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Farming and Power: Classic Period Maya Manioc and Maize Cultivation at Ceren, El Salvador

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FARMING AND POWER:
CLASSIC PERIOD MAYA MANIOC AND MAIZE
CULTIVATION AT CERÉN, EL SALVADOR

by

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B.A., St. Mary’s College of California, 2003
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A thesis submitted to the
Faculty of the Graduate School of the
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This thesis entitled:
Farming and Power: Classic Period Maya Manioc and Maize Cultivation
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The final copy of this thesis has been examined by the signatories, and we find that both the content and the form meet acceptable presentation standards of scholarly work in the above mentioned discipline.
Despite the centrality of agriculture to the functioning of Classic Period (c. A.D. 250-850) Maya society, little is known of how farming decisions were made, the extent of political oversight of agricultural production, and the level of individual autonomy for farmers within their communities. This dissertation focuses on the intersection of farming and power to assess the organization of manioc and maize cultivation at Cerén, El Salvador. The burial of the site beneath multiple meters of Loma Caldera tephra (c. A.D. 630) resulted in the extraordinary preservation of Cerén’s structures, features, artifacts, and agricultural fields, which affords a unique opportunity to document ancient cultivation techniques and their implications for sociocultural complexity.

Within the theoretical framework of practice theory, the daily practices of maize and manioc farming inscribed the Cerén landscape with evidence of farmers’ choices, community integration, and organization of agricultural production. These choices and sociopolitical forces can be interpreted from a farm-up perspective, whereby the Cerén agricultural fields form the evidentiary foundation from which to assess the social, political, economic, and ideological forces involved in manioc and maize cultivation.

The preservation of manioc and maize fields south of the Cerén site center allows us to see the variation in crop selection, cultivation methods, growth patterns, and field divisions. These data indicate that farmers had significant power in cultivation choices and practices at the site. The Cerén archaeological record also shows non-royal community organization was responsible for managing agricultural production, based on the evidence for a simultaneous manioc and maize harvest, an inferred community harvest feast, the remains of a public civic structure where political decisions were likely
centered, and an earthen *sacbe* (road) that both symbolically and physically linked the agricultural fields with the site center.

Agricultural production at Cerén was an individual, household, and community affair and this dissertation has implications for understanding ancient Maya agriculture (including the role of root crops in the Maya area), for connecting practice theory, political economy, and farming, and for reconstructing the complex social, political, and economic context in which people of the past once lived.
To My Family,
The Dixon-Riggers-Remington-Gunderson-Weiler Band

In Loving Memory of:

Leandro Isabel Flores Ramirez
who contributed greatly to this work
and whose friendship has contributed greatly to my life.

And

Lillian Maher ("Aunt Lil")
James Laub ("Uncle Jimmy")
Jay Musselman
who were with me throughout this process
Acknowledgments

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Chapter 1: Introduction

Introduction to the Project

What have been missing from research are detailed analyses of farming communities and the relations between farming communities and cities… Only with this analysis in hand can we adequately model the dynamics of organization in complex societies [Robin 2012: 4].

Peopling the past is a radical alternative to viewing farmers as faceless masses, the passive recipients of what the elite impose on them through direct coercion or state ideology [Erickson 2006: 353].

Despite the centrality of agriculture to the functioning of Classic Period (c. A.D. 250-850) Maya society, little is known of how farming decisions were made, the extent of political oversight of agricultural production, and the level of individual autonomy for farmers within their communities (Demarest 2004:173). This dissertation examines the southern agricultural fields of the Cerén site in El Salvador to better understand the social, political, and economic lives of the Cerén farmers and their families. Agricultural production at the site significantly contributed to the on-going construction and changing of social and political forces. The daily practice of farming inscribed the Cerén landscape with evidence of farmer autonomy, community integration, and organization of agricultural production by non-royal governance.

The Classic Maya civilization was part of the rich culture history of Mesoamerica (Coe 2011; Sharer and Traxler 2006) (Figure 1.1). Stretched across the landscape of Mexico, Belize, Guatemala, Honduras, and El Salvador are the grand palaces and temples, for which the Classic Period Maya are most well known (Figure 1.2). As a Classic Maya site (Sheets 2009), Cerén provides a unique opportunity to enrich our understanding of the lives of farmers in a time period best known for elite rulers. The burial of the site by multiple meters of volcanic ash (c. A.D.
630) resulted in the detailed preservation of agricultural fields and plants, as well as domestic structures (domiciles, kitchens, storage facilities), public buildings (religious, social, and political structures), cleared spaces (platforms, natural topography, and fallow fields), and an earthen sacbe (raised road) (Sheets 2002, 2007, ed. 2009; Sheets and Dixon 2011). In addition to maize fields in the area south of the site center, the discovery of intensively cultivate manioc (*Manihot esculenta* Crantz) fields make available a rare outlook on the farming lives of a Classic Period Maya community and an intensive production strategy (mono-cropping manioc cultivation) previously undocumentd in Mesoamerica. These data are poised to contribute to understanding of agricultural production, the social and political forces connected with farming, and our knowledge of commoners and farming organization for the region.

![Figure 1.1. Map Showing Cerén in Mesoamerica (Redrawn from Lohse and Gonlin 2007: xviii)]
Figure 1.2. Map of the Maya Area Showing the Cerén Site Location along the Southeastern Maya periphery (Redrawn from McKillop 2004:4 by Raining Wang)
The primary objective of this project is to examine Cerén’s political and social organization of production. David Webster (2002: 175) underscored that the “greatest ignorance about Maya farmers concerns the ancient political economy.” Preservation of organic materials and agricultural features remains a limiting factor in reconstructions of ancient Maya subsistence systems (Bronson 1966; Crane 1996; Murtha 2002; Sheets et al. 2012: 260-261) and has considerably restricted our ability to assess the degree of control, connection, and autonomy of ancient Maya farmers in relationship to local and regional political powers (Demarest 2004: 173). Cerén’s agricultural fields and plants powerfully inform an aspect of research lesser known for the region.

Compounding our lack of knowledge of ancient farming is an elite-centric bias in archaeological research (particularly in the Maya Classic Period, which is known for a fluorescence of monumental architecture and royal divine rulership). This has resulted in lack of informed reconstructions of farming, producing a view of farmers as passive and non-influential in social and political histories (Erickson 2006: 353; Robin 2012: 1-4). Elizabeth Brumfiel (1992) emphasized the problematic assumptions often made in the absence of archaeological data, stating:

[W]hen archaeologists fail to assign specific activities to these groups [women, peasants, and ethnic groups], dominant groups in contemporary society are free to depict them in any way they please. Most often, dominant groups will overstate the historical importance of their own group and undervalue the contributions of others, legitimating inequalities. In addition, when women, peasants, and ethnic groups are assigned no specific activities in the past, professional archaeologists make implicit assumptions about their roles and capabilities, resulting in the widespread acceptance of untested, and possibly erroneous, interpretation of archaeological data [Brumfiel 1992: 553].

Rather than a passive backdrop, agricultural production was a daily and structuring force in ancient Maya society. A Western bias for the separation of economic, social, political, and
religious life, as well as a lack of experience in the realm of traditional farming has made researchers liable to under-theorize the importance of agricultural production to the creation of past societies. Such cultivation wasn’t simply a way to feed people, but instead a pervasive and vital part of the lives of the ancient Maya.

Classic Period Maya agricultural studies have been critiqued for overly normative, simplified views of Maya agriculture and the construction of models that are too far removed from the available data (Murtha 2002: 7). K. Anne Pyburn critiqued an etic, ethnocentric view of ancient agriculture and politic economy in the Maya area, stating “our lack of respect for the local knowledge of the ancient Maya has allowed us to mistake diversity for chaos, sophistication for disorganization, and political economy for ecological ignorance” (Pyburn 1996: 236-237).

These data provide access to local knowledge involved in agricultural production and its organization. From the Cerén agricultural fields it is possible to question how fields were divided, the degree of control farmers had over crop choice and cultivation techniques, and the social and political forces involved in the organization of agricultural production at the site. In addition, the discovery of intensive manioc cultivation imparts a rare opportunity to examine an intensive agricultural system previously undocumented in Mesoamerica. A field-up perspective that examines social, political, religious, and economic life based on agricultural remains provides a special vantage point from which to view aspects of the sociopolitical economy of Cerén, the quotidian practices of farmers, and inform our understanding of Classic Period Maya agricultural production.
Maya Agriculture and the Political Economy

Farming was an essential and organizing daily practice for the vast majority of Maya people in the Classic Period (c. A.D. 250-850) and archaeologists have documented a wide-variety of intensification strategies utilized throughout the diverse area of the Maya Lowlands, Highlands, and Coastal regions (Fedick 1996; Lohse and Valdez 2004; Robin 2003, 2006; Wingard and Hayes 2013; Wyatt 2008). In addressing the degree of elite control over agricultural production and the role of farmers in shaping the political world, interpretations have ranged from top-down, elite dominance models (Adams and Jones 1981; Culbert 1988; Chase and Chase 1996; Henderson 1997: 145; J. Marcus 1976, 1983, 1993; McAnany 1989: 365; Scarborough et al. 2003) to bottom-up models of autonomous, self-sufficient farmers (Hayden 1994; Lucero 2006; McAnany 1993; Rice 1987; Yaeger 2000).

This study provides evidence for an additional model, one of non-royal governance (Sheets 2000, 2002c: 200-205) at the community level, which organized agricultural production through a combination of political and social forces. Cerén offers a case study for agricultural production and intensive manioc cultivation whereby the agricultural practices of community members can be linked to broader political, social, and economic structures. McAnany elucidated the potential interconnection of top-down and bottom-up approaches, stating:

Although we have no direct information regarding Classic Period Maya land tenure, the large residential groupings so typical of the lowland cities and hinterland suggest that they functioned as the organizational nexus of agricultural production. Overall, the Maya economy may be profitably conceptualized as a pluralistic one that included sectors organized by the multifaceted ties of kinship imbedded within the vertical tethers of kingship [McAnany 1993: 69].

This dissertation posits that the Cerén residential community was a nexus for the organization of agricultural production via non-royal governance that was probably
operationalized through sociopolitical institutions of lineage, kinship, and reciprocity. The 
maize and manioc fields show evidence for distinct separation between individual farmers’ 
production and autonomy in farming decisions, yet a community-wide integration of the physical 
orientation of fields and the timing and labor related to harvest.

The Cerén Site and Agricultural Production

Cerén was situated on a terrace west of the principal river of the Zapotitán Valley, the 
Río Sucio, in west-central El Salvador (Figure: 1.3). The site was dramatically buried by 3 to 6 
meters of Loma Caldera volcanic ash during the Classic Period (c. A.D. 630) (Sheets ed. 2002, 
2006). Since 1978, extensive archaeological research has been conducted on the rich assemblage 
of artifacts, plant remains, domestic and public structures, platforms, a plaza, an earthen sacbe, 
and agricultural fields at Cerén (Sheets ed. 2002, 2007, 2009; Sheets and Dixon 2011) (Figure: 
1.4).

![Figure 1.3. Location of the Cerén site center in El Salvador (Sheets et al. 2012: 261)](image)
The Loma Caldera eruption produced fine-grained ash that encased the Cerén plants preserving detailed agricultural data (Miller 2002). While these plants have long since decayed, the form of the plants remains in the ash, allowing for replicas to be made by filling hollow spaces with plaster (Sheets ed. 2002, 2009). A variety of floral species were grown at Cerén including, but not limited to malanga (*Xanthosoma sp.*), maize (*Zea mays*), manioc (*Manihot esculenta* Crantz), squash (*Cucurbita sp.*), cotton (*Gossypium hirsutum*), and cacao (*Theobroma cacao*) (Lentz et al. 1996; Lentz and Ramírez-Sosa 2002: 36-37; Sheets and Woodward 2002: 184).

Excavations in the site center revealed eight maize fields immediately adjacent to structures, only one of which was fallow, thus indicating continuous, permanent infield agriculture within the village (McKee 1990; Sheets and Woodward 2002: 184-186; Woodward...
Home gardens also supplied a substantial dietary contribution, both in calories and variety and additional resources such as plants used for medicine and fiber. There is considerable evidence for household-level specialization of particular home garden crops for intra-site trade (Lentz et al. 1996; Sheets 2000; Sheets and Woodward 2002: 186-191) (Figure: 1.5). Maize was hypothesized to be the only principal staple crop of Cerén until the recent discovery of intensively cultivated manioc fields (Dixon 2007, 2009, 2011b; Sheets 2007, ed. 2009; Sheets and Dixon 2011; Sheets et al. 2007; Sheets et al. 2012).

Since 2007, four separate manioc fields have been identified in the region south of the Cerén center and all of these had been harvested just prior to the eruption (Sheets 2007, ed. 2009; Sheets and Dixon 2011). Manioc (*cassava; yuca*) is a root crop that grows as a bush and produces approximately five to ten edible roots per plant (Figure: 1.6). The plant grows best with good drainage and less compacted soils (Cock 1985: 16-22; Isendahi 2011: 452-453), and it is known for the ease with which it can be grown and the crops’ tolerance of droughts and poor soil conditions (Cock 1985: 16-22; Dufour 1993, 1995). Scholars have hypothesized root crops (especially manioc) might have been an important part of ancient Maya diets and even agricultural insurance (Bronson 1966), however, the scarcity of direct archaeological evidence for manioc cultivation has greatly limited our understanding of the presence and uses of manioc in the past (Crane 1996; Flannery 1982; Hather and Hammond 1994; Lewenstein and Walker 1984: 25-38; Pohl et al. 1996; Pope et al. 2001; Miksieck 1991: 80; Sheets et al. 2012: 261-264).
Figure 1.5. Household 1: Garden, *Bodega* (Structure 6), and Kitchen (Structure 11) (Photograph by author)
Figure 1.6. Harvested Manioc (*Manihot esculenta* Crantz) Plant Showing Roots, Stalks, and Leaves (Photograph by author)
Cerén, including its agricultural fields, did not exist in isolation. Numerous contemporaneous regional elite centers were present in the Zapotitán Valley, including the large, regional center of Campana San Andrés, located 5 km southwest of the Cerén site (Black 1983; Sheets 2002: 3). The presence of Copador polychrome vessels (chemical signatures show these likely originated in the Copan valley of Honduras), obsidian prismatic blades, and jade axes demonstrate that Cerén villagers were engaged in a broader Zapotitán Valley and Maya regional economic system (Beaudry-Corbett et al. 2002; Brown 2001; Sheets 2000; Sheets 2002c: 203-204; Webster et al. 1997). Chapter 2 further situates Cerén in the context of Mesoamerica and specifically the Classic Period Maya area. In light of the recent findings of intensively cultivated manioc fields and a well-constructed, formal earthen sacbe at the site (Dixon 2011b), further questions have arisen regarding the political authority, economic roles, and farmer autonomy at this site. With emphasis typically placed on elite political power, many questions remain about the political organization of commoners. This study will examine the level at which Cerén villagers were active agents in their own political and economic success.

**Research Objectives**

This dissertation seeks to document the sociopolitical organization of agricultural production at Cerén through a detailed analysis of the southern maize and manioc fields and related evidence. To achieve this end, multiple objectives are developed in this work. These topics are briefly outlined and provide a framework within which to explore farmer autonomy and power at Cerén.
**Document Maize and Manioc Cultivation at Cerén**

The first objective of this project is to synthesize three years of archaeological research on the southern fields of Cerén and related findings. This dissertation unites data from 2007, 2009, and 2011 research at the site, as well as supplemental data from manioc planting experiments in 2012, in order to determine the overall spatial organization of agricultural production. I aim to document 1) the number and location of maize and manioc fields in the southern region, 2) the projected boundaries and sizes of fields, 3) the cultivation methods employed by Cerén farmers, and 4) how related evidence, such as cleared areas, platforms, fallow fields, and the earthen sacbe at the site, articulate with the southern fields.

**Identify Field Divisions and Evidence for Land-use and Land-ownership**

I also aim to discern and spatially locate evidence for field divisions and prospective connections with land tenure, use, and ownership. The study of field boundaries, including their degree of formality and the accessibly of each field will be explored. It is expected that the field divisions will provide important insight into how agricultural land was separated (e.g., large, potentially communal fields vs. sub-divided individual plots). The formality of these boundaries will aid in assessing the potential investment of farmers into their fields (i.e., landscape capital [see Brookfield 2001: 55; Blaikie and Brookfield 1987]) and the degree of importance placed on land separation. Interpretations of land-use (with potential connections to land ownership) will also be drawn from the divisions of the Cerén agricultural fields.

**Examine the Degree of Autonomy in Cerén Farming**

The southern Cerén agricultural fields will be scrutinized for evidence of farmer autonomy. Data from these fields include documentation of divergent planting techniques for
the same crop, variation in planting timing, and dynamic choices to rotate crops in the same location. Houston and Inomata (2009: 240-249) provide a model for testing the degree of elite control over agricultural production. They note that standardization and large-scale agricultural features are present when elite forces control agricultural production and alternatively, that fields show much more variation when households have control over agricultural production. With this in mind, the Cerén data are examined for potential evidence of farmers’ autonomy and power in farming decisions.

**Situate the Agricultural Research within the Cerén Community**

The agricultural fields of Cerén were part of a larger physical and social landscape. The in-depth investigation of the fields will be situated within the other findings at the site. The *sacbe* physically and symbolically linked the southern agricultural fields with the site center and the presence of this earthen road signifies connections within the site and beyond. Examining the service relationships between specific households and communal structures (Sheets ed. 2002) also allows a more detailed and dynamic picture for labor organization and power within the community, including agricultural labor. These data are utilized to illuminate the potential relationships between Cerén farmers, their community, and their fields.

**Discuss the Role of Communal Organization for Production by Non-Royal Governance**

The combination of agricultural fields, cleared spaces (including platforms, natural topographic areas, and fallow fields), domestic and public structures, artifacts, and the earthen *sacbe* are considered to examine the degree of community integration and organization of agricultural production. The organization of fields, tied by the directionality of all field boundaries with the predominant orientation of Cerén structures (30°) (Sheets 2002c: 198)
physically and ideologically integrated these spaces (Note: all degrees provided in this dissertation are measurements of azimuth, or degrees E of magnetic N). Evidence for a coordinated maize and manioc harvest that corresponded with a ritual feasting event (Brown 2001) is also examined as further support for a community level of power, planning, and action.

**Overview of Findings**

The Cerén fields provide neither indication of complete household autonomy nor elite control of agricultural production. Cerén evidence of farmer autonomy includes 1) numerous fields in a small area, 2) variation in the field size, crop types, and plant techniques for each field, and 3) dynamic rotation of fields between different crops, as well as establishing fallow periods. A community level of organization was also visible in these data that probably represent social and political links of reciprocity, lineage relationships, and governance by non-royal leaders, possibly lineage elders. Evidence for communal organization of agricultural production include: 1) coordinated orientation of all fields to 30° and 120° to match the central site organization 2) synchronization of manioc and maize harvests at the site, 3) a communal ritual feast (Brown 2001), 4) a central civic center (Gerstle 2002: 83-87) where community decisions were likely formed and disputes of land and resource use would have been settled, and 5) a model of service relationships between Cerén households with specific public structures (Sheets ed. 2002: 3, 4, 183).

**Defining Key Theoretical Concepts**

Multiple terms used in this dissertation have been differentially defined in the archaeological literature. I outline here central theoretical concepts as they are used throughout this study.
**Sociopolitical Economy**

Political Economy has often been used to discuss elite power over others in the society (e.g., Brumfiel and Earle 1987: 3; D’Altroy and Earle 1985: 188) and the participation of farmers in social and political forces has been largely ignored (Erickson 2006). Commoners, including farmers were active and dynamic agents in social, political, and economic systems (A. Joyce 2000, 2004). Political power was not isolated to the upper echelons of society, nor were political institutions (through which civic organization was achieved) only found at large, regional centers.

Agricultural production was likely organized through interwoven social and political forces from the regional centers to the humblest of households (Webster and Gonlin 1988) that would have had dynamic and varied responses, strategies, and conflicts at each level of society. Yaeger and Robin (2004: 149) noted that at the scale of the community, social and political dynamics are often integrated and cannot be desegregated. For this reason, I use a concept of the sociopolitical economy, whereby economic practices are seen as shaping and being shaped by political and social ideas and actions of community members.

**Household and Community**

Households are often identified as a fundamental social unit that is a level of organization immediately above the individual (Ashmore and Wilk 1988; Douglas and Gonlin 2012: 2; Hammel 1984: 40-41; Netting, Wilk, and Arnould 1984). In this way, households have been identified as coresidential activity groups (Ashmore and Wilk 1988). For the purposes of this study a household is viewed as a social group that shared economic, religious, and social connections and were linked through a specific residence or residential area, though not necessarily confined to a residential group (e.g., Household 1 where individuals shared a
domicile, *bodega* [storage facility], kitchen, and nearby activity areas, and had a service relationship with a nearby ceremonial building).

The concept of community has been variously defined, but is used in this dissertation as a supra-household social entity, where individuals interact and view themselves as connected (Yaeger and Cauto 2000: 6). Beyond a simple collection of households, communities are viewed from a practice theory approach as shaped by the repeated and patterned daily practices of individuals in interactions with one another, including in both tangible and imagined ways (Bourdieu 1977; Giddens 1979, 1984; Yaeger and Canuto 2000: 3). Individuals likely participated in multiple communities, including imagined communities (Anderson 1991) where members rarely interacted, yet viewed themselves as a linked and distinct group. Cerén was a residential community, whereby members shared a physical landscape (including households and agricultural fields) that demonstrated features of their connectivity, as well as social, political, and economic ties.

Participation in the Cerén community did not exclude members’ participation in other communities, nor did it mean there was not resistance, disagreement, or strategic maneuvering of Cerén residents (A. Joyce et al. 2001; A. Joyce 2000; A. Joyce and Weller 2007; Robin 2002a, 2002b, 2003; Wells 2006). This concept of community also does not suggest that all members experienced the community equally. Diversity of status, wealth, power, kin relations, ethnicity, gender, age, and other factors must have been a vibrant component of Cerén’s community. The Cerén community would have been experienced differently by various members of society and rather than a static integrated entity, this community was probably a contested and continuously constructed aspect of life. Cerén farmers had a multitude of identities and partook simultaneously in different communities, one of which was the residential community of the site.
Participation in the Cerén residential community is evidenced by the connection of the sociopolitical economy at the site beyond individual households and the daily practices of farmers.

**Practice Theory, Agency, and Power**

Practice theories in archaeology argue that the repeated actions and practices of people constructed and in turn were impacted by the structures of their society (A. Joyce 2000: 71-73; Ortner 1984, 1994). The related concept of agency, as used in practice theory approaches, emphasizes the dynamic, active, and sometimes strategic roles of all members of a society, not just those in high political offices (Bourdieu 1977; Giddens 1979: 94-95; Hodder 1991; R. Joyce 1993). Practice Theory views the social, political, religious, and economic structures of life as impacting daily life, but also constructed by repeated actions and practices.

From the vantage point of practice theory, power is defined as the capability of all people to make decisions and take actions that can reproduce or change their society (Giddens 1979: 88-94; A. Joyce 2000: 71). Power is the ability for individuals or groups to achieve desired outcomes and though all individuals did not experience power equally, all people would have exercised some degree of power (Earle 1997; A. Joyce 2000: 71-73; R. Joyce 1991; Robin 1999: 7). Following A. Joyce (2000: 71-73) power is seen as a “transformative capacity” available to all members of society, whereby they had the ability to make decisions and take actions.

Political power can be unified with economic choices and actions in the realm of practice. As individuals and the communities in which they are a part (imagined and real) decide and enact economic choices, including those that resist the broader social trends and structures, they simultaneously participate in social and political structures. Economic practices can impact social and political systems by demonstrating degrees of loyalty, unity, affiliation, as well as...
creating strategic opportunities to gain capital (political, social, or economic), resist authorities and social trends, and demonstrate various interests, beliefs, and tensions. Likewise, political power can impact economic practice through the degree of control and/or oversight exercised over production, distribution, and consumption, as well as the strategies of people navigating the myriad of political dynamics present in any community.

**Elites, Commoners, Peasants, and Farmers**

Archaeological research of the Classic Period Maya has identified a binary division of elites and commoners. These terms are used to divide royal from non-royal, and in some cases wealthy from less-wealthy individuals in past societies (Chase and Chase 2003; Lohse and Valdez 2004). Increasingly, researchers are examining the variability within and between these groups for the Maya area (McAnany 2010; Reed and Zeleznik, in press; Rice 2009; Richards-Rissetto 2010; Shortman and Ashmore 2012). One implication of this dissertation is to highlight the sociopolitical complexity present during the Classic Period and to challenge assumptions of commoners as under the total control of ruling forces or as humble, passive “have-nots”, and adds to heterarchical reconstructions of ancient societies. The sociopolitical complexity of Cerén highlights the diversity of structures and practices of past societies often rendered invisible in the archaeological record.

Two related terms, peasants and farmers, have also been clearly distinguished by some scholars (Netting 1993; Pyburn 1998; Robin 1999: 18; Wolf 1951, 1955). Both obviously refer to agriculturalists, yet peasants have been traditionally depicted as powerless, undervalued members of society, who are rarely seen as important to economic, social, or political change. The term peasant is therefore loaded in its implications that some individuals are less, or even not at all, important to the broader construction and function of societies. Adhering to the
distinction used by Robin (1999: 19), I utilized the term farmer to emphasize the dynamic capabilities of these individuals and their potential influence on social and political forces.

**Organization of Dissertation**

The following five chapters of this dissertation situate Cerén within Mesoamerica, discuss the theoretical context and implications of this study, present relevant data from three field seasons of research and relevant earlier research at the site, posit interpretations of these data, and explore the broader intellectual implications and contributes of this study. Together these chapters present a view of farming at Cerén as both an individual and community endeavor, where farmers both maintained the power to choose crops, farming techniques, and production cycles, while being connected with and sometimes integrated into larger social and political forces within the Cerén residential community. The view from the Cerén agricultural fields offers a unique perspective on the inter-working of social, political, religious, and economic forces related to the organization of agricultural production.

Chapter 2 situates the Cerén archaeological site in the physical, temporal, and cultural context of Mesoamerica and the Maya area. This chapter also provides a detailed description of the Cerén site, including an overview of the site’s location and discovery, as well as the archaeological research at the site from 1978 to the present. The key findings from excavations of the Cerén site center are presented before turning to a description of the research objectives of the 2005, 2007, 2009, 2011, and 2012 field seasons in the region south of the site center (Sheets 2007, ed. 2009; Sheets and Dixon 2011).

Chapter 3 examines the theoretical context of this research and critically examines related literature. The chapter further discusses the concept of political economy and develops the
concept of sociopolitical economy as it relates to archaeological research and reconstructions of ancient Maya agricultural production. The contribution of a practice theory approach to understanding Classic Period agriculture and sociopolitical economy is highlighted to better situate the importance and implications of this research.

Chapter 4 presents a brief description of the research methodology used at Cerén and explains the process of creating the plaster plant casts from the plant tephra cavities. In this chapter the data from the Cerén archaeological projects of 2007, 2009, and 2011 are aggregated and synthesized according to maize fields, manioc fields, cleared areas and platforms, the earthen sacbe, and related artifact and paleobotanical research. The analysis of these data provides documentation of the number and condition of agricultural fields and related evidence to better understand the organization of agricultural production at Cerén.

Chapter 5 affords interpretations of the data presented in Chapter 4. These interpretations focus on examining the data for evidence of farmer autonomy, community organization of production, and the connection of farming to the broader Cerén sociopolitical economy. This section argues for the power of farmers to decide which crops to plant, the timing of agricultural seasons, and which cultivation techniques to employ in their fields. The importance of field boundaries as both markers of separation and unifying links to the community are discussed, as well as the connection between the harvest and the communal ritual in the site center. Evidence of non-royal governance in management of Cerén life and farming is also explored.

Chapter 6 provides a summary of the project as well as a discussion of the implications of these findings. The documentation of intensive manioc cultivation is important to reconstructions of ancient Maya agriculture. Evidence for farmer autonomy in agricultural production combined with community non-royal governance organization of land-use and
harvest also extend to studies reconstructing sociopolitical systems in the past. The complexity of economic, social, and political data at Cerén challenges an over-simplified divide between commoners and elites in Maya society and simplified top-down or bottom-up models of the political economy. This chapter concludes with a discussion of additional research avenues for these topics at Cerén and in the Zapotitán Valley.

Little has been known of how farming decisions were made, the extent of political oversight of agricultural production, and the level of individual autonomy for farmers within the community and regional political context of the Classic Period Maya landscape (Demarest 2004:173; Webster 2002: 175). As Robin (2012: 16) elucidated, “interpreting the complexities of life in a farming community is essential for understanding larger issues of organization and change within complex societies.” Farming activities were a central organizing component of daily life for Cerén occupants and would have impacted and been impacted by intra- and inter-household dynamics. This study affords the extraordinary opportunity to examine the integration of political decisions and agricultural production in a Classic Period Maya village from a farm-up perspective and answer unaddressed questions in Maya commoner studies. The answers will unquestionably inform us about larger political processes in the Maya area during the Classic Period.
Chapter 2: Situating Cerén in the Maya Area and Mesoamerica

Introduction

This chapter situates the Cerén archaeological site in the physical, temporal, and cultural context of Mesoamerica, the Maya Area, and El Salvador. The chapter then explores the Cerén archaeological site in El Salvador, including the location, discovery, methodology, and research conducted at the site from 1978 until the present.

The rich cultural and physical diversity throughout Mesoamerica has shaped the region’s history (Evans 2013; McKillop 2004; Sharer and Traxler 2006). Unifying the diverse physical and social landscape are larger developments throughout the area that include: the initial settlement of the region, the origins of agricultural production, the rise of cities and states, socio-political reorganizations or collapses, post-formative social complexity, and European Colonialism (Evans 2013; Sharer and Traxler 2006). The Cerén site is a small piece of this broader regional context. The burial of Cerén by tephra (volcanic ash) c. A.D. 630 resulted in the extra-ordinary preservation of structures, artifacts, activity areas, agricultural fields, plant cavities, and paleoethnobotanical data (McKee 2007; Sheets 2002a). A series of research projects at the site have revealed domiciles, bodegas (storage buildings), kitchens, public structures, kitchen gardens, and a variety of agricultural fields (Sheets 2002a). After a brief discussion of the cultural, physical, and historical context, this chapter introduces the specialized methods that have been developed for locating and excavating remains at Cerén (including the preserved plant cavities) before summarizing the research findings at the site since 1978.
Ancient Mesoamerica

Conceptualized as a cultural designation, as well as a physical region, a variety of culture groups occupied and continue to occupy Mesoamerica, the area that extends through Mexico, Guatemala, Belize, Honduras, and El Salvador (Hendon and R. Joyce 2004; Kirchhoff 1943: 92-107). Originally defined as a geographic region by a checklist of shared cultural traits such as religious beliefs, technology, exchange systems, agricultural subsistence, language, and architectural features (Kirchhoff 1943: 92-107), a multitude of individual culture groups have since been explored throughout the Mesoamerican region (Evans 2013; Hendon and R. Joyce 2004). Linguistic and archaeological evidence demonstrate the intensive interaction of cultural groups throughout the history of Mesoamerica (Henderson 1997; Hendon and R. Joyce 2004, Kirchhoff 1943). The Maya, one of the many Mesoamerican culture-groups, are particularly relevant to this study given the artifact and architectural remains at Cerén indicate the site’s cultural affiliation with this group (discussed further below) (Sheets 2002a, 2006, 2009: 76).

Ancient Maya

The Maya area extends through a region approximately 324,000 km² in size in the modern-day countries of Guatemala, Belize, the western portions of Honduras and El Salvador, the Yucatan peninsula of Mexico, and the Mexican states of Chiapas and Tabasco (Evans 2013; McKillop 2004; Sharer and Traxler 2006) (see Figure 1.2). The Maya people and their languages have persisted despite the devastating impact of European Colonization and many instances of forced acculturation (Henderson 1997). There are twenty-eight distinct languages in the Mayan language family that are still spoken throughout the region today and all of these
languages have been influenced by other linguistic groups through time, particularly Mixe-Zoquean and Nahuatl (Sharer and Traxler 2006: 23). The unity of the Maya area is also reflected in the shared economic, social, and political history and features such as writing, calendric systems, material culture, monumental architecture and large urban centers (Evans 2013; Henderson 1997; McKillop 2004: 3-7).

**Location and Climate**

Topographically the Maya area is extremely diverse, with steep, rugged volcanic mountains, flat rainforest lowlands, bajos (seasonally wetlands), and coastal areas. The soils of these areas range from good agricultural areas with deep alluvial or volcanic soils to very unproductive soils that are thin and rocky (Sharer and Traxler 2006: 29). Traditionally the Maya area is divided into three basic geographical regions, the Pacific Coastal Plain, the Highlands, and the Lowlands. The Pre-Columbian Maya tradition spread throughout these regions from before 2000 B.C. to the Spanish contact period in the early 1500s (McKillop 2004: 7-14).

Throughout the Maya area, the seasons are divided into the dry season, generally from January to April, and the rainy season from approximately May to December (Foster 2002: 92; McKillop 2004: 34-35; West 1964: 220) with the average annual temperatures and precipitation varying between regions. The Zapotitán Valley, including the Cerén site is located in the Southern Highlands and will be discussed further below.

**The Maya Highlands**

North of the Pacific Coastal Plain are the Maya Highlands, which are divided into the Northern Highlands in northern Guatemala and Chiapas, Mexico and the Southern Highlands in southern Guatemala and the western regions of El Salvador and Honduras. The Maya Highlands
are approximately 800 m in elevation or higher with rich resources. There is earthquake and volcanic activity in this region due to the convergence of continental plates, the latter of which has resulted in fertile soils, particularly in large basins or valleys (Sharer and Traxler 2006: 34-41).

Cool temperatures are common at higher altitudes and the average annual temperature in the Maya Highlands is between 15°C and 25°C (59°F-77°F). The highest volcanoes, above 3000 m in elevation, have the coolest temperatures with frosts and occasional snow (Foster 2002; Sharer and Traxler 2006: 34; West 1964: 210-211). Annual rainfall varies throughout the highlands and is generally greater in the north. In the Chiapas and the Alta Verapaz average annual rainfall is over 3000 mm per year, whereas other areas of the highlands have an average rainfall of 2000-3000 mm per year. The Northern Highland area with the least rainfall are in the Motagua Valley and central Chiapas depression where there is shelter (in a rain shadow) from easterly trade winds and these areas average less than 1000 mm annually (Sharer and Traxler 2006: 34). The highlands historically were home to mixed evergreen and deciduous forest but have been impacted by long-term human settlement in the region (McKillop 2004: 36-39). Initially foraging groups occupied the area followed by a shift to agricultural based, sedentary societies. Powerful cultural centers, like Kaminaljuyu and Tonina, were located in highland valleys, and Chalchuapa and Copán in the highland-lowland transition valleys (Sharer and Traxler 2006: 35).

Southern Highlands

The Southern Highlands are located between the Pacific coast volcanic ranges and the great rift-valley system to the north (Henderson 1997; McKillop 2004; Sharer and Traxler 2006: 34-41). The fertile soils of this region have made it a desirable residence for humans for
thousands of years and the pre columbian population density was greater in the Southern Highlands than the Northern Highlands (Sharer and Traxler 2006: 38). There are rivers throughout the Southern Highlands, and the principal rivers flow to the north into the Motagua River, or farther west to the Grijalva River. The Southern Highlands contained many important resources including the central Maya obsidian quarries, El Chayal and Ixtepeque, as well as basaltic rocks for production of ground-stone tools (Sharer and Traxler 2006: 38).

**Connecting the Maya Area with Cerén**

The Maya area is home to a rich array of natural resources and variable edaphic conditions. The Pacific Coastal Plains, Maya Highlands, and Maya Lowlands all provided different growing conditions with various challenges and advantages for Maya farmers (Fedick 1996). The variation in rainfall, temperature, elevation, soil conditions and water availability all profoundly impacted Maya life and the array of trade networks, agricultural technologies, and environmental adaptations seen throughout Maya history (Fedick 1996; Sharer and Traxler 2006).

El Salvador is often considered the southeastern boundary of Maya area and much research has focused on determining if El Salvador was occupied by Maya ethnic groups (Bruhns 1996; Demarest 1986; Sharer 1984; Sharer and Traxler 2006; Sheets 1984). The Lempa River, which runs through the northern area of El Salvador is often used as a boundary for the Maya area, with areas north and west of the Lempa River being traditionally designated as part of the Maya and areas south and east of the Lempa River being seen as Lower Central America (McKee 2007: 34). It is clear from extensive research that there are no clear, distinct boundaries along the southeastern edge of the Maya area (Andrews 1976; Bruhns 1996; Demarest 1986;
Haberland 1960; Sharer 1984; Sheets 1984) and as Earnest (1976: 60) has discussed, the Lempa River was more likely an artery of trade and communication rather than a barrier between culture groups.

Cerén is positioned just south of the Lempa River near the river’s western edge. The Rio Sucio flows directly adjacent to the Cerén site and drains into the Rio Lempa. Given the artifacts and architecture identified at Cerén and their inferred political, social, and economic participation with other Maya sites, it seems the strongest cultural affiliation of this group would have been that of Maya (Sheets 2009: 76). Cerén villagers were engaged with the long-distance trade network of the Maya through regional markets for items such as jade axes, obsidian, and ceramics (e.g., Copador Ceramics at Cerén originating in the Copan valley) (Sheets 2000, 2002, 2009). Additionally, they built structures with bajareque (earth and poles), similar to traditional Maya residences and participated in Maya religious and political organization (Sheets 2000, 2009). There is strong evidence that the feasting ritual underway at Cerén when the Loma Caldera eruption occurred was connected to the harvest (further discussed below). The material culture, particularly the deer skull headdress, appears to match that of the cuch festival still practiced by modern Maya groups (Brown and Gerstle 2002: 102). While, there were likely many sub-cultures throughout the Maya region, Cerén villagers are most appropriately classified as the etic classification of Maya, in the Southern Maya Highlands (Sheets 2009).

**Maya Time Periods and the Prehistory of El Salvador**

The precolombian Maya time span is typically separated into distinct periods based on significant cultural-changes in the area. Most commonly archaeologists use a traditional regional time sequence of the PaleoIndian (12,000/20,000-8000 B.C.), Archaic (8000-2000 B.C.),
Preclassic (2000 B.C.-A.D. 300), Classic (A.D. 300-1000), and Postclassic (A.D. 1000-1500) (Hendon and Joyce 2004; Henderson 1997; Sharer and Traxler 2006). Such chronological divisions are markers of blurred boundaries with great diversity of political, economic, and social lives within each period (Sharer and Traxler 2006). Cerén represents a southeastern frontier region for the Classic Period Maya and is further contextualized here (Table 2.1).

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<tr>
<th>Period</th>
<th>Dates</th>
<th>Major Cultural Developments</th>
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<tr>
<td>Postclassic</td>
<td>A.D. 1000-1500</td>
<td>Reformulation and reorganization of states</td>
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<td>A.D. 300-1000</td>
<td>Complex sociopolitical complexity / Expansion and decline of centralized political state societies</td>
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<td>Preclassic</td>
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<td>Paleoindian</td>
<td>12,000/20,000 y.a.-8000 B.C.</td>
<td>Settlement of the Americas</td>
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Table 2.1. Description of Chronological Periods in the Maya Area and Associated Key Cultural Developments (adapted from Sharer and Traxler 2006: 98)

Archaeological research in El Salvador has gain momentum in recent decades (Black 1983: 62; McKee 2007: 77). While explorers such as Alvarado (2000 [1525]) and Stephens and Catherwood (Stephens 1969 [1841]) traveled in El Salvador, they did not record information about the archaeological remains of the region (McKee 2007: 26). E.G. Squier was the first to publish basic archaeological observations of El Salvador (Squier 1971 [1855]) and some early excavations were conducted in the country (e.g., Cobos 1992; Gonzalez 1906). A 1915 overview
of Salvadorian artifacts (Spindel 1915) was the first systematic archaeological research in country (Cobos 1992; Demarest 1986; Sharer 1978; Sheets 1984). Spinden (1915) defined three chronological periods based on the artifact styles and their associations in connection with Mesoamerica which included: the Archaic (Preclassic), the Maya (Classic), and the Post-Maya (Postclassic) (Spindel 1915). Later research at the Salvadorian archaeological sites of Chalchuapa helped to establish a stratigraphically based ceramic and architectural sequence for the region from the Early Preclassic through the Postclassic periods (Sharer 1978).

Unfortunately relatively few radiocarbon dates have been published from research in El Salvador, although the plethora of volcanic activity in the country is promising for future archaeological dating (McKee 2007: 34). In recent years the number of archaeological research projects in El Salvador has dramatically increased, including major projects at the sites of Chalchuapa, Cerén, San Andrés, Quelepa, Cihuatan, and others (Cobos 1992; Demarest 1986; McKee 2007; Sharer 1978; Sheets 1984). The Maya Classic Period and related research in El Salvador are outlined here given their significance to this study.

**Classic Period (A.D. 300-1000)**

The Classic Period, though no longer thought of as the only time of fluorescence in the Maya area, was a period of considerable growth in political, economic, and social complexity (Hendon and R. Joyce 2004; Sharer and Traxler 2006). The specialized artifacts and monumental architecture of this time period have made it the most studied and well-known period of Maya archaeology (Sharer and Traxler 2006: 287). The period is subdivided into the Early (A.D. 300-600), Late (A.D. 600-800), and Terminal (A.D. 800-1000) periods. Large stelae were erected during the Classic period documenting the major political events of many sites and
the presence of centralized religious ideology (Henderson 1997; Hendon and Joyce 2004; Sharer and Traxler 2006). Large, dense populations occupied competing city-states and the sites of Tikal, Copan, and Palenque typify the sophisticated public architecture and powerful aristocracies characteristic of the region during this Classic Period, when divine kingship connected religious belief with political power (Sharer and Traxler 2006: 287).

During the Terminal Classic Period (A.D. 750-1000) internal dynamics and external pressures seemingly strained the political system of the Maya area, particularly the Southern Maya Lowlands, resulting in what is generally referred to as a collapse (Demarest et al. 2004). During this time many cities were abandoned by elites, political upheaval and resistance was evident, and communication and exchange networks were disrupted (Demarest et al. 2004). These events are not unique to the Maya area and represent a larger Mesoamerican trend (Evans 2013). The period dramatically changed the political and social landscape of the Maya world and broke down the system of divine kingship in the central and southern lowlands (Sharer and Traxler 2006: 156). While many cities politically collapsed during the Terminal Classic Period, others located in the Northern Lowlands saw population increases and even the beginning of new city-states such as Chichén Itza and Mayapan (Sharer and Traxler 2006: 156).

**Classic Period in El Salvador**

*The Ilopango Eruption*

The early part of the Classic Period in El Salvador was marked by the catastrophic eruption of the Ilopango Volcano c. A.D. 405-535 located southeast of San Salvador (Dull et al. 2001). This eruption included air-fall ash and pyroclastic flows and surges (Dull et al. 2001; Hart and Steen-McIntyre 1983). The pyroclastic flows traveled up to 1100 m in elevation along the side of the San Salvador Volcano and then continued into the Zapotitán Valley (Hart and
Steen-McIntyre 1983: 14-22) and such flows devastated plant, animal, and human lives. It is estimated that there would not have been survivors in a 1000 km² area around the vent, killing an estimated 30,000 people within this zone (Sheets 2004: 113). The Ilopango eruption also deposited an enormous amount of tephra in varying amounts throughout El Salvador, for example there are deposits 50 meters deep near the epicenter of the eruption (Hart and Steen-McIntyre 1983: 21) and a meter or so in original depth near Chalchuapa (Sheets 1983). It is estimated that more than 300,000 people would have been displaced by the volcanic devastation and sites up to 100 km from Ilopango were likely abandoned due to the eruption and its impacts on agricultural production (Sheets 1983, 2004).

The Ilopango tephra forms a stratigraphic separator between the late Preclassic and the Classic Period (McKee 2007: 43-44). Dating the Ilopango eruption has been difficult due to its problematic position on the calibration curve and has resulted in a variation of dates from A.D. 146-374 (Sheets 1983), A.D. 80-260 and A.D. 130-385 (Stuiver et al. 1998), and A.D. 405-535 (Dull et al. 2001). The eruption was extremely devastating in El Salvador and likely had widespread impact throughout Mesoamerica (Dull et al 2001; Mehringer et al. 2005; McNeil 2004) and possibly the world (Sheets personal communication, 2012). The Ilopango eruption was particularly important to the Cerén site, given Cerén was built on top of the Tierra Blanca Joven (young white earth) tephra deposited by the eruption (Miller 2002: 11). This volcanic event powerfully impacted the cultural and physical landscape of the region. As Sheets commented, “It turned a lush cultivated environment into a white desert overnight” (2006:9). It was originally estimated that the Zapotitán Valley, and most of western El Salvador was abandoned for one or two centuries after the Ilopango eruption (Sharer 1984), yet new dates of both the Ilopango and Loma Caldera eruptions indicate that the area was likely repopulated
sooner than once thought (McKee 2007: 43). The destination of surviving emigrants from this eruption is unknown, though some have suggested the Maya lowlands (Dahlin 1979; Sharer and Gifford 1970; Sheets 1979) or that victims of the eruption would have fled to where they had kin and economic ties (Demarest 1988) that were beyond the zone of Ilopango devastation to areas such as eastern El Salvador, the Motagua Valley, Copan, and Kaminaljuyu (Dull et al. 2001).

Likely a small population remained in western El Salvador following the Ilopango eruption or returned during the Early Classic Period (McKee 2007: 47-48; Sheets 2009). It is uncertain exactly which groups were responsible for the reoccupation of western El Salvador after the Ilopango disaster. Sheets (1983b) suggested that based on polychrome ceramic and prismatic blade similarities western El Salvador was re-occupied by the Chorti Maya from the Copan area. Demarest (1988) suggested that local identities had likely formed by the Late Classic due to the distinction between domestic ceramics from El Salvador and those of Copan (Demarest 1988). There was considerable interaction between southeastern Maya area and western El Salvador after the Ilopango eruption and throughout the Classic Period (McKee 2007: 49).

During the Late Classic Period the Zapotitán Valley reached the peak of complexity and had connections throughout the Maya area, as evidenced by long-distance trade of obsidian from the Ixtepeque, Guatemala source, and jade from the Motagua River Valley (Sheets 2000: 221). A project from the University of Colorado, Boulder conducted a 15 percent stratified random survey of the valley (Black 1983: 62) and identified forty-two Late Classic archaeological sites. Black (1983: 83) estimated that the population of the valley was 40,000-100,000 people. The Zapotitán Valley formed a single polity (Sheets 1983) that included the primary regional center of Campana San Andrés (San Andrés) (with a population of thousands), as well as two smaller
regional centers that included pyramidal architecture, four larger villages with ritual
collection, three isolated ritual precincts, seven larger villages, fourteen smaller villages
without ritual construction, and eleven hamlets (Black 1983: 72; Sheets 1983). Cerén has been
interpreted as a larger village within this hierarchical reconstruction (Sheets 2000, 2002, 2006,
2009).

Post-Ilopango ceramics at San Andrés all date stylistically to the Late Classic Period
(Black 1983: 83) and recent research at San Andrés has dated charcoal samples from a burned
midden feature to A.D. 434-639 (cal 2-sigma) (McKee 2007: 51). Radiocarbon dating of the
Cerén thatch that was sealed by the Loma Caldera eruption (Miller 1992, 2002) offers further
evidence for the timing of the post-Ilopango reoccupation of the valley. McKee (2007: 51) has
reported a weighted average date for Cerén of A.D. 610-671 (cal 2-sigma [McKee 2002a: 7-8,
2007: 51; Stuiver et al. 1998]). The Loma Caldera eruption that deposited multiple meters of
volcanic tephra on the Cerén site is discussed in further detail below. There were other volcanic
eruptions that impacted residents of El Salvador during this time period, such as Boqueron in
A.D. 870-995 (McKee 2007: 52), although none were on the scale of the Ilopango disaster.

Beyond the Zapotitán Valley, Cerén was also probably tied with other centers throughout
El Salvador that were also reoccupied following the Ilopango disaster including Chalchuapa
(Sheets 1984), with the sites of Casa Blanca and Tazumal becoming the focus of the occupation
and El Trapiche remaining largely abandoned (Boggs 1945; Cobos 1994; McKee 2007; Sheets
1984). There were multiple ethnic groups throughout western El Salvador at the end of the Late
Classic Period. A new ethnic group, likely the Pipil from central Mexico (Folwer 1989) or
Mexicanized Maya from the Gulf Coast of Mexico (Bruhns 1996) occupied Cihuatan. The sites
of Tehuacan and Quelepa were linked with the Gulf Coast of Mexico, western El Salvador,
Copan, and the Guatemalan highlands, as well as Lower Central America (Andrews 1976: 183-186; Sheets 1984: 104). The archaeological record of Cerén shows similar ties throughout the Maya area (Sheets 2009), particularly with Copan and was possibly also in contact with Quelepa.

**The Zapotitán Valley and Cerén, El Salvador**

The Cerén site, named for the nearby town of Joya de Cerén, is located in west-central El Salvador, in the Southern Maya Highlands. The site has an average elevation of 440 meters, a northern latitude of 13°50’ and a western longitude of 89° 23’ (Loker 1980:5; Sheets 2002: 1). The site is positioned on a terrace west of the Río Sucio in the northeastern end of the Zapotitán Valley.

**The Zapotitán Valley**

**Location and Climate of the Valley**

The Zapotitán Valley is located approximately 35 km northwest of the country’s capital, San Salvador (Loker 1980; Zier 1978:52). The valley is a total of 546 km² (Black 1983: 65), is located at 14°N latitude, and ranges in elevation from 450 meters on the valley floor to 2,300 meters at the peak of the Santa Ana volcano (Black 1983: 63). The low-relief alluvial valley floor is approximately 182 km² with the rest of the valley, 364 km², comprised of volcanic hills (Black 1983: 67). The Zapotitán Valley is in an area of past and present volcanic activity and is surrounded by volcanic complexes including the Balsam Range to the south, Pliocene volcanic deposits to the north, the Santa Ana complex to the west, and the San Salvador complex to the southeast (Black 1983: 63) (Figure 2.1).
The Rio Sucio is the principal river draining the Zapotitán Valley, which flows into the Rio Lempa in the northeast (Sheets 1983: 8). There was a large lake in the middle of the valley from prehistoric time until 1950 when it was drained for agriculture (Sheets 2002: 1). Gallery forest of many species, such as oak and pine, surrounded the lake and the forest remained green year-round (Black 1983: 65-66; Daugherty 1969; Sheets 2002: 1-2). The rest of the valley, between 1000 and 2000 meters in elevation, was home to less dense forests of deciduous trees (Black 1983: 65-66; Daugherty 1969: 19-36; Sheets 1983: 8-9).

Figure 2.1. Map of the Zapotitán Valley Showing the Locations of Cerén and San Andrés (Reprinted from Sheets 1983: 4 with emphasis added to Cerén and San Andrés)

The climate is monsoonal and has an average annual temperature of approximately 24°C that ranges through the year from approximately 22°C to 26°C (Daugherty 1969: 19-36; Sheets 1983: 6). The rainy season extends from May through early November, and the dry season lasts
from November to April. At San Andrés, located approximately 5 km from Cerén, the average annual rainfall is 1660 +/- 300 mm and the mean annual temperature is 23.9°C, ranging from 22.2°C in December to 25.6°C in April (Daugherty 1969: 19-36; McKee 2007: 24).

Precipitation fluctuates between 1400 and 2000 mm, with much lower and higher levels possible. Approximately 96 percent of the valley’s precipitation falls in the rainy season, resulting in small and medium size streams drying up during the dry season (Daugherty 1969: 23). The edaphic conditions of the region today are likely the same or similar to those of the Classic Period, although, the majority of natural vegetation has been cleared from the valley where sugar cane; corn, vegetables, and other crops are now grown (Black 1983: 66; Daugherty 1969; Sheets 2002: 1). Rapid population growth, high population density, agricultural intensification, industrial development, and exotic flora and fauna have destroyed the natural vegetation of El Salvador. Humans in the region have impacted the flora and fauna over the past 150 years and frequent volcanic activity has effected humans, flora, and fauna throughout the area (Sheets 1983: 9, 2002, 2006).

**Agriculture in the Zapotitán Valley**

Fluctuations in temperatures and rainfall, as well as variability in the rainy season onset have had and continue to have major impacts on the human populations of the valley. Local farmers developed strategies to cope with highly variable rainfall (Sheets 2006, 2007, 2009; Sheets and Dixon 2011). Typically Zapotitán Valley farmers plant their maize fields in May, the beginning of the rainy season, and harvest in August. Beans and squash are generally planted in August and sometimes a second planting of maize. This timing is both to achieve the needed precipitation for growth and to avoid exposure of the plants to the strong north winds in
November, December, or January, called “nortes” (Sheets 2006). Though the valley is not significantly windy, strong winds often accompany the heavy downpours of the rainy season and pose a major risk factor for crops in the Zapotitán Valley. In excavations at Cerén near Household 2 (discussed below), five mature maize plants were found tied together with twine and it is hypothesized this was a strategy to deal with the wind-throw still facing Zapotitán Valley farmers today (Lentz and Ramírez-Sosa 2002: 34). Heavy precipitation downpours can also damage crops and cause soils to erode. Planting maize along small ridge tops that are perpendicular to group slope can aid in water infiltration and prevent major erosion (Sheets 2006: 4). The agricultural strategies of Classic Period Zapotitán Valley farmers, particularly those at Cerén will be discussed further in this dissertation (see Chapters 4 and 5).

**Volcanoes in the Zapotitán Valley and the Loma Caldera Eruption**

Volcanic activity has profoundly affected the geological landscape of the Zapotitán Valley. Though there are two large volcanic complexes, San Salvador to the west and Santa Ana to the east, a variety of smaller, local volcanic activities have impacted the valley (Sheets 2002: 1-2). Several eruptions have occurred from a fissure that extends north-northwest from Ilopango and San Salvador Volcano and includes the Laguna Caldera, Laguna Ciega, Boca Tronadora, Playon, and other volcanoes (Miller 1983: 13). Both lava flows and eruptions producing air-fall deposits have impacted the Zapotitán Valley. Coatepeque (c. 40000-10000 B.C.) and Ilopango (c. A.D. 405-535) both deposited tephra in the Zapotitán Valley that would have resulted in regional catastrophes (Miller 2002: 11-17). It is unknown if humans were present in the region during the Coatepeque eruption, but the high organic content, balanced pH levels, and high trace elements in the Coatepeque tephra formed very fertile soils in the valley years later (Sheets 2002:
2). The soil also had a high clay content that was later used by Cerén occupants for the construction of earthen buildings and ceramic vessels (Sheets 2002: 43-44). The Ilopango eruption, as discussed above, was a devastating event for the humans, flora, and fauna present in the region at the time. The *Tierra Blanca Joven* (TBJ), was acidic volcanic ash that was deposited throughout the Zapotitán Valley and resulted in human populations abandonment of the valley for at least a short time after the eruption, as is evident from the lack of Early Classic Period ceramics found at Zapotitán Valley sites (A.D. 300-600) (Beaudry 1983: 177; Black 1983: 82).

*The Loma Caldera Eruption*

While other volcanic events impacted the Zapotitán Valley, the Loma Caldera eruption (c. A.D. 610-671) (McKee 2007: 83) is particularly important to this study. Cerén was likely one of the first reoccupations of the Zapotitán Valley after the Ilopango eruption and the ceramic chronology of the site is (c. A.D. 500-700) Middle and Late Classic Period (Beaudry 1983: 178). The tephra from Ilopango’s eruption was weathered into an approximately 50 cm thick *Tierra Blanca Joven* (TBJ) juvenile soil, which formed the living surface of the Cerén site (McKee 2007: 83; Miller 2002: 15; Sheets 2002: 2). It is estimated Cerén was occupied for approximately a century before the Loma Caldera eruption buried it beneath three to five meters of volcanic ash (Sheets 2002: 2). The radiocarbon dates from Cerén indicate that the Loma Caldera eruption likely occurred c. A.D. 610-672 (cal 2 sigma) (McKee 2007: 83). Thus this Classic Period occupation is in the middle of deposits from these two eruptions. McKee (2007: 83-84) has estimated a 2-sigma time interval between the eruptions of 75 to 266 years, likely 150 to 200 years. Thus it is likely the Cerén site was occupied for approximately 100 years before its burial beneath the Loma Caldera tephra.
Excavations of the Cerén center included stratigraphic documentation of each tephra unit and were studied by volcanologists for both a stratigraphic framework and a reconstruction of the sequence of eruption events, including the timing of structural collapses during the eruption (Miller 2002). The Loma Caldera vent is located approximately 600 meters north of the Cerén site and the tephra thickness at Cerén is deepest in the northern portion of the site, approximately 545 cm deep, and thinner to the south of the site, approximately 350 cm (Miller 2002). Cerén is located in an ideal distance from the eruption source for preservation because a greater depth of tephra overburden would have made the site very difficult to find and a more shallow tephra overburden would not have allowed for the long-term preservation of the site (McKee 2007: 85; Miller 2002: 15).

There was no volcanic edifice prior to the Loma Caldera eruption though a volcanic cone formed around the vent during the eruption. A fissure opened in the ground as basaltic magma moved closer to the surface. The eruption likely lasted one to a few days, maximally one week, and deposited pyroclastic flow and air-fall layers over 20 km² during the several phases of the eruption (Miller 2002: 19-23). One of the first eruption events was a small earthquake estimated to be 4 on the Richter scale. The earthquake left linear fissures exposed on TBJ soils, and evidence on the eastern part of the site, near Structures 10 and 12 (Sheets 2002: 9) and in areas of the southern agricultural fields (Lamb and Heindel 2011: 24). Also during the early part of the eruption, there was a very loud noise created by the emission of steam as the magma contacted water from the Rio Sucio (Sheets 2002: 9). It is not clear how much time would have elapsed between the earthquake and initial pyroclastic flow and ash-fall deposits. It is possible Cerén villagers survived in structures during the first portion of the eruption and then left during pauses in the early phases of eruption (McKee 2007: 84). No individuals have been found inside or
around the site center but if a person had been exposed directly to any part of the pyroclastic surges or ash-fall they would have immediately asphyxiated (Sheets 2006).

Individual tephra beds, or in some cases groups of tephra beds, have been classified into stratigraphically numbered units from the base, the first phases of the eruption, to the top of the deposit, the last phases of the eruption (Miller 2002: 19-23) (Figure 2.2). There were alternating layers of air-fall and pyroclastic surges. The pyroclastic surges were initiated by steam explosions at 100°C that were created when the Rio Sucio water would erode through temporary tephra dams created in the eruption and would contact the magma (Miller 2002: 95). The initial eruption began when magma contacted the water of the Rio Sucio. The river was instantly vaporized in the first of these steam explosions and resulted in a lateral surge of tephra through the air, known now as Unit 1.

Unit 1 was fine-grained tephra that traveled at an estimated velocity of 50 to 200 km per hour (Miller 2002: 20). Approximately 20 to 30 cm of Unit 1 moist-tephra coated roofs, walls, trees and plants throughout the site. This unit coated thatch rooftops and protected them from fires; furthermore, this unit is largely responsible for the exceptional preservation of plants at the site (Miller 2002: 20-21). Artifacts were knocked off of the walls of buildings and pieces of some buildings were blasted off, though the buildings themselves remained standing (Sheets 2006). Pyroclastic-fall of ash and lapilli also accompanied this surge. The initial explosion that resulted in Unit 1 displaced the water and formed the first temporary tephra dam.

It is unknown how much time elapsed between Units 1 and 2. Unit 2 was a dry phase of the eruption due to the tephra dam around the eruption vent and lasted until the river eroded the dam, contacted the magma once again, and produced another steam explosion. During this phase
approximately 5 to 15 cm of coarse tephra was deposited on Cerén and ranged from ash to lapilli to 1 m diameter lava bombs at temperatures over 575°C (Miller 2002: 20-21). The lava bombs were created when tephra particles larger than a few centimeters in diameter were ejected into the air, formed an exterior crust as they cooled during flight, and exploded upon impact due to the very hot magma and gases inside the crust. These lava bomb explosions were often large enough to leave bomb sags or bomb craters (Miller 2002: 17). It was the Unit 2 tephra that
caught the Cerén thatch roofs on fire. The fires continued until the arrival of Unit 3, which deposited 60 to 75 cm of moist-tephra on top of the Unit 2 deposit. In addition to the Unit 1 tephra, Unit 3 is also largely responsible for the extraordinary preservation of plants and organic materials (Miller 2002: 21). The accumulation of the Unit 3 tephra on top of roofs caused their collapses.

The Loma Caldera eruption sequence continued to oscillate between dry tephra-falls and the moist lateral pyroclastic surges resulting in a total of fourteen units deposited approximately 5 meters in depth (Miller 2002: 13). Based on the activity remains of Cerén occupants it is inferred that the eruption occurred in the evening, after dinner and before sleep (Sheets 2002, 2004, 2006). Artifacts were mostly put away in storage and not in active use during the eruption. Dishes were mostly cleaned, though a few with food remains still present were identified in Structures 2 and 4. Typically dishes are cleaned immediately in a tropical climate to avoid animal and insect invasions. Sleeping mats were found rolled and placed in the rafters. It is thought the sun had already set and villagers would have fled the eruption in the dark of night (Sheets 2002, 2006). The Loma Caldera eruption occurred during the mid-rainy season, approximately August, as the maize (Zea mays) fields in multiple contexts were drying for harvest and ripe nance (Brysonima crassifolia) and guayaba (Psidium guajava) fruits were identified (Lentz et al. 1996).

The effects of the Loma Caldera eruption were localized to 10 to 20 km$^2$ surrounding the vent, where occupants would have either fled or perished in the eruption. Beyond this immediate zone nearby settlements might have experienced some adverse effects on crop growth for a few years due to tephra deposits, but the impact upon the rest of the Zapotitán Valley would have been minimal (McKee 2007: 89; Miller 2002: 15). Loma Caldera deposits have been identified
at the nearby site of Cambio (Chandler 1983), 2.5 km from Cerén, but have not been found at San Andrés, 5 km from Cerén (Begley et al. 1997; McKee 1999, 2007). If Cerén residents did escape the eruption, they likely resettled within the Zapotitán Valley (McKee 2007: 85). Due to this eruption, the typical cultural and natural formation processes that occur when a site is abandoned (Cameron 1991; Cameron and Tomka 1993; Schiffer 1987) did not occur at Cerén.

There was no post-abandonment scavenging (Lange and Rydberg 1972) due to the depth of the site’s burial and valuable items such as jadeite, obsidian prismatic blades, and shell beads were left in storage, likely a result of the need for occupants to flee the site (McKee 2007: 85). The deposition of approximately 5 meters of volcanic ash, particularly Units 1 and 3, resulted in the preservation of Cerén structures, artifacts, and plant remains. Plant remains were preserved as macrobotanical (e.g., carbonized beans) and microbotanical (e.g., phytoliths) remains, but the majority of plants decomposed leaving their molds in surrounding tephra (Sheets 1989, 2002).

The Discovery and Dating of Cerén

In 1976 the Instituto de Reglamento de Abastecimientos (IRA: Food Regulation Institute) of El Salvador began bulldozing an area near the town of Joya de Cerén for the construction of grain storage silos (Sheets 2002: 4). An unknown number of buried structures were reportedly destroyed during this construction and two prehistoric structures were left visible in the bulldozer cut beneath multiple meters of volcanic ash (Zier 1983: 119). Due to the excellent preservation of the structures, including some portions of thatch roofing, it was believed the structures were likely recent. The site remained visible in the bulldozer cut but was largely ignored until 1978 when Dr. Payson Sheets investigated further (Zier 1983: 119). Sheets and his research team from the University of Colorado, Boulder were conducting an
archaeological survey of the Zapotitán Valley when local residents directed Sheets to the bulldozer cut. Sheets examined the structures for any trace of recent activity, however, only encountered Classic Period Maya ceramics (Sheets 2002: 4, 2006). Multiple samples of the thatch roof were sent to University of Texas Radiocarbon Laboratory and returned with a date of A.D. 590 with a standard deviation of 90 years (A.D. 500-680). The accumulated radiocarbon dates for the site have a weighted average of A.D. 610-671 (cal 2-sigma [McKee 2002a, 2007: 83; Stuiver et al. 1998]).

Methodology and Summary of Cerén Archaeological Research

This section provides a summary of the research methodology employed in the excavation of Cerén, a summary of key research questions and discoveries, and an overview of the data recovered in the 2005-2012 field seasons. A total of seventeen structures have been confirmed in the site center and a series of investigations from 1978 to the present have focused on the site center, surrounding agricultural fields, and the recently discovered sacbe and have greatly aided in the reconstruction of the quotidian practices of site occupants (Sheets 2000, 2002: 43-44, 2007, 2009b; Sheets and Dixon 2011). The estimated population for the site is 100 to 200 people over an area of approximately 2 to 5 ha. According to Black (1983: 77-81) Cerén was a large village in the site hierarchy of the Zapotitán Valley. A summary of findings from the site is provided after a brief discussion of some of the specialized excavation techniques used at Cerén.
Cerén Archaeological Investigations

Methods:

Archaeological research has been conducted at Cerén from 1978 to the present (Sheets 2000, 2002, 2007, 2009; Sheets and Dixon 2011) and specialized methods have been employed in the excavation of Cerén given its unique preservation. A brief overview of the standing operating procedure for Cerén excavations in 2007, 2009, and 2011 is provided. After an excavation pit was established, surface artifacts and if present Postclassic deposits were collected and documented. Picks and shovels were used to rapidly remove the upper sequence of the Loma Caldera eruption, given there are not culturally significant data in the uppermost Loma Caldera tephra strata. Excavations slowed as we proceeded to more culturally sensitive layers and hoes and trowels were then used to clear the remaining tephra slowly. At this stage of excavation researchers were vigilant for hollow cavities preserved in the tephra.

The plant forms (molds) were preserved by the moist, fine-grained tephra of Units 1 and 3; thus, while most of the plant remains have decomposed, the hollow cavities with the mold of the plant have been left in the surrounding tephra. Upon encountering a hollow cavity in Cerén excavations the hole was first investigated and then plugged with newspaper. The area was pedestaled as excavations proceeded and once closer to the Cerén living surface dental plaster was poured into the hole, allowed to set, and then excavated (Sheets 2002, 2006). The result was a plaster cast of the plant growing on the Cerén horizon when the volcanic erupted.

Beyond the plant casts, paleoethnobotanical data were also collected (Lentz et al. 1996). Throughout Cerén excavations soil samples have been collected from various agricultural contexts at the site and processed with flotation and microscopic analysis (Lentz and Hoffer 2011; Sheets 2007, 2009b; Sheets and Dixon 2011). In excavations from 2007-2009 (discussed
further below and in chapter 4) ten liters of soil were collected from various contexts including the top of maize fields or manioc beds, walkways, cleared areas, platforms, and the sacbe and then manually floated in the laboratory to isolate microscopic evidence. David Lentz, Angie Hood, and Christine Hoffer have conducted in-depth analysis of these microbotanical remains and identified a variety of macro and microbotanical evidence from these contexts (Lentz and Hoffer 2011).

**Testing and Geophysical Research**

Upon its initial discovery in 1978, researchers excavated roughly one meter into the bulldozer cut to further examine the structures now known as Structures 1, a domicile, and Structure 6, an associated *ramada*-like structure (without walls), as well as a portion of a prehistoric maize field (Zier 1983: 124; Sheets 2002). Unsure if more structures had been similarly preserved in the region, researchers turned to geophysical exploration to aid in investigating beneath the large volcanic-tephra overburden (Conyers and Spetzler 2002: 24).

Geophysicists Hartmut Spetzler and Randolph Ware utilized three geophysical instruments in the initial exploration of the Cerén area: radar, resistivity, and seismic refraction (Loker 1983: 256-257). The four anomalies discovered during the radar and resistivity research were tested with impact-driven soil drilling and revealed stratigraphy indicative of Classic Period construction (Conyers and Spetzler 2002: 25-27; Loker 1983; Sheets 2002). Building construction at the site was done with pre-Ilopango clays that occur naturally below the TBJ living surface, but when used in construction were placed above the TBJ surface. Thus, researchers were able to identify the reverse stratigraphy as confirmation of the geophysical anomalies indicated by radar and resistivity data (Loker 1983).
The Salvadoran Civil War interrupted research at Cerén from 1981 to 1989. In 1989 geophysical research continued and excavations began (Sheets and McKee 1989). Electromagnetic induction (EM34-3) and ground-penetrating radar (GPR) both continued to be used in the survey of the site (Doolittle and Miller 1992). GPR has proved especially valuable in the investigations of Cerén, particularly as the resolution of the data has greatly increased in recent years (Conyers 2004; Dixon 2006; Loker 1983). Continued GPR surveys at the site have led to both the location of additional structures and the ability to map important archaeological and geological features of the ancient landscape (Conyers 1995, 2004; Dixon 2006).

In 2005 the geophysical investigation of Cerén was continued with electromagnetic induction and resistivity used to survey the western portion of the site (Figure 2.3: map 2005 area). This region is west of the excavated site center and while anomalies were found, the core-drilling did not reveal any structures (Sheets 2005). The lack of structures was initially puzzling, but the discovery of large manioc beds in 2007 (Figure 2.4: manioc beds) might give explanation to the presence of anomalies without structures. The manioc beds were constructed from the TBJ living surface, not the underlying Preclassic clays. Thus, the large beds might create electromagnetic anomalies, while the core-drilling would reveal natural stratigraphy (Dixon 2011). GPR has not yet been used in this area of the site, but has continued to be used in research to the south of the Cerén site center. The geophysical tools at Cerén have greatly aided in the reconstruction of the ancient landscapes identifying the location of structures, and in some regions possible agricultural fields (Conyers 2004; Dixon 2006).
Figure 2.3. Approximate Location of the 2005 Geophysical Survey in Relationship to the Cerén Site Center (Drawn with the assistance of Raining Wang)

Figure 2.4. Image of Author with Cerén Manioc Beds First Discovered in 2007 (Photograph by Payson Sheets)


**Site Center Excavation Results (pre-2000)**

The early research at Cerén focused on exploring the site center and a total of eleven structures were completely excavated from 1978-1996 (Sheets 1983, 2002; Sheets and Brown 1996; Sheets and Kievit 1992; Sheets and McKee 1989, 1990; Sheets and Simmons 1993). Portions of seven other structures have been identified but not fully excavated and therefore their functions are partially known or unknown. GPR data indicate there are likely additional structures dispersed throughout the area south of the site center (Conyers 2004; Dixon 2006).

The Cerén structures were all built with earthen architecture, with almost all of the structures made of *bajareque* (wattle-and-daub) (McKee 2007: 87). Cerén occupants first built a low earthen mound of Preclassic clay beneath each structure and on top of the mounds built a formal rectangular (except for in the case of two round kitchens) clay platform with vertical poles used to form walls. These poles were interlaced with horizontal vines or thinner poles, lashed to the roof beams with agave fiber ropes, and then mud was placed on both sides of the walls and carefully smoothed (Sheets 2002: 43-44). The grass thatch roofs of structures extended well beyond most of the structure walls (except Structures 10, 12, and kitchens), creating large (greater than the space inside of the walls) activity areas under the eaves protected from rain and sun (McKee 2002b: 58-71, 2007: 87-88). The majority of structures had an orientation of 30° with the notable exception of the religious complex public buildings Structures 10 and 12 (Sheets 2002: 201).

The site center was organized into identified households that contain multiple structures, activity spaces, gardens, and agricultural fields (Sheets 2002: 43-44). The structures comprising each household had specific functions that have been interpreted based on the associated features and artifacts (Table 2.2). Each household included a domicile (sleeping-structure) with a
sleeping bench in the back room, which is traditional in the Maya area, a *bodega* (storage facility) with a high number of ceramic vessels and food remains, as well as a high index of rodent preserved in the thatch roofing, and a kitchen with a hearth and abundant *manos* and *metates* (grinding stones), as well as ceramic vessels (Sheets 1992a, 2000, 2002: 43-44).

The site has a minimum of three households (summarized below), with a fourth cluster possibly indicated by the presence of the partially excavated building that has been preliminarily identified as a kitchen (Calvin 2002: 72-73). Associated with some of these households are specialized structures that are larger in size than other structures at the site and probably had communal functions such as a community civic center (Structure 3), a diviner’s structure
(Structure 12), a feasting building (Structure 10), and a sauna (Structure 9) (Sheets 2002, 2007: 198-203) (see Figure: 1.4). The close proximity of these specialty structures to particular households might reflect a service relationship between the households and associated communal building (Sheets 2002: 200-203). Following the recent work of McKee (2007), I will discuss these as Households 1, 2, and 4 for consistency, leaving Household 3 undesignated as there is possibly an additional household yet unexcavated between what are being referred to as Households 2 and 4 (McKee 2007).

Household 1 and Associated Specialized Structures

The structures exposed in the 1976 bulldozer cut were part of Household (HH) 1, including Structure 1, a domicile (Zier 1983: 119). Structure 1 was a bajareque building built on a clay platform and had a grass thatch roof extending beyond the structure’s walls (Zier 1983: 124). The bulldozer damaged a portion of the now 3.7 x 4.5 m structure, though comparative analysis from other structures suggests this was only a small portion. The structure was a domicile with one internal room that had a raised-clay bench. Researchers surmised that this domicile was likely use for multiple activities, including sleeping (Beaudry and Tucker 1989; Zier 1983: 140). There were multiple artifacts found within the structure, including many ceramic vessels, most of which had been stored hanging from the rafters, a ladle-handled censor, two informal grinding stones, a hammerstone, one small storage vessel with a spindle whorl likely used to produce cotton thread, three hematite cylinders, a miniature metate for grinding the hematite, and marine shell fragments (Beaudry and Tucker 1989; Beaudry-Corbett et al. 2002: 48-49).

The other structure visible in the bulldozer cut was Structure 5, which had an unclear function but has been hypothesized as an activity area for re-sharpening obsidian scrapers.
Structure 5 was a *ramada* style structure (without walls) approximately 1.9 x 2.75 m in size after the bulldozer cut and was positioned on a clay platform. Few artifacts were found associated with the structure including one obsidian flake and a few ceramic sherds (Beaudry-Corbett et al. 2002: 49; Zier 1983).

Within two meters of Structure 1 (HH 1 domicile) is Structure 6 (HH 1 *bodega* [storehouse]) (Beaudry and Tucker 1989; Beaudry-Corbett et al. 2002: 49-51; Mobley-Tanaka 1990). Structure 6 was approximately 1.8 x 2.1 m in size and was under renovation when the volcano erupted. The east wall had been completed but the other three were in progress with new canes inserted into walls but the mud not yet having been packed around these poles (Beaudry-Corbett 2002: 49). A total of 18 complete vessels were found in the structure, many of these having been elevated at the time of the eruption. Additionally researchers recovered a variety of artifacts including: two ceramic sherd-disks, likely spindle whorls, the skeletal remains of a duck with one leg tied to a pole, two complete *metates*, six *metate* fragments, one partial and two complete *manos*, seven obsidian prismatic blades, two obsidian scrapers, six hammerstones, and three biconially perforated “donut stones” (Beaudry and Tucker 1989; Beaudry-Corbett et al. 2002: 49-51; Mobley-Tanaka 1990). As with other bodegas at the site, there were also a relatively large number of mice skeletal remains in the thatch (Sheets 2002: 6, 77, 78, 151, 199).

South of Structure 6 is Structure 11, the HH 1 kitchen (Beaudry-Corbett et al. 2002: 51-53). The structure was a round, 4.5 m in diameter building with a small northern porch. It was constructed primarily with organic materials of vertical poles covered with thatch and a thatch roof that would have facilitated ventilation during cooking. There were two small bajareque columns framing the porch and creating a doorway. A three-stone hearth was found just east of the entrance and the artifacts associated with the structure included *metates* (one mounted on
horquetas [forked sticks]), twenty-five complete and five partial ceramic vessels, a polychrome painted gourd, obsidian scraper, hematite cylinders, a greenstone celt, and a miniature vessel with cinnabar (Beaudry-Corbett et al. 2002: 51-53; McKee 2007; Mobley-Tanaka 1990). Within the thatch roofing were obsidian artifacts and mice skeletons (Beaudry-Corbett et al. 2002: 53). The area between the bodega, Structure 6, and the kitchen, Structure 11, was kept very clear, probably to facilitate movement of people and food between storage and the cooking areas (Sheets 1992: 57).

A home garden, approximately 5 x 6 m, with a variety of plants was located south of Structure 6 and west of Structure 11 (Sheets and Woodward 2002: 188-189; Tucker 1990). Plants were organized in six rows of zoned biodiversity with a wide-array of plants such as piñuela (*Bromelia karatas*), malanga (*Xanthosoma violaceum*), maize (*Zea mays*), and manioc (*Manihot esculenta* Crantz) (Lentz et al. 1996; Sheets 2002; Woodward 2003). The rows of the garden were generally smaller than those of maize. Two maize fields surrounded the home garden to the south and to the northwest (Tucker 1990).

Immediately east of the Household 1 are two specialized structures that together form a ritual complex (Simmons and Sheets 2002: 110-113). The closest building to HH 1, Structure 10 is understood to have been used for production of communal festivals, such as feasting, and storage of ritual paraphernalia where multiple Cerén households would have gathered (Brown and Gerstle 2002: 102-103; Sheets 2002). The clay platform of the building is 3.2 x 3.5 m (Gerstle 1993) and it was constructed with bajareque (wattle and daub) walls approximately 2.2 m tall, four earthen columns on each corner of the structure, and a grass thatch roof.

The structure is oriented to 23°, which is distinct from the 30° orientation typical of other Cerén construction (Brown 2001: 372). There are walled-in corridors to the north, south, and
east of the building preventing entrance from those areas (Gerstle 1993). The building itself is divided into two rooms, east and west, with the building entrance on the eastern side, unlike the other structures at Cerén with northern entrances (Brown and Gerstle 2002: 99-100). The eastern room, which is at the front of the structure is 3.3 x 1.25 m and had many ritual paraphernalia artifacts such as a whitetail deer skull (*Odocoileus virginianus*) headdress that had been painted red with possibly some Maya blue pigment, a large caiman effigy storage jar filled with achiote (*Bixa orellana*) seeds, other storage jars, one of which contained squash seeds (*Cucurbita sp.*), and a painted gourd (Brown and Gerstle 2002: 99).

In the exterior northern and eastern corridors food production artifacts and features were found including two hearths, a *metate on horquetas* (forked sticks), ceramic vessels, a digging stick, burned maize (*Zea mays*) ears, four “donut stones”, a painted organic cylinder, a greenstone celt, a spindle whorl, obsidian blades, and antler and bone tools (Brown and Gerstle 2002: 99). This evidence led Brown and Gerstle (2002: 97) to suggest that this building was involved in preparing and distributing food for feasts. The eastern wall is much lower than other portions of the structure and was used to distribute food to site residents (Brown 2001: 373). Additionally, blood residue analysis from an obsidian blade in Structure 10 tested positive for human antiserum (Newman 1993: 182-184) suggesting this item could have been used in ceremonial bloodletting or an accidental cut during manufacture or use (McKee 2007: 119).

Structure 10 faces another important specialized structure to the east, Structure 12. Like Structure 10, Structure 12 also has a unique orientation to 15-20°, distinguishing it from other buildings and agricultural alignments at the site (Simmons and Sheets 2002: 105). Structure 12 has been interpreted as a ritual practitioner or diviner’s building and is located on high ground that overlooks the Rio Sucio. The structure was built on a clay platform that is roughly 3 x 3 m
and is architecturally complex with four rooms that have restricted doorways and interior spaces (Sheets and Sheets 1990; Sheets and Simmons 1993b). The floor of the structure is multi-leveled and ascends from the ground-surface outside to the highest level in the innermost room, which is thought to have represented moving from the secular to supernatural space (Brown and Gerstle 2002: 99). There are two windows made of latticed-poles and clay. The first window is located on the front, northern side of the structure to the west of the structure’s doorway and the second window is located in the south-western side of the building, with a hard packed footpath between the windows. Individuals would have had an initial encounter with the diviner at the first window and then proceeded to the second window in the back of the structure to received the results of the divining (Simmons and Sheets 2002: 106-108).

Evidence of divination is supported by ritual artifacts within the structure such as clay figurines, a deer antler, a small pile of beans, a mineral collection, and half of a Preclassic ceramic ring (Brown and Gerstle 2002; Simmons and Sheets 2002: 108-110). Also recovered in Structure 12 were obsidian blade fragments, shell (Olivella) beads, fragments from two painted gourds, a miniature vessel with cinnabar pigment, three manos, one metate, and a greenstone disk. Some of these artifacts were found in niches and might have been placed as offerings (Simmons and Sheets 2002: 110).

Household 2 and Associated Specialized Structures

Household 2 is located southwest of Household 1 and two structures were excavated in the household thus far, Structures 2 and 7 (McKee 2002b). Structure 2 was a domicile, similar to that of Structure 1. The Structure 2 domicile was constructed of bajareque, with the front wall constructed of canes tied with agave twine and a swinging door (McKee 2002b: 59b). This structure has two rooms separated by a bajareque wall with a doorway is positioned on top of a
4.22 x 3.42 m adobe platform that is 70 x 80 cm thick. The structure had a grass thatch roof that extended 1.5 m beyond the walls on all sides (McKee 2002b: 59, 2007: 97). The southern, interior room contained a bench with a large niche with three polychrome ceramic vessels, a painted gourd, and a marine shell fragment (*Spondylus calcifer*) inside. On top of the bench were a spatulate bone tool and a small basalt hammerstone (McKee 2002b: 63). The broken handles of ceramic vessels were incorporated into the walls (as with other structures, except the kitchen) and were used for hanging items and in many cases for securing doors shut (McKee 2002b: 60).

Inside the structure were two large ceramic sherds, a small tripod *incensario*, part of a storage jar, and two obsidian prismatic blades. Surrounding Structure 2 were a variety of additional artifacts including obsidian blades, biconically perforated donut stones, a carnivore tooth, two large mammal bone fragments, laja (flat stone) fragments, ceramic sherds, *jute* (*Pachychilus sp.*) snail shells, a spindle whorl, and a worked bone splinter (McKee 1990a, 2002b: 62-64). The only hearth found so far in Household 2 was next to the western wall of Structure 2 where charcoal staining indicated a fire was built between two 30 x 35 cm diameter stones, though the small amount of smoke staining on the structure suggests that hearth was not regularly used (McKee 2007: 101).

Structure 7 is located 1.3 m south of Structure 2 with the thatch roofs of these structures likely having overlapped and the compaction of the ground surface indicating this was an area with regular foot traffic (McKee 2002: 68). Structure 7 was a one-room *bajareque* building with a thatched roof built on a thin, clay platform approximately 2.8 x 3 m that served as the *bodega* (storehouse) of HH 2 (McKee 2002: 64). There was a small porch, 1.45 x 1.65m, on the north side of the structure. This structure faces Structure 2 and was used to store a variety of artifacts.
and plant remains as indicated by the paleobotanical remains from this location. There were 23 whole and seven partial ceramic vessels, including five large, storage jars containing the seeds of beans (*Phaseolus vulgaris*) and other species, polychrome dishes, a Copador polychrome bowl with monkey decoration, a Campana fine-line polychrome tripod plate, and large ceramic sherds (McKee 2002: 66-67, 2007: 105-106).

Other items found in Structure 7 were a lump of hematite wrapped in organic material, miniature ceramic vessels filled with cinnabar (Beaubien 1990), beads made of jadeite and other materials, incised shell pendant fragments, a small mammal bone, a cowrie and other shell fragments, obsidian prismatic blades, a greenstone celt, a bone needle fragment, and a spindle whorl made from carved coyol palm (*Acrocomia aculeate*) endocarp that was used to make fine thread (Lentz et al. 1996; McKee 2002, 2007: 106). There was wood ash deposited in various fallen context throughout Structure 7 and it is thought that these were stored in organic containers made of tree gourds and possibly used for a variety of tasks, most likely for soaking maize kernels overnight as limestone and lime were unavailable for this practices (McKee 2007: 108). Similar to the bodega and kitchen of Household 1, Structure 7 also had several rodent skeletons in the thatch roof (Sheets 2002).

An additional building, Structure 8, was identified roughly seven meters to the west of the Household 2. The preliminary excavation of the building showed wattle and daub architecture and many ceramic vessels, though the function and full extent of the structure remain unknown (Sheets 2012 personal communication). Approximately six meters south of Structure 7 is Structure 9, the specialized building associated with Household 2. Structure 9 was a sauna that measured 3.65 x 3.83 m in size, was constructed of solid 35 cm thick clay walls, and is notable for its *bajareque* domed roof (McKee 2002b). A grass thatch roof overlaid the
bajareque dome. Like the majority of Cerén structures, Structure 9 is oriented to 30°. The structure has an exterior bench on the eastern, northern, and western sides of the building and excavation of Structure 9 revealed no associated artifacts (McKee 2002b: 89-92). The north-facing door is short and can be entered on hands and knees. There is a 35 cm diameter clay circle above the entrance with an approximately 10 cm wide hole in its center that is plugged with clay and probably served as an air-vent to control the smoke and heat of the sauna (McKee 2002b: 91). The interior of Structure 9 has a hemispherical fire chamber in the center of the structure made of basalt river cobbles and clay that is approximately 80 cm in diameter and 75 cm high. Directly west of the structure are at least four laja stone seats facing northeast and east (McKee 2002b: 92).

A large depression southwest of Structure 9 was used for a *midden* (McKee 2002b: 69-70). Only one third of the projected circumference of the feature was excavated (approximately 4 x 4 m in area) and it is still unknown if the depression was a natural or human-made feature. The *midden* itself was composed of organic and inorganic artifacts, including wood charcoal and ash likely from the fire box of the sauna, ceramic sherds, obsidian prismatic blades and ground stone fragments, painted organic fragments, *bajareque* (fired clay), bone fragments, carbonized seeds, a perforated dog tooth, and plaster casts were made of maize cobs and tree branches (McKee 2002b: 69-70, 2007).

A maize field was located approximately three meters east of Structure 9 and portions of eight maize rows were excavated. McKee (2007: 111) interpreted the close proximity of agricultural fields to structures as possible evidence for insufficient land in the area for subsistence. Recent research in the agricultural fields south of the Cerén sites indicates this
might not be the case and there was likely sufficient land for agricultural subsistence in the close vicinity of the site (Sheets 2007, 2009; Sheets and Dixon 2011).

Household 4

The final partially excavated household at Cerén is one structure, Structure 4, of Household 4 (Gerstle and Sheets 2002: 74-80). This structure likely functioned as a bodega (storehouse), after having been converted from a domicile (Gerstle and Sheets 2002: 77). The artifacts suggested that the structure functioned as a storage facility, but the construction of the building is much more substantial than the other known bodegas at the site and resembles domiciles in Households 1 and 2 though without an interior bench. The building is a two-room structure, approximately 3.2 x 3.3 m that was constructed on a solid clay platform and had a grass thatch roof (Gerstle 1990; Gerstle and Sheets 2002: 74-75). The southern, eastern, and western-sides of the structure are bajareque and the northern side was constructed with poles (Gerstle 1990). As found in other bodegas, a large number of artifacts were present including storage jars, several obsidian prismatic blades, bone and antler tools, a greenstone axe, and ceramic vessels containing remains of cacao (*Theobroma cacao*) seeds, chiles (*Capsicum annuum*), and beans (*Phaseolus vulgaris*). A metate (grinding stone) was mounted on horquetas (sticks) and had last been used to grind cotton (*Gossypium hirsutum*) seeds (Gerstle and Sheets 2002: 77; Lentz and Ramírez-Sosa 2002: 36-37).

Household 4 also had an elevated shelf in the northern room and a bin storing maize (maize crib) that had been constructed on the floor using poles and clay. The maize crib was approximately 90 cm in diameter and contained husked corn on the cob (Gerstle 1990, Gerstle and Sheets 2002: 75-78). Portions of home gardens were found located south and west of Structure 4 that included plants that have not yet been found elsewhere at Cerén. Chile, cacao,
and guayaba were all found associated with Structure 4 (Lentz 1993), as well as a large maguey (
*Agave americana*) garden that would have produced a surplus of fiber much greater than the
needs of a single household (Sheets and Woodward 2002: 186-188). There were an estimated 70
agave plants in the garden that would have produced sufficient fiber for twelve households.
These data indicate that Household 4 was responsible for growing specialized plants for intra-site
use and/or exchange (Sheets and Woodward 2002: 188). Moreover, three pairs of sticks were
identified outside Structure 4 under the roof and another pair inside the north room of the
structure. These sticks were 20 cm in length, 3 to 4 cm in diameter, and were used to de-pulp
agave leaves to extract the fibers (Gerstle and Sheets 2002: 79).

Structure 16 is located nine meters northwest of Structure 4 and limited excavation of the
structure suggests that this was the Household 4 kitchen (Calvin 2002: 72-73). Structure 16 is a
circular structure, with pole walls that is estimated to be 4 m in diameter and contained an
assemblage that included a mounted *metate*, a ceramic jar, and a large ceramic sherd, as well as
abundant ceramic debris and carbon stains (Gerstle 1992: 69). Since Structures 14, 15, and 17
have yet to be fully excavated and their functions remain unknown, the majority of these
structures are not discussed in-depth in this dissertation. It is however important to note that
some of these structures might represent additional households.

Specialized Structure 3
Approximately ten meters east of Household 2 is Structure 3, a specialized structure that
probably served as a political or communal meetinghouse for the Cerén community (Gerstle
2002: 83-87; Sheets 2000, 2002). Structure 3 was probably the locus for decisions of communal
organization, dispute settlements, and planning. A non-royal, non-noble authority, such as
village elders, lineage heads, or founding household leaders would have probably united in this location for governing activities.

This is the largest building yet identified at the site, approximately 5 x 8 m in size and 3.5 m in height. The 30° orientation of the building matches the households and agricultural orientations throughout the site (Gerstle 2002: 83), with the notable exception of the two religious buildings, Structures 10 and 12. The walls were constructed of solid mud approximately 40 to 55 cm thick with a decorative cornice along the top of the outside wall. The grass thatch roof was supported by poles that were placed in the ground surface surrounding the structure, rather than directly in the architecture of the building (Gerstle 1989, 2002: 83-85).

There is an east-facing door that leads to the exterior, front room of the two-roomed building. This exterior, or front, room has two large benches on either side of the entrance that fill 75 percent of the space in the front room, while the interior, or back, room is wide but not deep and is void of any benches. This organization is the opposite of domiciles excavated at the site, where benches were always found in the interior room (Gerstle 2002: 83-87; Sheets 2002: 200). There are four niches built into the walls of the structure, two in the front room and two in the back, but only the northeastern niche contained an item, a spatulate bone tool (Gerstle 2002: 84).

Very few artifacts were present in Structure 3 at the time of the eruption. On top of the south bench of the front room there was a large open basin and a massive Guzapá: Miltitlan jar, approximately 50 cm in height (Gerstle 2002: 86) that has been hypothesized as used for storing and serving liquid that might have been chicha (maize beer) or even fermented manioc (Sheets 1992a: 95, 2002; 2009). A large, mostly un-modified stone and a biconically-perforated “donut stone,” possibly used as a mortar, were found in the interior room (Gerstle 2002: 86). Artifacts were found in the vicinity of the structure, including a storage jar on the structure’s front porch, a
perforated stone, an additional storage jar and a large ceramic sherd (Gerstle 2002: 86-87). The lack of domestic artifacts, the distinct architectural design and construction, including the buildings large size and the location of front benches all suggest a non-domicile function for the building. Only a select group of individuals could have fit within this structure at the same time and the plaza area would have been more appropriate for communal gatherings; therefore, it appears this structure was used for gathering a particular group or groups (Gerstle 2002: 87-88), probably community leaders, such as village elders for civic meetings (Sheets 2002: 200).

**Structure 13**

Southeast of Structure 3, between Household 2 and Structure 3, the corner and front of an additional building, Structure 13, was found (Gerstle 2002: 87). The southwest corner and front of the structure were excavated and revealed a portion of a large structure with the same construction techniques of Structure 3. Structure 13 was also constructed on a high platform, had large solid-clay walls, a wide cornice, and the same 30° orientation and included numerous artifacts such as a turtle-shell (carapace) possibly used as a drum, a stone ball, red pigment, an obsidian blade, two jars, and a restricted-mouth bowl. The artifact assemblage from Structure 13 is distinct from those of domestic contexts (Gerstle 1993: 66; 2002: 87).

While the function of the structure is unknown, this evidence indicates it was likely an additional communal structure and it is speculated that this would have been located on the south side of public plaza, with Structure 3 bounding the plaza to the west (Gerstle 1992: 66). The 480 m² plaza was constructed by cut-and-fill activity and had a smooth, clean surface covered with a thin layer of hard-pack red sand (Gerstle 1992: 66, 2002: 87).
Recent Archaeological Research at Cerén (2007-2012)

Since 2005 the Cerén archaeological research has focused on investigating the agricultural fields south of the site center. Three season of excavations (2007, 2009, 2011) have documented agricultural organization, discovered and studied intensively cultivated manioc, located an earthen sacbe (ancient Maya roadway), and documented land-use lines and farmer choices within distinct agricultural fields (Sheets 2007, 2009; Sheets and Dixon 2011). The 2005 geophysical exploration has already been discussed and the data from 2007 to the present are briefly outlined here with a more thorough discussion of the 2007, 2009, and 2011 found in Chapter 4.

2007

In 2007, GPR and excavations were conducted in the region south of the Cerén site center (Figure: 2.5). The GPR data are still awaiting detailed analysis and will likely aid greatly in future excavation at the site. The objective of the 2007 field season was to document agricultural fields south of the known site and examine if the intensive maize cultivation in the site center continued to the south (Sheets 2007). The project hypothesis was that intensity and productivity of maize would decrease with greater distance from the site center due to less careful tending, protection, and less fertilizing of plants further from the central living area (Sheets et al. 2007).

To achieve these objectives, six 2 x 3 m test pits were excavated approximately 200 m south of the Cerén site center. Test Pits 1 and 2 were side-by-side excavations placed 2 m apart and both discovered portions of the first intensively cultivated manioc field known in the Maya area (Dixon 2007). The manioc beds of these two test pits were determined to be part of one field because the beds shared the same orientation, were located in the close proximity to each other, had the same construction style, and had both been replanted (Dixon 2007).
Figure 2.5. Map Showing the Location of 2007 Test Pits 1-6 (Test Pits 3-6 are approximate location redrawn from Sheets 2007 with the assistance of Raining Wang)
Test Pits 3 and 4 were located west and uphill of Test Pits 1 and 2. These two excavations uncovered a cleared area that was likely once in manioc cultivation and now maintained as an open space, possibly an activity area (Blanford 2007). Test Pits 5 and 6 were located north of Test Pits 1 and 2, toward the Cerén site boundary, and these documented continued intensive maize cultivation in this region (Sheets 2007). The 2007 field season revealed a much higher agriculturally complexity than previously known for Cerén and led to further investigations in 2009 and 2011.

2009

The 2009 field season was organized around the manioc beds discovered in 2007 with the aim of investigating further manioc production south of the Cerén site center. The objective of the 2009 field season was to locate an area of pre-harvested manioc, which would likely facilitate a detailed estimate of manioc productivity, planting and harvesting techniques, and possibly document the extent of the previously identified manioc field.

Twenty operations were undertaken in 2009 (Ops. A-P, North, South, East, and West) and 10 of these excavations revealed evidence for manioc planting beds (Figures: 2.6 and 2.7). Beyond the discovery of additional manioc, all of which had been harvested just prior to the Loma Caldera eruption, this project also documented field organization, diversity in cultivation styles, multiple field boundaries, three distinct manioc fields, with evidence of potentially different land ownership and stylistic variation in planting, and the western and eastern boundaries of one of the manioc fields (Dixon 2009; Sheets 2009b). The results of these excavations provided a never before seen glimpse into the agricultural organization, variation in cultivation, and the importance of manioc at the Cerén site.
Figure 2.6. Map Showing the Location of 2009 Excavations [Operations A-P] (Redrawn from Sheets 2009 by Raining Wang)
Figure 2.7. Map Showing the 2009 Operations (A-P)
In 2011 research resumed at Cerén with the focus of further exploring the agricultural organization and manioc production closer to the Cerén site center. Fourteen test pits (Ops Q-AD) were excavated, thirteen of which were located inside the southern boundary of the Joya de Cerén archaeological park (Figures: 2.8 and 2.9). These excavations documented multiple maize fields, land-use boundaries, a possible domicile or field structure 200 meters south of the site center, cleared spaces some of which were likely previously under manioc cultivation, additional harvested manioc beds, and three sections of a sacbe (road) (Sheets and Dixon 2011).

Figure 2.8. Map Showing the Location of 2011 Excavations [Operations Q-AD] (Redrawn from Sheets and Dixon 2011 by Raining Wang)
The richness of these data are discussed further in Chapter 4. Additionally researchers conducted analyses of the history of \textit{malanga} (\textit{Xanthosoma}) use in the region (Heindel 2011) and of current gardens in the Cerén area today (Lamb 2011, 2012).

Figure 2.9. Map of 2011 Operations Q-AD
2012

The most recent Cerén field season did not involve excavations, but rather experimental planting and harvesting. In 2011 three small test plots were planted with manioc (*Manihot esculenta* Crantz) in different areas of Joya de Cerén and each of the three farmers was instructed to grow half of the crops in large earthen beds, such as those we have excavated at Cerén, and the other half to be grown in the style traditionally used in the area today, in other words without any large beds (Figure: 2.10). In 2012 the manioc at each of these three loci was documented, harvested, and measured. Unfortunately none of these three farmers followed the instructions to maintain the beds throughout the year, so upon the harvest in 2012 all of the manioc plants were growing out of the flat ground. Consequently, it was not possible to determine if the ancient growing techniques of large manioc beds were significantly more productive than those without beds.

Importantly, the issue was not likely a simple misunderstanding or mistranslation given that these are people we have worked with for years, who in some cases had assisted in excavation of the Classic Period manioc beds trying to be replicated. Rather, it appears a strong cultural logic might have intervened and possibly the habitual cultural training of how manioc was supposed to be grown, not in beds, was stronger than the idea of what was being asked of them. Since the manioc plants were successfully growing, it appears that the farmers decided that maintenance of the beds throughout the year was not necessary. The data of the growth of roots and stalks, as well as documentation of how many roots were left in the ground during harvest are not a large enough sample size to draw statistically meaningful results, but do provide some indication of manioc growth in the Zapotitán Valley today. Furthermore, the effort of removing manioc plants during harvest by pulling plants from the ground was much greater than
researchers had anticipated; though, this harvesting effort would have been reduced if the manioc had been planted in the beds with loose TBJ soil. This furthers an interpretation that the manioc plants at Cerén were likely harvested by a large work group, possibly comprised of a farmer’s kin and/ or extended community. These ideas are discussed further in Chapter 5.

Figure 2.10. Constructing and Planting Experimental Manioc Beds in a Test Plot (Photography by Payson Sheets)
Chapter Summary

The Cerén settlement was one of the first reoccupations of the Zapotitán Valley after the catastrophic Ilopango eruption (c. A.D. 405-535) (Dull et al. 2001) and the site was dramatically buried by the Loma Caldera volcanic ash c. A.D. 610-671 (McKee 2007). The preservation of structures, living surfaces, special features such as the sacbe, a variety of artifacts, agricultural fields, and plant remains and impressions all allow for a detailed reconstruction of the quotidian practices of the site’s occupants. The site is located in the Zapotitán Valley adjacent to the western bank of the Rio Sucio and actively participated in the political, social, religious, and economic networks of the valley and the Maya area.

Since its re-discovery in 1978, a series of excellent archaeological investigations have focused on the communal structures, households, and agriculture at the site and from this information have been able to better reconstruct political, social, and economic life at one Maya village. Located in the Southern Maya Highlands of Mesoamerica, the Classic Period Cerén site can contribute greatly to discussions of household archaeology, political economy, and agricultural production in the Maya world. This chapter outlined the geographical, cultural, and temporal context of Cerén to contextualize the research presented in this dissertation. The next chapter positions this research in the theoretical context of Maya agricultural studies, political economy, and practice theory.
Chapter 3: Socio-Political Economy and Agricultural Production

Theories of Classic Period Maya agriculture have varied greatly over the course of decades of archaeological studies in the region. Initially thought to be a simple system of extensive maize (Zea mays) swidden (simple slash-and-burn cultivation), in recent decades researchers have investigated the varied physical landscapes and widely divergent strategies and techniques of agricultural production employed throughout the Maya region (Fedick 1996b: 2-3; Turner II 1978). Previous approaches claiming the Maya were dependent on maize swidden agriculture, and then later that the entire region was a completely intensified agricultural landscape are both incorrect (Dunning 1996: 67; Fedick and Ford 1990). Research throughout the Maya area has documented huge variation in soil types, precipitation, and edaphic condition, as well as an array of agricultural strategies that were used throughout the vicinity, a strategy that Scott Fedick and colleagues (1996a) refer to as a managed mosaic. Archaeologists have begun applying a political economy approach to agriculture studies in the Maya area (e.g., Murtha 2002; Robin 2012; Yaeger and Robin 2004), which moves beyond simple documentation of agricultural remains and questions how agricultural production shaped and was shaped by economic, social, and political forces.

Broadly defined, political economy studies examine the interplay of political power and economic practices associated with production, distribution, and consumption (Feinman 2004; Roseberry 1988; Smith 2004: 77; Yoffee 1995). Agricultural production was a central component of the ancient Maya economy and a strong foundation of political power, though typically poor preservation substantially limits accurate reconstruction in this realm (Potter and
Many questions remain unanswered about Maya agriculture, social organization, and political economy including: What subsistence strategies were used to feed densely populated Maya cities and sustain these populations in times of drought? Were elite overseers involved in agricultural decision making at surrounding subsidiary settlements or did farmers have autonomy in their decisions about crop choices, timing of planting and harvesting, and production techniques? Were agricultural fields owned or held by the state, supra-household community, or household? To what degree were planting and harvesting carried out by individual families, supra-household cooperatives, or state-sponsored corporate work groups? Did farming communities specialize in particular crops and utilize a surplus in the market economy of their regions or was production focused on only individual household consumption needs? It is expected that the responses to each of these questions were diverse across the time and space of Maya prehistory (Lohse 2004; Yaeger and Robin 2004).

This study informs some aspects of these unknown features of the Maya political economy as they relate to agricultural production and organization. Archaeologists struggle to assess how food was grown and controlled, the degree of elite influence on agriculture, the organization of production and labor, and how agricultural production decisions were made (Dunning et al. 2003). This dissertation examines social, political, and economic landscapes of the Classic Period Maya from the agricultural fields that surrounded Cerén. While these data are specifically indicative of the political economy of the Cerén site, it is hoped that this reconstruction will inform models of political economies, specifically as they relate to agricultural production from a farmer-centric (Erickson 2006) perspective. Too often political economy approaches have relegated common farmers as powerless in the political system (Erickson 2006; A. Joyce and Weller 2007: 145; Levine 2007; Robin 2012). I utilize a political
economy approach from the lens of practice theory where all members of the past are viewed as political agents, whose collective actions shape and are shaped by the structures in which they live (Bourdieu 1977; Dobres and Robb 2000; Giddens 1979, 1984; Johnson 1999; A. Joyce 2000, 2004; Ortner 1984; Pauketat 2000, 2001, 2004; Wells 2006).

Furthermore, by examining political economy at a community level, the political forces of non-royal governance are investigated as they relate to agricultural production. Following Yaeger and Robin (2004: 149), I argue that it is not possible to disentangle the political and the social forces at the community level. Rather, people were both engaged in and influenced by the broader politics of their societies and at the same time were active participants in vast social networks including lineages, households, families, and reciprocal and redistributional economies. Ortner (1994: 401) encouraged that studies of domination should be balanced with those examining other, often less studied, social influences and forces (e.g., cooperation and reciprocity). Many political decisions at the community level were likely made and operationalized via social structures such as founding lineages, supra-household reciprocal systems, and identity affiliations, for instance gender, age, and status (McAnany 2010: 17). I utilize the term *sociopolitical economy* to refer to the economic practices that shape and are shaped by the political and social ideas and actions of community members in order to account for the immersed nature of political and social forces at the community level.

A sociopolitical economy perspective accounts for the political influences that are indeed at play in a community, as well as the upper echelons of society, and the social forces likely at the heart of the function and organization of the community matrix, including agricultural production. While often relegated by a modern, Western perspective to the lesser or even apolitical status, agricultural production and food can form both a basis of power and be
impacted by politics of a state, intermediate community, and/or household (Murtha 2002). The Cerén data afford an opportunity to examine the organization of agricultural production at the site, specifically the degree of farmer autonomy in planting choices, as well as the political and social forces, the sociopolitical economy, at play in agricultural organization.

**Macro Political Economy Theory**

Before moving to a discussion that situates agricultural production in Maya political economies, this section summarizes and critically examines recent theoretical approaches to political economy and political organization. In discussions of the complex interactions between political, social, and economic spheres in the Maya area, many scholars have turned towards a political economy approach (Earle 1997, 2002; Feinman and Nicholas 2004; Masson and Freidel 2002). In the broadest sense, the political economy is defined as the relationship between economic practices and political power (Roseberry 1988; Smith 2004: 77; Yoffee 1995). Blanton and colleagues (1996: 3) referred to the political economy as “...an analytical approach that elucidates the interactions of types and sources of power.” Researchers have utilized the terms “power over” and “power to” in an effort to distinguish coercive force of only elite rulers from the latter, capability and agency of individuals, regardless of their social position, to choose actions based upon persuasion and individual choice (Bender 1990; Cobb 1993: 50-51; Dirks et al. 1994; Earle 1997; Foucault 1980; Hodder 1991; A. Joyce 2000; Miller and Tilley 1984; McGuire and Paynter 1991; Wolf 1990: 586, 2001). For this research power is defined as the ability of individuals, of all socio-economic statuses, to make decisions and take action accordingly. Political economy examines the complex interplay of economic activities and political power (Cobb 1993; Roseberry 1989: 44); yet, political power and social organization
are often interrelated and not easily divisible, especially when considered at the community level (Yaeger and Robin 2004: 149).

The political economy theoretical perspective often includes studies of long-distance exchange, production specialization, emergence of complex societies, and the relationship between elites and commoners (Brumfiel 1980; D-Altroy and Earle 1985; G. Marcus and Fischer 1986; Roseberry 1988; Smith 1991). Various models of the political economy have been postulated and have been organized into heuristic categories outlined by Brumfiel and Earle (1987) which include 1)“adaptationist”, 2)“political”, and 3) commercial to which Levine (2007) has recently added 4)“practice theory and agency perspectives”. These approaches are summarized, with a priority given to the discussion of the Practice Theory approach given the importance of this perspective to my research.

1) Adaptationist approaches

Adaptationist approaches to political economy focus on the elite management of the economy for the benefit of the entire society by using political power to stimulate trade, create irrigation systems, or accumulate and store food for redistribution (Brumfiel and Earle 1987: 2; Muller 1987; Rathje 1972; Wittfogel 1957). This model draws heavily on a systems theory approach, where societies are viewed as well-integrated systems (Flannery 1972). Such approaches imply that these structures work to maintain a social and ecological equilibrium and often tend to consider people as rational actors who decision were logical and strategic. Less consideration is given to the choices and actions of all member of the society. This view often assumes commoners were powerless (Erickson 2006: 336) and does not account for the contested, various, and strategic actions of humans in the past that did not always work towards or create a harmonious, unified, integrated system (A. Joyce 2000).
2) Political approaches

Political approaches to political economy are focused on the power of elite managers to manipulate the economy for their own benefit and to extend their own power, what is commonly known as a top-down perspective (Brumfiel and Earle 1987: 3). These models are influenced by Marxist ideas about control over production and exchange, social inequality, and elite power (Levine 2007). In this vein, social classes are used to explain how members of the proletariat were used for the benefits of the bourgeoisie and the masses were thus manipulated and duped by calculating rulers. This paints an image of commoners as unintelligent, powerless, (to use Ruth Tringham’s (1991: 94) term) “faceless blobs” of history and their elite counterparts as conniving villains, both of which present caricatures of reality (Reed and Zeleznik in press).

At the macro-scale archaeologists have bisected the economy into products related to status and power and those related to subsistence. “Wealth” and “staple” finances (D’Altroy and Earle 1985; Earle 1997: 70-74) have been seen as mechanisms through which leaders generate resources. In this perspective “staple” finances (subsistence goods) were used to support elites and, if heavily depended upon by state institutions, required extensive storage facilities and transportation systems (D’Altroy and Earle 1985; Earle 1997: 70-73). In this approach the ability to store and distribute agricultural surplus would elevate agricultural production to a significant source of power (D’Altroy and Earle 1985). Control of production, infrastructure, and distribution of agricultural surplus were all potential vehicles for elite power through control and taxing of farmers (Carneiro 1970; Gilman 1987; G. Webster 1990). The wealth-staple finance model has been critiqued as too simplistic (Smith 2004: 86-87) and additional funding sources have been added to this model, including plunder, luxury goods tribute, goods or money taxation, rental of state land, commercial investments, and labor taxation (Smith 2004: 87).
These additional funding sources importantly outline a more complex view of ancient economies, though recognizing their archaeological signatures is challenging.

The political economy theories for the Maya generally concentrate on centralized, political power echoing the ideas of adaptationist and political approaches, whereby societies functioned in integrated ways, elite rulers held power, and commoners followed the choices and decisions of those in governmental seats of office. These models have been criticized as elite-centric and presenting overly normative views for past economies (Erickson 2006: 336-338; Levine 2007; Murtha 2002).

3) Commercial approaches

Commercial approaches to the political economy surmise that market forces (law of supply and demand, profit motive) shaped the economy (Brumfiel and Earl 1987: 1-2; Smith and Berdan 2003) and that elite rulers did not intervene in economic production or distribution, but benefited from the economy through systems of taxation and/or tribute (Levine 2007). While difficult to examine marketplaces archaeologically, Hirth (1998) outlines the types of evidence that might be used to identify marketplaces, particularly homogeneity of forms and types of artifacts from a market exchange. Evidence from Cerén shows that goods made locally had greater variation, while those obtained in market place exchanges showed significant uniformity in their manufacture, morphology, and distribution among households (Sheets 2000). Levine (2007: 50-51) expanded on Hirth’s (1998) argument, adding that the proportion, or ratio, of household production and consumption can indicate market participation. Commercial models have been critiqued for over reliance on profit motivations and a lack of cultural consideration in economic decision-making (Cheal 1989; Levine 2007; Sahlins 1972). The social organization of societies and systems of redistribution and reciprocity were equally or possibly more important
to many economies. The presence of a market does not mean that this was the only driving force or even the most primary aspect of economic production and organization (Ortner 1994: 40).

4) Practice Theory and Agency Approaches

Practice theory and agency approaches to the political economy have aimed to follow a practice theory informed notion (Bourdieu 1977; Giddens 1979; Ortner 1984, 1994) by considering all members of society, regardless of status or position, to be powerful, active participants in the social, political, and economic landscapes (Barber and Joyce 2007; Dobres and Robb 2000; Hutson 2002; Johnson 1999: 104; A. Joyce 2000, 2004; A. Joyce, Bustamante, and Levine 2001; Pauketat 2000, 2001, 2004; Robin 2003; Wells 2006). In this vein, archaeologists consider that the regular and repeated actions of past groups created the world in which they lived and that the archeological traces of those actions can be used to examine how societies were created, changed, resisted, and maintained.

Practice theory posits that the social, political, and economic landscapes are created by the practices of daily life and through actions, humans create the structures in which they live and then human actions are in turn influenced by these structures (R. Joyce 2000; Ortner 1984). From this perspective the economy is a collection of practices by all participating members in the society (Pauketat 2004: 26). Smith (2011:167-168) called for a middle-range theory in archaeology that focused on bridging high theory with archaeological data. I argue that Practice theory provides exactly such a bridge by examining data for the behavior outcomes of choices and practices, which in turn informs our understanding of social, religious, and political structures that created and were created by such activities.

The practice theory perspective counters traditional political economy approaches that were top-down, elite-driven, and over-generalized (Erickson 2006: 352-354). Erickson (2006:
348) criticized the political economy approach contending “that the political economy approach denies agency to farmers and underestimates their knowledge and cumulative efforts in creating vast areas of anthropogenic landscape.” An example of the elite-driven perspective described by Erickson is provided in Dunning’s (2004: 109) depiction of Maya farmsteads as “… the nexus between the relatively powerful and powerless members of Maya society.” Portrayals of Maya farmers, and commoners in general, as powerless represents the elite-centric perspective critiqued by Erickson and others (Lohse 2004; Netting 1993; Robin 2012; Yaeger and Robin 2004). Regardless of the degree of elite intervention in agricultural production, farmers would still have had the power to choose their own actions and make strategic decision to negotiate the political, social, and economic world in which they lived (Robin 2012: 3-4; Sheets 2000: 227-228). Referring to commoners as powerless denies the agency and capacity for any member of a society, regardless of position or status, to negotiate, resist, or accept the circumstances in which they live and the effect those actions (particularly en masse) might have on the structure of their society.

While Erickson’s (2006: 348) criticism of political economy highlights an important critique, the study of political economy does not inherently assume an overly elite bias or deny farmers autonomy or active participation in constructing their own social, political, and economic roles. It is necessary to highlight where many political economy studies have overemphasized state power or relegated farmers to passive, reactive, homogenous status, but the examination of political economies do not require a top-down perspective (Robin 2012; Yaeger and Robin 2004).

A. Joyce’s (2000, 2004) research at Oaxaca offers an example of how the intersections of religious, social, and political worlds with the economy might be considered. Joyce (2004)
examined the overlap of ritual, political, and economic spheres in the “sacred covenant” relationship in elite-commoner relations. He highlights that commoners’ tax and tribute to elites was likely analogous with the relationship of offerings between humans and gods (A. Joyce 2004: 195). Similarly E. Christian Wells (2006) developed a “ritual economy” approach that examined the relationship between cultural-religious beliefs and economic practices (Wells and Davis-Salazar 2007). Wells (2006: 278-284) outlined three areas of integration between agency approaches and political economy that include “social aspects of production,” “cultural contexts of circulation,” and the “moral dimension of consumption.” This dissertation emphasizes the “social aspects of production” outlined by Wells (2006: 278-284) that include the replication of social (identity, gender, class, kinship, and wealth) relations and hierarchies in the production of crafting and subsistence.

The standpoints with which we approach the past are highly influenced by the spatial scale of analysis we apply. Human agency and power can be interpreted at any scale despite having been traditionally applied from a household perspective (Barber and Joyce 2007; Dobres and Robb 2000; Hutson 2002; A. Joyce 2000; A. Joyce, Bustamante, and Levine 2001; Pauketat 2000). Likewise, a political economy perspective can be employed at various level of analysis ranging from the macro–level of state power to the micro-level of intra-household organization, though traditionally political economy theory has been used to examine elite-royal power (Levine 2007; Murtha 2002; Robin 2002a, 2002b). Each of the four approaches to political economy (adaptationist, political, commercial, and practice theory) is important. Elites made decisions for their own benefit and often for the benefit of all society; economic forces, such as supply and demand, played a key role in political and economic interactions; and the practices of individuals created, shaped, and were influenced by the social and political structures. Rather
than one being correct, each of these perspectives yields different understanding of the past based upon the focus of the research. A sociopolitical economy approach, informed by practice theory, is used to examine the Cerén data and results in a rare opportunity to see decisions and practices by individual farmers during the Classic Period.

Political Economy and the Ancient Maya

Scholars increasingly consider the decisions, authority, and control of economic production and distribution to be a critical component of understanding ancient life and recognize that past economies were interlinked with sociocultural and political landscapes (Smith 2004; Wells 2006). The ancient Maya economy was no doubt varied, diverse, and was integrated with sociopolitical organization and authority (McAnany 2010; Rice 2009; Richards-Rissetto 2010; Schortman and Ashmore 2012). Similar to the development of theories related to agricultural production, the simplistic view that elite rulers controlled all aspects of ancient Maya life has been replaced with more dynamic, complex reconstruction of varied past Maya political organization (Levine 2007; Murtha 2002; Robin 2012). The political economy approach to Maya archaeology has emphasized two major themes- first the degree of political centralization or autonomy present in systematic production, manufacture, and exchange of goods and second, the dichotomy of utilitarian and prestige-good economies (Masson 2002: 2-7; Masson and Freidel 2002).

While it is more difficult to reconstruct the social and political organization of subsistence, this reality certainly does not mean these aspects did not influence the production, distribution, and consumption of agricultural goods. The vast majority of ancient Maya populations were likely engaged in food production (Webster 1985: 380), the topic of this
dissertation. As Webster (2002: 175) stated the “greatest ignorance about Maya farmers concerns the ancient political economy.” This investigation into political economy examines the level of power and autonomy Cerén farmers had in production decisions, as well as the amount of power nearby elites at regional centers such as San Andrés might have had over agricultural production at Cerén and other surrounding agricultural communities. The preservation of the site affords unprecedented opportunity to examine the connection of sociopolitical dynamics and agricultural production of an ancient Maya community.

Some archaeologists in the Maya area have distinguished between the political economy and the economy as follows, “The political economy for the Maya area has been defined as the production and distribution of wealth or prestige items, while the general economy is defined as the production, exchange, and consumption of utilitarian or subsistence items” (Foias 2002: 230; also see McAnany 1993a, 1993b). This perspective is problematic in its implication that political forces were absent in the Maya subsistence economy and the prioritization of a Western perspective that divides political, social, economic, and sacred spheres when for many societies including the Maya these were inextricably woven together (Gonlin and Lohse 2007; McAnany 2010).

Discussions of political economy and production in the Maya area also heavily emphasize the relationship between commoners and elites. Maya commoners are traditionally thought of as passive, non-elite, food producers. David Webster (1985) depicted this divide as producers (commoners) and consumers (elites), though this dichotomy is clearly simplistic as both elites and commoners were consumers and potentially producers. Rosemary Joyce (1994: 182) furthered this position stating, “Thus the elite become those who use imported or elaborate goods, consume more of the goods in life (as seen in middens) and death (as seen in burials),
draw on greater energy for the construction of their living sites, and have less evidence of malnutrition or poor health.” Arlen and Diane Chase (1992: 3) articulated that elites were simply those who “run society’s institutions” and have wealth, status, and privilege in society. This fundamental division of Maya society has been supported by ethnohistoric documentation of early colonial Yucatan, which described the group as self-divided into two classes: *almebenob* (nobility) and *mazebualoh* (commoners). There were subclasses of each designation and while both nobility and commoners were often farmers, there was unequal distribution of access to farmland and ownership (Dunning 2004: 97; Restall 1997: 88-92). From this view, commoners are defined by default as not elite, or those without wealth, status, or privilege. More recent research has offered more direct focus on ancient Maya commoners (Gonlin and Lohse 2007; Lohse and Valdez 2004) and communities (Yaeger and Canuto 2000), rather than simply discussing what they are not.

The intended use for these binary divisions is to highlight the idea that commoners were responsible for supporting elite groups, yet the size of the elite group and the degree to which they were supported by commoners remains in question (Webster 1985). Critiques of the elite-commoner divide abound and highlight the often stereotyped homogeneity for both groups (J. Marcus 2004: 259), as well as the need to view either group in temporal and geographical context (Lohse and Gonlin 2007: xxiii). Furthermore, scholars have debated the presence of a continuum of economic classes and occupational heterogeneity for ancient Maya societies, including a merchant class (Adams and Smith 1981: 347; Blanton et al. 1993; A. Chase 1992; D. Chase 1986: 362; Roys 1962; Smith and Masson 2000: 20; Tozzer 1941). Growing evidence supports a view of continuums among commoners (e.g., Reed and Zeleznik 2013; Weller 2009).
Political economy models for the ancient Maya posit a variety of potential relationship between elite and commoner sectors of society as they relate to political power, social organization, and economic production. These political economy approaches in the Maya area can be classified into three heuristic models that hinge on the scale of the research. These models are a 1) “top down” perspective that focuses on macro-scale investigations, usually emphasizing elite power and control in shaping society; 2) a “bottom up” perspective that emphasizes the daily practices and importance of the household unit; and 3) a community non-royal governance perspective, that examines the political interaction and power at a supra-household level (Robin 2012; Sheets 2000, 2002c: 200-205).

**Macro-scale “Top Down” Approaches**

Although the elite members of ancient Maya society comprised two to ten percent of the population, they have long been the central focus of archaeological research in the area (Lohse and Valdez 2004; Sharer and Traxler 2006). “Top Down” approaches that focus on the upper echelons of ancient society have dominated the archaeological literature of the Maya, in part due to the durability of elite lives in the archaeological record, particularly when compared to their commoner counter-parts (A. Joyce and Weller 2007: 146; Lohse and Gonlin 2007: xxi). Emphasis on elites and city centers has often led to views of the Classic Maya commoners as under the direct control of elite rulers, with economic decisions and distribution of resources including agriculture at the will of the supreme elite class of society (Adams and Jones 1981; Chase and Chase 1996; Culbert 1988; J. Marcus 1976, 1983, 1993). While the extent of elite control of the subsistence economy is unknown in the Maya area, most of the archaeological literature suggests at least a partial role for elites in the decisions and organization of non-subsistence goods (Foias 2002: 235). Models of Maya settlement often imply relationships of
agricultural production and political economy, although rarely provide detailed evidence for their support. The terraces of Caracol, Belize are cited as an example of evidence for centralized elite control over agricultural production (Chase and Chase 1996), though the interpretations of these data are not necessarily indicative of elite-control (Murtha 2002). Top-down investigations of Maya agriculture focus on the systems of organization and production at the regional scale and interrelate with views of Maya settlement and political organization.

“Top down” Perspective and Maya Agriculture

Concentric Zone Model and In-Field/ Out-Field Production

The Concentric Zone Model depicts the Classic Period Maya settlement organization as elites residing in the epicenter of a site, with specialists surrounding the central elites, and non-elites surrounding the specialists in turn (Adams 1970; Becker 1973; Chase et al. 1990; Chase et al. 2002; Chase and Chase 1992; Fash 1991; Haviland 1972; Rice and Puleston 1981; Sabloff and Tortellot 1992). Thus the expectation is that monumental architecture is located in the center of sites and structure size and socio-economic status decreased with greater distance from the site center. Agricultural fields are assumed to primarily occupy the non-elite sector of settlement, while the city interiors are seen as more urban domains (Haviland 1972; Rice and Puleston 1981). This model posits a very strong urban-rural dichotomy that is probably inappropriate for the Classic Period Maya. It also typically assumes that political power was in the hands of an elite few, while the masses were merely the production cog of the larger societal wheel (Ashmore 2003; Iannone and Connel 2003).

In centralized models, agricultural production is seen as a means of supporting elite power (Masson 2002). A top-down model that focuses on centralized elite control of agricultural production describes producing communities that surrounded regional centers as suppliers of
economic goods, including food, that were consumed by elite. In this model strategies of taxation and/or tributes were used to support the state institutions (Ball 1993; Chase et al. 1990; McAnany 1989: 365; Rathje 1972; Rice 1987; Zeitlin 1993). Thus political centers and their elite occupants were viewed as consumers (Ball 1993; McAnany 1993a, 1993b; Rice 1987; Webster 1985). In this vein, elites were seen as linked to households through the consumption of agricultural goods. Freidel (1986: 414-415) discussed cacao, salt, and cotton stating,

>This goods provide a material link between the household and the palace, the village and the center. If these goods served as currencies in earlier periods, as most of them did at the time of contact, they would have provided a practical means of controlling a very much wider range of goods and services connected to them by equivalency [Freidel 1986: 414-415].

In this way the exchange of subsistence goods that were used as wealth currency is interpreted as a vehicle for garnishing and enforcing state power.

The topic of agricultural consumption has also been considered regarding assumptions about elite demands on commoner production (Haviland 1963; Thompson 1970). In discussions of Late Classic Period Maya collapse, archaeologists have cited the invasive, excessive demands of elites on commoners as a potential cause of social and political disruption (Hosler et al. 1977: 578). Webster’s (1985) reassessment of the degree to which elite consumption placed demands on commoners indicates that the demand was likely less significant than previously thought. Here the balance between elite consumption and commoner production has broader implication regarding political organization and social changes.

World Systems theory has been a strong influence on studies that emphasize a core and periphery relationship across landscapes (Blanton and Feinman 1984; Kepecs et al. 1994). In this view the periphery areas are responsible for producing surpluses that are then funneled into and controlled by the core areas. This creates an asymmetrical relationship of power and wealth
between core and periphery regions (Rathje 1972; Wallerstein 1974). As applied to agriculture in the Maya area, many adaptations have been put forth to account for the over-simplistic view of a basic core-periphery and elite-commoner dichotomy (Chase and Chase 1992; Schortman and Urban 1994). At the macroscale archaeologists have examined how leaders might manage the economy for the benefit of the entire society (adaptationist approaches) (Sanders and Price 1968; Sanders et al. 1979; Lucero 2006; Scarborough 2003) or alternatively for the benefit of themselves (political approaches) (Brumfiel 1991; Brumfiel and Earle 1987). Broad theories emphasizing a core-periphery relationship often give greater agency to elites and to the environment, while omitting agency of farmers to comply, resist, and strategize within systems of trade and production (A. Joyce and Weller 2007: 145-148; Ortner 1984: 142-144; Roseberry 1988: 167; Schortman and Urban 1994).

**Houselot Infield and Outfield Model**

The concentric organization of a core-periphery model is extended further in discussions of agriculture by an infield and outfield production model (Killion 1990). Here archaeologists have argued that in the gardens and fields within the immediate vicinity of commoner housetlots, infield, there is greater labor input and productivity while in the outfields, or areas further from the immediate household zone, crops are less tended and therefore less productive (Netting 1977, Killion 1990, Sanders 1981). The fields located closer to the central household area would produce higher agricultural yields due to increased protection from animal interference and the regular enrichment of soils from human waste (Lundell 1938; Puleston 1973; Sanders 1981; Wilken 1971). At the scale of individual housetlots, this organization of settlement also follows a concentric pattern with domestic structures in the center, a surrounding cleared area for various activities, then an intermediate area, surrounded by a garden and refuse area, and finally
agricultural fields that decrease in productivity as one moves from the house lot center outward. (Killion 1990).

In the infield-outfield view, the main Maya staples of maize, beans, and squash provided the central contribution to diet while garden crops were thought to afford diversity and supplemental calories in diets (Killion 1990). Archaeologists have estimated that infield production alone could not have sustained a family; however would have significantly supplied dietary intake given the high level of productivity. As Santley and colleagues noted (1986: 134), “While infield plots could never have provided all of the staple dietary needs of Lowland settlements, they would have produced important food and nutritional supplements without suffering the decreases in productivity to which outfield plots were subject.” In an ethnoarchaeological analysis of farming households in Sierra de las Tuxtlas, the average structural core made up only four percent of the overall house lot space, while sixty-two percent was designated as a garden area. This proportion underscores the integral role of garden and infield cultivation in relationship to household production (Killion 1990: 203).

Studies in this arena demonstrate a powerful relationship between intra-site settlement organization and agricultural intensification. Thus this presents a view of agricultural production moving from outfields to households and from rural areas to urban centers. This model might be inappropriate for a densely settled landscape, such as those posited for some of the Maya regional centers (Culbert and Rice 1990). Settlements might have been spaced too closely together to ever allow for true “outfields”, where all fields would have been within the in-field ranges of some household, particularly during the population expansions of the Classic Period. Research into the Cerén agricultural fields afford direct information to examine this model and to question how agricultural fields of one Classic Period Maya community were organized.
Future examinations of settlement and agricultural organization might continue to aid our knowledge of various subsistence systems employed throughout the Maya areas. Home gardens and infield cultivation were a vital part of ancient Maya subsistence in many Classic Period sites; yet, the dichotomization of infields and outfields and urban and rural has not proven accurate at several sites throughout the Maya area, for example Caracol, Belize (Chase and Chase 1998). In response to critiques of an overly binary model some archaeologists have suggested additional models for the organization of settlement and agricultural production, such as home gardens, infields, and outfields, and others have turned away completely from urban and rural dichotomies.

**Garden Cities and Cultivated Forests**

Evidence from Caracol, Belize shows nuclear family compounds distributed at patterned intervals within the intensive agricultural terracing system (Chase and Chase 1998; Dunning 2004: 108). This seemingly planned distribution of space has been interpreted as a “master” land-use/ agricultural-production plan with a centralized authority (at a supra-lineage level) indicated by the presence of organized and planned landscape, particularly the *landscape capital* of numerous terraces (Chase and Chase 1998). Debate continues regarding if other terraces throughout the Maya region were centrally controlled or under the management of individual households (Dunning et al. 1999; Leventhal and Ashmore 2004; Turner 1978; Wyatt 2008).

Remains at archaeological sites in the Maya area have also led researchers to argue that Classic Period cities were neither vacant ceremonial cities, nor purely urban environments, but rather garden cities (Chase and Chase 1998; Dunning 1992, 2003; Farrell 1997; Ford 2008; Killion et al. 1989; Smyth et al. 1995). Unlike the Concentric Zone and Infield/ Outfield models,
the Garden City model argues for agricultural cultivation both within the urban core and in the surrounding regions (Robin 2012:1). In other words,

Once conceptually separated in lieu of preconceived Western ‘urban’ and ‘rural’ dichotomies, we are now coming to recognize that Maya ‘sustaining’ and ‘urban’ areas can completely overlap, as they appear to do for the Late Classic ‘garden city’ of Caracol, Belize [Chase and Chase 1998 : 74].

At Caracol immensely numerous Late Classic agricultural terraces within and surrounding the city have provided a case study of one Maya city that seemingly encompassed both large-scale organized agricultural production and densely settled domestic, civic, and religious structures. This model emphasizes the intensive agricultural potential for Classic Period cities to support dense populations, such as the estimated 150,000 people present at the city’s peak, A.D. 650, as well as the elite control of agricultural production (Chase and Chase 1998).

The Caracol example also powerfully illustrates a lack of an infield and outfield dichotomy. The terraces extend not only in the urban core of the site but also to the surrounding plateau and foothills (Chase and Chase 1998: 61). It is possible this is evidence for an organized, planned landscape that was selected and controlled by ruling elites at Caracol. Alternatively, the continuous intensive agricultural production of the Caracol terraces may represent an increasing investment in agriculture as a response to elevated population levels (Murtha 2002: iii). If this is the case, the agricultural intensification, in the form of terrace investments, would in turn result in less and less distinction between infield and outfield cultivation (Chase and Chase 1998; Drennan 1988; Killion 1992: 6-8).

Caracol is not an anomaly on the Maya landscape. As with the terraces at Caracol, often intensified agricultural systems have been viewed as products of elite intervention, management, and control (Erickson 2006; Lohse 2004: 119). Beyond Caracol, other Maya sites have been
argued to have agricultural production within the urban and surrounding area, for example El Pilar, Albion Island, and Chunchucmil. At El Pilar, intensive agricultural productivity has been documented within and surrounding urban areas. Cultivated forests have been viewed as an extension of gardens at El Pilar (Ford 2008).

The Late Classic highly dense, community of Albion Island in Belize lacked a core-center and has been interpreted as a potential agricultural “colony” of larger political entities (Pyburn 1998). This outlook is highly centralized, whereby elite centers control an agricultural settlement for their own benefit, following the core–periphery relationship described above. Finally, Chunchucmil offers a similar example, where it was built as a “garden city” on thousands of garden beds that were artificially constructed by importing significant quantities of organic material from the coastal savannas. This evidence could be interpreted as a demonstration of elite power in their ability to construct landscape capital or alternatively could be interpreted as farmers’ adaptation to local environments (Beach 1998; Farrell 1997). Along this line, Pohl (1990) suggested the Late Preclassic drained fields of Belize also demonstrated elite power and others have examined water control in the form of reservoirs and channels for similar power relations (Lucero 1999, 2006) and a possible path to elite power (Ford 1996; Scarborough 1996).

In residential areas of Sayil there is evidence of urban farmsteads that show a correlation between large garden size, in-fields, and high-status residential compounds (Dunnings 2004: 105). This correlation has been interpreted as evidence for the first founder principle where the first families to settle a region maintain status and authority (Dunning 2004: 105; McAnany 1995: 96-97). While Caracol and other sites like it do not disprove an infield-outfield model of organization existed in the Maya area, these data do caution that each model be considered not
only in light of possible regional differences but also with regard to dynamic chronological changes within each location (Murtha 2002). These findings serve as a much needed reminder that an urban – rural dichotomy might be grossly misrepresentative of ancient Maya settlement and agricultural organization. Evidence such as garden cities suggest that at least some parts of Classic Period Maya landscape it was inappropriately to divide settlement between urban and rural and to deligate commoners as producers and elites consumers (Chase and Chase 1998: 74).

**Elite Controlled Regional Markets**

Researchers have indicated that a complex exchange system was present throughout the Maya area that possibly included a merchant class (Chase and Chase 1992) and a market system that was based either on: centralized elite sponsorship (Chase and Chase 1998; West 2002), regional specialization and participation (Scarborough 1998, 2006), ritual and social gatherings (Dahlin and Ardren 2002; Smith and Masson 2000: 114), and/ or ritual economy (Wells and McAnany 2008). Various models of regional market systems have been proposed for the Maya (Feinman and Nicholas 2004; Feinman et al. 2004). While markets actually might be more appropriated viewed from the community scale, from a “top-down” perspective markets can be seen as a loci for centralized control of farmer production, where elite-sponsored markets might have provided the forum of tribute or tax collection (Chase and Chase 1992; Hirth 1996, 1998).

Markets may have provided an opportunity to exchange subsistence goods, utilitarian items, and offer a venue for elite tribute collection (Chase and Chase 1998; Dahlin and Ardren 2002; Freidel 1986). Some major political centers probably hosted regional markets for surrounding, subordinate settlements (Masson and Peraza Lope 2004; West 2002). Solar-type marketing systems might have been present at Caracol (Chase 1998), where causeways linked the city’s peripheral producers to the central settlement area (Masson and Peraza Lope 2004:...
In this view urban centers are positioned in the middle of tributary hinterlands and each hinterland is connected to one market of a regional center (C. Smith 1976). This type of market would seemingly support a concentric settlement pattern and a core-periphery relationship between agricultural production and consumption. If Caracol had both garden cities and solar market relationships between the site core and surrounding communities, this would indicate the sociopolitical economy of the site was more complex with producers and consumers alike in both loci, embedded with each other through various contemporary systems potentially in place.

An image of Maya elite occupying centers while surrounded by agricultural fields and powerless peasants is clearly a gross oversimplification. Traditional “top down” studies emphasize the integration of numerous systems but tend to homogenize social interactions, typically ascribe agency to only a handful of “prime mover” elites, and do not account for the diversity of households and communities throughout the Maya territory.

Local Scale “Bottom Up” Approaches

The development of household archaeology in Maya studies has profoundly impacted our views and understandings of the ancient Maya. Given that some 90 percent of the population did not occupy the upper-most, royal echelon of society, household archaeology studies have examined the lives of the vast majority of ancient Maya people (Ashmore 2003; Iannone and Connel 2003; R. Joyce and Hendon 2000; Gonlin and Lohse 2007; Lohse and Valdez 2004; Robin 2012; Sheets 2000; Willey et al. 1965). From a bottom-up approach, archaeologists have examined how the quotidian practices of commoners and the cumulative choices of households might impact the broader social structures of Maya life, as well as inform archaeologists to the conditions of life for the ancient Maya. Such studies enlighten a view of the intra-household
variability (e.g., age, gender, and identity) that existed in Maya societies (Ardren 2002; Gonlin 2012; Hendon 2010; Robin 2006, 2012; Trachman and Valdez 2006).

Household archaeology presents a counter-balance to the overly elite focused and homogenized depictions of commoners so prolific in the Maya archaeological literature. Investigations at the household scale allow archaeologists to reconstruct the lives of the majority of the society as more diverse than previously imagined (Ashmore 2003; Gonlin and Lohse 2007; Sheets 2000, 2002). Farmers were not all the same and life was experienced differentially by members of societies based on their social position and identities (gender, age, social and economic status, etc.), more than just their status as commoners (Brumfiel 1992, 2006; Brumfiel and Robin 2008).

The maize swidden hypothesis, that stated dispersed, low density Maya populations were supported by basic, expansive swidden agriculture, is a bottom-up perspective that indicates local farmers would have produced agricultural goods for their own household consumption with some surplus being given to elites. In a swidden agriculture model, farming households produced agriculture for their own consumption and regional centers were seen often as vacant ceremonial centers, devoid of dense populations (Culbert and Rice 1990; Murtha 2002: 5). This is an extremely decentralized perspective, whereby population densities were low and agricultural production independent and non-intensive. While calculations of Classic Period Maya populations now indicate much larger populations that would have required agricultural intensification strategies (Culbert and Rice 1990), some archaeologists still posit that hinterland farmers would maintain autonomy and independence (Hayden 1994; Lucero 2006; McAnany 1993a).
Some archaeologists contend that Maya farmsteads, particularly in hinterland areas, were largely economically self-sufficient (Dahlin et al. 2005: 229-247; Hayden 1994; Lucero 2001, 2006: 296; McAnany 1993a; Rice 1987; Yaeger 2000). In this view, farming families had access to all of the resources required for their survival without elite or royal intervention and the unity of the Maya area was created via ritual gatherings (Lucero 2003; J. Marcus 2004; Scarborough 1998, 2003) and/or resources such as water (Lucero 1999, 2003, 2006; Marcus 2004).

Researchers have examined overlapping models of political economy whereby farmer autonomy increased with greater distance from city centers (Lucero 2006: 288). In this model, food for elites “likely came from land they owned in the vicinity of their grand homes” (Lucero 2006: 296), while hinterland settlements were relatively autonomous in farming. Similarly, religion and kinship are also seen as avenues of organization that were thought to have had little elite oversight or control (Adams and Smith 1981; Ball and Taschek 1991; Fox et al. 1996; Freidel 1986b; Hendon 1991; Sabloff 1986).

Archaeologists have argued for household independence in production and organization even within larger, political centers such as Copan (Sanders and Webster 1988). Others have described rural, local networks of trade that were independent of elite control in political centers (Scarborough and Valdez 2009). Countryside communities have been arguably reconstructed as autonomous in production and exchange decisions. While these investigations aid in informing the complexities present at the inter-household level, fewer studies tackle the complexities of inter-household heterogeneity and diversity (Robin 2012; Sheets 2000).
“Bottom Up” Perspective and Maya Agriculture (Agriculture and Household)

Practice Theory Informed Approaches

Increasingly studies analyze craft and food production with attention to the individual people who were positioned within politically, socially, and economically motivated contexts. Production is now often viewed as both a reflection and a structuring element of social relations such as identity, kinship, gender, and class (Hendon 1996; Shortman and Urban 2004: 200; Wells 2006).

In response to previous broad, overly normative approaches to Maya agriculture, some scholars have emphasized the need for documenting agricultural variability at a local level (Fedick 1996a; Robin 1999). “By so reducing Lowland Maya settlement to monolithic environmental, demographic, or cultural process, we turn our backs to the significance of inter- and intracommunity residential variability” (Levi 1996: 92). Robin (2006, 2012) has pioneered investigations of intra-community agricultural systems. Her study of gender organization within prehispanic Maya agriculture is based on both iconographic and archaeological evidence. Robin suggests that ambiguous depictions of the maize deity with the upper body of a male, and lower body of a female, combined with the lack of distinctive male or female associations with farming might indicate that it was the collaborative labor of both men and women (2006: 413). Robin’s (2012) research at Chan in Belize has furthered our understanding of Classic Period Maya agricultural and offers an insightful critique of the timeless view of Maya agricultural practices as unchanging from Colonial times into the more distant past.

Smallholders

Malthus’ (1798) and Boserup’s (1965) classic models of the relationships between agricultural production and population densities have each been critiqued for ignoring important social variables and for their traditional views of peasants as over-simplified and homogeneous
(Netting 1993: 2). This led Robert Netting to propose a new model for agricultural intensification of smallholders. Netting defines smallholders as,

…rural cultivators practicing intensive, permanent, diversified agriculture on relatively small farms in areas of dense population. The family household is the major corporate social unit for mobilizing agricultural labor, managing productive resources, and organizing consumption [Netting 1993:2].

The focus on household and family labor enriched earlier models examining the relationship between demography and agriculture with a more dynamic view of social life in the past at the community level. The smallholder approach merges the study of agriculture with people and the interrelationship of household, social, and agricultural organization (Stone 2001). In this way, scholars adopting a smallholder view attempt to connect household and local production with the broader political, social, and economic world (Pyburn 1998: 267-268).

In his model Netting (1993:13) provided a framework to re-examine agricultural intensification and the implications on household size and composition.

My own variation on the Boserup theme was to emphasize the role of the small, nuclear or polygynous family household as the social unit that typically mobilized labor, pooled consumption, and exercised tenure over the intensively tilled farm. I saw household size and composition as correlated with and responsive to farm area, cultivation techniques, and especially the labor needs of the agricultural operation [Netting 1993:13].

Netting interconnected the domestic structure with agricultural production. In his model a household unit is responsible for smallholder agriculture and utilizes coordinated, skilled labor of various types from all household members. From this perspective the autonomous choices and decisions of household members are viewed as essential to agricultural production. The smallholder approach highlights the key role of household strategies in the successful management of agricultural production (Netting 1993: 85-86; Stone 2001: 165-166). No longer satisfied to discuss agriculture as a broad system, the greatest strength of a smallholder model is
that it allows for social units that mobilize and strategize to best achieve agricultural and overall household success and sustainability (Netting 1993; Robin 2012; Stone 2001). While this consideration is an important component in understanding ancient Maya agricultural systems, it does not look within household composition for variation at a more individual scale and takes less account of the manners in which households would have been united. Mechanisms of sociopolitical organization are often ignored and households are viewed as the basic building blocks that nicely fit together to form a broader community. Such a view obscures the complexities of power and social forces at play in agricultural production and economic interactions between and within households.

Grappling with questions regarding the level of autonomy in production and individual household specialization requires a more detailed perspective of social and economic organization and a more dynamic and realistic understanding of food production in the past (Robin 2002b). The recent work at Chan is an example of how such a heterogeneous view of ancient Maya agriculture might be achieved and is further discussed in the context of a community with non-royal governance (Robin 2012). Traditional “bottom-up” household studies, have explored the lives and interactions of commoners, but often regard their actions in a vacuum separated from the political, social, and economic dynamics of elite rulers, communities, and internal household dynamics.

Following the work of Netting (1993) and others (e.g., Pyburn 1996, 1998; Robin 2012), I distinguish between farmers (Netting’s smallholder farmers) and peasants (Robin 2012: 2-3). Thus, this work examines the farmers of Cerén, who were actively engaged in the political, social, and economic landscapes in which they lived. Along these lines Erikson asserts, “Peopling the past is a radical alternative to viewing farmers as faceless masses, the passive
recipients of what the elite impose on them through direct coercion or state ideology” (2006: 353). Erickson’s farmer-centric perspective (2006: 350) can greatly inform our understanding of the social and political economies of the past.

**Interregional Scale: Non-Royal Governance and Community Models of Maya Political Economy**

In an attempt to encapsulate the wide range of agricultural production in the Maya area, researchers have increasingly turned toward the physical environment to examine regional differences (Dunning 1992, 1996; Fedick 1996a; Killion et al. 1989). To disentangle complex physical variation from one location to the next, archaeologists now recognize the need to first understand the physical differences in loci and then to begin examining how human interaction within these physical landscapes has varied throughout the Maya world (Fedick 1996: 337; Wingard and Hayes 2013). Fedick (1996c: 337) summarized this viewpoint,

> With perhaps the exception of home gardens, agriculture is something that occurs away from the ‘site’, as the residence, settlement, or city is usually perceived. Yet the characteristics and distribution of landscape elements represent the physical base upon which the agricultural system is built, and these elements have the potential to greatly influence the economic and political character of a region… we must seek to understand the complex interplay between human societies and the physical landscapes in which they function [Fedick 1996c: 337].

Studies of agriculture have increasingly utilized microbotanical and soil analyses to determine the potential agricultural production throughout the Maya area (Dixon 2013; Olson 1977:9; Netting 1996: 67; Wingard and Hayes 2013; Wingard 1992). Once believed to be comprised of only poor soils incapable of supporting dense populations, the great variability between sub-regions of the Maya landscape is now recognized (Fedick 1996a; Wingard 1992, 1996). Dunning (1996: 67) discussed the potential contributions of further physical landscape studies stating, “Soil studies can help us to understand more specifically what forms of
agriculture probably could or could not have been practiced in a given area (that is, to define the environmental parameters of cultural adaptation).” The application of soil analysis and modeling provided a view of vast regional diversity in physical landscape throughout the Maya world and likely varied agricultural production strategies available to farmers (Beach 1998; Beach et al. 2002; Hayes 2013; Sheets et al. 2012; Webb et al. 2004). Archaeologists have also begun to examine soil, vegetation, water, and topographic variation at the site level and use these to suggest status differences between households, resource management, and shifts in residential distribution (Hughbanks 1998; Kepecs and Boucher 1996; Levi 1996; Scarborough et al. 1995).

Similar to the variability of physical landscapes and production strategies now accepted for Maya agriculture, Lohse (2004: 119) highlighted, it is unlikely that one single decision-making structure, such as elite dominated or completely autonomous production models, was employed for the entire Classic Period Maya world. Following Lohse (2004: 120) a “bottom up” or “top-down” approach are both seen as inappropriate and inflexible by themselves, thus “our understanding of how different levels of social organization might have acted simultaneously as agricultural agents has remained, by and large, static.” A community level analysis can offer integration of household dynamics and political influences and present a more dynamic perspective of the multiple scales of influence present in Classic Period Maya life (Robin 2003, 2012; Yaeger and Canuto 2000: 12).

More than a simple conglomerate of households, Jason Yaeger and Marcello Canuto (2000: 6) defined community as the dynamic social practices and structures of aggregated households and acknowledged that in communities “there must exist physical venues for the repeated, meaningful interactions needed to create and maintain a community” (Yaeger and Canuto 2000: 6). Beyond the physical orientation and close proximity of residential units, socio-
cultural elements are also essential to defining and understanding a community. Participation in a community was an important way people defined themselves and were identified by others (Robin 2012; Yaeger and Canuto 2000: 5-9). Researchers continue to pursue data of how households interact at a broader level and how people identify and unite beyond the immediate family group. At this level of analysis various aspects of non-royal governance can be viewed through the practices of feasting, possible resource-specialized communities, and regional markets, each of which is significant to addressing the sociopolitical landscape of agricultural productivity. Non-royal governance in the form of community leaders, possibly elder and lineage heads, might have made decisions for the households connected in the economic, social, and political grouping of the community. Such decisions might have included dispute settlement, landscape organization and construction, communal labor, and scheduling of key inter-household events, such as feasting and harvest. These decisions were likely operationalized through lineages, family groups, and webs of reciprocity. Hence, governmental power of a community with non-royal governance would have been inherently interwoven with social organization.

**Sociopolitical Economy**

In the cases of the hinterland settlements of Chan Noohol and San Lorenzo in the Xunantunich polity, Yaeger and Robin (2004: 149) argued “Although our discipline tends to distinguish social organization and political economy, the two are interwoven inextricably in these commoner settlements.” The social organization tied to the political economy can be thought of in terms of Sharer and Traxler’s (2006: 635) social economy. Sharer and Traxler (2006: 635) defined the social economy as being where goods and services are organized by hierarchical and herterarchical control that lacks centralized political authority.
When examining the political and social economy of the Maya area, Sharer and Traxler (2006: 634) stated that in regard to most local agricultural and household products that production and distribution “were almost certainly in the hands of a heterarchically dominated social economy”. In contrast to typical top-town approaches, they defined the social economy as the goods and services produced and distributed without centralized political control (2006: 635). From this perspective it might be possible to view the Maya world as divided into different scales of interaction including the political economy as elite dominated, the social economy as community dominated, and the local economy as household dominated. The problem with this approach is that it implies the political function of society exists beyond the commoners and in the hands of the elite. Sharer and Traxler’s (2006) addition of the social economy facilitates a discussion of the vast political and social components of economic function at the community level, but by segregating the social to the community and the political to the elite centers, might accidentally force a continued perspective of commoners as a-political, reactive entities. It is more appropriate to discuss the political economy at multiple scales, as political power and governance were not only present in elite centers. At the community level, social organization and political power are enmeshed and not easily distinguished (McAnany 2010: 14). Furthermore, the political power sanctioned by the larger government structure and elite power, as well as through the community itself would have been operationalized through the social structures of each community such as family lineages, redistribution, and reciprocity all at work in addition to the governmental politics and market forces of the economy.

The concept of sociopolitical economy employed in this study examines the intersections of social organization, political power, and economic practices, recognizing that the choices and actions of humans shaped and were shaped by each of these spheres as well as their
interconnections. The archaeological record at Cerén allows for a radical farmer-centric approach (Erickson 2006) and informs our understanding of the social and political aspects of agricultural production in the Maya area.

**Community Non-Royal Governance Approaches**

It is hoped that through the use of the community level of analysis that both inter-household forces and decisions of governance, as well as individual daily practices will be visible. Commoners are increasingly seen as participating as political agents (Robin 2003, 2012) and Sheets (2002c: 219-227) outlined multiple economic scales in which commoners would have participated simultaneously. Sheets (2002c: 219-227) expounded 1) the household economy, where goods are produced and consumed within the household unit, 2) the horizontal or village economy, where “the production and distribution of services, and goods such as manioc, [were produced] inside the village and its environs, beyond the control, but not necessarily beyond the influence, of elites” (Sheets and Lentz 2012), and 3) the regional economy, where goods were produced for and exchanged at regional centers (Hearth 2012; Kestle 2012; Sheets 2002c) and I would add possibly other communities in the region through community-to-community trade relationships.

Status differentiation within sites or regions has long been documented in Maya archaeology, yet our understanding of the implications of those differences for economic, social, political, and religious interactions between people remains less studied. Recent work has examined the political participation at the community scale, termed non-royal governance (Sheets 2000; Robin 2012). Work at Chan in Belize (Robin 2003, 2012) and Cerén (Sheets 2000) has documented political functioning beyond the royal elite governance of regional centers and instead examine political organization at the community level (Robin 2012; Sheets 2000).
At Chan researchers have found extensive terrace agriculture surrounding dispersed households (Robin 2012). As Wyatt (2008: 58) stated, “A top down agricultural system, implemented and managed by elites in a short time span to increase production as suggested by some, would have neither the complexity nor the time depth that we see here at Chan.” Thus the connection between agricultural fields and political organization of agricultural production seem similar to the trends identified at Cerén (Sheets 2000, 2002a). Cerén was no doubt in close contact and relationship with the nearby center of San Andrés and another regional center 5 km to the north, like the Chan site was with Xunantunich (Robin 1999, 2012), yet, previous studies at the site have shown that Cerén community members probably maintained the ability to choose the markets where they would have traded (Sheets 2000: 227-229; 2002a). Such research provides a much more dynamic view of intra- and inter-community variability. This dissertation examines a detailed analysis of Cerén agriculture to provide a case study for the organization of agricultural production and an examination of the sociopolitical forces that would have impacted and been impacted by farming at the site.

Community Non-Royal Governance and Maya Agriculture

A variety of organization strategies have been discussed for community non-royal governance and Maya agriculture. Ethnographic work provides one basis for analogies and models of complex relationships between community organization and production (Beals 1973; Gutiérrez 2013; Orellana 1995). Archaeologists have examined the different types of power possibly used throughout ancient societies (Blanton et al. 1996), as well as how this power might have been supported and organized at a community non-royal level of governance such as feasting, resources specialized communities, and regional marketplaces. Each of these strategies is explored here.
Corporate and Network Strategies of Power

Blanton and colleagues (1996) bisected political strategies into network (individual-centered) and corporate (group-oriented) strategies (Blanton et al. 1996; Robin et al. 2012: 148). A simplified summary of this work is that the Individual-centered political strategies were focused on political actors controlling sources of power, whereas the corporate power strategies emphasized heterarchy and sharing of power among groups. Robin and colleagues (2012: 147-149) observed both strategies employed at Chan, with veneration of ancestors seen as individually-centered political strategies and ritual activity and feasting as the foundation for group-oriented power. The types and functioning of the political economy of communities (such as Chan and Cerén) afford greater insight into many questions of autonomy, power, and production. Chan and Cerén both show evidence of non-royal political buildings where community leaders, likely elders of founding families, could convene. Public structures at sites such as these demonstrate the distribution of political power beyond royal elites, the nature of which we are only beginning to understand (Robin 2012; Robin et al. 2012: 148; Sheets 2000, 2002c) (further discussed in Chapter 5).

Elsewhere evidence for possible non-royal governance has been documented where some groups of individuals or households were given greater access to goods and resources, including the best agricultural soils and productions (Dunning 2004: 106; Hayden and Cannon 1982; Lohse 2004: 130-137). These hierarchical corporate groups might correspond with lineage groups organized according to the first founder principle (McAnany 1995; Schele and Matthews 1999: 329) where founding families maintained status and greater access to resources (Weller 2009). Lohse (2004: 130-133) described two settlement patterns of organization at Dos Hombres, Belize, one of which was a corporate group pattern. The corporate group settlements had architectural hierarchy, light to moderate settlement density, and hierarchical access to
agricultural soils (Lohse 2004: 130-133). There were First Tier groups that were larger, more formal courtyard groups, which might have had “special purpose” roles (Lohse 2004: 130). The corporate groups were interpreted as hierarchical, circumscribed units with unequal access to localized resources that were larger and more formal in construction, and had access to the best agricultural soils (Lohse 2004: 130-133). The difference in status among the various groups within the corporate group pattern in part suggested that agricultural production might have been coordinated by First Tier residences and then followed by surrounding households. Research at Sayil in the Yucatan has shown a comparable pattern where certain domestic groups appear to have served as decision makers and administrators for the residential groups in their adjacent areas (Carmean 1998).

The second type of settlement pattern Lohse (2004: 133-135) described for Dos Hombres is the micro-community pattern. In this settlement type there were very dense residential clusters that were not easily distinguishable by status (Lohse 2004: 133). The micro-community pattern also had many more field walls that defined individual family compounds or house-lots, whereas the corporate group pattern usually lacked field boundary markers (Lohse 2004: 134). The Dos Hombres settlement that followed the micro-community pattern was centered around an *aguada* (enclosed depression that filled seasonally with water) and Lohse (2004:134) suggested this was a resource-specialized community, such as those described by Scarborough and colleagues (1999) that utilized the resources of the *aguada*. Residential hierarchy was lacking in this settlement type and Lohse (2004) posits that “collective action” resource management and exploitation strategies (Mabry 1996:12) might have been employed (this type of organization is discussed below) (Lohse 2004: 134).
In this way, Lohse (2004) argued for two forms of agricultural organization within the same site location, one hierarchical and the other heterarchical, though neither connected with elite political power. Lohse (2004: 136) stated “these finds place commoners squarely in the role of managing decentralized food production systems.” He did not elaborate on how such different organizations might be run internally or integrated into the same larger community. Lohse described the Dos Hombres data in terms of agricultural production and aspects of social organization, but did not address how political power might have also participated in this organization. Rather the lack of evidence for elite presence at the site was interpreted, as is often done in the Maya area, as the absence of political power at this level of organization. Many communities, like those described by Lohse, might have functioned through non-royal governance, such as that described for Cerén (Sheets 2002c; Sheets and Dixon 2011; this dissertation) and Chan (Robin 2012). This is an example of how political power is often conceived of only at an elite level and Cerén affords a rare opportunity to investigate this level of community power. While, elite power might also have still been present in community governance, at Cerén the lack of evidence for individual rulers or significant status differences between community members all suggest that the site’s governance was more heterogeneous in nature than hierarchical.

Evidence for varied organization of agricultural production and settlement decisions should be expected throughout the Classic Period Maya sociopolitical economies given the wide array of diversity recorded at sites throughout the Maya world. Following the variation in physical landscapes and agricultural strategies now recognized throughout the Maya region (Fedick 1996a; Sanders 1977), rather than a single model of agricultural production and
organization, it is more likely multiple organizational principles were in play regarding decision-making and authority in production.

The varying degree of centralized state power and farmer community autonomy are now viewed as a complex continuum that offer different perspectives and possibilities for social, political, and economic interactions (Fox et al. 1996; Iannone and Connell 2003; LeCount and Yaeger 2010; Marcus 1998; Robin 2012). As a replacement for traditional views of peasants that lacked autonomy, agricultural communities throughout the Maya region likely experienced varying degrees of state intervention or influence, self-governance, and autonomy (Robin 2012).

**Feasting**

Feasting can function as an important element of supra-household community and was probably a frequent part of Classic Period Maya life (Brown 2001: 368; LeCount 2010: 133; Yaeger and Canuto 2000). Feasts represent a substantial investment of goods and labor that can stimulate economic activity, reiterate social ties, and afford individuals or group’s political status (Brown 2001; Dietler and Hayden 2001; Dietler and Herbich 2001; Sheets 2002a). Feasting activities also constructed, highlighted, and challenged identities within the community, such as gender and hierarchy (A. Joyce 2010: 230; LeCount 2001; Pauketat et al. 2002).

Feasts are known ethnographically among both commoners and elites, though the upper class feasts were recorded to be more extravagant. In the context of the Maya community of San Lorenzo in Belize, Yaeger (2000: 133) has described feasting and communal labor as a form of affiliation practice whereby community membership was made explicit and social ties were created. At Cerén, the context of serving vessels, metates, and ceremonial items all indicate that a feast was underway at Structure 10 when the volcano erupted (Brown and Gerstle 2002: 97-103) and that this might have served the affiliation function described by Yaeger (2000: 133).
Agricultural production is directly connected with feasting in that agricultural products are the basis for such community events and the organization of production and labor are vital elements of hosting a successful feasting event. As discussed in this dissertation, the large-scale Cerén manioc and maize harvest appears connected with feasting, in a celebration of the harvest and/or providing manioc for the event. It was hoped that further residue analysis of ceramics at the site might aid in strengthening such a connection and possibly provide evidence for manioc fermentation but such residue signatures of manioc has been elusive (Payson Sheets personal communication, 2013). Feasting represents power beyond the state that perhaps could be used to collect tribute or tax but more likely was a complex system of status and kinship, reciprocity and redistribution. Feasts might serve to mobilize labor (A. Joyce 2010: 221), in the case of Cerén for the harvest. While not necessarily an organizing feature of agricultural production, feasts are always the outcome of agricultural labor and are tied to the sociopolitical organization of the community. Feasts provide evidence for a supra-household connection and were likely both mechanisms of sociopolitical affiliation and community building (A. Joyce 2010; Yaeger and Canuto 2000).

Resource Specialized Communities

Recognition of both hierarchical and heterarchical relations (Crumley 1995) within the Classic Period Maya world have had important implications for understanding Maya communities and agriculture. In examining the heterarchical organization of the Maya landscape, Scarborough and Valdez (2003) proposed a resource-specialized community model. They examined the Three Rivers Region of Belize and identified communities that were centered around specific environmental resources, such as aguada communities, like that described for Dos Hombres, Belize (Lohse 2004: 133-135), that would have exploited water resources and/or...
terrace communities that would have exploited agricultural resources (Scarborough and Valdez 2003: 12). The authors outlined local resource-specific settlements participating in a broader community economy via trade and social ties (Scarborough and Valdez 2003: 12). Agricultural surplus and trade were examined as essential, though not isolated, components of broader community formation and interaction. While it is unclear how broadly the resource-specialized settlements model can be applied in the Maya area, it is important to examine the role agricultural surplus likely had in inter-village and inter-community relations. Despite arguments that perishable staple crops would not have been transported long distances, agricultural surplus was still likely an important participant in the sociopolitical economy.

**Regional Markets**

Markets served as important loci of distribution for subsistence and non-subsistence goods. Though often viewed as elite sponsored or hosted functions, markets might have been an area of commoner power within the larger regional economy, whereby producers could decide which regional market centers to use (Sheets 2000: 227-228). As Sheets (2000: 119-223) depicted, the majority of items at Cerén were produced within the household or the village, but trade items, such as jade axes, polychrome pottery, obsidian blades, and hematite cylinders, linked villagers with a vertical regional economy. These trade items are expected to have resulted from organization and involvement of elites due to the long distance from whence they came, as well as their highly skilled manufacture. The standardization of the distribution of these types of items in Cerén households (following Hirth 1998: 463) suggested that the trade items in Cerén households were obtained at a centralized site, likely a regional marketplace (Sheets 2000: 223). Sheets (2000: 223-228) powerfully argued that commoners would have
probably had a choice in their market participation and supply-and-demand forces might have resulted in commoners’ choices impacting the larger political structures of marketplaces.

Archaeologists have cited the lack of domesticated animals of burden in the Maya area as evidence that long-distance trade of staple goods would not have been possible to inland destinations (Drennan 1984; Lucero 2006), yet the extensive networks of rivers and streams would have likely served as active and vibrant transportation routes. Even without long distance exchange of agricultural surplus, elite power might still be invested in agricultural production through tribute, taxation, and local demands of the regional markets. Archaeologists have sought to understand how surplus goods have been both generated and mobilized for political gain and control and alternatively how political control might influence production (Earle 2002: 1; Hirth 1996; Masson 2002). Often political economy is used to refer to how political institutions generate, use, and control surplus resources (Earle 2002:1; Hirth 1996: 204-205; Johnson and Earle 1987: 13, 2000; Levine 2007; Masson 2002: 2-4). Surplus is a concept that is often assumed and not well-defined (Webster 1985: 377). One definition of surplus is that which is “constructed by subtracting the biophysically minimal energy requirement from total energy production” (Webster 1985: 378). Wolf (1966) outlined “funds” of production include minimum fund (daily intake of calories for daily labor), replacement fund (daily intake of calories to maintain means of production such as tools and facilities or housing), ceremonial funds (reciprocal labor for religious or other activities), and fund of rent (production or labor of commoners that is appropriated by elites) (Webster 1985: 378-379). Surplus and markets were not necessarily influenced only by elite decisions, but also by the choices of individuals as to regional market in which to participate (Sheets 2000: 227-228).
Conclusions

Shifting views of population density and agricultural production have provided various accounts for the organization of agricultural production in the Maya area. Initial reconstruction of the Classic Period Maya world depicted small, dispersed populations supported by extensive maize *swidden* agriculture. In the mid-twentieth century archaeologists began to recognize that this model for the Maya was grossly inaccurate. Rather, population estimates suggested that during the Classic Period, the Maya world was filled with large, dense settlements of people who would have required a high degree of agricultural productivity to feed (Culbert and Rice 1990).

Following a reassessment of ancient population density, agricultural studies in the Maya area quickly shifted to documenting the types of agricultural intensification that might have been utilized such as terraces, home gardens, high-performance milpas, raised fields, or alternative crops. Archaeologists have identified the varied physical landscapes throughout the region with different soil quality, water availability, temperatures, and other edaphic conditions, and the varied array of agricultural strategies employed across these micro-landscapes (Fedick 1996a; Robin 2012).

Researchers are now questioning the political and social organization that created and was created by economic practices, such as agricultural production. Rather than simply documenting the type and extent of agricultural intensifications used by the ancient Maya, archaeologists are examining the role of such intensification strategies in the political economies. The majority of studies of Maya political economies are based on research of artifacts and domiciles but few incorporate direct agricultural data (Earle 1997: 1; Johnson and Earle 1987, 2000; Masson 2002). This emphasis is expected given the good preservation of pottery, ground-stone and chipped stone tools, and domiciles in comparison to agricultural remains.
Nevertheless direct agricultural data greatly inform discussions of the Maya political economy given that agricultural production and distribution were fundamental components of this economic and political system. As Lohse (2004: 117) articulated, “although our appreciation of the natural ‘mosaic’ within which the ancient Maya were situated has increased, it could be argued that our sensitivity to potential changes in the way people organized themselves to exploit different resources has not kept pace.” The degree to which individual households grew their own food for consumption or grew surpluses for exchange with other households, either in a formalized market system or informal system of trade and/or reciprocity remains unknown. The goal of this dissertation is to examine the political and social organization of agricultural production at Cerén. Models of ancient agriculture and the sociopolitical economy tend to shy away from examining specifically how the production of the past was organized and carried out at sites. Alternatively, studies of the Maya political economy do not readily clarify how agricultural production might have been influenced by social organization and political power.

Employing a sociopolitical economy approach, informed by practice theory, can afford greater insight into the social and political organization of production, the level of farmer autonomy in decision making, and the degree of elite control present in agricultural production. Theoretical consideration of social organization, community, household, practice theory, and agency influence our perspectives of the ancient Maya political, social, and economic worlds. This investigation into the sociopolitical economy examines the level of power and autonomy Cerén farmers had in production decisions, as well as the amount of influence nearby regional centers such as San Andrés might have had over agricultural production. The data from Cerén enrich and inform our knowledge of the quotidian practices of Maya communities and the articulation of the sociopolitical economies with agricultural production.
In Chapter 4, I present a brief description of research methodology, followed by a detailed review of the data collected from Cerén archaeological field seasons of 2007, 2009, and 2011. These data are organized into the categories of maize fields, manioc fields, cleared areas and platforms, *sacbe*, and a summary of related artifact and paleoethnobotanical research. The detailed analysis of these data afford the opportunity to examine the complex social, political, and economic practices intertwined with agricultural production to better assess the degree of control farmers had over their cultivation choices and examine the inter-workings of one Classic Period Maya community.
Chapter 4: Cerén Agricultural Production and Organization

Introduction

The research of this dissertation draws from three field seasons at Cerén, El Salvador conducted in 2007, 2009, and 2011. The Loma Caldera eruption (c. A.D. 630) that buried Cerén beneath 3 to 6 meters of volcanic ash resulted in not only the extraordinary preservation of earthen structures and artifacts, but also the agricultural fields and the forms of the plants once grown there (Sheets 2002b: 4-5). Data collected during these three field seasons included: maize and manioc agricultural remains, cleared areas (some of which were fallow or abandoned agricultural fields), an earthen sacbe (road), a small portion of a structure, and artifacts and paleobotanical remains from these contexts (Sheets et al. 2007; Sheets et al. 2012; Sheets and Dixon 2011). The agricultural data are presented here in detail followed by a brief summary of the other germane data collected during these excavations. The chapter begins with a brief synopsis of the three field seasons, a description of the data naming system for the site, and an overview of the data classification and methodology utilized in these excavations, before presenting the agricultural evidence and summarizing other related remains discovered in close proximity with the maize and manioc fields. This dissertation aggregates data from these three seasons to identify the number and extent of manioc and maize fields excavated to date at Cerén, as well as to compare and contrast plant cast data collected from these fields. These data substantially inform our understanding farmer autonomy, community non-royal governance, and organization of agricultural production at Cerén and in the Maya area.
Summary of 2007, 2009, and 2011 Field Seasons

A combined total of thirty-eight excavations were opened during these three field seasons, each of which is referred to as an operation. Six operations were conducted in 2007 (Test Pits 1-6), 18 operations in 2009 (Ops. North, South, East, West, and A-P, excluding Op E and N to prevent confusion), and 14 operations in 2011 (Ops. Q-AD) (Figure 4.1). The 2007 field season was aimed at investigating agricultural production in the region 200 meters south of the Cerén site center (Sheets 2007). Unexpectedly, this field season identified a small section of a manioc field with manioc beds that had been harvested just prior to the Loma Caldera eruption (Dixon 2007). These findings resulted in the 2009 project to explore the extent and intensity of manioc production at the site. The 2009 field season documented maize fields, cleared areas, and three manioc fields of which we were unable to locate the entire boundary of any of these fields (Sheets 2009b). Thus, we returned in 2011 to explore the area south of the Cerén structures and north of the known manioc fields to ascertain if manioc production continued into the site center.

The 2011 project identified diverse maize planting, cleared areas that included some possibly fallow or abandoned fields, a portion of an additional manioc field, the corner of a small structure, and the surprising discovery of an approximately 2 meter wide earthen *sacbe* (road) with formal drainage canals on either side (Sheets and Dixon 2011). Data presented in this dissertation are drawn from each of these field seasons and will first focus on the agricultural remains and then provide a brief summary of other evidence encountered in association with the agricultural fields.
Data Naming System for Excavations in 2007, 2009, and 2011

A modified operation-lot system was utilized to control Cerén data collection from previous field seasons. The Cerén site was given the designation of 295 during the Protoclassic Project that surveyed the Zapotitán Valley and this classification is assumed for all Cerén remains (McKee 2007: 135; Sheets 1983). Following previous site excavations we named operations for each pit excavated. To indicate a separation of these excavation within and to the south of the Cerén site boundary from those previously undertaken in the Cerén site center (McKee 2007; Sheets 2002a), we did not utilize the title of operation combined with a numerical
indicator (e.g., Op. 1) and instead used a variety of other naming mechanisms. This change allowed a distinction between the site center excavations conducted in the 1980s and 1990s and these excavations from 2007 and beyond. In 2007 excavations were designated Test Pit 1-6 and each one was 2 x 3 meters in size (Sheets et al. 2007). The initial excavations of 2009 were designated North, South, East, and West indicative of their positioning around Test Pits 1 and 2 of 2007, where manioc fields had been identified (Sheets 2009b). After the initial documentation of these four excavations, the remainder of the 2009 field season excavations utilized letter designation for operations (Operations A-P, excluding N and E, and including Ops. North, South, East, West). All of the eighteen 2009 operations were 3 x 3 meters in size, with some excavations being extended to include additional sub-operations (e.g. F-1 and F-2).

The 2011 naming designation followed that of 2009 and named the fourteen operations with letters, using double letters when needed (Q-Z; AA-AD) (Sheets and Dixon 2011). Each of the initial operations was 3 x 3 meters in size and in the case of Op. W an extension to the operation was added. Agricultural plant casts were each named with the operation number, the sub-operation number, a letter designating the cast, and a number designating multiple fragments of a likely same plant cast. These were all separated by hyphens (e.g., A-1-A-1). Given that few artifacts were excavated in each operation and there is excellent chronological control, these artifacts were named by Operation letter, sub-operation number, TBJ (Tierra Blanca Joven soil of the Cerén horizon, formed from the Ilopango eruption tephra), and a description of their type and when appropriate the location in the test pit (e.g., A-1-TBJ- Obsidian blade fragment found near NW corner of the operation). Few post-Classic remains have been found in our Cerén excavations, but when uncovered these were given a similar name of Operation letter, sub-operation letter, Post-Classic horizon, and a brief description.

The agricultural fields and plant casts form the evidentiary foundation of this dissertation. We have documented data pertaining to both maize and manioc plants and fields. The remains of agricultural plants consist of plant casts, some organic remains, and paleobotanical data.

Agricultural Plant Casts

The high degree of preservation of agricultural remains derives from the Loma Caldera eruption, namely the first few strata of tephra. The initial phase of the Loma Caldera eruption, now classified as Unit 1, was the result of magma contacting the water of the nearby Rio Sucio (Miller 2002: 15). When this event occurred it created a large steam explosion that pulverized magma into a fine-grained moist ash, Unit 1. This unit packed around structures, artifacts, agricultural fields, and agricultural plants and was ultimately responsible for the high quality of preservation at the site. The second tephra unit, Unit 2, deposited on Cerén was a small course-grained layer created when the eruption deposits temporarily dammed the river and more course materials were ejected from the eruption. The eruption continued with alternating wet and dry phases where wet phases creating the fine-grained tephra and dry phases the coarser materials. The Loma Caldera sequence is named in ascending order from the first tephra deposited on the Cerén living surface up to the last; therefore, during excavations we remove the units of tephra in descending order from Unit 14 to Unit 1 until we reach the Tierra Blanca Joven (TBJ) soil, which is the Cerén horizon (Miller 2002: 15-23).

This ash deposition has resulted in fine-grained preservation of agricultural data. While the plants have decomposed, they have left hollow cavities with the impressions of these plants conserved in the tephra of Unit 1. While excavating researchers meticulously looked for hollow cavities in the matrix and typically find these in Units 5 and lower. When a hollow cavity was
encountered it was filled with dental plaster, the area was pedestaled while the plaster sets, and then was excavated to reveal a plaster cast created from the mold of the plant’s void in the tephra (Sheets 2002a, 2006). This process allowed us to perceive the plant that was grown in this location c. A.D. 630. An identical process was followed when hollow cavities were found during the excavation within manioc beds, thus documenting the plants that were growing inside of the beds at the time of the Loma Caldera eruption (Dixon 2007, 2009, 2011a). Occasionally during the excavation of the plant casts some of the ancient organic materials were found encasing portions of the cast. These organic materials were collected in a sample and given to David Lentz for study.

**Analysis of Agricultural Plant Casts**

The dental plaster plant casts allow for a detailed view of the plants that were growing in Cerén fields at the time of the eruption (Figure 4.2). The analysis of these plants is essential but not without significant challenges. Cerén plant casts were each measured for length and diameter, which was measured in a minimum of two places, including the widest portion, on the cast and then averaged. The first methodological issue was dental plaster leakage. In some areas dental plaster had leaked out of the hollow cavity and into coarser materials, resulting in the distortion of the original plant form. When taking plant measurements I avoided any obvious areas of this occurrence and instead measured the actual plant cast. Throughout the course of each field season these data were entered into Microsoft Excel spreadsheets and organized according to provenience.
This dissertation research aggregates these data into separate proposed manioc and maize fields, allowing for better comparisons of different Cerén agricultural fields. The second methodological problem with analysis of these cast data is the issue of counting plants more than once. Unfortunately, due to the fragility of the plaster and the small cavities from the plant the majority of plant casts do not remain whole when excavated. To help correct for this issue, I
combined the manioc plant cast fragments that were known to be from the same plant by totaling the length and averaging the diameter of the plant casts. This step helped to ensure that manioc plants were not counted more than once in the overall averages and analysis of the data. Because multiple maize plants were excavated in single locations, this step was not possible for calculating the maize stalks. The average maize stalk diameter from each field is likely the most reliable data gleaned from these casts. The length of casts has been less useful given it is unclear if this length represents the actual height of the plant. In the case of Op. W, we measured plants casts while in situ which provided a better estimation of plant height for these maize fields. It is suggested that future research utilize measuring plant casts while in situ for height above the TBJ surface wherever possible to allow for more meaningful comparisons of plant height.

An additional methodological challenge faced by this research is that unequal quantities of fields were recovered in our excavations. Some excavations provided a much greater or lesser sample size of the association agricultural field than others and in some excavations the fields were only a small section of the actual excavated area (e.g. Op. S with the majority of the excavated area covering the sacbe and with a small portion of maize ridges bordering the sacbe). Thus, detailed quantitative analysis comparing field productivity is not appropriate. It was however possible to qualitatively describe the differences encountered in each field and the likely stage of production these fields were in at the time of the eruption.

**Agricultural Fields**

The plant casts were in situ in associated agricultural fields along the Cerén horizon ground-surface. These fields had ridges and furrows in the case of maize and large earthen beds in the case of manioc, all of which were made from packed TBJ soil. We developed standard measurements for fields that include measuring the height of ridges from the base of the furrow
to the top of the ridge and of the manioc beds from the base of the walkways between beds to the
top of one. We also measured the ridge-top to ridge-top spacing, or the wavelength, between
both the ridges and beds, recorded the magnetic orientation of the beds/ ridges, and documented
the slope of the furrow or walkway. Manioc and maize ridges were easily distinguishable from
one another given their difference is size and ridgetop to ridgetop spacing (Figure 4.3). Detailed
photography and mapping were conducted on each field and the loci of casts were recorded. We
also documented numerous field boundaries between fields of the same plant type (e.g., two
manioc fields), fields of different crops types (i.e. maize and manioc fields), and between fields
and cleared spaced (Figure 4.4) (Sheets and Dixon 2011).

Figure 4.3. Examples of Manioc Beds (Left) Compared with Maize Ridges (Right) (Photographs
by author)
Throughout these three field seasons we have relied upon the expertise of Dr. David Lentz and his graduate students, Angela Hood and Christine Hoffer, to identify both micro- and macro-botanical remains from excavation (Lentz and Hood 2009; Lentz and Hoffer 2011). Soil samples were collected from each excavation and in many cases multiple soil samples were taken within each excavation from important loci, including the *sacbe*, canals, agricultural fields, and cleared areas.

These samples allowed researchers to use water flotation to document small seeds and other plant parts that were not visible to excavators. The macro-remains (carbonized plant
materials) were collected during excavators or recovered after using a modified Apple Creek water flotation system (Pearsall 2000: 15; Sheets et al. 2012: 273). Samples of pollen and phytolith (silicaceous bodies from plant tissue) were also taken from these contexts. Microbotanical, particularly pollen, remains do not preserve well at Cerén possibly due to the high heat of the Loma Caldera tephra deposits (Sheets et al. 2012). Phytolith samples are now preferred for Cerén research given their greater tolerance of heat (Lentz and Hoffer 2011). Maize (Zea mays), palms (Sabal sp.), and a Cucurbita, possibly from a domesticated squash were all identified through phytoliths recovered from these excavations (Sheets et al. 2012). Starch grains have also been studied from Cerén, including from scrapings taken in 2011 from metates that were excavated in the site center during the 1980s and 1990s (Sheets 2002a). Starch grains diagnostic of maize but not manioc were identified, but the overall preservation of starch grains was also poor at Cerén (Sheets et al. 2012).

These data provide a solid foundation from which to examine farmer autonomy and the sociopolitical organization of agricultural production at the site.

**Manioc Farming**

The unquestioned assumption for primacy of maize in ancient Maya agriculture and diet has been challenged in the Maya area (Fedick 1996a; Gonlin and Dixon 2011), yet documentation of other agricultural remains continues to pose a challenge to archaeologists. As the paleobotanical analysis of this project suggests, some crops (e.g., manioc) might not readily preserve in the archaeological record of the Maya (Sheets et al. 2012: 260-261). While root crops, and in particular manioc, had been hypothesized decades ago as one possible additional staple to the Maya diet (Bronson 1966), little direct evidence for manioc cultivation has been recovered, potentially due to taphonomic processes. Thus, the ability to investigate manioc
fields at Cerén affords a rare and key opportunity to learn about ancient Maya agriculture (Sheets 2009b; Sheets and Dixon 2011; Sheets et al. 2007; Sheets et al. 2012).

Fields dedicated to manioc cultivation were first discovered in 2007 located 200 meters south of the Cerén site center (2007 Test Pits 1 and 2) (Dixon 2007) (Figure 4.5). These data combined with that of the 2009 and 2011 field seasons afford direct evidence for intensive manioc production at Cerén. To date portions of four different manioc fields have been recorded (Manioc Fields 1-4) all of which were constructed by the accumulation of TBJ soil into large, long raised beds. While we have documented some boundaries for these four manioc fields and projected others, the full extent of the field boundaries is currently unknown for any of the four fields (Figure 4.6).
Figure 4.6. Map showing the location of Manioc Field 1-4 and Fallow Manioc Fields (Created by Raining Wang)
Each of these fields had been harvested just prior to the Loma Caldera eruption. It is likely these fields were harvested very recently before the eruption given that the eruption is estimated to have occurred around August, during the rainy season when rains typically fall each afternoon (Sheets 2002b: 1) and that the micro-features of the earthen beds show no evidence of rain or erosion (Sheets et al. 2007). Given documentation of a few small manioc plants growing on the Cerén surface both in the site center and three small plants in Ops. K and P, we are confident that the lack of above-surface manioc plants in these fields is due to the fact that there were no manioc plants growing above the TBJ surface in these beds at the time of the eruption. Furthermore, the manioc beds show areas with depressions that appear similar to the depressions left when manioc is uprooted in harvest today (Figure 4.7). The depressions also suggest that the manioc plants were harvested by uprooting the entire plant at once, rather than digging out the roots by hand. This offers evidence that likely two or more people would have harvested the plant from the bed.

Figure 4.7. Cerén Manioc Bed with Arrow Pointing to a Depression Left from Harvesting (Photograph by author)
One calculation estimates that this region would have produced approximately 10 tons of harvested manioc roots (Sheets 2009b; Sheets et al. 2012: 273). Given this quantity and that manioc roots rot within a few days of removal from the ground, it is inferred these roots were immediately sold, traded, processed, or a combination of these activities. One possible processing method would be grinding manioc into flour, known in the region today as *almidón*, which can be stored for a year or longer (Dixon 2009; Sheets 2007, 2009b; Sheets et al. 2012).

**Summary of Manioc Data**

The average size of the manioc beds were approximately 20 cm wide, an average of 32 cm in height, and spaced an average of 115 cm from ridge-top to ridge-top. It is noteworthy that the size and shape of these raised beds remained consistent within each field but variation was shown between the shape and style of manioc beds of at least two fields. This difference has been interpreted as two different manioc planting styles. Based on the style of manioc planting, the height of the manioc beds ranged from an average of 23 cm to 41 cm. Multiple field boundaries have been identified between separate manioc fields, between manioc and maize fields, and between manioc fields and cleared areas (Sheets 2007, 2009b; Sheets and Dixon 2011). Each of the four fields, as well as all but one of the fallow fields that was previously cultivated with manioc, had a standard orientation that ranged from 117° to 125°, and an average magnetic orientation of 121°. These fields drain toward the nearby Rio Sucio. The construction of raised beds combined with this drainage pattern would be beneficial for manioc growth in the region, given manioc’s aversion to excess moisture (Cock 1982; Dufour 1994).

The four recently harvested manioc fields were in close proximity, located approximately 200 meters south of the center of the Cerén site. Pertinent data from each of the four fields will be outlined here and the fallow manioc fields will also be discussed.
**Manioc Field 1**

Field 1 is the first manioc field discovered at Cerén and was located furthest to the north and west of these four fields (see Figure 4.6). Field 1 is the most extensively documented section of Cerén manioc cultivation to date. Portions of Manioc Field 1 were identified in Test Pits 1 and 2 of 2007 and in Ops. North, D, F-2, H, I, J and the western portions of Ops F-1, G, L-1, L-2, and L-3 (Dixon 2009).

**Field Boundaries of Manioc Field 1**

Sections of the eastern and western boundaries of Manioc Field 1 were located. The western border of Manioc Field 1 was marked by the distinct termination of the manioc beds and a beginning to a cleared area, possibly a built up platform (documented in Ops. D, J, H) (Figure 4.8). This western boundary formed a clearly distinguishable edge to Manioc Field 1 that was aligned approximately 30° (Dixon 2009). The eastern boundary of Manioc Field 1 was more complex, with a distinct termination of the manioc and the beginning of a maize field along the northern portion of this boundary (documented in Ops. G, L 1-3) and a transition to another manioc field along the southern portion of the boundary (documented in Op. F-1) (Figure 4.9). Along this boundary we found manioc production in the west and maize production in the east.

Evidence of maize was found throughout the eastern fields of Ops. G and L 1-3, but in the southernmost area of the eastern field of Op. L-3 a manioc stalk was identified extending above the TBJ surface (Cluster 1 of Op. L-3). The stalk was approximately 10 cm in height, 2.4 cm in diameter, and had nodes and leaf scars that were indicative of manioc, specifically the diagnostic spiral pattern of the nodes along the stalk (Sheets et al. 2012: 276). It is expected this ridge marked the actual border between the maize cultivation in the north and the manioc cultivation of Manioc Field 2 in the south, although it is also possible that this was a single
manioc plant volunteer that was from either Manioc Field 1 in the west or Manioc Field 2 in the south.

Figure 4.8. A Portion of the Western Boundary of Manioc Field 1 Showing the Abrupt Termination of Manioc Field 1 Beds and the edge of a Cleared Areas (Photograph by author)
The southern section of Manioc Field 1’s eastern boundary was divided between Manioc Field 1 in the west and Manioc Field 2 in the east. This boundary was clearly identifiable as the beds of Manioc Field 1 met the walkways in between the manioc beds of Manioc Field 2 (Dixon 2009) (see Figure 4.6). This boundary was approximately perpendicular to the direction of the manioc beds, and had an approximate orientation of 30°. The boundary seamlessly connected with the boundary between Manioc Fields 1 and 2 and formed a continuous land-use line along the edge of Manioc Field 1 and Maize Field 1. These boundaries allow for a better understanding of the size of Manioc Field 1 and show that it was bordered to the west by a cleared area, possibly a constructed activity area, and to the east by a maize field in the north and
an additional manioc field, Manioc Field 2, in the south. The eastern to western extent of Manioc Field 1 was therefore distinguishable and measured 15 meters.

The northern and southern boundaries of Manioc Field 1 are still unknown. Excavations in Op. H provided the northern-most area of the field documented to date. The southern-most section yet documented of Manioc Field 1 was found in Op. F-1 and F-2. Based on the area between the sections of manioc cultivation documented in Op. F to the south and Op. H to the north, Manioc Field 1 extended a minimum of 40 meters from north to south (Dixon 2009).

*Beds of Manioc Field 1*

The manioc beds of Manioc Field 1 were uniform in size and shape with an average height of 21 cm and an average ridge spaced of 114 cm. These beds were all aligned to an average magnetic orientation of 120°. The beds were constructed with raised, almost vertical sides that peaked in a wide-flat bed top. The width of the top portion of the beds was approximately 45-50 cm (Dixon 2009) (Table 4.1). This form is recognizable when compared with that of Field 3, discussed further below. The manioc beds throughout Manioc Field 1 had been harvested just prior to the eruption. Evidence strongly suggests that the manioc was harvested by pulling the plant from the ground, which can result in multiple roots breaking off and being left in the ground during this kind of harvesting (Cock 1985).

<table>
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<th>Manioc Field #</th>
<th>Year Excavated</th>
<th>Magnetic Orientation (°E of mag. N)</th>
<th>Avg. Ridge-top Spacing (cm)</th>
<th>Avg. Bed Height (cm)</th>
<th>Avg. Slope (cm)</th>
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<td>2007: Test Pits 1 and 2</td>
<td>120</td>
<td>114</td>
<td>21</td>
<td>7</td>
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</table>

Table 4.1. Manioc Field 1 Bed Data
The numerous plant casts found growing inside of these beds evidently represent those that broke off during harvesting. Furthermore, this method of harvesting leaves a depression in the planting bed, such as those seen along many of the beds throughout Manioc Field 1 (e.g., Ops, North, D, H, I, F, L). These depressions and the few number of manioc stalks found indicates that the majority of this field had been harvested but not re-planted prior to the eruption. Of interest is that the manioc beds in Test Pits 1 and 2 did not show the depression and damage that other beds of this field did. The manioc beds of Test Pits 1 and 2 were more uniform in construction and were replanted, given the presence of a stalk in the beds (see Figure 4.5). These findings might show portions of the field where the replanting effort had begun.

*Plant Cast Assemblage of Manioc Field 1*

Approximately seventy-three manioc plant casts were recovered from this manioc field. These were identified as stalk fragments, roots, and unidentified plant fragments, likely manioc given their provenience and the lack of any distinguishable other plant type found in the ridges. A total of five stalk fragments, 32 manioc root fragments, and 42 unidentified manioc fragments were documented (Table 4.2). The high ratio of root and unidentifiable fragments to that of the lower numbers of stalks present is likely due to the nature of the manioc plant itself and the process of harvesting. Above the ground surface a manioc plant consists of a stalk with distinct nodes and large leaves, but beneath the ground the stalk typically connects with the original stalk from which it was grown, as well as roots (Figure 4.10). The ratio of few stalks and roots found in Manioc Field 1’s (and the other manioc fields at Cerén) plant cast assemblage is likely a result of the harvest. The few stalks found had the distinctive manioc nodes and leaf scars visible and were probably those left in the bed for the next cycle of growth, those that were originally planted, or those left in the ground for continued growth.
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Test Pits 1 and 2; Ops North, D, J, I and the western portions of G, L1-3, F1 and all of F2</td>
<td>7</td>
<td>9.5</td>
<td>1.8</td>
<td>63</td>
<td>60</td>
<td>6.4</td>
<td>2</td>
<td>118.2</td>
<td>2.9</td>
<td>most well documented manioc field at Cerén</td>
</tr>
<tr>
<td>2</td>
<td>F-1 (eastern portion)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>35</td>
<td>22.5</td>
<td>immediately east of field 1 and south of maize field 2</td>
</tr>
<tr>
<td>3</td>
<td>K and South</td>
<td>2</td>
<td>130.2</td>
<td>3.2</td>
<td>7</td>
<td>51.6</td>
<td>4.7</td>
<td>9</td>
<td>38.7</td>
<td>5.2</td>
<td>Very large beds- atypical of the style of other beds</td>
</tr>
<tr>
<td>4</td>
<td>AA</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1 large root (with 5 fragments)</td>
<td>72.3 (total length)</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>The south-western corner of the field (small portions of 2 beds- very poorly cast (wet casts)</td>
</tr>
<tr>
<td>5</td>
<td>A and C only</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>15</td>
<td>47.4</td>
<td>7</td>
<td>12</td>
<td>15</td>
<td>2.8</td>
<td>ABANDONED FIELD Does not include Test Pits 3 and 4 or Ops M, or West data; two likely weeds included in plant casts</td>
</tr>
<tr>
<td>6</td>
<td>AB and AC</td>
<td>1</td>
<td>2.4</td>
<td>1.6</td>
<td>2</td>
<td>20.9</td>
<td>6.7</td>
<td>1</td>
<td>7.4</td>
<td>3.5</td>
<td>Abandoned field- two weeds also found (avg. length 5.5; avg. diam. 5cm)</td>
</tr>
</tbody>
</table>

Table 4.2 Comparison of Field Averages for Manioc Field Plant Cast Assemblages
The few roots were presumably those that broke off during the harvesting process. The average stalk diameter from Manioc Field 1 was 1.7 cm, which is somewhat smaller than the stalk diameter of manioc casts found elsewhere at Cerén. The average stalk length of these casts was 13.7 cm, which is similar in size to the 10 cm stalk stakes that are often used to re-plant manioc (Cock 1985). Some of these stalks were possibly re-planted for the next cycle of growth, though given the small number of stalk fragments present in the plant cast assemblage and the non-uniform shape of the manioc beds from the field, it appears that the majority of Manioc Field 1 had been harvested but not replanted.

Figure 4.10. A Harvested Manioc (*Manihot esculenta* Crantz) Plant
(Photograph by author)
Manioc Field 2

Only a very small portion of Manioc Field 2 was documented (see Figure 4.6). This field appeared to have been constructed similarly to the beds of Manioc Field 1, though a field boundary clearly marked a separation between these two manioc fields. A portion of Manioc Field 2 was documented in the eastern portion of Op. F-1 and possibly in the very southern-most ridge of Op. L-3, given the presence of a manioc plant in this location (Figure 4.11). Based on the limited excavation in this precise area it is unclear if the manioc plant and associated ridge were a manioc bed or a maize ridge, though clearly the boundary between Manioc Field 2 and the maize field to the north was located nearby.

Figure 4.11. Western Boundary of Manioc Field 2 (Bottom) with Manioc Field 1 (Top) (Photograph by author)
Manioc Field 2 Boundaries

Manioc Field 2 had a known western boundary of Manioc Field 1 and had a northern boundary of Maize Field 2. In Op. F-1 the southern two beds of Manioc Field 2 were the typical height for manioc at Cerén, approximately 34 cm, yet the northern manioc bed was only 16 cm in height (Dixon 2009). It is likely that this smaller manioc bed marked the transition area between Manioc Field 2 and the Maize Field 2 to the north. The presence of a manioc plant in the southern-most ridge of Op. L-3, just north of Op. F-1) further supports this interpretation. Since very little of Manioc Field 2 has been excavated the western and southern boundaries of this field are still unknown. Despite this a third manioc field was approximately eight meters south of Manioc Field 2. This third manioc field was marked by a very different form of manioc bed construction, leading to the interpretation that the fields of Manioc Field 2 terminate somewhere five to eight meters south of their documented location. It is unknown how far these beds would have extended to the east, as it might have been a narrow but long field shape.

Beds of Manioc Field 2

Only small portions of three manioc beds were identified for Manioc Field 2. These beds had an average height of 25 cm, a ridge-top to ridge-top spacing of 114 cm, and were oriented 119° (Table 4.3). The beds were constructed in the same form as those of Manioc Field 1, with near-vertical sides and a broad, flat top to the bed. Like the other beds, these has been harvested just prior to the Loma Caldera eruption (Dixon 2009: 78), though it is difficult to determine if the beds had been replanted before the eruption given the small sample size of each manioc bed in Manioc Field 2.

Plant Cast Assemblage of Manioc Field 2

Only two plant casts were recovered from Manioc Field 2. One of these was a manioc stalk fragment that was 17.6 cm long and had an average diameter of 2.4 cm. The other manioc
plant fragment was 35 cm in length and 22.5 cm in diameter, and is suspected to be manioc root given its size and location in the manioc bed (see Table 4.2). It is unsurprising so few casts were recovered given the same portion of the field exposed.

<table>
<thead>
<tr>
<th>Manioc Field #</th>
<th>Year Excavated</th>
<th>Magnetic Orientation (°E of mag. N)</th>
<th>Avg. Ridge-top Spacing (cm)</th>
<th>Avg. Bed Height (cm)</th>
<th>Avg. Slope (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2009: Op. F-1 (eastern portion) and L-3 (one plant)</td>
<td>119</td>
<td>114</td>
<td>25</td>
<td>6</td>
</tr>
</tbody>
</table>

Table 4.3. Manioc Field 2 Bed Data

Manioc Field 3

Manioc Field 3 was located southeast of Manioc Fields 1 and 2 and was unlike the other manioc fields found thus far at Cerén. The different shape and large size of the manioc beds in Manioc Field 3 were located in Op. South and Op. K (Dixon 2009) (Figure 4.12). The uniformity of bed shape in this field and the presence of long roots and stalks in the planting beds suggested that this field had been harvested and replanted recently before the Loma Caldera eruption. While the replanting of the beds might partially explain their larger size than other manioc beds at Cerén, the shape of the bed is not explained by the replanting. Therefore, these beds have been designated as a separate field from Manioc Field 2. No known function for the different bed shapes has been identified. The slope in the area of Manioc Field 3 is no different from that of other areas of manioc cultivation that utilize a different bed shape, thus we do not believe these different styles were used as erosion control.
Figure 4.12. Manioc Bed Style A [avg. height 22 cm; avg. spacing 113 cm] (Left) Compared with Manioc Bed Style B (Right) [avg. height 40 cm; avg. spacing 143 cm] (Photographs by the author)

Field Boundaries of Manioc Field 3

None of the four field boundaries of Manioc Field 3 have been discovered, though the northern boundary can be projected given the presence of manioc beds in Manioc Field 2 that were of a different size and construction than those of this field (see Figure 4.6). At a maximum, the northern boundary would be located approximately five meters north of Op. South, yet given the beginning of an additional manioc field in Op. F-1 it is likely the northern boundary was close to the beds in Op. South. We have no current indication of the extent of Manioc Field 3 to the west of Op. South, nor to the south or west of Op. K. There are no confirmed boundaries to this field, but we know that it minimally extended 18 meters east to west and 10 meters north to south given the spacing between Ops. South and K. Additionally, the western boundary of Manioc Field 4 (discussed below) likely extended north and might have formed the eastern boundary of Manioc Field 3. This projected boundary was approximately 40 meters east of Op. K, which would mean if this field boundary did continue to that location then the distance of Manioc Field 3 would have an estimated east to west extent of approximately 60 meters.
Beds of Manioc Field 3

While the beds of Manioc Field 1 and 2 were broad, flat-topped and approximately 50 cm in width, the shape of the beds in Manioc Field 3 were very different. First the average height of the manioc beds in Manioc Field 3 was 40 cm, almost double the height of the beds in the other Cerén manioc fields. These beds were more sine-wave shaped in a cross-section view (Figure 4.13). The beds peaked into a narrow width, approximately 20-25 cm, and had steeper sloped sides. The beds of Manioc Field 3 were also spaced further apart than other manioc fields at Cerén, with an average ridge-top to ridge-top spacing of 143 cm (Table 4.4). The beds of this field were oriented approximately 122°. Long stalks and roots within the manioc beds suggest that these had already begun to grow (Dixon 2009).

Plant Cast Assemblage of Manioc Field 3

One small manioc stalk was found above the ground surface in Op. K and appears to be either early regrowth of the next cycle of planting or an immature stalk left to grow through another cycle (see Table 4.2). The diameter of the manioc stalk in Op. K was 2.7 cm. This stalk connected with a long root that extended throughout the middle bed of Op. K (Figure 4.14). In addition to this manioc stalk fragment, another clearly identifiable manioc stalk was found from Manioc Field 3. These stalks had an average length of 20.3 cm and an average stalk diameter of 5.4 cm. There were seven larger manioc root fragments that had an average diameter of 3.9 cm, some of which were very long, with an average length of 93 cm (See Table 4.2). The few roots in the beds indicate that the harvest had taken place, yet the uniform and maintained edges and top of the manioc beds suggest these beds had already been replanted and were beginning another round of manioc growth.
Table 4.4. Manioc Field 3 - Bed Data

<table>
<thead>
<tr>
<th>Manioc Field #</th>
<th>Year Excavated</th>
<th>Avg. Ridge-top Spacing (cm)</th>
<th>Avg. Bed Height (cm)</th>
<th>Ave. Slope (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>2009; Ops. South and K</td>
<td>143</td>
<td>40</td>
<td>6</td>
</tr>
</tbody>
</table>

Figure 4.13. Profile of Style A Manioc Bed (Right) Compared with Profile of Style B Manioc Bed (Left) (Photographs by Payson Sheets)
Manioc Field 4

A small section of Manioc Field 4 was located in Op. AA from the 2011 field season. Only limited portions of two beds were visible but the location and the style of the beds indicate that this was likely an additional Cerén manioc field (see Figure 4.2). Two cleared areas, one
with natural topography and the other that had been deliberately flattened, as well as a small section of a structure, Feature 1, were identified in association with Manioc Field 4.

Field Boundaries of Manioc Field 4

The small section of Manioc Field 4 identified was the southwestern corner of the field, thus providing evidence for both the southern and western boundaries of Manioc Field 4. If projected approximately 5 meters north of the Op AA excavation, the western boundary of Manioc Field 4 was located approximately 40 meters to the east of Op. K. This manioc field appeared to be distinct from Op. K not only because of this field boundary but also the style of the beds appears to mirror that of Fields 1 and 2 (Dixon 2011a) (Figure 4.15). The southwestern corner of Manioc Field 4 was marked by a cleared space to the west of the field that mimicked the natural topography of the region and a cleared space to the south that had been intentionally flattened and smoothed (Dixon 2011a; Halmbacher 2011). The flattened cleared area was possibly an activity area associated with the feature west of the area, which was a small portion of a structure.

Feature 1

Feature 1 of Op. AA was the northeast corner of a structure, with preserved thatch roof and charcoal beams above the corner of a clay platform (Figure 4.16). Only a small portion of the structure was visible in this excavation. As with previous structures at Cerén, the carbonized wood from the beams and the thatch was preserved by the tephra of Loma Caldera Units 1 and 3 (Sheets 2002b: 1). No walls were identified and we speculate that this could have been a domestic or storage facility, though without further excavations the structure’s function remains unknown (Sheets and Dixon 2011).
Figure 4.15. Op. AA with Manioc Field 4 (bottom left), Flattened and Cleared Area (top left), Feature 1 (top right), and Natural Topographic Cleared Area (bottom right) (Photograph by author)

Figure 4.16. Feature 1 in Op. AA with Carbonized Beams and Thatch (upper right) (Photograph by author)
Associated with Feature 1 were lithic, ceramic, and plant remains. Two complete prismatic obsidian blades were found within the thatch, signifying these items were being stored in the roof at the time of the eruption (Sheets 2011a). Domiciles and storage facilities within the Cerén site have shown similar evidence of obsidian prismatic blades storage (Sheets 2002d: 140, 2006). Usewear analysis indicates the blades had very little use and were likely recent additions to the tool kit of these individuals (Sheets 2011a). Also found in this region were a large ground stone artifact and a large ceramic vessel, likely an olla (ceramic jar for liquid storage) (Sheets 2011b; Sheets and Dixon 2011). Two additional plant casts were found in association with Feature 1 (Plant Casts A and B), one of which was classified as a maguey (agave) plant (David Lentz personal communication, 2011). The presence of a field structure or additional domestic or public structures in this region has implications for the settlement patter of the site and the organization of the agricultural landscape.

**Beds of Manioc Field 4**

Small sections of two manioc beds were identified in Manioc Field 4. These beds were oriented approximately 122° and had an average ridge-top to ridge-top spacing of 91 cm. The beds had an average height of 21 cm and were constructed with vertical walls and a broad flat top of the bed that was approximately 40 cm in width (Table 4.5). This style was similar to that of Manioc Fields 1 and 2. The lack of plant casts above the TBJ surface indicates that the beds were harvested prior to the eruption, but the small sample size of the field makes it difficult to ascertain if the beds had been re-planted.
Similar to most of the other manioc beds at Cerén, there were no plant casts above the TBJ living surface, indicating that the region had been recently harvested prior to the eruption. Unfortunately the ground in this area was very wet and the plaster did not set well. Thus there was only one large root, likely manioc, identified in one of the beds. The plant cast had a total length of 72.3 cm and an average diameter of 3.5 cm (See Table 4.2). The cast appeared to have been various roots but the preservation condition of the cast made identification difficult (Dixon 2011). There was significant organic material surrounding this cast and it was collected but unfortunately turned out to be unidentifiable. The striations in this organic material appear similar to manioc, but were not able to be confirmed. The size and shape of the beds, the appearance of large roots, and these organic data all support the interpretation of these beds as manioc cultivation (Dixon 2011).

**Fallow Manioc Fields**

One type of cleared area found at Cerén was that of fallow fields, specifically what appear to have been manioc beds, and in one case a maize field no longer in cultivation. Fallow fields were those where fields are scarcely visible on the ground surface and were clearly not being maintained as planting beds. These were fields that had been eroded, though sometimes were kept clear of weeds. These fields were areas where manioc had probably been grown an estimated six months or more prior to the eruption and where beds were not replanted or

<table>
<thead>
<tr>
<th>Manioc Field #</th>
<th>Year Excavated</th>
<th>Magnetic Orientation (°E of mag. N)</th>
<th>Avg. Ridge-top Spacing (cm)</th>
<th>Avg. Bed Height (cm)</th>
<th>Avg. Slope (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>2011: Op. AA</td>
<td>122</td>
<td>91</td>
<td>21</td>
<td>Unable to recover</td>
</tr>
</tbody>
</table>

Table 4.5. Manioc Field 4- Bed Data
Two different fallow manioc fields have been documented at Cerén with some evidence for a potential third.

**Probable Manioc Field 5 (fallow)**

A fallow manioc field was located in 2009 in Ops A and C (see Figure 4.6; Figure 4.17). This field had beds that were on average spaced 105 cm from ridge-top to ridge-top, were an average of 8 cm in height, and were oriented to 120° (Dixon 2009; Maloof 2009) (Table 4.6).

![Figure 4.17. Plan View of Op. A. Fallow Manioc Beds and Plant Cast Locations (Image by George Maloof 2009)](image)

<table>
<thead>
<tr>
<th>Manioc Field #</th>
<th>Year Excavated</th>
<th>Magnetic Orientation (°E of mag. N)</th>
<th>Avg. Ridge-top Spacing (cm)</th>
<th>Avg. Bed Height (cm)</th>
<th>Avg. Slope (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>2009: Ops. A and C</td>
<td>120</td>
<td>105</td>
<td>8</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 4.6. Manioc Field 5- Bed Data

The similar small height of the beds, their spacing, stage of erosion, and location all suggest this was one continuous planting area that was no longer in cultivation at the time of the
eruption. Included in the plant casts recovered from Manioc Field 5 were two weeds indicating the lack of maintenance for these beds. Four additional operations documented fallow agricultural fields that might be a continuation of Manioc Field 5 but given the tenuous classification of these operations as part of the field, they were not incorporated into average bed or plant cast measurements for Manioc Field 5. Of these four operations Op. West is the most probable extension of Manioc Field 5 with fallow beds oriented to 118° and spaced 100 cm from ridge-top to ridge-top were located in Op West (Maloof 2009; Dixon 2009). The fallow ridges in Op. M from 2009 are possibly another extension of this fallow manioc field. These beds were significantly eroded, but oriented approximately 125°, were 1.5 cm in height and spaced approximately 150-160 cm apart. The highly eroded nature of these beds made them more difficult to record (Dixon 2009; Maloof 2009).

*Manioc Field 6 (fallow)*

The documented section of Manioc Field 6 consisted of fallow beds that were perceptible along the cleared ground surface of Ops. AB and AC from 2011 (Figure 4.18). This field had beds that were oriented to an average of 118° and were spaced an average of 103 cm (Table 4.7). A significant height difference was present for these beds when measured from the south side of the ridge versus the north. As measured from the northern end (the down-slope side) the beds were considerably taller (average 23 cm in height), but when measured from the area south of the bed there was very little elevation (average of 3 cm in height). This is likely due to both the ground slope of the region’s topography and also a feature of erosion from greater run off (Dixon 2011a). A manioc plant was identified growing in Manioc Field 6 and two roots, likely manioc, were also recovered from the field. These manioc plants were likely volunteer plants.
Moreover, two weeds were also cast and offer further evidence that the field was not in active cultivation when the eruption took place (Dixon 2011a).

Figure 4.18. Fallow Manioc Field 6 in Op. AC
(Photograph by author)

<table>
<thead>
<tr>
<th>Manioc Field #</th>
<th>Year Excavated</th>
<th>Magnetic Orientation (°E of mag. N)</th>
<th>Avg. Ridge-top Spacing (cm)</th>
<th>Avg. Bed Height (cm)</th>
<th>Avg. Slope (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>2011: Ops. AB and AC</td>
<td>118</td>
<td>103</td>
<td>3 cm (from up-slope); 23 cm (from down-slope)</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 4.7. Manioc Field 6- Bed Data

*Possible Previous Manioc Field (fallowed)*

Fallow manioc beds were potentially visible in Test Pits 3 and 4 of 2007. Unfortunately only the spacing between the ridges, on average 115 cm, was recorded from Test Pits 3 and 4.

Other possible evidence for previous manioc cultivation was identified in a portion of one fallow field in Ops Y and AD excavated in 2011 (see Figure 4.6). A fallow field, possibly from manioc cultivation, was documented in the northern portion of Op. AD and the beds appeared to terminate into a cleared area. The average magnetic orientation for these beds was 35° and each
bed was largely eroded with a height of only 2.5 cm (Dixon 2011a). This northern field had ridges with an average height of 12.5 cm and an average spacing of 99.3 cm from ridge-top to ridge-top. This spacing is much more typical of manioc beds but maize plants were found growing in this region. The spacing and size, particularly the height, of these ridges indicate that these might have been fallow manioc beds. Furthermore, a plant cast of a manioc root was located in one of the fallow beds.

Located approximately 12 meters to the west of Op AD was Op. Y. The field boundary of the Op AD beds continued into Op Y, where maize ridges were found in the southern end of the operation and larger spaced and differently oriented ridges were found in the northern end of the excavation, forming a continuation of the boundary from Op. AD (Dixon 2011a; Lamb and Heindel 2011). The Op Y northern field was planted with maize, but given the spacing of these beds it is possible the field was previously used for manioc cultivation. These data suggest that an abandoned manioc field was being re-purposed for maize cultivation in this region (Dixon 2011a; Lamb and Heindel 2011). If this is evidence for a re-purposing of manioc fields for maize, it is an important reminder that field boundaries might have been fluid and cultivation of crops as dynamic as the lives of their farmers. The presence of these fallow agricultural fields help us identify that rather than being static and unchanging, agricultural fields, like all space, were negotiated and changed through time as the needs of individuals of that society changed.

Also in the 2009 field season researchers documented manioc plant casts in Op. P, located north of Manioc Field 4 and approximately 34 meters east of Manioc Field 3. Op. P revealed an area that had been mostly kept clear of vegetation, with a cleared area that followed the natural topography of the ground surface and in the southwest corner of the excavation a carefully leveled, flat surface, possibly a small platform (Maloof 2009) (Figure 4.19).
The two manioc plants, possible volunteers bordered the northeastern boundary of the leveled space in an approximate alignment of 120°. The southeastern side of the level space was framed by a squared mass of pre-TBJ clay rich soil that was 45 x 65 cm and averaged 25 cm in thickness (Maloof 2009: 45; Sheets et al. 2012: 266). It appears this mass stood as a clay block or pillar that formed a field boundary marker oriented 30°, approximately perpendicular to the manioc plants (Maloof 2009: 45). The clay feature had been slightly eroded by the rains but was still a clear separator of spaces, though it was not maintained, perhaps indicating it had served as an initial marker that was no longer as crucial to the separation of space. Nevertheless, the orientation of the block at a right angle with the manioc plants, in an alignment that mimicked the dominant architectural and agricultural magnetic orientation for Cerén strongly indicates this block was not only purposefully constructed but also meaningfully placed.
To the northeast of this feature we documented what appeared to be a shallow botanically rich midden (Maloof 2009: 46-47; Lentz and Hood 2009: 107). There was an abundance of charcoal, an unusually large quantity of carbonized beans, both the common (*Phaseolus vulgaris*) and lima beans (*Phaseolus lunatus*) variety, some maize kernels (*Zea mays*), and a possible squash rind (*Cucurbita sp.*) (David Lentz personal communication, 2009). Additionally some ceramic sherds, obsidian blade fragments, and *laja* (flat stone) fragments were also recovered from this small midden (Sheets 2009b: 86). The leveled surface had been intentionally coated with a layer of TBJ tephra approximately 6 cm thick and the midden was also covered with TBJ tephra indicating that it was not currently used as a midden at the time of the eruption. The two manioc plant casts were not planted in any ridges, had an average length of 14.5 cm, and an average stalk diameter of 2.6 cm (ranging from 1.4 cm and 4 cm) (Dixon 2009: 75). While it is possible that the manioc stalks were volunteers, given the location of the plants along the northern portion of the flattened surface, it seems more plausible the manioc stalks were used to mark a boundary of this feature.

The presence of large beds devoted only to manioc cultivation, the diversity of manioc production, and the quantity of manioc fields offer key insight into the importance of this crop to ancient Cerén farmers. A comparison of the beds from the four active and two, possibly three inactive manioc fields shows two different styles of manioc planting at Cerén, all of which had been recently harvested prior to the eruption (Table 4.8). Manioc was an important part of Cerén cultivation, which also focused on maize agriculture.
Table 4.8: Comparison of Manioc Bed Data per Field

Maize Farming

Maize (*Zea mays*) has long been considered a central component of ancient Maya agriculture and a staple to the diets of many during the Classic Period. At Cerén maize fields have been documented surrounding the central structures of the site and in the regions south of the site center (Sheets and Woodward 2002; Sheets et al. 2007; Sheets 2009b). The maize fields recorded during the 2007 to 2011 field seasons demonstrated continued maize cultivation south of the site center and a diversity of maize planting not previously known for Cerén.
**Summary of Maize Data**

Maize ridges found throughout Cerén and to the south of the site center generally had a ridge-top to ridge-top spacing of 70 to 90 cm, were typically 10 to 15 cm in height, and had the shape of a shallow sine-wave. Excavations within the Cerén central region have encountered eight maize milpas surrounding the site center (Sheets and Woodward 2002: 184-186). Many of these plant casts revealed maize stalks doubled over with maize cobs still attached. This doubled-over maize is a common agricultural harvesting technique to allow the ear of maize to dry (Tetlow 2009: 9). The average height of maize casts in the site center was 50-80 cm and the mature maize ears recovered were 15-20 cm in length (McKee 1990).

Portions of nine maize fields have been documented in the region south of the site center (Dixon 2007; Tetlow 2009; Lamb and Heindel 2011) (Figure 4.20). These fields vary in their stages of growth and in their planting styles. Two main styles of maize planting have been found at the site. The most common style of maize planting is that of formal ridges. The less common style of maize planting also involves the use of ridges, but with small inter-ridges between the less formal maize ridges and in some cases the use of mounds around maize plants. The inter-ridges were likely an artifact of the ridge construction technique used for these fields (Figure 4.21). The following section compares the ridges and plant casts of these fields.
Figure 4.20. Map of Maize Fields 1-9 and Fallow Field
(Map Prepared by Raining Wang)
Maize Field 1 (2007 Test Pits 5 and 6)

A maize field located south of Cerén was identified in Test Pits 5 and 6 excavated in 2007 (see Figure 4.20). The maize ridges were oriented an average of 125°, were spaced an average of 80 cm from ridge-top to ridge-top with an average height of 12 cm (Dixon 2007) (Table 4.9). This field was estimated to be juvenile maize given the small size of maize stalks, with an average stalk diameter of 1.5 cm and the recovery of only two maize ears, which were approximately 4 cm in diameter but described as small in size (Dixon 2007) (Table 4.10). There were regularly two to four plants per location in Maize Field 1, the maize plants were not bent over for harvest, and it is estimated this field was a few weeks away from full maturity.
<table>
<thead>
<tr>
<th>Maize Field #</th>
<th>Year Excavated</th>
<th>Magnetic Orientation (°E of mag. N)</th>
<th>Avg. Ridge-top Spacing (cm)</th>
<th>Avg. Ridge Height (cm)</th>
<th>Avg. Slope (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2007: Test Pits 5 and 6</td>
<td>124.5</td>
<td>80</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>2009: Ops. East, and the eastern fields of Ops. G and L 1-3</td>
<td>199</td>
<td>72.7</td>
<td>11</td>
<td>7.1</td>
</tr>
<tr>
<td>3</td>
<td>2011: Ops. Q and R</td>
<td>123</td>
<td>76.4</td>
<td>11.6</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>2011: Ops. U (west field) and W (west field)</td>
<td>126</td>
<td>84.7</td>
<td>7.5</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>2011: Ops. S and T</td>
<td>113.5</td>
<td>80.5</td>
<td>9.5</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>2011: Ops. U (east field) and W (east field)</td>
<td>126</td>
<td>82.6</td>
<td>8.5</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>2011: Ops. Y (north field) and AD (north field)</td>
<td>35</td>
<td>103.9</td>
<td>7.5</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>2011: Ops. Y (south field) and AD (south field)</td>
<td>124</td>
<td>94.4</td>
<td>5.8</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>2011: Op. X</td>
<td>108</td>
<td>68.2</td>
<td>13.7</td>
<td>-</td>
</tr>
<tr>
<td><strong>TOTAL Avg.</strong></td>
<td></td>
<td></td>
<td><strong>82.6</strong></td>
<td><strong>9.7</strong></td>
<td></td>
</tr>
</tbody>
</table>

Table 4.9. Comparison of Maize Ridges By Field
<table>
<thead>
<tr>
<th>Maize Field</th>
<th>Year Excavated</th>
<th>Avg. Stalk Length (cm)</th>
<th>Avg. Stalk Diam. (cm)</th>
<th>Total # of Maize Ears</th>
<th>Avg. Ear Length (cm)</th>
<th>Avg. Ear Diam. (cm)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2007: Test 5 and 6</td>
<td>11.8</td>
<td>1.4</td>
<td>2</td>
<td>16</td>
<td>4.3</td>
<td>Possible Adolescent Maize</td>
</tr>
<tr>
<td>2</td>
<td>2009: Ops. East G (east field) L 1-3 (east fields)</td>
<td>9.8</td>
<td>1.4</td>
<td>3</td>
<td>8.5</td>
<td>3.9</td>
<td>Well-developed field</td>
</tr>
<tr>
<td>3</td>
<td>2009: Ops. Q and R</td>
<td>17.1</td>
<td>1.6</td>
<td>15</td>
<td>15.8</td>
<td>4.1</td>
<td>Well-developed field- drying for harvest</td>
</tr>
<tr>
<td>4</td>
<td>2011: Ops. U (western field) and W (western field)</td>
<td>26</td>
<td>1.7</td>
<td>9</td>
<td>20</td>
<td>4.9</td>
<td>Well-developed field- drying for harvest Many of ears doubled-over</td>
</tr>
<tr>
<td>5</td>
<td>2011: Ops. S and T</td>
<td>16.9</td>
<td>1.8</td>
<td>2</td>
<td>18.1</td>
<td>4.8</td>
<td>Different planting style- inter-ridges</td>
</tr>
<tr>
<td>6</td>
<td>2011: Ops. U (eastern field) and W (eastern field)</td>
<td>33.6</td>
<td>2</td>
<td>5</td>
<td>15.2</td>
<td>3.9</td>
<td>Very well-developed field- neat ridges – drying for harvest Many ears doubled-over</td>
</tr>
<tr>
<td>7</td>
<td>2011: Ops. Y (north field) and AD (north field)</td>
<td>13.8</td>
<td>1.7</td>
<td>7</td>
<td>17</td>
<td>4.2</td>
<td>Large ridges and spacing- possibly previously used for manioc planting (manioc volunteer found on ridge in AD)</td>
</tr>
<tr>
<td>8</td>
<td>2011: Ops. Y (south field) and AD (south field)</td>
<td>14</td>
<td>1.1</td>
<td>1</td>
<td>18.2</td>
<td>3.1</td>
<td>Possible Adolescent Maize-Evidence for possible planting mounds</td>
</tr>
<tr>
<td>9</td>
<td>2011: Op. X</td>
<td>10.7</td>
<td>1.7</td>
<td>6</td>
<td>18.4</td>
<td>3.5</td>
<td>Maize field on a significant slope</td>
</tr>
<tr>
<td>Aband.</td>
<td>2009: Op. O</td>
<td>13.6</td>
<td>1.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Possibly Fallow maize field</td>
</tr>
<tr>
<td>Total Avg. (excluding Op. O)</td>
<td></td>
<td>17.1</td>
<td>1.6</td>
<td>5.7</td>
<td>16.3</td>
<td>4.1</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.10. Comparison of Maize Plant Cast Assemblage by Field
Maize Field 1 is therefore categorized as an adolescent maize field that would have reached full maturity within a few weeks without the intervention of the Loma Caldera eruption. In the northwestern area of Test Pit 5 a field boundary was discovered where the maize ridges terminated in a line just short of a flat, small platform or constructed surface. Only a small section of the platform was visible in excavations and it is possibly this region was an area for storing or processing agricultural remains (Sheets et al. 2012: 265-366). Thus the western limit of Maize Field 1 is marked by this abrupt transition to cleared area, likely a platform.

**Maize Field 2 (2009 Ops East, G, L)**

As discussed in relationship to manioc, Maize Field 1 was identified to the east of Manioc Field 1 and to the north of Manioc Field 2 (see Figure 4.20). These two manioc fields served as the western and southern borders of Maize Field 2, yet the northern and eastern extent of the field remains unknown. Located in the eastern portions of Ops. East, L 1-3, and G, the maize field had a minimum north to south extent of approximately 15 meters. Maize Field 2 was a mature maize field with stalks bent over for the harvest (Tetlow 2009: 12). The ridges had an average orientation of 119°, were spaced an average of 73 cm ridge-top to ridge-top with an average height of 11cm (Tetlow 2009: 12-14) (see Table 4.9). In general the ridges were well formed and regularly spaced; although, the two southern-most ridges of this field were a typical height for maize ridges (c. 10 cm) but had larger ridge width (c. 50 cm) when compared to the regular sized maize fields (c. 25 cm). A manioc plant cast was also identified on the southern-most ridge of this maize field. Moreover, the size of manioc beds in Manioc Field 2 to the south had a typical height for manioc of 33 cm, but the northern-most manioc bed was only 16 cm, likely marking the transition between Maize Field 2 and Manioc Field 2.
Maize casts recovered from Maize Field 2 had an average stalk diameter of 1.4 cm (see Table 4.10). A total of three fragments of maize ears were identified in the plant cast assemblage and these had an average diameter of 3.9 cm and an average length of 8.5 cm. The size of the plant casts and the positioning of these plants bent-over strongly suggest that Maize Field 2 was a mature maize field that was drying and ready for harvest at the time of the eruption. Of note is that the maize ridges of Maize Field 2 were oriented parallel with slope, following the orientation of the manioc ridges to the west. Maize fields previously identified at Cerén were found planted perpendicular to slope to maximize water infiltration, a vital component for maize growth (Payson Sheets personal communication, 2009). Maize Field 2 is oriented parallel to slope, facilitating greater water run-off, which is ideal for manioc growth but less ideal for maize cultivation. Such orientation might speak to the prioritization of manioc planting in this region over maize.

**Maize Field 3 (2011: Op Q and R)**

Maize Field 3 was located closer to the site center, in what has been termed the intermediate region between the southern manioc fields and the site center in the north. This maize field was well developed at the time of the eruption and had well-constructed ridges that were oriented an average of 123°, were spaced an average of 76.4 cm from ridge-top to ridge-top with an average height of 11.5 cm (see Table 4.9). The eastern boundary of this field is marked by the earthen *sacbe* (see Figure 4.20), where the field borders the western canal of the *sacbe*. The field extends an unknown distance to the west, though the cleared area identified in of Op. V approximately 50 meters to the west suggests the maize field terminates some distance before that point. Thus the maximum east to west extent of Maize Field 3 is approximately 50 meters.
It is unknown how far the field stretched to the south, but it is estimated that it abutted Maize Field 4 approximately 20 meters to the north. The average stalk diameter of Maize Field 3 was 1.6 cm (see Table 4.10). There were a total of fifteen maize ears recovered from this field that had an average length of 15.8 cm and an average diameter of 4.1 cm and one maize ear showed a few corn kernels. The high density of maize ears recovered from this field and the maturity of the plants indicate this was a mature maize field that was drying for harvest at the time of the eruption. Unfortunately the dental plaster did not set well and many casts from this field did not survive excavation.

**Maize Field 4 (2011 Ops U-west and W-west)**

Maize Field 4 was located immediately north of Maize Field 3 and it is possible that these two formed one continuous field, however, the current data show slight variations that have resulted in their segregation into two fields for the purposes of this analysis (see Figure 4.20). Like Maize Field 3, this field had an eastern termination at the western canal of the *sacbe* (Figure 4.22). This field was documented in the western fields of Ops. U and W. Segments of eight ridges were found in these two excavation and the ridges had an average orientation of 126°, an average height of 7.5 cm, and an average spacing of 84.7 cm from ridge-top to ridge-top (see Table 4.9). This field was only present in portions of each excavation but produced nine maize ears with an average diameter of 4.9 cm and an average length of 20 cm (see Table 4.10). The stalks had an average diameter of 1.7 cm and many were found doubled-over. In one instance in the western field of Op. W there were two ears of maize on a single stalk that had been doubled-over for harvest (Figure 4.23). Maize Field 4 was a mature maize field that was in the midst of harvest when the Loma Caldera vent erupted.
Figure 4.22. Maize Field 4 and the Western Canal of the Sacbe in Op. W (Photograph by author)

Figure 4.23. Maize Plant with Stalk Bent Over to Dry for Harvest and Double Maize Ears (Photograph by author)
**Maize Field 5 (2011: Ops. S and T)**

Excavation to the east of the *sacbe* revealed an additional maize field, Maize Field 5 in Ops. S and T of 2011 (see Figure 4.20). The close proximity of the maize identified in each of these operations and the similarities of ridge orientation and height, imply these were portions of a continuous field (Lamb and Heindel 2011). This field demonstrated a marked difference in ridge construction than the other field recovered at Cerén thus far (Lamb and Heindel 2011: 16-17, 26). The western boundary of Maize Field 5 was the eastern canal of the earthen *sacbe*. Maize Field 5 extended an unknown distance to the east, though it was at least six meters along the east-west axis. This field ranged an unknown distance to the south and appeared to terminate only a few meters to the north, where Maize Field 6 began. The average ridge orientation for Maize Field 5 was 113.5° and these ridges were an average of 9.5 cm in height and spaced 80.5 cm from ridge-top to ridge-top (see Table 4.9). Maize Field 5 was visible in Op. T and documented five ridges that were not well formed and had linear earthen features in the furrows between ridges, what we later termed inter-ridges (see Figure 4.21). The inter-ridges had an average height of 4 cm.

The ground surface throughout Maize Field 5 showed very irregular topography (Lamb and Heindel 2011). The maize stalks from Maize Field 5 had an average length of 16.9 cm and an average diameter of 1.8 cm (see Table 4.10). There were two maize ears identified in the plant cast assemblage and these had an average length of 18.1 cm and an average diameter of 4.8 cm. Maize Field 5 affords an example of a different style of maize planting used at Cerén. Eulalio Avalos, a local farmer who cultivates maize and beans south of the Cerén archaeological park, offered his feedback on the inter-ridges identified in Maize Field 5. He used an *acedon* (a hoe tool) to demonstrate how inter-ridges might be formed in the construction of maize ridges.
when sediment was pulled from the furrow areas up onto the top of the ridges (Eulalio Avalos personal communication, 2011; Lamb and Heindel 2011: 26).

**Maize Field 6: (2011: Ops U-east and W-east)**

Immediately north of Maize Field 5 was Maize Field 6, located in the eastern sections of Ops. U and W (see Figure 4.19). Maize Field 6 was clearly distinguished from Maize Field 5 based on the differences in the style and construction of the maize ridges. Like Maize Field 5, the western boundary of Maize Field 6 was the eastern canal of the earthen *sacbe* (Figure 4.24). Maize Field 6 extended an unknown distance to the east and to the north, but was minimally 25 meters from south to north. It is difficult to project the overall field size with only the southwest corner of the field documented. Seven partial ridges were recovered from Maize Field 6.

![Figure 4.24. Maize Field 6 and the Eastern Canal of the Sacbe in Op. W (Photograph by author)](image)
These ridges were more formal in construction, without the inter-ridges seen in Maize Field 5 and show evidence for a mature maize field with bent-over stalks in the process of harvesting. The ridges of Maize Field 6 had an average orientation of 126°, an average height of 8.5 cm, and an average ridge-top to ridge-top spacing of 82.6 cm (see Table 4.9). Maize stalks found in Maize Field 6 had an average diameter of 2 cm and five ears of maize were recovered that had an average length of 15.2 cm and an average diameter of 3.9 cm (see Table 4.10). Two of the maize ears were from the same plant. The ridges of Maize Field 6 were taller and more formally constructed than those of Maize Field 4 on the western side of the earthen sache.

Maize Field 7: (2011 Op Y-north and AD-north)

Maize Field 7 was located west of Maize Field 3 and was a region that had a significant natural topographic slope, with an average slope of 9° towards the north (see Figure 4.20). The southern boundary of Maize Field 7 was a field boundary with another maize field, Maize Field 8, that was oriented approximately perpendicular with this field. The northern and western boundaries of Maize Field 7 are unknown, yet the cleared area identified in Op. V, approximately 5 meters east of Maize Field 7 indicates that the southeastern corner of Maize Field 7 was within a few meters of Op. AD. The northern fields of Ops. Y and AD maize were found planted in a total of six ridges, an average of 35° in orientation, with an average ridge height of 7.5 cm, and an average ridge-top to ridge-top spacing of 103.9 cm (see Table 4.9) (Figure 4.25). There was a significant height difference between the eastern ridges of this field, located in Op. AD, which were approximately 2.5 cm in height, and the western ridges identified in Op Y, which were an average of 12.5 cm in height (Lamb and Heindel 2011: 21-22). The maize stalks from this field (all from Op Y-north) had an average diameter of 1.3 cm and seven ears of maize were recovered that had an average length of 17 cm and an average diameter of 4.2
cm (see Table 4.10). One possible interpretation for the bed height difference, the presence of maize in the western portion of the operation, and the large bed spacing is that this had previously been an area of manioc cultivation that had been re-purposed or re-claimed as a maize field. One manioc plant cast from the ridge in Op. AD lends further support to this claim (Dixon 2011a: 25). Additionally, the ridges of Maize Field 7 were planted parallel to the ground slope of the region, which would result in greater drainage of water run-off, which is more favorable of the needs of manioc than of maize.

Maize Field 8: (2011: Ops. Y-south and AD-south)

As discussed above, the northern boundary of Maize Field 8 abutted the southern boundary of Maize Field 7 (see Figure 4.20). Maize Field 8 was identified in the southern fields of Ops. Y and AD with a total of six ridges that were oriented approximately 124°, were an average of 5.8 cm in height and had an average ridge-top to ridge-top spacing of 94.4 cm (see Table 4.9). The orientation of these ridges was perpendicular to the ground slope of the region, which would have provided greater water accumulation to support maize growth. The ridges of Maize Field 8 were somewhat less formed that others at Cerén and mounds of tephra were found on the sides of ridges and in the furrows between ridges (Lamb and Heindel 2011) (Figure 4.26).
It is hypothesized that these mounds were planting mounds (explained below), as one contained a maize plant growing from the center. In discussions with local Salvadorian farmers, Leandro Flores, Nelson Alvarez, and William Alvarez, they suggested that these might be maize fields in the early stages of growth, since in the region today, maize ridges are created as plants grow and mature, not prior to their planting (Lamb and Heindel 2011: 26). These cultural informants explained that maize would not germinate if planted too deeply, so it is first allowed to grow and then mounds, and eventually ridges are built up around the plants, as the stalks grow taller and are at greater risk of wind-throw (Payson Sheets personal communication, 2012). It is possible that Maize Field 8 was in the early stages of growth and maize ridges had not yet been formed, or that this particular ancient farmer(s) did not utilize formal ridges for maize growth. The average diameter of maize stalks was only 1.1 cm and only one ear of maize was recovered from this field and it was approximately 3.1 cm in diameter (see Table 4.10). This evidence for the small size of maize plants in the field further supports the interpretation that this was a field in the early stages of production.


Maize Field 9 was located furthest west of all of the excavations undertaken from 2007 to 2011 (see Figure 4.20). This maize field was identified in Op. X, which was located 37 meters west of Op. AB, where a fallow manioc field had been identified. No field boundaries were recorded in the excavation of Op. X, though the location of the potential Manioc Field 6 to the east and north of the field indicate that Maize Field 9 probably did not extend much farther north or east (Figure 4.27). The ground slope was significant and ranged from 3° to 9°, with an average of 5.6°. The ridges were neither exactly parallel to slope nor perpendicular, but rather off set at an angle.
Figure 4.26. Maize Field 8 with Planting Mounds (upper right) and Maize Field 7 (lower left) (Photograph by author)

Figure 4.27. Maize Field 9 Ridges and Plant Casts in Op. X (Photograph by author)
This would have facilitated some catchment of water, but likely not so much as to jeopardize the plants in the case of excess run-off. This shows an adaptive strategy used by this farmer in coping with greater topographic slope. Six ridges of Maize Field 9 were recorded, with an average orientation of 108°, and average ridge height of 13.7 cm, and an average ridge spacing of 68.2 cm (Lamb and Heindel 2011) (see Table 4.9). The average maize stalk diameter for Maize Field 9 was 1.7 cm (see Table 4.10). There were fewer maize plants recovered from this field, yet a significant number of maize ears, six in total. The maize ears had an average length of 18.4 cm and an average diameter of 3.5 cm.

**Other Evidence for Maize Cultivation**

In the 2009 field season excavations in Ops. O and P afforded additional evidence for maize cultivation at Cerén (see Figure 4.20). Op. O was located approximately 12 meters west of the cleared area identified in Op. West as a section of a possibly fallow manioc field (see above discussion). There had been significant erosion of the ground surface in Op. O, but ridges were identified spaced 70 cm from ridge-top to ridge-top and twelve maize plant casts were retrieved from these ridges (Figure 4.28). The plant casts had an average diameter of 1.5 cm and no ears of maize were present. Researchers described some weeds present in the casts, though these did not survive excavation. It is possible this was a juvenile maize field planted in ridges from an earlier season of growth (Tetlow 2009) or that these maize plants were volunteers growing in a fallow maize field (Maloof 2009). While more data are needed to ascertain if either of these hypotheses is correct, the presence of eroded ridges and some weeds indicates that it was not as well maintained as other maize fields at Cerén and might have been a field left fallow or abandoned where volunteer maize plants were allowed to grow. The excavation of Op. P (see above discussion) also revealed one maize plant growing to the west of the Op. P midden and
north of the leveled-area platform. This plant had a stalk diameter of 1.2 cm and was apparently a volunteer plant that grew from a seed discarded into the nearby botanical midden (Tetlow 2009: 31).

These nine maize fields, as well as the additional evidence for maize cultivation at Cerén, illustrate that there was great variability in maize cultivation at the site. These data afford evidence for different planting styles, such as the use of inter-ridges and mounds, different planting strategies, such as the directionality of ridges in relationship to topographic slope, and different stages of cultivation, from early plantings to those mature fields in harvest. Such diversity highlights the dynamic use of space in the past and the potential autonomy of farmers in their cultivation choices. Furthermore, the array of field boundaries indicates a distinction between cultivation regions, probably between different cultivators.

Other findings from this research inform our understanding of the organization of agricultural and uses of space in the past including cleared areas, the earthen *sacbe*, and artifact and paleobotanical data. Each of these significant finds are introduced and discussed as they pertain to agricultural production and decision making at the site.

**Cleared Areas**

Cleared areas were documented in each of the three field seasons and are broadly defined as uncultivated spaces at the time of the Loma Caldera eruption. These spaces were kept relatively free of weeds. Three types of cleared areas have been created to classify these remains, which include: 1) deliberately leveled flat surface areas (possibly small platforms), 2) cleared areas that retained the natural topography of the landscape, and 3) cleared areas where fallow agricultural fields were still visible (Halmbacher 2011: 34). From 2007 to 2011 a total of 18 operations revealed one or more of these three types of cleared areas, all of which further our understanding of the layout and organization of cultivation at Cerén (Table 4.12) (Figure 4.29). The cleared, fallow agricultural beds were discussed above according to hypothesized cultigen type. The other two types of cleared areas might also inform our understandings of agricultural cultivation at Cerén.

Immediately west of Manioc Field 1 was a large intentionally flattened and cleared area, possibly considered a small platform that extended through the 2009 Ops. B, D, J, and H excavations (Maloof 2009: 39-42) (Figure 4.30). This cleared area was of the first type with a leveled, flat surface area minimally extending 18 meters from north to south and 10 meters from east to west, though the northern, western, and southern boundaries of this cleared area are still unknown. The leveled area was noticeably visible, as in Ops. D, J, and H, and had an average
slope of 5.3°, while the associated manioc fields had an average slope of 11°. It is hypothesized that this cleared, leveled area was potentially a short platform area used for in-field processing of agricultural remains (Maloof 2009: 39-42).

<table>
<thead>
<tr>
<th>Year Excavated and Provenience</th>
<th>Type of Cleared Area</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007: Test Pit 3</td>
<td>Type 3</td>
<td>Possible Section of Manioc Field 5</td>
</tr>
<tr>
<td>2007: Test Pit 4</td>
<td>Type 3</td>
<td>Possible Section of Manioc Field 5</td>
</tr>
<tr>
<td>2009: Op. West</td>
<td>Type 3</td>
<td>Possible Section of Manioc Field 5</td>
</tr>
<tr>
<td>2009: Op. B</td>
<td>Type 1</td>
<td>Cleared, leveled area (few plants)</td>
</tr>
<tr>
<td>2009: Op. C</td>
<td>Type 3</td>
<td>Manioc Field 5 with a manioc stalk cast</td>
</tr>
<tr>
<td>2009: Op. D</td>
<td>Type 1</td>
<td>Leveled, cleared area (platform) with a slope of 3°, compared with associate manioc ridges of Manioc Field 1 with a slope of 10°</td>
</tr>
<tr>
<td>2009: Op. H</td>
<td>Type 1</td>
<td>Very small portion of leveled, cleared area next to Manioc Field 1</td>
</tr>
<tr>
<td>2009: Op. J</td>
<td>Type 1</td>
<td>Leveled, cleared area (platform) with a slope of 7.5°, no plant remains, and a very small section of Manioc Field 1 with a slope of 12°.</td>
</tr>
<tr>
<td>2009: Op. M</td>
<td>Type 3</td>
<td>Possible Section of Manioc Field 5</td>
</tr>
<tr>
<td>2009: Op. O</td>
<td>Type 3</td>
<td>Fallow maize ridges</td>
</tr>
<tr>
<td>2009: Op. P</td>
<td>Type 1 and 2</td>
<td>Small midden and flattened platform</td>
</tr>
<tr>
<td>2011: Op. V</td>
<td>Type 1</td>
<td>Leveled, flattened area</td>
</tr>
<tr>
<td>2011: Op. Z</td>
<td>Type 2</td>
<td>Natural topographic ground surface</td>
</tr>
<tr>
<td>2011: Op. AA</td>
<td>Type 1 and 2</td>
<td>Manioc Field 4 with structure, natural topographic region, and leveled area</td>
</tr>
<tr>
<td>2011: Op. AB</td>
<td>Type 3</td>
<td>Part of Manioc Field 6 (fallow)</td>
</tr>
<tr>
<td>2011: Op. AC</td>
<td>Type 3</td>
<td>Part of Manioc Field 6 (fallow)</td>
</tr>
<tr>
<td>2011: Op. AD</td>
<td>Type 3</td>
<td>Possible Section of Maize Field 7/ previous manioc cultivation</td>
</tr>
</tbody>
</table>

Table 4.11. Three Types of Cleared Areas Found at Cerén
Figure 4.29. Location of Cerén Cleared Areas by Type
Two other cleared areas not discussed previously in this dissertation were Ops. V and Z (see Figure 4.29). Op. V was located 5.5 meters south-east of the potential fallow manioc field of Op. AD. Op. V exposed a cleared, leveled area that was similar to, though not connected with, those of the three other areas of type 1 level-cleared areas: Ops B, D, J, and H, Op. P, and Op. AA (Figure 4.31). Six ceramic sherds were found on the ground surface of Op. V but the only plant evidence identified was from a branch that was probably blown from a nearby tree into the area during the eruption (Halmbacher 2011: 34).

It is possible this was an additional agricultural processing area or another form of activity area. Op. Z was located approximately 30 meters west of the maize fields in Op. Y and
revealed the natural topographic surface of the TBJ soil with a slope of 14° toward the north (Halmbacher 2011: 35). There were no plants, with natural topographic features of the area. The evidence for these three types of cleared areas all associated with the Cerén agricultural fields inform our understanding of the use of the space including no weeds, found in this area, thus it seems to have been maintained as a cleared area in the past and the affiliated areas likely involved in agricultural production.

Cerén Earthen Sacbe

The earthen sacbe at Cerén, first identified in 2011, forms another data category. The Yucatec Maya word, sacbe (plural: sacheob), literally translates as “white way” but is used to describe a diversity of roadways throughout the Maya area, particularly in the Yucatan peninsula (Freidel et al. 1993: 77). Typically, these causeways were constructed with stone masonry and
coated with lime plaster, creating the white color to which the name refers (Folan 1991: 222). *Sacbeob* are found throughout the Maya region and the function and significance of these roads has been the focus of much archaeological inquiry (Chase and Chase 1994, 1996; Folan 1991; Freidel et al. 1993). *Sacbeob* demonstrate great variation in length, ranging from multiple meters to many kilometers (Folan 1991; Schwake 1999) and 1 to 30 meters in width (Justine Shaw personal communication to Payson Sheets, 2011; Cheetham 1995). *Sacbeob* also show great variation in height from a few centimeters to several meters and demonstrate a range in formality of associated drainage canals and ditches (Folan 1991; Schwake 1999).

*Sacbeob* were either created as a completed single entity or as separate sections that were connected over time and as with modern roadways, *sacbeob* also varied in width and height along any single road. (Folan 1991). Beyond the basic transportation function of roadways there are also ideological, religious, social, and political considerations (Chase and Chase 1996; Cheetham 1995; Folan 1991; Freidel et al. 1993; Schwake 1999; Tedlock 1985:11). While these sacbeob no doubt served utilitarian functions, it is also clear that more sacred associations were attributed to such features as well.

The Cerén earthen *sacbe* was approximately 2 m wide and 20 cm in height and had formal canals on each side (Dixon 2011b: 65-71). Portions of this feature were identified in three operations (Ops. S, U, and W) and it was a minimum of 42 meters in length (Figure 4.32). No termination of the feature was identified in either the northern area, closer to the site center, or the southern area, surrounded by the agricultural fields outlined in this dissertation. This feature was wider than would be required for transportation between the southern fields and the site and great care was taken in its construction. The earthen nature of the *sacbe* would have required regular upkeep and maintainence, further suggesting its importance to Cerén occupants.
Figure 4.32. Location of the Cerén Sacbe in Relationship to Site Center and 2011 Excavations
The sacbe was constructed from built up TBJ earth. The construction and maintenance of the road edges mirror that of the manioc beds, namely the building up of TBJ soil by taking the soil from areas between the beds and packing it up into large ridges. The sacbe appears to have been constructed and maintained by a similar method of removing TBJ from within the canals and packing it along the edge of the road (Dixon 2011b). It is expected that another source of TBJ soil would have also have been required because the canals did not hold the same volume of tephra as the sacbe construction required and the sediment in the canal would not have been as white in color. It appears that for the Cerén earthen sacbe an attention to white color was also taken into consideration given that the whitest TBJ sediment was used along the upper-most layer of the road (Figure 4.33). Such attention to color details strongly indicate that this sacbe was more than a basic transportation route, although it most certainly also served that purpose too.

Additionally, using the Munsell soil sample book we were able to identify slight color variation between the edges of the sacbe and the central region. Unlike the selection of the whiter TBJ for paving the sacbe, this color distinction correlated with the heavy compaction of the soil in the center, which was apparent tactiley, as well as in the profile of the sacbe. The most logical explanation for the central compaction and color differentiation is that this was an artifact of heavy foot traffic. The presence of multiple ceramic sherds and carbon remains that were trampled into the sacbe further support this interpretation (Dixon 2011b: 71).

The average magnetic orientation of the sacbe was $28.7^\circ$. The sacbe orientation curved slightly towards the east as it approached the site center, with the section of the sacbe excavated furthest south having an orientation of $25^\circ$, the central section of the sacbe excavated having an
orientation of 27°, and the northern-most section of the *sacbe* excavated having an orientation of 34° (Dixon 2011b) (Table 4.13).

Formal canals framed each side of the *sacbe* (Figure 4.34). The eastern canal had an average depth (also can be viewed at the *sacbe*’s height), as measured from the base of the canal to the top of the *sacbe*, of 19.9 cm, ranging from 12.3 - 27.6 cm. The western canal had an average depth of 20.2 cm. The edges of the *sacbe* along each of these canals appeared to have different levels of maintenance and formality.

<table>
<thead>
<tr>
<th>Year Excavated</th>
<th>Avg. Sacbe magnetic Orientation (° E of mag. N)</th>
<th>Avg. Sacbe Width</th>
<th>Avg. Sacbe Height from eastern canal (cm)</th>
<th>Avg. Sacbe Height from western canal (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011: Op. S</td>
<td>25</td>
<td>214</td>
<td>14.3 (max. 19 cm)</td>
<td>11.5 (max 13 cm)</td>
</tr>
<tr>
<td>2011: Op. U</td>
<td>27</td>
<td>193</td>
<td>18.5</td>
<td>34.2</td>
</tr>
<tr>
<td>2011: Op. W</td>
<td>34</td>
<td>151.3</td>
<td>27.6</td>
<td>22</td>
</tr>
</tbody>
</table>

Table 4.12: Cerén Earthen Sacbe Data
Excavation of Op. W offered a view of the *sacbe* with maize fields to the east and west of the canals (Figure 4.35). Given the differences in these two maize fields and their separation in space, it is estimated these were under the cultivation of different farmers. Moreover, the formality of construction of the eastern canal and the eastern edge of the *sacbe* appears to match the care with which the maize was planted in the eastern field of the operations.

Figure 4.34. Eastern Canal of Cerén *Sacbe* Section Located in Op. W
(Photograph by author)
Similarly, the less formal and seemingly less maintained western side of the sacbe mirrors the small and informal ridges of the western maize field. This might provide a possible insight into how the sacbe was maintained. Thus, the difference in sacbe maintenance from one side to the other of the sacbe might be a reflection of different caretakers for different sections or areas, whereby cultivators of fields were responsible for the maintenance of the sacbe adjacent to their fields (Dixon 2011b). This hypothesis requires further investigation and fortunately will be explored in the upcoming Cerén field season planned for the summer of 2013 (Sheets and Lentz 2012).

The sacbe continued south, toward the major Classic Period regional center in the Zapotitán Valley, San Andrés, located approximately 5 kilometers southwest. Georectified satellite imagery of San Andrés buildings found their orientation to be 25-29° and the sacbe had
an orientation of 25° along the southernmost excavated section (Dixon 2011b: 72). The section of the *sacbe* excavated furthest north, nearest the Cerén site center, had an average orientation of 34°, which is more similar to the 30° orientation typical of Cerén structures and agricultural orientations (Sheets 2002c: 198). Is this just a feature of the direction of the road or might this indicate a change in ideology or identity, a proper entry into the settlement that is aligned with the architectural buildings? It is also entirely possible that these orientations are a result of a sampling bias and future investigations focused on the *sacbe* will help inform these potential relationships.

Identification of a *sacbe* at Cerén has important implication for our understanding of not only these roads, but also the Cerén site itself. *Sacheob* are known to have utilitarian, ideological, and political functions in the Maya area (Chase and Chase 1994; Folan 1991; Freidel et al. 1993; Tedlock 1985: 11) and no doubt this Cerén *sacbe* shares many of these functions and meanings. The *sacbe* directly connected some of the agricultural fields with the site center, yet appears to be much larger and more formal than would be required for simply transporting crops from the fields to the central area (Dixon 2011b: 71-74). While it no doubt functioned as a raised, dry walkway, the nature of its construction indicate meaning beyond transportation function. The canals and sides of the *sacbe* were not uniform in construction or maintenance and it is possible that individual cultivators or families were responsible for sections of the *sacbe* maintenance as part of their political and economic participation in the Cerén community. The differences along the *sacbe* might be alternatively interpreted, as a reflection of different drainage needs according to slope features of the *sacbe* and surrounding landscape. This relationship will be explored further in the next chapter for its potential contributions to our
understanding of issues pertinent to political economy, agricultural production, and community at Cerén.

**Summary of Related Artifact and Paleoethnobotanical Analyses**

Artifacts were collected in each of the three field seasons detailed in this dissertation and included lithic and ceramic remains. The majority of lithic and ceramic artifacts were from the Classic Period horizon and some of these items are linked with agricultural production at the site (Sheets 2007; Sheets 2009b; Sheets and Dixon 2011). All ceramic sherds identified in these three field seasons were classified according to Marilyn Beaudry’s (1983) classification of ceramics for the Zapatitán Valley and her previous classification and interpretations of Cerén artifacts recovered from the site center (Beaudry-Corbett 2002; Sheets 2011b). The few ceramic sherds identified throughout the excavations of 2007 to 2011 provide little information directly related to agricultural production at the site, though a detailed analysis of the ceramics found at the site to date, including a residue analysis study might greatly inform our understanding of consumption at Cerén and perhaps aid in addressing questions regarding how the large quantity of maize and manioc grown at the site was being processed and used.

The majority of lithic artifacts found south of the Cerén site were obsidian blade fragments and use-wear analysis of these artifacts is directly pertinent to the reconstruction of Cerén agricultural production (Sheets 2009: 84-85). A total of twelve obsidian artifacts were recovered from the sheet midden of Op. P (Sheets 2009). One of these blades had unusual individual striations that were parallel to the blade’s edge. There were increased striations on the surface area where the majority of contact with the worked material would have occurred (Sheets 2009; Sheets et al. 2012). Similar use-wear was identified on an obsidian prismatic blade from Chunchucmil (Hutson et al. 2007: 461) and similar remains from Chalchuapa (Sheets et al.
Sheets and Heindel (2012) utilized replication experiments to show that similar usewear could be created from cutting manioc root cortex coated with a thin layer of TBJ volcanic ash (Payson Sheets personal communication, 2012). It is possible that this lithic evidence might be one of the few durable indicators of manioc processing, specifically decortication of manioc roots, that preserve in the archaeological record (Sheets 2009b; Sheets et al. 2012).

Soil sample studies revealed numerous specimens of macro-botanical remains, especially from the sheet midden in the 2009 Op. P. Maize (Zea mays), common beans (Phaseolus vulgaris) and lima beans (Phaseolus lunatus) were the dominant macrobotanical remains recovered from this context (Lentz and Hood 2009; Sheets et al. 2012: 274). A gourd rind (Lagenaria siceraria) and several tree fruits including jocote or hog plum (Spondias sp.), avocado (Persea Americana Miller), and nance were also found in the Op. P midden (Lentz and Hood 2009; Sheets et al. 2012: 274). The presence of these tree fruits further supports the idea that arboriculture was practiced at Cerén and residents relied on diverse subsistence strategies (Sheets et al. 2012).

Durable indicators for manioc rarely survive the archaeological record. There are two probable explanations for this situation. First, manioc is propagated vegetatively by cutting mature stems into stakes that are then placed in the ground (Cock 1982: 756). Second, manioc root preparation typically consists of grating, grinding, boiling, and fermenting (Miksicek 1991: 80), which result in less chance for manioc to become carbonized and thereby preserved (Sheets et al. 2012: 276).
Data Summary and Conclusions

Data collected from three field seasons of research at Cerén (2007, 2009, and 2011) afford an exceptional window into the organization of agricultural production at the site (Figure 4.36). Preservation greatly limits our understanding of ancient agriculture and the Cerén site provides important data regarding the Classic Period agricultural production at most sites. Fortunately, the preserved fields, including maize ridges and furrows, as well as manioc beds and the walkways between the beds, have allowed us to identify field boundaries and to document strategies employed by farmers for cultivation in the field south of the Cerén site.

Four manioc fields were identified and two additional fields where manioc had been previously cultivated. Overall the manioc beds were on average spaced 125 cm ridge-top to ridge-top and 31.2 cm in height, although these averaged varied based on the two separate manioc bed styles identified. The first manioc bed style consisted of broad, flat beds with almost vertical sides that were spaced on average 106 cm from ridge-top to ridge-top and were on average 22.3 cm in height. The second manioc bed style was a larger, taller bed with a narrower crest and sloping sides. This second style resulted in large sine-wave shaped beds that were spaced an average of 143 cm from ridge-top to ridge-top and were an average of 40 cm in height (Dixon 2007, 2009, 2011a).

Each of the four manioc fields discovered had been seemingly monocropped, given no other cultigens were found growing on or in any of the manioc beds, and all of these fields had been harvested just prior to the Loma Caldera eruption. Plant casts were found within the manioc beds and in a few, rare instances growing above the Tierra Blanca Joven (TBJ) soil. These manioc plant casts consisted of manioc stalks, roots, and unidentified plant fragments.
Figure 4.36. Overall Map of the known Agricultural Fields, Cleared Areas, and Sacbe at Cerén, El Salvador
The average diameter and total length of these casts were recorded and compared for each of the manioc fields at the site. The average stalk diameter for all manioc casts found was 2.2 cm, the average root length was 48.7 cm, and the average root diameter was 28.6 cm. When examining the differences between the two styles of manioc bed planting at Cerén, a comparison of the manioc stalk diameters from these fields indicates a difference.

The average manioc stalk diameter from Fields 1 and 2 was 2.1 cm and the average stalk diameter from Field 3 was 5.4 cm. This difference might be the result of placement in the cycle of planting, given the Field 3 had been replanted where Fields 1 and 2 had not. These data inform our knowledge regarding the intensive manioc production undertaken at Cerén. Manioc was being used beyond the simple model of production for consumption that is often described for the region today. That is, manioc was originally recorded at Cerén in the home gardens of the site center where only a few manioc plants were growing, planted with a diversity of other crops (Sheets and Woodward 2002: 189). Based on the presence of manioc in the Household 1 home garden, it was expected that the plant was grown for household consumption and would have been allowed to grow until individual roots were needed for immediate consumption (Lentz and Ramírez-Sosa 2002: 35). The discovery of fields of manioc beds that were all harvested at or very close to the same time, strongly suggests that this manioc was being used in a different manner. The most efficient and the easiest way to store manioc is to leave it growing in the field until it is required for use. That Cerén farmers chose to harvest this manioc in a single event demonstrates that the manioc was being used in a very different manner than basic root consumption. The juxtaposition of manioc plants in the home garden with the intensive, monocropped manioc fields south of the site center show that this crop had at least two different functions at the site.
The harvest of the intensive manioc fields was a coordinated effort and would have yielded a considerable amount of manioc that would have needed to have been processed or used with a few days of its removal from the ground. The quantity of manioc produced at Cerén and its isolation in dedicated, intensive manioc beds indicates that manioc was being grown in greater quantities and likely used for different purposes than previously suspected for Cerén. This is has important implication for understanding Classic Period agriculture and will be further explored in the next chapter.

Additionally, nine separate maize fields were identified, as well as one area where maize had been previously cultivated. Maize plant casts provide information regarding the stage of growth of the maize, showing if the plants were in harvest at the time of the eruption or had just begun to grow, as well as document a diversity of planting methods used by maize farmers. These differences in maize ridge construction and maintenance show potentially different farming choices. Furthermore, the planting of maize ridges adjacent to manioc beds in a way more suited for manioc growth (i.e., maize ridges planted parallel to ground slope creating significant amounts of water run-off and less water catchment) might indicate the importance of manioc growth in this area at this time.

The many field boundaries identified or projected formed clear borders between maize and manioc cultivation, multiple manioc fields, multiple maize fields, agricultural fields and cleared spaces, cleared spaces with natural topographic features and cleared spaces that were intentionally flattened, leveled, and/or made into small platforms, and between maize fields and the earthen sacbe. The diversity and quantity of field boundaries afford insight into the organization of production at Cerén. Also, evidence that in some areas manioc was possibly replanted with maize offers a dynamic view of agricultural fields in the past. These data offer a
rich array of information about field boundaries, different cultivation techniques, dynamic uses of space, and even potential identification of different farmers. These data will be discussed in terms of farmer autonomy, community organization, and sociopolitical economy in the following chapters.
Chapter 5: Agricultural Production and Implications for the Cerén Sociopolitical Economy

Introduction

The Cerén agricultural fields allow key insights into the organization of production and integration of agriculture into the broader sociopolitical economy of the site and the Zapotitán Valley. This dissertation synthesizes three field seasons of research and examines the connections between agricultural production and the sociopolitical economy. Evidence for diverse planting methods and choices were present showing two main species (maize and manioc), numerous fields of each crop, including at least four manioc fields and nine maize fields south of the site center, and different styles of growing both manioc and maize (see Chapter 4 for more detail; Sheets 2007, 2009b; Sheets and Dixon 2011). These data inform more than just the agricultural assemblage of Cerén; rather they speak to the dynamic relationships and decision-making of farmers, their community, and their integration into a sociopolitical economy at multiple scales of interaction.

A lack of autonomy in production was traditionally ascribed to Maya farmers (Adams and Jones 1981; Culbert 1988; Chase and Chase 1996; J. Marcus 1976; 1983,1993), yet more recent models hypothesize that agricultural communities had varying degrees of state and/or self-governance (Robin 2012: 3). Most scholars now agree there was a complex continuum varying from centralized state oversight of production to partial and even complete commoner autonomy (Fox et al. 1996; Iannone 2002; LeCount and Yaeger 2010; Marcus 1998; Robin 2012). Political power and governance were not only present in elite centers, but also throughout Classic Period
Maya communities (Lohse and Valdez 2004). Political policies and decisions were operationalized through the social structures of the community, such as family lineage, redistribution, and reciprocity (McAnany 1995, 2010: 9; Robin 2001, 2003, 2012; Yaeger and Robin 2004: 149). This dissertation utilizes the concept of sociopolitical economy to highlight the integration of these structures at the community level (Yaeger and Robin 2004: 149) and to describe the economic practices that shaped and were shaped by political and social ideas and actions of Cerén community members.

Archaeological preservation typically limits exploration of agricultural production, yet Cerén affords just such evidence. Utilizing a multi-scalar interpretive approach, it is possible to examine the Cerén agricultural fields and the related archaeological features for evidence of 1) the degree of farmer autonomy in planting methodology and choice, 2) community integration of land-use, harvest, and labor, and 3) social and political associations and connections within the Zapotitán Valley. The view from the ancient Cerén agricultural fields yields insight into the farmers’ power to make decisions about their crops, their connections with the organization and timing of harvest of the broader Cerén community, and their potential ties with sociopolitical dynamics of nearby contemporaneous Maya settlements.

Farmer Autonomy

Decisions by individual farmers at Cerén were visible in their choices about which crops were planted, the numerous boundaries used to separate and distinguish fields from one another, the variation in the style of planting beds and ridges between different fields, and the selective rotation between maize and manioc and between cultivating and leaving fields fallow (see
Chapter 4; Sheets 2007, 2009b; Sheets and Dixon 2011). These decisions indicate that Cerén cultivators maintained a degree of power and autonomy over production decisions and practices.

**Field Boundaries**

Field boundaries are given specific attention here to examine these data for evidence of farmer autonomy. Linear boundaries between Cerén agricultural fields were created by three different interfaces: 1) a clear variation between two different crops with distinctive planting forms (e.g., manioc beds and maize ridges) (Figure 5.1), 2) a separation between an agricultural field and a cleared area, platform, or the earthen sacbe (e.g., manioc beds terminating in an uncultivated, cleared space) (Figure 5.2), and 3) a visible juncture between two fields of the same crop type (e.g., two manioc fields staggered in their bed orientation with beds of one field meeting the walkways of the other) (Figure 5.3) (see Chapter 4; Sheets 2007, 2009b; Sheets and Dixon 2011). Each of these field boundary types formed a marked separation between areas of cultivation. The coordinated orientation of these field boundaries is discussed further in the context of community integration presented in the next section of this chapter. Here I focus on the presence of these boundaries as designations of the individual land plots of possibly separate farmers that might be connected with variation in land ownership or custodianship.

“Twenty years ago, Edward Hall (1966) pointed out that culture shapes the form, function, and meaning of space” (Sutro and Downing 1988: 29). Lines between agricultural fields mark an allocation of two different spaces—each field boundary was a cultural choice made by Cerén farmers. These field divisions (combined with the one known field boundary marker) highlight the conceptual and practical separation of spaces and agricultural yields. These types of agricultural field boundaries (i.e., not stone walls) rarely preserve in the
archaeological record and are important to compare with the known agricultural divisions and
the more often studied architectural boundaries for the Maya area (Gonlin 2004: 240).

Figure 5.1. Field Boundary Between Two Different Cultigens-Manioc (left) and Maize (right) (Photograph by author)
Figure 5.2. Field Boundary Between Cultivation and a Cleared Area- Maize Field (right) and a Portion of the Eastern Sacbe Canal of Op. W (left) (Photograph by author)

Figure 5.3. Field Boundary Between Two Fields of the Same Crop- Manioc Field 1 (Top) and Manioc Field 2 (Bottom) (Photograph by author)
The Chorti used fences made of plants and stones to differentiate milpas, gardens, house groups, and orchards (Wisdom 1940: 129). In Gonlin’s (2004) analysis of Maya architectural and field boundaries she defined sharp boundaries as “those that functioned to effectively divide and direct traffic and control privacy and territoriality” (Gonlin 2004: 241-242). The Cerén field boundaries form just such divisions of territoriality and clear designations between spaces. The abrupt termination of each field boundary according to a clear line indicates that these were intentional divisions. The numerous boundaries in a relatively small area and the separation between fields of the same crop point to a function of such boundaries as territory markers. While multiple fields might have been under the care of same land-user, a farmer would likely have maintained a single row of cultivation for ease of harvest, rather than separate the same crop (manioc), grown in the same manner, by staggering the beds and walkways. Furthermore, the differences in manioc bed styles and possibly maize ridge style or seasonality, all indicate that there were likely different farmers employing different cultivation techniques. It is possible that the separate land plots might distinguish land owners- although land ownership is more difficult to identify in the archaeological record or also separations between communal plots and those of individual households.

**Quantity of Field Boundaries**

Ten agricultural field boundaries have been documented in the fields south of the Cerén site center (Table 5.1) and nine boundaries have been projected based upon the location of adjacent different fields or cleared spaces. There is almost equal distribution of different boundary types, with three identified boundaries and six projected boundaries between agricultural fields and cleared areas, two identified boundaries and three projected boundaries
Table 5.1: Description of Cerén Field Boundaries

<table>
<thead>
<tr>
<th>Boundary Located Between:</th>
<th>Identified in Ops.</th>
<th>Estimated Orientation of Boundary (° E of magnetic N)</th>
<th>Approximate Length of Documented Boundary (meters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manioc Field 1 and Platform to the west</td>
<td>D, H, J</td>
<td>30°</td>
<td>18</td>
</tr>
<tr>
<td>Manioc Field 1 and Maize Field 2</td>
<td>G, L 1-3</td>
<td>30°</td>
<td>14</td>
</tr>
<tr>
<td>Manioc Field 1 and Maize Field 2</td>
<td>F-1 and L-3</td>
<td>30°</td>
<td>3</td>
</tr>
<tr>
<td>Maize Field 2 and Maize Field 2</td>
<td>F-1 and L 1-3</td>
<td>120°</td>
<td>2</td>
</tr>
<tr>
<td>Manioc Field 4 and Cleared Area to the West</td>
<td>AA</td>
<td>32°</td>
<td>1</td>
</tr>
<tr>
<td>Manioc Field 4 and Cleared Area to the South</td>
<td>AA</td>
<td>122°</td>
<td>1.5</td>
</tr>
<tr>
<td>Maize Field 4 and Sacbe</td>
<td>U and W western fields</td>
<td>36°</td>
<td>20</td>
</tr>
<tr>
<td>Maize Field 5 and Sacbe</td>
<td>S and T</td>
<td>24°</td>
<td>25</td>
</tr>
<tr>
<td>Maize Field 6 and Sacbe</td>
<td>U and W eastern fields</td>
<td>36°</td>
<td>20</td>
</tr>
<tr>
<td>Maize Field 7 and Maize Field 8</td>
<td>Y and AD</td>
<td>34°</td>
<td>10</td>
</tr>
</tbody>
</table>

between agricultural fields of the same crop, two identified boundaries between agricultural fields of two different crops, and three identified boundaries and one projected boundary between agricultural fields and the sacbe. Excavations from 2007 to 2011 have covered a region approximately 180 meters along the north-south axis, and approximately 250 meters along the east-west axis. These excavations were in selected portions of this overall region and did not
sample the entire 180 x 250 meter area. Most of the operations were concentrated in an area of approximately 100 x 100 meters and an additional area of approximately 250 x 30 meters. The numerous field boundaries in these areas demonstrate that land was being intentionally divided into small sections and Cerén farmers were attentive to the separation of fields. All field boundaries so far identified have had rigid terminations that oriented approximately 30° or 120° (see Chapter 4).

Based on these projected and known field boundaries, it is possible to roughly estimate the field size for some of the manioc and maize fields at Cerén (see Table 5.1). The largest recorded section of continuous manioc cultivation was found in Manioc Field 1. Though the northern and southern limits of this field have not yet been identified, based on the current known boundaries the field is estimated to be minimally 600 m² in total size. The other manioc fields found at Cerén have much smaller projected sizes, with Manioc Field 2 projected to have a width of 5 meters and an unknown length. Manioc Field 3 had a width of 5 meters and a length of at least 18 meters (90 m²) and the dimensions of Manioc Field 4 are unknown (Dixon 2007, 2009, 2011a).

Maize fields were divided into small units of tenure. Projecting the sizes of these fields is extremely difficult given that most fields have only one known boundary. Very rough estimates show that these maize fields ranged in size from 100 m² to 400 m². What is apparent is that clear distinctions were made between separate fields and this demarcation strongly indicates that separation of these spaces was significant and probably tied to individual farmers.

**Segregation of Same Species of Crop**

In three examples, clear boundaries were identified between fields growing the same type of crop and in three other cases similar boundaries were projected for fields of the same crop.
One of the confirmed examples was between two maize fields (Maize Fields 7 and 8) and was marked by the different orientation of the maize ridges in each field. One interpretation for the division of these two fields is that these were plots of separate individual land cultivators or owners. Another interpretation is that this field division was related to the rotation of fields between manioc and maize, discussed below.

The other two examples were both between separate manioc fields. The boundary between Manioc Fields 1 and 2 is one that marked a distinction between two fields of the same crop that were being grown in the same style of bed. The second projected boundary between Manioc Field 2 and 3 is between two fields with the same crop grown in two different styles of manioc beds. The separation of fields growing the same species points to a distinction between different farmers and likely pertaining to different households. It is also possible that such boundaries distinguish communal land plots from household fields.

It has been hypothesized that households would have diversified agricultural production as one strategy for risk management (Levi 1996: 98; Netting 1977; Wilk 1985). Manioc might have served as an important economic strategy for coping with climate uncertainty, given the ability of manioc to survive during drought and environmental fluctuations (Cock 1985:1-2). One possibility is that each household utilized intensive manioc cultivation to help mitigate the possible risks of other crops, such as maize. That each manioc field had been harvested recently before the Loma Caldera eruption and given that manioc roots spoil within a few day of harvest if not processed, indicates that the manioc was almost certainly processed immediately and was linked with a community-wide harvest and possibly communal labor (discussed further in the next section). That farmers created a separation between fields growing the same crops is evidence of a segregation of agricultural yields and potentially labor in some way, presumably
by household. While it is unclear how the manioc and maize yields were used, it is apparent that farmers maintained clear distinctions over their own fields and were not growing crops in larger state-controlled fields but as distinct plots, most likely associated with specific social units, possibly households. It is also unclear whether some of these fields were communal lands maintained separately from household plots, yet the variation in styles and numerous field divisions suggest that at least some of these fields were under the care of individuals farmers potentially related to separate households. Further data regarding how the crops were used once harvested might help to illuminate such a distinction.

**Planting Styles**

Additional support for Cerén farmer autonomy in cultivation choices is provided by different styles of manioc beds and maize ridges. The decisions of Cerén farmers to grow the same crops in different styles of planting beds or ridges might be linked with their family history and identity or might be an expression of their own experimentation with different planting methods. The distinct bed and ridge styles show the diverse farming techniques utilized by farmers and that these cultivators had the power to choose they style of beds and ridges to use.

**Manioc Beds**

In the case of manioc, two main styles of manioc bed cultivation have been identified thus far. The manioc beds of Manioc Fields 1, 2, and probably 4 were constructed with broad, flat tops and nearly vertical sides that are referred to as Style A. These beds were approximately 50 cm wide, 22 cm in height, and spaced 113 cm from ridge-top to ridge-top. The second style of manioc bed cultivation, Style B, was a sine-wave shape in the cross-section, with a narrow curved top and the sides of each bed having a more gradual slope than those of the other style. The Style B beds had an average top width of 23 cm, an average height of 40 cm, and an average
ridge spacing of 143 cm from ridge-top to ridge-top (see Chapter 4; Dixon 2007, 2009, 2011a) (Table 5.2). There are no known advantages to planting manioc in one of these styles or another. There were also no major ground-surface variance, such as slope differences or evidence of erosion that would suggest a practical function for these different planting bed sizes and shapes.

Manioc Fields 1, 2, and possibly 4 had been harvested prior to the Loma Caldera eruption, but had not yet been replanted. Manioc Field 3 had been harvested and was likely replanted prior to the eruption. This replanting might account for slight differences in bed height, but not the substantial differences shown from the two bed styles. Furthermore, the vertical bed sides of the first style and the sloped sides of the second bed style cannot be accounted for by the difference of replanted verses non-replanted fields. These styles appear to have been the choices of different farmers, which might point to separate family identities (i.e., inheritance of different planting techniques) or perhaps individual farmers who were experimenting with different planting bed styles.

<table>
<thead>
<tr>
<th></th>
<th><strong>STYLE A</strong></th>
<th><strong>STYLE B</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Location</strong></td>
<td>Manioc Fields 1, 2, and probably 4</td>
<td>Manioc Field 3</td>
</tr>
<tr>
<td><strong>Average Height</strong></td>
<td>22 cm</td>
<td>40 cm</td>
</tr>
<tr>
<td><strong>Average Wavelength (Ridge Spacing)</strong></td>
<td>113 cm</td>
<td>143 cm</td>
</tr>
<tr>
<td><strong>Approximate Shape</strong></td>
<td>Broad and Flat</td>
<td>Hyperbolic</td>
</tr>
</tbody>
</table>

Table 5.2: Comparison of Manioc Bed Styles

**Maize Ridges**

Similar to other Mesoamerican groups it is clear that cultivation of maize was one vital component of Cerén agriculture. The majority of maize fields at the site was planted in formal ridges that were approximately 10 cm in height and spaced approximately 80 cm from ridge-top to ridge-top (see Chapter 4; Dixon 2007; Lamb and Heindel 2011; Tetlow 2009; Sheets 2002a).
In this style of planting, clear furrows used as walkways separated the ridges. The less common style of maize planting was identified in Maize Field 5. This field also had ridges, though these ridges were significantly more inconsistent and had inter-ridges in the furrows (Lamb and Heindel 2011: 16). The ridges of this field had an average height of 9.5 cm, similar to that of the other maize ridges found throughout Cerén, but were substantially less uniform in construction. The inter-ridges were approximately 4 cm in height and the topography of this field was extremely irregular (Lamb and Heindel 2011: 16-17). Maize Field 5 was possibly constructed with a hoe used to form the ridges. While no agricultural hoes have yet been found at Cerén, stone hoes were identified at other Classic Period sites in the Maya area (Gonlin 2012: 86; McAnany 1992; L. Neff 2002). When this method is used to create ridges on either side of a furrow area, there can be inter-ridges left in the central region of the furrow where a small strip of sediment was not removed for ridge construction (Eulalio Avalos personal communication, 2011; Lamb and Heindel 2011: 26).

The presence of the inter-ridges and less formal maize ridges might be evidence for a different style of constructing maize fields, thus demonstrating variation in how farmers chose to maintain their fields. Alternatively, it is possible that this field shows an earlier stage of cultivation where formal ridges had not yet been smoothed and the inter-ridges had not yet been compacted by foot-traffic or erosion. There were two casts of maize ears discovered in the plant cast assemblage of Maize Field 5 and the average diameter of these ears was similar to the average diameter of maize ears from other more formally maintained fields (see Chapter 4). This similar size denotes the fields were in similar stages of growth, although only two maize ears were recovered from Maize Field 5, whereas excavations of other fields recorded a larger quantity of maize ears.
It is somewhat problematic to compare the quantity of maize ears recovered from each field given the wide variation in the percentages of each field excavated. In some cases a maize field was visible in only a small portion of the excavation and in others, the maize field extended through the entirety of multiple 3 x 3 meter excavations. Furthermore, the dental plaster used to create the plant casts in Maize Field 5 did not set well and resulted in the loss of some data (Lamb and Heindel 2011: 17). Nonetheless, Maize Field 5 was visible in an entire 3 x 3 meter operation and had 2 ears of maize present, whereas Maize Field 3 was visible throughout two 3 x 3 meter operations and revealed 15 ears of maize. Maize Field 5 shows either a different style or stage of cultivation, both of which suggest that farmers had autonomy in decisions of cultivation.

**Dynamic Landscape**

While the preservation of Cerén provided by the Loma Caldera tephra is of a single moment c. A.D. 630, this apparent snapshot in time does not mean the picture of Cerén is one of a static, unchanging society. Rather, with effort, evidence for the dynamic use of the landscape can also be gleaned from these data. The Cerén site, like any other archaeological site, is a product of its history. Few cultural and natural transforms have acted upon the site since it was covered by volcanic ash nearly 1,400 years ago.

**Rotation of Planting: Fallow**

Slight variations in the stages of growth are evident in the maize fields. In Maize Field 8 the presence of planting mounds, the lack of formal maize ridges, and the small maize stalk diameter all suggest that this field was in the early stages of growth when the volcano erupted (see Chapter 4; Lamb and Heindel 2011: 22-23, 27). This is similar to the maize field found in the site center that was a second planting with one plant per locality, and very small, dispersed maize plants (Zier 1983: 134-137). Second plantings of maize in August are still common in the
Zapotitán Valley today. In other regions we have identified mature maize fields, bent over to dry while awaiting harvest (e.g., Maize Field 6). In the excavation of Op. O in 2009, a probable fallow maize field was identified (Maloof 2009: 44; Tetlow 2009: 14). The ground surface was significantly eroded but ridges were spaced 70 cm from ridge-top to ridge-top. Twelve small maize plant casts were recovered with an average diameter of 1.5 cm and no casts of maize ears were present. Consequently, the field was interpreted as a juvenile maize field (Tetlow 2009: 14) in the early stages of planting or as a fallow field with volunteer maize plants (Maloof 2009: 44). The presence of weeds and eroded ridges support the latter interpretation. This evidence shows that farmers had the power to choose whether or not to plant particular locations or to leave these fallow or un-used for cultivation.

**Rotation of crops**

In two places maize was documented growing in ridges much larger than those of traditional maize fields (in the southern portion of Maize Field 2 and in Maize Field 7). In the transition between Manioc Field 2 and Maize Field 2, there was evidence for maize growing in former manioc beds. The two southern-most beds of Manioc Field 2 were approximately 34 cm in height, typical for manioc beds of this style at Cerén, while the northern most ridge of the field was only 16 cm in height (Dixon 2009: 60). This smaller manioc bed likely marked the boundary between these fields, though the boundary is less crisp than other field boundaries at the site. A single manioc plant was identified in the southern-most ridges of the Maize Field 2. Furthermore, the spacing of the Maize Field 2 ridges was very regular in the northern section of the field, approximately 73 cm from ridge-top to ridge-top, yet the southern ridges of this field had slightly wider spaced ridges, approximately 85 cm (See Chapter 4; Dixon 2009: 72; Tetlow
It appears that maize might have been planted in what could have served as manioc beds in an earlier cycle of cultivation demonstrating a shifting boundary between these two fields.

Similarly, in Maize Field 7 there is additional evidence for maize planted in previously constructed manioc beds. The ridges of Maize Field 7 were a typical height for maize ridges, approximately 8 cm, but were spaced 104 cm from ridge-top to ridge-top, which is more indicative of manioc beds. Moreover, the ridges of Maize Field 7 were planted parallel to ground-slope. Such ridge directionality would result in greater drainage of water run-off, which is more favorable to the needs of manioc as opposed to those of maize. A single manioc plant cast was identified in one of the ridges of Maize Field 7, likely this was growth left from a previous planting cycle in this region (Dixon 2011a). This remnant root, combined with the size and spacing of ridges indicate that a previously cultivated manioc field was re-purposed or re-claimed as a maize field. This farmer, or farmers, made a decision to change the cultigen used in this region. There is no known benefit to rotating manioc to maize in a field. Elsewhere, manioc has been recorded as typically the last plant grown in a cycle or field rotation due to the ability of the plant to grow in depleted soils (Cock 1985: 64).

In Peru, the Campa group planted monocropped manioc on the steepest terrain and intercropped manioc with maize on the flatter, more fertile land. The manioc and maize was intercropped for the first planting and then the density of maize plants was decreased and the density of manioc planting was increased as field fertility decreased (Cock 1985: 64). Thus, planting maize in an area of previous manioc cultivation might be due to the need for more maize for this household. It might also have been a region where maize could have successfully grown if it had not been planted there for a significant time prior or have been inter-planted with a less dense planting of manioc. The small size and lack of maintenance of the beds suggest that
in this case, it was likely a re-claiming and re-purposing of the beds for maize growth. This interpretation is further supported by a lack of evidence for manioc harvesting depressions in the beds, signifying that the maize was grown here without inter-planted manioc before the eruption. The transition from manioc fields to maize indicate the soil was likely able to support the more demanding needs of maize and that the decision to rotate these crops might have been related to seasonality or shifting needs of a household.

The maize fields of Cerén provided evidence of slight variation in the stage of growth for most fields. While the majority of fields were mature and awaiting harvest, others were less mature. Furthermore, decisions of changing use of the fields are visible in the areas that were previously cultivated and remained fallow at the time of the eruption or those areas where maize was planted in what were former manioc beds. These dynamic features of the Cerén agricultural fields speak to the choices of Cerén farmers with regard to a changing landscape and the repurposing of space.

**Community Organization and Non-Royal Governance**

Cerén farmers were tied with their community economically, socially, politically, and ritually. The structures, artifacts, and agricultural remains inscribed the connection between households and the integration of the ancient Cerén community as a social, political, and economic unit. Agricultural fields at the site show individual farmers were linked into a community organization and non-royal governance served to facilitate some of the patterns of production.
Field Boundaries

Boundaries between agricultural fields were not arbitrary lines, but rather each was oriented in a specific direction. The majority of these boundaries was oriented approximately 30°, or in the case of two field boundaries 90 degrees from that, 120°. In at least one instance the boundaries of two separate fields (Manioc Field 2 and Maize Field 2) connect to form one large line oriented 30° (see Figure 5.1). Many of the fields documented are in somewhat close proximity to one another and it is notable that all of the field boundaries identified to date share these approximate orientations, as do the associated ridges and beds (Dixon 2007, 2009, 2011a; Lamb and Heindel 2011; Tetlow 2009). Furthermore, the Cerén structures have an overall orientation of 30°, orientations that might be connected with the directionality of the nearby Rio Sucio (Sheets 2006). Symbolically and practically, these boundaries and field orientations connect each agricultural field with the surrounding fields as well as the site center. This physical link is a tangible remnant of communal organization of land-use in that the orientation of the built landscape shows unification between various farmers, households, and the community center.

Beyond the orientation of the agricultural beds and boundaries, these field boundaries also provide further evidence for connections beyond individual farmers and households. Access analysis is a useful analytical technique that is typically applied to architectural features (Fairclough 1992; Foster 1989; Hillier and Hanson 1984; D. Sanders 1990). Researchers examine phenomological features of the landscape, for visual, auditory, or physical connections and separations of space. These studies have successfully addressed the function and degree of privacy for many structures (Gonlin 2004: 244). This analytical tool is useful when applied to the interpretation of Cerén agricultural field boundaries. The Chorti used fences made of plants or stones to enclose milpas, gardens, orchards, and house groups (Wisdom 1940: 129). Fences
provide not only a clear separation of spaces, but also limit access between different fields. Likewise the documentation of stonewalls separating ancient fields were recorded throughout the Rio Bec region (Eaton 1975; Turner II 1978:170) and at Cobá (Manzanilla 1987). Stonewalls and fences are landscape features that limit the ease of access from one field to another and provide more permanent, lasting separation of space.

The Cerén agricultural fields have clear sharp boundaries, but there are no fences, no walls of any kind, and only one known field boundary marker. The field boundary marker is sizeable clay block that separates space without inhibiting transit between these areas (Maloof 2009: 45). None of the boundaries identified at Cerén to date would impede access between fields. The lack of such field fences and walls and the accessibility between fields indicates fields were distinguished, probably according to individual farmers or families, yet that these spaces were both visually and physically accessible to the broader community. Another major boundary at the site is formed by the sacbe. The sacbe demarcates the edge of each adjacent field but also serves to physically connect the agricultural fields with the site center and unknown loci to the south. The sacbe formed boundaries between individual fields and also facilitated access to agricultural fields and provided a link between these plots and the broader community. McAnany (1993b: 69) noted,

In an agrarian-based, stratified society, on the other hand, the underclass of producers generally do not really need the dominant class to complete the cycle of production. While the producers may need the political clout and military strength of the dominant class to protect their agricultural holdings, that dependency is contingent upon the relative stability of the macro-political climate and does not necessarily extend to the organization of agricultural production [McAnany 1993b: 69].

In this vein, while Cerén was integrated into various scales of sociopolitical institutions, residents were likely not reliant upon elite centers, such as San Andrés for organization of production. Control over production should not be confused as indicating that Cerén agricultural
production existed in isolation. The demands of elite centers such as San Andrés for taxation or tribute might have greatly impacted the choices made by Cerén farmers, yet these Cerén data indicate that farmers maintained autonomy over planting choices. Furthermore, the evidence show that such decisions were imbedding in the organization of agricultural production that was likely achieved at the local level of the community.

Community Harvest

The Loma Caldera eruption occurred during a harvest at Cerén (Sheets 2002b: 6). Based on evidence for multiple fields in the process of harvesting, ripe nance (*Brysonimacraspifolia*) and guayaba fruits, it is estimated that the eruption occurred in August (Lentz et al. 1996; Sheets 2002a). In the region today maize fields are often planted in May and harvested in August and possibly then replanted was a second planting of maize that is generally less productive than the first. If the maize stalks are left in the field after the ears of corn are harvested, then beans are regularly planted and use the abandoned maize stalks to climb. Squash might be interplanted with beans or grown with other plants (Payson Sheets personal communication, 2012). Both ancient maize and manioc fields at Cerén showed evidence of harvest. Many of the ancient maize stalks were bent over to dry in preparation for harvest and beans had only begun growing in two maize fields in the site center, though given the timing it is likely more beans would have been present in these fields if the eruption had occurred later in the season (Sheets 2002). Additionally, all of the manioc fields identified to date were harvested just prior to the eruption (Sheets 2007, 2009b; Sheets and Dixon 2011). Special attention is given to manioc harvesting, given the focus on manioc production in the region south of the Cerén site. In addition to four manioc fields and two or three abandoned manioc fields, maize fields also yielded clues regarding the importance of manioc in this region of planting. Maize Fields 2 and 7 were planted
in an orientation more conducive to manioc growth (parallel to slope) than that of maize (perpendicular to slope), demonstrating the planting organization favored manioc in this area.

**Ritual in the Site Center**

Harvest rituals and feasts are central aspects of many cultures, both past and present (Dietler and Hayden 2001; A. Joyce 2010; Klarich 2010; LeCount 2001; Pauketat et al. 2002). Cerén data show that a communal ritual was underway at one of the main public structures of the site, Structure 10, when the eruption occurred (Sheets 2002c: 201-203). Structure 10 was used for the production of communal festivals, feasting, and storage of ritual paraphernalia (Brown 2001; Brown and Gerstle 2002: 97). Ritual paraphernalia that was located inside the eastern room of Structure 10 included a whitetail deer (*Odocoileus virginianus*) skull headdress that had been painted red with possibly some Maya blue pigment as well (Brown 2001; Brown and Gerstle 2002: 99). The white-tailed deer is still utilized in the *cuch* ceremony of modern Maya groups to ensure a successful harvest (Pohl 1981). Also found in Structure 10 were a large alligator or caiman effigy storage jar filled with *achiote* (*Bixa orellana*) seeds, other storage vessels, a jar with squash seeds (*Curcurbita sp.*), and a painted gourd (Brown and Gerstle 2002: 99). In the exterior corridors, many food production artifacts and features were identified, such as a *metate* on *horquetas*, additional *metates*, two hearths, ceramic vessels, a digging stick, burnt maize ears, antler and bone tools, and obsidian blades (Brown and Gerstle 2002: 101-103). The feasting evidence, combined with the presence of ritual paraphernalia (particularly the deer skull headdress) suggest that ritual feasting was connected with the harvest, conceivably an event similar to the *cuch* harvest ceremony of modern Maya groups (Brown 2001; Pohl 1981).

Ritual feasts were a frequent part of Maya life and served as powerful community markers and opportunities for demonstrations of community affiliation (Yaeger and Canuto
2000), as well as a common theme throughout Mesoamerica (A. Joyce 2010). According to Yaeger (2000: 133), at the site of San Lorenzo, Belize, feasts and communal labor were practices of affiliation whereby community membership was expressed publically and social ties were created and maintained. Arthur Joyce (2010) summarized the various functions of feasting, including mobilization of labor (Dietler and Herbich 2001; Pollock 2003) and construction, maintenance, and negotiation of social identities (DeBoer 2001; Pauketat et al. 2002; Smith 2003). The complex social, political, economic, and ideological intersections present in feasting activities highlighted, constructed, and challenged identities such as gender, community, and hierarchy (A. Joyce 2010: 230). Evidence for feasting at Cerén, as well as for a community-wide harvest, and possible evidence of communal labor (discussed below) were likely necessary components of the sociopolitical economy. These data signify that farmers connected in a supra-household, communal group.

Agricultural labor provides the very basis of community events that include feasts and in this case, such labor and agricultural production might have been the stimulus for the event to provide farmers with extra-household support for the intensive labor required for harvest. Both manioc and maize harvesting were underway at Cerén when the eruption occurred and this feasting event tied that harvest labor into the greater Cerén community. The feast appears to have been a community specific event, not dictated or controlled by a regional state power, but instead, organized according to the structure of the community itself. A service relationship between Household 1 and Structure 10, the feasting storage and serving facility, are evident in their close proximity and the presence of ceramics and metates. Household 1 also probably maintained the structure and provided maize and tapiscadores for the feast. This relationship might have been organized through reciprocal social or kinship structures, such as the
mayordomia ritual relationships documented in modern Mesoamerica (Stephen 2005) or other forms of reciprocity among community members. A complex organization of status, kinship, redistribution, reciprocity, and non-royal governance were all involved in the production of this feasting event, which in turn tied agricultural production at the site, particularly the harvest, into the sociopolitical structures of the community.

Maize Harvest and Processing

Maize Fields 2, 3, 4, and 6 were clearly mature maize fields, with stalks bent over and ears dried for harvesting. Likewise, Maize Fields 7 and 9 were potentially mature fields that were in either harvest, or close to harvest, at the time of the eruption, although the conditions of these two fields are less clear (see Chapter 4). All but one of the maize fields in the site center were mature fields, and some had stalks bent over to dry for harvest (Sheets and Woodward 2002:185). While there was a distinction between fields based on clear field boundaries, there was also a larger community connection of a coordinated harvest. This event was probably due to seasonality, as the harvest feast would have integrated the maize harvest labor and perhaps manioc harvest with the entire community and possibly had been connected with supernatural dates and cycles (Stadelman 1940: 123-124).

After bending the maize stalks in half and leaving the maize ears to dry, farmers would then have needed to harvest the maize by removing the maize ears, typically by snapping the ears from the stalk or slicing open the husks with a sharp tool (*tapiscador*) and removing the ear of corn (Kramer 2005: 35; Stadelman 1940: 116; Vogt 2004: 27). The maize ears traditionally preferred for roasting and eating, *elotes* (early stage maize), are harvested earlier in the cycle of growth (Kramer 2005: 69; Stadelman 1940: 114; Steggerda 1941). That the Cerén maize stalks were bent signifies that this was the end of the maize harvest, when the maize would have been
used for grinding into flour or other purposes and some seeds would have been selected for replanting (Stadelman 1940: 116). In the Guatemalan community of Chimaltenango communal harvesting of maize has been recorded, where farmers relied on the assistance of neighbors to complete a harvest in one day (Stadelman 1940: 116). Given the co-occurring manioc harvest, it is probable that such communal harvesting of either reciprocal or redistributed labor was responsible for harvesting and processing these fields.

Less frequent analysis has focused on food processing and cooking of maize (Graff and Rodríguez-Alegría 2012; Klarich 2010). Dunning (1996) highlighted that areas of high phosphate residue on residential platform surfaces at Sayil were probable areas of maize processing (1996: 60). We have yet to identify an agricultural processing area at Cerén, yet the platforms and cleared areas might be just such areas. Once removed from the fields, maize ears would probably have either been tied in pairs and hung from rafters or cribbed (Stadelman 1940: 119; Vogt 2004: 27). The maize storage crib in Structure 4 contained husked corn on the cob, demonstrating some of the maize processing had occurred (Gerstle 1990, Gerstle and Sheets 2002: 75-78) (see Chapter 2).

Until recently (Graff and Rodriguez-Alegría 2012) little focus has been given to the amount of processing labor likely involved in maize and other food production in the past. Some studies have focused on using chemical residue analysis to identify processing areas (Dunning 1996; Terry et al. 2000) though less attention is given to the amount of labor involved in processing maize and other cultigens. Throughout Mesoamerica, food processing has been reconstructed as the domain of women and girls (Hendon 1996, 2003; R. Joyce 1993, 2000; McCafferty and McCafferty 1988), and scholars have recognized that researchers’ biases have influenced the lack of visibility to women’s lives and work in the past (Gero and Conkey 1991).
Analyses of farming in the Yucatan today have shown an association of plant processing as women’s work (Kintz 1990; Palerm 1967; Re Cruz 1996; Robin 2006: 411). While many Maya archaeologists readily record the presence of manos and metates for grinding, few discuss the amount of time and labor that would have been invested in processing maize to make flour, tortillas, chicha or other fermented beverages, and cornmeal (Kramer 2005: 107). In ethnographic studies of Xaltocan, Mexico, Rodríguez-Alegría (2010: 109) recorded the enthusiasm with which women recounted communal grinding efforts to prepare food for special events, such as weddings. Women described bringing their own manos and metates to the house of the betrothed and how the group spent approximately 8 hours grinding maize to prepare for the event. These practices were described as highly social events (Rodríguez-Alegría 2012: 109). The domestic effort required for processing the maize, and also manioc, from the Cerén fields might have been conducted in a similar manner, clearly emphasizing communal identity and social links between women of various households.

Tracy Sweely (1999) analyzed the metates from Household 1 at Cerén and argued that a group of women were grinding communally for the harvest. Sweely (1999) further suggested status and power differences between the women based on the position of the metates, particularly one metate that was in a position from which all others could be viewed (Sweely 1999). A key caveat to this research is that no direct evidence was found to suggest the metate users were women and this is based on a general association between women and grinding in the Maya area (R. Joyce 2000). The Cerén metate users might have been women, but gender roles and constructs might have varied throughout the ancient Maya world and it is somewhat problematic to assume that this was only women’s work.
Despite the obvious connection between agricultural production and processing labor, these remain typically bisected into separate spheres in the literature. In a discussion of dry season agriculture among the Kekchi Maya, Richard Wilk (1985: 47-55) described the process of planting and harvesting maize, provides estimates of the yields of farmers, and approximated the number of person-hours required for production (Wilk 1985: 51). Like many other studies in the Maya area cultivation is separated from the labor of processing food and consumption.

The effort of harvest does not end when a crop is removed from the field, yet these tasks have been conceptually divided in the archaeological literature, with focus on food processing a more recent development (Graff and Rodríguez-Alegria 2012; Klarich 2010). In Gonlin’s (2012: 84-87) depiction of the Classic Maya household, she outlines the vast types and quantity of labor needed for agrarian survival, patterned after ethnographic observations by Kramer (1998). In addition to agricultural labor, households typically engaged in cloth production, toolmaking, woodworking, gathering, beekeeping, childcare, animal tending, gardening, house maintenance and construction, firewood collecting and cutting, as well as other tasks (Gonlin 2012: 86). While many of these tasks are daily, others have seasonal schedules (Gonlin 2012: 101). The task of harvesting would be seasonal, while household labor would likely take on a different form, focus, and intensity during these periods. The harvesting of both maize and manioc at Cerén is significant because of the energy that would have been required to remove the plants from the field in a short time frame, but equally or more meaningfully, the labor and time required for processing, and then storing and serving these food stuffs. The amount of focused labor for this coordinated harvest indicates that extra-household support also played a key role in processing labor and might have served as a community affirming activity.
Women, men, and children might have all participated in harvesting maize, removing the husks, the shelling of ears, heating, soaking, and grinding the maize, not to mention planting and weeding earlier in the growth cycle. These tasks would have necessarily been divided according to the age and skill required, though young children and older children probably participated in various tasks with older children functioning as adult laborers (Kramer 2005: 43-45). The tools used for agricultural tasks by adults and older children would be identical (Kramer 1998, 2005) and therefore such tools in the archaeological record do not inform researchers about the age of their user (Gonlin 2012: 83). Robin (2006: 413) makes a case for both men and women participating in agricultural production. She highlights that no images of men or women farming are present in either elite carved images or figurines, and posits that the absence of this evidence might suggest that there was universal participation in agricultural production (Robin 2006: 413).

Due to the quantity of work required to simultaneously harvest the Cerén maize and manioc fields, as well as to process the yields of these harvests, it is almost certain that all able family members and extended family or household networks were employed during this time.

**The Manioc Harvest**

Manioc harvesting was also underway at the time of the eruption. It is noteworthy that every manioc field found at Cerén had been harvested just prior to the eruption, with only one field in the stage of replanting. Manioc does not require large beds for growth, although the beds might have provided loose soils that would facilitate better growth and easier harvesting (Cock 1985: 102, 112, 132). The effort and energy invested to produce manioc in this manner and the approximate 10 tons of harvested roots from this feast suggest that this crop was an essential component of Cerén agriculture. While manioc is typically grown for its starchy roots, the leaves of the plant are also edible and contain an average of 35 percent protein and vitamins,
most of which is digestible by humans (Dufour 1995: 150). The large amount of leaves produced in the Cerén fields would have required use or disposal in some manner. Additionally, portions of the stalks of the plant would have been used for replanting, though the remainder of stalks not cut for replanting had potential use as firewood.

*Harvest Labor*

That manioc and maize were both harvested during this time strongly implies a large, intensive labor output was underway, and communal reciprocity, extended household labor, or work groups would all have been required to achieve a harvest of this magnitude. Harvesting of manioc is extremely flexible and does not have to be conducted within a specific season or period of time (Cock 1985: 21). Manioc can be left growing for two to three years before being harvested or can be harvested plant by plant, or even root by root (where the plant is left standing and the roots are dug up) on an as needed basis for consumption (Cock 1985: 22). Thus, it is an interesting feature that all of the manioc beds found at Cerén to date had been harvested just prior to the Loma Caldera eruption, while the manic grown in the household kitchen garden was not.

Manioc is typically harvested by either manually pulling the entire plant from the ground or by removing the top of the manioc plant, digging up roots, and then removing the plant from the ground (Cock 1985: 71, 110). Manual labor is the primary source of the harvesting effort, though it has been recorded that farmers might leave the plant uncut and use the stalk as a level or tie a pole around the stump, if the manioc plant has been cut, to use that as a lever for easier extraction (Cock 1985: 71). Today in the Zapotitán Valley plants are left intact and harvested in a combined effort requiring two to three individuals (Figure 5.4).
Figure 5.4. Harvesting Manioc in Joya de Cerén, 2012
(Photograph by author)
Regardless of whether the manioc stalks are cut before or after harvest, this labor is still a part of the entire effort needed to harvest and process manioc plants. The Cerén beds show no signs of having had the manioc roots dug up, but rather show areas where the entire plant was removed at once. This style of manioc harvesting is a very labor-intensive process for larger manioc plants and usually requires the labor of multiple people to extract a plant. A few roots are typically broken off during this process and remain in the ground. Planting beds, such as those documented at Cerén, serve to reduce some of the labor needed to extract the plants, as they provide more arable soil.

If the manioc plant is not cut before harvest, then once removed from the ground, each large plant must be transported to an area for initial processing. Typically the roots are removed from the plant, presumably by snapping them loose in ancient times, or using a knife or axe of some kind. The stalks might be cut immediately into stakes for the next cycle of planting, or temporarily stored to be cut into stakes at a later time. If leaves are to be eaten, those would also need to be removed from the plant and processed immediately, given manioc leaves will deteriorate even faster than roots, in a period of less than 24 hours.

The labor likely used to harvest this quantity of manioc in a relatively short time period, at most only a few days, would have required the participation of many individuals, likely well beyond the make-up of individual households. Almost certainly men, women, and children would have been involved in the various tasks needed to harvest and initially process the manioc plants. Furthermore, it is probable that extended family groups or community work groups would have been required to achieve not only the large amount of harvesting and initial processing required for these fields, but also the additional processing of the manioc roots after they were removed from the fields and transported to a processing area. Such efforts were likely
organized by non-royal community leaders and operationalized through forces of kinship, lineage, reciprocity, and redistribution.

*Manioc Uses and Processing*

The discovery of manioc grown in intensive, mono-cropped fields suggests that manioc was being used for something beyond the traditional household consumption of roots documented in the site center (Dixon 2007, 2009, 2011a; Sheets et al. 2012). In the region today manioc is most often grown in household gardens and roots are dug up as needed by a household as in ancient times. Entire fields of mono-cropped manioc that were simultaneously harvested indicate that manioc was being used in a different manner.

Once harvested manioc roots deteriorate quickly, typically within 24 hours, if not immediately consumed or processed into another form. This deterioration is accelerated if the root cortex has been removed (Sheets et al. 2012: 273). Upon harvesting manioc roots are either 1) consumed immediately, 2) quickly traded and consumed, 3) dried, ground, and stored as a flour, 4) juiced to form an adhesive liquid, or 5) fermented into a drink (Lancaster et al. 1982). The volume of the Cerén manioc harvest implies it is doubtful that a high percentage of the roots would have been used in immediate household consumption.

The quantity of roots recovered from these fields in such a short period of time strongly suggests that the manioc roots were either quickly traded and/or processed, beyond being boiled or roasted for consumption. Manioc can be eaten raw, though this practice is a rarity (Lancaster et al. 1982: 22). If traded, it seems probable the consumers would have processed the manioc, given the quantity of the roots harvested and the speed with which manioc roots rot. Today, manioc produced for sale or trade in markets is typically harvested in batches that are taken immediately to a nearby market to be sold directly to a consumer. The harvesting is regulated to
balance with the demand for roots and the entire fields are therefore not harvested at the same time (Cock 1985: 33). The size of the manioc harvest at Cerén suggests that the manioc was most probably processed either at Cerén or the final destination of these roots. This is different than a model where smaller sections of manioc fields would have been harvested and distributed at more regular intervals. The most likely uses for the manioc roots would be as a flour, an adhesive paste, and/or a fermented drink (Sheets et al. 2012: 273).

Manioc has been regarded as a useful subsistence crop, particularly given its tolerance to droughts and the high level of carbohydrates in the roots (Cock 1985: 1-2). All raw manioc contains hydrogen cyanide (HCN), though manioc varies in the amount of cyanide contained from high-cyanide manioc, the so called “bitter” variety with cyanide concentrations above 100 ppm, to the “sweet” variety, or low-cyanide manioc with cyanide concentrations below 100 ppm (Dufour 1995: 150). The variation between these toxicity levels is based on the cultivar, as well as the season, climate, and edaphic conditions (Dufour 1995: 208: Lancaster et al. 1982).

It is thought the manioc at Cerén was of the low-cyanide variety (David Lentz personal communication, 2009) and the lack of processing tools (e.g., grater boards, budares, and tipitis) strongly supports this interpretation (Lancaster et al. 1982: 13-16). In ethnographic studies low-cyanide manioc was typical part of a food system with other staples such as maize or the high-cyanide manioc (Renvoize 1972), although there is a case where low-cyanide manioc was recorded as a staple crop on the eastern slopes of the Andes. There are less elaborate processing techniques associated with the sweet variety of manioc when compared with its bitter counterpart (Dufour 1995: 149), and by removing the cortex or peeling sweet manioc, most of the cyanide content is removed (Dufour 1995: 153).
Four possible processing techniques for the Cerén manioc are explored. First, manioc roots can be dried and ground into flour (Lancaster 1982: 22). To produce manioc flour, the roots are harvested and then the cortex of the root is removed, usually by slicing down the length of the root and peeling off the cortex from the root. Once the decortication is complete, the roots are cut into small segments, usually a few centimeters in diameter, sometimes referred to as cassava chips (Lancaster 1982: 19-24). They are then placed in the sun to dry for eight days. After they are dried the roots are ground with a mano and metate, or a mortar and pestle, into a powder or flour (Figure 5.5).

Figure 5.5. Grinding Dried Manioc Disks with a Mano and Metate in Joya de Cerén, 2009 (Photograph by author)
As long as it remains in a dry location flour can be stored for a year or more and is used in the same way as other flours are for cooking (Dixon 2009). Second, starch can be extracted from manioc roots to create adhesives (Cook 1985: 49). The manioc roots are peeled, finely grated, and then a form of filtration is used to remove the liquid containing the starch from the fiber. The starch is extracted from the liquid through sedimentation, allowed to dry, and it then can be milled into a fine powder. The resulting starch can be used in a variety of ways, including as an adhesive, such as what was used to apply pigment to Cerén structures (Payson Sheets personal communication, 2013). Residents of Joya de Cerén have also reported that manioc could be used for a starch for clothing, a basic paste by creating a mush from the roots and water, or even to calm stomach aches (Elena Garcia personal communication, 2007).

A very popular use for manioc is as a fermented beverage (Cock 1982, 1985; Lancaster et al. 1982: 25; Fournier García and Mondragón Barrios 2012: 62; McGovern 2009: 198-230; Tarble de Scaramelli and Scaramelli 2012). Manioc “beers” are widespread throughout tropical America and in the Amazon lowlands have been recorded as the beer of choice (Lancaster et al. 1982: 25). The fermented manioc drink is commonly referred to as chicha (fermented beverages, most often made from maize), the same name used to refer to similarly created maize beers (Lancaster et al. 1982: 25; McGovern 2009: 206). There are two main ways to produce manioc beer, either through mastication or non-mastication techniques. In non-mastication techniques, manioc fermented drinks were created in multiple ways. The Makiritare group of Venezuela prepared alcoholic manioc drinks by leaving roots in a flowing stream for a week before removing and mashing them, adding water, and then letting the mixture stand for three days before drinking (Lancaster et al. 1982: 25). The Mojo group of Brazil would crush and sieve manioc roots, allow these to ferment, then would strain the mash through perforated vessels
to produce an alcoholic liquid (Lancaster et al. 1982: 25). Other methods of producing manioc fermented drinks included fermenting grated manioc roots in a basket covered with leaves or placing manioc bread in water for three days and then adding sugarcane juice (Lancaster et al. 1982: 25).

The second and more common method of manioc fermentation involved mastication. Mastication speeds the fermentation process with salivary enzymes initiating the conversion of the manioc starch to sugar. There are many cultural traditions association with mastication of fermented beverages, and in some cases, taboos or preferences for who is allowed to chew the manioc (e.g., young girls only or the oldest women) (Lancaster et al. 1982: 25).

There is a variety of fermented manioc beverages created through different mastication methods. The Tupinamba of Brazil use boiled, thinly sliced manioc roots, and then had young girls squeeze and chew the pieces, which are then mixed with water and heated on the fire. Once heated, the liquor is poured into jars, covered with leaves, and left to ferment for 2 to 3 days (Lancaster et al. 1982: 25-26). The Yuruna group of Brazil creates a fermented manioc beverage by filling a canoe with a large amount of partly chewed manioc, sometimes adding bananas, and then covering the canoe with leaves. The manioc mash is left alone for a few days to allow for fermentation (Lancaster et al. 1982: 26). Manioc bread can also be chewed and then left to ferment for one to three days; beyond three days of fermentation, it is reportedly too sour to drink (Lancaster et al. 1982: 26). Other fruits and vegetables can be added during the preparation of manioc alcoholic beverages, including maize flour (Lancaster et al. 1982: 26).

To date no diagnostic processing areas or massive collections of storage vessels for agricultural yields have been found at the site. Thus, it is not possible to know for sure how these plants were being used or which method of fermentation would have been employed if the
Cerén manioc was used for an alcoholic beverage. Residue analysis studies of the vessels recovered from the site, particularly the large vessel from Structure 3 (discussed further below), might yield enlightening data in understanding how the plants of Cerén were being consumed and used. Unfortunately, bio-indicators for manioc have proven elusive in all testing to date (Sheets et al. 2012).

The manioc fields of Cerén were very carefully maintained, kept clear of debris and of other plants or weeds, slope was maintained for good drainage, and careful effort was put into the cultivation, harvesting, and presumably processing of the crop. It is possible that this care implies that these manioc fields had a special function or use within the site. If these manioc yields were fermented into an alcoholic beverage, or if used in combination with or without maize for the production of chicha, it is possible the crop had ritual or supernatural significance. The use of fermented drinks in key ritual and political contexts throughout Mesoamerica has been well documented (Fournier García and Mondragón Barrios 2012). The use of manioc for this purpose might have warranted more careful planting and tending of the crops.

Many of the harvested roots could have been used in the ritual feast, yet it seems improbable this quantity of manioc would be consumed in this form. The most likely use of manioc at Cerén was either as a flour or a fermented beverage, given the quantity of manioc harvested at one period of time and the speed with which the roots rot. If the manioc was used to create an alcoholic drink, many containers would have been required for this process. There is evidence of ceramic olla jars and gourds that would have served as containers. A future detailed reassessment of the quantity of these types of artifacts might help to identify the most probably use of the crop at the site. Similarly, there is a high probability the manioc was processed into flour and stored at the site, traded, and/or given as tribute. Documentation of processing and
storage areas and further studies of metates at the site might yield important data to examine the uses of these manioc yields.

While such speculations await further evidence, it is clear that the manioc grown at Cerén was given great attention and care, much more care than is required for the growth of this hardy plant. Whether this care signifies importance in nutritional, social, or ritual contexts, its worth and use beyond household consumption of roots is none-the-less evident by the large, well-cared for beds and the coordinated harvest. The large amount of labor required for the manioc harvest and processing strongly suggests that in addition to farmers’ cultivation choices, there was also a communal organization of production and large communal efforts coordinated at Cerén.

Communal Structures

Excavations of the Cerén site center have documented a combination of domestic and public structures intermixed throughout the site (Sheets 2002a). The relationships between these buildings and their proposed functions as religious, communal, and governance centers informs our interpretations of the sociopolitical economy of the site and the possible non-royal governance that was responsible for organizing Cerén agricultural production.

To date, five public, communal structures have been identified at Cerén: Structures 3, 9, 10, 12, and 13 (Sheets 2002a). Each of these public structures had features distinguishing it from domestic buildings, such as its shape, size, decoration, and function. Associated spatially with each of these communal structures was an adjacent, nearby domestic complex. Cerén domiciles typically had an associated bodega (storehouse), kitchen, and garden or milpa nearby (Sheets 2002a: 43-44). The physical link of specific households with communal buildings points to a service relationship between that household and the associated public structure or structures (Sheets 2002: 3, 4, 183). Proximity is a common measure of stewardship in archaeological
contexts and in this case shows a clear relationship between households and public buildings. The relationship between domestic structures and public structures signifies a key reminder to archaeologists that economic, social, and political complexities in the past were much greater than are preserved in the archaeological record. The rich complexity of public buildings affords a heterogeneous and complex image of a non-royal Classic Period Maya agricultural community.

In the case of Household 1, the domicile, bodega, kitchen, garden, and maize fields are directly adjacent to the large ritual buildings: Structure 10 where feasts were likely centered (Brown and Gerstle 2002) and Structure 12, which functioned as the diviner’s building (Simmons and Sheets 2002). Wattle and daub construction requires regular maintenance to the walls and floors, as well as less frequent maintenance of the thatch roofs. The positioning of Structures 10 and 12 in such close proximity to Household 1’s domicile, bodega, and kitchen all indicate a service relationship between the occupants of this household and these structures (Sheets 2002a: 3, 4, 183). The diviner and the feasting areas were used by more than just the occupants of Household 1 and served to connect the larger community (Sheets 2002c: 200-205).

The Structure 9 sauna and Household 2 show analogous proximities to that of Household 1 and Structures 10 and 12 (Sheets 2002a: 3, 4, 183). The sweat bath, Structure 9, was found immediately adjacent to Household 2’s domicile, bodega, and milpa. It is suspected that the formal and elaborate construction of the building, including a domed roof and its large size suggest it was used by the community (McKee 2002b: 93-96). There was also a collection of approximately ten laja (stone) seats located in association with the sauna. This suggests that the sauna was likely used in a small communal setting (McKee 2002b: 93). Ethnographic records indicate that sweat baths were pivotal in communities for both quotidian and ritual events. Based on the proximity of Household 2 and possibly Household 7, it is surmised that this household, or
these households, were probable caretakers or custodians of the community sweat bath (McKee 2002a: 96).

Lastly, Structure 3 has been interpreted as a seat of non-royal governance, and part of the Cerén civic complex that included Structure 13, a public structure of unknown function, and a plaza area (Gerstle 2002). Structure 3 is the largest building identified at Cerén to date (approximately 8 x 5 meters and up to 1.25 meters in height) (Gerstle 2002: 83). It was a two-room building with solid-walls that sat on a clay platform and was covered by a large thatched roof (Gerstle 2002: 83). The front room of the structure had a solid-clay bench on either side and the interior room was a wide but space without benches (Gerstle 2002). Benches in the exterior room have been associated with civic, political structures in the Maya area to manifest power publically, whereas domiciles typically have the opposite organization with the interior room having a sleeping bench for privacy (Sharer and Traxler 2006: 489-490).

Further support for a civic function of this structure was that only five artifacts were found in Structure 3, including a massive 60 cm tall jar on one of the front room benches. This vessel likely contained a liquid, previously hypothesized as a corn-based chicha (Gerstle 2002: 88) - although this beverage may also have been chicha made from manioc or a combination of maize and manioc (Lancaster et al. 1982: 25). It was hoped that residue analysis of this vessel and others at Cerén might afford key evidence for the use of manioc and maize at Cerén, particularly as fermented beverages, and could provide vital evidence for how agricultural yields were processed and used at the site for ritual purposes. Unfortunately, researchers have been unable to find a bioindicator for manioc that would be visible in residue analysis of ceramics (Payson Sheets personal communication, 2013). Structure 3 could have provided a meeting center for non-royal governance and decisions about harvest, and overall agricultural production
plans and organization might have stemmed from such gatherings. The evidence from Structure 3, combined with the service relationship between households and community structures and lack of any indication for an individual leader, all signify that power was likely distributed between leaders, elders, or family lineage heads at the site (Blanton et al. 1996).

The earthen construction of Cerén is different from that of contemporaneous construction at the nearby center of San Andrés. While adobe bricks were used at San Andrés, only a few loose adobe bricks were found at Cerén near Structures 2 and 3, none of which were in construction contexts (Gerstle 2002: 85). The distinct form of building construction at Cerén might have marked the community’s individual identity. It is possible that other similarly constructed sites were present in the Zapotitán Valley, yet under typical preservation conditions for tropical areas, these sites would not be found. There are, however, numerous other equally sized settlements in the Zapotitán Valley, the presence of which demonstrate the complex social, political, and economy activity of this region during the Classic Period (Black 1983).

The form of the buildings and the presence of communal complexes including both religious and civic buildings indicate that Cerén maintained a distinctive community identity. The distribution of public structures throughout the community further supports the presence of a corporate form of governance, whereby governance was spread throughout the community and not consolidated in the hands of one person or family. That households were responsible for the custodianship of different communal structures indicates that power was not concentrated into one household group or family. Despite the fact that Cerén was a part of the Zapotitán Valley, the Cerén community maintained its own identity and autonomy in organization of communal events and, as shown in this dissertation, agricultural production.
Political Economy in the Zapotitán Valley

The major regional center of San Andrés was located 5 km south of the Cerén site. The Cerén community no doubt had connections and relationships and might have even viewed themselves as a part of the broader San Andrés settlement and the other approximately dozen elite centers in the region, yet the Cerén site maintained clear distinctions from San Andrés, particularly in the architectural construction discussed above.

The exposed sections of the earthen sacbe at Cerén tracks towards San Andrés, yet it might also terminate well before that area. Sacbeob are known to have had utilitarian, ideological, and political functions in the Maya area (Chase and Chase 1994; Folan 1991; Freidel et al. 1993; Tedlock 1985: 111). In comparison to the informal footpaths used for transportation at the site, the Cerén sacbe was carefully constructed and heavily used, as there is a great deal of compaction on the top of the road and compacted ceramic sherds and carbon remains were trampled into it (Figure 5.6) (Dixon 2011b). The size (c. 2 meters in width) and the careful selection of white tephra for the upper-most layer of the sacbe, point toward an ideological role of this road beyond basic utilitarian functions.

Overall, the sacbe was well-maintained, as each side of the road would have required continual maintenance, especially during the rainy season, in order to preserve the edges from erosion. The edges of the sacbe were packed with tephra from the canals and were significantly less compacted than the central area of the feature (Dixon 2011b). The three excavated sections of the sacbe show divergent levels of canal maintenance and construction, with some areas more formal and well-maintained, and other areas having less defined canals. This variance in sacbe edge and canal maintenance might correlate with different adjacent field plots or be related with variations in water flow.
I hypothesize that such differences are indicative of different sections of care-taking responsibilities, where farmers of adjacent fields were responsible for a part of sacbe maintenance and care, suggesting little centralized authority in its maintenance. In Op. W, exposure of maize fields on either edge of the sacbe allowed for the direct comparison between fields on either end of the sacbe. This comparison showed variation in maize ridge construction (see Chapter 4; Heindel and Lamb 2011) and a difference between the edges on either side of the sacbe (Dixon 2011b). The construction and maintenance of the sacbe might further support a model for distributed community service relationships of communal features. If the edges of the sacbe bordering different fields show variation in care and maintenance, then these differences might represent variation in care-taking responsibility where owners of adjacent field would have been responsible for the maintenance of a portion of the sacbe (Dixon 2011b).
The *sacbe* will be investigated in an upcoming research project to further explore its limits and direction (Sheets and Lentz 2012). If the *sacbe* does connect with San Andrés, it would suggest a formal relationship between the two sites, and possibly more involvement of elites in the lives of the Cerén occupants. It is also probable that a system of earthen *sacbeob* existed throughout the valley, previously unknown to archaeologists due to a lack of preservation. The upcoming project will also examine the possibility that additional Cerén *sacbeob* connect Cerén to other sites in the valley.

Regardless of whether a formal link existed between Cerén and San Andrés (or other regional centers, such as the one 5 km north of Cerén), the evidence from the site center and the agricultural fields all suggest that, even within broader relationships on the Zapotitán Valley, the Cerén community had its own identity, organizational power, and non-royal governing systems. The agricultural fields inform a view of Cerén whereby farmers had autonomy over crop choices and techniques, yet were integrated into a broader level of supra-household, community organization by religious, social, economic, and political forces. The sociopolitical economy of the site was one in which farmers had agency and power, the community emphasized a corporate strategy of rule, and the nearby elite center, while no doubt important, was not completely dominant over the site. Cerenians had the power to decide which of many elite centers with which to exchange their surplus food, crafts, or labor for obsidian, shell, pigments, jade axes, jade beads, and polychrome ceramics (Sheets 2009a).

**Summary and Conclusions**

Cerén agricultural fields show evidence for farmer autonomy in choices about cultivation techniques and the selection of which crops to grow where and when. Field boundaries were
sharp and typically oriented with the same configuration of almost all of the Cerén structures to 30°. This evidence, combined with the large quantity of field plots in a small area, implies that the Cerén fields were marked as separate spaces of cultivation for specific households, possibly by different land custodians or owners. The field boundaries were permeable, non-obstructive transitions from one agricultural field to another or from agricultural fields to cleared spaces. Community organization is evident in both the overall orientation of field boundaries and in the coordinated manioc and maize harvest. The harvest ritual or feast at Structure 10 provides further evidence of the community integration of this agricultural production (Brown and Gerstle 2002). The Maya cuch ceremony utilizes white-tailed deer, such as the one found at Cerén, to celebrate the harvest and agricultural productivity (Brown and Gerstle 2002: 102). Despite the major cultural disruptions since the Classic Period, it is appears possible that the symbolism of these ceremonies is linked given the presence at Cerén of a deer skull headdress at a ritual feast during the harvest (Brown 2001; Brown and Gerstle 2002).

The quantity of maize and manioc harvested in a short period of time, just prior to the Loma Caldera eruption, would have required the efforts of multiple people, well beyond the resources of a single farmer for each plot. Moreover, the processing labor required, particularly for the manioc yields, would have necessitated the participation of men, women, and children in each household, as well as possibly the extended family or community support. The harvest feast might have served to both mark the appropriate timing of the harvest and to draw together communal labor for these efforts. The proposed service relationships between Cerén households and communal structures, as well as potentially between farmers and sacbe sections, afford a model of organized communal effort. Such organization might have sprung from the centralized decisions of community leaders, who would have probably met in Structure 3. Such leaders
might have been communal elders, heads of founding families, or representatives of different lineages. The communal nature of this leadership is evidenced by the lack of identification of any single leader or person, no significant stratification between households, and the distribution of public structures among numerous households in the community (Blanton et al. 1996).

McAnany (1993b: 69) stated, “Although we have no direct information regarding Classic Period Maya land tenure, the large residential grouping so typical of the lowland cities and hinterland suggest that they functioned as the organizational nexus of agricultural production.” Cerén affords direct evidence of Classic Period Maya land tenure and the evidence from these fields supports a model of community based organization of agricultural production. Cerén was integrated into the sociopolitical economy of the Zapotitán Valley and the Maya world, yet the variable integration of this community into these broader structures does not mean that the agricultural organization or other forms of production at the site were under the control of elite leaders.

Based solely on proximity, Cerén might have been interpreted as an agricultural subsidiary of San Andrés or other larger nearby centers. McAnany (1993b: 73) argued, the elite corps of each city (both the royal dynasties and minor elite lineages undoubtedly had direct control of large tracts of rich arable land upon with maize and “elite-consumption” crops such as cacao and cotton were grown wherever soil and rainfall conditions permitted, the agricultural labor on these lands being supplied by corvée labor. From the overwhelming evidence of monumental architecture, it is clear that the ruling class was certainly able to muster corvée labor [McAnany 1993b: 73].

Cerén was not an agricultural subsidiary and Cerén fields were not under the control of a managing royal power or through the use of corvée labor. Rather, archaeological evidence from the Cerén fields strongly supports a model whereby the nexus of agricultural production was at the community level, with a form of non-royal governance. Such non-royal governance might have been influenced by ‘founding families” (McAnany 1995), kinship, and community elders.
The lack of evidence for elite control of production does not, however, suggest that relationships between Cerén and San Andrés or other regional centers did not impact cultivation decisions. Requirements of tax or tribute might have significantly influenced Cerén farmers’ decisions without overseeing the day-to-day methods of cultivation. Connections of agricultural production to nearby centers would require much further exploration of the Zapotitan Valley during the Classic Period.

The presence of communal structures (including the probable governance building, Structure 3) and the lack of an individualistic ruling power visible at the site, all indicate that decisions and negotiations of the community’s organization of agriculture and other internal functions were achieved through corporate governance that lacked a large degree of hierarchy (Blanton et al. 1996). Communal decisions were likely reached through the meeting of key community leaders, possibly based on their status as lineage heads or founding family members, and that these decisions were likely operationalized through ties of kinship, ideology, redistribution, and reciprocity more than elite law.

Cerén no doubt had complex social, political, ideological, and economic interactions with the large, regional centers of the Zapotitán Valley, particularly San Andrés; yet, such relationships do not inherently imply top-down control of agricultural production. Rather, artifact analysis conducted by Sheets (2000) showed that Cerén occupants supplied many of their own artifacts, with a system of intra-site surplus production and exchange. He argued that more specialized and valuable goods, such as polychrome pottery and obsidian prismatic blades would have been procured at a regional market, though Cerén households would have probably been able to decide which regional center to use (Sheets 2000). The Cerén evidence provides an informative case study of how the fields and agricultural production of one community were
likely organized. There is currently no evidence for how the yields of these fields were used and it is possible that some of these agricultural products were part of a tax or tribute to nearby centers. Regardless of how the agricultural produce was used at Cerén, farmers had the autonomy and power to decide what crops to grow, where, and in what manner and the community governance seemingly was responsible for organizing labor, harvest, and land-use.
Chapter 6: Summary, Conclusions, and Implications

Introduction

This dissertation presents the analysis of three field seasons (2007, 2009, and 2011) of research at Cerén and related previous research at the site to better understand the relationships of farmer autonomy, organization of agricultural production, and sociopolitical economy at a community level of analysis. The burial of Cerén c. A.D. 630 by the Loma Caldera tephra preserved evidence of quotidian practices of a Classic Period Maya farming community. The location of Cerén in close proximity to regional centers of the Zapotitán Valley, particularly San Andrés, and the presence of trade goods (such as polychrome pottery, prismatic obsidian blades, shell, pigments, jade axes, and beads) demonstrate the connection of the site within a broader regional economy of the valley and beyond (Sheets 2000). Yet as previous research at the site (Sheets 2000) and this dissertation demonstrate, Cerén maintained a strong community identity and the power to enact its own social, ritual, economic, and political decisions.

The Maya archaeological literature has traditionally and understandably focused on the highest level of political organization where hierarchical relationships are posited for major and minor regional centers with surrounding villages, while farming communities are seen as small, simple, and less significant to the function of social, political, and economy life (Adams and Jones 1981; Ball and Taschek 1991; Bullard 1960; Demarest 1992; Houston and Stuart 1996; J. Marcus 1993: 115-116). While household archaeology has begun to correct this elite-centric bias of the past (Dunning et al. 1999; Douglas and Gonlin 2012; A. Joyce 2000, 2001; Lohse and Valdez 2004; Gonlin 1993; Gonlin and Lohse 2007; Robin 2003; Sheets 2006), in the realm of
agriculture, limited preservation has obscured our understanding of how agricultural production was organized and the degree of autonomy ancient Maya farmers may have experienced. Elite authority was inscribed on monuments, yet the role of other forms of sociopolitical functioning, particularly related to agricultural production, remain more difficult to ascertain (Hendon 1991, 1996, 2010; R. Joyce 1993, 2000; Robin 2002b: 23). Rather than political power ascribed to the elite few of Classic Period Maya society, political powers were present throughout a gradient of socio-economic status (Reed and Zeleznik, in press).

Cerén affords a case study of non-royal governance, whereby a community organized and controlled their own agricultural production and used at least some of that production for a community feasting event (Brown and Gerstle 2002: 97-103). We must avoid both the assumption that Cerén represents all Classic Period Maya sites and that Cerén is unique. The Cerén evidence for intensive manioc mono-cropping and maize cultivation is viewed in the context of diverse strategies and approaches to agriculture throughout the Maya world (Fedick 1996). The implications of these findings extend to Maya agricultural production and organization, the connections of practice theory, political economy, and farming, and the role of non-royal governance in neighborhood (Arnauld, Manzanilla, and Smith 2012), community (Yaeger and Canuto 2000), and household and commoner studies (Douglas and Gonlin 2012; Lohse and Valdez 2004; Gonlin 1993; Gonlin and Lohse 2007; Robin 2003; Sheets 2000).

**Summary of Research**

Three field seasons of Cerén research (2007, 2009, 2011) have focused on agricultural production in the southern region of the site and have documented maize fields, manioc fields, an earthen *sacbe*, a corner of a structure, and various forms of cleared spaces (Sheets 2007, 2009b;
Sheets and Dixon 2011). This dissertation synthesizes these data and provides an analysis of the number, condition, and state of agricultural fields in the region south of the Cerén site center to better understand the organization of agricultural production. The Loma Caldera eruption resulted in the extraordinary preservation of Cerén’s earthen architecture, including both domestic and public structures, living spaces and platforms, artifacts, and agricultural fields. In the absence of this volcanic event very few of these remains would have survived the typical natural and cultural transforms of the region. The first and third phases of the eruption consisted of fine-grained, moist tephra that packed around plants in such a way as to preserve their form in the matrix. Thus, in addition to the agricultural ridges, beds, and field boundaries visible at Cerén, we were also able to create plaster casts from the tephra molds of ancient plants (Sheets 2002b: 6-7). The detailed preservation of ancient Cerén’s agricultural fields and the plants that once grew there provide a profound opportunity to examine agricultural production, sociopolitical organization, and farmer autonomy at the site.

These data include nine maize fields located south of the Cerén site center, in addition to the eight maize fields previously documented adjacent to Cerén structures (Sheets and Woodward 2002: 185). Typical maize planting at Cerén was in ridges approximately 10 cm in height and spaced around 80 cm from ridge-top to ridge-top (Dixon 2007; Tetlow 2009; Lamb and Heindel 2011; Sheets and Woodward 2002: 184). The maize fields south of the Cerén site center were in a variety of stages of cultivation, though the majority of the fields were in the process of or very close to the time of harvest when the eruption occurred, with many of the maize plants found bent over, drying in preparation for the harvest. The maize ridges also showed variation in construction techniques (discussed further below). It is difficult to estimate the size of these maize land-plots due to the location of only small sections of each field and only
one, or at most two, boundaries having been documented or reasonably projected for each field. Based on the known boundaries, these maize fields were small in size ranging very roughly from 100 m$^2$ to 400 m$^2$ or more.

This project also discovered intensive mono-cropping of manioc south of the Cerén site center (Dixon 2007, 2009, 2011a). Portions of four manioc fields have been identified to date, all of which had been harvested just prior to the Loma Caldera eruption. In the case of Manioc Fields 1 and 2, the beds showed areas of depressions, where manioc plants had been pulled from the ground with few remaining roots and stalks left in the beds (Dixon 2007, 2009, 2011a). Manioc Field 3 had been harvested and re-planted shortly before the eruption. There was not a large enough sample of Manioc Field 4 to determine if these beds had been replanted. All of the Cerén manioc beds lacked evidence of having been impacted or damaged by rain. This suggests that the beds were harvested approximately a few days before the eruption, given it was the rainy season and the earthen beds would have shown evidence of such rains and erosion. Future experimental studies could examine the rate at which similar beds weather during the rainy season to better assess the time between the manioc harvest and the eruption.

Two styles of manioc beds were recorded and have been interpreted as separate cultivation techniques of manioc farmers. The manioc fields were constructed with large earthen beds that facilitated loose soils, good drainage for the crop, and slightly easier extraction of the plants during harvest. An estimated minimum of 10 metric tons of manioc roots would have been yielded from the known Cerén manioc fields (Sheets et al. 2012). The largest documented Cerén manioc field thus far is Manioc Field 1 (approximately 600 m$^2$) and the northern and southern extents of the field are yet to be located (Dixon 2009, 2011a).
It is possible that Cerén provided manioc for other sites in the valley? Manioc was certainly a larger part of ancient Maya diets in the Zapatitán Valley, and possibly elsewhere, than once thought. Intensive manioc and maize cultivation, as well as the variety of species grown in gardens and arboriculture (Lamb 2011, 2012; Lentz and Ramírez-Sosa 2002: 33-42) provided the Cerén community with a diversified agricultural portfolio. Manioc offered an economic strategy for coping with climate uncertainty in the form of drought since the crop will cease growing yet the underground roots remain edible- making growing it a potentially vital drought protection strategy (Cock 1985: 18). While it is unknown precisely how the manioc was used at the site, the coordinated, intensive harvest indicates the roots were quickly traded, or more probably were processed into flour and/or a fermented beverage then consumed, traded, and/or, put into long-term storage.

Agricultural field boundaries provide a crucial domain of evidence for this study. Ten agricultural field boundaries were documented in the southern fields and nine additional boundaries have been projected. The linear boundaries identified for the agricultural fields were formed by four different interface types: 1) a separation between two different crops with distinct planting forms (e.g., manioc beds and maize ridges), 2) a disjuncture between two fields of the same crop (e.g., two manioc fields with staggered bed locations where the beds of one field aligned with the walkways of the other), 3) a termination of an agriculture field with the canal lining the earthen sacbe, and 4) a separation of an agricultural field and an adjacent cleared area. The cleared spaces included a) uncultivated and natural topographic areas, b) cleared, flat constructed floors or small-platforms, and c) fallow fields maintained as cleared areas. The quantity and formality of field boundaries’ terminations and the estimated small size for the agricultural plots indicate that land was divided into small sections and Cerén farmers were
decidedly attentive to field separations. These divisions were all oriented in the same direction, displaying a community level of organization.

Discovered in association with the Cerén agricultural fields and cleared areas were the approximately 2 meter wide earthen sacbe, a corner of a small structure (possibly a field house or domestic storage facility), and a variety of paleobotanical, ceramic, and lithic evidence (see Chapter 4). These data, as well as previous research from the Cerén site center, will be included in the discussion below as such findings pertain to interpretations of Cerén agricultural organization and the sociopolitical economy at the site. This research has important implications for 1) our understanding of ancient Maya agricultural, including the role of root crops in the Maya area, 2) the connections of practice theory, political economy, and farming, and 3) household and commoner studies. The impacts to each of these domains will be explored.

**Implications for Ancient Maya Agricultural Production**

While root crops were previously hypothesized as a potential staple for the ancient Maya (Bronson 1966), Cerén provides the first direct evidence for intensive manioc production in the Maya world (Sheets et al. 2012). These data inform both our understanding of the potential role of manioc in the Maya area, as well as the uses of the crop within Cerén.

**Manioc and the Maya**

This section will briefly review the significant attributes of the plant and contextualize the Cerén findings in Maya agricultural studies. Manioc is a plant with many advantageous characteristics because it requires less energy for planting, tending, and harvesting common for other Mesoamerican crops and requires loose soils and good drainage for growth (Cock 1982; Leon 1968). Harvesting manioc is exceptionally flexible in timing and does not need to be
completed in a specific season or time-frame (Cock 1985: 21, 110-111). The plants can be harvested as soon as six months after planting or they can be left growing in the field for two to three years before being harvested. Given the potential flexibility of manioc harvesting, many households leave the plant growing in the home garden until it is needed for immediate consumption, harvesting it on a plant-by-plant, or root-by-root, basis. These considerations are imperative when analyzing the potential position of the crop as a drought-coping strategy and a food or drink source at Cerén, as well as assessing the effort and energy that was invested into these manioc fields. Cerén farmers made specific decisions about where and how manioc was planted and the harvested.

Manioc botanical remains do not preserve well in the archaeological record and are extremely difficult to document in the Maya area (Sheets et al. 2012: 60) (isolated only to a few instances of carbonized remains [Miksieck 1991: 180] and pollen grain identifications [Crane 1996; Dunning et al. 2006; Pohl et al. 1996; Pope et al. 2001]). Pollen evidence allows the identification of only the genus *Manihot* and therefore researchers do not know if the evidence is for a wild or domesticated variety (Sheets et al. 2012: 60). In the absence of such physical evidence, scholars have turned to ethnographic and linguistic data to support the prominence of root crops in the past. Manioc was cultivated in seven out of ten ethnographically recorded Maya groups (Bronson 1966; Wisdom 1940: 56) and in the case of the Chorti group, manioc was grown in fields separate from other crops (Wisdom 1940: 56). The word for manioc (*tz-iXn*) was also present in most major branches of the Mayan languages, which has been presented as further evidence for its use in ancient agricultural production (Bronson 1966).

In response to twentieth century archaeologists’ exuding enthusiasm for the possible role of manioc in ancient Maya agriculture, Flannery criticized scholars who “believed in faith [in
Precolumbian manioc cultivation] because there is no archaeological evidence to support it” (Flannery 1982: ix). Flannery’s caveat was reasonable at the time. Preservation of durable manioc indicators, such as pollen, phytoliths, or starch grains, has been remarkably elusive (Sheets et al. 2012: 60). Consequently despite archaeological focus on the crop, few remains of manioc have been recovered from Maya sites. The difficulty documenting manioc in the past makes the results of this dissertation even more powerful, given these data provide direct evidence for intensive manioc cultivation in one Classic Period Maya community. There are important implications of the presence of intensive manioc monocropping at Cerén in the areas of agricultural production and demography.

Most theories of Maya agriculture now focus on multiregional hypotheses that provide a more dynamic and nuanced approach to the variety and diversity of agricultural practices of Classic Period Maya farmers (Fedick 1996a). The mosaic model posits that no single agricultural strategy was used for the Maya and a wide range of variance in soil type, water availability, slope, and edaphic conditions across the Maya landscape influenced agricultural production (Dunning et al. 1997; Fedick 1989, 1996a; Wingard and Hayes 2013). Farmers throughout the Maya area relied on diverse subsistence strategies for survival and their agricultural choices and practices should be viewed in the context of farmers actively navigating political, social, economic, religious, and environmental landscapes.

Of course the Cerén system is not viewed as typical of all Maya sites throughout space and time; nevertheless, Cerén imparts a model of how manioc was used in the past. Technological innovations, artifacts, and ideological concepts were readily shared throughout the Classic Period Maya world (Evans 2013; Sharer and Traxler 2006). The artifact assemblage of the site shows Cerén was integrated into this broader sociopolitical economy (Sheets 2000) and it
seems illogical to assume that their agricultural system would have been unknown to, isolated from, or unused by other surrounding sites. Manioc would have grown well in portions of the Maya realm dryer than Cerén and those with as much rainfall or possibly more if farmers were creating similar elevated planting beds. The Loma Caldera eruption resulted in the preservation of Cerén but this does not make the site itself unique in its make-up, functioning, or organization. Rather, it simply offers archaeologists a more detailed, chronologically controlled view of one ancient Maya community as a case study of intensive manioc cultivation.

**Models of Cerén Manioc Production and Implications for Agricultural Studies**

The finding of intensive manioc cultivation challenged the previous model of manioc use at the site. Initial documentation of manioc at Cerén was limited to a few plants in household contexts, including in the Household 1 garden, where half of one row was dedicated to manioc cultivation (Lentz and Ramírez-Sosa 2002: 35; Sheets and Woodward 2002: 189). This evidence pointed to a model of manioc cultivation whereby a few plants were grown for each household and roots were individually harvested for immediate consumption (Lentz and Ramírez-Sosa 2002: 35). In this context, manioc was viewed as one aspect of household self-sufficiency. As Sheets (2002c: 204) stated,

> Each household appears to have been self-sufficient in the production of basic foods from kitchen gardens, milpas, and probably outfields. These foods included maize, beans, *Xanthosoma*, manioc, probably squash, and medicinal and decorative plants from gardens [Sheets 2002c: 204].

> The presence of four mono-cropped, intensively cultivated manioc fields immediately south of the site center demonstrates that manioc was a more integral aspect of Cerén agricultural production than formerly known. The juxtaposition of manioc grown in home gardens and in mono-cropped fields suggests that the crop was being utilized in different manners at the site.
Three major implications for agricultural studies can be gleaned from the Cerén manioc fields: 1) a crop might have served multiple functions in the past and/or had various associated functions and meanings beyond subsistence, 2) the prioritized position of maize in Mesoamerica might obscure the diversity of the agricultural techniques and landscape of the past, and 3) agricultural fields might have been an integral part of daily residential life for community members.

First, the evidence for Cerén manioc use suggests at least two different uses for the plant within the community. Each of the four manioc fields identified south of the Cerén site center was harvested immediately prior to the Loma Caldera eruption. The large output of manioc from the fields (an approximate minimum of 10 metric tons of harvested manioc roots) indicates that the roots from these fields were processed, stored, used in feasts, traded, and/or used as tribute given the speed with which harvested manioc roots spoil. In contrast, the manioc in household gardens of the site center must have been used on an individual basis for immediate household consumption. Thus, these data show us that the same plant was purposed in at least two divergent uses. Such evidence caution archaeologists that simply noting the presence of a crop at a site does not allow for the accurate understanding of its role.

Beyond different functions, plants might also be given different meaning. These four manioc fields were planted in close proximity to the Cerén site center (approximately 200 meters away). Manioc does not require a substantial investment of labor during its growth and while some basic weeding is sometimes done (Cock 1985: 55-56), it is not needed for plant growth and is rarely done by manioc farmers in El Salvador today (Payson Sheets personal communication, 2013). The sub-soil growth of the roots also provides some protection for the plants against animal herbivory (Cock 1985). The use of beds would have required much more-systematic
maintenance than the non-bed planting variety. These Cerén farmers chose to invest resources into manioc bed production and had the power to decide how much to grow, in what style, and when, which will be discussed further in a discussion of connecting practice theory and farming.

That these fields were grown in beds that required more frequent care and that these fields were located in a prioritized position where the community would have had direct and regular access to the fields might suggest an elevated position of these crops nutritionally or symbolically. This evidence might speak to the importance of the crop for subsistence at the site, or perhaps a super-natural significance. It is widely accepted that fermented drinks were often essential elements of Mesoamerican ritual and civic ceremonies (Fournier García and Mondragón Barrios 2012: 59). If the Cerén manioc was being fermented into an alcoholic beverage it is possible that the crop was viewed as having supernatural importance and therefore grown in special plots located close to the site center (Nancy Gonlin personal communication, 2012). Without knowledge of how the manioc was used it is possible only to speculate the potential meanings of such differences.

Second, agricultural reconstructions of the past can be biased based upon preservation and ideological differences of crops. Maize was an important crop for Maya subsistence, but also symbolism (Taube 1985). The Maize god is a prominent figure in Maya iconography and referenced in the Popul Voh creation myth (McKillop 2004: 271; Sharer and Traxler 2006: 729). Moreover, archaeologists regularly encounter maize pollen in excavations, given the prolific pollination of the plant (Staller et al. 2009). Maize kernels also have hard seed casings (Staller et al. 2009) that are easily carbonized and therefore evident in the archaeological record. The lack of iconographic references to root crops or a manioc deity, combined with the fact that manioc rarely survives the archaeological record due to its lack of durable features and that it
propagates vegetatively (Cock 1985: 756; Sheets et al. 2012: 260-261, 276) have understandably led to a view for the priority of maize cultivation throughout the Maya area. The Cerén data allow us to question not that maize was important in Mesoamerica, but rather the assumption that it was more important than other crops, a view termed “maize-centrism” (Gonlin and Dixon 2011).

The care with which the manioc beds were created and maintained supports the interpretation of the manioc fields as deemed worthy of investment by these farmers. This care is especially evident in light of the fact that manioc can be readily grown without the investment in large beds (Cock 1985). To maximize drainage (an important condition of good manioc growth), all of the manioc beds were oriented parallel to ground slope. In the case of Maize Field 2, the maize ridges adjacent and downslope of Manioc Field 1 were also oriented parallel to slope. At Cerén, maize fields were typically planted perpendicular to ground slope in order to facilitate greater water infiltration. Therefore, in this region manioc growth set the overall orientation of cultivation and the needs of manioc were prioritized over maize. Such evidence serves to confront a maize-centric bias in Mesoamerica, whereby researchers assume the primacy of maize cultivation over other crops (Gonlin and Dixon 2011). Maize was undoubtedly a vital component of Mesoamerican agriculture that remains prominent in epigraphic, iconographic, and paleobotanical findings, yet a diversity of crops and cultivation methods has now been documented for the ancient Maya and maize should be reconsidered as one plant, as one staple crop, within a complex subsistence system (Fedick 1996a).

Finally, researchers should be cautious to avoid assumptions of domestic and public spaces, particularly in assumptions that agricultural fields are non-residential spaces. Patricia McAnany (1995: 69-78) provided a biotic continuum model for the Maya in which she discussed...
the variation of Maya Classic Period settlements from those associated with “pristine” rain forest to those that are continually, permanently cultivated (McAnanly 1995: 74). She posited that the later areas “envelop the house and are so thoroughly managed and continuously cropped that the term ‘field’ seems to be a misnomer” (McAnany 1995: 77). Along these lines, David Lentz (2012) found paleoethnobotanical evidence for agroforestry at Chan, Belize. These findings align with what L. Theodore Neff (2012) described as “residential agricultural space”, namely the area of cleared space surrounding households and the associated permanently cultivated gardens, orchards, and fields (2012: 306). This designation is further supported by Gillespie’s (2000: 157) statement that,

It is important to note that the house as an ordered place may extend beyond the building itself. Among the Tzotzil Maya of Zinacantán, the term for house (na), refers to the extended family that occupies a residential compound (sna, possessed house), but it also signifies the space that encompasses the dwellings, granaries, sweathouses, maize fields, fruit trees, and surrounding fence [Gillespie 2000: 157].

The Cerén manioc fields were integrated into the daily landscape of site residents and the required maintenance of these beds would have resulted in regular activity in these regions of residential agricultural space. Future exploration of the region surrounding the southern Cerén fields will inform our knowledge of how closely integrated these fields were with the households and daily lives of Cerénians.

Archaeological reconstructions of agriculture would be enriched by considering the potential multitude of plant uses and meanings, by confronting assumptions about the primacy of one system or crop over others, and by avoiding assumptions that all agricultural fields were conceived of and used as non-domestic spaces. The Cerén data suggest that manioc was used in multiple ways at the site, possibly had multiple meanings, its growth was in some instances
prioritized over the needs of maize, and it was integrated into daily life and domestic spaces of the community.

**Implications for Connecting Practice Theory, Political Economy, and Farming**

This project aims to correct a Western bias in research of the ancient Maya, whereby agricultural production is viewed as a static backdrop to political and social life. Instead, through the lens of practice theory agricultural production is viewed as a major structuring aspect of sociopolitical and religious practices of the past.

Political Economy studies examine the interconnection of political forces and economic practices, and investigate how economic consumption, distribution, and production impacted, and were impacted by, political power (Feinman 2004; Roseberry 1988; Smith 2004: 77; Yoffee 1995). Critics have pointed out that in regard to the study of Mesoamerican agriculture and commoners, the political economy approaches in archaeology have often relegated farmers to powerless positions in the political process (Erickson 2006: 335-338; Robin 2012: 1-6). Yaeger and Robin (2004: 149) have also challenged the false division of political and social forces at the community level, where individuals were engaged with broader politics and vast social networks simultaneously. A sociopolitical economy perspective examines the economic practices that shape and were shaped by political and social structures, ideas, and actions of community members. Political decisions would not have been operationalized without the social and economic networks and systems, particularly webs of reciprocity and kinship. These data allow for insight into the sociopolitical economy at various scales, from individual farming choices, to community organization and power, and somewhat less directly to the regional forces of the Zapotitán Valley.
Farmer Autonomy

The ability to identify individual land-plots and what was grown there facilitates interpretations of the degree of power Cerén farmers had over their own planting methods, techniques, and choices. Field boundaries, divergent styles of cultivation, and dynamic rotation of crops all suggest that Cerén farmers were responsible for and had power to enact their own cultivation decisions, without the direct intervention, oversight, or control of a centralized governmental, elite authority.

The existence of thirteen fields (9 maize and 4 manioc), as well as evidence for additional fallow fields, in an approximately 20,000 m² (2 hectare) area demonstrates that divisions of land-plots were significant to the allocation of space and the separation of agricultural produce. The large quantity of field boundaries (10 documented and 9 projected) between fields of different crops, fields of the same crop, and fields and cleared spaces all highlight the importance of land-use (and possibly land-ownership) designations. The Cerén agricultural field boundaries are marked by a distinctive termination, or sharp boundary (Gonlin 2004: 241-242) that delineates a clear territorial line. It is possible that each field was owned or used by different farmers or households, or that some farmers chose to divide their land between different crops, or even to designate specific plots of cultivation that were intended for different purposes (e.g. tribute, household use, communal obligations, etc.).

The most likely interpretation is that many of the fields were used, and/or owned, by different farmers or household groups. The field boundaries were distinctive allocations of space, yet were not marked with fences, stonewalls, or other forms of more obtrusive, permanent boundary divisions. One boundary marker, a large clay block was located at a field boundary (Maloof 2009: 45), but this too was a permeable boundary that would not have prohibited transit between fields. The same crops were in some cases found growing in adjacent fields. In the
case of Manioc Fields 1 and 2 the manioc beds of Field 1 became the walkways of Manioc Field 2 (Dixon 2009: 59). The manioc beds were similar in construction and there was no known reason to divide the fields in this manner. Thus, it appears the designation was intended to separate the agricultural plots of different farmers.

In another example, the different construction styles of manioc beds marked a division between Manioc Fields 2 and 3 (Dixon 2009: 78). Style A beds were the more common type of planting beds discovered and were an average of 22 cm in height, 50 cm wide, and spaced 113 cm from ridge-top to ridge-top (Dixon 2007, 2009, 2011a). These beds had almost vertical sides and broad, flat tops. Style B manioc beds were an average of 40 cm in height, 23 cm in width, and spaced 143 cm from ridge-top to ridge-top. Style B beds were much larger in height and spacing than those of Style A and the Style B beds had a sine-wave shape in a cross-section view, with a narrow peak and long sloping sides (Dixon 2007, 2009, 2011a). Any advantage to either style of manioc bed construction is currently unknown and the ground-surfaces of both Style A and Style B manioc fields did not show any variation in slope or evidence of erosion. The implication for these different cultivation styles is that farmers had the authority to select their own method of manioc bed construction. Perhaps these agricultural techniques were identity markers for different family’s production styles, or even the experimentation of a particular farmer to see if a certain style was more productive.

In addition to the manioc styles, the possible styles of maize cultivation were also visible: the first and most popular style with maize planted in formal, uniform ridges, the second style with small inter-ridges between inconsistent, uneven ridges, and the third style with planting mounds that lacked ridges (Lamb and Heindel 2011). These styles represent either different approaches to planting maize or fields in different stages of cultivation. In either case, these data
speak to the power farmers had to make cultivation decisions. If the small inter-ridges do represent a different maize style, this further supports the position that Cerén farmers had the power to decide which planting method to use. Alternatively, if these styles show different stages of cultivation, then we can surmise that farmers had the power to decide planting schedules.

Evidence of fallow fields, as well as the rotation between manioc and maize in areas advances the argument that Cerén farmers had a range of choices and the power to enact those decisions in their agricultural fields. Fields that appear to have been second plantings and others that were fallow indicate that farmers decided the seasonality of their plantings and harvest, despite the broader community harvest event underway at the site when the volcano erupted. In two cases maize was planted in what were likely re-purposed manioc beds (see discussion of Maize Fields 2 and 7 in Chapter 4). Decisions of changing uses for fields and the dynamic rotation of crops speak to the power of farmers to select and change their agricultural production; thus, showing the lack of elite domination of every aspect of ancient life. These data indicate that Cerén farmers had significant power in the decisions of manioc and maize cultivation, yet were also connected into a broader community structure.

**Community Organization of Agricultural Production and Cerén Non-Royal Governance**

The Cerén agricultural fields and associated remains show aspects of communal organization of production, likely achieved through sociopolitical forces and non-royal governance. A variety of evidence suggest that while farmers maintained autonomy in choices of what crops to grow and farming techniques and styles, these farmers were also participating in a wider community that organized the layout of fields and the social, political, and religious
forces involved in a community-wide harvest. This non-royal and non-hierarchical governance likely convened in Structure 3 and was probably responsibly for setting the overall field orientations, as well as aiding in dispute settlement as needed.

In addition to information about farmer autonomy at Cerén, the agricultural field boundaries at Cerén also yield evidence for community organization of agricultural production. The field boundaries were precise and crisp but unobtrusive. Transit between agricultural fields and the site center was facilitated by the earthen sacbe. The sacbe extended through many of the southern fields and directly linked agricultural plots with one another and the site center. The rigid termination of fields to a boundary oriented 30° or 120° offers additional evidence of a unifying concept of both agricultural fields and site center. The maize ridges and manioc beds followed this same orientation, as did almost all of the Cerén structures (Sheets 2002a: 198). Such organization physically and symbolically linked the agricultural fields with the Cerén community and demonstrates the communal organization of land-use in the region. This also marked Cerén as a distinct settlement from other center, such as San Andrés that did not share this orientation.

The quantity of manioc harvested in such a short period of time required that the manioc was 1) quickly traded or offered as tribute and then immediately consumed or processed by consumers in the Zapotitán Valley, 2) processed into a flour that could have been stored and/or traded, or 3) processed into a fermented beverage and drank by Cerén community members and/or traded. It is unlikely that the manioc roots were used or traded for immediate consumption, given the care with which the manioc was grown and the harvesting of so many roots at one time. The easiest and most effective place to store manioc for future use is to leave it in the field. By harvesting the manioc roots, the farmers had to then quickly use or process the
crop. If this manioc were used for root consumption trade, it seems more likely that the manioc harvest would have occurred in stages rather than in one large event, given the speed with which harvested manioc roots spoil. Roots could have been traded in a large singular effort such as this if the roots were then processed into flour or fermented by households throughout the Zapotitán Valley or in elite centers. If not immediately traded, then the Cerén manioc was most likely processed at the site and either used, traded, given as tribute, stored, or some combination of these.

The manioc fields show that a massive community effort was underway when the Loma Caldera eruption occurred. The labor required to harvest and then possibly process all of the manioc fields in such a short time frame would have been substantial. Apart from removing the manioc plants from the beds, the separation of the leaves, stalks, and roots would have been a necessary step in the process. At least some of the stalks were cut into stakes for replanting and the roots would have been immediately transported for trade or more probably processed. Root processing would have required the removal of the cortex and then these roots would have been either cut into segments, sun-dried, and ground into flour or would have been put through a multi-stage fermenting process. In addition to the manioc harvest, maize harvesting was also underway at the site. Once removed from the fields maize would have required some combination of husking, shelling of ears, heating, soaking, and grinding (Kramer 2005:43-45).

A maize bin was identified in Structure 4, interpreted as a storehouse, that had shucked maize ears with kernels still attached to the cob (Gerstle and Sheets 2002: 78). Also in Structure 4, multiple gourds were found containing wood ash that in the absence of limestone can be used to aid in maize soaking before grinding (Gerstle and Sheets 2002: 78). The decision to harvest maize and manioc simultaneously indicates that there were many people involved in this event.
Given that manioc does not need to be harvested at a particular time or season, it is very significant that the manioc harvesting labor was timed with that of the maize harvest. These harvests strongly tie with the ceremonial feasting underway in Structure 10 at the time of the eruption (Brown and Gerstle 2002). The ritual paraphernalia associated with the feasting evidence included a white-tailed deer (*Odocoileus virginianus*) skull mask (Brown and Gerstle 2002: 99). Contemporary Maya groups use white-tailed deer in the *cuch* ceremony to ensure a successful harvest (Pohl 1981). The additional evidence for feasting signals that this ritual feast was connected with the harvest, conceivably an event similar to the Modern Maya *cuch* harvest ceremony (Brown 2001; Pohl 1981). The Cerén feast likely served to unite and organize the community for harvest, although this is not to suggest that it would have been only integrating or experienced by all members of the community similarly.

Agricultural studies in the Maya area and elsewhere have traditionally focused primarily on field labor and until recently little focus was given to the amount of processing (Graff and Rodríguez-Alegría 2012) and cooking (Klarich 2010) required for food production. Given that food processing has been reconstructed as women’s work throughout Mesoamerica (Hendon 1996, 2003; R. Joyce 1993, 2000; McCafferty and McCafferty 1988), scholars have suggested that researchers’ biases have previously obscured the visibility of women’s lives and work (Gero and Conkey 1991). The Cerén data show that the manioc harvest and simultaneous maize harvest, as well as the subsequent required processing would have required an intensive and substantial investment of household and communal labor, which would have included both the energy and time of all able members of the society. The labor likely used in this coordinated manioc and maize harvest and processing would have required the participation of individuals well beyond the make-up of any individual family or household group. Men, women, and
children would have almost certainly been involved in these various tasks, as well as the labor required to provide daily support for harvesting (Kramer 2005: 43-45; Robin 2003: 413).

Based on the association of women with food production in other regions of Mesoamerica, Tracey Sweeley (1999) posited that the numerous metates in Household 1 and Structure 10 likely showed the coordinated grinding effort of Cerén women in preparation for the feast. She suggested that local status and power differences were present between these individuals, given the location of metates, particularly one metate that was in a position from which all others could be viewed (Sweely 1999). It was assumed these metates were employed in grinding maize, but some or all of these metates might also have been used to grind manioc if it was being consumed in the harvest feast.

When discussing gender it is vital to be cautious of the over-generalization or the application of gender roles to an entire region (Gero and Conkey 1991; Ortner 1984; Robin 2002b: 20). Cynthia Robin (2002b: 20) examined the role of women in Maya farming communities and juxtaposed the case of the Yucatec Maya, where men are viewed as the primary farmers with that of the Lancandon Maya, where ideally both men and women were seen as responsible for agriculture. A Yucatec-centric perspective of the Maya combined with Western binary divisions of domestic and public spaces (e.g., Landa 1941) might further obscure an understanding of gender relations in the past. Fields could have been planted, tended, and harvested by either men or women, or by both, just as metates could have been used by all members of society, or by a specific gender. Robin (2002b: 21) underscores Palerm’s (1967) finding that there is not a uniform division of agricultural labor across the lines of gender in the Maya area. In line with Robin’s (2002b: 28, 2012) assessment of Chan Nool activity areas, the Cerén fields were active and visible aspects of the daily activity for community members and
such data serve to deconstruct a Western model of a domestic-public divide that would associate women with domestic spaces and activities.

We do not have the evidence necessary to determine who was harvesting the Cerén fields, but we certainly can recognize that a communal organization of labor was required to achieve all of the integrated tasks needed to for this task. This agricultural labor has key implications in terms of the Cerén sociopolitical economy. The coordination and cooperation of community members would have been required for success and these data show interdependence between farming households, probably organized through non-royal governance and extensive social networks. The feast underway in the Cerén site center (Brown and Gerstle 2002: 97-103) would have provided a unifying sociopolitical force that could have served for community-formation, social reinforcement, and mobilization of communal labor, though also probably had multiple meanings for different participants, even including conflict and resistance. This event functioned to unify the community while providing necessary labor for large-scale harvest and was a critical vehicle for organizing agricultural production at the site.

**Power and Sociopolitical Organization**

The public structure affiliated with the feasting event, Structure 10, was just one of multiple public buildings at the site. These public buildings suggest a community nexus, where decisions were consensually made, rather than dictated by nearby ruling elite centers. Structure 3 has been interpreted as a locus of civic meeting (non-royal governance), where village leaders could have conferred for communal decisions (Gerstle 2002: 88). The presence of benches in the front of this structure and a small ceramic assemblage that suggests a large amount of a liquid was consumed here, point to an interpretation of this building as a political center (Gerstle 2002: 88). The beverage that was stored in the large vessel (olla) of Structure 3 was once assumed to
be maize *chicha* (Gerstle 2002: 88), however, in light of the manioc fields the use of maize for this purpose can no longer be simply assumed (e.g., manioc and maize *chicha* documented by Lancaster et al. 1982: 25; McGovern 2009: 206).

Evidence for a service relationship between households and public structures has been posited based on the close proximity of each public structure, or set of structures, with a specific household (e.g., Household 1 and Structures 10 and 12). The absence of any one extremely elevated individual or family, combined with the distribution of notable public structures across multiple households strongly indicates that the political, religious, social, and economic leadership of Cerén was communally based, possibly shared by founding families or key lineage heads. The planned investigation of the sacbe in the summer of 2013 will examine the possibility of a continued service relationship between specific farmers and the bordering sections of the *sacbe*. It is possible that *sacbe* maintenance was the responsibility of farmers whose fields were adjacent (Dixon 2011b) or that other forms of communal labor were utilized for *sacbe* maintenance and this research will continue to inform our understanding of the sociopolitical economy at Cerén.

A question that arises from this dissertation is how much of the Maya sociopolitical economy remains unseen in the archaeological record? Cerén data should give pause to those archaeologists who are adamant for top-down models where elite power is hypothesized as pervasive throughout Maya life (e.g., Henderson 1997: 145). While elite power was undoubtedly important (and is more readily visible in the archaeological record), a multitude of nested sociopolitical structures were present in ancient life. Gillespie (2000: 158-159) summarized a basic ideological theme in Maya perspectives of the world,
The Maya conceive the universe as a series of concentric containers and materialize this functional imagery for themselves at the local level as a series of nested houses, reflecting the concentric principle of Mesoamerican sociocosmology that organizes all of space. [Gillespie 2000: 158-159]

It is possible that the sociopolitical economy present at Cerén might have mimicked some of the same structures and complex relations present throughout the Zapotitán Valley. The communal nature of organization at Cerén and the lack of a singular ruler might speak to broader political organization in the valley. The presence of numerous Zapotitán Valley elite centers, the evidence of Cerén’s community autonomy, and the possible competitive jockeying in which elite centers might have engaged to attract followers (Sheets 2000: 227-228) points to an emphasis on communal, corporate strategies of power (Blanford 1996: 14). Substantially more data are needed to assess the sociopolitical economy of the Zapotitán Valley; yet, Cerén affords a model for how one community organized agricultural production and sociopolitical life.

**Implications for Household and Commoner Studies**

The findings of this dissertation also speak to aspects of household and community studies in the Maya area. As research on household archaeology and commoner studies continue to expand throughout the Maya world, it is necessary to question basic assumptions in the literature. In this section I will briefly discuss two main assumptions that this dissertation calls into question- first, the binary division of elite and commoners and second, the uniformity of ancient agricultural production. Though these two assumptions have been dealt with in the literature, the Cerén data provide a different vantage point from which to consider these issues.

First, Cerén was neither the humblest of the Maya (Webster and Gonlin 1988) nor the elite of society. A binary division of commoners and elites can obscure the extensive variation that evidently existed in social and political organization (Iannone and Connell 2003; Reed and
Zeleznik, in press) and dynamic community interactions of households and communities throughout the Zapotitán Valley. The problem of the invisible Maya (Ashmore 1981: 61; Johnston 2004; Rice and Culbert 1990: 14-15; Webster and Gonlin 1988: 173, 185) can be extended much further beyond minimally mounded residential settlements (Johnston 2004) than perhaps once thought. The earthen structures of Cerén lack the stone architecture that typically preserves in the archaeological record.

When considering those who built homes out of perishable materials and without stone, archaeologists might be biased to think these individuals were poor and without access to the same resources or power as those whose households were constructed on stone platforms. In fact, the Cerén site demonstrates 1) a rich array of households with domiciles, kitchens, and bodegas; 2) an extensive assemblage of artifacts, including trade goods and prestige items (e.g., jade axe, obsidian prismatic blades, shells, cacao, and polychrome pottery), and 3) public structures that included ritual centers such as the diviner’s building (Structure 12) and areas for feasting (Structure 10), the communal spaces of the sweat bath (Structure 9) and the plaza, and a central location for political decision-making (Structure 3). Without the Loma Caldera eruption this vibrant and complex array would have likely been reduced to bajareque (wattle and daub) fragments and ceramic sherds, which at best would have been interpreted by archaeologists as a humble Maya settlement. There is no way to know the number of settlements such as Cerén than might have been present in the Classic Period Maya landscape, although numerous settlement of similar size (as well as larger and smaller settlements) were documented throughout the Zapotitán Valley. Perhaps there are many other complex middle level sites that were constructed entirely of wattle and daub architecture, and thus largely invisible archaeologically. The
presence of Cerén can inform our understanding of the sociopolitical economy and remind archaeologists of the wealth of information not preserved through time.

Second, researchers now readily accept that Maya agricultural production was not uniform or simplistic (Fedick 1996a; Sharer and Traxler 2006); however, much of this research examines the types of crops used, the various edaphic conditions, and the agricultural techniques employed, without examining the equally important efforts of food production and cooking. As archaeologists pursue more balanced assessments of ancient food systems (Klarich 2010; Graff and Rodríguez-Alegria 2012; Robin 2002b, 2012), it is important to recognize that agricultural production, food processing, and cooking were interrelated, connected, and coordinated tasks.

It is vital that we begin to conceptually link the effort of harvest with that of the associated food production and household activities. By compartmentalizing these processes, we create an artificial divide that does not reflect the lived reality of communities. While understandable that volumes are required to incorporate studies of food processing (Klarich 2010) and cooking (Graff and Rodríguez-Alegria 2012), it is also crucial to begin discussing how the larger organization of these activities would have been coordinated. The coordination of labor in intensive events during the year, such as the harvest and the harvest ceremonies, would have served as an important motivational and organizing force in social, political, religious, and economic relationships. In a system dependent on webs of reciprocal exchange, these events would have served as community affiliating processes and unifying tasks for various members of society, across divides of gender, age, status, and lineage; yet, such events would also have probably included rivalries, complex social interactions, resistance, and even probably disputes (A. Joyce and Weller 2007).
Future Research Avenues

As with all archaeological research, additional investigations will aid in our understanding of the sociopolitical economy of the site and the organization of agricultural production. The upcoming exploration of the Cerén *sacbe* will allow for documentation of where the road connects in the site center and potentially where it is headed to the south of the site. It will also allow for the examination of potential maintenance relationships between farmers and *sacbe* sections (Sheets and Lentz 2012).

Future study of the ceramic distribution at the site and possibly residue analysis could aid in interpretations of how the manioc and maize, as well as other crops, were utilized at the site. Unfortunately searches for durable residue indicators of manioc have been unsuccessful. Yet, the distribution of specific types of ceramic vessels throughout the site might continue to inform our understandings of the relationships between households (Beaudry-Corbett 2002). The form of such vessels might allow for a quantitative assessment of the general types of food used at Cerén in the past and perhaps the distribution of these different types between households.

The examination of potential agricultural processing areas could yield enormous contributions to our understanding of the use of manioc and other foodstuffs at Cerén. The corners of platforms located in the southern fields could be relocated and investigated for possible evidence of initial processing zones. Similarly, the corner of a structure encountered south of Manioc Field 4 could be relocated and investigated, as this might have served as a storage or processing location. Notably, such an investigation would require significant planning for the protection of the area from looting since it is currently outside the boundary of the official and well-guarded Cerén Archaeological Park.
Obviously research should continue to examine the extent of manioc cultivation at Cerén and the quantity of manioc harvested just before the volcano erupted. A promising location for future investigations would be in the region southwest of Cerén where geophysical survey and drill hole testing were conducted in 2005 (Sheets 2005). The 2005 electromagnetic resistivity data showed multiple anomalies considered as possible structures. Had the structures been present in the areas of these anomalies, inverted stratigraphy would have been identified in the drill holes, given that structures at Cerén are built with the Preclassic soils that underlie the Tierra Blanca Joven (TBJ) living surface (Sheets 2005). Instead, all of the 2005 drilling samples had normal Cerén stratigraphy. At that time we had no knowledge of the manioc cultivation at Cerén, and thus did not have an explanation for why we might see geophysical anomalies in areas with intact Cerén stratigraphy. This situation could have been caused by large manioc beds were growing in the region west of the Cerén site center at the time of the eruption.

The addition of more manioc fields at Cerén would further inform our understanding of the role of the crop at this site. A few of the questions that remain about Cerén manioc production include: 1) Were all of the Cerén manioc fields harvested at once or were some plots on a different harvest schedule?, 2) How much manioc was produced by Cerén?, and 3) Was the manioc yield consumed by the community (if so, how) or did Cerén supply manioc roots to other sites in the region through trade and/or tribute? The benefits of any of the above research at Cerén must be carefully balanced with the ability to preserve the site and the slow tempo this level of fine-grained research requires.

Last, only fifteen percent of the Zapotitán Valley has been surveyed (Black 1983: 62) and much of the early excavations at the nearby center of San Andrés were not recorded. A critical research component will be connecting Cerén with other archaeological sites in the region. In
addition to the pursuit of the southern extent of the Cerén *sacbe*, a test-pit survey project between Cerén and San Andrés could also help to identify how far the Cerén site architecture and/or agricultural support zone extend to the south, as well as its relationship with the outskirts of San Andrés. Continued excavations throughout the Zapotitán Valley would greatly contextualize our research at Cerén and aid in better understanding the participation of the site within the valley’s sociopolitical economy (Webster et al. 1997).

**Conclusions**

This dissertation has focused on the intersection of farming and power in order to assess the organization of manioc and maize cultivation at Cerén, El Salvador. The burial of the site beneath multiple meters of Loma Caldera tephra (c. A.D. 630) resulted in its extraordinary preservation, which affords a unique opportunity to document ancient cultivation techniques and their implications for sociocultural complexity. Within the theoretical framework of practice theory, the daily practices of maize and manioc farming inscribed the Cerén landscape with evidence of farmers’ choices, community integration, and organization of agricultural production. These choices and sociopolitical forces are interpreted from a farm-up perspective, whereby the Cerén agricultural fields form the evidentiary foundation from which to assess the social, political, economic, and ideological factors involved in manioc and maize cultivation.

Agricultural production was a complex and essential aspect of Classic Period Maya society and communities throughout the region structured their lives, and in turn had their lives structured, by the organization of agricultural production. Simplistic reconstructions of nameless, faceless peasants producing crops for the powerful elites distort the vibrant, complicated, contested reality of lived experiences. From a people-centric (Erickson 2006: 352)
and a farm-up perspective, the process of cultivating manioc and maize at Cerén involved dynamic interactions of social, economic, political, and ideological spheres.

Results of this research into the agricultural production at the site support previous findings that Cerén was not controlled by nearby ruling elite centers but rather maintained its own independent identity and organization (Sheets 2002: 200). Cerén farming was a blend of individual power and community management. Evidence of farmer autonomy is seen in the variation in crop selection, cultivation methods, growth patterns, and field divisions of both manioc and maize. Concurrently, these data also indicate that non-royal community organization was responsible for managing agricultural production, based on the evidence for a simultaneous manioc and maize harvest, an inferred community harvest feast (Brown and Gerstle 2002), the orientation of field boundaries and structures, the remains of a public civic structure where political decisions where likely centered (Gerstle 2002), and an earthen sacbe (road) that both symbolically and physically linked the agricultural fields with the site center.

The Cerén agricultural fields and their associated remains serve to enrich and diversify our understanding of the past and afford a more dynamic reconstruction of Classic Period commoners. People of all socioeconomic statuses had power, motivations, strategies, and numerous identities. Agricultural production at Cerén was an individual, household, and community affair and this dissertation has implications for understanding ancient Maya agriculture (including the role of root crops in the Maya area), for connecting practice theory, political economy, and farming, and for reconstructing the complex, social, political, and economic context in which people of the past once lived. The ancient farmers of Classic Maya society thrived within a particular historical and cultural context, which has now been further elucidated through the documentation and interpretation of Cerén manioc and maize cultivation.
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