuma	*Lúcuma*	*Pouteria lucuma*	95
Pacay	*Pacae*	*Inga feuillei*	2
Passion fruit	*Maracuyá*	*Passiflora* spp.	1
Miscellaneous/Wild			
Barrel cactus		*Echinocactus* spp.	
Bindweed cf.		*Convulvus* spp. cf.	2
Borage family cf.		Boraginaceae	1
Column cactus cf.		*Cereus* spp. cf.	1
Field madder		*Sherardia arvensis*	1
Grass family		Poaceae	18
Knotweed		*Polygonum* spp.	3
Legume family (all)		Fabaceae	208
Legume family (weedy legume)		Fabaceae	26
Legume family cf.		Fabaceae cf.	17
Lupine	*Tarwi*	*Lupinus* spp.	1
Mallow family		Malvaceae	16
Mesquite	*Algorrobo*	*Prosopis pallida*	9
Mesquite cf.	*Algorrobo*	*Prosopis pallida* cf.	4

Common Name (English)	**Common Name (Spanish)**	**Taxonomic Name**	**Count (n)**
Mustard Family		Brassicaceae	1
Nightshade family		Solanaceae	3
Opuntia	*Tuna*	*Opuntia* spp.	2
Opuntia cf.	*Tuna*	*Opuntia* spp. cf.	2
Panic grass	*Grama*	*Panicum* spp.	1
Plantain		*Plantago* spp.	1
Pondweed		*Potamogeton* spp.	3
Pondweed cf.		*Potamogeton* spp. cf.	1
Prunus cf.		*Prunus* spp. cf.	1
Purslane	*Verdolago*	*Portulaca* spp.	1
Rattlepod	*Crotalaria*	*Crotalaria* spp.	50
Rattlepod cf.	*Crotalaria*	Crotalaria spp. cf.	41
Rose family		Rosaceae	1
Sage	*Salvia*	*Salvia* spp.	1
Saltbush	*Orache*	*Atriplex* spp.	1
Sedge family		Cyperaceae	48
Sida cf.	*Pichana*	*Sida* spp. cf.	1
Sow thistle cf.	*Pichana*	*Sonchus* spp. cf.	2
Spurge		*Euphorbia* spp. cf.	1
Sunflower family		Asteraceae	3
Trianthema	*Trianthema*	*Trianthema* spp.	2
Vervain cf.	*Verbena*	*Verbena* spp. cf.	2
Vetch cf.	*Haba*	*Vicia* spp. cf.	2
Viola cf.	*Viola*	*Viola spp. cf.*	1
UID			392
UID seed			218

MV-83

The 18 MV-83 samples total 22.9 L of soil and yielded a total carbonized plant weight of 18.2 g, 15.1 g of which are represented by wood charcoal (Table 4.5). Excluding wood, the MV-225 assemblage contains 661 specimens representing 24 taxonomic categories.

Table 4.5 Counts of plant taxa identified at MV-83.

Soil Volume = 22.9 L
Total Plant Weight = 18.2 g
Total Wood Weight = 15.1 g

Common Name (English)	**Common Name (Spanish)**	**Taxonomic Name**	**Count (n)**
Cultigens			
Chenopod	*Quinoa*	*Chenopodium quinoa*	1
Cotton	*Algodón*	*Gossypium barbadense*	4
Gourd	*Mate*	*Lagenaria siceraria*	3
Maize cob frag	*Maíz*	*Zea mays*	10
Maize cupule	*Maíz*	*Zea mays*	255
Maize glume	*Maíz*	*Zea mays*	4
Maize kernel	*Maíz*	*Zea mays*	31
Peanut	*Maní*	*Arachis hypogeae*	1
Squash	*Zapallo*	*Cucurbita* spp.	2
Fruits			
Avocado	*Palta*	*Persea americana*	3
Golden berry	*Aguaymanto*	*Physalis peruviana*	14
Guava	*Guayaba*	*Psidium* spp.	3
Lucuma	*Lúcuma*	*Pouteria lucuma*	18
Miscellaneous/Wild			
Amaranth	*Kiwicha*	*Amaranthus* spp.	2
Barrel cactus		Echinocactus spp.	10
Grass family		Poaceae	44
Grass family cf.		Poaceae	2
Legume family (all)		Fabaceae	20
Mallow family		Malvaceae	3
Mesquite	*Algorrobo*	*Prosopis pallida*	5
Nightshade family		Solanaceae	2
Purslane	*Verdolago*	*Portulaca* spp.	4
Rattlepod	*Crotalaria*	*Crotalaria* spp.	5
Rubus		*Rubus* spp.	1
Rubus		*Rubus* spp. cf.	1
Sedge family		Cyperaceae	3

Common Name (English)	Common Name (Spanish)	Taxonomic Name	Count (n)
Sunflower family		Asteraceae	7
Tillandsia	*Achupalla*	*Tillandsia* spp.	2
Trianthema	*Trianthema*	*Trianthema* spp.	6
UID			168
UID seed			27

Galindo

The 10 Galindo samples total 63.8 L of soil and yielded a total carbonized plant weight of 60.9 g, 60.2 g of which are represented by wood charcoal (Table 4.6). Excluding wood, the MV-225 assemblage contains 798 specimens representing 32 taxonomic categories.

Table 4.6 Counts of plant taxa identified at Galindo (adapted from Lockard 2005:Appendix 8).

Soil Volume = 63.8 L
Total Plant Weight = 60.9 g
Total Wood Weight = 60.2 g

Common Name (English)	Common Name (Spanish)	Taxonomic Name	Count (n)
Cultigens			
Chili pepper	*Ají*	*Capsicum* spp.	10
Coca	*Coca*	*Erythroxylum novogranatense* var. Truxillense	4
Common bean	*Frijól*	*Phaseolus vulgaris*	21
Cotton	*Algodón*	*Gossypium barbadense*	52
Cotton cf.	*Algodón*	*Gossypium barbadense* cf.	2
Gourd	*Mate*	*Lagenaria siceraria*	3
Maize cob frag	*Maíz*	*Zea mays*	6
Maize cupule	*Maíz*	*Zea mays*	212
Maize glume	*Maíz*	*Zea mays*	26

Common Name (English)	**Common Name (Spanish)**	**Taxonomic Name**	**Count (n)**
Maize kernel	*Maíz*	*Zea mays*	70
Peanut	*Maní*	*Arachis hypogeae*	3
Squash	*Zapallo*	*Cucurbita* spp.	2
Fruits			
Golden berry	*Aguaymanto*	*Physalis peruviana*	37
Guava	*Guayaba*	*Psidium* spp.	24
Lucuma	*Lúcuma*	*Pouteria lucuma*	7
Miscellaneous/Wild			
Amaranth	*Kiwicha*	*Amaranthus* spp.	51
Cactus family		Cactaceae	3
Feather grass		*Chloris virgata*	44
Fogfruit	*Turre hembra*	*Phyla canescens*	2
Crown grass cf.	*Gramalote*	*Paspalum* spp. cf.	1
Grass family		Poaceae	6
Legume family (all)		Fabaceae	14
Mallow		*Malva* spp.	133
Mesquite	*Algorrobo*	*Prosopis pallida*	40
Mint family cf.		Laminaceae cf.	1
Nightshade family		Solanaceae	4
Plantain		*Plantago* spp.	12
Poppy family		*Papaveraceae*	2
Purslane	*Verdolago*	*Portulaca oleraceae*	3
Ragweed	*Ambrosía*	*Ambrosia* spp.	1
Sandbur	*Pega Pega*	*Cenchrus echinatus*	2
Sedge	*Piri Piri*	*Cyperus farex*	2
Sida	*Pichana*	*Sida* spp.	9
Spurge		*Euphorbia* spp.	3
Sunflower family		Asteraceae	11
Trianthema	*Trianthema*	*Trianthema* spp.	13
Vervain	*Verbena*	*Verbena* spp.	1
UID			327

While there are some similarities in the taxa inventories across the sites, the quantitative analysis in the following section illustrates differences in abundance and contexts of use. However, the species inventories themselves reveal some interesting patterns. Some foods that typically are characterized as quintessentially 'coastal' (e.g., maize, chili peppers) and 'highland' (e.g., lupine/*tarwi*, potatoes, quinoa, vetch) *(sensu* Hodge 1947) are documented at both the local coastal settlement at MV-224 and the highland colony site of MV-225 in the Gallinazo/Early Moche phases. I discuss this pattern with specific attention paid to chenopod in my ubiquity analysis below.

The presence of potato starches on the coastal Gallinazo ceramics from MV-224 is particularly interesting. Potatoes have an iconic 'highland' association (e.g., Graves 2001; Hastorf 2012; National Research Council 1989; Sammells 2010; Towle 1961; Zimmerer 1998); indeed, they are successfully cultivated between 2,000 and 4,000 masl. It is likely that potatoes were not being grown at or adjacent to the MV-224 and MV-225 sites; rather, they may have been transported from the local highlands, possibly by llama caravans in the form in *chuño* (dried potato). The Inka had an elaborate system of storehouses used to provision travelers and soldiers; among the items stocked in storehouses were chuño and other dried foods, including *charqui* (a form of dried llama meat for which jerky is named) (e.g., D'Altroy 2002). Indigenous miners sent to work in the colonial-era mines of Potosí, Bolivia were provisioned with chuño produced elsewhere in the highlands and transported by llama caravans.

The fact that potato starches were recovered on artifacts from both the local coastal settlement (MV-224) and the highland colony site (MV-225) may speak to the nature of interaction between costeño and serrano groups during the Gallinazo/Early Moche phases.

As discussed in Chapter 3, recent household excavations, including at the highland colony of MV-225, have shed new light on the dynamics of highland-coastal contact and interaction during this period (Billman et al. 2004; Briceño and Billman 2007, 2008, 2009; Fariss 2012; Ringberg 2012). As discussed in Chapter 3, recent research has questioned aggressive warfare arguments, suggesting that highland-coastal interaction may have been cooperative/complementary rather than strictly conflicting (Fariss 2012; Ringberg 2012; see also Topic and Topic 1987). Ringberg (2012:271; see also Briceño and Billman 2007) suggests that highland and coastal groups may have established mutually beneficial relationships to exchange food, pottery, labor, and possibly marriage partners.

Highland migrants may have imported foods such as potato from their homeland, as part of ties to social memory and/or to make statements about political and cultural identity (see Abbotts 2011; Marte 2012; Ray 2004). They also exchanged potato with local coastal residents of the Moche Valley (possibly in the form of dried chuño), where it was incorporated into one pot meals. Alternatively, women in intermarried highland-coastal households may have cooked potatoes directly at both residential sites. Regardless, the presence of the potato starches at both sites presents an intriguing possibility for reimagining the ethnic 'highland' affiliation of the potato taxon in middle valley chaupiyunga contact zones.

Quantitative Analysis: Changes in Plant Use through Time

While the raw counts presented above document the range of taxa identified at the study sites, they do not offer much interpretive value in unstandardized form. Raw counts, however, can be used to measure species richness and evenness. I begin my comparative analysis employing these measures.

Species Diversity

As discussed above, species diversity can be examined along two key variables, controlling for sample size: (1) richness, or the number of taxa in a given assemblage, and evenness, or the uniformity of distribution of taxa in an assemblage (Kintigh 1984, 1989). The DIVERS program simulates a large number of assemblages based on the categories and sample size of a given archaeobotanical assemblage and produces expectations that can be compared with actual data. Archaeological assemblages are not directly compared to each other; rather actual diversity values are compared with expected values for the sample, and are plotted against a sample size with a 90% confidence interval. If a value falls above the confidence interval, then it is more diverse than expected, and if a value falls below the confidence interval, then it is less diverse than expected (VanDerwarker 2006:78).

With regards to richness, or the number of taxa (Figure 4.5), of the five sites, only La Poza is as rich as expected. MV-83 falls just on the lower limit of expected richness, but the other three sites fall well below the lower limit, particularly MV-224, the coastal Gallinazo phase settlement. This trend indicates that there are less categories of taxa in the MV-224, MV-225 and Galindo assemblages than would be expected given the size of the assemblages.

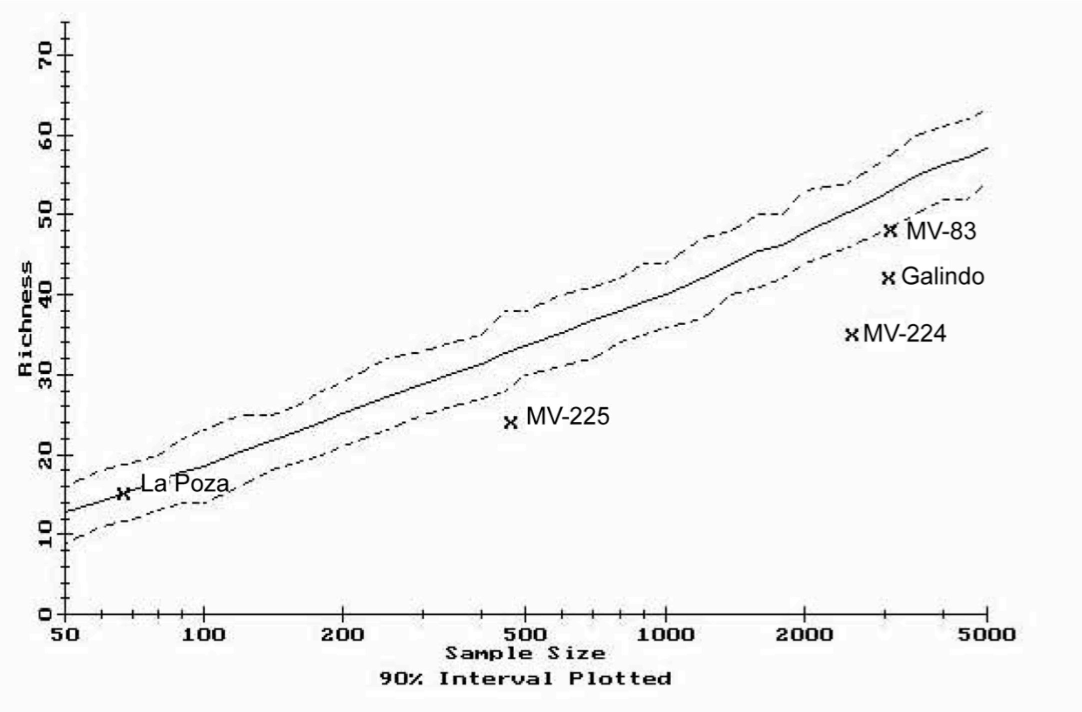

Figure 4.5 DIVERS richness plot of plant remains from the five EIP Moche Valley sites.

With regards to evenness, or the uniformity of distribution of taxa, (Figure 4.6), none of the samples are as even as would be expected given their sample sizes. La Poza and MV-83 are more even than expected, and MV-224, MV-225, and Galindo are less even than expected. These patterns are likely due to the predominance of maize in these sites. It appears that the MV-224, MV-225, and Galindo assemblages are more heavily skewed towards maize than either the Salinar phase La Poza site or the Middle Moche Phase MV-83 site. As I will discuss below, maize intensification appears to have occurred during the Gallinazo/Early Moche phases, in advance of the consolidation and expansion of the Southern Moche polity. The intensification of maize resulted not only in increased maize abundance at these sites, but also is related to potential shifts in processing and preparation for consumption.

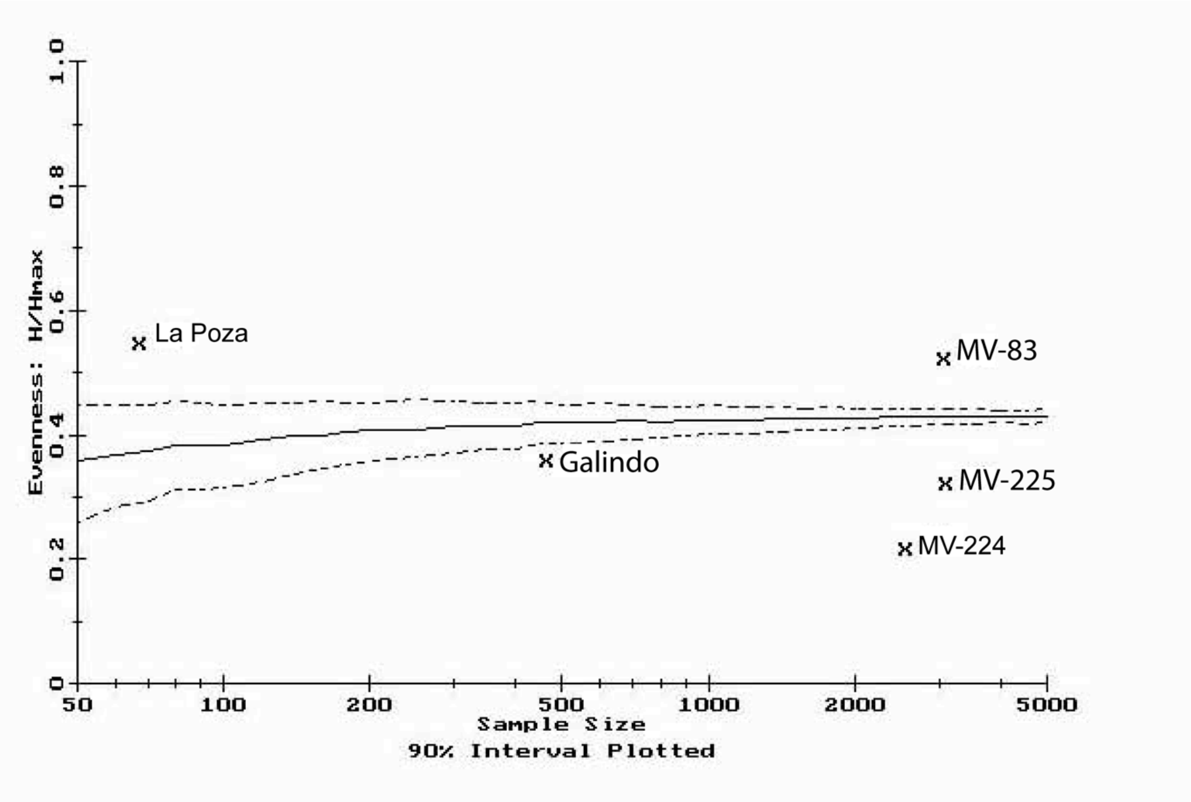

Figure 4.6 DIVERS evenness plot of plant remains from the five EIP Moche Valley sites.

Ubiquity Analysis

As discussed above, ubiquity analysis is a presence/absence analysis that measures the occurrence frequency of a particular taxon in a given number of samples. I calculated ubiquity values for all five sites and ranked resources in descending order by ubiquity values to examine changes through time in the intensity of plant use. I report all ubiquity values for each taxon identified in the five study sites, and I discuss taxa that display interesting trends in more detail.

La Poza ubiquity values (Table 4.7) indicate that maize is the most ubiquitous taxon at that site, present in 41.9 percent of the samples. Other ubiquitous taxa include tillandsia, with 35.3 percent ubiquity, and lucuma, with 23.5 percent ubiquity. The remaining taxa were present in less than 18 percent of the samples. While maize has the highest ubiquity value of the La Poza taxa documented here, its ubiquity is much lower than other middle Moche Valley sites dating to the Gallinazo/Early Moche phases, discussed further below.

Table 4.7 Ubiquity of plant remains at La Poza (cf. identifications not included).

Common Name	Taxonomic Name	Ubiquity (%)
Maize	*Zea mays*	41.2
Tillandsia	*Tillandsia* spp.	35.3
Lucuma	*Pouteria lucuma*	23.5
Cotton	*Gossypium barbadense*	17.6
Gourd	*Lageneria siceraria*	17.6
Grass Family	Poaceae	17.6
Guava	*Psidium* spp.	17.6
Shoreline purslane	*Sesuvium* spp.	17.6
Barrel cactus	*Echinocactus* spp.	11.8
Legume Family (Weedy)	Fabaceae	11.8
Legume Family (All)	Fabaceae	23.5
Sunflower Family	Asteraceae	11.8
Avocado	*Persea americana*	5.9
Nightshade Family	Solanaceae	5.9
Trianthema	*Trianthema* spp.	5.9

MV-224 ubiquity values (Table 4.8) indicate that maize is the most ubiquitous taxon at that site, present in 88.4 percent of the samples. Other ubiquitous taxa include Fabaceae (58.1%), barrel cactus (34.9%), Poaceae (25.6%), rattlepod (23.3%), and quinoa (20.9%). The remaining taxa were present in less than 20 percent of the samples.

Table 4.8 Ubiquity of plant remains at MV-224 (cf. identifications not included).

Common Name	Taxonomic Name	Ubiquity (%)
Maize	*Zea mays*	88.4
Legume family (total)	Fabaceae	58.1
Barrel cactus	*Echinocactus* spp.	34.9
Grass family	Poaceae	25.6
Rattlepod	*Crotalaria* spp.	23.3
Chenopod	*Chenopodium quinoa*	20.9
Chili pepper	*Capsicum* spp.	16.3
Legume family (weedy)	Fabaceae	16.3
Gourd	*Lagenaria siceraria*	16.3
Lucuma	*Pouteria lucuma*	16.3
Legume family (possible domesticated bean)	Fabaceae	14.0
Guava	*Psidium* spp.	14.0
Purslane	*Portulaca* spp.	14.0
Squash	*Cucurbita* spp.	14.0
Golden berry	*Physalis peruvianus*	11.6
Mallow family	Malvaceae	11.6
Opuntia	*Opuntia* spp.	11.6
Avocado	*Persea americana*	9.3
Common bean	*Phaseolus vulgaris*	9.3
Pacay	*Inga feiullei*	9.3
Sunflower family	Asteraceae	7.0
Cheno/am	*Chenopodium/Amaranthus* spp.	7.0
Sedge family	Cyperaceae	7.0
Lima bean	*Phaseolus lunatus*	4.7
Mesquite	*Prosopis pallida*	4.7
Nightshade family	Solanaceae	4.7
Trianthema	*Trianthema* spp.	4.7
Cactus family	Cactaceae	2.3
Elderberry	*Sambucus peruvianus*	2.3
Lippia	*Lippia* spp.	2.3
Mesquite/acacia	*Prosopis/Acacia* spp.	2.3
Passion fruit	*Passiflora* spp.	2.3
Peanut	*Arachis hypogeae*	2.3
Sapote Family	Sapotaceae	2.3

MV-225 ubiquity values (Table 4.9) indicate that maize is the most ubiquitous taxon at that site, present in 94.2% of the samples. Other ubiquitous taxa include Fabaceae (56.2%), followed by avocado (20.4%) and guava (19.7%). The remaining taxa were present in less than 19 percent of the samples.

Table 4.9 Ubiquity of plant remains at MV-225 (cf. identifications not included).

Common Name	Taxonomic Name	Ubiquity (%)
Maize	*Zea mays*	94.2
Legume family (total)	Fabaceae	56.2
Avocado	*Persea americana*	20.4
Guava	*Psidium* spp.	19.7
Rattlepod	*Crotalaria* spp.	16.8
Lucuma	*Pouteria lucuma*	16.1
Sedge family	Cyperaceae	16.1
Chili pepper	*Capsicum* spp.	13.1
Barrel cactus	*Echinocactus* spp.	13.1
Gourd	*Lagenaria siceraria*	12.4
Sunflower	Asteraceae	10.9
Legume family (possible domesticated bean)	Fabaceae	10.9
Grass family	Poaceae	9.5
Common bean	*Phaseolus vulgaris*	8.8
Legume family (weedy)	Fabaceae	8.8
Mallow family	Malvaceae	8.0
Chenopod	*Chenopodium quinoa*	6.6
Squash	*Cucurbita* spp.	6.6
Golden berry	*Physalis peruvianus*	4.4
Mesquite	*Prosopis pallida*	4.4
Peanut	*Arachis hypogeae*	2.9
Knotweed	*Polygonum* spp.	2.2
Nightshade family	Solanaceae	2.2
Lima bean	*Phaseolus lunatus*	1.5
Opuntia	*Opuntia* cf.	1.5
Pacay	*Inga feiullei*	1.5
Bindweed	*Convulvus* spp.	0.7
Coca	*Erythroxylum novogranatense* var. *truxillense*	0.7

Common Name	**Taxonomic Name**	**Ubiquity (%)**
Elderberry	*Sambucus peruvianus*	0.7
Field madder	*Sherardia arvensis*	0.7
Lupine	*Lupinus* spp.	0.7
Panic grass	*Panicum* spp.	0.7
Passion fruit	*Passiflora* spp.	0.7
Plantain	*Plantago* spp.	0.7
Pondweed	*Potamogeton* spp.	0.7
Purslane	*Portulaca* spp.	0.7
Rose family	Rosaceae	0.7
Sage	*Salvia* spp.	0.7
Saltbush	*Atriplex* spp.	0.7
Sida	*Sida* spp.	0.7
Spurge	*Euphorbia* spp.	0.7
Trianthema	*Trianthema* spp.	0.7

MV-83 ubiquity values (Table 4.10) indicate that maize is the most ubiquitous taxon at that site, present in 72.2 percent of the samples. Other ubiquitous taxa include Fabaceae (55.6%), Poaceae (50.0%), lucuma (38.9%), and barrel cactus (33.3%).

Table 4.10 Ubiquity of plant remains at MV-83 (cf. identifications not included).

Common Name	**Taxonomic Name**	**Ubiquity (%)**
Maize	*Zea mays*	72.2
Legume family (total)	Fabaceae	55.6
Grass family	Poaceae	50.0
Lucuma	*Pouteria lucuma*	38.9
Barrel cactus	*Echinocactus* spp.	33.3
Sunflower family	Asteraceae	27.8
Golden berry	*Physalis peruvianus*	27.8
Trianthema	*Trianthema* spp.	22.2
Rattlepod	*Crotalaria* spp.	16.7
Mallow family	Malvaceae	16.7
Purslane	*Portulaca* spp.	16.7
Tillandsia	*Tillandsia* spp.	11.1
Amaranth	*Amaranthus* spp.	11.1
Avocado	*Persea americana*	11.1

Common Name	Taxonomic Name	Ubiquity (%)
Cotton	*Gossypium barbadense*	11.1
Legume family (weedy)	Fabaceae	11.1
Legume family (possible domesticated bean)	Fabaceae	11.1
Sedge family	Cyperaceae	11.1
Nightshade family	Solanaceae	11.1
Squash	*Cucurbita* spp.	11.1
Chenopod	*Chenopodium quinoa*	5.6
Gourd	*Lageneria siceraria*	5.6
Mesquite	*Prosopis pallida*	5.6
Peanut	*Arachis hypogeae*	5.6
Rubus	*Rubus* spp.	5.6
Guava	*Psidium* spp.	1.5

Galindo ubiquity values (Table 4.11) indicate that maize is the most ubiquitous taxon at that site, present in 90 percent of the samples. Other ubiquitous taxa include cotton (80%), common bean (60%), mallow (60%), amaranth (50%), Fabaceae (50%), guava (50%), and golden berry (50%).

Table 4.11 Ubiquity of plant remains at Galindo (cf. identifications not included).

Common Name	Taxonomic Name	Ubiquity (%)
Maize	*Zea mays*	90.0
Cotton	*Gossypium barbadense*	80.0
Common bean	*Phaseolus vulgaris*	60.0
Mallow	Malvaceae	60.0
Amaranth	*Amaranthus* spp.	50.0
Legume family (All)	Fabaceae	50.0
Guava	*Psidium* spp.	50.0
Golden berry	*Physalis peruvianus*	50.0
Grass family	Poaceae	40.0
Trianthema	*Trianthema* spp.	40.0
Chili pepper	*Capsicum* spp.	20.0
Gourd	*Lageneria siceraria*	20.0
Lucuma	*Pouteria lucuma*	20.0

Common Name	Taxonomic Name	Ubiquity (%)
Poppy family	Papaveraceae	20.0
Purslane	*Portulaca* spp.	20.0
Spurge	*Euphorbia* spp.	20.0
Sunflower family	Asteraceae	20.0
Cactus family	Cactaceae	10.0
Coca	*Erythroxylum novogranatense* var. Truxillense	10.0
Feather grass	*Chloris virgata*	10.0
Fogfruit	*Phyla canescens*	10.0
Nightshade family	Solanaceae	10.0
Peanut	*Arachis hypogeae*	10.0
Plantain	*Plantago* spp.	10.0
Ragweed	*Ambrosia* spp.	10.0
Sandbur	*Cenchrus echinatus*	10.0
Sedge	*Cyperus farex*	10.0
Sida	*Sida* spp.	10.0
Squash	*Cucurbita* spp.	10.0
Vervain	*Verbena* spp.	10.0

A few interesting trends emerge from the assessment of ubiquity values. The ubiquity values indicate the importance of maize at these EIP Moche Valley sites. Six-row, 8-row, and 10-row cob types were identified in some of the different assemblages (see Appendix 5-6), indicating that at least three different varieties of maize were grown near to or adjacent to the study sites[18]. Maize is present in all five assemblages in the form of kernels, cobs, cupules, and glumes, discussed further below. Across all five sites, maize is the most ubiquitous taxon. As ubiquity addresses occurrence frequency and not abundance, the higher ubiquity values for maize relative to other plant resources indicate that maize was processed and prepared more regularly and in a wider variety of site locales than other plant resources. This trend is unsurprising, as maize requires more processing than other plant

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[18] A quantification of maize row numbers was not conducted for this dissertation; however, such an analysis could be conducted in future research to shed light on potential changes in maize varieties during the period of intensification in the EIP.

resources that are consumed whole. The recovery of all parts of the plant (kernels, cobs, cupules, glumes) indicates a close relationship between planting, harvesting, processing, and consumption of this plant. The importance of maize in different contexts across these five sites is clear, but this importance does shift through time.

A comparative assessment of maize ubiquity values (Figure 4.7) reveals a dramatic increase from 41.5 percent ubiquity at the Salinar phase La Poza site to 88.4 percent at MV-224 and 94.2 percent at MV225 in the Gallinazo/Early Moche phases. Maize ubiquity drops to 72.2 percent at MV-83 in the Middle Moche phase, and is witnessed in high ubiquity again at Galindo in the Late Moche phase at 90 percent (although Galindo is represented by the smallest number of samples, an issue I discuss below). These trends in maize ubiquity values suggest changes in context of use of maize throughout the EIP. While processed and prepared less regularly at La Poza during the Salinar phase, maize was used broadly in domestic contexts in the Gallinazo/Early Moche phases at MV-224 and MV-226. Maize use becomes slightly more restricted in use during the Middle Moche phase at MV-83, and then is used broadly again during Late Moche phase at Galindo. While these trends may simply reflect differences in the types of contexts from which flotation samples were collected, these trends also may relate to changes in overall maize abundance (although not necessarily), as well as shifts in the spatial organization of where maize was processed and prepared.

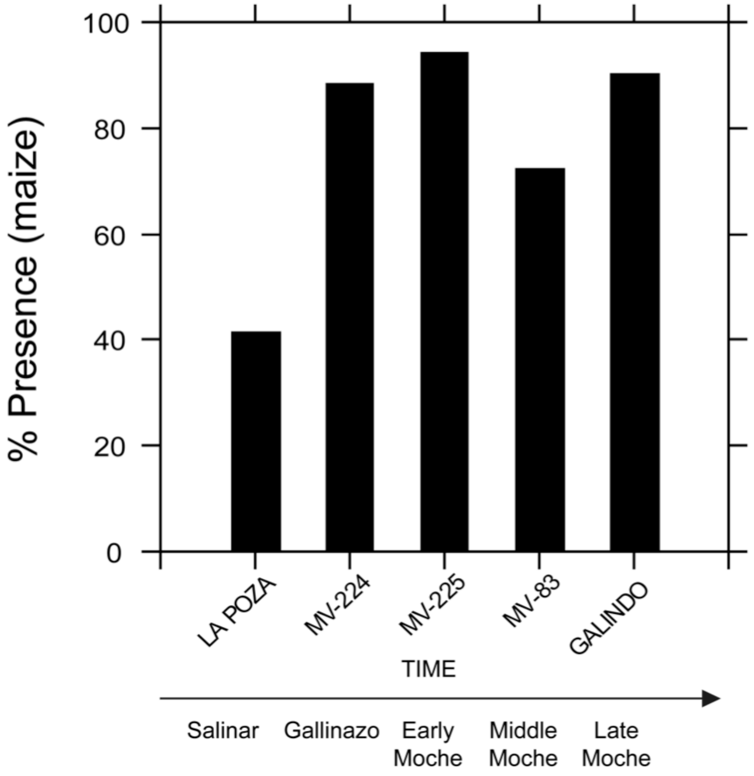

Figure 4.7 Maize ubiquity (% presence) through time.

Alongside maize, similar shifts in ubiquity values are noted for members of the Fabaceae family. Some members of the Fabaceae family present in the five Moche Valley assemblages could be identified to the genus or species level, including domesticated legumes (common beans, lima beans, and peanuts), along with a number of weedy legumes. However, some remains only could be identified to the family level if they lacked clear diagnostic attributes to aid in more specific identification. For example, common beans and peanuts share many of the same attributes; if an attachment scar was not present, then it was impossible to determine the difference between these two taxa. As the common bean and peanut represent different genera, these specimens were recorded as "Fabaceae," although noted as probable domesticated beans.

Domesticated Fabaceae, including common beans, lima beans, and peanuts, have low ubiquity values across the study sites (see Tables 4.7-4.11), likely due to preservation bias. As beans are consumed in their entirety after cooking, they are less likely to appear in archaeological assemblages than plant foods that require processing (e.g., maize). Indeed, no clear domesticated beans were identified in the La Poza or MV-83 assemblages (although members of the Fabaceae family were identified). A number of partial or complete domesticated bean fragments were present in the MV-224, MV-225, and MV-83 assemblages; in addition, some specimens that could only be classified to the family level of Fabaceae likely represent domesticated forms, but lacked diagnostics to distinguish between common bean, peanut, and pacay.

However, the lack of domesticated beans at La Poza and MV-83, when considered in relation to overall Fabaceae presence, may have some implication for cropping strategies. If we group all of the Fabaceae for each assemblage together (a category that comprises domesticated legumes, probable domesticated legumes, and weedy legumes) and chart ubiquity values through time (Figure 4.8), we see an increase from 23.5 percent ubiquity at La Poza to 58.1 percent at MV-224. This ubiquity trend remains fairly consistent across the remaining three study sites through time, with Fabaceae ubiquity values of 56.2 percent, 55.6 percent, and 50 percent for MV-225, MV-83, and Galindo, respectively. I interpret these trends along two lines, suggesting that the increases in Fabaceae may represent (1) increased collection/incidental intrusion of weedy leguminous taxa that grow in and along fields as maize production increased, and (2) possible intercropping of maize and beans. As discussed above, intercropping *Phaseolus* beans (*P. vulgaris* and *P. lunatus*) with maize would have provided benefits to both plants; nitrogen fixation from beans benefits maize plants, and beans benefit from having the maize stalks to climb during growth (Giller 2001; Lentz 2000; Smartt 1988).

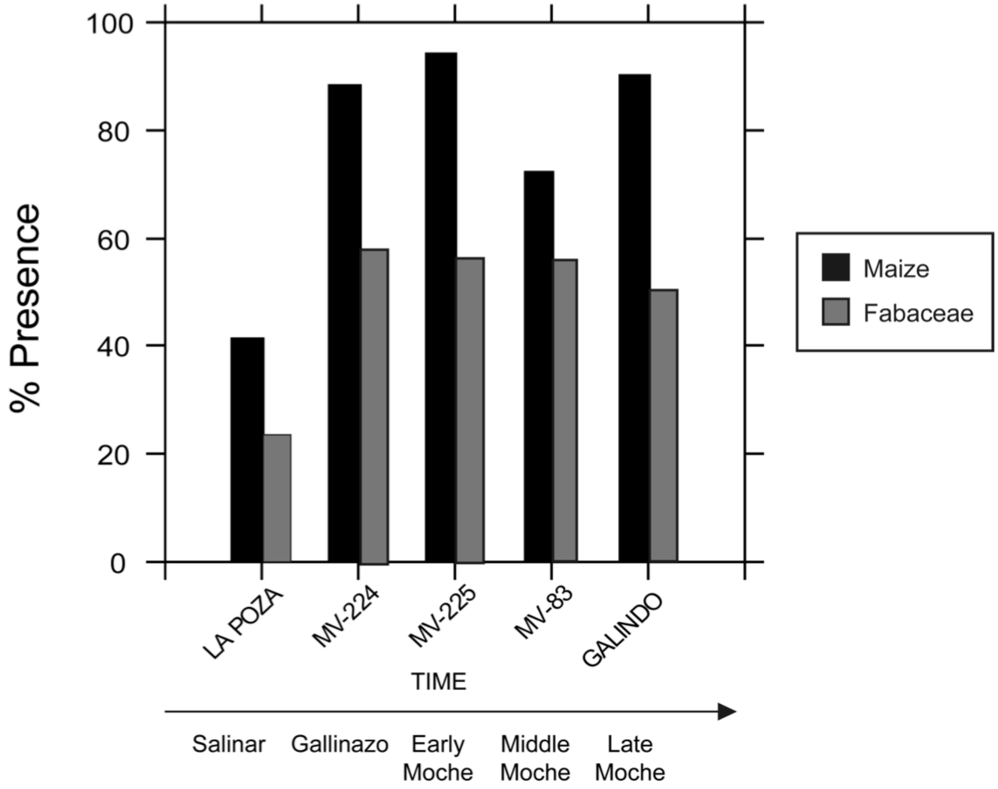

Figure 4.8 Maize and Fabaceae (Legume family) ubiquity (% presence) through time.

Trends in chenopod ubiquity are interesting as well. As discussed above, chenopod is an iconic 'highland' crop, often cultivated in high elevation, semi-arid regions with potato, other Andean tubers, and lupine (*tarwi*) (Bruno 2006; Bruno and Whitehead 2003; Pearsall 2008). No chenopods were documented at the Salinar phase La Poza site or at the Late Moche phase Galindo site, but chenopods were documented at MV-224, MV-225, and MV-83. While chenopod ubiquity is low at all three of those sites, chenopods actually have a much higher ubiquity at MV-224 (20.9%), compared to MV-225 (6.6%) and MV-83 (5.6%).

Chenopods can be cultivated from sea level up to 4,000 masl, and in this study their use is much more widespread at the coastal MV-224 site than it is at the highland colony site of MV-225 (or the Middle Moche MV-83 site). This pattern gives us pause to reconsider rigid taxonomic distinctions that give a taxon like chenopod a quintessential 'highland' identity in cuisine (like the potato discussed above); rather, interaction, melding, and movement between the coast and highlands, which likely involved the exchange of resources as well as knowledge of plant cultivation strategies, contributed to the formation of middle valley chaupiyunga cuisines. Furthermore, as foodways often are divided by social status, identity/ethnicity, or context, it seems problematic to attribute such a singular identity category as 'highland' to a particular food taxon.

Another taxon of note is cotton. While ubiquity values for cotton are low at La Poza (17.6%) and MV-83 (11.1%), no cotton seeds were recovered in the MV-224 and MV-225 assemblages. In contrast, cotton seeds have a very high ubiquity value (80%) in the Galindo samples. This trend is noteworthy in that it sheds light on practices related to an important economic activity, spinning and weaving. The fact that no cotton seeds were recovered in either the MV-224 or MV-225 assemblages indicates that cotton fiber textile production may not have been practiced widely at these sites. This issue may be a result of preservation bias, as cotton seeds may be less likely to enter fires than food taxa; however, carbonized cotton seeds were recovered in the other middle valley assemblages (MV-83 and Galindo), including in very high ubiquity at Galindo.

Ringberg (2012:132) reports the presence of ceramic disk spindle whorls known as *torteros* (disk-shaped) and *piruros* (bead or cylinder-shaped) in patio spaces at MV-225, suggesting that women, or possible children and elderly of both genders, used open, well-lit patio spaces for spinning and weaving. Although the sample size of torteros at MV-225 was small, ethnographic evidence suggests that large tortero whorls were used on the Peruvian north coast to ply heavier fibers (such as camelid fibers) into rope or twine (Vreeland 1986:382). Wooden spindle whorls may have been used for this purpose as well (for documentation of wooden whorls in the Andes, see Bird 1979; Conlee 2003; Frame 1983; Goodell 1969; Vreeland 1986). The lack of cotton seeds in the archaeobotanical assemblage at MV-225 (as well as MV-224) may indicate that camelid fiber spinning took precedence over cotton fiber spinning during the Gallinazo/Early Moche phases. Indeed, the highland occupants of MV-225 houses and tended camelids, a tradition that continued at MV-83 and Galindo.

Amber VanDerwarker (see Billman et al. 2000) found that camelids were the main source of meat at MV-83, and that households processed the whole animal for consumption, in contrast to obtaining dried meat (*charqui*) or leg meat. These animals were likely used for their wool in addition to meat. The presence of camelids at these middle valley sites also challenges long-standing typologies that categorize such as animals as exclusively 'highland' in nature (see Shimada and Shimada 1985)—as the local costeño occupants of MV-224 appear to have interacted and likely intermarried and cohabitated with serrano colonists, they likely bred and herded camelids as well for wool and meat. Future analyses of faunal assemblages from MV-224 and MV-225 will likely clarify the nature of these dynamics.

With respect to ubiquity overall, Galindo witnessed a greater range of taxa that are highly ubiquitous in the assemblage as compared to the other assemblages, which are dominated by five or less taxa. However, the Galindo archaeobotanical dataset is made up of only ten samples. While this sample number meets Hubbard's (1976:160) minimum threshold for ubiquity calculation (discussed above), having fewer samples more severely skews frequency scores of rare taxa. As a result, I interpret rare taxa ubiquity values with caution. I will use the taxon of coca as an example. Coca is a special use taxon; it is neither ubiquitous nor abundant in the Moche Valley samples. Indeed, only one coca seed was recovered in the MV-225 assemblage, and four coca seeds total were recovered from the Galindo assemblage (all from a hearth that Lockard [2005, 2013] interprets as high status). The paucity of coca in these deposits likely is related to preservation biases. Coca leaves are chewed raw (often with a catalyzing agent, such as *cal*, or quicklime), and stems and seeds are separated before the *bola*, or wad of leaves, is placed in the mouth for chewing. In the of context quotidian routines, coca chewing likely would have been done along walks to agricultural fields or when laboring in fields, to provide energy and to act as an appetite suppressant. Coca seeds are therefore unlikely to be burned and dropped in cooking fires and therefore are less likely to leave behind carbonized remains at domestic habitation sites.

It is likely that the residents of these Moche Valley sites grew and consumed coca, particularly the residents of the Middle Valley sites; indeed, the middle valley sites are located within primary production zones for coca for the valley determined by agro-ecological zonation models (Fariss 2012:149; see also Riesco 1995). While conducting research for this dissertation in the Moche Valley, I frequently noticed the presence of coca in family smallholdings and community gardens throughout the middle valley (this modern presence is also documented in the upper Moche valley; see Boswell 2016). In their analysis of oral health indicators and phytoliths from dental calculus, Gagnon et al. (2013) argue that coca use decreased among the coastal skeletal population buried at Cerro Oreja from the

Salinar to Gallinazo phases; they attribute this pattern to the occupation of the coca-growing regions of the Moche Valley by highlanders during the Gallinazo phase. Ethnohistorical research has documented that control of limited coca fields was an important source of wealth and a site of conflict between coastal and highland groups in this region (Netherly 1988; Rostworowski 1988), dynamics Billman (1996) argues extended deeper into the past (see also Dillehay 1979). It would be intriguing to compare the coastal skeletal population at Cerro Oreja to an EIP highland burial population to test this hypothesis (unfortunately, such data are currently unavailable, an issue I discuss further in Chapter 5). Regardless, coca probably was an important resource consumed by residents of the Moche Valley during the Gallinazo/Early Moche phases, including highland colonists; the fact that coca is unlikely to be preserved in carbonized form appears to be the reason for its paucity in the Moche Valley samples. Returning to the ubiquity problem noted above, the single coca seed recovered at MV-225 out of 143 samples produced a ubiquity value of 0.7 percent, whereas the four coca seeds recovered at Galindo out of 10 samples produced a ubiquity value of 10 percent. Represented by one and four specimens at MV-225 and Galindo, respectively, it cannot be said that coca was truly more abundant or used more widely at Galindo than MV-225, although ubiquity values might cause a reader to infer otherwise.

In summary, a basic assessment of the plant assemblages from the five Moche Valley sites reveals some broad similarities in (1) the types of plants collected and produced; and (2) the importance of maize relative to other taxa at the sites. Despite these similarities, however, quantitative analysis reveals significant differences in terms of the standardized counts of different plant food categories, differences that allow us to offer insight into the nature of subsistence shifts related to maize and other cultigen intensification.

Exploratory Data Analysis

To further explore changes in plant use through time, I turn to an exploratory data analysis using box plots to assess statistical difference between the five Moche Valley assemblages. As discussed above, if the notched areas of any of the boxes (denoted by the hourglass shape and representing the 95 percent confidence intervals) do not overlap, then the distributions are significantly different at the 0.05 level. Outliers are depicted as asterisks and far outliers as open circles. In some cases, distributions of smaller sample sizes will cause notched boxes to overextend and then fold back on themselves. All plots are logarithmically transformed.

I initially began my analysis by comparing densities (i.e., taxa counts divided by soil volume) of maize, other cultigens, fruits, and miscellaneous/wild resources across the five different sites. What I found was that every single plant category was represented in greater density at MV-83 than at the other sites. I therefore calculated total plant density, finding that there was a significant difference in the overall density of plant remains between MV-83 and the other study sites (Figure 4.9). This pattern may reflect several things: better plant preservation, a change in the manner of plant deposition, a difference in disposal patterns, a reflection of higher settlement population in the areas sampled at MV-83 compared to the other study sites, etc. What is clear, however, is that density measures cannot speak to differences in plant diet/use in this particular comparison.

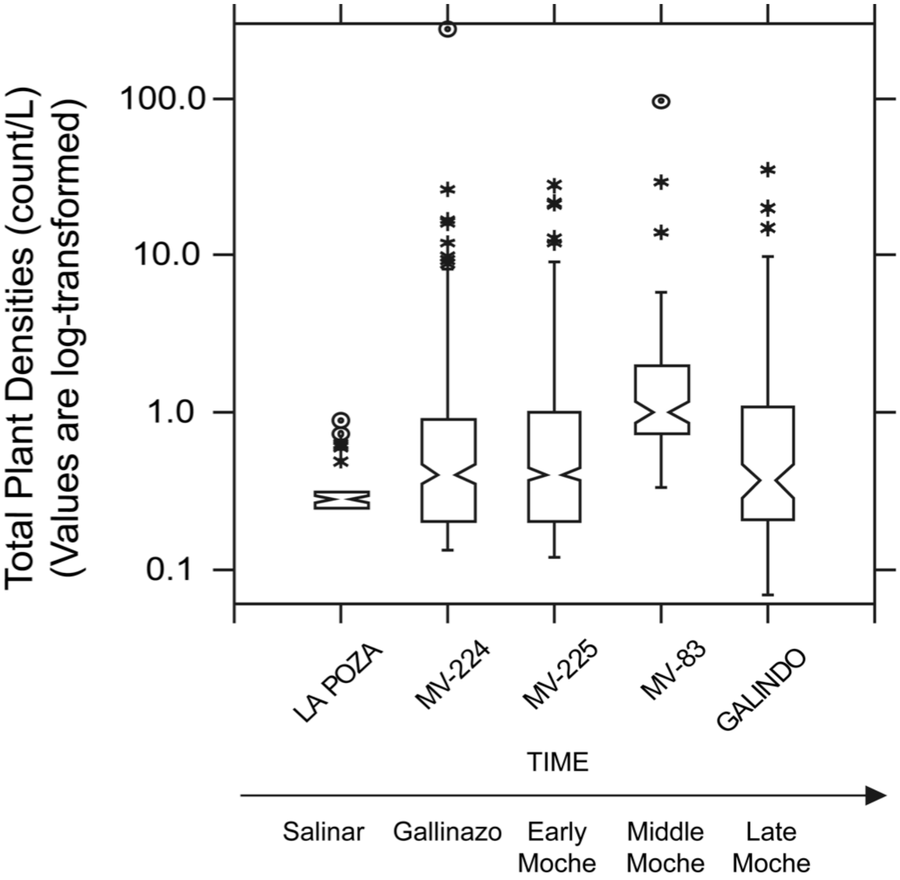

Figure 4.9 Box plot comparison of total plant density (counts/soil volume) for the five EIP study sites.

I thus consider other measures of abundance for comparing plant collection and production across the study sites. To this end, I standardize by plant weight to create standardized counts (taxon counts/plant weight per sample). As discussed above, standardizing by plant weight provides a useful alternative to density measures, because standardizing by soil volume does not control for the range of non-plant related activities that contribute to the deposits from which soil samples derive. Unlike the density measure, standardizing by plant weight considers the contribution of a specific plant (or category of plants) solely in terms of plant-related activities, and often more accurately reflects spatial or temporal differences in plant use.

I begin my comparisons using standardized counts with an examination of maize use across the study sites, with a separate consideration of maize kernels, cupules, glumes, and total maize remains. I follow this examination with a comparison of standardized counts of other field cultigens, fruits, and miscellaneous/wild resources. An understanding of changes in maize production requires a consideration of changes that occurred (or did not occur) in the entire plant subsistence system, and thus I explore trends in the collection and production of all plant food categories through time.

I first calculated standardized counts of maize kernels, which are the portions of the plant destined for consumption (Figure 4.10). These box plots reveal that standardized counts of kernels are significantly higher at the Gallinazo-phase MV-224 site than at the Salinar-phase La Poza site. Standardized kernel counts at the highland Gallinazo/Early Moche MV-225 site drop in comparison, but remain consistent with kernels at the Middle Moche phase MV-83 site and the Late Moche Galindo site, which are still significantly higher than La Poza.

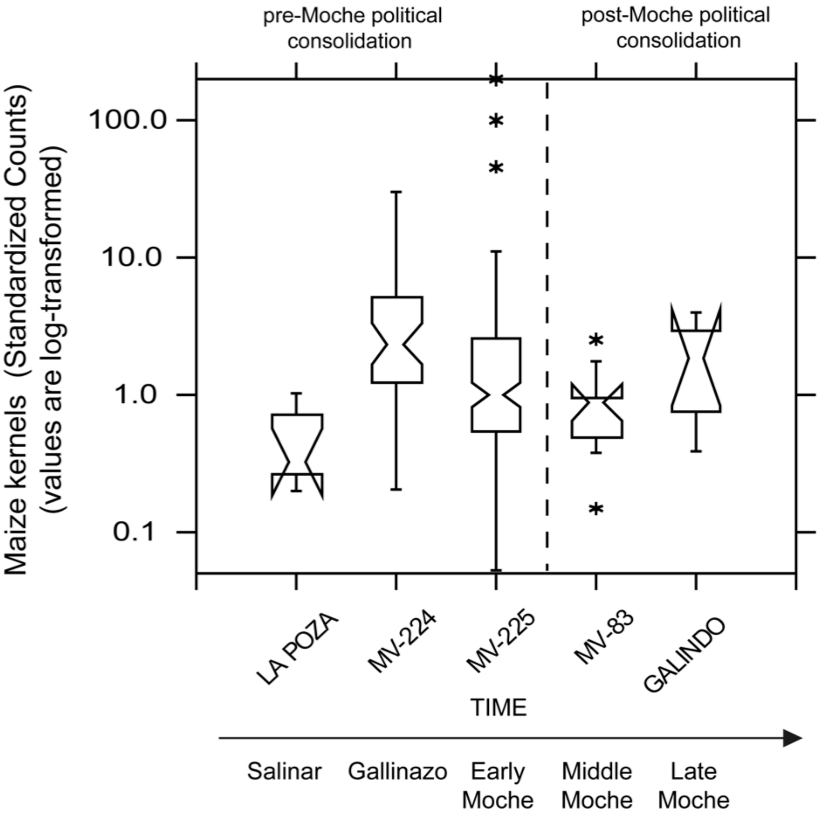

Figure 4.10 Box plot comparison of standardized counts of maize kernels (counts/plant weight) for the five EIP study sites.

Standardized counts of maize cupules (Figure 4.11), which represent processing discard, reveal a significant difference from the preceding Salinar phase through the Gallinazo phase, well in advance of the Moche political expansion. The La Poza maize cupule standardized counts overlap slightly with the MV-83 distribution, but do not overlap with those witnessed at Galindo. Overall, similar processing levels were maintained after polity consolidation, after a dramatic increase from the Salinar to Gallinazo phases.

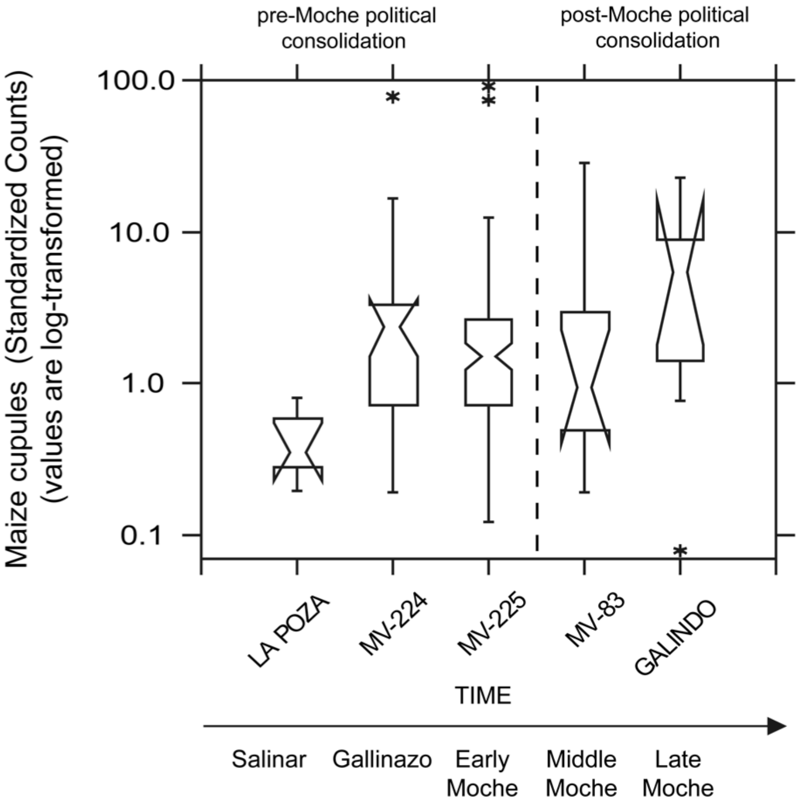

Figure 4.11 Box plot comparison of standardized counts of maize cupules (counts/plant weight) for the five EIP study sites.

Standardized counts of maize glumes, or maize embryos, reveal a further interesting pattern (Figure 4.12). Glumes are another form of processing discard; glumes will become separated from kernels when maize is ground in preparation for boiling (in the form of soups, stews, and gruel) or when germinated maize (*jora*) is ground to make chicha. *No* glumes were recovered at La Poza, and MV-224 and MV-225 witness significantly higher standardized counts of glumes than MV-83.

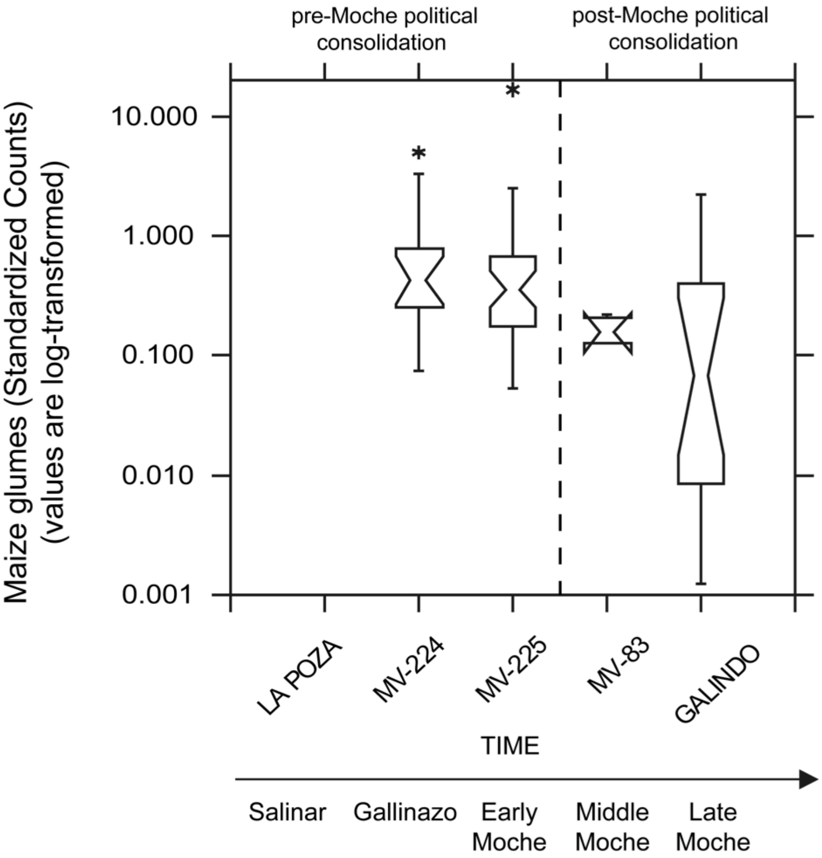

Figure 4.12 Box plot comparison of standardized counts of maize glumes (counts/plant weight) for the five EIP study sites.

Standardized counts of the total amount of maize recovered from each site, including kernels, cupules, and glumes, lends further insight into the nature of increased maize production during the EIP (Figure 4.13). While a significant increase in maize abundance occurs from the Salinar and Gallinazo phase transition, this maize increase occurs *before* the Southern Moche polity consolidated. Residents of the local coastal and highland colony settlements of MV-224 and MV-225, respectively, appear to have engaged in similar levels of maize production, levels that remain consistent with those witnessed in the Middle and Late Moche periods at MV-83 and Galindo, respectively. There may have been shifts in how maize was prepared (for one pot meals as well as chicha); how it flowed in and out of sites for tribute purposes; or how it was consumed at community events (discussed further below); but Moche Valley site residents appear to have been engaged in intensive maize cultivation prior to regional political consolidation.

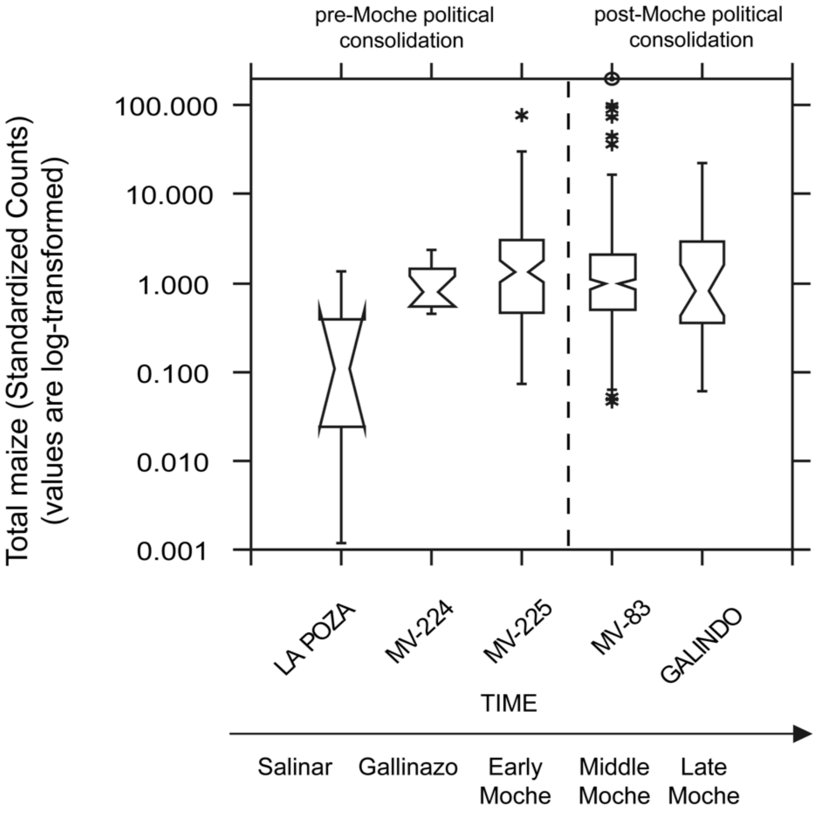

Figure 4.13 Box plot comparison of standardized counts of total maize remains (counts/plant weight) for the five EIP study sites.

A consideration of all cultigens produced at these sites (Figure 4.14), which include chili pepper, coca, common bean, cotton, gourd, lima bean, peanut, quinoa, and squash, reveals that higher levels of cultigen production took place at the Gallinazo/Early Moche MV-224 and MV-225 sites than in either the preceding Salinar phase *or* the Middle Moche phase, when the polity had consolidated. Cultigen levels witnessed at Galindo are comparable to those at the Gallinazo/Early Moche phase MV-224 and MV-225 sites.

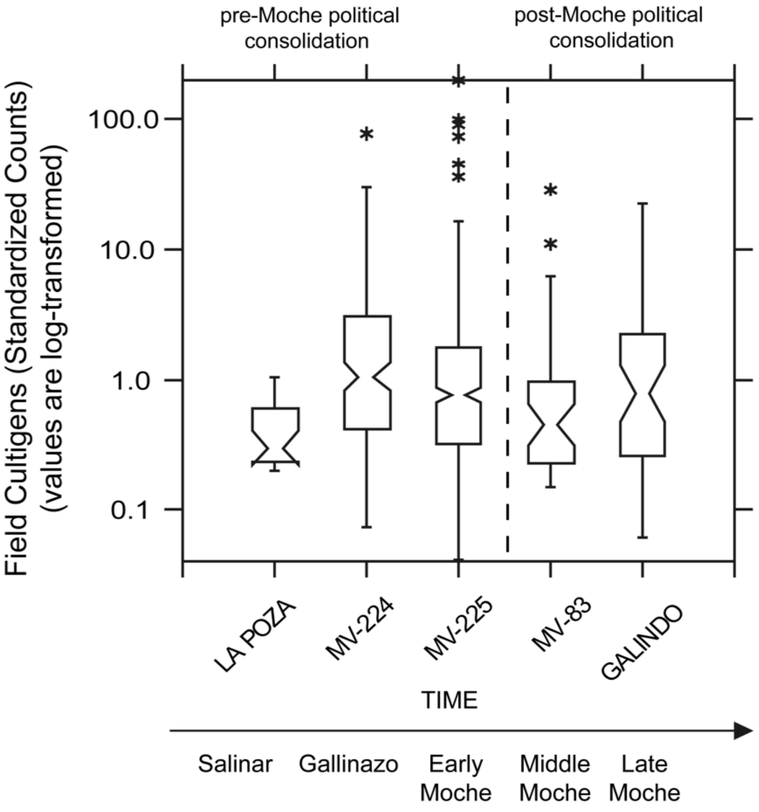

Figure 4.14 Box plot comparison of standardized counts of all cultigens (counts/plant weight) for the five EIP study sites.

It is clear that maize dominated the field production systems at these study sites; if we consider field cultigens other than maize (Figure 4.15), we see significantly higher standardized counts of cultigens at the Gallinazo-phase MV-224 site than at the Salinar-phase La Poza site. Cultigen levels decrease at MV-225 and remain consistent at MV-83, and then rise again at Galindo in the Late Moche phase (but not significantly).

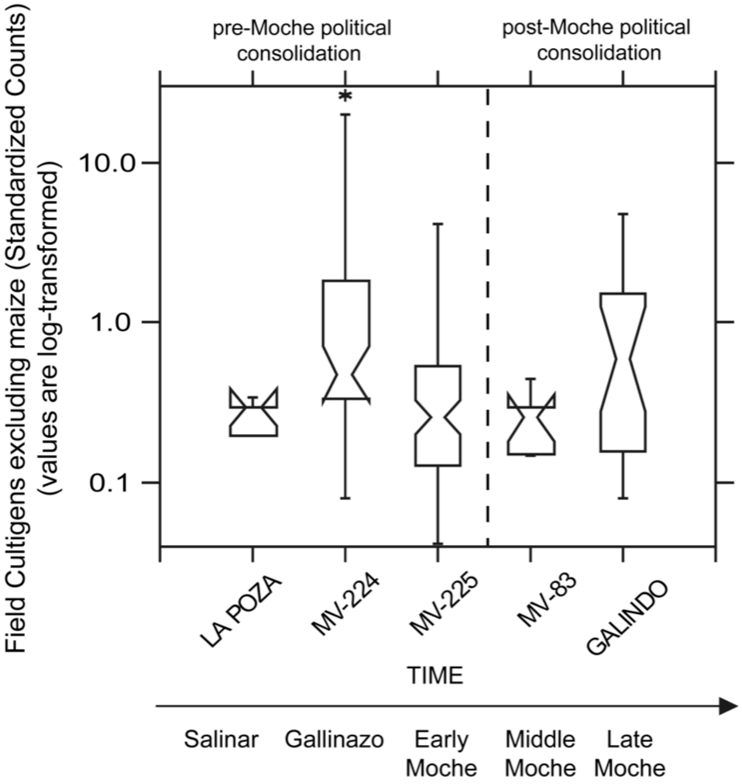

Figure 4.15 Box plot comparison of standardized counts of field cultigens excluding maize (counts/plant weight) for the five EIP study sites.

It is interesting that the coastal MV-224 site residents appear to have grown a more diverse range of field cultigens than the highland MV-225 site residents. Scholars (e.g., Billman 1996; Fariss 2012; Ringberg 2012) have hypothesized that highland migrants moved into the middle Moche valley during the Gallinazo/Early Moche phases to take advantage of prime maize growing zones; while the highland residents of MV-225 did grow a range of other cultigens (chili pepper, coca, common bean, cotton, gourd, lima bean, peanut, quinoa, and squash), they did appear to have privileged maize over these other cultigens. While standardized counts of cultigens excluding maize are significantly lower at MV-225 and MV-83 compared to MV-224, levels are comparable between Galindo and MV-224. As discussed in Chapter 3, Pozorski (1979:177) suggests that the production of maize was emphasized at the expense of other cultigens at Galindo; however, while the ubiquity of maize is much higher at Galindo than the ubiquity of squash and gourds (see Table 4.11.), an evaluation of standardized counts reveals high levels of other field cultigens besides maize at Galindo. Maize likely was processed and prepared more regularly and in a wider variety of site locales at Galindo than other plant resources, but other field cultigens did remain important during the Late Moche period.

Turning to a comparison of standardized counts of fruits (Figure 4.16), including tree crops (avocado, guava, lucuma, pacay) and other fruits (cactus fruits, elderberry, golden berry, passion fruit, and wild plum/cherry), we see comparable levels across all five sites. Thus, when Moche Valley residents intensified cultigen production in the Gallinazo/Early Moche phases, they continued to rely on fruit tree management and fruit collection. This consideration of standardized counts of fruits from systematically collected soil samples counters Pozorski's (1979:176) argument that fruits decreased in importance during the Moche period.

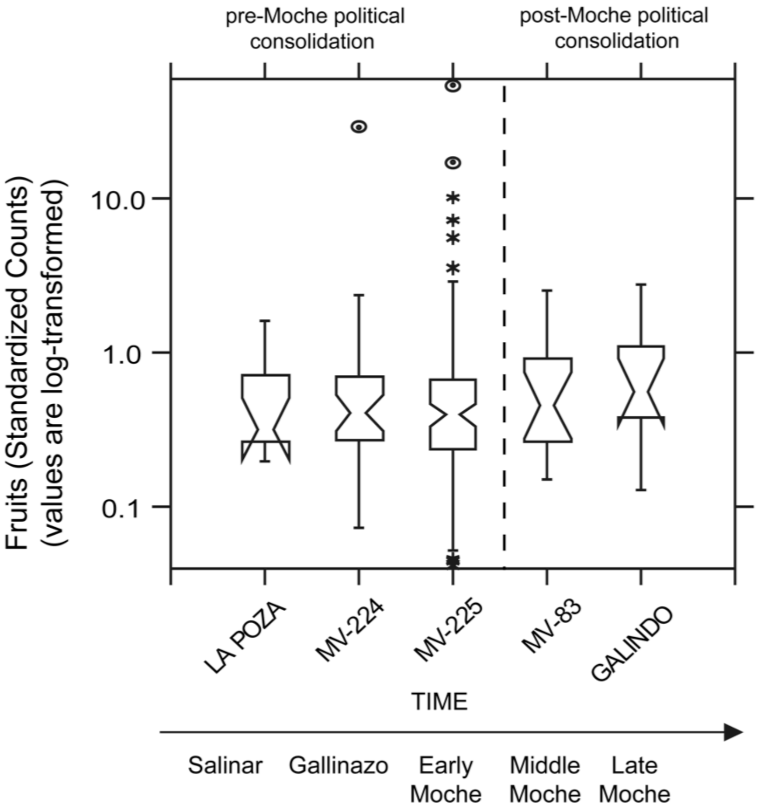

Figure 4.16 Box plot comparison of standardized counts of fruits (counts/plant weight) for the five EIP study sites.

On-farm tree planting would have served as a mean of diversifying farming systems while intensifying cultigen production. As summarized by VanDerwarker (2005, 2006), models of shifting cultivation and tree management, including those proposed by Killion (1987, 1990, 1992) and Peters (2000), suggest that as people invested more time and labor into farming annuals, they also invested more energy in caring for economically useful trees. As a result, we might expect that evidence for an increasing dependence on maize should be accompanied by an increase in the proportion of tree fruits in the diet. This hypothesis is not supported by the plant data from the five sites; a box plot comparison of the standardized counts of tree crops (avocado, guava, lucuma, pacay) (Figure 4.17) displays the same pattern as total fruits (see Figure 4.16).

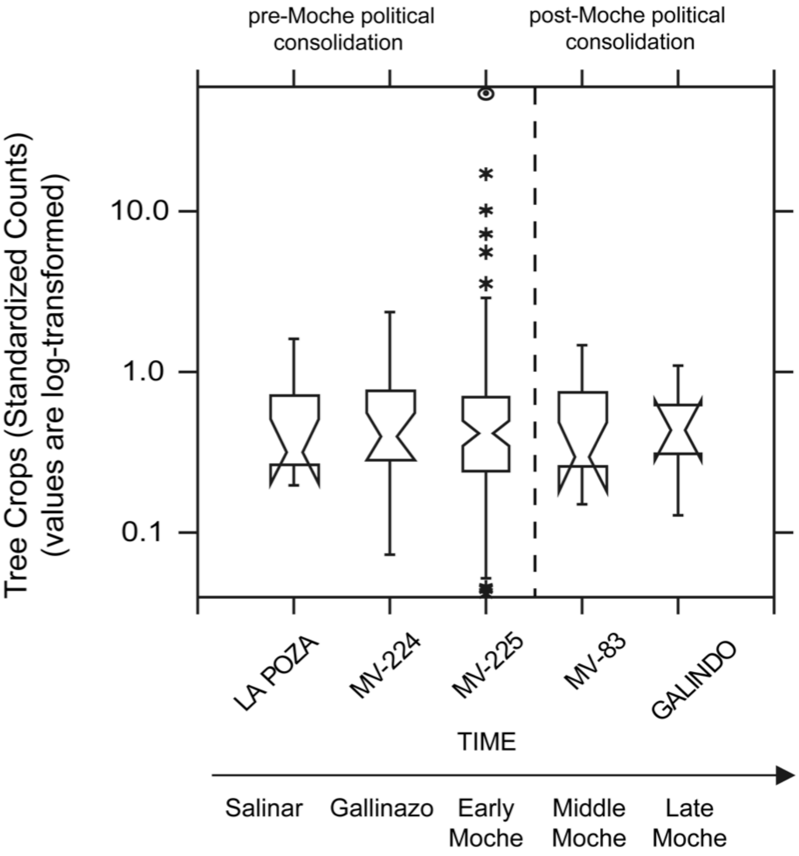

Figure 4.17 Box plot comparison of standardized counts of tree crops (counts/plant weight) for the five EIP study sites.

The box plots of standardized counts to not suggest a relative increase; however, Moche Valley residents appear to have maintained their reliance on fruit trees regardless of changes in production—cultigen intensification does not occur as a trade off with fruit trees. To explore this issue further, I aggregated data into categories of tree crops and field crops, dividing the sum of counts of tree crops (avocado, lucuma, and pacay) by the sum of counts of field crops (chili pepper, coca, common bean, cotton, gourd, lima bean, peanut, quinoa, and squash) to calculate a ratio of tree crops to field crops for each of the five study sites. I display these ratios as dot charts, which reveal a dramatic decrease through time (Figure 4.18). La Poza has a substantially higher ratio of tree crops : field crops compared to the other sites. As demonstrated above, maize and other cultigen production intensified during the Gallinazo phase. In the preceding Salinar phase at La Poza, fruits appear to have been more important relative to field cultigens, particularly compared to the other sites. Indeed, MV-224 has the lowest ratio of tree crops : field crops of the five sites. However, as discussed above, tree crops remain in the diet during the Gallinazo through Late Moche Phases, with similar standardized counts across the five assemblages (see Figure 4.17.). Fruit trees, including avocado, lucuma, and pacay trees, likely were cultivated along the edges of fields and canals at these sites. These tree crops would have required careful husbandry, including pruning, manuring, and periodic defoliating to sustain seasonal rhythms (see Dollfus 1982:45), while Moche Valley residents engaged in intensive field cultivation.

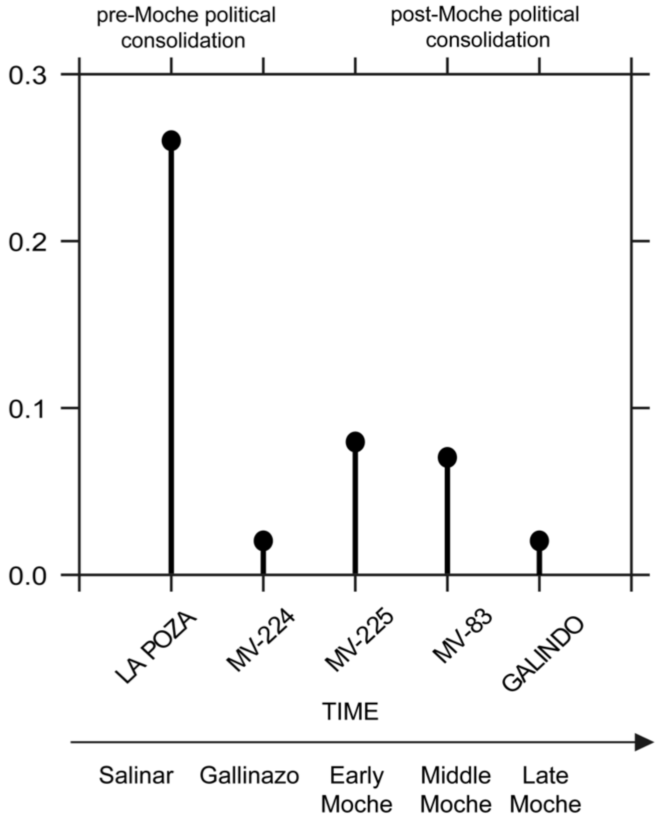

Figure 4.18 Dot chart of tree crop to field crop ratios for the five EIP study sites.

Finally, a comparison of standardized counts of miscellaneous/wild resources (Figure 4.19) reveals overall similarities through time, although the assemblage from MV-224 has significantly higher standardized counts of this plant category than the assemblage from MV-225. MV-224 site residents may have intentionally collected a greater amount of miscellaneous/wild resources for a variety of economic purposes (edible, medicinal, technological), or a greater abundance of these plants may have ended up as incidentals in the MV-224 assemblage, potentially clinging to clothing or livestock as farmers returned from their fields.

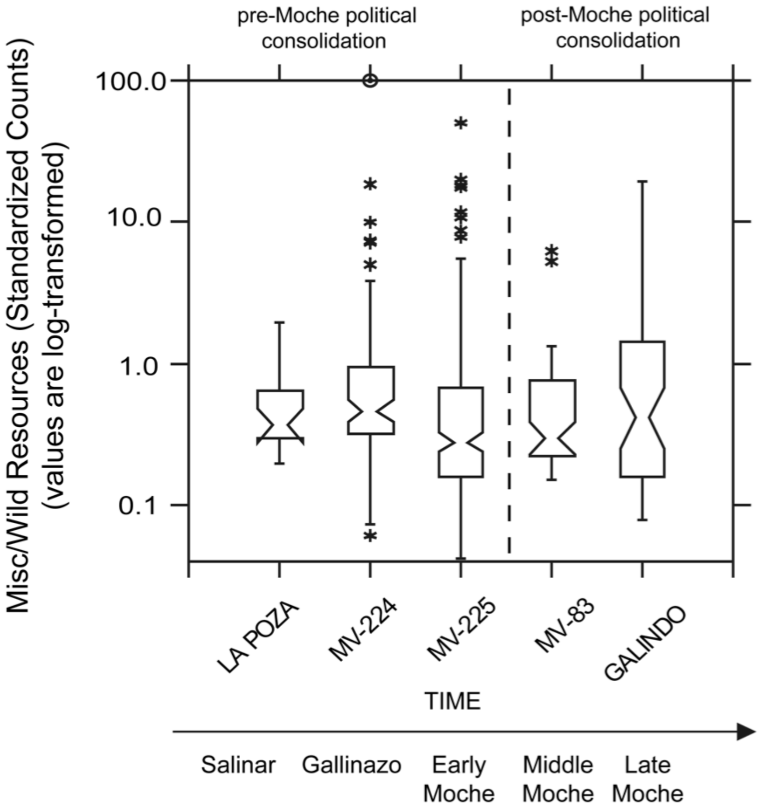

Figure 4.19 Box plot comparison of standardized counts of miscellaneous/wild resources (counts/plant weight) for the five EIP study sites.

Discussion

Considering the patterns in these data together, what did the landscape of farming, arboriculture, and wild plant food collection look like in the EIP? The plant data presented in this chapter lend insight into two key issues: (1) the nature and timing of agricultural intensification during the EIP; and (2) the dynamics of culture contact and interaction, during a period that witnessed an influx of migrants from the neighboring highlands during the Gallinazo and Early Moche phases. The diversity and ubiquity analyses, as well as the standardized count comparisons, suggest that maize and other cultigen production increased dramatically during the Gallinazo and Early Moche phases (A.D. 1-300). I interpret these increases as evidence of agricultural intensification. The term intensification, as traditionally defined, refers to a process by which crop production increases such that greater inputs are invested per unit of land with the goal of increasing yields (Ames 1985:158; Betts and Friesen 2004:358; Boserup 1965; Netting 1993:28-29). It is difficult for archaeologists to measure crop production per unit of land; however, through analyses of macrobotanical data, we can define increases in production yields and levels of processing. Ames (1985) distinguishes between productivity and production, in which productivity refers to the classic definition of intensification as output per unit of land (*sensu* Boserup 1965). Production, on the other hand, refers to the level of output (Ames 1985; Betts and Friesen 2004), where increases in output (i.e., yields) are production increases, and production increases are taken to represent agricultural intensification, whether this is achieved through increasing productivity per unit of land, increasing productivity through adding new or expanding existing fields, or through creating entirely new fields. I subscribe to this latter definition of production in which changes in overall production are correlated with changes in intensification.

In the Salinar phase (400 B.C. – A.D. 1), there were significantly lower standardized counts of all maize categories at La Poza, as well as total cultigens. Standardized counts of cultigens excluding maize at La Poza align with other sites, with the exception of MV-224. As La Poza is adjacent to the coast, it is possible that less maize was grown at the site in favor of a focus on marine resources (an integration with faunal data would be necessary to test that hypothesis). Indeed, ratios of tree crops to field crops indicate the greater importance of fruit trees relative to cultigens at La Poza, particularly compared to the other sites. Maize was the most ubiquitous taxon at La Poza, however, and according to Millaire et al. (2016:6021), while maize remains were present in the EIP middens at La Poza, they were absent in Early Horizon (ca. 1000 – 400 B.C.) levels at the site, as well at the nearby Initial Period (1500-1200 B.C.) fishing village of Gramalote[19]. Furthermore, preliminary analysis of human remains from La Poza suggests that EIP residents were shorter than their predecessors at Gramalote, which scholars suggest may be related to the shift from a subsistence regime rich in marine proteins and well-balanced plant carbohydrates to one that relied on a narrower set of marine resources, camelid meat, and maize, with dietary disruption in childhood ultimately leading to shorter stature (Millaire et al. 2016: 6021; Pezo-Lanfranco and Eggers 2013; Prieto 2015). By the Salinar Phase, La Poza site residents clearly had access to maize, whether locally grown or imported; however, this level was significantly lower than levels in the subsequent Gallinazo and Early Moche phases.

Standardized counts of maize and other cultigens at MV-224 and MV-225 mirror, or

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[19] These trends of maize in earlier levels at La Poza and at Gramalote are not based on paleoethnobotanical analysis; rather, ideas about maize use are based on maize fragments collected during excavation (without screening).

in some cases exceed, the standardized counts of those categories at MV-83. I interpret the MV-224 and MV-225 plant data along two lines: increases in cultigen production (including maize) may have related to (1) fulfilling tribute demands or (2) consumption of foodstuffs at larger suprahousehold events (or possibly a combination of both activities). Billman (2010) proposes that a regional political economy emerged in the Moche Valley during the EIP that was based primarily on the extraction of tribute from farming households in exchange for access to land and water via irrigation canals. While previous scholarship had imagined such dynamics to occur during the Moche era, earlier tribute demands may have come from local coastal polities, including the paramount coastal center of Cerro Oreja (see Chapter 3). Indeed, Lambert et al. (2012; see also Gagnon 2006, 2008; Gagnon and Weisen 2013) use bone chemistry data and dental markers from coastal skeletal populations at Cerro Oreja to suggest that maize production intensified during the Gallinazo phase. They compare data from Guañape, Salinar, and Gallinazo phase burials from Cerro Oreja and reveal a significant increase in the $\delta^{13}C$ signature from the Salinar to the Gallinazo phase (see Lambert et al. 2012:158, Figure 3). Coastal households, including MV-224, may have been tied to tribute obligations with polities like Cerro Oreja, and thus increased their production and processing of staple cultigens like maize.

The mobilization of surplus requires the intensification of food production (e.g., Earle 1997). In order to produce enough food to satisfy tribute demands in addition to daily household needs, farmers have to increase production; these production increases can be accomplished through intensification or extensification, but the latter requires a lot of arable land. Models of regional political economy, in this region and others, posit that inequalities resulted as differential control of floodplain agriculture was exploited by elites as a means to co-opt the labor of others, generating agricultural surpluses to achieve power and participate in exchange networks with other communities and ethnic groups (Bawden 1996; Billman 1996; Moseley 1992; see also Carneiro 1970; Haas 1987; D'Altroy and Earle 1985; Earle 1997). Farmers would have had to increase their yields, thus requiring more time and labor investment into agricultural tasks.

There was some variation between the local coastal site (MV-224) and the highland site (MV-225) with respect to maize kernels and other field cultigens. Indeed, MV-224 has significantly higher standardized counts of these plant food categories than all of the sites except Galindo. It is possible that highland migrants occupying the site of MV-225 were not subjected to the same demands as rural coastal sites from centers like Cerro Oreja. Highlanders living in the middle Moche Valley clearly targeted the prime maize growing areas of the chaupiyunga zone, processing comparable levels of maize to those processed post-political consolidation. Maize likely was emphasized over other field cultigens at MV-225; diversity indices reveal that the archaeobotanical assemblage at MV-225 is less rich and less even than expected, and MV-225 had significantly fewer standardized counts of other cultigens than maize compared to MV-224. Like their coastal Gallinazo neighbors, the highland residents at MV-225 also relied on a range of fruits and economically useful wild resources. Highlanders appear to have engaged in exchange relationships with fellow costeños as well, in the form of ideas, foodstuffs, and possibly marriage partners. The archaeobotanical data from both the MV-224 and MV-225 households effectively blur long-standing taxonomic classifications of 'highland' and 'coastal' foods.

Indeed, quintessential 'highland' foods including potato and quinoa were recovered at both sites (indeed, quinoa is more ubiquitous at the coastal MV-224 site than the highland

MV-225 site). Chenopods have a wide cultivation range, and can effectively be cultivated from sea level to 4,000 masl (Brack Egg 1999:132). Potatoes are more restricted in their cultivation range (2,000-4,000 masl); this elevation exceeds that of the middle Moche Valley. Highland migrants living at MV-225 may have imported potatoes from their homelands, which could have been transported via llama (possibly in the form of freeze-dried chuño). These potatoes may have been exchanged with local coastal households; Gallinazo ceramics recovered from MV-224 produced starch grain residues of potatoes as well as maize. Camelids may have been tended and herded at both sites as well; an absence of cotton seeds in the record at both MV-224 and MV-225 suggests a possible reliance on camelid wool for textile production (although this pattern may be a preservation issue). Furthermore, a wide range of miscellaneous/wild taxa likely were used as animal fodder for camelids whose dung could have been used to fertilize fields and serve as fuel.

As a result of this exchange of foodstuffs (and possibly marriage partners), I suggest that highland and coastal groups likely established mutually beneficial relationships during this period, including relationships revolving around food and farming. These relationships may have included fiestas and religious gatherings. This point brings me to my second frame of interpretation for changes in cultigen production. The intensification of agricultural production likely was tied to the consumption of foodstuffs at larger suprahousehold events. These events may have taken place in the form of masa (work parties), or community events, including those involving religious rituals. The maize cupule and glume data may have something to bear on this issue.

Maize cupules represent the inedible by-products of processing maize to remove the kernels. Glumes represent another form of processing discard, as glumes will become separated from kernels when maize is ground. Significant increases in maize processing occurred between the Salinar and Early Moche phases, evidenced by increases in standardized counts of cupules and glumes (see Figures 4.11 and 4.12, respectively). This elevated processing may have been conducted for a variety of reasons: to produce enough maize to feed families while funneling a portion of yields to regional elites as tribute payments, or to process maize for consumption for suprahousehold community events[20] (or both). The processing discard may indicate maize shelling in preparation for boiling (in the form of soups, stews, and gruel), or preparation for germinated maize (*jora*) to be ground to make chicha. *No* glumes were recovered at La Poza, and MV-224 and MV-225 have significantly higher standardized counts of glumes than MV-83. These trends may indicate shifts in processing strategies, including a higher level of preparation of soups and stews as well as chicha for community ritual events at MV-224 and MV-225.

Ethnographic accounts have documented a variety of smaller-scale ritual events that took place in rural villages and households throughout the Andes (e.g., Allen 1988; Bruno 2008; Gose 1994; Isbell 1978; Poole 1984). Some of these rituals specifically pertain to the agricultural cycle. In her ethnoarchaeological study of Aymara farmers in the Taraco peninsula, Bruno (2008) describes agricultural rituals among kin groups, where major agricultural projects (e.g., planting, harvesting) are punctuated by meals that are prepared by women. Foods including bread, fruit, *pasankalla* (a puffed, sweetened corn), coca, leaves, soft drinks, beer, and grain alcohol were consumed to mark these events (Bruno 2008:196).

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[20] Processing trends may also relate to infield/outfield cultivation models (Killion 1987; 1990; VanDerwarker 2005, 2006), where people store and process maize at houselots if infields are cultivated intensively, vs. processing in fields if cultivating in outfields. However, as VanDerwarker (2006:105) identifies, whether people practice intensive or extensive cultivation strategies, they still need to process their maize, and where they do so depends on how close their fields are to houselots.

Similar community events may have occurred at sites in the middle Moche Valley throughout the history of field cultivation; however, an elevated scale appears to have been reached during the Gallinazo and Early Moche phases.

In his discussion of plant and animal remains recovered from the Preceramic site of Cerro Lampay in the Fortaleza Valley in the Norte Chico region of Peru, Vega-Centeno (2007) suggests that these remains constitute evidence of ritual feasting. According to Vega-Centeno, this type of feasting was community-based and served as a means of reconstituting leadership in the context of a loose political structure. Duncan et al. (2009; see Duncan 2010) make a similar argument for the roughly contemporaneous site of Buena Vista in the Chillón Valley of central Peru. Neither Vega-Centeno nor Duncan and colleagues propose food production as an economic foundation for accumulation on the part of leaders, necessary for financing feasting events; rather, they emphasize community events and the ritual significance of food in early complex societies. Certainly, the Gallinazo and Early Moche phases witnessed much greater levels of complex social organization than these Preceramic sites, but the consideration of the effects of community-based ritual events should not be dismissed.

If we accept that plant food intensification occurred prior to Moche political consolidation during the Gallinazo and Early Moche phases, this intensification may not have been orchestrated by those aspiring to *create* political hierarchies; rather, it may have occurred in the contexts of larger social/religious negotiations. The political dimensions of intensified food production that occurred during this period probably were pursued alongside traditionally acceptable parameters (including ritual events), but ultimately reached an exaggerated scale, resulting in unintended consequences for the participants involved (see Pauketat 2000). Ultimately, maize likely was incorporated into a longer history of social and religious negotiations involving plant foods (including fruits and other cultigens) in which surplus production aided in the support of craftspeople and the fueling of community events that simultaneously reinforced status differences and community cohesion.

By the Middle Moche phase (A.D. 400-700), residents at MV-83 maintained high levels of agricultural production and processing, with standardized counts of maize cupules and total maize mirroring trends witnessed in the preceding Gallinazo/Early Moche phases. Based on the presence of a large number of batanes (grinding stones) at MV-83, Gumerman and Briceño (2003) suggest that site residents were involved in a high degree of agricultural production and processing, likely to fulfill elite tributary demands of the Southern Moche polity (see also Billman 2010). MV-83 residents (including members of lower status households) appear to have been engaged in intensive agricultural production to feed themselves as well as meet tribute demands, with a greater focus on maize than other field cultigens (like MV-225, MV-83 displays significantly fewer standardized counts of non-maize cultigens). MV-83 households may also have engaged in mobilizing masa (work parties) through the redistribution of chicha, coca, and other consumables. Billman (2010) argues that by sponsoring masa, MV-83 residents could have functioned as an intermediate node in the Moche administrative network, providing a connection between the rural populations of the middle Moche valley and paramount elites at the Huacas de Moche. Indeed, Surridge's (2010) lithic analysis (part of the Moche Origins Project) indicates a pattern of declining hoe use in elite households by the Middle Moche phase (ca. AD 400–600), suggesting a shift in high-status domestic economies to ascribed positions that focused on mobilizing the labor of others, in order to redistribute crafts and foodstuffs such as chicha.

However, these levels of intensive maize production and processing were already in place in the earlier phases in the Moche Valley. In this vein, the extraction of agricultural products witnessed during the peak of Moche power can be considered a continuation of patterns to which households had already long become accustomed, which may have represented kin-level rather than state-centered organization. Patterns in maize ubiquity, as well as glume data, suggest some differences in maize use at MV-83 compared to other periods, however. The drop in maize ubiquity at MV-83 (see Figure 4.7) may have been the result of more restricted uses of maize, possibly related to partitioning between status groups.

Galindo residents engaged in levels of food production, of maize and other cultigens, comparable to those of the Gallinazo and Moche phases. Late Moche phase (A.D. 700-800) residents of the Moche Valley also experienced a series of droughts and strong El Niño events (Bawden 2001; Dillehay and Kolata 2004; Moseley and Deeds 1982; Moseley et al. 2008; Shimada 1994). This period has been linked to the decline of Moche centralized political authority, possibly as a result of internal class struggle; changes in elite ideology and conflict with external polities have been proposed for the decline of Moche polities as well (Castillo 2000, 2001; McClelland 1990; Shimada et al. 1991). Swenson (2006:113) argues that feasting was implicated in localized strategies of political empowerment in the Jequetepeque Valley in the Late Moche period, and that these strategies, directed by lower level kin groups, “subverted elite authority and urban-based social control in the region.” It is possible that social groups at Galindo participated in commensal events related to strengthening local community cohesion during this period. The small number of soil samples from Moche phase contexts at Galindo discussed in this dissertation (n = 10) also come from both high status and low status residential contexts (n = 8), along with two civic/ceremonial contexts. The relationships between activities conducted across these different contexts is difficult to determine from the limited sample size. More samples from solely residential areas at Galindo might produce different patterning. Regardless, Galindo residents were producing and processing high levels of maize and other cultigens even during the decline of the Moche polity, levels that were comparable to those witnessed during the Gallinazo and Early Moche phases, prior to the Southern Moche polity consolidation.

Regardless of how maize and other economic cultigens were used, key changes appear to have occurred in the local domestic and political economies of the middle Moche Valley *in advance* of the dramatic expansion of the Moche polity in the ca. A.D. 300, during the preceding Gallinazo phase (A.D. 1-200). As Gagnon (2006, 2008; Gagnon and Wiesen 2013; Lambert et al. 2012) argues, these economic shifts would have resulted in changing patterns of labor, gender roles, and diet. Bone chemistry studies and oral health indicators suggest that males buried at Cerro Oreja had higher maize intakes, likely a result of participation in public commensal events involving chicha consumption, along with meat and other foods. In contrast, women and children buried at Cerro Oreja had poorer dental health, as a result of greater consumption of carbohydrates relative to meat (Gagnon 2006, 2008; Gagnon and Wiesen 2013). Males appear to have had more access to coca than females as well, evidenced by oral health indicators and phytoliths recovered from dental calculus (Gagnon et al. 2013)[21].

The maize data presented here challenge assumptions about the link between agricultural intensification and political complexity. Indeed, scholars are critiquing these assumptions in other parts of the Andes as well as more broadly in the New World. Stable isotope anlaysis of skeletal remains from the site of Conchopata suggest that generalized maize consumtion was well established in the Ayacucho Valley by approximately 800 B.C. (Finucane 2009:538), and that reliance on maize agriculture preceded the processes of urbanization and formation of the complex Wari polity. Further, dental evidence from the site of Huari indicates that high maize and coca consumption persisted after the decline of the polity (Tribbet and Tung 2010). Stable isotope data from mummified humans from the Ayacucho Valley dating to A.D. 1490–1640 also show evidence of sustained maize consumption (Finucane 2007), suggesting that maize use was not a state introduction but a deeply rooted practice that remained unaffected by state decline. Other areas of the Wari empire were less centered on maize; for example, at the site of Cerro Baul, Goldstein et al. (2009; Sayre et al. 2012) suggest that the importance of molle (*Schinus molle*) paralleled the role of maize for the Inka.

In their discussion of intensive maize agriculture in the Mississippian world, VanDerwarker et al. (2017; see also VanDerwarker, Wilson, and Bardolph 2013) also critique uncritical assumptions about maize and political complexity. The Eastern Woodlands region of the United States witnessed the development of several large hierarchically organized polities including Cahokia, the most complex prehistoric polity in

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[21] Gagnon et al. (2013:203; see Piperno 2006) acknowledge that the coca plant does not produce many taxonomically distinct phytoliths. Their assessment of leaf-related tissue (parenchyma, sclerenchyma, and polygonal phyoliths) produced the closest match for coca.

North America (Emerson 1997; Fowler 1997; Kelly 1990; Milner 1990; Pauketat 2004; Pauketat and Emerson 1997), Moundville (Knight and Steponaitis 1998; Scarry 1986; Steponaitis and Scarry 2014; Wilson 2008), and Etowah (Cobb and King 2005; King 2003; Larson 1971). In the regional literature, intensive maize agriculture has long been treated as a synonym for complexity, included in the suite of cultural hallmarks that define Mississippian, along with shell tempered pottery, wall trench architecture, moundbuilding, and the presence of hereditary inequality and complex social organization (e.g., Cobb 2003; Griffin 1967; Knight 1986; Pauketat 2004, 2007; Smith 1986).

Most models for the development of sociopolitical hierarchies in early Mississippian polities rely on emerging elites' ability to control and distribute agricultural surplus (e.g., Welch 1991). However, in the cases of the three largest Mississippian polities (Cahokia, Moundville, Etowah), intensive plant food production (of maize and indigenous grains) preceded the formation of regional hierarchies. In some regions, plant food production appears to have been intensified around the same time as the establishment of local smaller regional political hierarchies (e.g., the Central Illinois River Valley, see VanDerwarker, Wilson, and Bardolph 2013). This view suggests that complex forms of social organization are not necessary prerequisites for the intensification of food production (*sensu* Ford 1985:14). Surplus production does not determine political complexity, but it certainly appears to be an element that, when combined with other variables (e.g., ambitious kin groups, community religious/ritual events, and other antecedent traditions that defined group identities and solidarities), can potentially transform the social and political history of a region.

What were the implications for shifts in prehistoric labor, particularly along gendered lines? We can conceptualize this issue in terms of labor related to intensified farming, as well as intensified processing of foodstuffs. In the context of intensification, in addition to expansion of irrigation systems, farmers would have had to reduce crop fallowing time in order to increase yields. To maintain and increase soil fertility, Moche Valley farmers likely maintained some systems of crop rotation and fallow in order to replenish soil nutrients, but also intercropped nitrogen fixing legumes (e.g., common beans, lima beans, pacay, lupine/*tarwi*) with maize. Weeds likely would have been removed from fields so that cultigens could grow to their full potential; these weeds may have been collected and retained if they held economic value (as food, fodder, medicine, etc.), or they may have unintentionally become incorporated into the Moche Valley archaeobotanical assemblages clinging to livestock or clothing. In addition to crop rotation and nitrogen fixation, farmers may have used camelid dung as fertilizer, likely grazing their animals in harvested and fallowed fields so that the dung could be incorporated into the fields (see Winterhalder et al. 1974). Site residents also may have dumped kitchen or cleaning ashes onto fields as a source of fertilizer as well.

In Boserup's (1965) classic study, *The Conditions of Agricultural Growth*, she describes various practices that farmers employ to maintain productive fields in the face of shortening fallow periods. While her model has been critiqued for its reliance on population pressure as a primary mechanism for technological change, she nonetheless posits some useful considerations about prehistoric labor and agricultural intensification. Techniques of intensification include tilling soils to remove vegetation, weeding, fertilizing with manure, and irrigation. Boserup argued that ultimately, all of these practices increase work for the farmer. She asserted that intensive agricultural systems did not actually produce more in relation to effort exerted, and that an inverse relationship existed between labor input and productive yield. According to Boserup (965:41-43), intensive systems were actually less efficient than extensive long-fallow systems in the long run (for a counterargument, see Conelly 1992).

I imagine that both local coastal and migrant highland residents of the Moche Valley increased their labor investments during the Gallinazo/Early Moche Phases (A.D. 1-300), as they focused on intensive cultigen (including maize) production and also maintained tree crop management. Increased labor inputs may have resulted in changes to seasonality and scheduling as well, with respect to preparing fields, planting, tending, and harvesting times. This increased labor investment would have impacted entire families, likely along gendered lines.

Bruno (2008:194-195) discusses gendered labor partitioning related to farming in her discussion of Aymara famers in the Taraco Peninsula of the Lake Titicaca Basin. According to Bruno, agricultural work is shared between different members of the family, as well as friends and neighbors, including work that needs to be completed within a short period of time. Plowing, planting, weeding, and harvesting are all tasks that need to be done at particular moments when conditions are favorable, and these tasks require a good deal of physical labor, which requires the participation and coordination of many people. While field preparation, planting, and harvesting require the help of many people, only a few people perform weeding and crop processing.

In contemporary Andean farming systems, women often invest in seed storage, planting, and post-harvest processing (sometimes accompanied by children and elderly family members), while men tend to engage in field maintenance and harvesting. In the case of the Moche Valley, the shifts in gendered labor that accompany intensive farming appear to have occurred well in advance of Moche political expansion ca. A.D. 300. Aside from planting, field maintenance, and harvesting, in the context of intensive farming, what might the staging of food preparation and processing have looked like? I discuss this issue in the next chapter through a detailed spatial analysis of plant data recovered from MV-225.

CHAPTER 5

FROM DINING TO DISCARD: EXPLORING FOOD, GENDER, AND SPACE AT AN EIP HIGHLAND COLONY

In this chapter, I review archaeological approaches to spatial analysis that employ paleoethnobotanical data. I then discuss the results of my intra-site spatial analysis of MV-225, the Gallinazo/Early Moche (A.D. 1-300) highland colony. Detailed architectural analyses by Ringberg (2012; see also Billman et al. 2004; Briceño and Billman 2007, 2008, 2009) afford us a closer look with respect to how foodways were organized at this site[22], which I then test independently using a Principal Component Analysis, detailed below. Now that we have established what resources highland migrants were actually targeting in the Gallinazo/Early Moche phases, in the context of intensive agricultural production, what might the staging of food production and processing have looked like? In addition to the types and amounts of foods consumed, which I examine diachronically for the five Moche Valley sites in Chapter 4, socially constructed cuisine preferences can be archaeologically evident from distribution patterns across space.

As Hastorf (1991:137; see Bourdieu 1977) highlights, ethnographic studies have shown that we can see differential spatial patterning of artifacts in storage contexts, food preparation loci, refuse disposal areas, and in or near domestic structures; such patterns are the result of habitual domestic practices. Within the past decade, spatial analyses have

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[22] Detailed architectural studies linked to provenience data of soil samples are not currently available for the other sites considered in this dissertation. It is my goal to employ similar types of analyses discussed in this chapter once such data become available in future work on this project.

become increasingly more common in archaeological studies of foodways, by paleoethnobotanists as well as faunal analysts. Archaeologists have successfully used spatial analysis of different contexts (elite/non-elite, ritual/domestic, public/private etc.) to examine the intersection of food-related activities with status, political economy, gender, ritual, and the public/private division (e.g., Cutright 2009; Gero and Scattolin 2002; Gumerman 1994; Hastorf 1990, 1991; Marston 2010; Twiss 2012; VanDerwarker and Detwiler 2002; VanDerwarker and Idol 2008; VanDerwarker et al. 2014; Welch and Scarry 1995; Wright 2000). However, as VanDerwarker et al. (2014) point out, despite an increase in the number of studies that focus on spatial variability, this approach nevertheless represents a relatively rare analytical mode in the subdiscipline, particularly with respect to actual *analysis*—that is, some studies simply describe spatial observations based on tabular data, but fewer still make use of robust quantitative techniques to evaluate spatial patterning in paleoethnobotanical datasets.

VanDerwarker et al. 2014 (see also VanDerwarker and Bardolph 2017; VanDerwarker et al. 2016) highlight two ways that paleoethnobotanists approach spatial analysis. The first approach assigns spatial contexts prior to conducting quantitative analysis of the plant data (e.g., Gumerman 1991, 1994; Hald and Charles 2008; Hastorf 1990, 1991; Marston 2010; Peres et al. 2010; VanDerwarker and Detwiler 2002). Generally, these contexts are defined based on analyses of archaeological datasets other than the plant materials. The most common assignments relate to elite/non-elite contexts and public/domestic architectural areas.

One of the best-documented cases of spatial analysis of foodways in the Andes is Hastorf's classic example of how the Inka interfered with the local political economy of the

Sausa people in the Upper Mantaro River Valley of central Peru (Hastorf 1990, 1991, 2001; see also D'Altroy and Hastorf 2001). Hastorf's analysis of plant data from Sausa house floors dating both prior and subsequent to Inka control of the Upper Mantaro River Valley reveals a shift in plant diet for local elites and non-elites. Prior to Inka domination, during the Wanka II Period (A.D. 1300-1460), elite and non-elite status was clearly differentiated through plant foodways. Hastorf demonstrates that the shift to imperial control led to a leveling of local status differences. A subsequent study by Gumerman (1991, 1994) compares Hastorf's findings to his data from the Lambayeque occupation of Pacatnamu in the Jequetepeque Valley. Sociospatial contexts at Pacatnamu were defined primarily on the basis of architectural and artifactual analysis, including beads, copper, and textiles, with categories including elites, commoners, specialized fishermen, and full-time weavers. Gumerman's (1991, 1994) analysis indicates that elites and weavers had very similar diets, dominated by chili peppers and maize, whereas commoners ate fewer domesticates, relying more heavily on wild greens and fruits. His analysis revealed that the primary food producers (commoners) were engaged in agricultural production to support the leadership and attached specialists.

As discussed in Chapter 4, Lockard (2005, 2013) attempted to make comparisons of elite vs. non-elite use of plant foodways in the Moche contexts at Galindo, assigning socio-spatial contexts of elite, non-elite, and civic/ceremonial to different areas of the site that he sampled. He argues that elites had increased access to maize and cotton and sole access to coca; however, due to the small number of samples analyzed (n = 10), it is difficult to determine if the patterns are in fact valid (as discussed in Chapter 4, only four coca seeds were recovered from the Moche contexts at Galindo; this pattern is likely due to preservation biases associated with coca rather than elite restriction and control of access).

These types of analyses (i.e., analyses of predetermined social spaces) have been employed in other New and Old World case studies as well. For example, VanDerwarker and Detwiler (2002) analyzed plant remains from the Coweeta Creek site, a seventeenth-century Cherokee village in southwestern North Carolina. They assigned their samples to domestic vs. public spaces based on their proximity to domestic structures versus the public-oriented townhouse. Their comparison of standardized counts of plant taxa in different spatial contexts revealed that plant food processing took place near townhouses (typically considered to be a ‘male’ domain), thus complicating assumptions about gendered segregation of space in protohistoric Cherokee communities. In the Old World, Marston (2010, 2012) analyzed wood charcoal from public and domestic contexts (defined via architectural style) at the site of Gordion in Turkey. He documented that while oak was chosen as the primary construction material for domestic architecture (a resource locally available close to the site), pine was chosen for the construction of public architecture. As pine was located at a greater distance from the site, laborers participating in monumental construction likely were required to travel significant differences to procure pine for special purpose construction.

The second approach to spatial analysis uses quantitative analysis of the plant data itself as the starting point for defining different contexts (VanDerwarker et al. 2014; see also VanDerwarker and Bardolph 2017; VanDerwarker et al. 2016). In this approach, space is not defined according to public/private, quotidian/ritual, or other social or functional categories prior to conducting the analysis of the plant data. Indirect approaches, such as

Principal Component Analysis or Correspondence Analysis, allow for more open-ended explorations of the dataset and do not presume that the variables affecting the botanical data are known. These types of indirect approaches attempt to identify outliers from plant assemblages from different social spaces (defined by features or units) that do not fit with the majority of the data.

VanDerwarker and Idol (2008) and VanDerwarker et al. (2007) successfully employ this second type of approach in their analysis of archaeobotanical remains from features from two pre- and post-contact farming villages in Southern Virginia and North Carolina, respectively. These sites include the late prehistoric (A.D. 1250-1430) Buzzard Rock site in the Roanoke Valley of Southern Virginia (VanDerwarker and Idol 2008) and the contact-period site of Upper Saratown in northern North Carolina (VanDerwarker et al. 2007). The authors analyze plant data from numerous features that were excavated at both sites, and they use spatial analysis to document variation in plant remains amongst the various features, and to identify any features that differed from the central tendency in order to determine the organization of plant processing at the sites. At the Buzzard Rock site, a Principal Component Analysis identified two features that clearly deviated from the central tendency, as they yielded more than 166,000 maize kernels. The authors interpret this pattern as evidence of ritual burning of a portion of a new maize harvest as part of traditional renewal ceremonialism (VanDerwarker and Idol 2008). A Principal Component Analysis also identified two chronologically distinct features at the Upper Saratown site that were significantly different from one another in terms of plant content. VanDerwarker et al. (2007) interpret these differences as representing a temporal shift in the emphasis of renewal ceremonialism towards an exclusive set of native plant foods, which also included enormous quantities of maize.

The highland migrant presence in the Moche Valley presents an excellent opportunity to employ similar types of analyses. Drawing on spatial contexts defined by Ringberg (2012; see also Billman et al. 2004; Briceño and Billman 2007, 2008, 2009), I explore the associations of plant remains with domestic spaces including kitchens, patios, sleeping areas, and general living/working spaces, along with associated features including hearths and ash pits (detailed below). I then use a Principal Component Analysis to independently assess the relationships between the plant data and different features (n = 59) at the site to search for outliers that do not fit with the majority of the data. The archaeobotanical data from MV-225 presented in this dissertation have revealed what resources migrants were actually targeting (see Chapter 4), but we can also use the plant data to consider how foodways were organized with respect to gender, status, and public/private divisions.

Approach One: Spatial Contexts Assigned Prior to Analysis

For her dissertation, Ringberg (2012) conducted a detailed architectural analysis of the three compounds at MV-225, Compounds 1, 3, and 6 (see Chapter 3), excavated over the course of six field seasons by the Moche Origins Project (Billman et al. 2004; Briceño and Billman 2007, 2008, 2009). According to Ringberg (2012:71), the basic physical structure of residences in the Andes is relatively easy to identify because residences typically contain spatially discrete kitchens, storage rooms, and patios (see Bawden 1982b; Brennan 1978; Janusek 2004; Stanish 1989; Vaughn 2005). The multi-room and patio residences at MV-225 are in close spatial proximity but are constructed in discrete units with natural and cultural boundaries such as terraces and retaining walls. Ringberg (2012) examined the sizes of rooms and houses, their construction techniques, and the presence or absence of certain features to interpret functional use as well as differential social status among the three excavated compounds at MV-225. Based on size and quality of architectural construction, Compound 1 likely represents the largest known residence dating to the highland occupation of the middle valley, and may have been the home of the paramount elite of the largest polity of highland colonists (Billman et al. 2004; Briceño and Billman 2007, 2008, 2009; Ringberg 2012). Compound 1 occupies a large modified terrace that appears to have been chosen chiefly for its size and commanding view over the valley and the adjacent Quebrada del León (dry ravine below the site). The other two compounds, Compounds 3 and 6, represent an intermediate class of residential architecture (Compound 3 is the smallest of three compounds), and are interpreted as compounds that housed lower-status residents than the residents of Compound 1.

Across the three compounds, Ringberg (2012:87) recorded 33 rooms, 15 patio and terrace spaces, and 82 interior subfeatures. For a list of functional designation by provenience designation (PD), see Appendix 7 (see also Ringberg 2012:88-91). Compounds generally comprised kitchens, patios, terraces, storage spaces, sleeping spaces, midden spaces, and large *batanes* (grinding stones) and *chungas* (pestles). Ringberg (2012:91-96) describes the functional aspects, sizes, and dimensions of these different spaces in detail. Formal kitchens generally were enclosed on four sides and roofed, with hearths and associated ash deposits, along with vessel rests. Kitchens have a few other interior features (e.g., bins, benches), which vary between kitchens, indicating that some households designed their cooking spaces in different manners. Walls were constructed either from stone or from *quincha* (cane and mud). Related to formal kitchens are cooking spaces that may have been semi-open but sheltered, with low stone foundations that supported quincha walls.

Patios were open spaces for conducting activities, often constructed on artificial terraces with retaining walls. Daily use patios were unroofed and usually contained batanes and chungas (often with batanes so large as to be immovable features). Patio spaces occasionally contained vessel supports, post holes, and ash deposits as well (Ringberg 2012:93). Functionally related to patios are terraces, which Ringberg argues served formal public purposes as gathering spaces, including for ritual events. Storage and sleeping spaces were enclosed with masonry walls, and generally were free of debris and lack hearths. Ringberg (2012:95) also defines corridors and staircases, multifunctional passageways that primarily served as routes between or entryways into rooms or patios, sometimes providing steps and landings as they passed through multi-level spaces. Several small square or circular cists lined with upright stone slabs were interpreted as burial cists as well (although the burials themselves had been removed at some point during occupation or abandonment). Finally, Ringberg (2012:96) discusses six enclosed spaces that could not be classified to a specific function.

With these functional designations in mind, we can consider the relationships between plant remains recovered from excavations at MV-225 and the designated social spaces. As discussed in Chapter 4, in my soil sample selection, I prioritized contained contexts (hearths, ash pits), floors/activity surfaces (from patios and enclosed masonry rooms of different functional categories) and midden fill, as these contexts should represent a range of activities including those related to food processing and consumption. I begin my analysis by comparing total plant density (i.e., taxa counts divided by soil volume) across the three compounds (Figure 5.1). Densities are comparable across all three compounds; there do not appear to be any differences in plant preservation, plant deposition, disposal patterns, or other taphonomic differences across the three compounds.

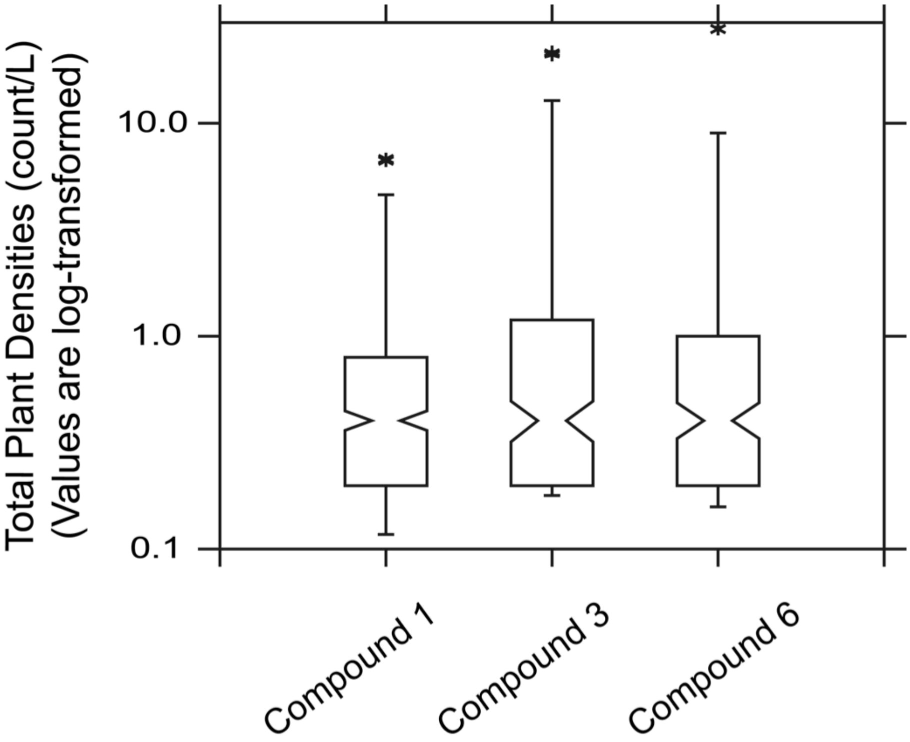

Figure 5.1 Total plant densities Compounds 1,3, and 6, MV-225.

As a result, I use densities measures to consider potential differences between types of functional spaces: kitchens, patios (this category also includes terraces), storage rooms, and other (this “other” category pertains to spaces such as sleeping spaces, corridors, staircases, and rooms of unknown function). A comparison of total density of plant remains by functional category (Figure 5.2) reveals no significant differences between the different types of functional spaces. Plant remains generally are evenly distributed across different spatial contexts at MV-225.

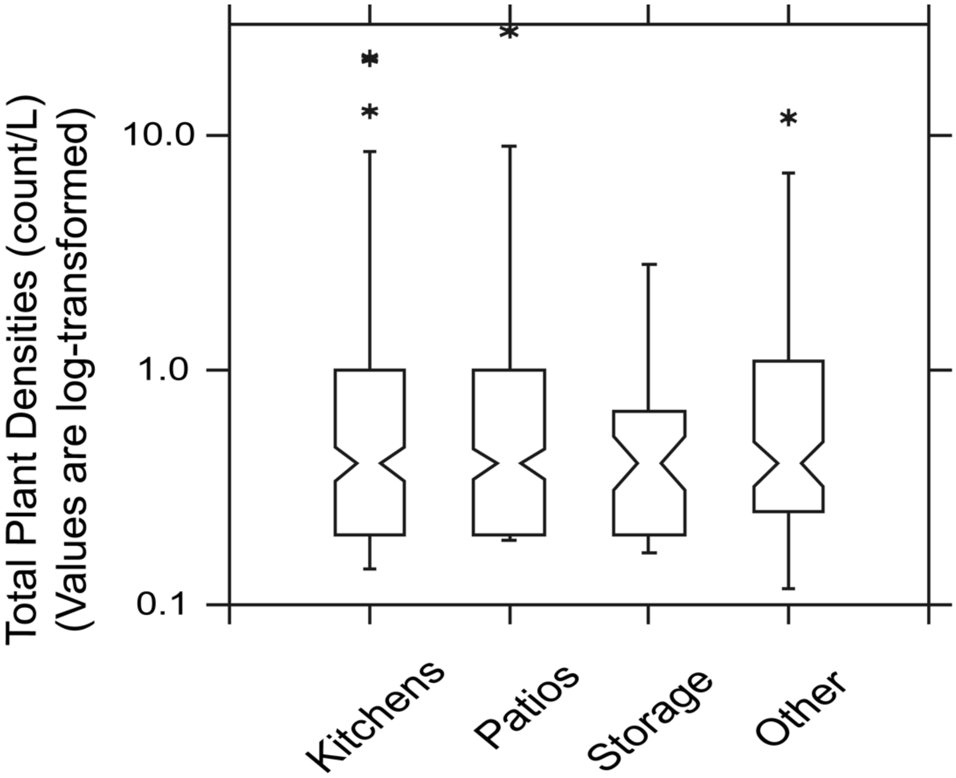

Figure 5.2 Total plant densities by functional category, MV-225.

I ran similar comparisons by functional space for the categories of plant resources considered in Chapter 4: maize kernels, maize cupules, maize glumes, and total maize, along with cultigens, fruits, and miscellaneous/wild resources. Densities of maize kernels, total maize, cultigens, and fruits were similar across functional spaces; no significant differences emerged in any of those analyses. Differences did emerge, however, with respect to maize cupules, maize glumes, and miscellaneous/wild resources. In terms of maize cupules (Figure 5.3), significantly more cupules were recovered from samples taken from kitchens than from patios or storage spaces (although cupule densities overlap with the “other” category).

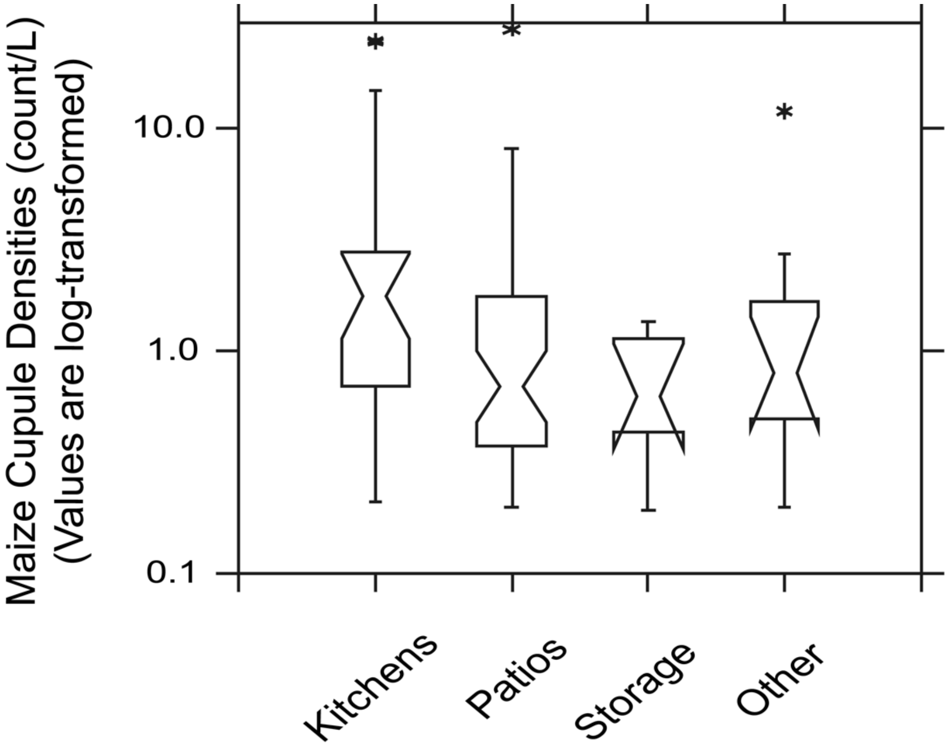

Figure 5.3 Densities of maize cupules by functional category, MV-225.

Maize glume densities overlap for kitchen, patio, and “other” spaces (Figure 5.4), but there were significantly fewer maize glumes recovered from storage rooms (although the sample size of glumes is small overall for all of these different spatial contexts, evidenced by the notched boxes overextending and then fold back on themselves, see Chapter 4).

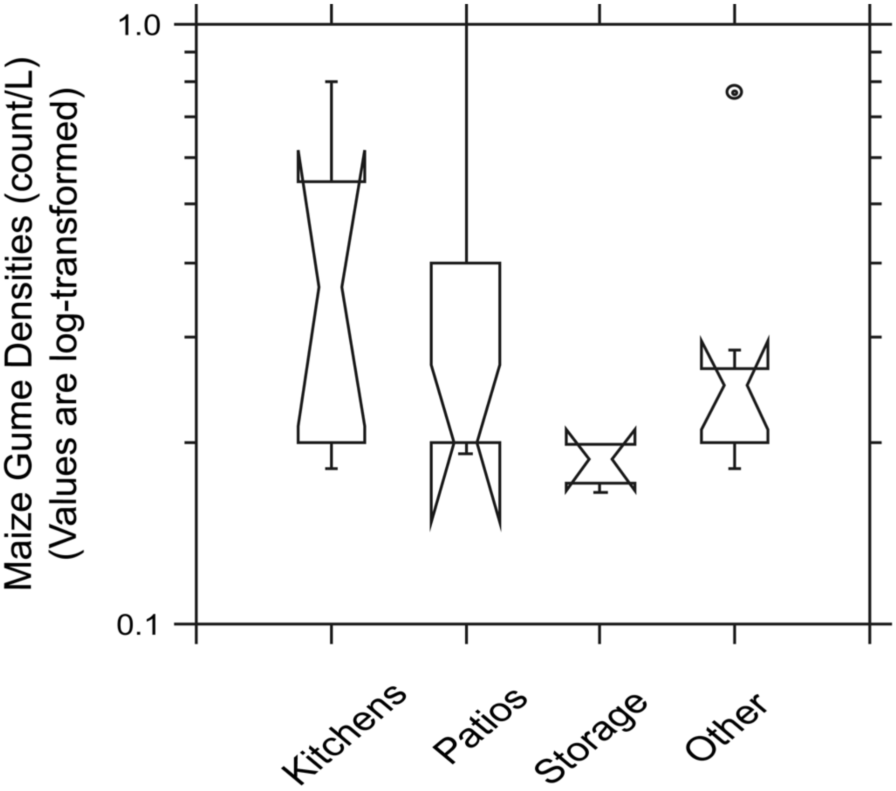

Figure 5.4 Densities of maize glumes by functional category, MV-225.

With respect to miscellaneous/wild resources (Figure 5.5), significantly fewer miscellaneous/wild resources were recovered from storage contexts compared to the other functional spaces.

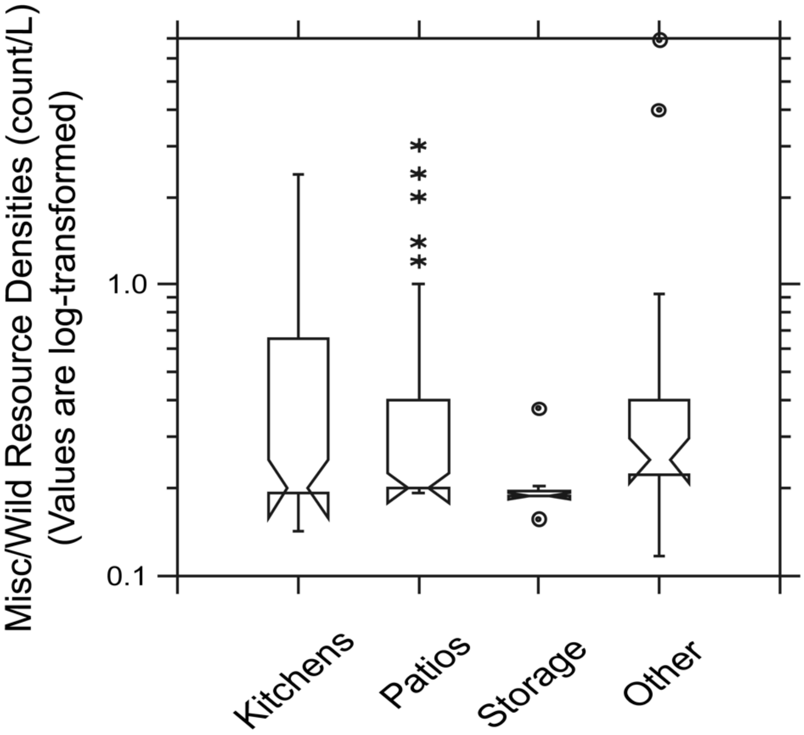

Figure 5.5 Densities of miscellaneous/wild resources by functional category, MV-225.

In some respects, these patterns may seem obvious; one would not expect processing discard (i.e., cupules, glumes) to end up in storage contexts. The fact that significantly fewer miscellaneous/wild resources were deposited in storage contexts indicates that wild resources were not targeted for long-term storage; rather, storage repositories would have been used for dried cultigens (including maize, an easily storable crop that may have been stored un-shucked on the cob), potentially along with some dried fruits as well. The pattern of significantly higher maize cupules recovered from samples taken from kitchens than from patios is intriguing; MV-225 site residents (primarily women) appear to have been processing maize primarily within enclosed kitchen spaces, rather than in outdoor patios. This restriction of visibility, with women processing maize out of view within kitchen walls, may speak to increased gender segregation that often accompanies processes like agricultural intensification (discussed in Chapter 2).

To consider the location of plant food processing in more detail, I examine variation in plant data by feature. Each sample analyzed in this dissertation is associated with a specific provenience designation (PD). Features were assigned numbers (1 through n) by Moche Origins Project excavators, and interior subfeatures such as hearths, ash pits, benches, bins, etc. were assigned subfeature numbers in sequence when documented in excavation (e.g., 1.01, 1.02). I group the data from all PDs associated with particular features (and subfeatures) at the site and look for any that deviate from the central tendency of the assemblage using a Principal Component Analysis, detailed below.

Approach Two: Using Plant Data as the Starting Point for Analysis

As discussed above, the second approach to spatial analysis uses quantitative analysis of the plant data itself as the starting point for defining different contexts (VanDerwarker et al. 2014; see also VanDerwarker and Bardolph 2017; VanDerwarker et al. 2016). Rather than relying on social or functional categories already assigned to spatial contexts, this approach uses plant remains from samples, features, units, etc. for an exploratory analysis that seeks to identify outliers, i.e., deposits that deviate from the central tendency of the plant assemblage. In this case I aggregated all plant data by feature (samples from 59 different features were analyzed from MV-225), attempting to identify features that are statistical outliers. I then compare those outliers to Ringberg's (2012) assignment of functional space. Multivariate statistics are necessary for such an approach. The use of multivariate statistics has become increasingly common within archaeology, and has proven to be a useful tool for paleoethnobotanists, including for intrasite-level analyses. Multivariate statistics can be used to discover structure or patterning within a dataset, highlight relationships between samples, summarize and succinctly present large datasets, reduce noise and identify outliers, or classify or separate samples based on their contents (Gauch 1982; Smith 2014).

To determine which features differ significantly in terms of abundance and representation of plant foods, I use a Principal Component Analysis (PCA). PCA is a statistical method that considers a set of variables to determine which variables are relatively independent of one another (Shennan 1997; Wulder 2005) and has been successfully employed in paleoethnobotanical analyses (e.g., Hillman 1984; Jones 1983, 1984, 1987; VanDerwarker and Idol 2008; VanDerwarker et al. 2007; VanDerwarker et al. 2014; for a recent summary see Smith 2014). By using several cases (e.g., features), PCA can determine how similar or different the cases are in terms of the variables used to describe them (e.g., plant taxa). The method I employed determined the relatedness of variables by calculating correlation coefficients. Variables are then grouped into subsets based on relatedness and combined into factors (e.g., components) (Wulder 2004).

I ran a principal component analysis using the SYSTAT statistical package. Following the basic criteria of principal component analysis that uses a correlation matrix, I used plant densities and only included taxa that occurred in multiple samples and in sufficient quantity to provide meaningful results (in this case, only taxa that occurred in five or more samples were included). Component loadings are provided in Table 5.1 (density data used in the PCA are listed in Appendix 8).

Table 5.1 Component loadings used in the Principal Components Analysis.

Taxon	Component 1	Component 2
Avocado	0.486	-0.35
Barrel cactus	0.546	0.73
Chili pepper	0.976	-0.081
Common bean	0.034	0.261
Golden berry	0.636	0.541
Gourd	0.023	0.075
Grass family	0.13	0.427
Guava	0.969	-0.111
Legume family	0.733	-0.023
Lucuma	0.027	0.134
Maize	0.035	0.253
Mallow	0.041	0.463
Quinoa	0.713	-0.574
Rattlepod	0.659	-0.569
Sedge family	0.937	0.081
Squash	0.442	0.313
Sunflower family	0.182	0.567

When we plot the PCA in two-dimensional space (Figures 5.6 and 5.7), we can see that some features and associated subfeatures deviate from the central tendency of the plant assemblage (Features 5, 5.11, 12, 12.04, 17.01, 25, 38, and 62.07).

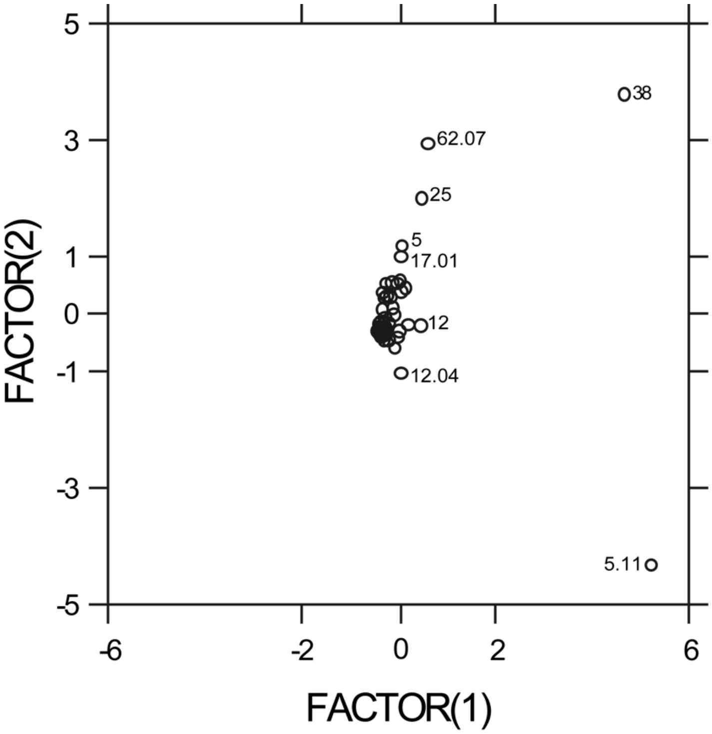

Figure 5.6 Factor scores plot for the PCA of plant assemblages from the MV-225 features.

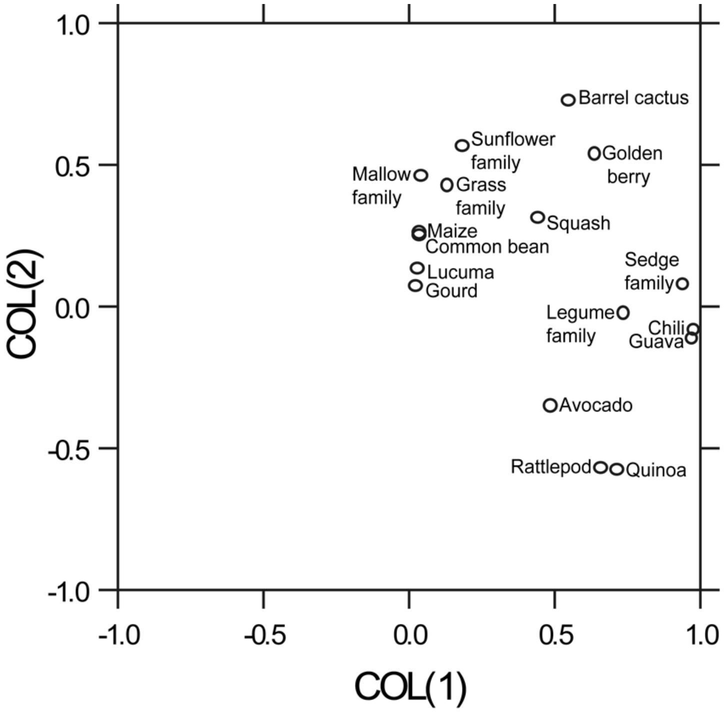

Figure 5.7 Factor loadings plot for the PCA of plant assemblages from MV-225 features.

Features 5, 12, 25, and 38 are enclosed masonry rooms that Ringberg (2012) designates as kitchens. This designation is primarily based on the presence of domestic trash and hearths (see Ringberg 2012:Tables 5.2.2.-5.2.4). Feature 5 is located in Compound 1, and Feature 5.11 is an ash-filled pit located within the feature. Feature 12 is also located in Compound 1; four hearths were documented inside this kitchen feature, including Feature 12.04. Features 25 and 38 are located in Compound 3. Two other features, Features 17.01 and 62.07, are classified with different functions. Feature 17.01 appears to have served as a bin or trough within a storage room (Feature 17) inside Compound 1. Feature 62.07 is a hearth (based on the presence of charcoal); according to Ringberg (2012:307), the hearth appears to predate the construction of a patio feature in Compound 6.

A series of hearths and ash deposits, as well at least four packed sediment floors, led Ringberg (2012:125) to suggest that Feature 5 functioned as one of the most heavily and repeatedly used rooms in all of the residences excavated at MV-225. All but three of the plant taxa included in the PCA are present in Feature 5, and Feature 5 assemblage stands out in terms of maize density (see Table 5.1, Figure 5.7). Feature 5.11, one of six hearths within the Feature 5, has unusually high densities of rattlepod and quinoa, along with avocado, chili pepper, and guava. Feature 12 departs only slightly from the central tendency of the plant assemblage, but Feature 12.04, a hearth located within that feature, deviates further. Feature 25 has a high diversity of plant taxa compared to other MV-225 features, as well as a high density of maize. Feature 38 has a high density of golden berry and barrel cactus remains; while golden berries were consumed widely for their commensal and medicinal properties (see Chapter 4), the high density of barrel cactus remains, which may represent incidental inclusions, is more difficult to interpret. Why a large density of barrel cactus seeds would have ended up in this feature is unclear, aside from plant remains caught in floor sweepings that may have been secondarily deposited.

Overall, a wide range of plant foods as well as a large amount of plant foods appears to have been processed and prepared in these features. Bins and hearths were also found in association with the occupation surfaces (floor) of these features; Ringberg (2012) interprets bins within kitchen features to have been associated with hearths, likely filled with ash dumps and hearth cleaning material when in use. Excavators also frequently encountered guinea pig coprolites in the rest of the kitchen contexts. The abundance of plant remains encountered in Features 25, 12, 25, and 38, coupled with the diversity of taxa, support the interpretation of kitchen functions.

The other features that are pulled apart in the PCA include Features 17.01 and 62.07. As mentioned above, Feature 17.01 appears to have served as a bin or trough made of stone and mortar within a storage room (Feature 17) inside Compound 1. As described by Ringberg (2012:95), "unlike kitchens, the floors of storage spaces were usually free of debris, show less remodeling, and have no hearths." The higher density of certain plant remains in Feature 17.01 relative to other features in the assemblage may be the result of storage bin cleaning that involved burning events. Feature 62.07 is a hearth that predates the creation of a patio (Feature 62) in Compound 6 (Ringberg 2012:307). This feature has a high density of maize remains as well as some other taxa relative to the other features; maize and other foodstuffs were likely processed adjacent to this feature and discarded in the hearth.

Discussion

Overall, the facts that (1) significantly more maize cupules (i.e., evidence of processing discard) were recovered in kitchens than patios, and (2) kitchen features are pulled from the central tendency in the Principal Component Analysis, are intriguing. As mentioned above, formal kitchens in the residential compounds at MV-225 would have been walled and roofed. As Ringberg (2012:113) describes, “with a small cooking fire in the corner, [kitchens] would have been dark, smoky, intimate spaces where individuals or small groups prepared daily meals, ate and rested.” In the context of intensive agricultural production during the Gallinazo/Early Moche phase occupation of MV-225, women and children likely spent ample time in enclosed kitchen spaces, preparing foods for daily meals along with larger supra-household commensal events. These women may have been ethnic highlanders, or they also may have been local *costeños* that married into the MV-225 households.

Some support for the idea of intermarriage comes from the ceramic assemblages at MV-225. Indeed, Castillo Incised and Castillo plainwares, diagnostic of coastal Gallinazo phase sites (e.g., MV-224), dominated the pottery type distributions for floor contact contexts at MV-225, whereas highland style pottery, including Otuzco, Quinga, along with what Ringberg designates as Cerro León wares, dominate Compound 1 (Ringberg 2012:102). Overall, highland style pottery types dominate the assemblage (Ringberg 2012:253) (and indeed, coupled with architectural and burial cist style data, indicate the site to be a highland colony). However, the presence of local coastal wares supports the idea that local costeños interacted and intermingled, and possibly intermarried, with highland colonists, and manufactured and used coastal-style wares at MV-225. Ringberg (2012:271) argues the opposite, stating that coastal women marrying into highland lineages may not have been common at MV-225. She cites the predominance of functionally highland culinary vessels and the evidence for spinning activity (i.e., the dominance of disk-style *tortero* spindle whorls) as evidence that coastal women likely did not marry into highland lineages at MV-225.

However, the fact that MV-225 residents used coastal cooking pots and highland serving wares suggests to me that coastal women possibly did intermarry into highland households, and that they continued to use their traditional coastal-style cooking pots in more hidden, behind-the-scenes contexts while using highland-style fineware serving vessels in more visible public and ritual settings. Scholars in other regions have documented similar dynamics in culture contact or colonial settings, where women in inter-ethnic households maintained traditional practices related to foodways in behind-the-scenes domestic spaces while advertising other identities and affiliations through the use of material media, including servingwares, in public spaces (e.g., Deagan 1973; Trocolli 1992; see also Bardolph 2014; Neuzil 2008; Wilson et al. 2017).

In addition to cooking inside enclosed kitchen spaces, domestic food preparation clearly also took place out of doors, as plant remains were documented in patio spaces as well as enclosed features such as kitchens. Large batanes also are located on patios, indicating that food processing likely occurred in those spaces (although the data discussed above indicate that significantly more maize cupules were recovered from kitchens than from patios, see Figure 5.3). According to Ringberg (2012:132), many potsherd disk spindle whorls were recovered from patios, indicating that women (as well as young children and the elderly) used these open spaces for spinning and weaving. Patios also would have served as spaces for the manufacture and maintenance of tools (by men and women), along with metalworking activities. Large accumulations of plant remains over time, however, occurred in enclosed kitchens, including the Feature 25 and Feature 38 kitchens in the smaller residential Compound 3, a compound that is interpreted to be lower status than Compound 1. According to Ringberg (2012:108), Compounds 3 and 6 provided ample space for daily, more private household activities, but had no apparent open public gathering spaces. Compound 1 is the only residence at MV-225 to have this type of public space; at the top of this compound, two large patio/terrace features make up the largest flat, open space of the entire area. Ringberg (2012:110) describes these patio/terrace features as well-suited to receiving and hosting large-scale gatherings, and that one of the terraces, Feature 22, "would have provided ample space for food preparation as well as for guests." Ringberg emphasizes the importance of ancestor rituals and the hosting of large-scale public events at MV-225, including on the patio terraces of Compound 1.

However, it does not appear that MV-225 residents (i.e., women) were preparing extraordinary amounts of food, for feasts or other purposes, in open-air spaces associated with the Compound 1 terraces. Indeed, patio or terrace features did not deviate from any of the other features in terms of plant content in the PCA, although enclosed kitchen features from Compound 1 (Features 5 and 12) did depart from the others. Women likely prepared food in private, behind-the-scenes contexts for supra-household events and public displays that were performed on patio terraces at Compound 1. These women may have prepared for public events totally apart from, and without being included, in such events. Men also may have been involved in preparations for supra-household events, possibly providing game or camelids and organizing butchering and roasting activities while women prepared chicha and cooked foods such as soups and stews. The food remains in the MV-225 archaeobotanical assemblage likely accumulated from a repeated series of cooking events, for daily meals but also potentially for larger commensal events that likely occurred in

Compound 1, in which women, including lower status women in Compounds 3 and 6, may not have participated (at least in terms of consumption).

In her ethnoarchaeological study of contemporary households in the Upper Mantaro Valley of central Peru, Sikkink (2001) reported a distribution of plant remains in household contexts where there was a lower density of charred seeds where many different activities occurred, including outdoor patios, and more charred material was deposited in kitchens and storage areas, located inside enclosed structures. Taxa diversity was greatest in kitchen contexts. In Hastorf's (1991) seminal analysis of food, space, and gender among the Sausa residents under Inka control in the Upper Mantaro Valley, she found a similar pattern: plant food remains were more densely deposited and more diverse in kitchen structures than in patio areas. Hastorf (1991:143-144) argues that kitchen features, used for cooking, eating, food and fuel storage, and refuse disposal, were likely "women's domains." Hastorf argues that during the period of Inka control of Sausa life, there was an escalation of women's labor to support sociopolitical activities, activities that she interprets as primarily male in participation.

Indeed, the analysis of stable carbon and nitrogen isotope data from burials in Sausa households indicate that men and women had differential access to plant foods, including maize, which she suggests was consumed in the form of chicha. Under Inka hegemony, it appears that women were processing more chicha, but that men were the ones actually consuming it, likely at gatherings, rituals, and masa (work parties). While women appear to have participated in labor to produce maize chicha, they did not participate in supra-household commensal events where chicha was served. Gagnon (2006, 2008; Gagnon and Wiesen 2013) found a similar pattern with respect to gendered access to maize during the

Gallinazo phase in the Moche Valley, from burial data excavated from the paramount coastal center of Cerro Oreja (discussed in Chapter 3). Gagnon documents that men consumed more maize than women during this period (which she argues was consumed in the form of chicha), likely during participation in state or elite-sponsored work parties (Gagnon 2008:180). Oral health indicators and phytoliths from dental calculus further suggest that males had more access to coca than females at Cerro Oreja during the Gallinazo phase (Gagnon et al 2013).

Unfortunately, there are no burial data available for similar stable isotope or oral health studies from MV-225; all human remains at the site were removed from burials prior to or during abandonment. Ringberg (2012:103) attributes the cleaning of cist tombs at MV-225 to activities of the site residents, rather than looters post-abandonment, as looters tend to remove intact artifacts that have high portability and market value such as fine pottery, metal objects, or beads (not human remains). Aside from scattered tiny bone fragments and a few phalanges in burial cists at the site—items likely purposefully cached in tombs upon abandonment, or a result of "loss refuse," (Ringberg 2012:103, citing Schiffer 1996:76-79)—no skeletal collections are available for bone chemistry or dental analyses. However, it is possible that gendered segregation similar to the cases described above occurred amongst the residents at MV-225 during the Gallinazo/Early Moche phases, where women likely were responsible for food preparation, for daily meals as well as for supra-household events in which they may not have participated.

In the context of intensive agricultural production witnessed during the Gallinazo and Early Moche phases, this type of gender segregation likely occurred before the Southern Moche polity consolidated. Women likely cooked and prepared meals in kitchens throughout the three compounds at the site, processing foods on batanes in patio spaces, while also spinning, weaving, and manufacturing tools, likely alongside men, as well as their other family members, including children and the elderly. Cooking soups and stews and preparing chicha for larger events occurred inside the private spaces of closed-off kitchens, and likely resulted in gender segregation of those preparing food versus those who consumed it. It bears noting, however, that women themselves are not a homogenous group—women of higher status (potentially those married to higher status men, possibly residing in Compound 1 at MV-225) may have had more access to certain resources than others. Unfortunately, the data discussed in this dissertation do not have the resolution to elucidate such an issue.

In her spatial analysis of Sausa households in the Upper Mantaro Valley, Hastorf (1991) argues that Andean women's status diminished under Inka rule, but that women probably did not lose their means of domestic production at home. Women in the MV-225 households likely maintained autonomy in some domestic tasks, remaining in charge of processing and storing harvests and making decisions about kitchen and storage areas (Hastorf 1991; Skar 1981). Their status also may have diminished, however, as agricultural production intensified, and as a result, the labor of women of increased, which included planting fields, and processing and preparing foods for daily meals, supra-household events, and to meet tribute demands. Unfortunately, the view from MV-225 is but one perspective. A diachronic comparison of spatial patterns witnessed at all of the Moche Valley sites discussed in this dissertation would make for a truly robust comparison of changes in spatial organization of women's labor. At this point, a combination of detailed architectural analyses, coupled with specific provenience data for plant remains recovered, is not available for the other sites. This issue can be pursued further in future research.

CHAPTER 6

CONCLUDING THOUGHTS

To return to the questions posed at the beginning of this dissertation, how can studies of agricultural systems and the ways that people interact with foods they produce, eat, and discard lead us to new understandings about social relations in the past? How do labor roles, gender relations, and status-based inequalities relate to these types of interactions? I present data that address these issues in Chapter 4 and 5, tracing changes in subsistence, including agricultural intensification, from the Salinar (400–1 B.C.) through Late Moche (A.D. 700–800) phases in the Moche Valley of north coastal Peru. I incorporate theory from a variety of disciplines, including ecological and practice-oriented perspectives, to discuss the roles of gender dynamics, labor relations, and political hierarchies during a complementary and coterminous period of state formation and diaspora.

Understanding the relationship between agricultural intensification and ancient sociopolitical complexity is a question that has long resonated with archaeological research interests, both within and outside of the field of paleoethnobotany. Researchers have sought to demonstrate positive correlations between intensive maize cultivation and sociopolitical complexity throughout the Americas—every urban and state level society in Mesoamerica, from Monte Alban and the Classic Maya, to Teotihuacan and the Aztec (Mexica) civilizations of Central Mexico, had subsistence economies based on maize (Biskowski 2000; Feinman et al. 1987; Hassig 1985; Stark 1990; Whitmore and Turner 2000). To the North, complex polities from the Pueblo communities of the Southwest (Benson et al. 2006; Galinat and Gunnerson 1963; Hard et al. 1996; Matson 2016) to the Mississippian polities in the Southeast and Midwest (e.g., Kidder and Fritz 1993; Lopinot 1992, 1994, 1997; Scarry 1993a; 1993b; Simon 2014; VanDerwarker et al. 2017) relied on maize as a staple crop. Maize also played a key role in the political economy of a wide range of Andean polities, most notably the Inka empire (Cobo 1979; Logan et al. 2012; Morris 1979; Murra 1980, 1986; Pizarro 1965[1571]; Poma de Ayala 1987[1615]; Staller 2006), the Wari empire (Finucane et al. 2006; Goldstein et al. 2009; Schreiber 1992; Valdez 2006), the Chimu empire (Moore 1989), the Tiwanaku polity (Hastorf et al. 2006; Goldstein 2003; Wright et al. 2003), and, as I demonstrate in this dissertation, the complex, highly stratified Southern Moche polity (see also Lambert et al. 2012; Pozorski 1979). However, plant food cultivation, including intensive maize cultivation, played variable roles in Andean polities, some of which were not necessarily related to hierarchy or aggrandizement. In the case of the Southern Moche polity, rather than having a causal role in the emergence of social hierarchies, I argue that changes in plant food cultivation (including agricultural intensification) likely were embedded in the changing social relations that eventually led to the development of hierarchies.

In this chapter, I summarize the patterns reported in Chapters 4 and 5 and present an updated view of agricultural strategies, gendered labor, and social life in the Moche Valley EIP, prior to and post-dating the consolidation of the complex, hierarchically organized Southern Moche polity. In doing so, I relate these regional issues to the larger theoretical topics discussed in Chapter 2. Understanding the relationship between agricultural intensification and sociopolitical complexity in north coastal Peru has been hindered by the paucity of systematically collected subsistence data. The research presented in this study addresses this issue specifically for the Moche Valley EIP through the analysis of data from multiple sites. An understanding of changes in maize production requires a consideration of changes that occurred in the entire plant subsistence system; thus, I explore trends in the collection and production of a variety of plant food categories during this time. In his reconsideration of food production in the Cahokian world, Lopinot (1997:54) identified a "zeacentric bias," i.e., a tendency to elevate the importance of maize in food production strategies relative to other crops. I would argue that a similar zeacentric bias looms in much of the Andean literature, where considerations of maize agriculture (including maize intensification) often take place at the expense of evaluating other key economic cultigens (including tree crops). In this dissertation, I evaluate all categories of plant foods recovered from flotation and dry-sieving, including small seeds that would be entirely overlooked without systematic collection and analysis of bulk soil samples (small seeds that indeed have been overlooked in previous investigations on the Peruvian north coast). However, a thorough investigation of the relationship between agricultural intensification and Moche sociopolitical development requires a systematic comparison of data from multiple sites and valleys. This study has established an inventory of plant remains from the Moche Valley that can be compared to other datasets when they become available in the future.

Summary of Patterns

The archaeobotanical data presented in this dissertation paint a picture of shifts in plant cultivation and collection, including agricultural intensification, over five cultural horizons during the EIP (400 B.C. – 800 A.D.). The following section summarizes the plant data to pinpoint the nature and timing of maize intensification and resulting implications for gender- and status-based household labor. Patterns in the plant data suggest an intensification of maize production in the Gallinazo/Early Moche phases, *in advance* of the dramatic expansion of the Southern Moche polity in the A.D. 300s. However, Moche Valley residents continued to cultivate other field and tree crops and collect fleshy fruits and other miscellaneous wild resources.

Analysis of 225 soil samples from five EIP sites revealed that Moche Valley residents relied on a range of plant foods, including field cultigens, tree crops, other fruits, and miscellaneous wild resources, some which have known economic uses. Across the five sites, there were some similarities in the types of plants collected and produced, but the plant data indicate that maize was the most important resource, with the highest ubiquity of all taxa at all five sites. However, maize ubiquity changes through time, with a dramatic increase from the coastal Salinar phase (400–1 B.C.) La Poza site to the middle valley Gallinazo/Early Moche (A.D. 1–300) MV-224 and MV-225 sites. Maize ubiquity decreases at MV-83 in the Middle Moche (A.D. 400–700) phase, and is highly ubiquitous again at Galindo in the Late Moche (A.D. 700–800) phase, suggesting changes in context of use during the Salinar and Middle Moche phases.

Standardizing by plant weight revealed further differences in plant food categories, differences that offer insight into the nature of subsistence shifts related to maize intensification. Standardized counts of various portions of the maize plant, including kernels, cupules, and glumes, as well as total standardized maize counts, indicate significant differences from the Salinar through the Gallinazo phases, well in advance of the Moche political expansion, with similar maize processing levels maintained after polity consolidation. Residents of the local coastal and highland colony settlements of MV-224 and MV-225, respectively, appear to have engaged in similar levels of maize production, levels that remain consistent with production in the Middle and Late Moche periods. The maize data presented in this study lend further support to arguments made by Lambert et al. (2012; see also Gagnon 2006, 2008; Gagnon and Wiesen 2013), who use bone chemistry data and dental markers from coastal skeletal populations at Cerro Oreja to suggest that maize production intensified during the Gallinazo phase, in advance of the expansion of the Moche polity.

Patterns in the plant data from this dissertation reveal that the production of other field cultigens increased in the Gallinazo/Early Moche phases as well. Standardized counts of all field cultigens (including and excluding maize) are significantly higher at MV-224 than they are at La Poza. The coastal MV-224 residents grew a more diverse range of field cultigens than their highland colony neighbors at MV-225. Scholars (e.g., Billman 1996; Fariss 2012; Ringberg 2012) have hypothesized that highland migrants moved into the middle Moche Valley during the Gallinazo/Early Moche phases to take advantage of prime maize growing zones. While the highland residents at MV-225 did grow a range of other field cultigens (chili pepper, coca, common beans, cotton, gourd, lima bean, peanut, quinoa, and squash), they appear to have privileged maize over these other cultigens. Higher levels of cultigen production took place at the Gallinazo/Early Moche sites than in either the preceding Salinar phase *or* the Middle Moche phase, when the Southern Moche polity had consolidated. Cultigen levels rose again at Galindo, which may have related to different farming and plant food production strategies practiced as a result of Galindo's context as a political center.

While Moche Valley residents were intensifying their cultigen production, they were not doing so as a trade off with fruit tree management or fruit collection. On-farm tree planting would have served as a mean of diversifying farming systems while intensifying cultigen production. A comparison of standardized counts of tree crops (avocado, guava, lucuma, and pacay) reveals no changes through time, a pattern mirrored in the total fruit data, which include fleshy fruits. Miscellaneous/wild resources are comparable across all five sites as well, although MV-224 has a significantly higher representation of wild/miscellaneous resources than MV-225, a pattern that may relate to intentional procurement or incidental inclusion in the archaeobotanical assemblage.

Overall, these data demonstrate an increase in cultigen production during the Gallinazo/Early Moche phases, with a continued reliance on tree management and the collection of fruits and other wild resources. A high level of agricultural production was already underway before the height of Moche power—food production appears to have intensified during the Gallinazo phase, likely through the expansion of irrigation systems, shifts in crops produced, the use of manure (likely llama manure) as fertilizer, and decreases in the length of fallowing. To maintain and increase soil fertility, Moche Valley farmers appear to have intercropped nitrogen-fixing legumes (common beans, lima beans, pacay, lupine/*tarwi*) with maize. Weeds likely would have been removed from fields so that cultigens could grow to their full potential; these weeds may have been collected and retained if they held economic value (as food, fodder, medicine, etc.), or they may have unintentionally become incorporated into the Moche Valley archaeobotanical assemblages clinging to livestock or clothing. Moche Valley farmers also may have introduced new and more productive varieties of cultigens during the Gallinazo/Early Moche phases, including maize. While a systematic analysis of maize varieties was not conducted for this study, Bird and Bird (1980) report that new varieties of maize were introduced in the neighboring Chicama Valley during the Gallinazo phase, based on their analysis of a large sample of desiccated maize cobs from Huaca Prieta. It is possible that this dynamic took place in the Moche Valley during this time period as well.

I interpret the changes in cultigen production (including intensified maize production) during the Gallinazo/Early Moche phases in the Moche Valley along two lines: (1) the fulfillment of tribute demands; and (2) the consumption of foodstuffs at larger suprahousehold events, such as community religious/ritual events or *masa* (work parties). Billman (2010) proposes that a regional political economy emerged in the Moche Valley during the EIP that was based primarily on the extraction of tribute from farming households in exchange for access to land and water via irrigation canals. While previous scholarship had imagined such dynamics to occur during the Moche era, earlier tribute demands may have come from local coastal polities, including the paramount coastal center of Cerro Oreja (see Gagnon 2006, 2008; Gagnon and Wiesen 2013; Lambert et al. 2012). The local coastal residents of MV-224 may have been subjected to potential tribute demands from polities such as Cerro Oreja, tribute demands from which the migrant highlanders at MV-225 may have been exempt. Indeed, the highlanders at MV-225 may have been tied to other tribute-based relationships with other migrant highland polities, including in the (lower) Sinsicap and Cruz Blanca areas of the Moche Valley, where Billman (1996) identified other highland site clusters. Data from additional highland EIP sites in the valley are needed to test this hypothesis.

In addition to the preparation of foods, including maize, for potential tribute obligations, plant foods were likely prepared and consumed at supra-household events. These events may have been organized by ambitious kin groups for community religious/ritual gatherings or masa (work parties), or other types of commensal events that defined group identities and solidarities. Maize likely was incorporated into a variety of social and religious negotiations involving plant foods (including other field cultigens, fruits, and wild resources) in which surplus production aided in the support of craftspeople and the fueling of community events that simultaneously reinforced status differences and community cohesion.

Increased labor investment and agricultural intensification also appear to have occurred through interaction and exchange, of ideas, goods, and possibly marriage partners, between local coastal and migrant highland groups that occupied the Moche Valley during the Gallinazo and Early Moche phases (A.D. 1–300). By examining foodways at sites in the middle valley *chaupiyunga*, a dynamic contact zone from prehistory to today, I question rigid taxonomic classifications of ‘highland’ and ‘coastal’ that scholars assign to archaeological sites. A comparison of plant data from coeval *costeño* and *serrano* households challenges long-held assumptions about the material divisions between these groups; indeed, resources considered to be quintessentially ‘highland,’ e.g., potato, quinoa, or ‘coastal,’ e.g., chili peppers, coca, fruits, maize, are documented at both site types in the middle valley during the EIP. Highland and coastal peoples likely established mutually beneficial relationships that revolved around food and farming, including fiestas and religious gatherings. Countering the claim that plant food intensification was orchestrated by those aspiring to *create* political hierarchies, I argue that it likely occurred in the contexts of larger social/religious negotiations initiated among interallied and intermarried kin groups that ultimately reached an exaggerated scale during the Moche period.

By the Middle Moche phase (A.D. 400–700), the residents at MV-8 (including members of lower status households) appear to have been engaged in intensive agricultural production to feed themselves as well as meet tribute demands, with a greater focus on maize than on other cultigens. MV-83 households may also have engaged in mobilizing masa (work parties) through the redistribution of chicha, coca, and other consumables. However, Moche Valley households had probably been long accustomed to such tribute demands and social events involving food, as these dynamics appear to have been taking place in earlier periods. In the Late Moche phase (A.D. 700–800) in the Moche Valley, it is possible that social groups at Galindo participated in commensal events related to strengthening local community cohesion during the decline of Moche centralized political authority. The relationships between activities conducted at Galindo, however, are difficult to determine from the limited sample size of archaeobotanical data.

Regardless, the plant data presented in this study indicates that key changes occurred in the local domestic and political economies of the middle Moche Valley *in advance* of the dramatic expansion of the Moche polity in the A.D. 300s. The extraction of agricultural products during the peak of Moche power likely was a continuation of patterns to which households had already long become accustomed, which may have represented kin-level rather than state-centered organization. Substantial increases in labor investment related to farming and processing, with resulting implications for gender and status, appear to have occurred prior to the onset of Moche hegemony.

I evaluate the gendered aspects of these changes in domestic economy through a spatial analysis of archaeobotanical data from MV-225, the EIP highland colony site (detailed in Chapter 5). Specifically, I explore the staging of food preparation and consumption events in the contexts of public and private spaces. Intrasite spatial analysis revealed that a significant amount of food processing, including of maize, occurred in enclosed (private) kitchen spaces at MV-225. Women likely were responsible for this food processing, which included processing for daily meals as well as for supra-household events that took place on terraces and patios, but women may not have participated in the consumption of foodstuffs prepared. The spatial trends in the MV-225 plant data, where plant food remains were more dense and more diverse in enclosed kitchen structures than in outside patios or other features, mirror those documented ethnographically and archaeologically among households in the Upper Mantaro Valley of central Peru (Hastorf 1991, 2001; Sikkink 2001). Hastorf (1991:143-144) argues that kitchen features, used for cooking, eating, food and fuel storage, and refuse disposal, were likely "women's domains," and that during the period of Inka hegemony, there was an escalation of women's labor to support sociopolitical activities, activities that she interprets as primarily male in orientation.

At the Sausa sites under Inka control in the Upper Mantaro Valley (Hastorf 1991), as well as during the Gallinazo occupation of Cerro Oreja in the lower Moche Valley (Gagnon 2006, 2008; Gagnon and Wiesen 2013; Gagnon et al. 2013), bone chemistry studies and oral health indicators from burial populations indicate differential access to foodstuffs, including chicha and coca, along gendered lines. Although we lack burial data from the other Moche Valley sites discussed in this dissertation, it is possible that similar gendered dynamics occurred in the context of agricultural intensification with respect to consumption at MV-224 and MV-225. Many Andean researchers have questioned whether state development implied increases in women's labor and changes in women's social status (e.g., Costin 1998, 2016; Costin and Earle 1989; Gero 1992; Hastorf 1991; Silverblatt 1987, 1991). As agricultural production intensified in the Moche Valley EIP, I submit that women's status may have diminished while their labor increased, labor that included planting fields as well as processing and preparing food and drink (including chicha) for daily meals, supra-household events, and to meet tribute demands. Once more detailed analyses of architectural data are completed and functional assignments of social spaces are designated for other Moche Valley sites, this issue can be examined from a diachronic perspective.

Concluding Thoughts on Food, Identity, and Moche Valley Society

Ultimately, this study provides a bottom-up view of the rural households of the Moche Valley whose labor related to plant food production created, transformed, and sustained the population that we understand as Moche. With the exception of a few seminal studies (e.g., Gumerman 1991; Pozorski 1976, 1979, 1982; see also Hastorf 1990, 1991), in a region where academic and popular imaginations historically have been focused on monumental architecture, large mortuary contexts, and power-wielding elites, paleoethnobotany's contribution to reconstructing the quotidian past is not particularly well-known. The fact that both professional discourse and popular audience presentations of the ancient Moche (and the ancient Andes more broadly) overwhelmingly have centered on the more romantic and macro-scale aspects of the past makes research on the micro-scale all the more significant.

Feminist scholars have pointed out that the tendency to neglect the seemingly unspectacular productive labor of women has led to a skewed picture of social and economic relations in the past and underpins the continuing devaluation of women's work in contemporary Western societies (Brumfiel 1991; Janowski 2012; Moore 1988; Pollock 2012; Rodríguez-Alegría and Graff 2012; Watson and Kennedy 1991). Reconstructing elements of domestic labor in prehistory can shed light on aspects of daily life that are frequently downplayed or ignored in the writing of larger scale structural histories. While this case study is centered on the ancient Peruvian north coast, the topics I consider should be broadly relevant to scholars interested in foodways, gender and identity studies, labor, migration, and social inequality.

Furthermore, this discussion of Moche Valley foodways, while considered through the lens of archaeological data, has been shaped by and has implications for people in the political present. The Moche Valley of north coastal Peru represents an area of multiple stakeholders with varying interests and claims to the past, and various amounts of political and social power in the present. Within the past few decades, increasing numbers of migrants from the neighboring highlands have relocated to interandean valleys (including the Moche Valley), motivated primarily by economic reasons. Population increases and lack of available land have resulted in legal disputes as a result of rapid sub-division and selling of lots, along with encroachment on archaeological sites and destruction of local patrimony. The deployment of legal recourse and development initiatives, however, has been compounded by deep-seated racism, which reflects and reproduces the legitimacy and hegemony of a dominant culture and ethnic group.

As discussed Chapter 1, Peru has long witnessed a historical conceptual divide between people of the coast (*la costa*) and people of the Andean highlands (*la sierra*) (e.g., Ackerman 1991; Covey 2000; Gelles 1996, 2000; Goldstein 2005; Lau 2004; Mannheim 1991; Orlove 1991; Weismantel 1988). Coastal society and *criollo* culture (i.e., people of Spanish descent born in the Americas) are at the center of Peruvian nation-building; indeed, popular and national cultural discourses present the Spanish-speaking, white minority as the model of modernity, the embodiment of legitimate national culture, and the key to Peru's future. Members of highland communities, on the other hand, often referred to as *indios*

(“Indians”) or *campesinos* (“peasants”), have long been subjected to negative stereotypes characterizing them as backward and unproductive (see Gelles 2000). Contemporary Andean women in these rural households suffer a double burden of racism and sexism. This fact has resulted in the marginalization of highland migrants, many of whom reside in impoverished squatter communities, including in the middle Moche Valley.

Looking into the Future from the Past

Looking forward, I can envision more of an ethnographic component to this project. I have discussed various ethnographic and ethnohistoric analogs, particularly with regards to gender and labor models, for interpreting the data presented in this dissertation. I recognize that not all aspects of past behavior are represented in the present (for long-standing critiques of ethnoarchaeological models, see Kramer 1979; Simms 1992; Yellen 1977). Furthermore, no process of social change is homogenous, and women themselves are not a homogenous group. Class differences are critical in explaining the different activities and opportunities open to women in the Andes (and throughout the developing world). Ethnographic interviews with members of Moche Valley households, including women, may shed light on procurement strategies, cooking techniques, and ingredients used to prepare meals; while not a direct analog to the past, such data could provide a complement to the archaeological record discussed in this study.

Such an approach also has potential for conducting archaeology within a decolonizing framework. By decolonizing, I refer to the recent research paradigm that recognizes the colonial foundation on which archaeological interpretations have been built, but seeks to undermine this foundation and the conventions that reinforce it by conducting archaeology that is more representative of, responsible for, and relevant for Indigenous communities (e.g., Atalay 2006; Lydon and Rizvi 2016; Oland et al. 2012). On a global scale, decolonizing practices vary widely, but have largely been grounded in inclusiveness, collaboration, and engagement with descendant communities. From informal conversations to formal presentations, I hope to share the findings of this dissertation with Moche Valley community members. This project has been conducted in collaboration with MOCHE, Inc., a 501c3 nonprofit dedicated to protecting archaeological sites through community heritage empowerment. MOCHE, Inc. works to improve the standard of living of rural communities in Peru, through programs focused on health, education, and sustainable economic development including a local women's craft collective (Figure 6.1). In return, local communities members pledge to protect archaeological sites. As a staff member of MOCHE, Inc., I have conducted site damage assessments alongside local residents, attended community cleanups, and participated in community heritage preservation workshops. In future involvement with MOCHE, Inc., I hope to present findings from this dissertation to community members in a public audience (and more accessible) form.

Figure 6.1 Members of the MOCHE, Inc. women's artisan co-op, Mujeres Organizadas Caminando Hacia la Esperanza (Organized Women Walking towards Hope), sell their wares in the community of Ciudad de Dios (photo by D. Bardolph July 2015).

There are many future potential research opportunities available for this project as well. The Late Moche (A.D. 700–800) dynamic in the middle Moche Valley is still not particularly well understood. Indeed, there was a Late Moche occupation at the site of MV-223 in Quebrada del León, at the base of Cerro León and the MV-224 and MV-225 sites (Figure 6.2). Excavations by the Moche Origins Project in 2012 yielded soil samples from the site that could be included in future analyses. The site has several deposits suggestive of El Niño events, including ritual offerings and abandonment events potentially related to these climatic phenomena (Billman personal communication 2012).

Figure 6.2 View of MV-223, a Late Moche (A.D. 700-800) site in Quebrada del León (Photo by D. Bardolph July 2011).

Various north coast scholars have documented cultural responses to El Niño events, including changes in subsistence (e.g., Moore 1989; Sandweiss et al. 1996); this topic could be pursued in greater detail in the Moche Valley. Indeed, as I write this dissertation in Spring 2017, Peru is experiencing a late season El Niño, with substantial impacts on various communities in the Moche Valley (including Cuidad de Dios, where MV-83 is located). Rains and flooding have destroyed many community water systems and caused homes to collapse. Significant damage is caused by lack of proper infrastructure in the region. Many of the research questions posed by archaeologists in the region about issues in the past relate to dynamics witnessed in the political present, issues that stem from the effects of colonial efforts conducted over the last 500 years. Archaeology, particularly household archaeology, has the potential to document the *longue-durée* of responses to environmental catastrophes in addition to processes of social and political change.

Evaluation of any of these issues requires a careful consideration of multiple types of data along multiple scales. The integration of multiple types of evidence (micro and macrobotanical remains, faunal data, bone chemistry and other bioarchaeological data, and artifacts) has enormous potential to contribute to debates about inequality and complex polity formation. Broader regional comparisons that extend outside of the Andes are beneficial as well. For example, a wealth of research on foodways and inequality, including considerations of gender, has been conducted in Mesoamerica (e.g., Blake et al. 1992; Chisholm and Blake 2006; Morehart 2008; Morehart and Helmke 2008; Rosenswig 2006, 2007; Turkon 2007; VanDerwarker 2006, 2010) as well as the Eastern Woodlands of North America (e.g., Ambrose et al. 2003; Jackson and Scott 2003; Johannessen 1993; Pauketat et al. 2002; Welch and Scarry 1995; Wilson et al. 2017; VanDerwarker and Detwiler 2002). Indeed, literature from those regions has strongly shaped my interpretations of the Andean past.

To close this dissertation, I come back to the notion of scale. This project reveals how a seemingly mundane category of archaeological data (archaeobotanical data) can shed light on myriad social processes related to the negotiation of ethnic identities, gender relations, and domestic labor. Following Silliman (2010a), in my consideration of Moche Valley social and political change, I give consideration to issues of agency, practice, memory, and gender; talk about artifacts that tell history rather than those that just tell time; move away from preconceived and typological ideas about material culture or food items; and pay close attention to microscale contexts like households. It is my hope that future scholars will continue to embrace such approaches. The more rigorous we are in the application of those approaches, the better we can compare datasets to build a more robust picture of Andean social life, past and present.

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APPENDIX I

DESSICATED PLANT MATERIAL FROM MV-225

Site	PD	FS	Common Name	Scientific Name	Count (n)	Weight (g)[1]
MV-224	2101	15	UID seed		4	1.24
MV-224	2106	13	UID seed		3	1.89
MV-224	2108	16	Corn kernel	*Zea mays*	1	0.35
MV-224	2110	15	Corn cob	*Zea mays*	1	0.14
MV-224	2116	9	Corn cob	*Zea mays*	2	0.19
MV-224	2117	1	Gourd rind	*Lagenaria siceraria*	2	0.35
MV-224	2117	1	Squash seed	*Cucurbita* spp.	1	Neg
MV-224	2117	14	Corn cob	*Zea mays*	3	0.26
MV-224	2117	14	Gourd rind	*Lagenaria siceraria*	1	Neg
MV-224	2117	14	Peanut shell	*Arachis hypogaea*	5	0.2
MV-224	2117	14	Squash seed	*Cucurbita* spp.	4	0.14
MV-224	2117	14	UID seed		1	0.06
MV-224	2127	7	Squash seed	*Cucurbita* spp.	2	Neg
MV-224	2154	2	Corn kernel	*Zea mays*	1	Neg
MV-224	2154	2	Peanut shell	*Arachis hypogaea*	4	Neg
MV-224	2154	2	UID rind		1	0.03
MV-224	2154	2	UID seed pod		2	Neg
MV-224	2154	4	UID seed		1	0.05
MV-224	2154	11	Peanut shell	*Arachis hypogaea*	35	1.96
MV-224	2155	4	Corn cob	*Zea mays*	6	0.11
MV-224	2155	4	Gourd rind	*Lagenaria siceraria*	5	0.37
MV-224	2155	4	Peanut shell	*Arachis hypogaea*	1	Neg
MV-224	2155	4	Squash seed	*Cucurbita* spp.	2	0.02
MV-224	2155	4	UID seed		1	0.56
MV-224	2155	4	UID seed pod		1	0.02
MV-224	2155	11	Avocado pit	*Persea americana*	1	1.33
MV-224	2202	10	Corn cob	*Zea mays*	2	0.22
MV-224	2203	6	Avocado pit	*Persea americana*	1	0.05
MV-224	2203	6	UID seed		1	0.32
MV-225	1149	7	UID seed pod		1	0.34
MV-225	1172	11	UID seed pod		3	0.06
MV-225	1177	12	UID seed pod		11	0.21
MV-225	1185	22	UID rind		1	0.12
MV-225	1185	22	UID seed pod		1	Neg
MV-225	1192	15	Squash seed	*Cucurbita* spp.	2	0.06
MV-225	1202	17	UID seed pod		1	0.54
MV-225	1204	10	Squash seed	*Cucurbita* spp.	4	0.18

Site	PD	FS	Common Name	Scientific Name	Count (n)	Weight (g)[1]
MV-225	1204	10	UID seed pod		19	0.26
MV-225	1206	12	UID seed pod		1	1.06
MV-225	1209	15	UID seed pod		2	0.06
MV-225	1209	30	Corn cob	*Zea mays*	2	0.36
MV-225	1209	30	UID seed pod		1	0.02
MV-225	1209	30	UID seed pod		12	0.37
MV-225	1223	9	Squash	*Cucurbita* spp.	5	0.05
MV-225	1223	15	Peanut shell	*Arachis hypogaea*	2	0.04
MV-225	1223	15	Squash seed	*Cucurbita* spp.	1	Neg
MV-225	1230	1	Gourd rind	*Lagenaria siceraria*	15	1.15
MV-225	1231	8	UID rind		1	0.03
MV-225	1231	8	UID seed		1	Neg
MV-225	1236	15	Avocado pit	*Persea americana*	3	0.035
MV-225	1246	8	Avocado pit	*Persea americana*	9	1.69
MV-225	1246	8	Chili pepper seed	*Capsicum* spp.	6	Neg
MV-225	1246	8	Gourd rind	*Lagenaria siceraria*	3	0.07
MV-225	1257	18	Avocado pit	*Persea americana*	1	0.41
MV-225	1259	6	Corn cob	*Zea mays*	1	0.51
MV-225	1259	6	UID seed cap		1	0.04
MV-225	1263	9	Corn cob	*Zea mays*	1	0.04
MV-225	1263	9	UID rind		1	Neg
MV-225	1263	11	Corn cob	*Zea mays*	5	0.22
MV-225	1263	12	Corn cob	*Zea mays*	9	0.59
MV-225	1269	27	UID seed		1	Neg
MV-225	1270	1	Squash seed	*Cucurbita* spp.	2	Neg

[1] Specimen weight listed as neglible ("neg") if less than 0.01 g.

APPENDIX II

Provenience Information and Basic Flotation Sample Measures

Site	Area	Unit/Level	Volume (L)	Total Plant Weight (g)	Total Wood Weight (g)
La Poza	5	C2-MT01	4.4	5.07	5.98
La Poza	5	C6-MT03	5	No plants or wood recovered	
La Poza	8	RC5-RSG01-MT01	3.3	No plants or wood recovered	
La Poza	21	C2-MT01	2.4	No plants or wood recovered	
La Poza	21	C2-MT02	0.6	No plants or wood recovered	
La Poza	21	C2-MT03	3.6	1.55	1.42
La Poza	28	RC2-MT01	3.6	1.55	1.42
La Poza	28	RC2-MT02	1.5	0.21	0.21
La Poza	28	RC2-MT03	1.3	No plants or wood recovered	
La Poza	28	RC4-MT04	2.2	0.84	0.81
La Poza	28	RC4-MT06	4.4	3.35	3.33
La Poza	28	RC4-MT07	4	2.82	2.82
La Poza	28	RC4-MT08	4.4	2.92	2.78
La Poza	36	RC2-MT01	3.5	1.23	1.19
La Poza	36	RC2-MT01	4.4	2.92	2.78
La Poza	36	RC2-MT01	3.5	1.23	1.19
La Poza	36	RC3-MT 02	3.4	4.25	4.01
La Poza	38	RC6-MT02	4.4	3.39	3.16
La Poza	38	RC7-MT03	3.1	No plants or wood recovered	

Site	PD	FS	Volume (L)	Total Plant Weight (g)[1]	Total Wood Weight (g)[1]
MV-224	2012	1	5	2.62	2.6
MV-224	2014	1	5	2.55	2.43
MV-224	2017	1	5.25	2.93	2.84
MV-224	2018	1	5.5	2.96	2.84
MV-224	2023	1	5	3.42	3.23
MV-224	2024	1	7.5	2.24	2.12
MV-224	2105	15	5	3.84	3.78
MV-224	2107	1	6.5	5.16	5.07
MV-224	2111	1	6	1.45	1.45
MV-224	2114	1	6	9.72	9.69
MV-224	2121	1	5	0.24	0.22
MV-224	2123	1	5	1.57	1.52
MV-224	2125	1	5.5	1.53	1.47
MV-224	2125	1	5.5	1.53	1.47

Site	PD	FS	Volume (L)	Total Plant Weight (g)[1]	Total Wood Weight (g)[1]
MV-224	2131	1	4.5	3.93	3.91
MV-224	2133	1	3.5	7.01	6.77
MV-224	2134	1	5	12.59	12.23
MV-224	2135	1	5	2.16	2.02
MV-224	2138	1	5.25	0.06	0.06
MV-224	2142	1	5	0.98	0.83
MV-224	2143	1	4.5	2.64	2.56
MV-224	2146	1	5	13.61	12.84
MV-224	2147	1	3	0.8	0.8
MV-224	2148	1	5	3	2.68
MV-224	2150	2	5.25	0.66	0.66
MV-224	2152	1	3.25	1.87	1.79
MV-224	2153	1	4	2.36	2.32
MV-224	2157	1	6.5	0.2	0.2
MV-224	2159	1	4.6	16.42	11.5
MV-224	2160	1	3.5	3.14	3.14
MV-224	2161	1	1.7	0.02	0.02
MV-224	2162	2	3.5	0.02	0.02
MV-224	2163	1	4	0.19	0.14
MV-224	2164	1	4	NEG	NEG
MV-224	2165	1	4	0	0
MV-224	2167	1	4	3.18	3.07
MV-224	2168	1	5	0.27	0.27
MV-224	2173	1	4.5	2.38	2.34
MV-224	2174	1	0.25	0.1	0.1
MV-224	2177	1	4	4.47	4.36
MV-224	2179	1	6	4.29	3.79
MV-224	2179	2	5	5.25	3.8
MV-224	2206	11	2	2.61	2.61
MV-224	2207	15	2.25	2.06	2
MV-225	1083	1	7.0	15.84	15.73
MV-225	1087	1	7.0	2.10	1.79
MV-225	1088	1	7.0	3.54	3.51
MV-225	1091	1	5.75	0.63	0.63
MV-225	1093	1	3.5	3.66	3.43
MV-225	1097	1	8.5	3.31	3.27
MV-225	1099	1	5.0	2.06	1.92
MV-225	1111	1	5.0	3.03	2.99
MV-225	1113	1	5.0	2.93	2.89
MV-225	1117	1	5.0	1.84	1.53
MV-225	1121	1	3.25	1.42	1.37

Site	PD	FS	Volume (L)	Total Plant Weight (g)[1]	Total Wood Weight (g)[1]
MV-225	1122	1	5.0	7.01	6.69
MV-225	1123	1	4.0	4.08	3.95
MV-225	1126	1	3.5	0.87	0.84
MV-225	1168	14	4.0	1.54	1.53
MV-225	1177	14	5.0	2.26	2.20
MV-225	1201	6	5.0	3.57	3.57
MV-225	1206	15	5.0	3.80	3.77
MV-225	1213	1	5.0	5.54	5.39
MV-225	1221	2	0.6	0.05	0.05
MV-225	1222	1	6.3	0.24	0.24
MV-225	1235	1	5.0	2.14	2.08
MV-225	1236	1	5.2	4.25	3.98
MV-225	1236	2	5.2	3.64	3.34
MV-225	1244	1	5.6	0.40	0.40
MV-225	1249	1	4.6	1.81	1.81
MV-225	1250	1	5.1	1.43	1.43
MV-225	1251	1	4.8	10.08	10.05
MV-225	1257	1	5.0	2.90	2.86
MV-225	1257	1	5.0	2.90	2.86
MV-225	1262	1	5.0	0.72	0.70
MV-225	1266	1	5.0	12.11	11.87
MV-225	1266	2	5.0	3.34	3.32
MV-225	1270	6	5.4	0.77	0.77
MV-225	1271	11	5.2	3.81	3.81
MV-225	1273	1	5.5	1.21	1.21
MV-225	1275	1	5.0	2.45	2.40
MV-225	1276	1	1.0	0.05	0.05
MV-225	1277	1	3.0	0.08	0.08
MV-225	1289	1	5.8	5.04	4.70
MV-225	1292	1	1.3	0.61	0.60
MV-225	1293	2	5.0	4.23	4.14
MV-225	1294	1	2.5	2.49	2.49
MV-225	1295	1	5.3	1.33	1.33
MV-225	1299	1	5.0	3.16	3.07
MV-225	1314	1	3.0	1.01	0.99
MV-225	1316	1	5.0	5.69	5.49
MV-225	1316	2	5.0	6.16	6.07
MV-225	1349	1	5.0	1.50	1.49
MV-225	1353	1	5.0	1.69	1.62
MV-225	1362	13	5.0	NEG	NEG
MV-225	1363	1	5.0	19.76	19.53

Site	PD	FS	Volume (L)	Total Plant Weight (g)[1]	Total Wood Weight (g)[1]
MV-225	1367	1	5.0	22.38	17.35
MV-225	1367	3	5.0	11.29	10.88
MV-225	1369	1	5.0	3.10	3.09
MV-225	1374	13	5.5	10.93	10.62
MV-225	1375	1	5.0	0.06	0.05
MV-225	1379	1	5.0	4.97	4.87
MV-225	1379	2	5.0	1.42	1.35
MV-225	1383	1	4.8	3.70	3.70
MV-225	1385	1	5.0	1.58	1.51
MV-225	1386	1	5.0	1.83	1.80
MV-225	1387	1	5.2	13.49	13.08
MV-225	1389	1	5.0	8.04	7.67
MV-225	1390	1	5.0	5.97	5.79
MV-225	1392	1	3.5	2.22	2.19
MV-225	1393	1	5.5	18.94	16.20
MV-225	1394	1	5.0	21.53	20.45
MV-225	1408	10	5.0	7.29	7.19
MV-225	1409	1	5.0	5.61	5.39
MV-225	1422	12	5.2	1.83	1.83
MV-225	1424	1	4.0	1.31	1.19
MV-225	1427	1	5.0	5.52	5.42
MV-225	1428	1	5.0	0.08	0.08
MV-225	1436	16	5.0	1.80	1.80
MV-225	1437	1	5.0	1.58	1.58
MV-225	1438	1	5.0	0.89	0.86
MV-225	1439	1	5.0	0.72	0.72
MV-225	1446	15	5.0	0.11	4.86
MV-225	1458	1	5.0	1.16	1.15
MV-225	1458	1	5.0	1.16	1.15
MV-225	1459	1	5.0	1.12	1.02
MV-225	1465	1	5.5	4.07	4.02
MV-225	1469	1	5.0	7.49	7.49
MV-225	1473	1	5.0	2.88	2.63
MV-225	1475	1	5.2	4.51	4.31
MV-225	1494	1	5.0	1.37	1.37
MV-225	1496	1	5.0	3.11	2.71
MV-225	1510	1	4.0	16.25	16.18
MV-225	1512	1	5.0	2.32	2.24
MV-225	1513	1	5.0	3.20	3.03
MV-225	1515	1	5.0	0.42	0.42
MV-225	1516	1	5.0	3.60	3.39

Site	PD	FS	Volume (L)	Total Plant Weight (g)[1]	Total Wood Weight (g)[1]
MV-225	1517	1	5.0	0.69	0.69
MV-225	1643	2	2.50	2.00	2.00
MV-225	1657	1	5.0	3.40	3.36
MV-225	1661	11	5.5	3.21	3.20
MV-225	1664	1	1.7	1.54	1.51
MV-225	1667	1	5.5	4.87	4.78
MV-225	1677	8	4.3	1.99	1.97
MV-225	1692	10	5.0	2.33	2.20
MV-225	1701	1	5.0	9.99	9.39
MV-225	1702	1	5.0	3.30	3.14
MV-225	1703	1	4.0	9.26	9.12
MV-225	1705	1	2.5	1.51	1.47
MV-225	1731	1	6.0	4.79	4.39
MV-225	1736	2	2.0	0.63	0.63
MV-225	1739	1	5.0	1.66	1.64
MV-225	1784	1	5.0	3.87	3.46
MV-225	1792	1	5.0	4.18	4.13
MV-225	1802	1	3.5	0.57	0.57
MV-225	1804	1	5.0	7.77	7.66
MV-225	1809	1	5.0	3.75	3.68
MV-225	1816	2	5.0	1.95	1.77
MV-225	1821	1	5.0	1.78	1.54
MV-225	1828	1	5.2	3.35	3.23
MV-225	1829	1	5.0	24.06	23.88
MV-225	1834	1	5.0	0.02	0.02
MV-225	1835	1	5.5	6.21	5.68
MV-225	1846	1	5.0	0.52	0.52
MV-225	1855	3	5.0	0.05	0.05
MV-225	1856	1	5.0	8.70	8.50
MV-225	1861	1	4.8	2.84	2.70
MV-225	1861	11	5.0	5.24	5.14
MV-225	1862	1	5.0	2.22	2.18
MV-225	1862	2	5.0	3.24	3.22
MV-225	1880	1	1.0	0.88	0.86
MV-225	1881	1	0.5	0.19	0.16
MV-225	1885	1	4.0	2.58	2.51
MV-225	1889	1	5.0	2.72	2.52
MV-225	1889	2	5.0	7.91	7.58
MV-225	1891	1	5.0	2.20	2.03
MV-83[2]	254	2	0.325	0.07	0.06
MV-83[2]	254	6	1.0	3.34	3.34

Site	PD	FS	Volume (L)	Total Plant Weight (g)[1]	Total Wood Weight (g)[1]
MV-83[2]	254	7	1.25	2.17	2.16
MV-83[2]	256	1	1.0	4.46	4.46
MV-83[2]	264	1	0.85	3.85	3.73
MV-83[2]	275	10	1.0	2.19	2.19
MV-83[2]	275	11.1	1.5	5.25	5.23
MV-83[2]	275	11.2	1.0	2.10	2.10
MV-83[2]	275	11.3	1.0	3.59	3.53
MV-83[2]	275	13	0.25	0.52	0.52
MV-83[2]	276	1	1.50	3.98	3.81
MV-83[2]	281	1	1.25	4.45	4.44
MV-83[2]	281	2	1.25	3.39	3.37
MV-83[2]	286	9	3.0	6.61	6.37
MV-83[2]	293	1	2.0	6.71	4.42
MV-83[2]	296	8	0.5	0.16	0.16
MV-83[2]	317	7	1.0	4.39	4.29
MV-83[2]	321	8	2.5	2.17	2.17
MV-83[2]	321	15	2.0	1.19	1.13
Galindo[3]	4	93	4	12.6	12.6
Galindo[3]	88	90	6.5	2.3	2.2
Galindo[3]	260	225	3.75	6.3	6.3
Galindo[3]	271	205	5	NEG	NEG
Galindo[3]	304	155	11.3	7.8	7.8
Galindo[3]	332	196	14.5	7.6	7.5
Galindo[3]	371	269	12.75	16.6	16.5
Galindo[3]	428	570	2.75	1.8	1.8
Galindo[3]	587	577	3.25	5.9	5.9
Galindo[3]	594	581	5.3	NEG	NEG

[1] Specimen weight listed as neglible (“neg”) if less than 0.01 g.

[2] Provenience information and soil volume information adapted from Gagnon and Schaeffer 2002:Table 2

[3] Provenience information and soil volume information adapted from Lockard 2009:Table 7.2

APPENDIX III

INVENTORY OF PLANTS IDENTIFIED AT LA POZA

Area	Feature/Level	Common Name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
5	C2-MT01	Barrel cactus	*Echinocactus* spp.	2	Neg
5	C2-MT01	Cotton	*Gossypium barbadense*	1	Neg
5	C2-MT01	Gourd	*Lagenaria siceraria*	1	0.01
5	C2-MT01	Guava	*Psidium* spp.	1	Neg
5	C2-MT01	Legume family (Weedy)	Fabaceae	1	Neg
5	C2-MT01	Maize cupule	*Zea mays*	1	Neg
5	C2-MT01	Maize cupule cf.	*Zea mays* cf.	1	Neg
5	C2-MT01	Maize kernel	*Zea mays*	1	Neg
5	C2-MT01	Shoreline purslane	*Sesuvium* spp.	1	Neg
5	C2-MT01	Tillandsia	*Tillandsia* spp.	1	0.08
5	C2-MT01	UID		2	Neg
5	C2-MT01	UID seed		3	Neg
5	C6-MT03	No plants or wood recovered			
8	RC5-RSG01-MT01	No plants or wood recovered			
21	C2-MT01	No plants or wood recovered			
21	C2-MT02	No plants or wood recovered			
21	C2-MT03	Golden berry	*Physalis peruviana*	1	Neg
21	C2-MT03	Grass family	Poaceae	1	Neg
21	C2-MT03	Tillandsia	*Tillandsia* spp.	3	0.13
21	C2-MT03	UID		4	Neg
28	RC2-MT01	Barrel cactus	*Echinocactus* spp.	1	Neg
28	RC2-MT01	Guava	*Psidium* spp.	2	Neg
28	RC2-MT01	Grass family	Poaceae	2	Neg
28	RC2-MT01	Legume family (Weedy)	Fabaceae	1	Neg
28	RC2-MT01	Maize kernel	*Zea mays*	1	Neg
28	RC2-MT01	Maize kernel cf.	*Zea mays* cf.	1	Neg
28	RC2-MT01	Shoreline purslane	*Sesuvium* spp.	1	Neg
28	RC2-MT01	Trianthema	*Trianthema* spp.	1	Neg
28	RC2-MT01	UID		2	Neg
28	RC2-MT02	UID		2	Neg
28	RC2-MT03	No plants or wood recovered			
28	RC4-MT04	Tillandsia	*Tillandsia* spp.	1	0.03
28	RC4-MT04	UID		3	Neg
28	RC4-MT04	UID seed		2	Neg
28	RC4-MT06	Cotton	*Gossypium barbadense*	1	Neg
28	RC4-MT06	Legume family	Fabaceae	1	Neg

Area	Feature/Level	Common Name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
28	RC4-MT06	Golden berry	*Physalis peruviana*	1	Neg
28	RC4-MT06	Gourd	*Lagenaria siceraria*	1	0.02
28	RC4-MT06	Guava	*Psidium* spp.	1	Neg
28	RC4-MT06	Maize cupule	*Zea mays*	2	Neg
28	RC4-MT06	Maize kernel	*Zea mays*	1	Neg
28	RC4-MT06	Nightshade family	Solanaceae	1	Neg
28	RC4-MT06	Shoreline purslane	*Sesuvium* spp.	2	Neg
28	RC4-MT06	Sunflower family	Asteraceae	1	Neg
28	RC4-MT07	Maize cupule	*Zea mays*	1	Neg
28	RC4-MT07	Maize cupule cf.	*Zea mays* cf.	1	Neg
28	RC4-MT07	Maize kernel	*Zea mays*	1	Neg
28	RC4-MT07	UID		4	Neg
28	RC4-MT08	Gourd	*Lagenaria siceraria*	1	0.01
28	RC4-MT08	Lucuma	*Pouteria lucuma*	1	Neg
28	RC4-MT08	Maize cupule	*Zea mays*	1	Neg
28	RC4-MT08	Maize cupule cf.	*Zea mays* cf.	1	Neg
28	RC4-MT08	Maize kernel	*Zea mays*	3	0.03
28	RC4-MT08	Tillandsia	*Tillandsia* spp.	1	0.1
28	RC4-MT08	UID		1	Neg
28	RC4-MT08	UID seed		2	Neg
36	RC2-MT01	Chili pepper cf.	*Capsicum* spp. cf.	1	Neg
36	RC2-MT01	Guava	*Psidium* spp.	1	Neg
36	RC2-MT01	Lucuma	*Pouteria lucuma*	2	Neg
36	RC2-MT01	Maize cupule	*Zea mays*	1	Neg
36	RC2-MT01	Maize kernel frag	*Zea mays*	1	0.01
36	RC2-MT01	Tillandsia	*Tillandsia* spp.	1	0.03
36	RC2-MT01	UID		11	Neg
36	RC3-MT 02	Avocado	*Persea americana*	2	0.18
36	RC3-MT 02	Guava	*Psidium* spp.	1	Neg
36	RC3-MT 02	Legume family	Fabaceae	1	Neg
36	RC3-MT 02	Lucuma	*Pouteria lucuma*	1	Neg
36	RC3-MT 02	Maize cob	*Zea mays*	1	0.01
36	RC3-MT 02	Maize cupule	*Zea mays*	1	Neg
36	RC3-MT 02	Maize kernel	*Zea mays*	1	Neg
36	RC3-MT 02	UID		11	0.05
38	RC6-MT02	Cotton	*Gossypium barbadense*	1	Neg
38	RC6-MT02	Grass family	Poaceae	1	Neg
38	RC6-MT02	Legume family cf.	Fabaceae cf.	1	Neg
38	RC6-MT02	Lucuma	*Pouteria lucuma*	1	Neg
38	RC6-MT02	Maize cupule	*Zea mays*	2	Neg
38	RC6-MT02	Maize cupule cf.	*Zea mays* cf.	2	Neg

Area	Feature/Level	Common Name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
38	RC6-MT02	Maize kernel	*Zea mays*	1	0.04
38	RC6-MT02	Maize kernel cf.	*Zea mays* cf.	2	0.01
38	RC6-MT02	Tillandsia	*Tillandsia* spp.	1	0.14
38	RC6-MT02	UID		2	Neg
38	RC7-MT03	No plants or wood recovered			

[1] cf. = identification probable but not definite
[2] Specimen weight listed as neglible ("neg") if less than 0.01 g.

APPENDIX IV

INVENTORY OF PLANTS RECOVERED AT MV-224

PD	FS	Common Name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
2012	1	Chili pepper	*Capsicum* spp.	1	Neg
2012	1	Maize cupule	*Zea mays*	7	0.02
2012	1	Maize kernel	*Zea mays*	1	Neg
2012	1	Milk thistle	*Silybum* spp. cf.	1	Neg
2012	1	UID		2	Neg
2014	1	Maize cob	*Zea mays*	1	Neg
2014	1	Maize cupule	*Zea mays*	6	Neg
2014	1	Maize cupule cf.	*Zea mays* cf.	2	Neg
2014	1	Maize kernel	*Zea mays*	4	Neg
2014	1	Pacay	*Inga feuillei*	1	0.12
2014	1	Squash	*Cucurbita* spp.	1	Neg
2014	1	UID		4	Neg
2017	1	Barrel cactus	*Echinocactus* spp.	1	Neg
2017	1	Legume family (possible domesticated bean)	Fabaceae	1	Neg
2017	1	Legume family (weedy)	Fabaceae	1	Neg
2017	1	Lucuma	*Pouteria lucuma*	8	Neg
2017	1	Maize cob	*Zea mays*	2	0.02
2017	1	Maize cupule	*Zea mays*	8	0.01
2017	1	Maize kernel	*Zea mays*	3	0.02
2017	1	Maize kernel cf.	*Zea mays* cf.	1	Neg
2017	1	Pacay	*Inga feuillei*	1	0.04
2017	1	Rattlepod	*Crotalaria* spp.	1	Neg
2018	1	Legume family	Fabaceae	1	0.03
2018	1	Lucuma	*Pouteria lucuma*	1	Neg
2018	1	Maize cob	*Zea mays*	3	0.05
2018	1	Maize cupule	*Zea mays*	2	Neg
2018	1	Maize glume	*Zea mays*	1	Neg
2018	1	Maize kernel	*Zea mays*	10	0.04
2018	1	UID		3	Neg
2023	1	Maize cob	*Zea mays*	3	0.07
2023	1	Maize cupule	*Zea mays*	3	0.01
2023	1	Maize cupule cf.	*Zea mays* cf.	2	Neg
2023	1	Maize glume	*Zea mays*	1	Neg
2023	1	Maize kernel	*Zea mays*	8	0.03
2023	1	Maize kernel cf.	*Zea mays* cf.	3	0.01
2023	1	Peanut	*Arachis hypogaea*	1	0.04

PD	FS	Common Name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
2023	1	UID		7	Neg
2023	1	UID seed		3	0.03
2024	1	Avocado	*Persea americana*	1	0.01
2024	1	Barrel cactus	*Echinocactus* spp.	1	Neg
2024	1	Chili pepper	*Capsicum* spp.	1	Neg
2024	1	Legume family (possible domesticated bean)	Fabaceae	2	0.06
2024	1	Maize cupule	*Zea mays*	7	0.01
2024	1	Maize cupule cf.	*Zea mays* cf.	1	Neg
2024	1	Maize kernel	*Zea mays*	7	0.03
2024	1	Maize kernel cf.	*Zea mays* cf.	2	Neg
2024	1	Mallow family	Malvaceae cf. *Malvastrum* spp.	1	Neg
2024	1	Rattlepod	*Crotalaria* spp.	1	Neg
2024	1	UID		8	0.01
2024	1	UID seed		1	Neg
2105	15	Gourd	*Lagenaria siceraria*	1	Neg
2105	15	Legume family	Fabaceae	2	0.02
2105	15	Lucuma	*Pouteria lucuma*	1	Neg
2105	15	Maize kernel	*Zea mays*	10	0.04
2107	1	Legume family	Fabaceae	2	0.01
2107	1	Maize cob	*Zea mays*	8	0.03
2107	1	Maize cupule	*Zea mays*	1	Neg
2107	1	Maize glume	*Zea mays*	1	Neg
2107	1	Maize kernel	*Zea mays*	9	0.05
2107	1	Sedge family	Cyperaceae	1	Neg
2107	1	UID seed		1	Neg
2111	1	Barrel cactus	*Echinocactus* spp.	1	Neg
2111	1	Maize cupule	*Zea mays*	4	Neg
2111	1	UID		4	Neg
2111	1	UID seed		1	Neg
2114	1	Grass family	Poaceae	1	Neg
2114	1	Legume family	Fabaceae	2	0.03
2114	1	Maize cob	*Zea mays*	1	Neg
2114	1	Maize cupule	*Zea mays*	4	Neg
2114	1	Maize cupule cf.	*Zea mays* cf.	2	Neg
2114	1	Maize kernel	*Zea mays*	2	Neg
2114	1	Maize kernel cf.	*Zea mays* cf.	1	Neg
2114	1	UID		1	Neg
2114	1	UID seed		2	Neg
2121	1	Legume family (possible domesticated bean)	Fabaceae	2	0.02
2121	1	Maize kernel	*Zea mays*	2	Neg

PD	FS	Common Name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
2121	1	Mallow family	Malvaceae cf. *Malvastrum* spp.	1	Neg
2121	1	UID		2	Neg
2123	1	Maize cupule	*Zea mays*	1	Neg
2123	1	Maize kernel	*Zea mays*	8	0.03
2123	1	Squash	*Cucurbita* spp.	1	0.02
2125	1	Barrel cactus	*Echinocactus* spp.	2	Neg
2125	1	Gourd	*Lagenaria siceraria*	2	Neg
2125	1	Grass family	Poaceae	2	Neg
2125	1	Guava	*Psidium* spp.	1	Neg
2125	1	Maize cupule	*Zea mays*	3	Neg
2125	1	Maize glume	*Zea mays*	5	0.04
2125	1	Maize glume cf.	*Zea mays* cf.	1	Neg
2125	1	Maize kernel	*Zea mays*	5	0.02
2125	1	Maize kernel cf.	*Zea mays* cf.	3	Neg
2125	1	Rattlepod	*Crotalaria* spp.	1	Neg
2125	1	Sedge family cf.	Cyperaceae cf.	1	Neg
2125	1	UID		5	Neg
2125	1	UID fruit case		2	Neg
2125	1	UID seed		5	Neg
2131	1	Barrel cactus	*Echinocactus* spp.	1	Neg
2131	1	Gourd	*Lagenaria siceraria*	1	Neg
2131	1	Grass family	Poaceae	1	Neg
2131	1	Legume family (weedy)	Fabaceae	1	Neg
2131	1	Maize cupule	*Zea mays*	3	Neg
2131	1	Maize kernel	*Zea mays*	7	0.02
2131	1	Maize kernel cf.	*Zea mays* cf.	1	Neg
2131	1	Passion fruit	*Passiflora* spp.	2	Neg
2131	1	UID seed		1	Neg
2131	1	Oregano	*Lippia* spp.	2	Neg
2131	1	Opuntia	*Opuntia* spp.	1	Neg
2133	1	Avocado	*Persea americana*	2	0.08
2133	1	Gourd	*Lagenaria siceraria*	1	Neg
2133	1	Grass family	Poaceae	1	Neg
2133	1	Legume family	Fabaceae	2	0.01
2133	1	Legume family (weedy)	Fabaceae	2	Neg
2133	1	Legume family (weedy) cf.	Fabaceae cf.	1	Neg
2133	1	Maize cob	*Zea mays*	1	Neg
2133	1	Maize cob cf.	*Zea mays* cf.	2	0.02
2133	1	Maize cupule	*Zea mays*	25	0.04
2133	1	Maize cupule cf.	*Zea mays* cf.	1	Neg
2133	1	Maize kernel	*Zea mays*	16	0.08

PD	FS	Common Name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
2133	1	Mesquite	*Prosopis pallida*	3	Neg
2133	1	Rattlepod	*Crotalaria* spp.	4	Neg
2133	1	Sedge family	Cyperaceae	1	Neg
2133	1	UID		7	0.01
2133	1	UID seed		4	Neg
2134	1	Barrel cactus	*Echinocactus* spp.	1	Neg
2134	1	Gourd	*Lagenaria siceraria*	1	0.02
2134	1	Legume family (possible domesticated bean)	Fabaceae	1	0.03
2134	1	Lucuma	*Pouteria lucuma*	5	0.12
2134	1	Maize cob	*Zea mays*	1	0.02
2134	1	Maize cupule	*Zea mays*	7	0.02
2134	1	Maize cupule cf.	*Zea mays* cf.	1	Neg
2134	1	Maize glume	*Zea mays*	1	Neg
2134	1	Maize kernel	*Zea mays*	6	0.02
2134	1	Maize kernel cf.	*Zea mays* cf.	2	Neg
2134	1	UID		7	0.03
2134	1	UID		2	0.1
2135	1	Barrel cactus	*Echinocactus* spp.	1	Neg
2135	1	Guava	*Psidium* spp.	1	Neg
2135	1	Maize cob	*Zea mays*	3	0.08
2135	1	Maize cupule	*Zea mays*	1	Neg
2135	1	Maize glume	*Zea mays*	2	Neg
2135	1	Maize glume cf.	*Zea mays* cf.	1	Neg
2135	1	Maize kernel	*Zea mays*	11	0.06
2135	1	Mallow family	Malvaceae	2	Neg
2135	1	UID		5	Neg
2135	1	UID seed		3	Neg
2135	1	Vetch cf.	*Vicia* spp. cf.	1	Neg
2138	1	Maize cupule	*Zea mays*	1	Neg
2138	1	Maize cupule cf.	*Zea mays* cf.	1	Neg
2142	1	Barrel cactus	*Echinocactus* spp.	7	Neg
2142	1	Common bean cf.	*Phaseolus vulgaris* cf.	2	0.03
2142	1	Legume family	Fabaceae	2	0.05
2142	1	Maize cupule	*Zea mays*	5	0.02
2142	1	Maize kernel	*Zea mays*	7	0.05
2142	1	Maize kernel cf.	*Zea mays* cf.	1	Neg
2142	1	UID		1	Neg
2143	1	Barrel cactus	*Echinocactus* spp.	1	Neg
2143	1	Cactus family	Cactaceae	1	Neg
2143	1	Chili pepper (var. Baccatum)	*Capsicum baccatum*	1	Neg
2143	1	Maize cupule	*Zea mays*	6	0.01

PD	FS	Common Name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
2143	1	Maize glume	*Zea mays*	1	Neg
2143	1	Maize glume cf.	*Zea mays* cf.	1	Neg
2143	1	Maize kernel	*Zea mays*	9	0.07
2143	1	UID fruit seed		1	Neg
2143	1	UID seed		4	Neg
2146	1	Chenopod	*Chenopodium quinoa*	3	Neg
2146	1	Chenopod cf.	*Chenopodium quinoa* cf.	1	Neg
2146	1	Grass family	Poaceae	1	Neg
2146	1	Guava	*Psidium* spp.	2	Neg
2146	1	Legume family	Fabaceae	7	0.18
2146	1	Lucuma	*Pouteria lucuma*	1	0.03
2146	1	Maize cob	*Zea mays*	10	0.06
2146	1	Maize cupule	*Zea mays*	19	0.03
2146	1	Maize cupule cf.	*Zea mays* cf.	1	Neg
2146	1	Maize glume	*Zea mays*	1	Neg
2146	1	Maize glume cf.	*Zea mays* cf.	1	Neg
2146	1	Maize kernel	*Zea mays*	45	0.32
2146	1	Maize kernel cf.	*Zea mays* cf.	1	Neg
2146	1	Rattlepod	*Crotalaria* spp.	2	Neg
2146	1	Sapote family	Sapotaceae	1	0.12
2146	1	UID		9	0.03
2146	1	UID seed		7	Neg
2147	1	Maize kernel	*Zea mays*	1	Neg
2147	1	Squash	*Cucurbita* spp.	1	Neg
2147	1	UID		1	Neg
2148	1	Common bean	*Phaseolus vulgaris*	1	0.05
2148	1	Legume family cf.	Fabaceae cf.	1	0.05
2148	1	Lima bean	*Phaseolus lunatus*	1	0.16
2148	1	Lucuma	*Pouteria lucuma*	3	Neg
2148	1	Maize cupule	*Zea mays*	7	0.01
2148	1	Maize cupule cf.	*Zea mays* cf.	1	Neg
2148	1	Maize glume	*Zea mays*	2	Neg
2148	1	Maize kernel	*Zea mays*	11	0.03
2148	1	Nightshade family	Solanaceae	1	Neg
2148	1	UID		6	0.02
2150	2	Elderberry	*Sambucus peruviana*	1	Neg
2150	2	Maize kernel	*Zea mays*	3	Neg
2150	2	Opuntia cf.	*Opuntia* spp. cf.	1	Neg
2150	2	UID seed		1	Neg
2150	2	UID seed coat		1	Neg
2152	1	Barrel cactus	*Echinocactus* spp.	1	Neg

PD	FS	Common Name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
2152	1	Chenopod	*Chenopodium quinoa*	1	Neg
2152	1	Golden berry cf.	*Physalis peruviana* cf.	1	Neg
2152	1	Grass family	Poaceae	1	Neg
2152	1	Guava	*Psidium* spp.	2	Neg
2152	1	Legume family (possible domesticated bean)	Fabaceae	2	0.03
2152	1	Legume family (weedy)	Fabaceae	1	Neg
2152	1	Maize cob	*Zea mays*	1	0.01
2152	1	Maize cupule	*Zea mays*	2	Neg
2152	1	Maize glume	*Zea mays*	1	Neg
2152	1	Maize kernel	*Zea mays*	5	0.03
2152	1	Maize kernel cf.	*Zea mays* cf.	3	0.01
2152	1	Mallow family	Malvaceae cf. *Malvastrum* spp.	1	Neg
2152	1	Rattlepod	*Crotalaria* spp.	1	Neg
2152	1	Sedge family	Cyperaceae	1	Neg
2152	1	UID seed		2	Neg
2153	1	Barrel cactus	*Echinocactus* spp.	1	Neg
2153	1	Cheno/am	*Chenopodium/Amaranthus* spp.	2	Neg
2153	1	Chenopod	*Chenopodium quinoa*	1	Neg
2153	1	Chili pepper	*Capsicum* spp.	1	Neg
2153	1	Maize cob	*Zea mays*	2	0.01
2153	1	Maize cob cf.	*Zea mays* cf.	2	Neg
2153	1	Maize cupule	*Zea mays*	1	Neg
2153	1	Maize glume	*Zea mays*	1	Neg
2153	1	Maize kernel	*Zea mays*	14	0.03
2153	1	Maize kernel cf.	*Zea mays* cf.	1	Neg
2153	1	rattlepod	*Crotalaria* spp.	1	Neg
2153	1	UID		3	Neg
2153	1	UID seed		2	Neg
2157	1	Chenopod	*Chenopodium quinoa*	1	Neg
2157	1	Chili pepper cf.	*Capsicum* spp. cf.	1	Neg
2157	1	Gourd	*Lagenaria siceraria*	2	Neg
2157	1	Grass family cf.	Poaceae cf.	1	Neg
2157	1	Legume family (weedy)	Fabaceae	1	Neg
2157	1	Maize cupule	*Zea mays*	3	Neg
2157	1	Maize cupule cf.	*Zea mays* cf.	1	Neg
2157	1	Maize glume	*Zea mays*	1	Neg
2157	1	Maize kernel	*Zea mays*	2	Neg
2157	1	Purslane	*Portulaca* spp.	1	Neg
2157	1	Squash	*Cucurbita* spp.	1	Neg
2157	1	UID		3	Neg
2157	1	UID fruit case		2	Neg

PD	FS	Common Name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
2157	1	UID seed		3	Neg
2157	1	Vetch cf.	*Vicia* spp. cf.	1	Neg
2159	1	Barrel cactus	*Echinocactus* spp.	4	Neg
2159	1	Grass family cf.	Poaceae cf.	1	Neg
2159	1	Maize cob	*Zea mays*	41	1.7
2159	1	Maize cupule	*Zea mays*	1276	3.2
2159	1	Maize kernel	*Zea mays*	5	0.02
2159	1	Opuntia	*Opuntia* spp.	2	Neg
2159	1	Trianthema	*Trianthema* spp.	1	Neg
2159	1	UID seed		5	Neg
2159	1	Vervain cf.	*Verbena* spp. cf.	1	Neg
2160	1	Avocado	*Persea americana*	7	0.1
2160	1	Barrel cactus	*Echinocactus* spp.	1	Neg
2160	1	Chenopod	*Chenopodium quinoa*	1	Neg
2160	1	Common bean	*Phaseolus vulgaris*	2	Neg
2160	1	Golden berry	*Physalis peruviana*	92	0.05
2160	1	Gourd cf.	*Lagenaria siceraria* cf.	3	Neg
2160	1	Grass family	Poaceae	3	Neg
2160	1	Legume family	Fabaceae	1	Neg
2160	1	Legume family (weedy)	Fabaceae	2	Neg
2160	1	Maize cupule	*Zea mays*	9	Neg
2160	1	Maize cupule cf.	*Zea mays* cf.	2	Neg
2160	1	Maize kernel	*Zea mays*	27	0.1
2160	1	Maize kernel cf.	*Zea mays* cf.	5	Neg
2160	1	Mallow family	Malvaceae cf. *Malvastrum* spp.	8	Neg
2160	1	Opuntia	*Opuntia* spp.	5	Neg
2160	1	Purslane	*Portulaca* spp.	3	Neg
2160	1	Squash	*Cucurbita* spp.	4	Neg
2160	1	UID		4	Neg
2160	1	UID seed		1	Neg
2160	1	Wildbean cf.	*Strophostyles helvola*	1	Neg
2161	1	No plants recovered			
2162	2	Barrel cactus	*Echinocactus* spp.	2	Neg
2162	2	Maize cupule cf.	*Zea mays* cf.	1	Neg
2162	2	UID		4	Neg
2162	2	UID seed		3	Neg
2163	1	Chili pepper	*Capsicum* spp.	5	0.03
2163	1	UID		1	0.02
2164	1	No plants recovered			
2165	1	No plants or wood recovered			
2167	1	Legume family	Fabaceae	1	0.04

PD	FS	Common Name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
2167	1	Maize cupule	*Zea mays*	25	0.05
2167	1	Maize cupule cf.	*Zea mays* cf.	2	Neg
2167	1	Maize kernel	*Zea mays*	6	0.02
2167	1	Mallow family cf.	Malvaceae cf.	1	Neg
2167	1	Nightshade family	Solanaceae	1	Neg
2167	1	UID		3	Neg
2167	1	UID fruit case		2	Neg
2168	1	Cheno/am	*Chenopodium/Amaranthus* spp.	2	Neg
2168	1	Chenopod	*Chenopodium quinoa*	3	Neg
2168	1	Grass family	Poaceae	1	Neg
2168	1	Legume family	Fabaceae	1	Neg
2168	1	Maize cupule	*Zea mays*	2	Neg
2168	1	Maize kernel	*Zea mays*	2	Neg
2168	1	Mesquite	*Prosopis pallida*	1	Neg
2168	1	Mesquite/acacia	*Prosopis/Acacia* spp.	1	Neg
2168	1	Purslane	*Portulaca* spp.	2	Neg
2168	1	UID		3	Neg
2173	1	Chenopod	*Chenopodium quinoa*	14	Neg
2173	1	Golden berry	*Physalis peruviana*	1	Neg
2173	1	Maize kernel	*Zea mays*	3	0.01
2173	1	Purslane	*Portulaca* spp.	44	0.03
2173	1	Vervain cf.	*Verbena* spp. cf.	1	Neg
2174	1	Chili pepper	*Capsicum* spp.	2	Neg
2174	1	Chili pepper cf.	*Capsicum* spp. cf.	1	Neg
2174	1	Maize kernel	*Zea mays*	3	Neg
2174	1	Maize kernel cf.	*Zea mays*	1	Neg
2174	1	Mesquite cf.	*Prosopis pallida*	1	Neg
2174	1	Purslane	*Portulaca* spp.	1	Neg
2174	1	Sunflower family	Asteraceae	1	Neg
2174	1	UID seed		8	Neg
2177	1	Guava	*Psidium* spp.	1	Neg
2177	1	Legume family	Fabaceae	1	Neg
2177	1	Maize cob	*Zea mays*	2	0.03
2177	1	Maize cupule	*Zea mays*	11	0.05
2177	1	Maize glume	*Zea mays*	1	Neg
2177	1	Maize glume cf.	*Zea mays* cf.	2	Neg
2177	1	Maize kernel	*Zea mays*	6	0.03
2177	1	UID seed		3	Neg
2179	1	Avocado	*Persea americana*	1	Neg
2179	1	Barrel cactus	*Echinocactus* spp.	3	Neg
2179	1	Cheno/am	*Chenopodium/Amaranthus* spp.	3	Neg

PD	FS	Common Name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
2179	1	Chenopod	*Chenopodium quinoa*	2	Neg
2179	1	Chili pepper	*Capsicum* spp.	3	Neg
2179	1	Common bean	*Phaseolus vulgaris*	2	Neg
2179	1	Golden berry	*Physalis peruviana*	2	Neg
2179	1	Grass family	Poaceae	3	Neg
2179	1	Legume family	Fabaceae	2	Neg
2179	1	Lima bean	*Phaseolus lunatus*	1	Neg
2179	1	Maize cob	*Zea mays*	1	Neg
2179	1	Maize cupule	*Zea mays*	11	Neg
2179	1	Maize cupule cf.	*Zea mays* cf.	10	Neg
2179	1	Maize glume	*Zea mays*	7	Neg
2179	1	Maize glume cf.	*Zea mays* cf.	1	Neg
2179	1	Maize kernel	*Zea mays*	121	0.53
2179	1	Maize kernel cf.	*Zea mays* cf.	32	Neg
2179	1	Opuntia	*Opuntia* spp.	2	Neg
2179	1	Pacay	*Inga feuillei*	5	Neg
2179	1	Purslane	*Portulaca* spp.	5	Neg
2179	1	rattlepod	*Crotalaria* spp.	7	Neg
2179	1	Squash	*Cucurbita* spp.	2	Neg
2179	1	Squash cf.	*Cucurbita* spp. cf.	1	Neg
2179	1	Trianthema	*Trianthema* spp.	1	Neg
2179	1	UID		4	Neg
2179	1	UID seed		3	Neg
2179	2	Common bean	*Phaseolus vulgaris*	9	0.13
2179	2	Common bean cf.	*Phaseolus vulgaris* cf.	7	0.25
2179	2	Golden berry	*Physalis peruviana*	1	Neg
2179	2	Grass family	Poaceae	2	Neg
2179	2	Legume family (possible domesticated bean)	Fabaceae	10	0.15
2179	2	Lima bean cf.	*Phaseolus lunatus*	2	0.07
2179	2	Maize cob	*Zea mays*	2	Neg
2179	2	Maize cupule	*Zea mays*	47	0.2
2179	2	Maize cupule cf.	*Zea mays* cf.	5	Neg
2179	2	Maize kernel	*Zea mays*	95	0.5
2179	2	Opuntia	*Opuntia* spp.	2	Neg
2179	2	Pacay	*Inga feuillei*	4	0.15
2179	2	Rattlepod	*Crotalaria* spp.	4	Neg
2179	2	UID		1	Neg
2206	11	Chenopod	*Chenopodium quinoa*	1	Neg
2206	11	Golden berry	*Physalis peruviana*	1	Neg
2206	11	Grass family	Poaceae	1	Neg
2206	11	Legume family (weedy)	Fabaceae	1	Neg

PD	FS	Common Name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
2206	11	Maize cob	*Zea mays*	2	Neg
2206	11	Maize cupule	*Zea mays*	2	Neg
2206	11	Maize cupule cf.	*Zea mays* cf.	1	Neg
2206	11	Maize kernel	*Zea mays*	7	Neg
2206	11	Rattlepod	*Crotalaria* spp.	1	Neg
2206	11	Sunflower family	Asteraceae	1	Neg
2206	11	UID		1	Neg
2206	11	UID fruit seed		2	Neg
2207	15	Gourd	*Lagenaria siceraria*	1	Neg
2207	15	Guava	*Psidium* spp.	1	Neg
2207	15	Maize cob	*Zea mays*	2	0.04
2207	15	Maize cupule	*Zea mays*	1	Neg
2207	15	Maize kernel	*Zea mays*	2	0.04
2207	15	Sunflower family	Asteraceae	1	Neg

[1] cf. = identification probable but not definite
[2] Specimen weight listed as neglible ("neg") if less than 0.01 g.

APPENDIX V

INVENTORY OF PLANTS RECOVERED AT MV-225

PD	**FS**	**Common name**[1]	**Taxonomic Name**[1]	**Count (n)**	**Weight (g)**[2]
1083	1	Avocado	*Persea americana*	1	Neg
1083	1	Chili pepper	*Capsicum* spp.	1	Neg
1083	1	Gourd	*Lagenaria siceraria*	2	0.01
1083	1	Legume family	Fabaceae	5	0.01
1083	1	Maize cob	*Zea mays*	6	0.03
1083	1	Maize cupule	*Zea mays*	11	0.02
1083	1	Maize cupule cf.	*Zea mays* cf.	1	Neg
1083	1	Maize kernel	*Zea mays*	14	0.04
1083	1	Mesquite	*Prosopis pallida*	1	Neg
1083	1	Sunflower family	Asteraceae	1	Neg
1083	1	UID		5	Neg
1083	1	UID seed		7	Neg
1087	1	Barrel cactus	*Echinocactus* spp.	4	Neg
1087	1	Maize cupule	*Zea mays*	3	Neg
1087	1	Maize cupule cf.	*Zea mays* cf.	4	Neg
1087	1	Maize kernel	*Zea mays*	6	0.03
1088	1	Maize cupule	*Zea mays*	8	Neg
1088	1	Maize kernel	*Zea mays*	4	0.03
1088	1	Squash	*Cucurbita* spp.	4	Neg
1088	1	UID seed		1	Neg
1091	1	Chili pepper cf.	*Capsicum* spp. cf.	1	Neg
1091	1	Maize cupule	*Zea mays*	1	Neg
1091	1	Maize kernel	*Zea mays*	1	Neg
1091	1	UID seed		2	Neg
1093	1	Avocado	*Persea americana*	2	0.15
1093	1	Gourd	*Lagenaria siceraria*	1	Neg
1093	1	Maize cob	*Zea mays*	5	0.04
1093	1	Maize cob cf.	*Zea mays* cf.	1	0.01
1093	1	Maize cupule	*Zea mays*	10	0.01
1093	1	Maize cupule cf.	*Zea mays* cf.	2	Neg
1093	1	Maize kernel	*Zea mays*	11	0.02
1093	1	Sunflower family	Asteraceae	1	Neg
1093	1	UID		7	Neg
1097	1	Guava	*Psidium* spp.	2	Neg

PD	FS	Common name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
1097	1	Rattlepod	*Crotalaria* spp.	1	Neg
1097	1	Maize cupule	*Zea mays*	5	0.01
1097	1	Maize kernel	*Zea mays*	3	0.02
1097	1	Squash	*Cucurbita* spp.	2	0.01
1097	1	UID seed		2	Neg
1099	1	Avocado	*Persea americana*	2	Neg
1099	1	Golden berry	*Physalis peruviana*	1	Neg
1099	1	Legume family	Fabaceae	2	Neg
1099	1	Lucuma	*Pouteria lucuma*	6	0.02
1099	1	Maize cob	*Zea mays*	5	0.03
1099	1	Maize cupule	*Zea mays*	20	0.04
1099	1	Maize kernel	*Zea mays* cf.	3	0.05
1099	1	Squash cf.	*Cucurbita* spp. cf.	2	Neg
1099	1	UID		4	Neg
1111	1	Legume family cf.	Fabaceae cf.	1	Neg
1111	1	Lucuma	*Pouteria lucuma*	1	Neg
1111	1	Maize cupule	*Zea mays*	6	0.01
1111	1	Maize kernel	*Zea mays*	6	0.02
1111	1	UID		3	0.01
1113	1	Maize cupule	*Zea mays*	3	0.01
1113	1	Maize kernel	*Zea mays*	9	0.03
1113	1	UID		1	Neg
1117	1	Common bean	*Phaseolus vulgaris*	2	0.26
1117	1	Maize cob	*Zea mays*	2	0.03
1117	1	Maize cupule	*Zea mays*	4	0.01
1117	1	Maize kernel	*Zea mays*	2	0.01
1117	1	Nightshade family	Solanaceae	1	Neg
1117	1	UID		1	Neg
1121	1	Chenopod	*Chenopodium quinoa*	2	Neg
1121	1	Chili pepper	*Capsicum* spp.	1	Neg
1121	1	Grass family	Poaceae	3	Neg
1121	1	Guava	*Psidium* spp.	1	Neg
1121	1	Legume family	Fabaceae	1	Neg
1121	1	Lucuma	*Pouteria lucuma*	4	0.01
1121	1	Maize cupule	*Zea mays*	2	Neg
1121	1	Mallow family	Malvaceae cf. *Malvastrum* spp.	1	Neg
1121	1	Rattlepod	*Crotalaria* spp.	1	Neg
1121	1	UID		8	0.04
1121	1	UID seed		6	Neg

PD	FS	Common name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
1122	1	Chenopod	*Chenopodium quinoa*	1	Neg
1122	1	Common bean cf.	*Phaseolus vulgaris* cf.	5	0.13
1122	1	Legume family	Fabaceae	2	0.01
1122	1	Maize cob	*Zea mays*	11	0.05
1122	1	Maize cupule	*Zea mays*	4	Neg
1122	1	Maize glume	*Zea mays*	3	Neg
1122	1	Maize kernel	*Zea mays*	21	0.11
1122	1	UID		4	0.02
1123	1	Legume family	Fabaceae	2	0.02
1123	1	Maize cupule	*Zea mays*	4	Neg
1123	1	Maize glume	*Zea mays*	1	Neg
1123	1	Maize kernel	*Zea mays*	11	0.05
1123	1	Maize kernel cf.	*Zea mays* cf.	3	Neg
1123	1	Pacay	*Inga feuillei*	1	0.07
1123	1	Saltbush	*Atriplex* sp.	1	Neg
1123	1	Sedge family	Cyperaceae	1	Neg
1123	1	UID		2	Neg
1123	1	UID seed		2	Neg
1126	1	Maize glume	*Zea mays*	1	Neg
1126	1	Maize kernel	*Zea mays*	5	0.03
1126	1	UID		2	Neg
1168	14	Maize cupule	*Zea mays*	5	Neg
1168	14	Maize cupule cf.	*Zea mays* cf.	1	Neg
1168	14	Maize kernel	*Zea mays*	7	0.02
1168	14	UID		2	Neg
1177	14	Barrel cactus	*Echinocactus* spp.	1	Neg
1177	14	Legume family (possible domesticated bean)	Fabaceae	1	0.06
1177	14	Maize cupule	*Zea mays*	5	Neg
1177	14	Maize kernel	*Zea mays*	4	Neg
1177	14	UID		3	Neg
1177	14	UID seed		8	Neg
1201	6	Avocado	*Persea americana*	2	Neg
1201	6	Grass family	Poaceae	1	Neg
1201	6	Maize cupule	*Zea mays*	1	Neg
1201	6	Maize kernel	*Zea mays*	3	Neg
1201	6	Maize kernel cf.	*Zea mays* cf.	1	Neg
1201	6	UID seed		2	Neg
1206	15	Maize cob	*Zea mays*	1	0.01

PD	FS	Common name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
1206	15	Maize cupule	*Zea mays*	2	Neg
1206	15	Maize kernel	*Zea mays*	2	Neg
1206	15	Squash cf.	*Cucurbita* spp. cf.	1	0.02
1206	15	UID		1	Neg
1206	15	UID seed		1	Neg
1213	1	Avocado	*Persea americana*	1	0.01
1213	1	Barrel cactus	*Echinocactus* spp.	4	Neg
1213	1	Guava	*Psidium* spp.	2	Neg
1213	1	Legume family	Fabaceae	1	0.04
1213	1	Maize cob	*Zea mays*	5	0.03
1213	1	Maize cupule	*Zea mays*	18	0.02
1213	1	Maize cupule cf.	*Zea mays* cf.	6	Neg
1213	1	Maize kernel	*Zea mays*	11	0.02
1213	1	Rattlepod	*Crotalaria* spp.	1	Neg
1213	1	Squash	*Cucurbita* spp.	1	0.03
1213	1	UID		4	Neg
1213	1	UID seed		12	Neg
1221	1	No plants recovered			
1222	1	Chenopod	*Chenopodium quinoa*	1	Neg
1222	1	Maize kernel	*Zea mays*	2	Neg
1222	1	UID		2	Neg
1235	1	Column cactus	*Cereus* sp. cf.	1	Neg
1235	1	Lucuma	*Pouteria lucuma*	3	Neg
1235	1	Maize cob	*Zea mays*	1	0.03
1235	1	Maize cupule	*Zea mays*	7	0.01
1235	1	Maize cupule cf.	*Zea mays* cf.	1	Neg
1235	1	Maize kernel	*Zea mays*	5	0.02
1235	1	Sida	*Sida* sp. cf.	1	Neg
1235	1	UID seed		2	Neg
1236	1	Avocado	*Persea americana*	2	Neg
1236	1	Legume family	Fabaceae	7	0.1
1236	1	Maize cob	*Zea mays*	3	0.01
1236	1	Maize cob (6-row variety)	*Zea mays*	1	0.07
1236	1	Maize cupule	*Zea mays*	10	0.02
1236	1	Maize cupule cf.	*Zea mays* cf.	3	Neg
1236	1	Maize glume	*Zea mays*	1	Neg
1236	1	Maize kernel	*Zea mays*	16	0.06
1236	1	Maize kernel cf.	*Zea mays* cf.	3	0.01
1236	1	UID		3	Neg

PD	FS	Common name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
1236	1	UID seed		36	Neg
1236	2	Coca	*Erythroxylum novogranatense* var. *truxillense*	1	Neg
1236	2	Common bean cf.	*Phaseolus vulgaris* cf.	1	0.1
1236	2	Gourd	*Lagenaria siceraria*	1	0.05
1236	2	Legume family	Fabaceae	1	0.01
1236	2	Legume family (possible domesticated bean)	Fabaceae	2	0.07
1236	2	Lucuma	*Pouteria lucuma*	1	Neg
1236	2	Maize cob	*Zea mays*	7	0.03
1236	2	Maize cupule	*Zea mays*	1	Neg
1236	2	Maize kernel	*Zea mays*	5	0.04
1236	2	Rattlepod	*Crotalaria* spp.	1	Neg
1236	2	UID		4	Neg
1236	2	UID seed		5	Neg
1244	1	Chili pepper	*Capsicum* spp.	1	Neg
1244	1	Maize cob cf.	*Zea mays* cf.	2	Neg
1244	1	Maize cupule	*Zea mays*	1	Neg
1244	1	Maize glume	*Zea mays*	1	Neg
1244	1	Maize kernel cf.	*Zea mays* cf.	1	Neg
1244	1	UID		1	Neg
1244	1	UID seed		1	Neg
1249	1	Chenopod	*Chenopodium quinoa*	1	Neg
1249	1	Legume family	Fabaceae	1	Neg
1249	1	Maize kernel	*Zea mays*	1	Neg
1249	1	UID		1	Neg
1250	1	Grass family	Poaceae	1	Neg
1250	1	Maize kernel	*Zea mays*	1	Neg
1251	1	Maize cupule	*Zea mays*	3	Neg
1251	1	Maize kernel	*Zea mays*	8	0.05
1257	1	Maize kernel	*Zea mays*	7	0.04
1257	1	Opuntia	*Opuntia* spp.	1	Neg
1257	1	UID		2	Neg
1257	1	UID fruit case		1	Neg
1257	1	UID seed		1	Neg
1262	1	Legume family cf.	Fabaceae cf.	4	Neg
1262	1	Maize cupule	*Zea mays*	1	Neg
1262	1	Maize glume	*Zea mays*	1	Neg
1262	1	Maize kernel	*Zea mays*	9	0.02
1262	1	UID seed		1	Neg

PD	FS	Common name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
1266	1	Chenopod	*Chenopodium quinoa*	1	Neg
1266	1	Legume family	Fabaceae	12	0.07
1266	1	Rattlepod	*Crotalaria* spp.	1	Neg
1266	1	Legume family (weedy)	Fabaceae	1	Neg
1266	1	Legume family cf.	Fabaceae cf.	2	Neg
1266	1	Maize cob	*Zea mays*	8	0.07
1266	1	Maize cupule	*Zea mays*	18	0.04
1266	1	Maize kernel	*Zea mays*	9	0.03
1266	1	Maize kernel cf.	*Zea mays* cf.	1	Neg
1266	1	Peanut cf.	*Arachis hypogaea* cf.	1	0.03
1266	1	UID		4	Neg
1266	2	Avocado	*Persea americana*	1	0.01
1266	2	Grass family	Poaceae	2	Neg
1266	2	Guava cf.	*Psidium* spp. cf.	1	Neg
1266	2	Legume family	Fabaceae	1	Neg
1266	2	Maize cupule	*Zea mays*	1	Neg
1266	2	Maize kernel	*Zea mays*	5	0.01
1266	2	UID		3	Neg
1270	6	UID		3	Neg
1270	11	Maize cob	*Zea mays*	2	0.04
1270	11	Maize glume cf.	*Zea mays* cf.	1	Neg
1270	11	UID		3	Neg
1270	11	UID seed		1	Neg
1271	11	Maize kernel	*Zea mays*	2	Neg
1271	11	UID seed		1	Neg
1273	1	Maize cupule	*Zea mays*	1	Neg
1273	1	Maize kernel	*Zea mays*	1	Neg
1275	1	Barrel cactus	*Echinocactus* spp.	1	Neg
1275	1	Guava	*Psidium* spp.	1	Neg
1275	1	Maize cob	*Zea mays*	3	0.02
1275	1	Maize cupule	*Zea mays*	5	Neg
1275	1	Maize glume	*Zea mays*	1	Neg
1275	1	Maize kernel	*Zea mays*	7	0.03
1275	1	Sunflower family	Asteraceae	2	Neg
1275	1	UID seed		1	Neg
1276	1	Maize kernel cf.	*Zea mays* cf.	1	Neg
1277	1	Maize kernel cf.	*Zea mays* cf.	1	Neg
1289	1	Avocado	*Persea americana*	2	0.01
1289	1	Gourd	*Lagenaria siceraria*	1	0.01

PD	**FS**	**Common name[1]**	**Taxonomic Name[1]**	**Count (n)**	**Weight (g)[2]**
1289	1	Guava	*Psidium* spp.	1	Neg
1289	1	Legume family	Fabaceae	1	Neg
1289	1	Legume family (possible domesticated bean)	Fabaceae	6	0.22
1289	1	Maize cob	*Zea mays*	2	0.02
1289	1	Maize cupule	*Zea mays*	2	Neg
1289	1	Maize kernel	*Zea mays*	5	0.02
1289	1	UID		16	0.05
1289	1	UID seed		2	Neg
1292	1	Maize cupule	*Zea mays*	1	Neg
1292	1	Maize cupule cf.	*Zea mays* cf.	1	Neg
1292	1	Maize glume	*Zea mays*	1	Neg
1292	1	Maize kernel	*Zea mays*	5	0.01
1292	1	Sedge family	Cyperaceae	1	Neg
1293	2	Barrel cactus	*Echinocactus* spp.	1	Neg
1293	2	Legume family (possible domesticated bean)	Fabaceae	2	0.11
1293	2	Maize cob	*Zea mays*	3	0.03
1293	2	Maize cupule	*Zea mays*	20	0.02
1293	2	Maize glume	*Zea mays*	4	Neg
1293	2	Maize kernel	*Zea mays*	10	0.02
1293	2	Maize kernel cf.	*Zea mays* cf.	1	Neg
1293	2	UID		4	Neg
1293	2	UID seed		1	Neg
1294	1	Maize cupule	*Zea mays*	1	Neg
1294	1	Maize kernel cf.	*Zea mays* cf.	3	Neg
1295	1	Maize cupule	*Zea mays*	2	Neg
1295	1	Maize kernel	*Zea mays*	1	Neg
1299	1	Maize cob	*Zea mays*	2	0.02
1299	1	Maize cob cf.	*Zea mays* cf.	1	0.01
1299	1	Maize cupule	*Zea mays*	12	0.01
1299	1	Maize cupule cf.	*Zea mays* cf.	1	Neg
1299	1	Maize kernel	*Zea mays*	6	0.04
1299	1	Maize kernel cf.	*Zea mays* cf.	4	Neg
1299	1	UID		2	Neg
1314	1	Maize cupule	*Zea mays*	2	Neg
1314	1	Maize cupule cf.	*Zea mays* cf.	2	Neg
1314	1	Maize glume cf.	*Zea mays* cf.	1	Neg
1314	1	Maize kernel	*Zea mays*	5	0.02
1314	1	Mesquite cf.	*Prosopis pallida* cf.	1	Neg

PD	FS	Common name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
1316	1	Avocado	*Persea americana*	2	0.1
1316	1	Legume family	*Fabaceae*	1	0.03
1316	1	Maize cob	*Zea mays*	5	0.03
1316	1	Sunflower family	Asteraceae	1	Neg
1316	1	Maize cupule	*Zea mays*	10	Neg
1316	1	Maize cupule cf.	*Zea mays* cf.	1	Neg
1316	1	Maize kernel	*Zea mays*	10	Neg
1316	1	Opuntia	*Opuntia* spp.	1	Neg
1316	1	Peanut	*Arachis hypogaea*	1	0.03
1316	1	UID		5	0.01
1316	1	UID seed		3	Neg
1316	2	Chenopod	*Chenopodium quinoa*	1	Neg
1316	2	Legume family	Fabaceae	1	Neg
1316	2	Maize cob	*Zea mays*	3	0.02
1316	2	Maize cupule	*Zea mays*	5	0.02
1316	2	Maize cupule cf.	*Zea mays* cf.	2	Neg
1316	2	Maize glume	*Zea mays*	1	Neg
1316	2	Maize kernel	*Zea mays*	16	0.05
1316	2	Maize kernel cf.	*Zea mays* cf.	1	Neg
1316	2	Opuntia cf.	*Opuntia* spp. cf.	1	Neg
1316	2	Rattlepod	*Crotalaria* spp.	1	Neg
1316	2	UID		2	Neg
1349	1	Legume family	Fabaceae	2	Neg
1349	1	Maize cob	*Zea mays*	2	0.01
1349	1	Maize cupule	*Zea mays*	2	Neg
1349	1	Maize kernel	*Zea mays*	2	Neg
1349	1	UID		1	Neg
1349	1	UID seed		1	Neg
1353	1	Avocado	*Persea americana*	2	0.01
1353	1	Guava	*Psidium* spp.	1	Neg
1353	1	Legume family	Fabaceae	7	0.04
1353	1	Maize cob	*Zea mays*	3	0.01
1353	1	Maize cupule	*Zea mays*	5	0.01
1353	1	Rattlepod	*Crotalaria* spp.	7	Neg
1353	1	UID		2	Neg
1362	13	Maize kernel cf.	*Zea mays* cf.	1	Neg
1363	1	Barrel cactus	*Echinocactus* spp.	4	Neg
1363	1	Chili pepper (var. Chinense)	*Capsicum chinense*	1	Neg
1363	1	Legume family	Fabaceae	3	0.05

PD	FS	Common name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
1363	1	Lima bean	*Phaseolus lunatus*	1	0.06
1363	1	Maize cob	*Zea mays*	17	0.05
1363	1	Maize cupule	*Zea mays*	15	0.02
1363	1	Sedge family	Cyperaceae	6	Neg
1363	1	Maize glume	*Zea mays*	3	Neg
1363	1	Maize kernel	*Zea mays*	12	0.05
1363	1	Mallow family	Malvaceae cf. *Malvastrum* spp.	2	Neg
1363	1	Squash cf.	*Cucurbita* spp. cf.	1	0.04
1363	1	UID		12	0.03
1363	1	UID fruit case		1	Neg
1363	1	UID seed		16	Neg
1367	1	Avocado	*Persea americana*	20	2.89
1367	1	Common bean	*Phaseolus vulgaris*	4	0.23
1367	1	Gourd	*Lagenaria siceraria*	3	0.02
1367	1	Grass family	Poaceae	2	Neg
1367	1	Guava	*Psidium* spp.	1	Neg
1367	1	Legume family	Fabaceae	9	0.16
1367	1	Lucuma	*Pouteria lucuma*	3	Neg
1367	1	Maize cob	*Zea mays*	43	0.62
1367	1	Maize cob (6-row variety)	*Zea mays*	2	0.59
1367	1	Maize cupule	*Zea mays*	106	0.29
1367	1	Maize cupule cf.	*Zea mays* cf.	3	Neg
1367	1	Maize kernel	*Zea mays*	6	0.03
1367	1	Pacay	*Inga feuillei*	1	0.06
1367	1	Prunus	*Prunus* sp. cf.	1	Neg
1367	1	Sedge family	Cyperaceae	6	Neg
1367	1	Sunflower family	Asteraceae	2	Neg
1367	1	UID		17	0.14
1367	1	UID fruit case		3	Neg
1367	1	UID seed		2	Neg
1367	1	UID seed case		1	Neg
1367	3	Common bean	*Phaseolus vulgaris*	2	0.07
1367	3	Guava	*Psidium* spp.	3	Neg
1367	3	Guava cf.	*Psidium* spp. cf.	2	Neg
1367	3	Legume family	Fabaceae	12	0.14
1367	3	Legume family (possible domesticated bean)	Fabaceae	1	0.05
1367	3	Legume family (weedy)	Fabaceae	1	Neg
1367	3	Maize cob	*Zea mays*	18	0.08

PD	FS	Common name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
1367	3	Maize cupule	*Zea mays*	64	0.09
1367	3	Maize cupule cf.	*Zea mays* cf.	1	Neg
1367	3	Maize glume	*Zea mays*	1	Neg
1367	3	Maize kernel	*Zea mays*	10	0.03
1367	3	Sedge family	Cyperaceae	7	Neg
1367	3	Grass family	Poaceae	1	Neg
1367	3	Mesquite	*Prosopis pallida*	1	Neg
1367	3	Pondweed	*Potamogeton* spp.	3	Neg
1367	3	Sow thistle cf.	*Sonchus* sp. cf.	2	Neg
1367	3	UID		5	Neg
1367	3	UID seed		1	Neg
1369	1	Barrel cactus	*Echinocactus* spp.	5	Neg
1369	1	Legume family	Fabaceae	1	Neg
1369	1	Maize cupule	*Zea mays*	3	Neg
1369	1	Maize kernel	*Zea mays*	2	0.01
1369	1	Sunflower family	Asteraceae	5	Neg
1369	1	UID		1	Neg
1374	13	Guava	*Psidium* spp.	2	Neg
1374	13	Legume family (possible domesticated bean)	Fabaceae	5	0.11
1374	13	Legume family cf.	Fabaceae cf.	2	Neg
1374	13	Maize cob	*Zea mays*	8	0.05
1374	13	Maize cupule	*Zea mays*	18	0.04
1374	13	Maize cupule cf.	*Zea mays* cf.	3	Neg
1374	13	Maize glume	*Zea mays*	2	Neg
1374	13	Maize kernel	*Zea mays*	4	0.04
1374	13	Mallow family	Malvaceae cf. *Malvastrum* spp.	1	Neg
1374	13	Peanut	*Arachis hypogaea*	1	0.03
1374	13	Peanut cf.	*Arachis hypogaea* cf.	2	0.04
1374	13	UID		2	Neg
1374	13	UID fruit case		2	Neg
1374	13	UID seed		1	Neg
1375	1	Maize glume	*Zea mays*	1	Neg
1375	1	Maize kernel	*Zea mays*	6	0.01
1375	1	UID		1	Neg
1379	1	Chili pepper cf.	*Capsicum* spp. cf.	1	Neg
1379	1	Maize cob	*Zea mays*	2	0.02
1379	1	Maize cupule	*Zea mays*	3	Neg
1379	1	Maize kernel	*Zea mays*	8	0.07

PD	FS	Common name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
1379	1	Rattlepod	*Crotalaria* spp.	2	Neg
1379	1	Sedge family	Cyperaceae	1	Neg
1379	1	UID		3	0.01
1379	2	Guava	*Psidium* spp.	1	Neg
1379	2	Maize cupule cf.	*Zea mays* cf.	1	Neg
1379	2	Maize kernel	*Zea mays*	4	0.05
1379	2	Maize kernel cf.	*Zea mays* cf.	3	0.02
1383	1	Maize cupule	*Zea mays*	1	Neg
1383	1	Maize cupule cf.	*Zea mays* cf.	1	Neg
1383	1	Maize kernel	*Zea mays*	3	Neg
1383	1	UID		2	Neg
1383	1	UID seed		1	Neg
1385	1	Legume family	Fabaceae	7	0.04
1385	1	Maize cob	*Zea mays*	3	0.02
1385	1	Maize cupule	*Zea mays*	3	0.01
1385	1	Maize kernel	*Zea mays*	1	Neg
1385	1	UID seed		2	Neg
1386	1	Avocado	*Persea americana*	1	Neg
1386	1	Gourd	*Lagenaria siceraria*	3	Neg
1386	1	Guava	*Psidium* spp.	1	Neg
1386	1	Maize cob	*Zea mays*	1	0.03
1386	1	Maize cupule	*Zea mays*	1	Neg
1386	1	Maize glume cf.	*Zea mays* cf.	1	Neg
1386	1	Maize kernel	*Zea mays*	2	Neg
1386	1	Mallow family	Malvaceae cf. *Malvastrum* spp.	1	Neg
1386	1	Sedge family	Cyperaceae	1	Neg
1386	1	UID		4	Neg
1386	1	UID seed		1	Neg
1387	1	Avocado	*Persea americana*	1	0.25
1387	1	Barrel cactus	*Echinocactus* spp.	1	Neg
1387	1	Gourd	*Lagenaria siceraria*	2	0.12
1387	1	Grass family	Poaceae	1	Neg
1387	1	Legume family	Fabaceae	1	Neg
1387	1	Lucuma	*Pouteria lucuma*	1	Neg
1387	1	Maize kernel	*Zea mays*	5	0.04
1387	1	Mallow family	Malvaceae cf. *Malvastrum* spp.	1	Neg
1387	1	Purslane	*Portulaca* sp.	1	Neg
1389	1	Chili pepper	*Capsicum* spp.	1	Neg
1389	1	Gourd	*Lagenaria siceraria*	13	0.1

PD	FS	Common name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
1389	1	Legume family	Fabaceae	9	0.06
1389	1	Maize cob	*Zea mays*	8	0.05
1389	1	Maize cupule	*Zea mays*	13	0.02
1389	1	Rattlepod	*Crotalaria* spp.	1	Neg
1389	1	Sedge family	Cyperaceae	3	Neg
1389	1	Sunflower family	Asteraceae	1	Neg
1389	1	Maize cupule cf.	*Zea mays* cf.	1	Neg
1389	1	Maize kernel	*Zea mays*	9	0.05
1389	1	Mallow family	Malvaceae cf. *Malvastrum* spp.	1	Neg
1389	1	Peanut	*Arachis hypogaea*	1	0.08
1389	1	Pondweed cf.	*Potamogeton* spp. cf.	1	Neg
1389	1	UID		8	0.01
1390	1	Legume family	Fabaceae	1	0.01
1390	1	Maize cob	*Zea mays*	9	Neg
1390	1	Maize cupule	*Zea mays*	4	0.01
1390	1	Maize cupule cf.	*Zea mays* cf.	1	Neg
1390	1	Maize glume	*Zea mays*	3	0.07
1390	1	Maize kernel	*Zea mays*	15	0.09
1390	1	Maize kernel cf.	*Zea mays* cf.	2	Neg
1390	1	UID		2	Neg
1392	1	Maize cob	*Zea mays*	1	0.02
1392	1	Maize kernel	*Zea mays*	2	0.01
1392	1	UID		2	Neg
1392	1	UID seed		1	Neg
1393	1	Avocado	*Persea americana*	1	1.22
1393	1	Chili pepper	*Capsicum* spp.	2	Neg
1393	1	Chili pepper (var. Baccatum)	*Capsicum baccatum*	1	Neg
1393	1	Chili pepper (var. Chinense)	*Capsicum chinense*	2	Neg
1393	1	Chili pepper cf.	*Capsicum* spp. cf.	4	Neg
1393	1	Common bean	*Phaseolus vulgaris*	1	0.04
1393	1	Common bean cf.	*Phaseolus vulgaris* cf.	1	0.03
1393	1	Gourd	*Lagenaria siceraria*	5	0.13
1393	1	Guava	*Psidium* spp.	1	Neg
1393	1	Legume family (possible domesticated bean)	Fabaceae	1	0.01
1393	1	Legume family (weedy)	Fabaceae	1	Neg
1393	1	legume family (weedy) cf.	Fabaceae	2	Neg
1393	1	Lucuma	*Pouteria lucuma*	1	Neg
1393	1	Maize cob	*Zea mays*	20	0.12

PD	**FS**	**Common name**[1]	**Taxonomic Name**[1]	**Count (n)**	**Weight (g)**[2]
1393	1	Maize cob (10-row variety)	*Zea mays*	1	0.24
1393	1	Maize cob (6-row variety)	*Zea mays*	2	0.5
1393	1	Maize cupule	*Zea mays*	119	0.22
1393	1	Maize cupule cf.	*Zea mays* cf.	1	Neg
1393	1	Maize glume	*Zea mays*	1	Neg
1393	1	Sedge family	Cyperaceae	1	Neg
1393	1	Sunflower family	Asteraceae	2	Neg
1393	1	Field madder	*Sherardia arvensis*	1	Neg
1393	1	Grass family	Poaceae	1	Neg
1393	1	Maize kernel	*Zea mays*	5	0.06
1393	1	Mallow family	Malvaceae	3	Neg
1393	1	Mesquite	*Prosopis pallida*	1	Neg
1393	1	Peanut	*Arachis hypogaea*	3	0.07
1393	1	Peanut cf.	*Arachis hypogaea* cf.	2	0.09
1393	1	UID		5	0.01
1393	1	UID fruit case		4	Neg
1393	1	UID seed		1	Neg
1394	1	Chili pepper	*Capsicum* spp.	1	Neg
1394	1	Chili pepper (var. Baccatum)	*Capsicum baccatum*	3	Neg
1394	1	Common bean	*Phaseolus vulgaris*	1	0.03
1394	1	Gourd	*Lagenaria siceraria*	5	0.06
1394	1	Guava	*Psidium* spp.	1	Neg
1394	1	Guava cf.	*Psidium* spp. cf.	1	Neg
1394	1	Legume family (weedy)	Fabaceae	1	Neg
1394	1	Legume family cf.	Fabaceae cf.	1	0.12
1394	1	Lucuma	*Pouteria lucuma*	12	0.02
1394	1	Maize cob	*Zea mays*	1	0.38
1394	1	Maize cupule	*Zea mays*	6	0.04
1394	1	Maize cupule cf.	*Zea mays* cf.	64	0.14
1394	1	Maize glume	*Zea mays*	2	Neg
1394	1	Maize kernel	*Zea mays*	25	0.22
1394	1	Sedge family	Cyperaceae	6	Neg
1394	1	Sunflower family	Asteraceae	1	Neg
1394	1	UID		19	0.05
1394	1	UID fruit case		8	0.02
1394	1	UID seed		5	Neg
1408	10	Gourd	*Lagenaria siceraria*	1	0.02
1408	10	Lucuma	*Pouteria lucuma*	2	Neg
1408	10	Maize cob	*Zea mays*	8	0.04

PD	FS	Common name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
1408	10	Maize cupule	*Zea mays*	4	Neg
1408	10	Maize kernel	*Zea mays*	8	0.04
1408	10	Rattlepod	*Crotalaria* spp.	1	Neg
1408	10	Sunflower family	Asteraceae	1	Neg
1408	10	UID		4	Neg
1409	1	Legume family	Fabaceae	5	0.06
1409	1	Legume family (weedy)	Fabaceae	1	Neg
1409	1	Gourd	*Lagenaria siceraria*	3	0.02
1409	1	Maize cob (6-row variety)	*Zea mays*	1	0.14
1409	1	Maize cupule	*Zea mays*	1	Neg
1409	1	Maize kernel	*Zea mays*	1	Neg
1409	1	UID		1	Neg
1422	12	Avocado	*Persea americana*	1	Neg
1422	12	Chenopod	*Chenopodium quinoa*	1	Neg
1422	12	Maize cupule	*Zea mays*	2	Neg
1422	12	Maize glume	*Zea mays*	1	Neg
1422	12	UID		2	Neg
1422	12	UID seed		1	Neg
1424	1	Guava	*Psidium* spp.	1	Neg
1424	1	Maize kernel	*Zea mays*	6	0.1
1424	1	Spurge	*Euphorbia* spp.	1	Neg
1424	1	UID		2	0.02
1427	1	Avocado	*Persea americana*	3	0.04
1427	1	Bindweed	*Convulvus* spp. cf.	2	Neg
1427	1	Legume family	Fabaceae	3	Neg
1427	1	Maize cob	*Zea mays*	3	0.01
1427	1	Maize cupule	*Zea mays*	7	0.02
1427	1	Maize kernel	*Zea mays*	4	0.03
1427	1	Sage	*Salvia* spp.	1	Neg
1427	1	Sedge family	Cyperaceae	1	Neg
1427	1	UID		1	Neg
1427	1	UID seed		1	Neg
1428	1	Maize cupule	*Zea mays*	1	Neg
1428	1	Maize glume cf.	*Zea mays* cf.	1	Neg
1428	1	UID seed		2	Neg
1436	16	Maize cob	*Zea mays*	1	Neg
1436	16	Maize cupule	*Zea mays*	1	Neg
1436	16	Maize kernel	*Zea mays*	1	Neg
1437	1	Grass family	Poaceae	1	Neg

PD	FS	Common name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
1437	1	Maize cupule	*Zea mays*	1	Neg
1437	1	Rattlepod	*Crotalaria* spp.	1	Neg
1437	1	UID seed		1	Neg
1438	1	Maize cupule cf.	*Zea mays* cf.	1	Neg
1438	1	Peanut cf.	*Arachis hypogaea* cf.	1	0.03
1439	1	Barrel cactus	*Echinocactus* spp.	2	Neg
1439	1	Knotweed	*Polygonum* spp.	1	Neg
1439	1	Maize kernel	*Zea mays*	1	Neg
1439	1	UID		2	Neg
1446	15	Avocado	*Persea americana*	6	0.01
1446	15	Legume family	Fabaceae	2	0.01
1446	15	Maize cob	*Zea mays*	4	0.03
1446	15	Maize cupule	*Zea mays*	10	0.01
1446	15	Maize kernel	*Zea mays*	5	0.04
1446	15	Maize kernel cf.	*Zea mays* cf.	3	Neg
1446	15	Squash cf.	*Cucurbita* spp. cf.	1	0.01
1446	15	UID		2	neg
1458	1	Guava cf.	*Psidium* spp. cf.	1	Neg
1458	1	Maize cupule	*Zea mays*	2	Neg
1458	1	Maize cupule cf.	*Zea mays* cf.	1	Neg
1458	1	Maize kernel	*Zea mays*	13	0.03
1458	1	Maize kernel cf.	*Zea mays* cf.	1	Neg
1458	1	Rattlepod	*Crotalaria* spp.	1	Neg
1458	1	UID seed		1	Neg
1458	1	UID seeed		1	Neg
1458	1	Vetch cf.	*Vicia* spp. cf.	1	Neg
1459	1	Avocado	*Persea americana*	4	Neg
1459	1	Legume family (weedy)	Fabaceae	2	Neg
1459	1	Maize cob	*Zea mays*	1	0.01
1459	1	Maize cupule	*Zea mays*	9	Neg
1459	1	Maize kernel	*Zea mays*	17	0.06
1459	1	Maize kernel cf.	*Zea mays* cf.	3	Neg
1459	1	Rattlepod	*Crotalaria* spp.	12	0.03
1459	1	UID seed		6	Neg
1465	1	Avocado	*Persea americana*	1	
1465	1	Borage family	Boraginaceae cf.	1	Neg
1465	1	Chenopod	*Chenopodium quinoa*	2	
1465	1	Chili pepper (var. Baccatum)	*Capsicum baccatum*	1	Neg
1465	1	Guava	*Psidium* spp.	1	Neg

PD	FS	Common name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
1465	1	Knotweed	*Polygonum* spp.	1	Neg
1465	1	Legume family	Fabaceae	2	
1465	1	Legume family (possible domesticated bean)	Fabaceae	2	0.01
1465	1	Maize cupule	*Zea mays*	3	Neg
1465	1	Maize glume	*Zea mays*	3	Neg
1465	1	Rattlepod	*Crotalaria* spp.	2	Neg
1465	1	Sedge family	Cyperaceae	1	Neg
1465	1	Maize kernel	*Zea mays*	9	0.04
1465	1	Maize kernel cf.	*Zea mays* cf.	1	Neg
1465	1	Trianthema	*Trianthema* spp.	1	
1465	1	UID		4	Neg
1465	1	UID fruit case		2	Neg
1465	1	UID seed		6	Neg
1469	1	Avocado	*Persea americana*	4	0.01
1469	1	Knotweed	*Polygonum* spp.	1	Neg
1469	1	Legume family cf.	Fabaceae cf.	1	Neg
1469	1	Lima bean	*Phaseolus lunatus*	1	0.06
1469	1	Maize cob	*Zea mays*	2	0.01
1469	1	Maize cupule	*Zea mays*	11	0.02
1469	1	Maize cupule cf.	*Zea mays* cf.	1	Neg
1469	1	Maize kernel	*Zea mays*	6	0.01
1469	1	Squash	*Cucurbita* spp. cf.	1	0.02
1469	1	UID		2	Neg
1469	1	UID seed		4	Neg
1473	1	Common bean cf.	*Phaseolus vulgaris* cf.	1	0.04
1473	1	Legume family	Fabaceae	3	0.02
1473	1	Legume family (possible domesticated bean)	Fabaceae	2	0.07
1473	1	Lima bean cf.	*Phaseolus lunatus* cf.	1	0.04
1473	1	Lucuma	*Pouteria lucuma*	1	Neg
1473	1	Maize cupule	*Zea mays*	4	Neg
1473	1	Maize glume	*Zea mays*	1	Neg
1473	1	Maize kernel	*Zea mays*	12	0.07
1473	1	UID		4	0.01
1473	1	UID seed		2	Neg
1475	1	Avocado	*Persea americana*	12	0.04
1475	1	Common bean	*Phaseolus vulgaris*	3	0.09
1475	1	Guava	*Psidium* spp.	2	Neg
1475	1	Legume family	Fabaceae	1	Neg

PD	FS	Common name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
1475	1	Lucuma	*Pouteria lucuma*	4	0.05
1475	1	Maize cupule	*Zea mays*	8	Neg
1475	1	Maize kernel	*Zea mays*	12	0.06
1475	1	Rattlepod	*Crotalaria* spp.	3	Neg
1475	1	Rose family	Rosaceae	1	Neg
1475	1	UID		2	Neg
1494	1	Legume family	Fabaceae cf.	1	Neg
1494	1	Maize cupule	*Zea mays*	1	Neg
1494	1	Maize kernel	*Zea mays*	3	Neg
1494	1	Passion fruit	*Passiflora* spp.	1	Neg
1494	1	UID		2	Neg
1496	1	Guava	*Psidium* spp.	3	Neg
1496	1	Maize cob	*Zea mays*	1	Neg
1496	1	Maize cob (8-row variety)	*Zea mays*	1	0.36
1496	1	Maize cupule	*Zea mays*	11	0.02
1496	1	Maize cupule cf.	*Zea mays* cf.	1	Neg
1496	1	Maize glume	*Zea mays*	1	Neg
1496	1	Maize kernel	*Zea mays*	7	0.02
1496	1	Rattlepod	*Crotalaria* spp.	1	Neg
1496	1	UID		3	Neg
1496	1	UID seed		2	Neg
1510	1	Legume family (possible domesticated bean)	Fabaceae	2	0.01
1510	1	Maize cob	*Zea mays*	12	0.06
1510	1	Maize cupule	*Zea mays*	2	Neg
1510	1	Maize kernel	*Zea mays*	2	Neg
1510	1	UID seed		2	Neg
1512	1	Barrel cactus	*Echinocactus* spp.	1	Neg
1512	1	Legume family	Fabaceae	2	0.05
1512	1	Maize cob	*Zea mays*	3	0.01
1512	1	Maize cupule	*Zea mays*	6	0.01
1512	1	Maize kernel	*Zea mays*	2	Neg
1512	1	UID		3	0.01
1513	1	Grass family	Poaceae	1	Neg
1513	1	Guava	*Psidium* spp.	1	Neg
1513	1	Legume family	Fabaceae	1	Neg
1513	1	Lima bean cf.	*Phaseolus lunatus* cf.	1	0.06
1513	1	Maize cob	*Zea mays*	2	0.02
1513	1	Maize cupule	*Zea mays*	19	0.05

PD	FS	Common name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
1513	1	Maize cupule cf.	*Zea mays* cf.	2	Neg
1513	1	Maize glume	*Zea mays*	1	Neg
1513	1	Maize kernel	*Zea mays*	2	Neg
1513	1	Peanut cf.	*Arachis hypogaea* cf.	1	0.04
1513	1	UID		6	Neg
1515	1	Maize cupule	*Zea mays*	1	
1516	1	Common bean	*Phaseolus vulgaris*	2	0.04
1516	1	Sedge family	Cyperaceae	1	Neg
1516	1	Golden berry	*Physalis peruviana*	1	Neg
1516	1	Legume family (possible domesticated bean)	Fabaceae	5	0.16
1516	1	Maize cob	*Zea mays*	1	Neg
1516	1	Maize cupule	*Zea mays*	2	Neg
1516	1	Maize glume	*Zea mays*	2	Neg
1516	1	Maize kernel	*Zea mays*	4	0.01
1516	1	Mallow family	Malvaceae	1	Neg
1516	1	Nightshade family	Solanaceae	1	Neg
1516	1	UID seed		4	Neg
1517	1	Maize kernel	*Zea mays*	2	Neg
1517	1	UID seed		1	Neg
1643	1	Barrel cactus	*Echinocactus* spp.	1	Neg
1643	1	Chili pepper	*Capsicum* spp.	1	Neg
1643	1	Golden berry	*Physalis peruviana*	1	Neg
1643	1	Guava	*Psidium* spp.	1	Neg
1643	1	Guava cf.	*Psidium* spp. cf.	1	Neg
1643	1	Legume family (possible domesticated bean)	Fabaceae	1	Neg
1643	1	Maize cupule	*Zea mays*	3	Neg
1643	1	Maize glume cf.	*Zea mays* cf.	2	Neg
1643	1	Squash	*Cucurbita* spp.	1	0.03
1643	1	UID		1	Neg
1643	2	Maize kernel	*Zea mays*	2	Neg
1657	1	Maize cob	*Zea mays*	3	0.02
1657	1	Maize cupule	*Zea mays*	6	0.01
1657	1	Maize cupule cf.	*Zea mays* cf.	2	Neg
1657	1	Maize kernel	*Zea mays*	6	0.01
1657	1	UID		3	Neg
1661	11	Guava	*Psidium* spp.	1	Neg
1661	11	Maize cupule	*Zea mays*	3	Neg
1661	11	Maize cupule cf.	*Zea mays* cf.	1	Neg

PD	**FS**	**Common name**[1]	**Taxonomic Name**[1]	**Count (n)**	**Weight (g)**[2]
1661	11	Maize glume cf.	*Zea mays* cf.	1	Neg
1661	11	Maize kernel	*Zea mays*	3	0.01
1661	11	Mallow family	Malvaceae cf. *Malvastrum* spp.	1	Neg
1661	11	UID seed		1	Neg
1664	1	Legume family	Fabaceae	2	Neg
1664	1	Maize cob	*Zea mays*	1	0.03
1664	1	Maize cupule	*Zea mays*	3	Neg
1664	1	Rattlepod	*Crotalaria* spp.	1	Neg
1664	1	Maize kernel	*Zea mays*	3	Neg
1664	1	UID		3	Neg
1667	1	Chenopod cf.	*Chenopodium quinoa* cf.	1	Neg
1667	1	Lucuma	*Pouteria lucuma*	1	Neg
1667	1	Maize cob	*Zea mays*	6	0.02
1667	1	Maize cupule	*Zea mays*	15	0.01
1667	1	Maize cupule cf.	*Zea mays* cf.	3	Neg
1667	1	Maize glume	*Zea mays*	1	Neg
1667	1	Maize kernel	*Zea mays*	3	Neg
1667	1	Sedge family	Cyperaceae	38	0.06
1667	1	Sunflower family	Asteraceae	1	Neg
1667	1	UID		5	Neg
1667	1	UID seed		6	Neg
1677	8	Maize cob	*Zea mays*	2	0.01
1677	8	Maize cupule	*Zea mays*	4	0.01
1677	8	Maize kernel	*Zea mays*	1	Neg
1677	8	Sedge family	Cyperaceae	1	Neg
1677	8	UID		2	Neg
1677	8	UID seed		1	Neg
1692	10	Chili pepper	*Capsicum* spp.	1	Neg
1692	10	Legume family	Fabaceae	1	Neg
1692	10	Legume family (possible domesticated bean)	Fabaceae	1	0.05
1692	10	Lucuma	*Pouteria lucuma*	1	Neg
1692	10	Maize cupule	*Zea mays*	2	Neg
1692	10	Maize cupule cf.	*Zea mays* cf.	1	Neg
1692	10	Maize kernel	*Zea mays*	16	0.08
1692	10	UID seed		2	Neg
1701	1	Chili pepper (var. Chinense)	*Capsicum chinense*	1	Neg
1701	1	Gourd	*Lagenaria siceraria*	1	0.01
1701	1	Legume family	Fabaceae	2	0.04

PD	**FS**	**Common name**[1]	**Taxonomic Name**[1]	**Count (n)**	**Weight (g)**[2]
1701	1	Lucuma	*Pouteria lucuma*	1	0.04
1701	1	Maize cob	*Zea mays*	9	0.07
1701	1	Maize cupule	*Zea mays*	23	0.06
1701	1	Maize glume	*Zea mays*	1	Neg
1701	1	Maize kernel	*Zea mays*	43	0.28
1701	1	Sedge family	Cyperaceae	1	Neg
1701	1	Sunflower family	Asteraceae	1	Neg
1701	1	UID		11	0.1
1701	1	UID seed		3	Neg
1701	1	Vervain cf.	*Verbena* spp. cf.	1	Neg
1702	1	Legume family (possible domesticated bean)	Fabaceae	2	0.02
1702	1	Legume family (weedy)	Fabaceae	2	Neg
1702	1	Maize cob	*Zea mays*	1	0.01
1702	1	Maize cupule	*Zea mays*	5	0.02
1702	1	Maize cupule cf.	*Zea mays* cf.	1	Neg
1702	1	Maize kernel	*Zea mays*	9	0.11
1702	1	UID		1	Neg
1702	1	UID seed		8	Neg
1703	1	Barrel cactus	*Echinocactus* spp.	2	Neg
1703	1	Chili pepper cf.	*Capsicum* spp. cf.	1	Neg
1703	1	Gourd	*Lagenaria siceraria*	1	Neg
1703	1	Guava	*Psidium* spp.	1	Neg
1703	1	Legume family (weedy)	Fabaceae	1	Neg
1703	1	Legume family cf.	Fabaceae	1	Neg
1703	1	Lucuma	*Pouteria lucuma*	3	Neg
1703	1	Maize cupule	*Zea mays*	7	Neg
1703	1	Maize glume	*Zea mays*	1	Neg
1703	1	Maize kernel	*Zea mays*	29	0.1
1703	1	Maize kernel cf.	*Zea mays* cf.	4	Neg
1703	1	Poaceae	Poaceae	1	Neg
1703	1	Rattlepod	*Crotalaria* spp.	1	Neg
1703	1	UID		14	0.04
1703	1	UID seed		2	Neg
1705	1	Golden berry	*Physalis peruviana*	1	Neg
1705	1	Legume family	Fabaceae	1	0.01
1705	1	Maize cupule	*Zea mays*	1	Neg
1705	1	Maize kernel	*Zea mays*	5	0.03
1705	1	UID		3	Neg

PD	FS	Common name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
1705	1	UID seed		2	Neg
1731	1	Avocado	*Persea americana*	4	0.27
1731	1	Maize cob	*Zea mays*	2	0.01
1731	1	Maize cupule	*Zea mays*	3	Neg
1731	1	Maize cupule cf.	*Zea mays* cf.	4	Neg
1731	1	Maize glume	*Zea mays*	1	Neg
1731	1	Maize kernel	*Zea mays*	21	0.13
1731	1	UID		3	0.01
1731	1	Vervain cf.	*Verbena* spp. cf.	1	Neg
1736	2	Maize cob cf.	*Zea mays* cf.	1	Neg
1736	2	Maize cupule	*Zea mays*	2	Neg
1736	2	Maize glume	*Zea mays*	1	Neg
1736	2	Maize kernel	*Zea mays*	3	Neg
1736	2	UID		2	Neg
1739	1	Legume family	Fabaceae	1	Neg
1739	1	Maize cob	*Zea mays*	3	Neg
1739	1	Maize cupule	*Zea mays*	7	0.02
1739	1	Maize kernel	*Zea mays*	4	Neg
1739	1	UID		1	Neg
1784	1	Avocado	*Persea americana*	1	0.15
1784	1	Chili pepper (var. Chinense)	*Capsicum chinense*	1	Neg
1784	1	Common bean	*Phaseolus vulgaris*	2	0.02
1784	1	Grass family	Poaceae	1	Neg
1784	1	Guava	*Psidium* spp.	2	Neg
1784	1	Legume family	Fabaceae	2	Neg
1784	1	Lucuma	*Pouteria lucuma*	1	0.16
1784	1	Maize cob	*Zea mays*	10	0.06
1784	1	Maize cob cf.	*Zea mays* cf.	1	Neg
1784	1	Maize cupule	*Zea mays*	6	0.01
1784	1	Maize kernel	*Zea mays*	4	0.01
1784	1	Mesquite	*Prosopis pallida*	1	Neg
1784	1	Panic grass	*Panicum* spp.	1	Neg
1784	1	Rattlepod	*Crotalaria* spp.	1	Neg
1784	1	Squash	*Cucurbita* spp.	1	Neg
1784	1	UID		5	Neg
1784	1	UID seed		3	Neg
1792	1	Avocado	*Persea americana*	3	0.02
1792	1	Guava	*Psidium* spp.	1	Neg
1792	1	Maize cob	*Zea mays*	4	0.03

PD	FS	Common name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
1792	1	Maize cupule	*Zea mays*	3	Neg
1792	1	Maize kernel	*Zea mays*	5	0.02
1792	1	Mesquite cf.	*Prosopis pallida* cf.	2	Neg
1792	1	Plantain	*Plantago* spp.	1	Neg
1792	1	UID		4	Neg
1792	1	UID seed		1	Neg
1802	1	No plants recovered			
1804	1	Chenopod	*Chenopodium quinoa*	1	Neg
1804	1	Rattlepod	*Crotalaria* spp.	2	Neg
1804	1	Rattlepod cf.	*Crotalaria* spp. cf.	1	Neg
1804	1	Gourd	*Lagenaria siceraria*	1	0.01
1804	1	Legume family	Fabaceae	4	0.04
1804	1	Lupine	*Lupinus* spp.	1	Neg
1804	1	Maize cob	*Zea mays*	4	0.02
1804	1	Maize cupule	*Zea mays*	20	0.02
1804	1	Maize cupule cf.	*Zea mays* cf.	2	Neg
1804	1	Maize glume	*Zea mays*	1	Neg
1804	1	Maize kernel	*Zea mays*	9	0.02
1804	1	Mallow family	Malvaceae	3	Neg
1804	1	Sedge family	Cyperaceae	1	Neg
1809	1	Barrel cactus	*Echinocactus* spp.	4	Neg
1809	1	Gourd	*Lagenaria siceraria*	1	Neg
1809	1	Guava	*Psidium* spp.	21	0.04
1809	1	Legume family	Fabaceae	3	0.02
1809	1	Legume family (weedy)	Fabaceae	1	Neg
1809	1	Maize cupule	*Zea mays*	3	Neg
1809	1	Maize cupule cf.	*Zea mays* cf.	1	Neg
1809	1	Maize kernel	*Zea mays*	2	Neg
1809	1	No plants recovered			
1809	1	UID		6	0.01
1816	1	Common bean	*Phaseolus vulgaris*	1	0.11
1816	1	Maize cob	*Zea mays*	1	0.01
1816	1	Maize glume	*Zea mays*	1	Neg
1816	1	Maize kernel	*Zea mays*	6	0.05
1816	1	Rattlepod	*Crotalaria* spp.	7	Neg
1816	1	UID		8	0.02
1816	1	UID fruit case		1	Neg
1816	1	UID seed		2	Neg
1816	2	Avocado	*Persea americana*	3	0.08

PD	FS	Common name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
1816	2	Guava	*Psidium* spp.	1	Neg
1816	2	Legume family	Fabaceae	1	0.03
1816	2	Legume family (weedy)	Fabaceae	1	Neg
1816	2	Maize cupule	*Zea mays*	5	Neg
1816	2	Maize cupule cf.	*Zea mays* cf.	1	Neg
1816	2	Maize glume	*Zea mays*	1	Neg
1816	2	Maize kernel	*Zea mays*	14	0.07
1816	2	Maize kernel cf.	*Zea mays* cf.	2	Neg
1816	2	Sedge family	Cyperaceae	1	Neg
1816	2	Sunflower family	Asteraceae	1	Neg
1816	2	UID		12	0.03
1816	2	UID seed		3	Neg
1821	1	Avocado	*Persea americana*	2	0.23
1821	1	Avocado cf.	*Persea americana* cf.	1	Neg
1821	1	Chili pepper cf.	*Capsicum* spp. cf.	1	Neg
1821	1	Maize cob	*Zea mays*	3	0.01
1821	1	Maize cupule	*Zea mays*	2	Neg
1821	1	UID seed		1	Neg
1828	1	Golden berry cf.	*Physalis peruviana* cf.	1	Neg
1828	1	Legume family	Fabaceae	2	Neg
1828	1	Maize cob	*Zea mays*	5	0.03
1828	1	Maize cupule	*Zea mays*	11	0.03
1828	1	Maize cupule cf.	*Zea mays* cf.	2	Neg
1828	1	Maize kernel	*Zea mays*	11	0.06
1828	1	UID seed		1	Neg
1829	1	Avocado	*Persea americana*	1	Neg
1829	1	Maize cob	*Zea mays*	11	0.12
1829	1	Maize cupule	*Zea mays*	8	0.04
1829	1	Maize kernel	*Zea mays*	6	Neg
1829	1	Mesquite	*Prosopis pallida*	4	0.02
1829	1	Mesquite cf.	*Prosopis pallida* cf.	1	Neg
1829	1	Mustard family	Brassicaceae cf.	1	Neg
1829	1	Squash	*Cucurbita* spp.	1	Neg
1829	1	UID		1	Neg
1829	1	UID seed		2	Neg
1829	1	Vetch cf.	*Vicia* spp. cf.	1	Neg
1834	1	Legume family (weedy)	Fabaceae	1	Neg
1834	1	Maize kernel	*Zea mays*	4	Neg
1834	1	Maize kernel cf.	*Zea mays* cf.	1	Neg

PD	FS	Common name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
1835	1	Barrel cactus	*Echinocactus* spp.	1	Neg
1835	1	Chenopod cf.	*Chenopodium quinoa* cf.	1	Neg
1835	1	Common bean	*Phaseolus vulgaris*	6	0.3
1835	1	Golden berry	*Physalis peruviana*	1	Neg
1835	1	Legume family	Fabaceae	13	0.13
1835	1	Maize cob	*Zea mays*	9	0.04
1835	1	Maize cupule	*Zea mays*	13	0.02
1835	1	Maize kernel	*Zea mays*	18	0.04
1835	1	Squash	*Cucurbita* spp.	1	Neg
1835	1	UID		5	Neg
1846	1	No plants recovered			
1855	1	Legume family	Fabaceae	2	Neg
1855	1	Maize cupule	*Zea mays*	2	Neg
1855	1	Maize kernel	*Zea mays*	1	Neg
1855	1	Maize kernel cf.	*Zea mays* cf.	4	Neg
1855	1	Sedge family	Cyperaceae	3	Neg
1855	1	UID seed		1	Neg
1855	3	Barrel cactus	*Echinocactus* spp.	1	Neg
1855	3	Legume family	Fabaceae	2	0.03
1855	3	Maize cupule	*Zea mays*	1	Neg
1855	3	Maize kernel	*Zea mays*	2	Neg
1855	3	Maize kernel cf.	*Zea mays* cf.	1	Neg
1855	3	UID		2	Neg
1855	3	UID seed		2	Neg
1855	3	Violet	*Viola* spp.	1	Neg
1856	1	Barrel cactus	*Echinocactus* spp.	1	Neg
1856	1	Maize cob	*Zea mays*	5	0.06
1856	1	Maize cob cf.	*Zea mays* cf.	3	0.01
1856	1	Maize cupule	*Zea mays*	11	0.02
1856	1	Maize cupule cf.	*Zea mays* cf.	2	Neg
1856	1	Maize glume	*Zea mays*	1	Neg
1856	1	Maize glume cf.	*Zea mays* cf.	1	Neg
1856	1	Maize kernel	*Zea mays*	7	0.1
1856	1	Rattlepod	*Crotalaria* spp.	1	Neg
1856	1	UID		6	0.01
1856	1	UID fruit case		1	Neg
1861	1	Chili pepper cf.	*Capsicum* spp. cf.	1	Neg
1861	1	Common bean	*Phaseolus vulgaris*	1	0.07
1861	1	Maize cupule	*Zea mays*	1	Neg

PD	FS	Common name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
1861	1	Maize kernel	*Zea mays*	10	0.05
1861	1	Maize kernel cf.	*Zea mays* cf.	1	Neg
1861	1	UID		11	0.02
1861	11	Avocado cf.	*Persea americana* cf.	1	0.02
1861	11	Chili pepper (var. Chinense)	*Capsicum chinense*	1	Neg
1861	11	Gourd	*Lagenaria siceraria*	1	0.01
1861	11	Maize cob	*Zea mays*	3	0.01
1861	11	Maize cupule	*Zea mays*	7	0.01
1861	11	Maize glume	*Zea mays*	2	Neg
1861	11	Maize kernel	*Zea mays*	11	0.05
1861	11	UID		5	Neg
1861	11	UID seed		1	Neg
1862	1	Avocado	*Persea americana*	1	0.01
1862	1	Legume family cf.	Fabaceae cf.	1	Neg
1862	1	Maize cob cf.	*Zea mays* cf.	1	Neg
1862	1	Maize cupule	*Zea mays*	6	Neg
1862	1	Maize kernel	*Zea mays*	6	0.01
1862	1	UID		2	0.02
1862	2	Guava	*Psidium* spp.	2	Neg
1862	2	Maize cob	*Zea mays*	1	Neg
1862	2	Maize cupule	*Zea mays*	1	Neg
1862	2	Maize kernel	*Zea mays*	8	0.02
1862	2	UID		2	Neg
1880	1	Lucuma	*Pouteria lucuma*	9	0.02
1880	1	Maize cupule cf.	*Zea mays* cf.	2	Neg
1880	1	Maize glume cf.	*Zea mays* cf.	1	Neg
1880	1	Sedge family	Cyperaceae	1	Neg
1880	1	Squash	*Cucurbita* spp.	1	0.01
1880	1	UID seed		1	Neg
1881	1	Maize cob	*Zea mays*	2	0.01
1881	1	Maize cupule	*Zea mays*	14	0.02
1881	1	Maize cupule cf.	*Zea mays* cf.	3	Neg
1881	1	Maize kernel	*Zea mays*	2	Neg
1885	1	Barrel cactus	*Echinocactus* spp.	1	Neg
1885	1	Legume family	Fabaceae	2	0.03
1885	1	Maize cob	*Zea mays*	1	Neg
1885	1	Maize cupule	*Zea mays*	7	0.01
1885	1	Maize cupule cf.	*Zea mays* cf.	3	Neg
1885	1	Maize kernel	*Zea mays*	5	0.02

PD	**FS**	**Common name**[1]	**Taxonomic Name**[1]	**Count (n)**	**Weight (g)**[2]
1885	1	Maize kernel cf.	*Zea mays* cf.	6	0.01
1885	1	Mesquite	*Prosopis pallida*	1	Neg
1885	1	Nightshade family	Solanaceae	1	Neg
1885	1	Opuntia cf.	*Opuntia* spp. cf.	1	Neg
1885	1	UID		7	Neg
1887	1	Avocado cf.	*Persea americana* cf.	1	Neg
1887	1	Maize cob	*Zea mays*	1	Neg
1889	1	Barrel cactus	*Echinocactus* spp.	15	0.01
1889	1	Chili pepper	*Capsicum* spp.	1	Neg
1889	1	Sunflower family	Asteraceae	2	Neg
1889	1	Chili pepper (var. Chinense)	*Capsicum chinense*	1	Neg
1889	1	Chili pepper cf.	*Capsicum* spp. cf.	2	Neg
1889	1	Common bean	*Phaseolus vulgaris*	2	0.08
1889	1	Grass family	Poaceae	2	Neg
1889	1	Legume family	Fabaceae	1	0.07
1889	1	Legume family (weedy)	Fabaceae	4	Neg
1889	1	Legume family cf.	Fabaceae cf.	1	Neg
1889	1	Maize cob	*Zea mays*	4	0.01
1889	1	Maize cupule	*Zea mays*	12	Neg
1889	1	Maize cupule cf.	*Zea mays* cf.	2	Neg
1889	1	Maize glume	*Zea mays*	2	Neg
1889	1	Maize glume	*Zea mays*	1	Neg
1889	1	Maize kernel	*Zea mays*	26	0.03
1889	1	Maize kernel cf.	*Zea mays* cf.	3	Neg
1889	1	Sedge family	Cyperaceae	5	Neg
1889	2	Elderberry	*Sambucus peruviana*	1	Neg
1889	2	Golden berry	*Physalis peruviana*	1	Neg
1889	2	Guava	*Psidium* spp.	2	Neg
1889	2	Legume family (weedy)	Fabaceae	10	Neg
1889	2	Lucuma	*Pouteria lucuma*	1	Neg
1889	2	Maize cob	*Zea mays*	8	0.07
1889	2	Maize cupule	*Zea mays*	41	0.09
1889	2	Maize cupule cf.	*Zea mays* cf.	3	Neg
1889	2	Maize glume	*Zea mays*	5	0.02
1889	2	Maize kernel	*Zea mays*	33	0.13
1889	2	Maize kernel cf.	*Zea mays* cf.	4	Neg
1889	2	Mallow family	Malvaceae cf. *Malvastrum* spp.	1	Neg
1889	2	Sedge family	Cyperaceae	1	Neg
1889	2	UID		12	0.01

PD	**FS**	**Common name**[1]	**Taxonomic Name**[1]	**Count (n)**	**Weight (g)**[2]
1889	2	UID seed		9	0.01
1891	1	Avocado	*Persea americana*	16	0.08
1891	1	Lucuma	*Pouteria lucuma*	39	0.17
1891	1	Maize cob cf.	*Zea mays* cf.	1	Neg
1891	1	Maize cupule	*Zea mays*	1	Neg
1891	1	Maize cupule cf.	*Zea mays* cf.	1	Neg
1891	1	Maize kernel	*Zea mays*	1	Neg
1891	1	UID		4	Neg
1891	1	UID seed		1	Neg

[1] cf. = identification probable but not definite
[2] Specimen weight listed as neglible ("neg") if less than 0.01 g.

APPENDIX VI

INVENTORY OF PLANTS RECOVERED AT MV-83

PD	FS	Common Name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
254	2	UID		1	0.01
254	6	Maize cupule	*Zea mays*	1	Neg
254	6	UID		12	Neg
254	7	Barrel cactus	*Echinocactus* spp.	1	Neg
254	7	Golden berry	*Physalis peruviana*	1	Neg
254	7	Maize kernel	*Zea mays*	2	Neg
254	7	UID		5	0.01
254	7	UID seed		1	Neg
256	1	Barrel cactus	*Echinocactus* spp.	1	Neg
256	1	Grass family	Poaceae	1	Neg
256	1	Mallow family	Malvaceae	1	Neg
256	1	Purslane	*Portulaca* spp.	2	Neg
256	1	Sunflower family	Asteraceae	2	Neg
256	1	Sunflower family cf.	Asteraceae cf.	1	Neg
256	1	UID		1	Neg
256	1	UID seed		5	Neg
264	1	Avocado	*Persea americana*	1	Neg
264	1	Cotton	*Gossypium barbadense*	1	Neg
264	1	Grass family	Poaceae	1	Neg
264	1	Lucuma	*Pouteria lucuma*	1	Neg
264	1	Maize cupule	*Zea mays*	2	Neg
264	1	Maize glume	*Zea mays*	1	Neg
264	1	Maize kernel	*Zea mays*	2	0.01
264	1	Mesquite	*Prosopis pallida*	5	0.01
264	1	Nightshade family	Solanaceae	1	Neg
264	1	Purslane	*Portulaca* spp.	1	Neg
264	1	Squash	*Cucurbita* spp.	1	0.02
264	1	Trianthema	*Trianthema* spp.	2	Neg
264	1	UID		10	0.08
264	1	UID seed		4	Neg
275	10	Grass family	Poaceae	1	Neg
275	10	Maize cupule	*Zea mays*	1	Neg
275	11.1	Barrel cactus	*Echinocactus* spp.	1	Neg
275	11.1	Grass family	Poaceae	4	Neg
275	11.1	Legume family	Fabaceae	1	Neg
275	11.1	Maize cupule	*Zea mays*	1	Neg
275	11.1	Maize kernel	*Zea mays*	2	0.02

PD	FS	Common Name[1]	Taxonomic Name[1]	Count (n)	Weight (g)[2]
275	11.1	Purslane	*Portulaca* spp.	1	Neg
275	11.1	Trianthema	*Trianthema* spp.	2	Neg
275	11.1	UID		4	Neg
275	11.1	UID seed		1	Neg
275	11.2	Grass family	Poaceae	2	Neg
275	11.2	Legume family	Fabaceae	1	Neg
275	11.2	Lucuma	*Pouteria lucuma*	2	Neg
275	11.2	Maize cupule	*Zea mays*	2	Neg
275	11.2	Maize kernel	*Zea mays*	2	Neg
275	11.2	Rubus cf.	*Rubus* spp. cf.	1	Neg
275	11.2	Sunflower family	Asteraceae	1	Neg
275	11.2	UID		4	Neg
275	11.2	UID seed		2	Neg
275	11.3	Grass family	Poaceae	4	Neg
275	11.3	Legume family (weedy)	Fabaceae	1	Neg
275	11.3	Lucuma	*Pouteria lucuma*	1	Neg
275	11.3	Maize cupule	*Zea mays*	5	0.01
275	11.3	Maize kernel	*Zea mays*	2	Neg
275	11.3	Rattlepod	*Crotalaria* spp.	1	Neg
275	11.3	Sedge family	Cyperaceae	2	Neg
275	11.3	Tillandsia	*Tillandsia* spp.	1	0.04
275	11.3	UID		4	0.01
275	11.3	UID seed		1	Neg
275	13	No plants recovered			
276	1	Grass family	Poaceae	21	Neg
276	1	Grass family	Poaceae cf.	1	Neg
276	1	Legume family	Fabaceae	6	0.03
276	1	Legume family (possible domesticated bean)	Fabaceae	1	0.01
276	1	Legume family (weedy)	Fabaceae	3	0.01
276	1	Lucuma	*Pouteria lucuma*	1	Neg
276	1	Maize cupule	*Zea mays*	44	0.06
276	1	Maize kernel	*Zea mays*	7	0.01
276	1	Rubus	*Rubus* spp. cf.	1	Neg
276	1	Trianthema	*Trianthema* spp.	1	Neg
276	1	UID		41	0.05
276	1	UID seed		2	Neg
276	1	UID seed		2	Neg
281	1	Barrel cactus	*Echinocactus* spp.	5	Neg
281	1	Golden berry	*Physalis peruviana*	4	Neg
281	1	Legume family	Fabaceae	1	Neg
281	1	Rattlepod	*Crotalaria* spp.	1	Neg

PD	FS	**Common Name**[1]	**Taxonomic Name**[1]	**Count (n)**	**Weight (g)**[2]
281	1	Sedge family	Cyperaceae	1	Neg
281	1	Sunflower family	Asteraceae	1	Neg
281	1	UID		11	0.01
281	1	UID seed		1	Neg
281	1	UID seed		1	Neg
281	2	Barrel cactus	*Echinocactus* spp.	1	Neg
281	2	Golden berry	*Physalis peruviana*	1	Neg
281	2	Lucuma	*Pouteria lucuma*	2	Neg
281	2	Maize cupule	*Zea mays*	2	Neg
281	2	Maize kernel	*Zea mays*	3	Neg
281	2	UID		4	0.02
286	9	Amaranth	*Amaranthus* spp.	1	Neg
286	9	Barrel cactus	*Echinocactus* spp.	1	Neg
286	9	Chenopod	*Chenopodium quinoa*	1	Neg
286	9	Golden berry	*Physalis peruviana*	3	0.02
286	9	Golden berry cf.	*Physalis peruviana* cf.	1	Neg
286	9	Grass family	Poaceae	1	Neg
286	9	Grass family cf.	Poaceae cf.	1	Neg
286	9	Guava	*Psidium* spp.	1	Neg
286	9	Maize cob	*Zea mays*	1	0.03
286	9	Maize glume	*Zea mays*	1	
286	9	Maize kernel	*Zea mays*	6	0.03
286	9	Mallow family	Malvaceae	1	Neg
286	9	Nightshade family	Solanaceae	1	Neg
286	9	Peanut	*Arachis hypogaea*	1	0.07
286	9	UID		20	0.09
286	9	UID seed		3	Neg
293	1	Amaranth	*Amaranthus* spp.	2	Neg
293	1	Avocado	*Persea americana*	2	0.51
293	1	Cotton	*Gossypium barbadense*	3	Neg
293	1	Golden berry	*Physalis peruviana*	4	Neg
293	1	Gourd	*Lagenaria siceraria*	3	0.06
293	1	Grass family	Poaceae	9	Neg
293	1	Legume family	Fabaceae	5	0.01
293	1	Lucuma	*Pouteria lucuma*	10	0.02
293	1	Maize cob (6-row variety)	*Zea mays*	9	0.82
293	1	Maize cupule	*Zea mays*	193	0.8
293	1	Maize glume	*Zea mays*	1	Neg
293	1	Maize kernel	*Zea mays*	1	Neg
293	1	Mallow family	Malvaceae	1	Neg
293	1	Rattlepod	*Crotalaria* spp.	2	Neg

PD	**FS**	**Common Name**[1]	**Taxonomic Name**[1]	**Count (n)**	**Weight (g)**[2]
293	1	Squash	*Cucurbita* spp.	1	0.01
293	1	Sunflower family	Asteraceae	1	Neg
293	1	UID		33	0.06
293	1	UID seed		3	Neg
296	8	Maize cupule	*Zea mays*	1	Neg
296	8	Trianthema	*Trianthema* spp.	1	Neg
296	8	UID		8	Neg
317	7	Guava	*Psidium* spp.	2	Neg
317	7	Legume family (possible domesticated bean)	Fabaceae	1	0.06
317	7	Lucuma	*Pouteria lucuma*	1	Neg
317	7	Maize glume	*Zea mays*	1	Neg
317	7	Sunflower family	Asteraceae	1	Neg
317	7	UID		7	0.04
321	8	Maize cupule	*Zea mays*	3	Neg
321	8	Maize kernel	*Zea mays*	1	Neg
321	8	UID		3	Neg
321	15	Maize kernel	*Zea mays*	3	0.04
321	15	Tillandsia	*Tillandsia* spp.	1	0.02
321	15	UID seed		1	Neg

[1] cf. = identification probable but not definite
[2] Specimen weight listed as neglible ("neg") if less than 0.01 g.

APPENDIX VII

FUNCTIONAL DESIGNATION BY PROVENIENCE MV-225

PD	FS	Volume (L)	Total Plant Weight (g)	Total Wood Weight (g)	Compound	Feature	Function (Ringberg 2012)
1083	1	7.0	15.84	15.73	1	5	Kitchen
1091	1	5.75	0.63	0.63	1	5	Kitchen
1213	1	5.0	5.54	5.39	1	5	Kitchen
1236	1	5.2	4.25	3.98	1	5	Kitchen
1236	2	5.2	3.64	3.34	1	5	Kitchen
1299	1	5.0	3.16	3.07	1	5	Kitchen
1369	1	5.0	3.10	3.09	1	5	Kitchen
1408	10	5.0	7.29	7.19	1	5	Kitchen
1661	11	5.5	3.21	3.20	1	5	Kitchen
1677	8	4.3	1.99	1.97	1	5	Kitchen
1293	2	5.0	4.23	4.14	1	5.04	Hearth
1375	1	5.0	0.06	0.05	1	5.08	Hearth
1409	1	5.0	5.61	5.39	1	5.1	Hearth
1465	1	5.5	4.07	4.02	1	5.11	Ash-filled pit
1469	1	5.0	7.49	7.49	1	5.12	Ash-filled pit
1664	1	1.7	1.54	1.51	1	5.13	Hearth
1294	1	2.5	2.49	2.49	1	6	Storage
1168	14	4.0	1.54	1.53	1	7	Sleeping/corridor
1250	1	5.1	1.43	1.43	1	7	Sleeping/corridor
1289	1	5.8	5.04	4.70	1	7	Sleeping/corridor
1292	1	1.3	0.61	0.60	1	7.01	Hearth
1097	1	8.5	3.31	3.27	1	8	Special use
1123	1	4.0	4.08	3.95	1	8.04	Vessel support
1099	1	5.0	2.06	1.92	1	10	Special use
1093	1	3.5	3.66	3.43	1	10.01	Hearth
1353	1	5.0	1.69	1.62	1	12	Kitchen
1458	1	5.0	1.16	1.15	1	12	Kitchen
1475	1	5.2	4.51	4.31	1	12.01	Hearth
1459	1	5.0	1.12	1.02	1	12.04	Hearth
1113	1	5.0	2.93	2.89	1	14	Patio
1117	1	5.0	1.84	1.53	1	14	Patio
1201	6	5.0	3.57	3.57	1	15	Storage
1249	1	4.6	1.81	1.81	1	15	Storage
1206	15	5.0	3.80	3.77	1	16	Storage
1251	1	4.8	10.08	10.05	1	16	Storage
1262	1	5.0	0.72	0.70	1	16	Storage
1111	1	5.0	3.03	2.99	1	17	Storage

PD	FS	Volume (L)	Total Plant Weight (g)	Total Wood Weight (g)	Compound	Feature	Function (Ringberg 2012)
1121	1	3.25	1.42	1.37	1	17.01	Bin/trough
1126	1	3.5	0.87	0.84	1	17.01	Bin/trough
1087	1	5.0	2.10	1.79	1	18	Patio
1088	1	5.0	3.54	3.51	1	18	Patio
1122	1	5.0	7.01	6.69	1	18	Patio
1692	10	5.0	2.33	2.20	1	18	Patio
1701	1	5.0	9.99	9.39	1	18.03	Hearth
1702	1	5.0	3.30	3.14	1	18.04	Hearth
1235	1	5.0	2.14	2.08	1	20	Storage
1271	11	5.2	3.81	3.81	1	20	Storage
1275	1	5.0	2.45	2.40	1	20	Storage
1177	14	5.0	2.26	2.20	1	22	Patio/terrace
1383	1	4.8	3.70	3.70	1	22	Patio/terrace
1349	1	5.0	1.50	1.49	1	22.01	Cist/burial
1392	1	3.5	2.22	2.19	1	22.02	Hearth
1385	1	5.0	1.58	1.51	1	22.05	Hearth
1386	1	5.0	1.83	1.80	1	22.06	Ash deposit
1387	1	5.2	13.49	13.08	1	22.07	Ash deposit
1389	1	5.0	8.04	7.67	1	22.08	Ash deposit
1390	1	5.0	5.97	5.79	1	22.09	Hearth
1295	1	5.3	1.33	1.33	1	23	Patio
1422	12	5.2	1.83	1.83	1	32	Patio
1427	1	5.0	5.52	5.42	1	32	Patio
1428	1	5.0	0.08	0.08	1	32	Patio
1512	1	5.0	2.32	2.24	1	32	Patio
1513	1	5.0	3.20	3.03	1	32	Patio
1515	1	5.0	0.42	0.42	1	32	Patio
1516	1	5.0	3.60	3.39	1	32	Patio
1517	1	5.0	0.69	0.69	1	32	Patio
1473	1	5.0	2.88	2.63	1	41	Cooking (semi-open)
1496	1	5.0	3.11	2.71	1	41.02	Hearth
1446	15	5.0	0.11	4.86	1	44	Patio/terrace
1494	1	5.0	1.37	1.37	1	44	Patio/terrace
1510	1	4.0	16.25	16.18	1	44.01	Hearth
1424	1	4.0	1.31	1.19	1	47.01	Unknown
1703	1	4.0	9.26	9.12	1	54.02	Hearth
1705	1	2.5	1.51	1.47	1	55.01	Bin
1363	1	5.0	19.76	19.53	3	25	Kitchen
1374	13	5.5	10.93	10.62	3	25	Kitchen
1379	1	5.0	4.97	4.87	3	25	Kitchen
1379	2	5.0	1.42	1.35	3	25	Kitchen

PD	FS	Volume (L)	Total Plant Weight (g)	Total Wood Weight (g)	Compound	Feature	Function (Ringberg 2012)
1367	1	5.0	22.38	17.35	3	25	Kitchen
1367	3	5.0	11.29	10.88	3	25	Kitchen
1393	1	5.5	18.94	16.20	3	25	Kitchen
1394	1	5.0	21.53	20.45	3	25.04	Hearth
1314	1	3.0	1.01	0.99	3	27	Storage
1244	1	5.6	0.40	0.40	3	28	Storage
1270	11	5.4	0.30	0.26	3	28	Storage
1273	1	5.5	1.21	1.21	3	29	Kitchen
1257	1	5.0	2.90	2.86	3	33	Cist/burial
1266	1	5.0	12.11	11.87	3	33	Cist/burial
1266	2	5.0	3.34	3.32	3	33	Cist/burial
1643	1	0.25	3.06	3.03	3	38	Unknown
1643	2	2.5	2.00	2.00	3	38	Unknown
1437	1	5.0	1.58	1.58	3	38	Unknown
1657	1	5.0	3.40	3.36	3	38	Unknown
1667	1	5.5	4.87	4.78	3	38	Unknown
1436	16	5.0	1.80	1.80	3	39	Patio
1439	1	5.0	0.72	0.72	3	39	Patio
1885	1	4.0	2.58	2.51	6	51	Patio
1861	1	4.8	2.84	2.70	6	51	Patio
1861	11	5.0	5.24	5.14	6	51	Patio
1881	1	0.5	0.19	0.16	6	51.01	Hearth
1880	1	1.0	0.88	0.86	6	51.02	Hearth
1891	1	5.0	2.20	2.03	6	51.02	Hearth
1731	1	6.0	4.79	4.39	6	57	Storage
1739	1	5.0	1.66	1.64	6	57	Storage
1835	1	5.5	6.21	5.68	6	58.01	Hearth
1792	1	5.0	4.18	4.13	6	59	Corridor
1829	1	5.0	24.06	23.88	6	59.02	Ash deposit
1821	1	5.0	1.78	1.54	6	62	Patio
1828	1	5.2	3.35	3.23	6	62	Patio
1816	1	5.0	3.40	3.21	6	62.02	Hearth
1816	2	5.0	1.95	1.77	6	62.02	Hearth
1855	1	5.0	0.17	0.17	6	62.03	Hearth
1855	3	5.0	0.05	0.05	6	62.03	Hearth
1856	1	5.0	8.70	8.50	6	62.05	Hearth
1856	1	5.0	8.70	8.50	6	62.05	Hearth
1862	1	5.0	2.22	2.18	6	62.05	Hearth
1862	2	5.0	3.24	3.22	6	62.05	Hearth
1889	1	5.0	2.72	2.52	6	62.07	Hearth
1889	2	5.0	7.91	7.58	6	62.07	Hearth

APPENDIX VIII

DENSITY DATA USED IN THE PRINCIPAL COMPONENT ANALYSIS

Feature	**Avocado**	**Barrel cactus**	**Chili pepper**	**Common bean**	**Golden berry**	**Gourd**	**Grass family**	**Guava**	**Legume family**	**Lucuma**	**Maize**	**Mallow family**	**Quinoa**	**Rattlepod**	**Sedge family**	**Squash**	**Sunflower family**
5	0.2	0.9	0.1	0	0	0.2	0	0.3	0.6	0.3	3.2	0.2	0	0.2	0.2	0.2	0.4
5.04	0	0.2	0	0	0	0	0	0	0.4	0	7.4	0	0	0	0	0	0
5.1	0	0	0	0	0	5.1	0	0	5.1	0	0.6	0	0	0	0	0	0
5.11	5.1	0	5.1	0	0	0	0	5.1	5.1	0	2.7	0	5.1	5.1	5.1	0	0
5.12	5.1	0	0	0	0	0	0	0	0	0	3.8	0	0	0	0	5.1	0
5.13	0	0	0	0	0	0	0	0	1.2	0	4.1	0	0	0.6	0	0	0
7	0.3	0	0	0	0	0.2	0.2	0.2	1.2	0	1.5	0	0	0	0	0	0
7.01	0	0	0	0	0	0	0	0	0	0	5.4	0	0	0	0.8	0	0
8	0	0	0	0	0	0	0	0.2	0	0	0.9	0	0	0.1	0	0.2	0
8.04	0	0	0	0	0	0	0	0	0.5	0	4	0	0	0	0.3	0	0
10	0.4	0	0	0	0.2	0	0	0	0.4	1.2	5.6	0	0	0	0	0	0
10.01	0.6	0	0	0	0	0.3	0	0	0	0	7.4	0	0	0	0	0	0.3
12	0.4	0	0	0	0	0	0	0.2	1.4	0	2.3	0	0	0.8	0	0	0
12.01	2.3	0	0	0.6	0	0	0	0.4	0.2	0.8	3.8	0	0	0.6	0	0	0
12.04	0.8	0	0	0	0	0	0	0	0.4	0	5.4	0	0	2.4	0	0	0
15	0.4	0	0	0	0	0	0.2	0	0.2	0	0.5	0	0.2	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0.2	2.4	0	0	0	0	0	0
17.01	0	0	0.3	0	0	0	0.9	0.3	0.3	1.2	1.2	0.3	0.6	0.3	0	0	0
18	0	0.8	0.2	0	0	0	0	0	0.4	0.2	4	0	0.2	0	0	0.8	0
18.03	0	0	0.2	0	0	0.2	0	0	0.4	0.2	15.2	0	0	0	0.2	0	0.2
18.04	0	0	0	0	0	0	0	0	0.8	0	3	0	0	0	0	0	0
20	0	0.2	0	0	0	0	0	0.2	0	0.6	2	0	0	0	0	0	0.4
22	0	0.2	0	0	0	0	0	0	0.2	0	1.3	0	0	0	0	0	0
22.01	0	0	0	0	0	0	0	0	0.4	0	1.2	0	0	0	0	0	0
22.05	0	0	0	0	0	0	0	0	1.4	0	1.4	0	0	0	0	0	0
22.06	0.2	0	0	0	0	0.6	0	0.2	0	0	0.8	0.2	0	0	0.2	0	0
22.07	0.2	0.2	0	0	0	0.4	0.2	0	0.2	0.2	1	0.2	0	0	0	0	0
22.08	0	0	0.2	0	0	2.6	0	0	1.8	0	6	0.2	0	0.2	0.6	0	0.2
22.09	0	0	0	0	0	0	0	0	0.2	0	6.2	0	0	0	0	0	0
25	2	0.8	0.6	0.5	0	0.8	0.3	0.3	1.3	0.4	13.7	0.4	0	0.4	0	0	0.4
25.04	0	0	0.8	0.2	0	1	0	0.2	0.2	2.4	6.8	0	0	0	1.2	0	0.2
28	0	0	0.2	0	0	0	0	0	0	0	0.4	0	0	0	0	0	0
32	0.4	0.2	0	0.4	0.2	0	0.2	0.2	0.6	0	1.6	0.2	0.2	0	0	0	0

Feature	**Avocado**	**Barrel cactus**	**Chili pepper**	**Common bean**	**Golden berry**	**Gourd**	**Grass family**	**Guava**	**Legume family**	**Lucuma**	**Maize**	**Mallow family**	**Quinoa**	**Rattlepod**	**Sedge family**	**Squash**	**Sunflower family**
33	0.2	0	0	0	0	0	0.4	0	1.4	0	3.2	0	0.2	0.2	0.2	0	0
38	0	4	4	0	4	0	0.2	4	4	0.2	2.5	0	0	0.2	6.9	4	0.2
39	0	0.4	0	0	0	0	0	0	0	0	0.4	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	1	0.2	3.4	0	0	0	0	0	0
41.02	0	0	0	0	0	0	0	0.6	0	0	4.2	0	0	0.2	0	0	0
44	1.2	0	0	0	0	0	0	0	0.4	0	2.3	0	0	0	0	0	0
44.01	0	0	0	0	0	0	0	0	0.5	0	4	0	0	0	0	0	0
47.01	0	0	0	0	0	0	0	0.3	0	0	1.5	0	0	0	0	0	0
51	0	0.3	0.2	0.2	0	0.2	0	0	0.5	0	3.4	0	0	0	0	0	0
51.02	3.2	0	0	0	0	0	0	0	0	8	36	0	0	0	1	1	0
54.02	0	0.5	0	0	0	0.3	0.3	0.3	0.3	0.8	9.3	0	0	0.3	0	0	0
55.01	0	0	0	0	0.4	0	0	0	0.4	0	2.4	0	0	0	0	0	0
57	0.7	0	0	0	0	0	0	0	0.2	0	3.7	0	0	0	0	0	0
58.01	0	0.2	0	1.1	0.2	0	0	0	2.4	0	7.3	0	0	0	0	0.2	0
59	0.6	0	0	0	0	0	0	0.2	0	0	2.4	0	0	0	0	0	0
59.02	0.2	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0.2	0
62	0.4	0	0	0	0	0	0	0	0.4	0	3.1	0	0	0	0	0	0
62.02	0.6	0	0	0.2	0	0	0	0.2	0.4	0	2.8	0	0	1.4	0.2	0	0.2
62.03	0	0.2	0	0	0	0	0	0	0.4	0	0.6	0	0	0	0.6	0	0
62.04	0	0	0	0	0	0	0	0	0.2	0	0.8	0	0	0	0	0	0
62.05	0.2	0.2	0	0	0	0	0	0.4	0	0	3.1	0	0	0.2	0	0	0
62.07	0	3	0.4	0.4	0.2	0	0.4	0.4	1.5	0.2	13.2	0.2	0	0	0	0	0.4