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Chunchucmil's Urban Population

Scott R. Hutson, Aline Magnoni, Traci Ardren,
Chelsea Blackmore, and Travis W. Stanton

The previous chapter established that nearly all of what we mapped at Chunchucmil was occupied at the end of the Early Classic period. This allows us to combine mapping and excavation to discuss the structure of the city at this critical time. As we explain below, settlement in and around Chunchucmil was not homogeneous. We lump this settlement into five zones each with different characteristics: (1) site center, (2) residential core, (3) residential periphery, (4) settlement fingers, and (5) hinterland. This chapter presents the characteristics (size, settlement density, kinds of occupation) of these zones and then supplies a population estimate. One of the most surprising characteristics of the first zone we discuss—the site center—is that it lacks the features of a regal-ritual center. In other words, unlike many other Maya sites, Chunchucmil was not built to host massive ceremonies celebrating the glory of a ruler. Whereas such ceremonies are said to have attracted people to other Maya cities, something else must have drawn people to Chunchucmil.

The very high density of structures in the next zone—the residential core, with over 1,000 structures per square kilometer—suggests that quite a lot of people were indeed drawn to Chunchucmil. Settlement in the residential periphery is less than half as dense as settlement in the residential core, but still high compared to many Maya cities (Culbert and Rice 1990:table 1.2). We estimate Chunchucmil's population after completing two tasks. First, we need to get a better handle on the functions of the structures in these zones. We cannot assume that every building was a house (Haviland 1966). Therefore, in addition to discussing each zone

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in the aggregate, we also describe one excavated architectural group from each of the most populous zones: the site center, the residential core, and the residential periphery. These descriptions communicate a deeper sense of what life was like in the city. Second, since our map does not cover the entire city, we have to estimate how much of the city lies beyond our map and project what portions of that area pertain to what zones. Though the residential core encircles the site center and the residential periphery encircles the residential core, Chunchucmil is not concentric in the sense discussed by Burgess (1925): the two ring-like residential zones contain neither different industries nor people of different social classes or ethnicities. After distinguishing the residential periphery from the final two zones—settlement fingers and hinterland—we conclude with population estimates.

THE SITE CENTER

The site center as we have drawn it in figure 5.1 covers approximately 0.55 km^2. The site center boundary in figure 5.1 should not be considered sharp. Both the site center and the zone that encircles it—the residential core—have *albarradas*, *callejuelas*, and residential groups. However, the site center stands out in many ways. First, it has a heavy concentration of *sacbes*, open spaces, and buildings over eight meters tall, all three of which are much less common in the residential core. Second, the site center contains the site's major marketplace and the only ballcourt. Finally, the stone barricade (figure 4.8) roughly follows what we consider to be the approximate boundaries of the site center, even though this feature was built late in the site's history (see chapter 4).

Table 5.1 shows that the site center also differs from the residential core in subtle ways. For example, compared to the residential core, the site center has more structures per group (8.29 vs. 5.26) and more platforms per group (1.25 vs. 0.94). The fact that the site center has more monumental compounds and that some of these compounds have relatively large numbers of structures and platforms explains this discrepancy. The site center also has double the amount of *metates* per group compared to the residential core (4.2 per group vs. 2.1 per group; see table 5.1). The gross number of *metates* per structure is also higher in the site center. Removing the Xnokol-phase platforms (which have lots of *metates*) from the calculation does not alter this conclusion. Extra food preparation for ceremonies in the site center might explain this abundance of *metates* in the site center. Finally, the number of quarries, *sascaberas*, and depressions per group is larger in the site center than the other zones, but when measured per structure, the site center and the residential core have remarkably similar numbers of these features. Both have fewer than the residential periphery (table 5.1). We did not calculate the volume of quarries, *sascaberas*, and depressions.

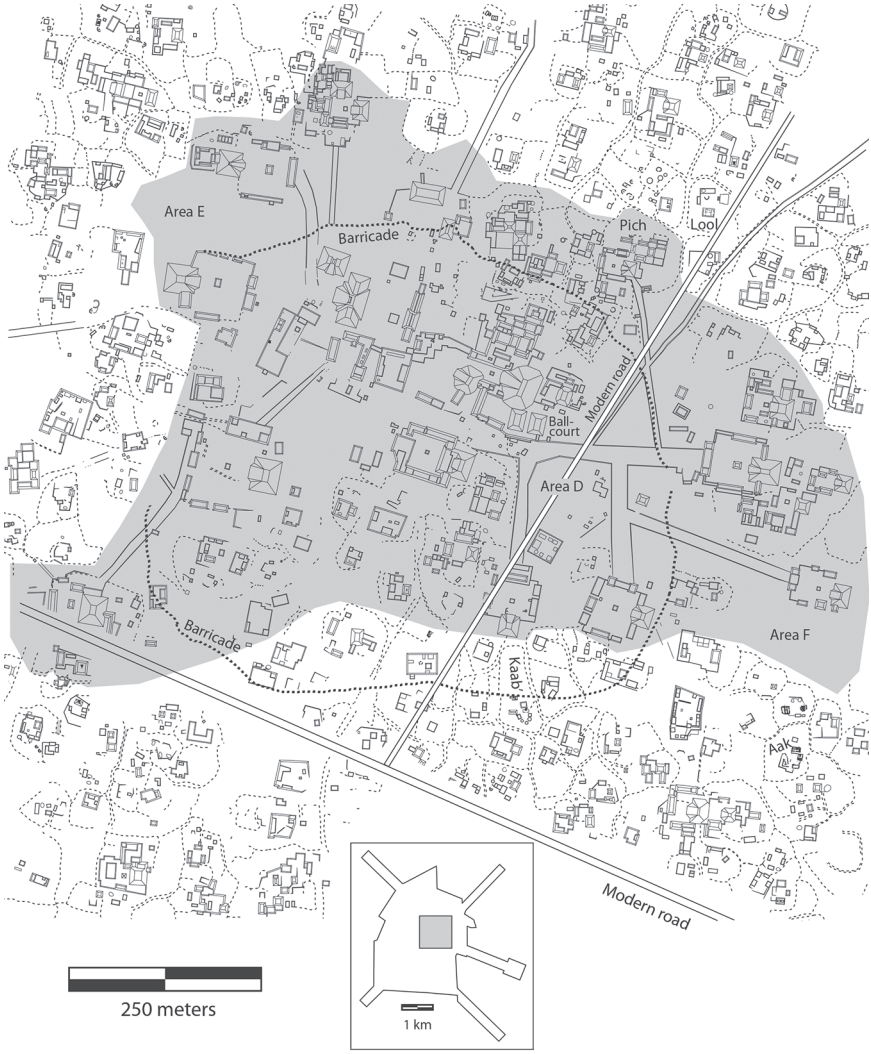


Figure 5.1. A portion of the Chunchucmil map showing the site center (shaded in gray) and a portion of the surrounding residential core. The inset box at the bottom of the figure shows the location of this portion within the fully mapped area at Chunchucmil.

As noted in the introduction, Chunchucmil's site center does not look like that of a regal-ritual site. According to Sanders and Webster (1988), who draw upon Fox (1977), the function of a regal-ritual center is to demonstrate the power of the king. Since power was demonstrated though ritual performance, a regal-ritual center

Table 5.1. Quantities of mapped features and their distribution across the three major zones of Chunchucmil.

	Site center	*Residential core*	*Residential periphery*
Groups	63	1,005	325
Structures	522	5,287	1,383
Structures per group	8.29	5.26	4.26
Platforms	79	946	271
Platforms per group	1.25	0.94	0.83
Chich mounds	15	496	498
Chich mounds per structure	0.03	0.09	0.36
Chich mounds per group	0.24	0.49	1.53
Metates	267	2081	279
Metates per structure	0.51	0.39	0.20
Metates per group	4.24	2.07	0.86
Querns	10	52	12
Sascaberas	17	178	61
Sascaberas per structure	0.03	0.03	0.04
Sascaberas per group	0.27	0.18	0.19
Quarries	13	131	51
Quarries per structure	0.02	0.02	0.04
Quarries per group	0.21	0.13	0.16
Depressions	29	285	99
Depressions per structure	0.06	0.05	0.07
Depressions per group	0.46	0.28	0.30
Hectares	43.75	496.78	353.14

should have at its core a great plaza with grandiose architecture and sculptural art. Chunchucmil lacks these (Dahlin 2009:347; Dahlin and Ardren 2002:268–270). For a large Maya site, Chunchucmil's public spaces look remarkably secular—they are not places for masses of pilgrims to visit and residents to worship. Instead of a great public plaza framed by a single complex of enormous temples, Chunchucmil has over a dozen monumental compounds in its site center. While the tops of a number of pyramids are conspicuous against the skyline from almost anywhere in the site, none exceeds 20 m high, relatively low for a major center. As the population

estimates at the end of this chapter show, Chunchucmil certainly had a large enough labor force if its leaders wanted to build the kind of grandiose ceremonial temples, palaces, and acropolises that grace other ancient Maya centers. As discussed in chapter 3, most of Chunchucmil's largest temple complexes—quadrangles—have the same configuration—a square patio with a pyramid (ranging between 8 and 17.5 m tall) usually on the east side, long platforms on the other three sides, and a low square platform in the center (Dahlin and Ardren 2002:268). The map in figure 2.5 shows the location of all but one quadrangle and their spatial relationships to *sacbes*. The quadrangle not located in figure 2.5 (Group S7W7-B) is located on the southwest side of the residential periphery. As noted in chapter 3 (see table 3.1), we subdivide quadrangles into two group types. Quadrangles in group type 1 ($n = 8$) have no subsidiary patios; those in group type 2 do ($n = 7$). Eleven of the 15 quadrangles are found in the site center. Based on diagnostic ceramics recovered from test pits placed in each of the site's quadrangles, all of the quadrangles were built in the Early Classic period, most likely the latter part, but several, such as the Xpim quadrangle (N1W2-C/Op. 28), have Preclassic ceramics, indicating that they could have been built in Late Preclassic. In some of the quadrangles occupation continued into the first part of the Late Classic.

The performance spaces inside the main patio of each quadrangle were small, averaging 2,500 m^2. Moreover, these spaces were, for the most part, deliberately shielded from public view by other still-extant buildings and walls (Dahlin et al. 2007). Though the quadrangle with the tallest temple—the Chakah quadrangle—also has the most subsidiary patios and the site's only ballcourt (the ballcourt is labeled in figure 5.1; the Chakah temple is directly north of the ballcourt), it too lacks a large performance space. Beyond the quadrangles, there are empty spaces in the site center, such as Areas E and F in figure 5.1, that are large enough to have hosted public ceremonies. Yet Areas E and F are unmodified, containing uneven bedrock outcrops, whereas the patios of quadrangles have been artificially flattened. (Area D, the marketplace discussed in chapter 11, was artificially flattened and contained with several buildings.) Furthermore, unlike quadrangles, Areas E and F do not have temples or viewing stands facing them. They are hardly conducive to witnessing the kinds of liturgical dramas that priests and kings performed elsewhere in the Maya world.

Despite the lack of a major performance space, Chunchucmil's streets (*callejuelas*) usher large numbers of people into the site center. They extend outward from the *sacbes* and the mundane empty spaces into the residential zones like spokes on a wheel. In the absence of a major ceremonial nucleus, why the concern to funnel people into the site center? Certainly, some attended the ceremonies held within the quadrangles. Area D in figure 5.1 holds another answer. In chapter 11, we present

multiple lines of evidence that Area D was a marketplace attended by people all over the site and beyond.

Though quadrangles are not the only architectural compounds in the site center, they dominate the site center. We therefore present the results of excavations in the Pich Group, a type 2 quadrangle, as a way of describing what was going on in one of these architectural compounds.

The Pich Group (N1E1-C, Op. 3E/9A) is a complex quadrangle (e.g., group type 2) consisting of a main patio, several smaller patios with adjacent structures to the northeast, and another patio to the south (figure 5.2). The main patio, which has an area of 625 m^2, contains an 8.5-m-high pyramid on the east side (Str. N1E1–27), four range structures, and a small central platform. The group is enclosed on three sides by an *albarrada*, or low-lying boundary wall characteristic of the site. Although the *albarrada* does not extend around the southwestern portion of the group, smaller structures and platforms along Pich's southern edge restrict access to patio areas. Sacbe 6, originating from the site center, intersects the group's southeast corner, allowing controlled access to the main activity areas from the center of the site. While one of the smaller quadrangle groups at Chunchucmil, the Pich Group contains a layout that is so similar to other quadrangles that we believe data from Pich can be effectively considered representative of the quadrangle groups overall.

Initial testing of architecture at the Pich Group was focused on the establishment of a chronology for the major construction. Small units were placed in the main patio floor (Op. 3E2), the westernmost structure (N1E1–22) across from the pyramid (Op. 9A1), and a possible residential structure in one of the smaller adjacent patios (Op. 9A2). These units provided a ceramic sample that confirmed that these major elements of the group were all constructed in the Early Classic period. Operation 9A1 revealed that Str. N1E1–22 consisted of a well-made open room with a wide doorway that faced the pyramid. It had a series of plaster floors and masonry walls preserved to a height of over 1 m. The remains of a wide central staircase on the patio side of the structure were visible from the surface. These features suggested to us that the main Pich patio area was not a purely residential space, nor were the structures flanking the patio all platforms or work areas. This large open room, with plenty of interior private space yet easily accessible from the main patio of the group was an early indication that the quadrangles may have been an arena for activities and interactions that did not fit easily within traditional models for either "elite" or "residential" architectural settings at Classic Maya urban centers.

Later horizontal excavations at Pich focused on Structures N1E1–23 and N1E1–29, two quite different structures than those previously sampled. Both were selected to expand the range of data available to us on the types of activities conducted at

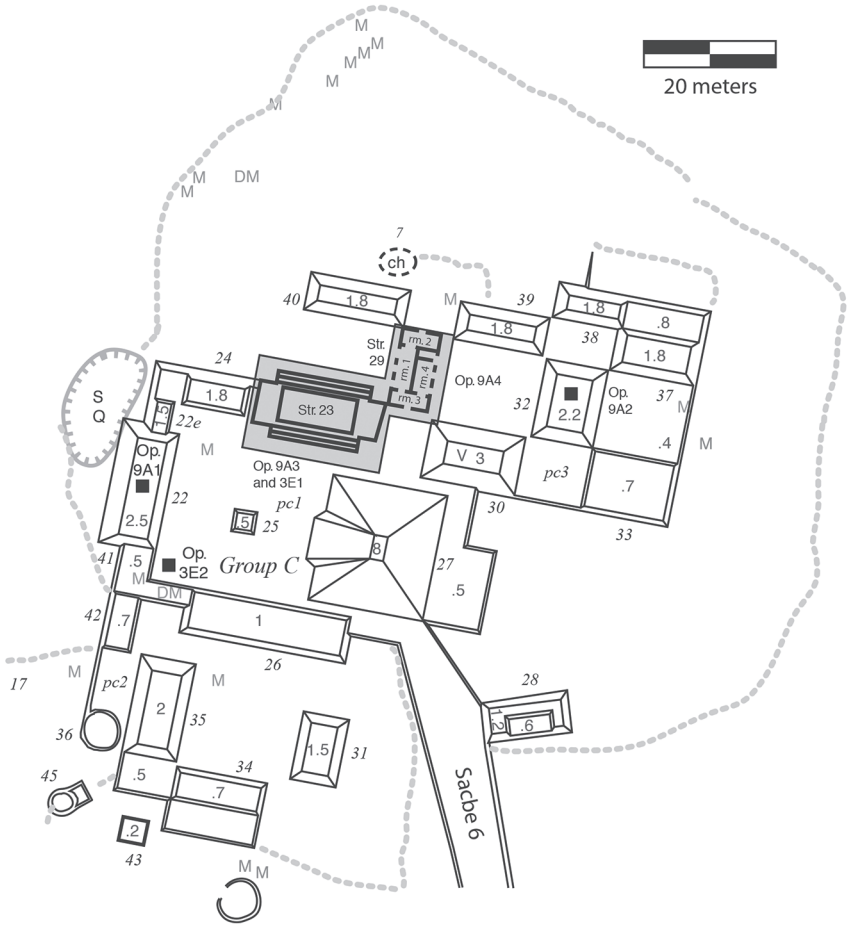


Figure 5.2. Map of Group N1E1-C/Pich, an example of a type 2 group (complex quadrangle). Areas shaded in gray represent extent of horizontal excavations. Solid black squares represent test pits.

quadrangles, especially the daily activities that might best help us to understand the nature of who lived in this particular group, and how quadrangle groups fit into the overall settlement pattern of the city. Structures N1E1–23 and N1E1–29 represent at least two different types of activities that we believe occurred at quadrangle groups. Structure 23 is a large low-lying rectangular platform that measures 19.1 m long by 8.3 m wide. The platform acts as the northern boundary between the main patio and a smaller patio directly north. Staircases to the north and south provided access into and out of these two areas. The platform was covered in multiple fine plaster

surfaces but did not contain any evidence of a superstructure. In its final phase, the platform was covered by red stucco across the summit and adjacent staircases.

Although the platform underwent a number of construction episodes to amplify the available surface space, ceramic evidence indicates they were a series of closely spaced events confined to the Late Aak phase (late Early Classic). Initially, Structure 23 was smaller, nearly 4.7 m shorter in length and 1 m shorter in height. While the southern staircase was part of this earliest phase, the northern staircase was added later during the construction of Structure 29. The addition of the staircase coincided with the extension of the platform to the west when the platform was raised to its current height of 2.2 m. Artifactual evidence of the activities that may have occurred at Structure 23 was scarce although it clearly offered a large open space visible to those inside the group and adjacent areas as well as access in and out of two patio areas. Hardly private, anyone standing on the large open and elevated surface of Structure 23 would have been easily seen from a distance. But the design of the quadrangle made access to Structure 23 very difficult to anyone but those allowed into the main patio area.

Located on the northeast corner of Structure 23, Structure 29 is a four-room building, measuring 11.5 m long and 5.5 m wide. Like Structure 23, the entire building, exterior and interior, was covered in red painted stucco. A central wall divides the building into two parallel sets of rooms with smaller rooms at either end. The larger rooms, labeled Rooms 1 and 4, measure 6.5 m long and 1.8 m wide. Each of these rooms contains three doorways that allow access to their respective patio areas. On its north side, Room 4 contains a stucco bench, approximately 58 cm high, that spanned the width of the room. As the southeast corner of the bench projected into the middle of Doorway 10, we believe that the bench was part of a later construction episode.

The smaller set of rooms on the northern and southern ends of Structure 29, labeled Rooms 2 and 3, both measure 4.2 m long and 1.55 m wide. While they act as corridors between Rooms 1 and 4, they also provide access to the exterior of the building. Room 3's exterior door provides immediate access to the northeast corner of the main patio. Room 2's exterior door allows a person to leave the architectural spaces of the Pich Group and access a broad (1,500 m^2) unbuilt space to the north of the buildings, enclosed by Pich's *albarrada*. There are nine *metates* and a double *metate* in this space. Although artifacts were found throughout the four rooms, Room 2 appears to have been a locus of activity, especially food preparation, within the structure. In the western third of the room, we identified an unusual feature that may represent debris from a hearth. It was characterized by an ashy soil matrix and an extensive concentration of burnt ceramic sherds, limestone, and calcified animal bone and shell. Although the feature was only 15 cm deep, it contained over 4,000

grams of ceramics, remnants of at least two deer (*Odocoileus* sp.), and a number of shell fragments from edible marine species. The rest of the room was littered with similar material, although not in the same quantity, and a large limestone *metate* was adjacent to the possible hearth materials. Limestone fragments were placed underneath the *metate* in order to angle the spout closer to the floor. Ceramics from this feature include a high percentage of broken domestic wares such as nearly complete examples of a Chumayel *cazuela*, Maxcanu *olla*, Oxil *olla*, Xanabá *cajete*, and Hunabchen *cajete*.

The spatial relationship between Structures 23 and 29 indicates a high degree of mobilization in and between the main patio and the adjacent patios to the northeast. The association of the bench and material remains found in Structure 29 suggests that this structure may have been a residential area within the Pich Group, where food preparation and other domestic activities occurred. The design of this structure is consistent with local Early Classic architectural traditions in the use of parallel rooms open to patio areas via multiple doorways. Few of the other unexcavated structures in the Pich Group are likely candidates for residential buildings, given their sharply sloping profiles. A number of the structures in the adjacent area northeast of the main patio resemble Structure 22, the high-walled, large, open room across from the pyramid.

The main patio was largely empty of material evidence that might contribute to a better understanding of what activities occurred there. However, soils analysis of the main patios of three other quadrangles (Groups S1W1-H/Guaje, N1E1-G/Chakah, and S1E2-C/Chukum) suggests that feasting took place in quadrangle patios (Dahlin et al. 2010:211–212). Although a number of *mano* fragments were found along the eastern edge of Structure 23, that is also the area closest to Structure 29, where food preparation likely occurred. We have not been able to find evidence of a particular commodity or trade good associated with the Pich quadrangle. The types and forms of ceramics recovered from Structure 23 are consistent with construction fill from across the site (highly eroded sherds from domestic forms) and do not shed light on activities conducted on this platform. Chronological indicators are more definitive and demonstrate that the structures around the main patio of the Pich quadrangle were likely constructed first, early in the Early Classic period. Within a short period of time, the platform that formed the northern boundary of this quadrangle was expanded a number of times and a spacious residential area was added to the group. The residential structure was also modified repeatedly during the Early Classic period, with original doorways sealed off and access to the patio areas increasingly restricted.

We are confident that quadrangles were multifunction spaces that accommodated domestic functions as well as commercial activities. Whereas McAnany (2004:155)

argues that at Caracol and Tikal food for ceremonies was prepared well beyond the central ceremonial spaces, there is ample evidence of food preparation within the Pich Group. The 16 *metates* and two double *metates* within the group attest to extensive corn grinding while Structure 29 had ample evidence for the preparation of food and a bench feature characteristic of mid-elite residential space. The location of this building adjacent to, but separate from, the main patio suggests to us that other activities took place within the quadrangle patio, perhaps activities that required an open area for the display of goods. Elite nodes of sites such as Calakmul (Robin 2004), Aguateca (Inomata and Triadan 2000), and Tikal (Moholy Nagy 1997) show evidence of crafting fine goods. Material evidence of crafting or ritual is not preserved at Structure 23 but the design of this platform provided ample area for interactions that were visible to those within the group, yet shielded from the rest of the occupants of the city. Crafting perishable goods such as woven-fiber products (textiles or baskets—see chapter 10) could have occurred in this space as could the display of goods as part of exchange negotiations that we argue upheld the city.

The precise activities that took place in the Pich Group and the other quadrangles at Chunchucmil remain difficult to identify based upon artifact evidence. Historic records suggest further avenues for exploration. Sixteenth-century ethnohistorical documents such as the *Códice de Calkiní* and Bishop Diego de Landa's *Relación de las Cosas de Yucatán* both mention that in the first years of European contact, Maya centers had storehouses filled with products such as fish, honey, beeswax, cloth, and thread (Landa 1978; Piña Chan 1978). At Calkini, 35 km southeast of Chunchucmil, the *halach uinic* (lord) gathered 50 large jars of honey to give as tribute to Francisco Montejo in 1541. While these documents describe practices that occurred many centuries after the main occupation of Chunchucmil, they speak to the resources of the native Maya economy. Large open rooms such as Structure 22 could have been storage facilities for the warehousing of local resources exchanged for trade goods, such as bushels of salt, honey, beeswax, dried fish, plant-fiber products, or cloth. Alternatively, these rooms might have held precious trade items out of sight during economic negotiations.

In his review of ethnohistorical documents relevant to a reconstruction of the Postclassic Maya economy of Yucatán, Roman Piña Chan reports that, at Mayapán, there was a house of commerce and trade where visiting merchants took their goods to meet with the stewards of local lords who knew what their lord needed (Piña Chan 1978:43). In Landa's writings, we find a description of these same stewards who were in charge of provisioning the chief's house, which also functioned as a setting of official authority and business (Landa 1978:12). In 1582, Landa's main Maya informant on indigenous culture also authored his own brief description of Maya

customs that mentions that visitors to Maya settlements were always housed and fed by their hosts, and merchants were the only class of visitor from whom payment for these services was expected (Tozzer 1941:231).

The Postclassic economy of Yucatán was different in many important ways from the system in operation at Chunchucmil in the Early Classic period many hundreds of years earlier. However, it is intriguing to consider the Pich Group and the other quadrangles at Chunchucmil in light of these descriptions of the native economy. If the systems of tribute that emerged late in the prehispanic period originated in earlier indigenous economic systems of production, as most scholars believe, then facilities for the storage of goods prepared for trade as well as amenities for merchants should be expected in the archaeological record of the Classic period. Structure 29, in the heart of the Pich Group, might be a location where such merchants were fed and housed, close to the facilities where their goods were safely stored. On the other hand, Structure 23, a large open area, and Structure 22, the private room, likely functioned as areas for the display of trade items and commodities prepared for exchange. We favor an interpretation of quadrangles that acknowledges the combination of both private and semipublic spaces inherent in their design (Ardren 2015; Ringle and Bey 2001). The patios and platforms of quadrangles provided arenas for the performance of elite activities such as the many forms of diplomacy and hospitality that accompany trade negotiations. Patios in the larger quadrangles could have held several thousand people for occasional neighborhood or district-level ceremonies (see below). Evidence for feasting in patio areas, formalized and restricted access to interior areas, and the presence of large open architectural features indicate a plan to accommodate small numbers of people within elite settings for largely performative activities.

THE RESIDENTIAL CORE

The residential core (figure 5.3) surrounds the site center on all sides yet the boundary between the site center and the residential core is fuzzy. Houselots—domestic groups consisting of small platforms usually facing a patio and surrounded by dry-laid stone walls called *albarradas* (see chapter 2)—dominate the residential core. Chunchucmil's houselots bunch together like the cells of a honeycomb, clearly visible in the northeast and south/southeast portions of figure 5.1 (see also figure 2.4).

Spatial features within the residential core permit tentative identification of large corporate groups. As described in chapter 2, alleyways called *callejuelas* weave through the residential core, connecting houselots to *sacbes* and open spaces in the site center. Because the major *callejuelas* at the site are like spokes emanating from the site center and because there are no lateral *callejuelas* that link different spokes,

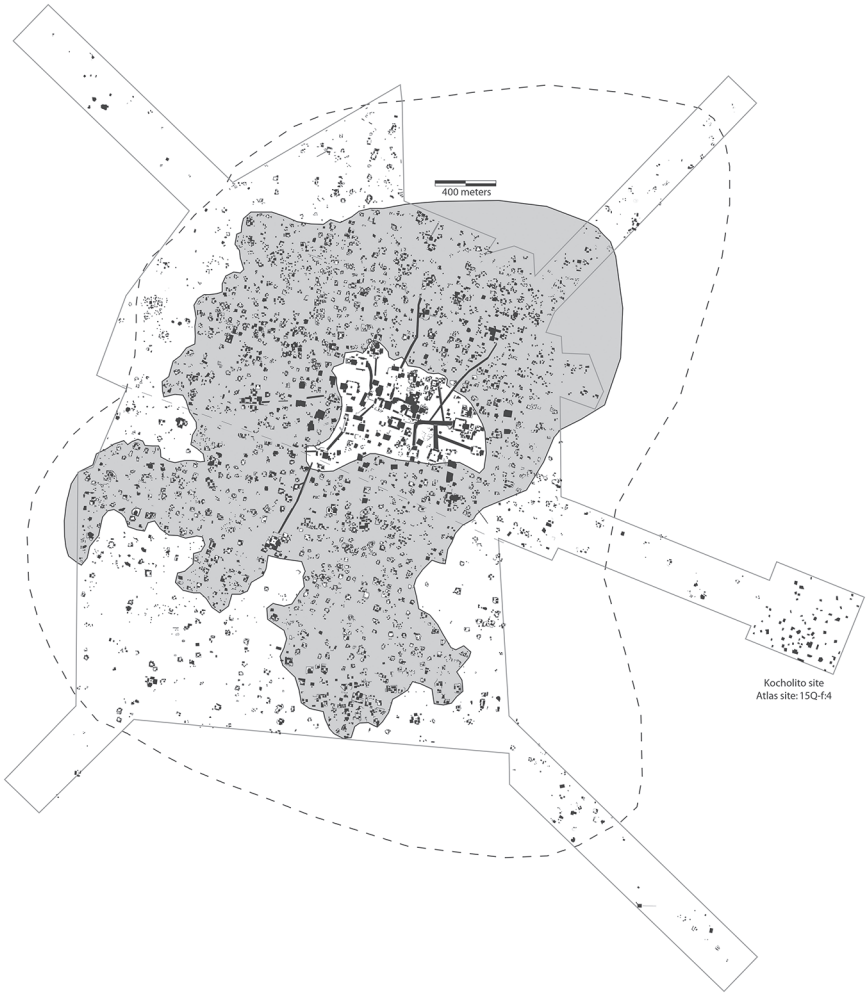


Figure 5.3. Map of architecture from the entire 11.67-km² map. The gray area represents the residential core while the dotted line encircles the residential periphery.

people who lived on the same spoke saw more of each other than people living on other spokes. These frequent interactions among a predictable set of people sharing the same spoke probably resulted in the creation of neighborhoods containing between 200 and 800 people or districts with over 1,000 people (Hutson 2016). Such potential corporate groups at Chunchucmil are larger than the lineages (Hageman 2004) and communities (Peuramaki-Brown 2013; Yaeger 2000)

discussed by other archaeologists but equivalent in size to the barrios in sixteenth-century towns in northern Yucatán described by Roys (1957). The people living in these neighborhoods and districts probably attended ceremonies at a particular quadrangle, thus further solidifying corporate identity.

Intensive excavations within five houselots in the residential core (and one houselot within the next zone, the residential periphery) reveal that most were multiple-family compounds with ancestor shrines (Hutson et al. 2004; Hutson et al. 2006; Magnoni 2008). Diagnostic ceramics from test pits in 119 additional houselots from all areas of the site show that they were occupied during the late part of the Early Classic, contemporaneous with the quadrangles. Most houselots were occupied only during this period (see chapter 4).

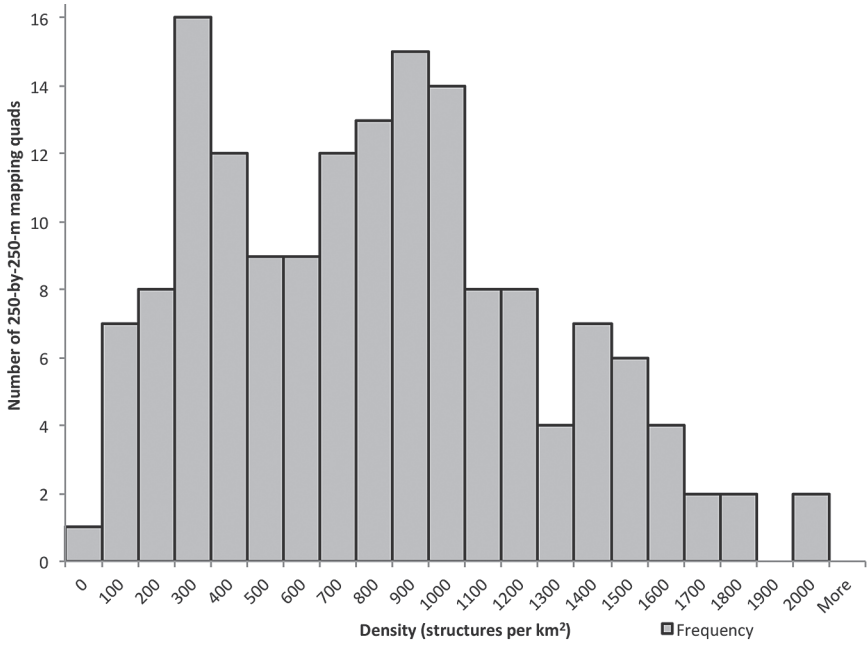
The main distinction between the residential core and the residential periphery is settlement density (table 5.2). Our calculations of settlement density within the core are inexact because the boundary between the residential periphery and the residential core is fuzzy in many places (it is fuzziest and most arbitrary on the eastern and northern edges of the map, where settlement density tapers gradually). Though we have drawn this boundary sharply in figure 5.3, the edges should be considered approximate. To arrive at settlement densities for Chunchucmil's three main zones (site center, residential core, and residential periphery), we calculated the settlement density for each 250-by-250-m map quad (see figure 2.1) and assigned each quad to one of the three zones. We assigned 81 of the 159 quads to the residential core. The total number of structures in these 81 quads is 5,287 and the area covered by these quads is 5.06 km^2, yielding a settlement density of 1,064 structures per square kilometer (table 5.2). If the 496 *chich* mounds in these 81 quads are considered structures, structure density rises to 1,164 structures per square kilometer. In contrast, the density of the 62 quads that we assigned to the residential periphery is 392 structures per square kilometer (532 structures per km^2 if *chich* mounds are included). This is a strong difference in structure density (1,064 per km^2 vs. 392 per km^2) but the actual settlement densities in both zones vary quite a bit. Within the residential core, the density of structures per quad ranges from 527 per square kilometer to 1,984 per square kilometer (median is 992 per km^2). Within the periphery, the density of structures per quad ranges from 64 per square kilometer to 928 per square kilometer (median is 352 per km^2). Though these data show that some quads assigned to the periphery actually have a higher settlement density than quads assigned to the residential core, much of this results from the fact that some of the 250-by-250-m map quads contain areas that grade from one zone to the next. In any case, a histogram of settlement densities per quad (table 5.3) shows a mode between 300 and 400 (the residential periphery), a mode between 900 and 1,000 (the residential core), and a clear gap between these two modes.

Table 5.2. Population estimates for Chunchucmil during the height of its occupation in the sixth and seventh centuries CE

						Conservative estimate			*Less conservative estimate*		
	Area mapped	*Estimated area of zone*	*Type of building*	*Buildings per km*	*Total buildings*	*Total houses*[1]	*People per house*	*Total people*	*Total houses*[2]	*People per house*	*Total people*
Site center	0.55 km^2	0.55 km^2	structure	949	522	261	5	1,305	261	5	1,305
			chich mound	35	19				9.5	4	38
Res. core	4.97 km^2	5.85 km^2	structure	1,064	6,224	3,890	5	19,450	5,290	5	26,452
			chich mound	100	584				292	4	1,168
Res. periphery	3.53 km^2	8.7 km^2	structure	392	3,410	2,132	5	10,660	2,899	5	14,493
			chich mound	141.1	1,227.8				614	4	2,456
Fingers					360				306	5	1,530
Total								31,415			47,441

1. Following the justification given in the text, we estimate that 50% of the structures in the site center were houses and that 62.5% of the structures in residential core and periphery were houses.
2. For this less-conservative estimate we propose that 50% of the chich mounds were houses and that 80% of the structures in the residential core and periphery were houses.

Table 5.3. Histogram of structure densities per 250-by-250-m quad.



In addition to having a higher structure density, the residential core has more *metates* and more *chich* mounds per group and per structure than the residential periphery (table 5.2). On the other hand, the residential periphery has slightly more quarries, *sascaberas,* and depressions than the residential core (table 5.2).

As figure 5.3 shows, the residential core extends to the northeast beyond the edge of the 9.3-km^2 block. The northeast transect, however, helps delimit the approximate extent of the residential core in this direction. At a point 600 m from the beginning of the transect and 1.74 km from the site-center datum, structure density drops from 925 per square kilometer to 384 per square kilometer. In the areas to the west and south of this point, where we lack mapping coverage, we have interpolated the boundaries of the residential core. The area contained within the residential core boundary line as drawn in figure 5.3 contains about 6.4 km^2. Subtracting the 0.55 km^2 that pertains to the site center leaves an area of 5.85 km^2 for the residential core (this is larger than the 5.06 km^2 that pertain to the 81 quads, because some of the residential core lies beyond the map).

We conducted intensive excavations in five houselots in the residential core (the Lool Group [N2E2-N, Op. 13], the Aak Group [S2E2-F, Op. 9C/3G], the Kaab' Group [S2E1-G, Op. 9D/3H], the Muuch Group [S2E2-C, Op. 10], and the

Chiwol Group [S2E3-L, Op. 9F/3I]). The following discussion of the results of the excavations in the Kaab' Group provides a sense of what life was like in a houselot in the residential core during Chunchucmil's peak population (see also Hutson 2010 for extended treatment of daily life in other houselots).

The Kaab' Group (S2E1-G, Op. 9D/3H) is located near the south-central edge of the site core (figure 5.1) and consists of nine structures (group type 9) grouped into two patios (figure 5.4). The largest of the group's structures—32, 33, and 34—face the north patio whereas the rest encircle the south patio. The group's *albarrada* walls enclose 4,300 m^2 of space, which is close to the average size—4,451 m^2—of Chunchucmil's houselots. Aline Magnoni (2008) directed 353 m^2 of excavation within the Kaab' Group. These excavations consisted of complete exposures of Structures 32 and 34, partial exposure of six other structures, test pits in the two patios, and dozens of 50-by-50-cm pits placed at the corners of a 5-by-5-m grid covering the non-architectural space of the houselot. Extensive geochemical sampling of floors and outdoor areas provides critical information for the reconstruction of activity areas and use of space.

The buildings with the most stonework—32, 33, and 34—are also the locations of the three earliest constructions detected at the group, dating to the latter part of the Early Classic. Late Preclassic ceramics in construction fill indicate an earlier occupation, but we have no other evidence from this phase at the Kaab' Group. Of the three earliest buildings, two (33 and 34) feature massive boulders, indicating a specific choice of architectural style, distinctive from other groups at Chunchucmil. In its earliest construction stage, Structure 34, on the east side of the patio, featured a square platform supporting a C-shaped superstructure with walls 1.5 –1.8 m thick. Rough boulders lined the interior faces of these walls, possibly to recreate the semblance of a cave. The C-shaped structure originally enclosed a 4-by-4-m space with an opening to the west in the direction of the patio. Several deposits during the first construction stage sacralized the structure: a burial in the substructural platform, a cache of burnt sherds underneath the floor in the center of the platform, and a Chencoh Thin Orange bowl cached under the step at the interface between the patio and the structure (figure 5.5). These deposits, an altar-like bench built during the second construction stage, the structure's square shape, its placement on the east side of the patio, and its cave-like interior all suggest that Structure 34 served as a shrine (Becker 1991; Leventhal 1983). On the basis of mapping alone, many but not a majority of houselots at Chunchucmil appear to have had shrines and those houselots with shrines share a more orderly spatial layout (Magnoni et al. 2012). Also during the Early Classic, Structure 33 stood on the south side of the patio and consisted of a boulder-lined platform (figure 5.6), measuring 12-by-6 m, with a perishable

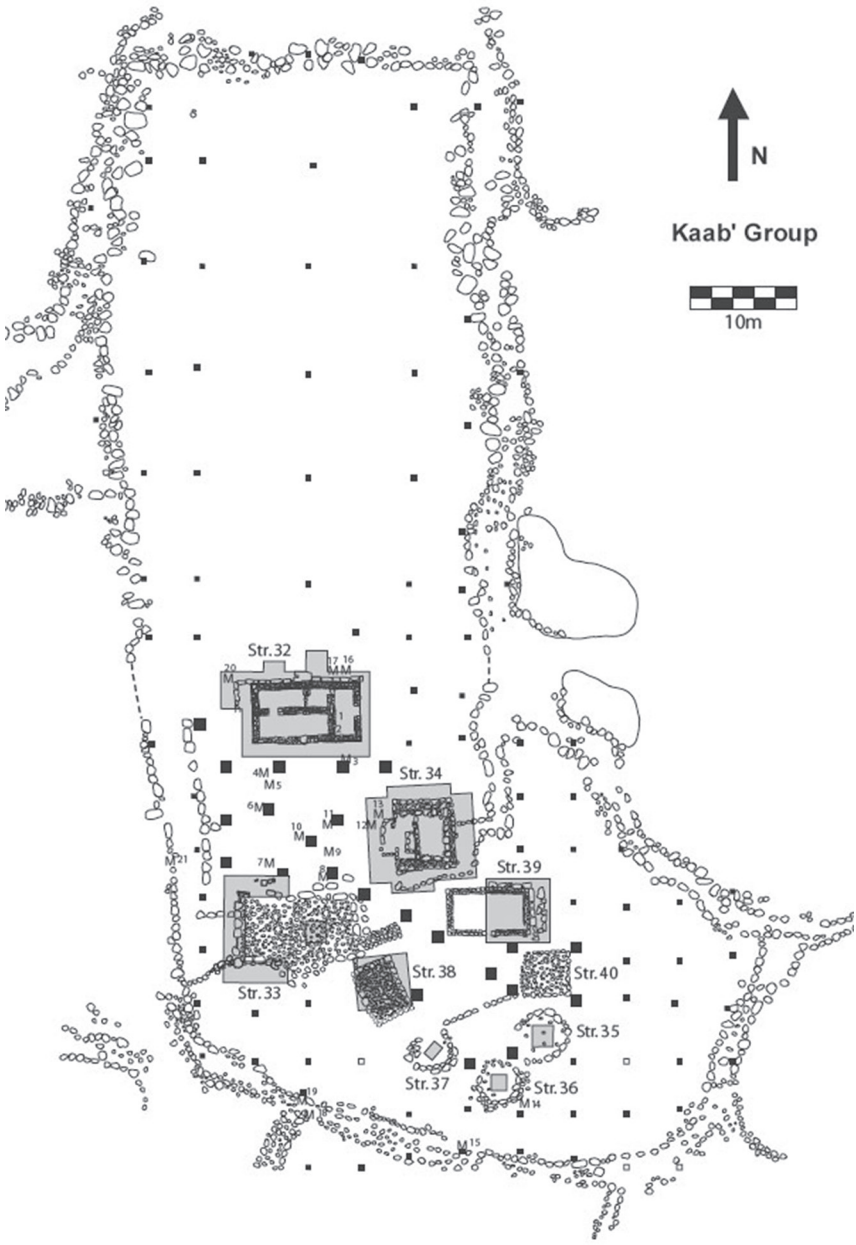


Figure 5.4. Map of Group S2E1-G/Kaab', a type 9 group (medium houselot/*albarrada* group). Black squares and areas shaded in gray represent excavations.

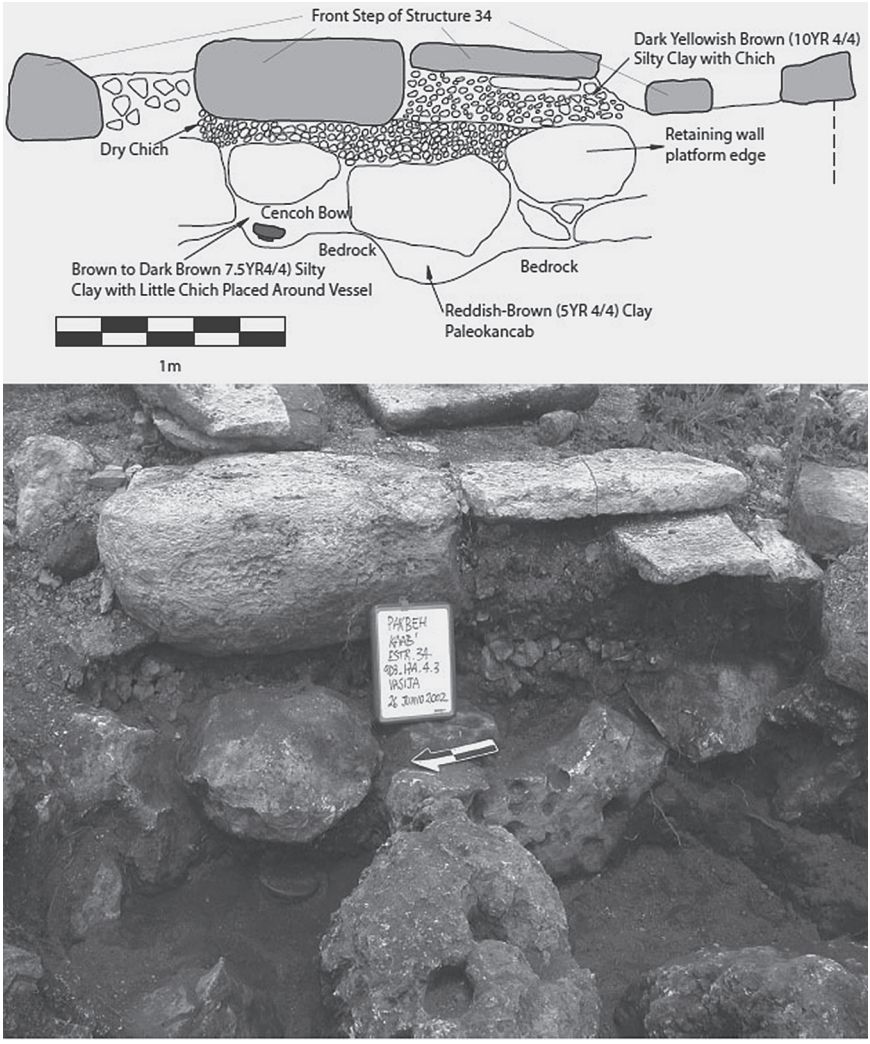


Figure 5.5. Drawing and photo showing the placement of the cached Chencoh bowl under the front step of structure S2E1–34.

superstructure. Structure 32-sub stood on the north side of the patio and consisted of a plaster floor supporting a perishable superstructure.

At the very beginning of the Late Classic period, the inhabitants of the Kaab' Group modified their built environment in many ways. On top of Structure 32-sub's original plaster floor they built a four-room masonry structure with a vaulted roof.

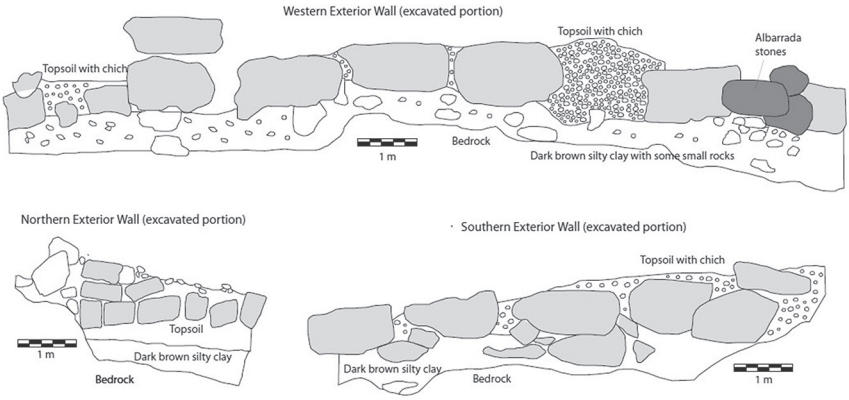


Figure 5.6. Exterior profiles of excavated portion of Structure S2E1–33 (showing only the first and second course of in situ boulders).

The new Structure 32 was the group's most elaborate residence and likely housed Kaab's lead family. All other houselots that have been extensively excavated at Chunchucmil (Aak, Muuch, Lool, Balam, Chiwool) have elaborate residences (see also Hendon 1991). Other Late Classic Kaab' families probably lived on top of Structure 33, but also in smaller residences on the newly constructed south patio. The structures framing this patio include three small, round, auxiliary structures, one of which (36) served as the Kaab' Group's kitchen, two rectangular structures (38 and 39), and a square one (40) consisting of stone platforms with perishable superstructures. Excavations at Structure 38, whose platform was lined with boulders, yielded high densities of obsidian and chert tools, as well as high phosphate and manganese levels, suggesting the working of organic materials and some other undetermined materials. In addition to serving as a work space, Structure 38 may have also served as a residence, though this is not clear. Structure 39, a crudely shaped boulder platform supporting the cut-stone foundation braces for a residence, yielded evidence of shell-working, especially on the eastern terrace. Thus, Structure 39 likely served both as a residence and work space. Structures 35, 37, and 40 were likely used as storage facilities, given the low level of phosphates and artifacts found inside them.

Back at the north patio, Structure 32 also contains evidence for mixed uses. Of Structure 32's four rooms, one was probably for sleeping, one for storage, one for greeting visitors, and one for craft activities (as evidenced by two *metates*, high phosphate levels, and a few shells), although each room may have had additional uses. Structure 32 was ritually terminated and carefully torn down in the first part of the Late Classic. A series of events accompanied this episode, including the burial of the

bundled bones of an older child (7–11 years old), the placement of complete ceramic vessels, and the destruction of several large jars in conjunction with tearing down the vault and the building's walls. After destruction and abandonment of Structure 32, residents continued to inhabit the group and the northern patio floor was raised. The northern patio contained 11 grinding stones (*metates*) and grinding-stone fragments. Chemical analysis of the patio surface suggests that these *metates* were used to process both organic and inorganic materials in two separate production areas.

The inhabitants of the Kaab' Group kept their patios clean and tossed much of their garbage into what has been called an intermediate zone: an area along the edges of the patios and behind the structures (Arnold 1990; Deal 1985; Hayden and Cannon 1983; Killion 1992). Interestingly, the intermediate zone does not show a strong correlation between phosphates and ceramic debris, suggesting an intentional separation of organic remains (concentration of phosphate close to structures and platform edges) and inorganic remains (ceramics, shells, obsidian, and high levels of manganese clustered in two accumulations, one located between Structures 34 and 39 and the other between Structures 33 and 38). Most of the space within the *albarradas* that delimit the Kaab' houselot lies beyond the structures, patios, and intermediate areas. Much of this area was probably devoted to gardening and arboriculture, as has been documented in the non-built spaces of the Aak Group (Hutson et al. 2007). The portions to the south, which were closer to the living quarters, were likely the fertilized garden areas, as indicated by higher phosphate levels, while the northern portion of the garden, with low phosphate levels, was likely used for arboriculture.

Several themes about life in a Chunchucmil houselot arise from this brief overview of the construction history and activities within the Kaab' Group. In terms of production, the data show a nuanced domestic economy typical of what Hirth (2009a) has called "multi-crafting." Shell-working, gardening, intensive grinding, and intensive processing of organic materials may have positioned the Kaab' Group to take advantage of local markets, while also making the group economically resilient.

Regarding social organization, a household on the scale of an extended family occupied the Kaab' houselot. Following Ashmore and Wilk (1988), households are groups of people who participate together in a polythetic set of activities including production, consumption, residence, and social and physical reproduction. Inequality existed among the nuclear families within the Kaab' household. One family lived in a large, vaulted house with multiple rooms (Structure 32). Another family lived in a perishable house that was nevertheless rather large and built on top of a substantial stone platform (Structure 33). The other families lived in small, perishable buildings. The families in Structures 32 and 33 shared the more prestigious patio of the group: the one with the group's domestic shrine (Structure 34).

Given that the structures on the north patio were the first to be occupied, it stands to reason that the higher status of the families living on the north patio derives in part from their longer tenure in the group (see also Haviland 1988; Hendon 1991; McAnany 1995). This same pattern (variation in size and cost of the different houses, with older houses being more elaborate) also holds for the other intensively excavated houselots at Chunchucmil (Hutson 2010). The destruction of Structure 32 suggests that relations among the families within Kaab' were dynamic, that the lead family, the one residing in elaborate Structure 32, could not reproduce its standing indefinitely. Excavations in the Aak Group also suggest changes in group leadership (Hutson et al. 2004)

Despite the varied statuses of the families within the Kaab' houselot, several factors solidified bonds among them and produced a distinct identity. The houselot walls themselves mark perhaps the most obvious evidence of corporate identity: Kaab's inhabitants delineated their own shared space by using stone fences to divide themselves from the rest of the site. Household identity was realized and reproduced through the daily practices and routines in the material settings of the houselot, the buildings, and the extramural spaces. Kaab' Group members ate from the same kitchen and participated in the same ritual activities at the shared shrine: Structure 34. The shrine itself, with its unusually thick, boulder-lined walls, was likely a material focus of the Kaab' Group's distinct corporate identity. Excavations elsewhere at Chunchucmil show that household shrines take unique forms from houselot to houselot. Boulders at the Kaab' Group are not limited to Structure 34; builders used them to different degrees in all of the group's three to four probable residences: Structures 32, 33, and 39 (and possibly 38). The dedicatory events in Structure 34 were essential in the establishment of the group and its associated territorial and membership rights at this specific location in the wider Chunchucmil landscape (Gillespie 2000; McAnany 1995). Furthermore, the incorporation of mortuary deposits in Structure 34 provided the household with a place for the preservation of the memory of important ancestors, as well as the continuous reproduction of the household identity through time (McAnany 1995). The veneration of these ancestors was the focal point for the collective identity of the corporate group (Gillespie 2000). Continuity of social memory was perpetuated with the erection, dedication, and continued use, by different generations of house members, of the dwellings and shrines that harbored ancestors or their heirlooms (Gillespie 2000).

THE RESIDENTIAL PERIPHERY

Houselots encircled by stone *albarrada* walls dominate the residential periphery, just as in the residential core, but in the periphery, alleyways/*callejuelas* are rare,

open space is abundant, and average settlement density—392 structures per square kilometer—is nearly a third of that in the residential core. Compared to the residential core, the periphery also has triple the number of chich mounds per group (see table 5.2). We therefore find a very strong inverse correlation between settlement density and *chich* mounds. *Chich* mounds are much more common when there is more space, and this relation may provide a clue to their function. *Metates* are far less common in the periphery than in the core (0.86 per group vs. 2.07 per group). This is odd given that the core has only slightly more structures per group than the periphery (5.26 vs 4.26; see table 5.2).

A drop to between 67 and 39 structures per square kilometer, a density equivalent to areas labeled "intersite" in other surveys (Rice and Rice 1990), marks the outer edges of the residential periphery. Figure 5.3 shows the edge of the residential periphery, though this edge is approximate because much of it has been interpolated through unmapped areas (see Tourtellot 1993:233 for the risks involved in interpolation based on transects). We base our interpolation of the edge on data from the mapping transects, which, with the exception of the east transect, provide a clear view of the drop to low settlement densities (see Hutson et al. 2008 for extensive details on the transects). Eight hundred meters out on the SE transect, settlement density drops from 350 to 64 structures per square kilometer. The middle segment of the NE transect has a density of 384 structures per square kilometer whereas the final 200 m of the transect has a density of 50 structures per square kilometer. Though 200 m is a small area for this judgment, informal reconnaissance beyond the edge of the transect reveals very little settlement. The entire 1.6-km-long northwest transect and the entire 0.6-km-long southwest transect have densities of 64 and 39 structures per square kilometer, respectively. The area within the residential periphery boundary line as drawn in figure 5.2 contains about 15.1 km^2. Subtracting the 6.4 km^2 that pertains to the residential core and site center leaves an area of 8.7 km^2 for the residential periphery.

Although the residential periphery is less dense than the residential core, the periphery does not lack large, wealthy houselots. In other words, Chunchucmil does not exhibit the spatial pattern discussed by Bishop Landa, in which the richest and most powerful people live closest to the site center (Diane Chase [1986] notes that Landa's account, rather than an accurate description of precolonial settlements in Yucatán, may have been plagiarized from earlier descriptions of colonial towns elsewhere in Latin America). Archaeologists have debated whether this spatial pattern, often called concentric, existed at Classic-period sites such as Tikal, Cobá, and Dzibilchaltún (Arnold and Ford 1980; Folan et al. 1982, 2009; Haviland 1966, 1970, 1982; Hutson 2016; Kurjack 1974). At Chunchucmil, houselots with substantial architecture (group type 10), implying greater control of resources, are just as

common in the residential periphery as they are in the residential core (Hutson et al. 2006; Magnoni et al. 2012). Parenthetically, houselots with larger architecture also have more space within their *albarrada* walls, implying larger gardens, craft spaces, and/or orchards. Throughout the site houselots with substantial resources are interspersed among houselots with fewer resources (Hutson and Magnoni 2011; Magnoni et al. 2012).

Though many houselots in the residential periphery have been test-pitted, one houselot, nicknamed "Balam," received intensive mapping and extensive shovel testing. We describe this houselot in detail in order to communicate a deeper sense of what life may have been like in the residential periphery.

The Balam Group (S4W8-F/Op. 33) is located about 2.1 km southwest of the site center. As figure 5.7 shows, a *chichbe* (pair of stone alignments with a cobble surface in between; see chapter 2 for fuller discussion of *chichbes*) encircles the houselot. One neighboring group to the south (S5W8-C) is contiguous with the houselot and appears to share a portion of the *chichbe* (see site map online). Another neighboring group (S4W8-E) lies to the north, 35 m beyond the north edge of the Balam *chichbe*, but there are no neighbors for at least 100 m to the east and west. The *chichbe* delimiting the Balam houselot encloses 2810 m^2. The houselot consists of four structures arranged around an artificially elevated, four-sided patio that rises 40 cm above the natural ground surface. The structure on the west of the patio (S4W8–17) had a vaulted stone roof whose rubble stands nearly 3 m high. It appears to be an "elaborate residence": compared to other residences, elaborate residences were built at greater cost (a vaulted roof, for example) and have larger floor plans (Hendon 1991). The north structure (S4W8–20), which measures about 11-by-6 m, had a perishable roof and masonry walls delimiting several rooms. It appears to be residential as well. The south structure (S4W8–19) is a low platform with stone foundation braces and a perishable superstructure. It may have been a residence or perhaps a kitchen. The east structure (S4W8–18), measuring 5.5-by-5.5-by-1.2 m, is a platform presumably topped with a perishable superstructure. The platform is higher than the north and south structures: much of the elevation of the north structure seen in figure 5.7 results from the collapsed masonry walls built above the platform. The east structure appears to have had a ritual focus, based on its square shape, its higher platform, and its position on the east side of the patio (Becker 1991; Leventhal 1983). A *callejón*/stone-lined walkway (see chapter 2) links the northeast corner of the patio to the east edge of the *chichbe*, establishing that the primary entrance to the houselot was on the east side, facing the site center. The Balam Group has a 65-cm-deep *sascabera* north of the patio.

Excavations in the Balam houselot began with 95 pits measuring 50-by-50 cm. The pits were located on the corners of a 5-by-5-m grid blanketing the non-architectural

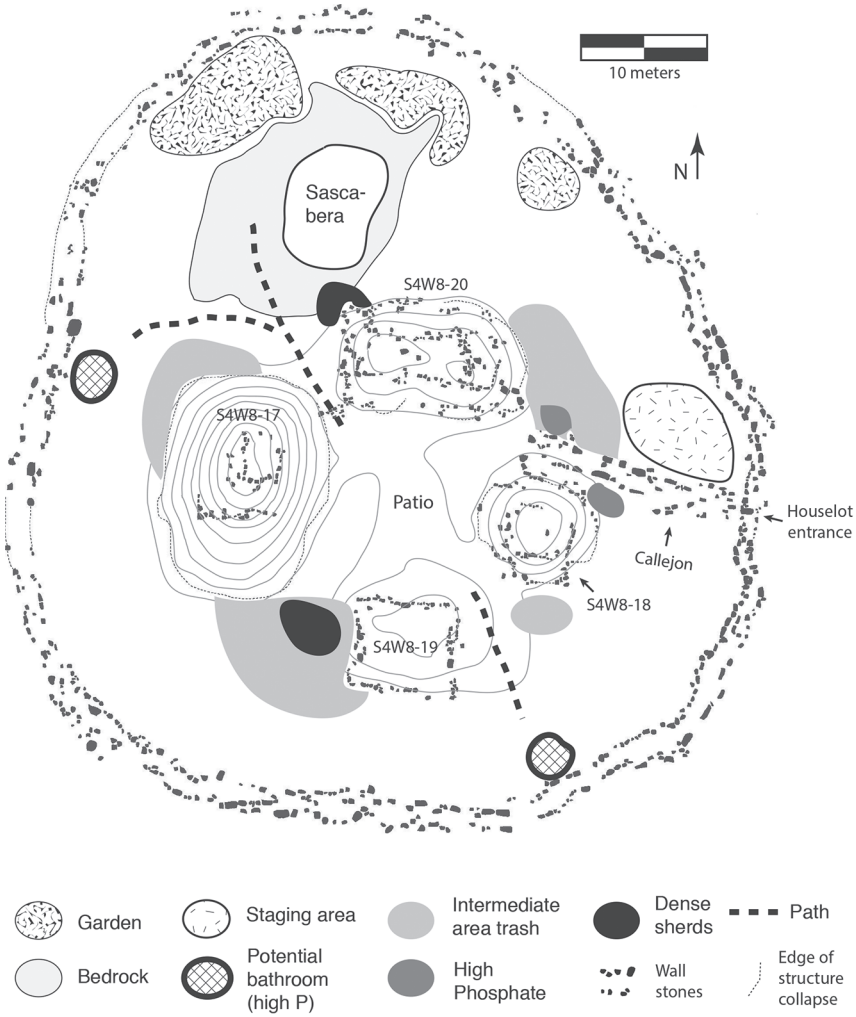


Figure 5.7. Map of Group S4W8-F/Balam, a type 10 group (small houselot/*albarrada* group). Activity areas and discard areas have been highlighted. Contour lines represent 30-cm topographic intervals. A *callejón* is a path delimited by stone alignments.

spaces of the houselot. The two pits with the most ceramic debris were later expanded to 2-by-1-m test pits. Like most houselots, the Balam Group was occupied at the end of the Early Classic and vacated during the early portion of the Late Classic. We did not excavate standing architecture. Mehlich II phosphate analysis (see Terry et al. 2000) was conducted on soil samples from each of the 95 pits.

The grid of excavations and phosphate tests helped build a sense of how the spaces in the houselot were used (figure 5.7). Light scatters of broken pottery and above-average levels of phosphate were found along the edges of the patio, with the exception of the northwest corner. In ethnoarchaeological studies of twentieth-century Maya houselots, such scatters develop as people move debris off the patio surface and deposit it along the edges, beside the structures, where it is not as much of a nuisance (Deal 1985; Hayden and Cannon 1983; Hutson et al. 2007). The fact that soil samples from the patio had no phosphate buildup matches the expected chemical signature of a frequently cleaned and maintained space (Barba and Ortíz 1992:77; Middleton and Price 1996:679). By analogy with modern houselots that exhibit the same pattern of debris, the garbage along the edge of the patio is most likely in secondary context. The densest accumulation of pottery is on the west side of the south structure (S4W8–18). Of the 250 sherds that came from the 2-by-1-m test pit at this spot, most were body sherds not diagnostic to vessel form. Identifiable vessel forms include jars, large dishes, *cajetes*, and bowls, with no particular form dominating. Such an assemblage suggests preparation, storage, and service of food, thus lending support to the suggestion that Structure S4W8–18 may have been a kitchen.

The highest phosphate levels near the patio came from an area just east of the northeast edge of the patio, at the end of the *callejón* leading to the east boundary of the houselot. A swath of high phosphates also extends eastward along the *callejón*. Two processes may contribute to the higher phosphate readings in this part of the houselot. First, since this area is connected to the houselot's east entranceway, and since the area immediately to the east of the houselot has no architecture, it is possible that crops grown past the east edge of the houselot were brought into the houselot using the east *callejón* and processed next to the *callejón*. If so, the organic debris from crop processing might have contributed to the high phosphate readings. Other organic matter (neglected scraps of fuel, building materials, etc.) coming into the houselot along the *callejón* and left in that space may also have contributed to the higher phosphate readings. The sole obsidian artifact recovered from the Balam Group, a fragment of a prismatic blade, was found on the western edge of this proposed processing/activity area, what Killion (1992) would call a "staging area." Alternatively, the high phosphates in this area may result from deposition of organic material generated on the patio or perhaps at Structures 19 and 20. However, the fact that the elevated phosphates extend eastward along the *callejón*, 10 m past the patio edge, gives more support to the suggestion that this was a staging area.

The shortest route from the *sascabera* to the patio enters the patio at its northwest corner. The fact that this northwest corner had neither trash nor phosphate buildup supports the idea that this was in fact used as a walking path. We found

the second-highest concentration of sherds just off this path between the *sascabera* and Structure 20. This trash accumulation probably resulted from people depositing debris from the patio as they walked north along the pathway. The *sascabera*, a 65-cm-deep pit that is by far the lowest spot in the houselot, had relatively little trash in it, thus differing from ethnoarchaeologically based expectations that people dump trash in areas of lower elevation (Hayden and Cannon 1983:126; Arnold 1990:918).

The five highest phosphate concentrations in the entire houselot came from five spots on the north edge of the houselot. One of these phosphate samples was fractionated (see Eidt 1977; Lillios 1992; Miller and Gleason 1994; Schuldenrein 1995) and the results indicate artificial enrichment in the ancient past. Above-average phosphate readings came from nearby shovel tests as well. Our interpretation of this broad cloud of high phosphate concentrations in the northern sector of the Balam Group is that they represent artificial fertilization for gardening. This interpretation is strengthened by the fact that there is very little hard inorganic refuse in the vicinity to dull agricultural tools and the fact that, though there is bedrock nearby, none of the soils in this area are less than 15 cm deep. The next-highest phosphate readings came from a shovel test along the western edge of the houselot and a shovel test along the southeast edge of the houselot. The phosphates from the unit on the western edge were fractionated and shown to represent ancient phosphate enrichment. Neither of these spots co-occur with inorganic trash. Since the soils here are not as deep as the proposed garden area to the north, we think that these two spots are where the houselot residents went to the bathroom. At the same time, we acknowledge that without botanical data, it is difficult to distinguish a bathroom from a garden area.

SETTLEMENT FINGERS

In the discussion of the residential periphery, we noted that the east transect does not show a clear distinction between the residential periphery and the lower-density hinterland. Not counting the more-dense settlement at the western end of the east transect, settlement density for the rest of the transect is 120 structures per square kilometer. This is twice the density of settlement beyond the residential periphery on the other transects. Settlement density on the east transect remains constant for 1 km until, at 2.35 km east of the site-center datum, settlement density increases. Here, the transect connects with Kocholito (figure 5.3), a cluster of mounds first recorded by the Archaeological Atlas of Yucatán, in the 1970s, as a site separate from Chunchucmil: site 15Q-f–4 (Garza Tarazona de González and Kurjack 1980). Settlement density in the 1-km stretch between Chunchucmil and Kocholito may represent a corridor, or "finger," of settlement that links Kocholito with the rest of

Chunchucmil. Two test pits date a patio group on the western edge of Kocholito to the late part of the Early Classic period, the same period in which Chunchucmil became an urban center. Another settlement finger may connect Chunchucmil to the site of Yokop (see chapter 8) to the southwest. We estimate that such fingers cover at least 3 km^2. If we consider these fingers to be part of Chunchucmil, then they would add to the estimate of Chunchucmil's population size, but not by much since the density of settlement on them is relatively low (120 structures per km^2).

HINTERLAND

As noted in the section on the residential periphery, the hinterland consists of space whose structure density ranges from 39 to 67 structures per square kilometer, similar to densities of "intersite" areas in other surveys (Rice and Rice 1990). Chunchucmil's hinterland, however, is not homogeneous. Based on patterns in the presence or absence of *albarradas* and in the distribution of obsidian, we divide the dispersed area beyond the residential periphery into an inner hinterland and an outer hinterland. Regarding *albarradas*, surveys conducted by Hixson and Mazeau (see chapter 8) show that the number of houses encircled by houselot walls drops precipitously at a distance of 5 km beyond the site-center datum (Hutson et al. 2008:33). The 5-km radial distance also marks a significant drop in access to obsidian: hinterland houses within the 5-km radius yielded more than six times as much obsidian per cubic meter of excavation than houses beyond the 5-km radius (see chapter 13 for a consideration of what this distance implies for the hinterland reach of Chunchucmil's marketplace). At the same time, the amount of obsidian per cubic meter of excavation from inner hinterlands is still three times less that of the site center, the residential core, and the residential periphery.

SYNTHESIS: URBAN CHUNCHUCMIL AND GREATER CHUNCHUCMIL

As many writers have concluded, the boundaries of Maya cities are not always clear due to the dispersed nature of Maya settlement patterns (Freidel 1981; Isendahl and Smith 2013; Sanders 1981). The foregoing discussion about the settlement zones of Chunchucmil affirms that the boundaries of Chunchucmil are also not very clear. At the same time, three lines of data (settlement density, access to obsidian, and presence/absence of albarradas) allow us to propose two different boundaries. The first boundary separates the site center, the residential core, and the residential periphery from the hinterland (both inner and outer). This boundary delimits what we call *urban Chunchucmil*, which covers 15.1 km^2. Settlement density is at least six times higher within urban Chunchucmil and access to obsidian is three times

higher. The difference in settlement density may seem merely quantitative and not meaningful to people in the past. Joyce Marcus (1983, 2000; Marcus and Sabloff 2008) has argued many times that the Maya did not distinguish between city dwellers and those living in rural outskirts (but see Restall 1997:20). Nevertheless, we have argued (Hutson et al. 2008) that the drop in settlement density at the edge of the site had effects on social relations that make for a qualitatively different life experience. The drop in density from 350 to 60 structures per square kilometer results in different intensities of interaction on either side of the threshold: beyond it, residences are diffusely situated, therefore making interpersonal contact less frequent. Within the threshold, houselots have many next-door neighbors, implying frequent contact. The higher frequency of interpersonal contact implies a more dense social fabric. Sharp drops in settlement density are thus more than fodder for etic distinctions. They have a proxemically experienced component shared all across the site. This shared experience may have been the basis for a generalized urban identity (either imagined or understood unconsciously) not found beyond the site (Ardren 2015; Magnoni et al. 2014). Nevertheless, the boundary between urban Chunchucmil and beyond is still blurry in places, particularly where settlement fingers extend from Chunchucmil out to other nearby sites.

Greater Chunchucmil consists of urban Chunchucmil as well as the inner hinterland. This term acknowledges that there are similarities—sharing of *albarradas*, better access to obsidian—between urban Chunchucmil and many of the dispersed hinterland houselots located within 5 km of the Chunchucmil site-center datum. Greater Chunchucmil covers approximately 64 km^2, though survey and transects suggest that this 64 km^2 contained many large pockets without architecture.

POPULATION ESTIMATES

In this section, we provide a population estimate for urban Chunchucmil. To reiterate, urban Chunchucmil consists of the site center, the residential core, and the residential periphery, though possibly also the settlement fingers. In the Maya area, most researchers estimate population by determining the number of houses at a site and then multiplying by the number of residents per house. The commonly used figure of 5.6 people per house comes from Redfield and Villa Rojas's (1934) ethnographic study of the Yucatec Maya village of Chan Kom, Yucatán. This figure was used at Mayapán (A. L. Smith 1962) and at Tikal (Haviland 1970). Alternative figures have been put forward based on sixteenth-century ethnohistorical accounts (e.g., the Cozumel census of 1570; Roys et al. 1940), such as Haviland's (1972) figure of 4.9 individuals in a nuclear family. Mayanists have applied this figure, rounded up to five, at Tikal (Haviland 1972) and Late Classic Seibal (Tourtellot 1988). Sanders

(in Rice and Culbert 1990) has suggested the lower figure of four individuals per house based on sixteenth-century Mexican census data. Other colonial census data suggest anywhere from 6 to 13.58 individuals per house (Roys et al. 1940; Ringle and Andrews 1990:table 11.7). Here we use the most commonly used figure of five persons per residential structure.

Having settled on the quantity of people per residence, we now need to estimate what proportion of structures at Chunchucmil were residences. We should reiterate from chapter 2 that basal platforms, on top of which structures sat, were tabulated apart from structures, so they already do not figure in the count. Excavations of the Kaab' and Balam residential groups described above as well as other groups at Chunchucmil (Hutson et al. 2004) show that such groups contained one or more residential structures as well as auxiliary structures that were used as kitchens, storage spaces, and processing areas, and the occasional shrine. Most buildings were arranged around one or more common patios. Since a group of leading archaeologists argued that ancient houses must have had at least 20 m^2 of roofed space to support a family of four to five people (Ashmore 1981:47; see also Kolb 1985; Tourtellot 1983:37), we considered structures with less than 20 m^2 of surface area to be auxiliary structures as opposed to residences. Extensive excavations in four residential groups have corroborated the notion that smaller structures were non-residential and were used for a variety of other purposes (Magnoni et al. 2004; Hutson 2010; Hutson et al. 2004). We found that 16.5 percent of structures in the 9.3 km^2 have less than 20 m^2 of surface area. Domestic shrines were eliminated from the count. Though shrines are sometimes recognizable by their eastern location in the residential group, their square dimensions, and their often relatively tall architecture (Becker 1991; Hutson et al. 2004), it is not possible to detect all of them without excavation. In a closely tabulated sample of 392 houselots containing 1,767 structures, we identified 134 structures as shrines and another 118 structures as potential shrines. Assuming half of the potential shrines were actually shrines, this means 193 of 1,767 structures were shrines, or 11 percent (Magnoni et al. 2012:appendix 1). Finally, just to be conservative, we presume that another 5 percent of structures were also not residences.

In summary, we believe 32.5 percent of structures were not residences (16.5% auxiliary structures measuring less than 20 m^2, 11% shrines, and 5% other). For Tikal, Haviland (1965) concluded that 16.5 percent of total structures were non-residential. For Seibal, Tourtellot (1983, 1990) put the percentage of non-residential structures at 14.3 percent. Thus, when estimating population density, these researchers reduced the structure count by about 15 percent. Since we reduce our count by 32.5 percent and since we do not include *chich* mounds, we consider our population estimates to be conservatively low.

Yet we are not through reducing the structure count because we cannot assume that all structures were contemporaneous. Following our conclusions in chapter 4, we agree that the vast majority of Chunchucmil was occupied at the end of the Early Classic, so we apply a correction factor of only 5 percent to account for non-contemporaneous structures. Finally, we should also consider that not all structures within a residential group were actually in use at all times because of changing household life cycles. Thus, we apply another 5 percent correction factor to account for this. In sum, we reduce the structure count by another 10 percent to account for lack of contemporaneity.

On the other hand, we have to consider that the number of houses may have been undercounted since structures made of perishable materials do not preserve and are archaeologically invisible. We infer their presence, however, because several basal platforms, which were not part of our structure count, had no visible structures on top. We assume that these platforms supported perishable structures. To account for the invisibility of perishable structures, we add 5 percent to our count of residences. Because of the shallow soils and lack of alluviation or colluviation, we believe that the construction of later buildings was the only major process that buried structures at Chunchucmil. In over 800 off-mound test pits and about 500 off-mound shovel tests we failed to find more than a single buried structure. Thus, we believe that there were almost no "invisible structures" (Chase 1990; Johnston 2004; Pyburn et al. 1998) hidden by soil. Finally, because of the low amount of vegetation and extremely intense mapping methods (see chapter 2) we feel that we found nearly all visible features. Thus, although we add 5 percent for residences made of perishable materials, we do not add a positive correction factor for buried or missed structures.

In summary, to convert the number of structures to a number of contemporaneously inhabited residences, we take out 32.5 percent for non-residential structures and 10 percent for possible lack of contemporaneity. But, we add 5 percent to account for perishable structures that disappeared. Combined, these adjustments move us to reduce the total number of structures by 37.5 percent to arrive at the number of contemporaneous residences.

Table 5.2 shows the remaining calculations. Given that the residential core covers 5.85 km^2 and has 1,064 structures per square kilometer, the total number of structures for the core would be 6,224. After the 37.5 percent reduction, we have 3,890 houses. With five people per house, this comes to 19,450 people for the residential core. Given that the residential periphery covers 8.7 km^2 and has 392 structures per square kilometer, the total number of structures in the periphery would be 3,410. The 37.5 percent reduction leaves 2,132 houses. With five people per house, this comes to 10,660 people for the residential periphery. The site center contains 522 structures, but, due to the presence of a greater proportion of temples and non-residential

structures, as well as the fact that most of the 19 Late/Terminal Classic platforms are in the center, we use a 50 percent correction factor. This leaves 261 residences and a total of 1,305 people. Combined, the population of the 15.1-km^2 area we call urban Chunchucmil—site center, residential core, and residential periphery—is 31,415.

For three reasons, our estimate of 31,415 people is conservative. First, if we assume that the settlement fingers, with a density of about 120 structures per square kilometer, are part of urban Chunchucmil and that these fingers cover 3 km^2, then they add 1,530 people to the estimate, this time using a 15 percent reduction factor (see below). Second, our estimate did not account for *chich* mounds. In their population estimate for Sayil, Tourtellot et al. (1990) consider every *chich* mound, regardless of size, to house a family of four. As noted in chapter 2, it is likely that some *chich* mounds were indeed residences. For example, at Komchen, Ringle and Andrews (1990) found a *chich* mound with a burial; burials are most often found in residences. Having found *chich* mounds with plaster floors and caches, Pyburn et al. (1998) consider *chich* mounds to be permanent residences as opposed to temporary field houses. If the large *chich* mounds we mapped in the residential core and residential periphery are residences, they are also unlikely to be temporary field houses, since they are located within the city. If we consider that half of the estimated 1,830 *chich* mounds within urban Chunchucmil were occupied by a family of four (and that the other half were arboricultural features [Kepecs and Boucher 1996] and/or auxiliary structures), then these 915 *chich* residences would house 3,660 people. Third, if we follow the common southern lowland 15 percent reduction as opposed to the 37.5 percent reduction discussed above, this would add another 10,836 people to the population estimate. Combined, these three adjustments would increase our population estimate to 47,441 people for the residential core and residential periphery (see table 5.2). We consider this figure an upper limit for the population. Following Cowgill's (1990) advice that population estimates should be presented as a range between rounded numbers in order to avoid the spurious impression of precision (see also Ringle and Andrews 1990:219), we believe between 31,000 and 48,000 people lived at Chunchucmil during the Late Aak phase (late Early Classic) (see also Magnoni 2007). These figures yield a settlement density of between 2,000 and 3,000 people per square kilometer. For the 5.85-km^2 residential core alone, the settlement density would be between 3,300 and 4,520 people per square kilometer.

SUMMARY

If the map presented in chapter 2 provides a skeletal understanding of Chunchucmil, in this chapter we added flesh and blood to that skeleton in two ways. First, we organized the map into five zones (site center, residential core, residential periphery,

settlement fingers, and hinterland) and described the general features of each zone. Second, we used excavation data from a quadrangle and a pair of houselots to give a sense of what life was like in each of the three largest zones. Several findings emerged from this analysis. We now recap three of them. First, Chunchucmil's site center does not match the expectations of a regal-ritual center. Chunchucmil lacks a grand plaza for royal performance and rather than having a single massive acropolis or palace complex fit for a king, Chunchucmil has many quadrangles of similar layout and scale. Second, Chunchucmil was not organized concentrically as Folan and others define it: large, wealthy houselots are just as likely to be located near the center of the site as they are on the edges and in between. Third, and perhaps most important, density calculations coupled with the chronological data from chapter 4 permit a conservative estimate of 31,000 people living in 15 km^2. Whereas the site center contained many ceremonial groups, houselots dominate the extremely dense residential core and moderately dense residential periphery.

This conclusion underlines Chunchucmil's status as a major urban center and one of the largest Maya cities. For example, the estimated number of people living in the central 16 km^2 of Tikal—13,275 (Culbert et al. 1990)—is less than half the number of people living in 15 km^2 at Chunchucmil. Closer to home, Dzibilchaltún has 8,390 structures in 19 km^2 (Kurjack 1974:94). If we apply the same reduction factor to convert structures to houses and assume five people per house, we get about 26,000 people for Dzibilchaltún; at least 4,000 fewer than Chunchucmil in an area that is 27 percent larger.

Several questions arise from our conclusions about Chunchucmil's large size and high settlement density. First, what opportunities did the local environment provide for feeding all of these people? Second, did the people of Chunchucmil have all of these resources for themselves, or did they have to share them with a sizable rural population? Third, would there have been enough food for everyone? We answer the first question in the next two chapters (6 and 7). We answer the second question in chapter 8, and we answer the third question in chapter 9. In short, we believe that the people of Chunchucmil had to trade with other regions for a portion of their food. The food shortage and the fact that Chunchucmil was not a regal-ritual center bring up a final question. If Chunchucmil's growth and urban development were not driven by abundant food resources or the public rituals of a divine king and his retinue, what attracted people to the city? In chapters 11 and 12, we make the case that Chunchucmil's growth and urban development were driven by long-distance trade of salt, obsidian, and other items, that the success of this trade attracted a population that eventually exceeded regional carrying capacity, and that growing food deficits were compensated by a burgeoning market economy in staple supplies (Dahlin et al. 2007:369).