

The Neighborhood Marketplaces of Yaxnohcah

Armando Anaya Hernández

Universidad Autónoma de Campeche

Kathryn Reese-Taylor

University of Calgary

Debra S. Walker

University of Florida, Florida Museum of Natural History

and

Nicholas P. Dunning

University of Cincinnati

ABSTRACT

This study focuses on the identification of Maya neighborhood marketplaces during the Late/Terminal Classic period (550-900 CE) in the urban landscape of Yaxnohcah, Campeche, Mexico. We use a configurational and contextual approach to identify four marketplaces that are situated in a strategic inner ring 1.5–2.5 km from the epicenter of the city. Physical features of the marketplaces include a plaza area of 2000–3100 m², low perimeter platforms surrounding the plazas, multiple corner entries, easy access to pedestrian corridors, association with large elite households or civic complexes, and equidistance from other neighborhood marketplaces. Artifact frequencies within the plaza support the identification of these complexes as markets, while a locational analysis identifies the service area of each. Finally, we consider the role of these marketplaces as anchors for residential zones during the Late Classic period.[Maya, Campeche, Late Classic, Neighborhoods, Marketplaces]

Shortly after the Spanish conquest, Friar Diego De Landa recorded the presence of marketplaces in the Yucatan peninsula in his *Relación de las Cosas de Yucatán* (Landa 2013). This, and other colonial sources, indicate that trade permeated all levels of Late Postclassic Maya society. Nevertheless, marketplaces and the market economy were largely ignored in Maya archaeology until recently. As twenty-first century researchers intensified their focus on lowland Maya economies, they revealed a long history of managed markets prior to Spanish contact (D. Chase and A. Chase 2014; King 2015a, 2015b, 2017; King and Shaw 2015).

Recent research indicates that lowland Maya markets occupied a wide range of spaces and infrastructure types ranging from highly formal places with substantial permanent structures, as at Tikal, Calakmul, and Pueblito, to more ephemeral spaces with minimal or less formally organized infrastructure as at Caracol, Chunchucmil, and Sayil (D.

Chase and A. Chase 2014; Dahlin et al. 2007; Hutson, Terry, and Dahlin 2017; Jones 1996, 2015; Ruhl, Dunning, and Carr 2018; Terry, Bair, and Coronel 2015; Tourtellot et al. 1988; Wurtzburg 1991). Systematic soil testing has been employed at a number of urban markets to document the probable former existence of perishable structures including market stalls and food production and vending areas (Dahlin et al. 2010; Terry, Bair, and Coronel 2015). In addition, studies of artifact distribution can suggest the location of marketplaces (A. Chase and D. Chase 2004; D. Chase and A. Chase 2014; see also Garraty 2009; Hirth 1998; Ossa [2021] this volume). Notably, a configurational approach to marketplace identification has been employed in southern Campeche and in the Caracol region of Belize (D. Chase and A. Chase 2014; Ruhl, Dunning, and Carr 2018). Increased documentation of urban spaces used as at least part-time marketplaces, and the strong possibility

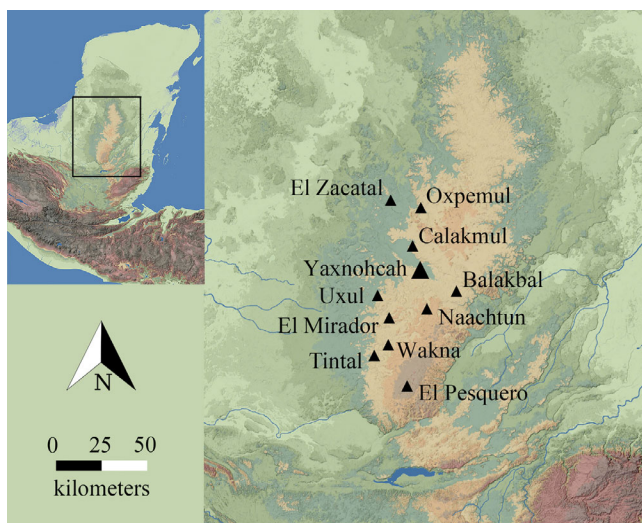


Figure 9.1. Location of Yaxnohcah within the Central Karstic Uplands of the Maya region. (map by K. Reese-Taylor) [This figure appears in color in the online issue]

of some “retro-continuity” between Late Postclassic market economies and their Classic period antecedents, suggests that a market economy did indeed emerge in the Classic Maya world, if not earlier (King 2015a, 2015b, 2017).

Market studies have tended to focus primarily on central markets, those located within the civic core of larger settlements during the Classic period (300–900 CE). With the exception of the Caracol studies (A. Chase and D. Chase 2004; D. Chase and A. Chase 2014), markets in neighborhoods and outlying districts have been neglected in the literature. In most cases, central marketplaces are located in large plazas, greater than 3000 to 60,000 m² (Dahlin et al. 2010), and adjacent to or near substantial administrative or religious structures. This leads to a skewed understanding of urban commerce. Even though the presence of smaller peripheral markets is assumed, the focus on markets in the epicenters of large sites masks decentralized exchange networks, often involving part-time producers.

In contrast, our study focuses on the identification of smaller Late Classic (600–900 CE) marketplaces located in outlying neighborhoods or districts at Yaxnohcah, Campeche, Mexico (Figure 9.1). We adopt a conjunctive methodology, using both a configurational and contextual approach to analyze four large complexes, to argue that Yaxnohcah developed a market system that was periodic and non-centralized, situated in places and at times that served itinerant merchants, local producers, and consumers. Interestingly, the possible neighborhood marketplaces are situated in the vicinity of Late Preclassic civic nodes, suggesting that the concerns that shaped the urban landscape

in the Preclassic also influenced the Late Classic urban form.

Identification of Ancient Marketplaces

Here, we briefly discuss approaches to the study of ancient marketplaces that are relevant to the methods used in our study. Consideration of the historical background of these approaches is addressed in other chapters in this volume (Masson [2021] Chapter 8; Murakami [2021] Chapter 2; Paris [2021] Chapter 1). A brief discussion of the methods used by archaeologists to identify marketplaces is more pertinent to our study. We address the three basic types of approaches: configurational, contextual, and distributional.

Configurational

Configurational approaches to market identification prioritize architectural features (the form), spatial layout, and location. According to Hirth (1998), researchers using a configurational approach have over-relied on ethnohistoric descriptions of colonial markets, as well as studies of Indigenous markets in Mesoamerica, to develop the criteria for the identification of their pre-Columbian counterparts. Lidar has changed that, greatly enhancing the viability of configurational analyses, as seen in recent studies at Caracol (A. Chase and D. Chase 2004, D. Chase and A. Chase 2014) and in southern Campeche (Ruhl, Dunning, and Carr 2018). Importantly, broad spatial relationships and low-lying architectural features, which were previously difficult to distinguish, are clearly visible in lidar imagery.

The Caracol study identified causeway termini plazas as possible marketplaces (A. Chase and D. Chase 2004, D. Chase and A. Chase 2014). Termini plaza markets were located in an inner ring 3–3.5 km from the epicenter of the city and appear to have been established at the beginning of the Late Classic. Other marketplaces were situated in an outer ring roughly five to eight kilometers from the epicenter. These termini plaza marketplaces were established as far-flung communities were incorporated into the Caracol metropolitan area and were generally in proximity to public architecture in secondary civic nodes.

The termini plazas at the city of Caracol measured between 2,800 and 4,620 m², within the range of market sizes recorded from various modern and ancient settlements throughout Mesoamerica (Beals 1975; Dahlin et al. 2007; Feinman and Nicholas 2010; Ossa, Smith, and Lobo 2017; Pluckhahn 2009), and were encircled by long, low buildings. Their location on ancient causeways argues for easy access for both local and distant buyers and sellers, and

their proximity to elite residential groups or secondary civic nodes suggests local administrative control of the spaces.

Ruhl and colleagues (2018) analyzed hillshades derived from NASA G-LiHT lidar imagery obtained over the southern state of Campeche, Mexico. While not a comprehensive survey, the G-LiHT is a window on a broad urban landscape that was densely occupied, but is underexplored presently. The G-LiHT transects are approximately 380 m in width and of varying lengths, covering roughly 2,600 km in the Yucatan Peninsula, which translates into a total area of 1000 km² (Cook et al. 2013; Golden et al. 2016; Ruhl, Dunning, and Carr 2018). For this study, researchers modeled their search criteria on the form of two well-known marketplaces, Tikal's East Plaza and Calakmul's Chiik Nahb. As a result, all identified markets consisted of substantial nested constructions; the plazas within each group covered an area between 60,000 and 23,000 m². Nine potential marketplaces were identified based on these criteria. The "nested" marketplaces consist of an outer perimeter of mounds, generally rectangular in shape, but at times arced, which are consistently less than 2 m in height. Long, narrow constructions of very low height, some as low as 0.2 m in height, are located within the perimeter and were likely the foundation for vendor stalls (Becker 2015; Dahlin 2003; Folan, Gunn, and Domínguez Carrasco 2001; Jones 1996, 2015; Laporte and Chocón 2008; Tinkler 1973; Wurtzburg 1991).

Spatial relationships between each nested group and other parts of the built environment were considered as well. Although the narrow window supplied by the G-LiHT imagery limited what interpretations could be drawn, patterns emerged. First, each of the potential "nested" marketplaces was positioned adjacent to ancient Maya plazas containing civic architecture. Second, the distance between "nested" marketplaces was roughly 19 km, which Ruhl and colleagues (2018) interpret as appropriate travel time between markets, but which is more likely a function of the distribution of urban centers in this region. The marketplaces extend from near the Laguna de Terminos well into the Central Karstic Uplands.

Contextual

The contextual approach "infers the existence of marketplaces from the presence of cultural features" that are thought to require a system of market exchange to exist (Hirth 1998, 453). Most often these cultural features are associated with urbanization or full-time craft specialization. This approach is used with configuration or distribution to infer a market economy. For instance, alongside con-

figurational and distributional approaches, Chase and Chase (2014) offered a contextual analysis of markets based on Caracol's Late Classic population and its organization of production. They conservatively estimated Caracol's population at 100,000 in 650 CE, with a density of 563 people per km² (Chase and Chase 2014, 5). Their evidence reveals that extensive production was managed at the household level as either full- or part-time specialization. Since no evidence for attached specialists was found, they suggest production was controlled at the household level. Surplus production was indicated for a variety of commodities and resources. Obsidian was widely distributed throughout the city, recovered in 115 of 118 household excavations in plazas, three terrace excavations, and three excavations in the epicenter. Chert was equally widespread, recovered from almost every excavation at Caracol; a total of fifteen production locales has been suggested. Extensive working of conch shell was identified in three residential groups, and evidence for the manufacture of objects from *Spondylus* shell was found in another. Finally, textile production was suggested by the recovery of 60 spindle whirles from 26 households. According to D. Chase and A. Chase (2014), this record of surplus goods manufactured by autonomous household producers strongly indicates a market economy.

Hutson, Terry and Dahlin (2017) applied a contextual approach to argue for a market economy at Chunchucmil, a large city, with a population of some 31,415 spread over 15.1 km². Population density exceeds that of central Tikal, estimated at 13,275 people in 16 km². Moreover, viable land in the Chunchucmil sustaining area could not have supplied enough food for both urban and rural residents. Chunchucmil is located in the driest part of the northern Maya Lowlands, where soils are especially thin and poor in quality. Food imports were imperative to sustain high population levels, and market exchange would have been essential to food security.

Although evidence for extensive craft specialization is lacking at Chunchucmil, it is likely that trade in salt and other perishable commodities was the foundation of the city's economy (Dahlin et al. 2017). Sea salt produced at coastal locations such as the nearby Celestún salt flats was a dietary requirement needed by inland communities. It also provided a mordant for dyes, and could be used as a preservative for fish, shellfish, meat, and other organics. Sea salt was consumed by Tikal's inhabitants during the Classic period (Wright 2005); similarly, Celestun salt was consumed at Chunchucmil and exported to Peten in colonial times (Andrews 1983). Sea salt produced by evaporative pans, as at Celestun, was higher in quality and required less effort than the boiling method used in coastal Belize (McKillop 2002).

The people of Chunchucmil probably grew and traded cash crops such as achiote and cochineal. Achiote (annatto)

was used for dye, body paint, hair colorant, as pigment in mural painting, and also for medicine; cochineal was a valuable carmine dye extracted from an insect that lives on the nopal cactus and was used for a vibrant red-orange dye. Both were available along the Gulf Coast near Chunchucmil in pre-Contact and historic times (Contreras Sánchez 1991; Dahlin et al. 2017; Roys 1943). In addition, the savanna to the west of Chunchucmil provided abundant cordage material. Fibers for cordage appears to have been a uniquely valuable resource for the inhabitants of Chunchucmil, and use wear analysis on lithic tools suggests that certain households specialized in processing agave fibers (Dahlin et al. 2017, 234). In sum, although evidence for craft specialization is minimal at present, a market economy was highly advantageous for the long-distance trade necessary to import much needed food staples and export surplus perishable commodities.

Distributional

The distributional approach proposed by Kenneth Hirth (1998) is a quantitative measurement of the differential distribution of commodities among consumer households. Greater homogeneity among households indicates equal access to goods, a proxy for market economies. Hirth's initial study focused on easily obtainable commodities in the Xochicalco region, pottery and obsidian, and concluded that there was little distinction in the assemblages between elite and ordinary houses (Hirth 1998, 463). Many studies since have employed the distributional approach to support market exchange in the Maya Lowlands (Braswell et al. 2003; Chase and Chase 2014; Fry 2003; Hutson, Terry, and Dahlin 2017; Sagebiel 2005; West 2002). However, Shaw (2012) cautions that distributional studies should be used in conjunction with other studies that directly identify marketplaces; as Stanton and Gallareta Negrón (2001) point out in their study of Sotuta ceramics, the distribution of goods can result from an array of complex behaviors, of which market exchange is one possibility. Nonetheless, in a study of obsidian distribution from the Terminal Classic Chichén Itza area, Braswell et al. (2003, 41) found no meaningful status-based differentiation in obsidian from varying sources, rather a homogeneity in source procurement patterns, reflective of market exchanges. Masson and Freidel (2012, figure 9.3) summarize the equitable distribution of nonlocal goods from eight Maya sites from the Late Preclassic to the Postclassic periods and observe that craft specialization in both central and peripheral households and homogenous distribution of local goods appear in the Late Preclassic at Tikal. They argue persuasively that these

patterns of distribution reflect market exchange as early as the Late Preclassic (Masson and Freidel 2012, 463).

The Yaxnohcah Urban Setting

Yaxnohcah is situated in the heart of the Central Karstic Uplands (CKU), an area in the center of the Yucatán Peninsula with an elevation of between 180 and 430 m asl (see Figure 9.1). The physiography of the region consists of rocky limestone ridges and undulating well-drained uplands, amidst low-lying karst depressions with seasonal wetlands (*bajos*). While some of the *bajos* drain only internally, many of the larger *bajos* in the CKU have westward seasonal flow into three river systems that drain into the Gulf of Mexico via the San Pedro Martir, Candelaria, and Desempeño. The immense east–west oriented Bajo Laberinto, a regionally dominant physiographic feature, includes a drainage break with an eastward flow originating near Yaxnohcah, eventually running into the Rio Hondo system and the Caribbean.

The settlement of Yaxnohcah covers over 40 km² and spans an upland ridge between the Bajo Laberinto to the north and the smaller Bajo Tomatal, lying to the south of the primary civic precinct (Figure 9.2). The southern margin of the Bajo Laberinto at Yaxnohcah includes a number of inlets, where fingers of *bajo* protrude into the uplands. The Bajo Tomatal covers some 4 km² and is situated at a higher elevation than Laberinto, into which it seasonally sheds runoff.

Since 2011, the Proyecto Arqueológico Yaxnohcah (PAY) has investigated the factors that contributed to the establishment, growth, and success of this urban landscape through lidar prospection, ground verification, and archaeological excavations (Anaya Hernández, Peuramaki-Brown, and Reese-Taylor 2016; Anaya Hernández and Reese-Taylor 2017; Reese-Taylor and Anaya Hernández 2013). The 2014 lidar survey of the region has allowed us to identify the magnitude and plan of the settlement, revealing a central precinct and four large civic complexes located in the intercardinal directions, along with numerous, roads, and water reservoirs.

As of 2019, we have recorded 5347 mounds, 56% of these are isolated mounds, while the remaining 44% are arranged around open spaces, forming a total of 548 patio groups. The settlement is organized into dispersed, nucleated clusters intermingled with tracts of land that could contain water storage facilities, agricultural fields, orchards, and managed forests. The clusters appear to be organized into neighborhoods anchored to the four large civic complexes in the intercardinal directions.

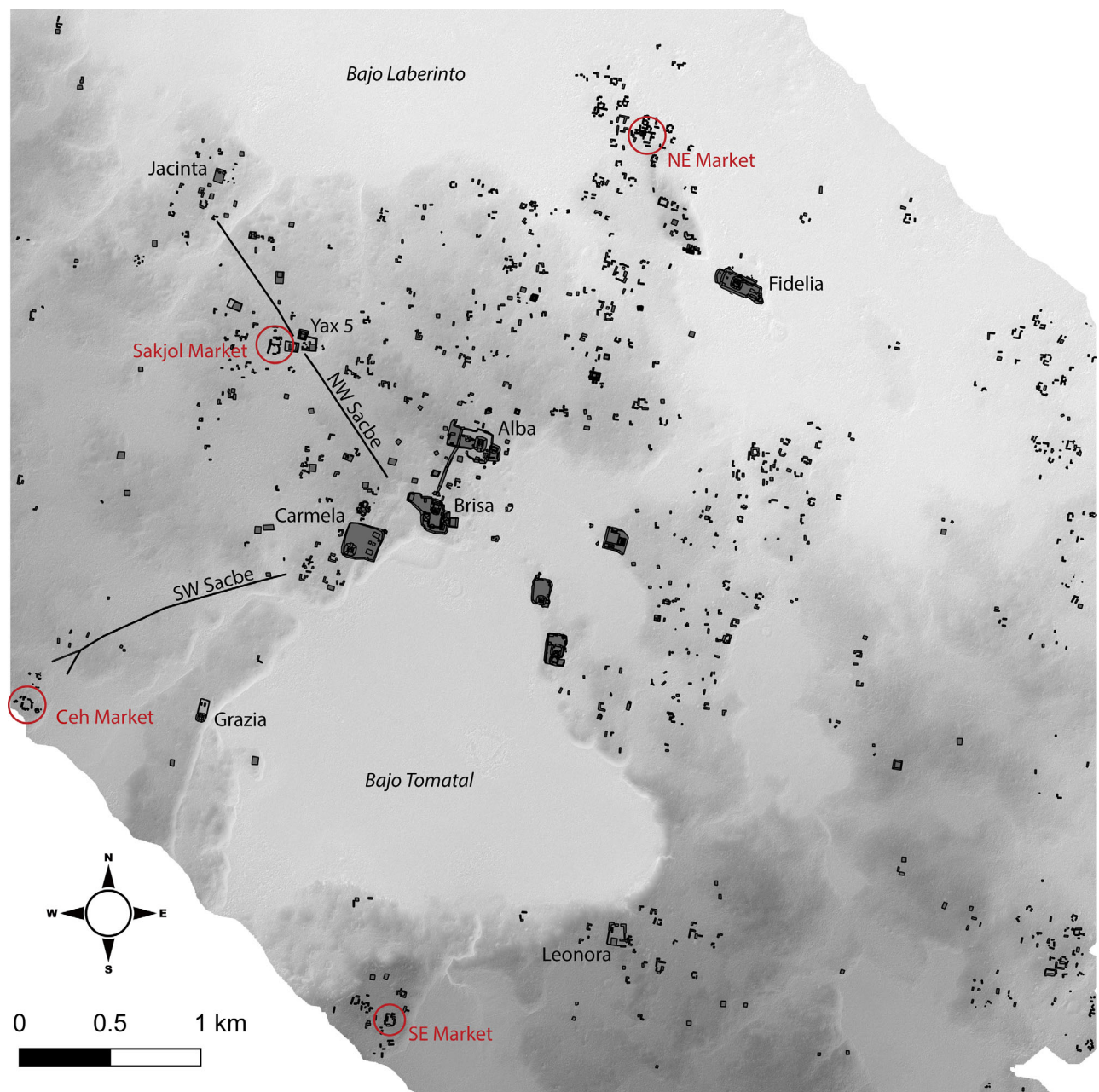


Figure 9.2. Map of Yaxnohcah with marketplaces, select civic complexes, and major saceob (roadways) identified. (map by A. Anaya Hernández and K. Reese-Taylor) [This figure appears in color in the online issue]

Each of these neighborhoods contained infrastructure and services for local residents. For instance, each zone had a large reservoir, generally located on the edge of a bajo, as well as numerous smaller multi-household water tanks, which would have provided potable water for households and possibly also for agricultural purposes. In addition, a series of radial, intrasite *saceb*s (ancient Maya causeways) connected outlying civic complexes and their surrounding

settlement to the center. Moreover, we also contend that neighborhoods enjoyed an integral commercial service in the form of a “built” marketplace (Becker 2015) that served the needs of the local vendors, producers, and inhabitants. Neighborhood marketplaces also established commercial ties among buyers and sellers in other zones and integrated these economic relationships into a cohesive market system.

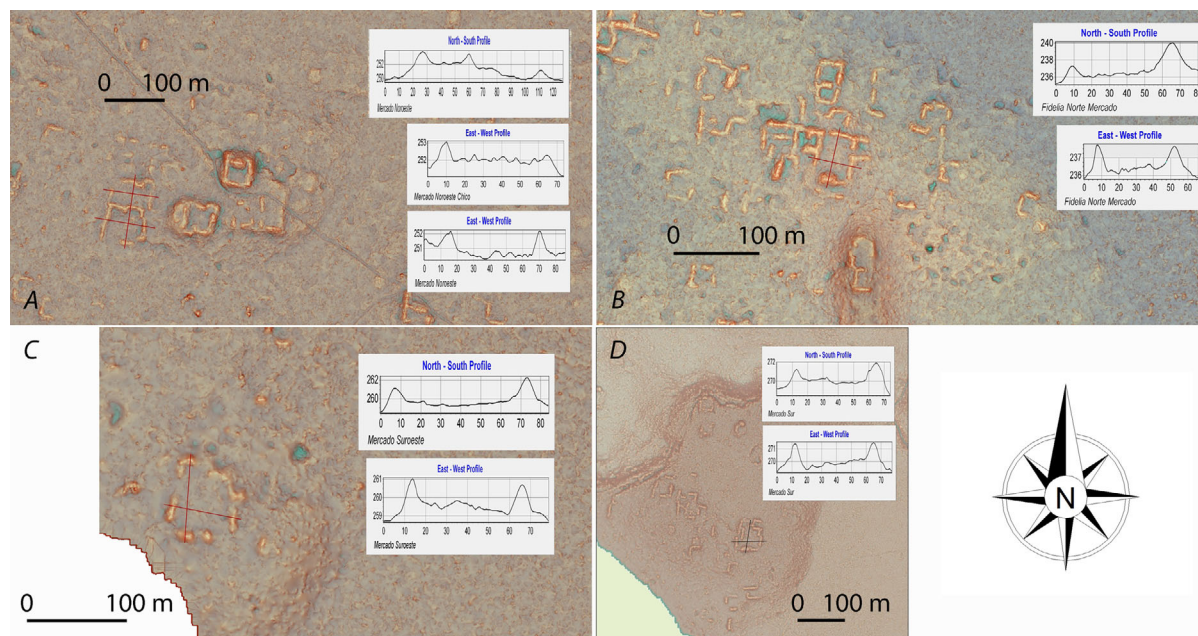


Figure 9.3. Results of lidar survey showing marketplaces at Yaxnohcah. A. Northeast Marketplace. B. Sakjol Marketplace. C. Ceh Marketplace. D. Southeast Marketplace [This figure appears in color in the online issue]

Identifying Neighborhood Markets

As stated previously, we use a conjunctive methodology consisting of a direct configurational approach and an indirect contextual approach to identify neighborhood markets. Our configurational approach includes specific physical characteristics and associations to define the built marketplace, while our contextual approach focuses on urban processes and the integration of expansive cityscapes.

The form of the physical market

At Yaxnohcah, four potential marketplaces have been identified based on shared physical features (Figure 9.3). These include:

- a plaza area of 2000–3100 m², which is larger than patios in Yaxnohcah's courtyard groups;
- a perimeter of low platforms less than 2 m in height;
- multiple corner entryways, one having a more ample opening for greater access, which is larger than those found in most residential groups at Yaxnohcah;
- a strategic position near a *sacbe* or a central location easily accessed by surrounding households;
- located in a strategic inner ring roughly 1.5–2.5 km from the epicenter (measured from the center of the Brisa E-group);
- equidistant from other neighborhood marketplaces; and

- associated with elite residential groups and/or secondary civic complexes.

Northeast Market

The Northeast Market is located 2.4 km northeast of the epicenter. A large plaza covering 2090 m² with four entrances one in the east and three in the northwest, southeast, and southwest corners (Figure 9.3A). All platforms on the perimeter are less than 2 m high, with the exception of one structure near the southwest entrance, which measures almost 3 m in height, and conjoins with an ancillary lower platform to the east. This lower platform is located on the southern side, directly east of what appears to be the plaza's principal entrance on the southwest corner.

The Northeast Market sits in the midst of a dense nucleated cluster. Although there is no apparent *sacbe* nearby, there is an unimpeded approach up a gentle slope on the southwest side of the complex and easy access through the southwest corner entrance. Several large elite residential patio groups are nearby, and the Late Preclassic Fidelia civic complex is 967 m to the southwest. Test excavations on the exterior of the residential group to the north yielded Late and Terminal Classic ceramics.

Sakjol (Tayra) Market

The Sakjol Market is a double market, composed of two adjoining plazas, located in Yaxnohcah's northwestern zone, 1.32 km from the epicenter (Figure 9.3B). The smaller

northern plaza (Sakjol Norte) measures 2081 m² and the larger southern plaza (Sakjol Sur) measures 2565 m². Sakjol Norte is elevated above Sakjol Sur by almost two meters. Sakjol Norte is rectangular in shape, but with a small, rounded extension in the northeast corner. The perimeter of Sakjol Norte is formed by a series of low platforms; the southern platform constitutes the northern perimeter of Sakjol Sur. All platforms measure less than 2 m high. The east platform is at most 1 m in height. The perimeter of the Sakjol Sur plaza is also formed by low platforms, but due to the base elevation differential, the conjoined (northern) platform measures almost 3 m above the interior ground surface of Sakjol Sur.

Sakjol Norte has two corner entrances, in the northwest and the southeast (see Figure 9.3B). Sakjol Sur also has two entrances, in the southwest and the southeast corners. There does not appear to be any way to travel between the plazas without exiting one and entering the other. The northwest *sacbe*, an important traffic artery in the Yaxnohcah landscape, lies 117 meters northeast of Sakjol Norte's center. It links the northwest zone with the Brisa E-group at the epicenter. The largest civic complex near the Sakjol Market is the Late Preclassic Jacinta complex, located 968 meters to the northwest. A prominent residential elite group, Yax-5, is also closely associated with the Sakjol Market. Yax-5, which is situated atop the northwest *sacbe*, immediately east of Sakjol Norte.

Visual verification from the lidar survey revealed that the interior of the Sakjol Sur plaza contained at least three *chich* platforms.¹ The larger platform measured 55 m² in area and 1 m in height and was located near the northeast corner. The two smaller mounds are single-course constructions less than 30 cm high and 25 m² in area; one was located near the southwest entrance and the other was adjacent to the southern platform on the centerline.

Sakjol Norte was the focus of test excavations during the 2016 season, when a series of shovel tests, 35 cm³, were placed throughout the plaza on a ten-meter grid. Densities were reported using artifact counts per cubic meter to allow comparisons with similar studies. High concentrations of artifacts greater than 350 per cubic meter were recovered in several areas. Of particular note are two areas that yielded extremely high densities (more than 955 artifacts per cubic meter): one near the northeast corner and the other in the plaza center. Four areas in Sakjol Norte contained lithics in quantities greater than 200 per cubic meter: at the northwest entrance, in the plaza center, in the northeast corner, and in the northern sector. Ceramics were distributed similarly to the lithics, with four areas of concentration greater than 350 per cubic meter: near the northwest entrance, in

the north sector, in the northeast corner, and at the southeast entrance.

Ceh (Deer) Market

The Ceh Market is located in the southwestern sector of the site, 2.5 km from the center of the Brisa E-Group, and measures 2780 m² in area (see Figure 9.3C). The closest civic architecture currently known is another Late Preclassic group, the Grazia complex, which is located 970 m to the east. The north side of Ceh Market sits on the edge of a five-meter-high escarpment, which would have increased its prominence on the landscape. The southwest *sacbe* lies 283 meters to the northeast of the center of the Ceh Market.

The Ceh Market has four entrances at the northwest corner, the southwest corner (main entrance), the southeast corner, and the east side. Platforms on the perimeter are all less than two meters high. Several small *chich* mounds, approximately 20–40 cm in height, were observed in the plaza center. The largest *chich* platform was situated in the north central area and had an area of 150 m².

Using the same methodology employed in the Sakjol Market, shovel test excavations were conducted in the Ceh Market during the 2018 season. High concentrations of artifacts, greater than 200 artifacts per cubic meter, were found near the west entrance, and in the in the northeastern plaza quadrant, near a small cobble mound. High frequencies of ceramics, greater than 200 per cubic meter, were found only near the west entrance. Very few lithics were recovered in shovel tests, although a small concentration (70 per cubic meter) was noted in the northeastern quadrant, near the small *chich* mound, which also yielded a dense concentration of ceramics.

Southeast Market

The Southeast Market has been identified solely by lidar (Figure 9.3D). This market lies less than three kilometers from the center of the Brisa E-group and 1.34 km west-southwest of the Leonora civic complex (Figure 9.2). The closest elite residential compound lies immediately northwest. The interior plaza of the market is 2731 m². Like the other complexes, the Southeast Market has four entrances: two located in the north and east, one in the southwest corner, and the main entrance in the southeast corner.

The market perimeter is formed by low-lying platforms, two meters high or less, with the exception of one 4 m-high platform, situated on the southern perimeter, directly east of the southwest entrance. There appears to be at least one low platform in the center, measuring 0.5 meters in height and with an area of ca. 50 m².

Table 9.1. Characteristics of neighborhood markets at Yaxnohcah

Characteristic	Sakjol norte Sakjol sur (NW)	Ceh (SW)	Northeast	Southeast
Plaza area	2081 m ² 2565 m ²	2780 m ²	2090 m ²	2731 m ²
Main entrance location(s)	16 m, NW corner 25 m, SW corner	18 m, SE corner	18 m, SW corner	12 m, SE corner
Perimeter platform height	<2 m one on the boundary between the two markets, 3 m in height when viewed from Sak Jol sur plaza	<2 m	<2 m; one on southern perimeter, 3 m in height	<2 m; one in southern perimeter, 4 m in height
Low interior chich mounds present?	yes	yes	yes	?
Near roadways?	yes	yes	no	no
Located near elite residential groups?	yes	?	yes	yes

Summary of formal characteristics

What is striking about these markets is the consistency of their shared architectural and locational features (Table 9.1). The less-than-two-meters-high perimeter mounds contain interior plaza spaces that measure between 2000 and 3000 m². A few three-meters-tall platforms on the perimeter are placed near an entrance. Wide corner entrances are evident, with openings ranging from 12 to 25 m in width. Three of the four plazas contain low cobble platforms. These low *chich* mounds are similar to the cobble platforms (10–15 cm in height) seen at Chunchucmil (Dahlin 2003), El Coyote (Wells 2003), Xunantunich (Keller 2006), and Chan (Cap 2012). Such shared features suggest a formal architectural grammar for smaller neighborhood marketplaces at Yaxnohcah, which may be replicated in the region.

Artifact Distributions

Artifact distributions gleaned from shovel tests in the Sakjol and Ceh marketplaces show remarkable similarities with distributional studies from plazas at Buenavista del Cayo (Cap 2015), Xunantunich (Keller 2006) and El Coyote (Wells 2003). Cap (2015) conducted 188 shovel tests, both on and off the plaza, throughout the 16,700 m² East Plaza at Buenavista del Cayo, Belize. Her shovel tests measured on average 71 cm³ and were spaced approximately 10 meters apart in a grid. To balance all frequencies across shovel tests and excavations, Cap reported all densities in

artifacts per cubic meter. The average artifact density for Buenavista del Cayo, Belize was 1,010 per cubic meter and the median was 571 per cubic meter. Areas of higher density, defined as above the average of 1,010 per cubic meter, were located both on- and off-plaza in the northern sector and in the central sector, adjacent to the northeast corner of Structure 3. Ceramics were the most abundant artifact type and their density distribution mirrored that of the total artifact density distribution. Chert artifacts were the second most abundant artifact type and were concentrated on-plaza in the northeast corner and northwest corners, although the northeast corner had much higher concentrations.

Wells (2003) conducted a series of test excavations spaced 10 meters apart in the main plaza at El Coyote and also reported the density distribution in artifacts per cubic meter. The average density was 120.5 per cubic meter and the median was 5 artifacts per cubic meter. Several areas had concentrations in excess of the average. The highest concentration was located in the southeast corner of the plaza.

Keller (2006) developed a posthole testing program, which she deployed in over 240 tests the Lost Plaza and terraces near the Xunantunich civic complex, Group C. Each posthole measured 20 cm in diameter and was excavated to bedrock, sterile, or a depth of 1 m. Based on the number of artifacts per posthole, she created four space-use categories.² Clean space (0–189 artifacts) represents space that is carefully swept clean of debris. Maintained space (190–349 artifacts) suggests space that is neatly maintained. Moderate refuse-disposal locations (350–954 artifacts) are temporary discard areas and heavy refuse-disposal locations

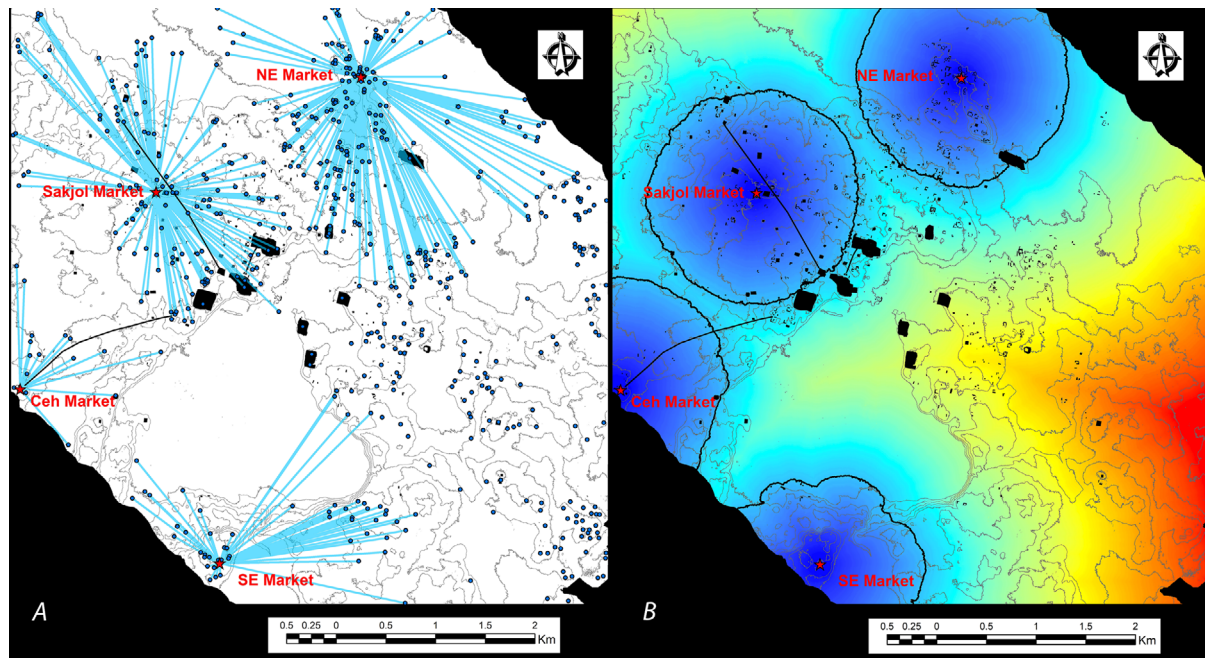


Figure 9.5. Two complementary methods of identifying market service areas. A. Results of the location-allocation analysis on the identified marketplaces of Yaxnohcah, showing the patio groups within 60 minutes of travel of a marketplace, as a proxy for marketplace service areas. B. Marketplace service areas defined by cost distance between marketplaces and the peripheries, in which the color spectrum (blue to cyan to yellow to red) indicates increasingly “costly” travel. (maps by A. Anaya Hernández) [This figure appears in color in the online issue]

not confirmed this supposition. The intrasite distance between each marketplace also created a spatial network that is telling, possibly reflecting variables, such as distribution area, travel time between markets, periodicity, and administrative structures.

From these data sets, two related analyses were run in ArcGIS 10.5: a location-allocation analysis and a cost-distance analysis (Figure 9.5). To analyze the marketplace spatial network, a location-allocation algorithm was carried out using the Network Analyst tool in ArcGIS 10.5. Location-allocation (LA) models are commonly used to identify the optimal location of facilities for the efficient distribution of goods or services. The LA model is also used to evaluate existing facilities in terms of minimizing total distance/time for users (Yeh and Chow 1996). The tool identifies locations that can supply demand points in the most efficient manner, based on specific criteria. A final objective is to allocate the most demand points to the nearest facilities in terms of cost effectiveness. The resulting model represents demand points attached to facilities through connecting lines.

The location-allocation algorithm was applied to the area encompassing the four proposed marketplaces to assess their coverage of 548 patio groups that represent demand points. A service area radius of 1.25 km resulted,

with very little overlap noticed (Figure 9.5A). Within these areas, 387 patio groups were served by the four marketplaces, representing 70.6% of the 548 patio groups. Moreover, the distance between marketplaces was fairly uniform at 2.5 km (Figure 9.5B), ranging from 2.38 km (between the Northeast and Sakjol Marketplaces) to 5.106 km (between the Southeast and Northeast Marketplaces). In a study using least cost path analysis to detect market service areas, D. Chase and A. Chase (2014) identified a roughly 3 km diameter service area at Caracol, and markets were positioned so that a maximum of 5.3 km existed between the various locations. The remarkably consistent marketplace service areas and spatial distribution at both Caracol and Yaxnohcah indicates a widespread, lowland Maya pattern. Interestingly, market service areas at Caracol and Yaxnohcah differ from the service areas of markets in the Aztec markets in the Basin of Mexico, which appear to have been considerably larger service areas: 4–8 km (Blanton 1996, 59) and 8–12 km (Minc 2006, 99). Moreover, the overall equidistant distribution of marketplaces at both Yaxnohcah and Caracol suggests that neighborhood marketplaces may have alternated the hosting of market activities on a fixed interval schedule, similar to periodic markets in rural Southeast Asia and Medieval Europe (Biddick 1985; Nishitani and Badenoch 2013; Skinner 1964), possibly

using a set interval derived from one of the Maya calendrical cycles.³

Conclusions

In this study we have deployed a configurational approach with a distributional approach and location analysis to identify four neighborhood marketplaces at the site of Yaxnohcah. Physical features that characterize these neighborhood markets include: a plaza area of between 2000 and 3100 m²; a perimeter consisting of low platforms, less than two meters in height; multiple entryways in corners, with one corner having a wider opening for primary access; a strategic position, often situated near a *sacbe* or in a central location with easy access by surrounding households; a location roughly 1.5–2.5 km from the epicenter of city and equidistant from other neighborhood marketplaces; and an association with elite residential groups and/or proximity to secondary civic complexes.

Artifact distributions from shovel tests in the Yaxnohcah neighborhood markets were compared with those from other markets situated in plazas at three other Late Classic sites. Striking similarities in artifacts frequencies and distributions were recognized among the Yaxnohcah marketplaces and those from the El Coyote and Xunanatunich plazas. Location-allocation analyses suggested that each marketplace had a service area with a diameter of approximately 2.5 km, similar to the service area of 3 km recorded in the neighborhood marketplaces at Caracol.

Significantly, the identification of neighborhood marketplaces at Yaxnohcah supports an economic model based on extensive market exchanges during the Late Classic period. Moreover, the existence of neighborhood markets suggests that local producers, both full-time and part-time, were crucial actors in the market economy. As previously mentioned, at least three of Yaxnohcah's neighborhood marketplaces were located in the vicinity of Late Preclassic civic nodes. The Northeast Marketplace was situated near the Fidelia complex, the Sakjol Marketplace was situated near the Jacinta complex, and the Ceh marketplace was situated near the Grazia complex. While the Southeast Marketplace is located near the Leonora complex, excavations have not confirmed the date of either one. Late Preclassic civic complexes with important religious functions were located near significant infrastructure features and resource areas and served to anchor residential settlement (Vázquez López, Anaya Hernández, and Reese-Taylor 2019). This suggests a possible transition in neighborhood civic life from religious to economic activities to integrate urban settlement zones during the Late Classic.

Notes

1. *Chich* is a Maya term that refers to small cobbles and pebbles that were used in the construction of low platforms and mounds.

2. For comparison purposes, we have modified Keller's artifact counts from her posthole tests, which were approximately 20 cm in diameter and 100 cm in height and extrapolated to a cubic meter. Keller's original categories were clean space (0–5), maintained space (6–10), moderate refuse disposal (11–29), and heavy refuse disposal (> 30).

3. We suggest that marketplace intervals were structured within cycles of 20 days, a temporal period common in both Classic Maya calendars.

Acknowledgments

We would like to thank Elizabeth Paris for inviting us to participate in the urban commerce working group at the 2017 Chacmool Conference, University of Calgary. We would also like to thank Chris Carr, Alberto Flores, Mikaela Radford, Nathan Parrott, Guillermo Cordova, Billy Jimenez, Rafael Kan, Neri Requena, Jose Zamudio for assistance with the marketplace excavations in the 2016 and 2018 seasons. Support for the 2016 field season was provided by grants from the Social Sciences and Humanities Research Council of Canada and the University of Calgary. Support for the 2018 season was provided by grants from the National Science Foundation and the Social Sciences and Humanities Research Council of Canada. Funding for the lidar survey was provided by a donation from Jerry Murdock and Venture Capital Partners and a grant from the Social sciences and Humanities Research Council of Canada.

References Cited

- Andrews, Anthony P. 1983. *Ancient Salt Production and Trade*. Tucson: The University of Arizona Press.
- Anaya Hernández, Armando, Meaghan Peuramaki-Brown, and Kathryn Reese-Taylor, eds. 2016. *Proyecto Arqueológico Yaxnohcah, Informe de las 2014–2015 Temporadas de Investigaciones*. Report submitted to the Instituto Nacional de Antropología e Historia, Mexico D.F.
- Anaya Hernández, Armando, and Kathryn Reese-Taylor, eds. 2017. *Proyecto Arqueológico Yaxnohcah, Informe de la 2016 Temporada de Investigaciones*. Report submitted to the Instituto Nacional de Antropología e Historia, Mexico DF.

- Beals, Ralph L. 1975. *The Peasant Marketing System of Oaxaca, Mexico*. Berkeley: University of California Press.
- Becker, Marshall Joseph. 2015. "Ancient Maya Markets: Architectural Grammar and Market Identifications." In *Ancient Maya Marketplaces: The Archaeology of Transient Space*, edited by Eleanor King, 90–110. Tucson: The University of Arizona Press.
- Biddick, Kathleen. 1985. "Medieval English Peasants and Market Involvement." *The Journal of Economic History* 45 (4): 823–31.
- Blanton, Richard E. 1996. "A Consideration of Causality in the Growth of Empire: A Comparative Perspective." In *Aztec Imperial Strategies*, edited by Frances F. Berdan, Richard E. Blanton, Elizabeth Hill Boone, Mary G. Hodge, Michael E. Smith, and Emily Umberger, 219–27. Washington, DC: Dumbarton Oaks Research Library and Collection.
- Braswell, Geoffrey E., and Michael D. Glascock. 2003. "The Emergence of Market Economies in the Ancient Maya World: Obsidian Exchange in Terminal Classic Yucatán, Mexico." In *Geochemical Evidence for Long-Distance Exchange*, edited by Michael D. Glascock, 33–52. Scientific Archaeology for the Third Millennium. Westport: Bergin and Garvey.
- Cap, Bernadette. 2012. "Empty" Spaces and Public Places: A Microscopic View of Chan's Late Classic West Plaza." In *Chan: An Ancient Maya Farming Community*, edited by Cynthia Robin, 150–70. Tallahassee: University Press of Florida.
- Cap, Bernadette. 2015. "How to Know It When We See It: Marketplace Identification at the Classic Maya Site of Buenavista de Cayo." In *Ancient Maya Marketplaces: The Archaeology of Transient Space*, edited by Eleanor King, 111–37. Tucson: The University of Arizona Press.
- Chase, Arlen F., and Diane Z. Chase. 2004. "Exploring Ancient Economic Relationships at Caracol, Belize." *Research Reports in Belizean Archaeology* 1: 115–27.
- Chase, Diane Z., and Arlen F. Chase. 2014. "Ancient Maya Markets and the Economic Integration of Caracol, Belize." *Ancient Mesoamerica* 25 (1): 239–50.
- Cook, Bruce D., Lawrence A. Corp, Ross F. Nelson, Elizabeth M. Middleton, Douglas C. Morton, Joel T. McCorkel, Jeffrey G. Masek, Kenneth J. Ranson, Vuong Ly, and Paul M. Montesano. 2013. "NASA Goddard's LiDAR, Hyperspectral and Thermal (G-LiHT) Airborne Imager." *Remote Sensing* 5 (8): 4045–66.
- Contreras Sánchez, Alicia del Carmen. 1991. "Los Circuitos Comerciales del Palo de Tinte (1750–1807)." In *España y Nueva España: Sus Acciones Transmarítimas, Memorias del I Simposio Internacional (Mexico 1990)*, 171–200. Mexico DF: Universidad Iberoamericana.
- Dahlin, Bruce H. 2003. "Chunchucmil: A Complex Economy in NW Yucatan." *Mexicon* 25: 129–38.
- Dahlin, Bruce H., Christopher T. Jensen, Richard E. Terry, David R. Wright, and Timothy Beach. 2007. "In Search of an Ancient Maya Market." *Latin American Antiquity* 18 (4): 363–84.
- Dahlin, Bruce H., Daniel Bair, Tim Beach, Matthew Moriarty, and Richard E. Terry. 2010. "The Dirt on Food: Ancient Feasts and Markets Among the Lowland Maya." In *Pre-Columbian Foodways: Interdisciplinary Approaches to Food, Culture, and Markets in Ancient Mesoamerica*, edited by John Edward Staller and Michael Carrasco, 191–232. New York: Springer.
- Dahlin, Bruce H., Traci Ardren, David R. Hixson, and Anthony P. Andrews. 2017. "Perishable Resources Produced for Exchange in the Chunchucmil Economic Region." In *Ancient Maya Commerce: Multidisciplinary Research at Chunchucmil*, edited by Scott Hutson, 221–40. Boulder: University Press of Colorado.
- Feinman, Gary M., and Linda M. Nicholas. 2010. "A Multiscalar Perspective on Market Exchange in the Classic-Period Valley of Oaxaca." In *Archaeological Approaches to Market Exchange in Ancient Societies*, edited by Christopher P. Garraty and Barbara L. Stark, 85–98. Boulder: University Press of Colorado.
- Folan, William J., Joel D. Gunn, and Maria del Rosario Domínguez Carrasco. 2001. "Triadic Temples, Central Plazas, and Dynastic Palaces: Diachronic Analysis of the Royal Court Complex, Calakmul, Campeche, Mexico." In *Royal Courts of the Maya*, Vol. 2, edited by Takeshi Inomata and Stephen D. Houston, 223–65. Boulder: Westview Press.

- Fry, Robert E. 2003. "The Peripheries of Tikal." In *Tikal: Dynasties, Foreigners and Affairs of State*, edited by Jeremy A. Sabloff, 143–70. Santa Fe: School of American Research Press.
- Garraty, Christopher P. 2009. "Evaluating the Distributional Approach to Inferring Marketplace Exchange: A Test Case from the Mexican Gulf Lowlands." *Latin American Antiquity* 20: 157–74.
- Golden, Charles, Timothy Murtha, Bruce Cook, Derek S. Shaffer, Whittaker Schroder, Elijah J. Hermit, Omar Alcover Firpi, and Andrew K. Scherer. 2016. "Reanalyzing Environmental Lidar Data for Archaeology: Mesoamerican Applications and Implications." *Journal of Archaeological Science: Reports* 9: 293–308.
- Hirth, Kenneth G. 1998. "The Distributional Approach: A New Way to Identify Marketplace Exchange in the Archaeological Record." *Current Anthropology* 39: 451–76.
- Hutson, Scott R., Richard E. Terry, Bruce H. Dahlin. 2017. "Marketing within Chunchucmil." In *Ancient Maya Commerce*, edited by S. R. Hutson, 241–71. Boulder: University Press of Colorado.
- Jones, Christopher. 1996. *Excavations in the East Plaza of Tikal*. Tikal Report 16, vol. I. University Museum Monograph 92. Philadelphia: University of Pennsylvania Museum of Archaeology and Anthropology.
- Jones, Christopher. 2015. "The Marketplace at Tikal." In *The Ancient Maya Marketplace: The Archaeology of Transient Space*, edited by Eleanor King, 67–89. Tucson: University of Arizona Press.
- Keller, Angela H. 2006. "Roads to the Center: The Design, use and Meaning of the Roads of Xunantunich, Belize." PhD diss., Department of Anthropology, University of Pennsylvania.
- King, Eleanor M., ed. 2015a. *The Ancient Maya Marketplace: The Archaeology of Transient Space*. Tucson: University of Arizona Press.
- King, Eleanor M. 2015b. "The Ethnohistoric Evidence for Maya Markets and Its Archaeological Implications." In *The Ancient Maya Marketplace: The Archaeology of Transient Space*, edited by Eleanor M. King, 33–65. Tucson: University of Arizona Press.
- King, Eleanor M. 2017. "Rethinking the Role of Early Economies in the Rise of Maya States: A View from the Lowlands." In *The Origins of Maya States*, edited by Robert Sharer, Loa Traxler, and Jeremy Sabloff, 417–60. Philadelphia: The University of Pennsylvania Museum Press.
- King, Eleanor M., and Leslie Shaw. 2015. "Research on Maya Markets." In *The Ancient Maya Marketplace: The Archaeology of Transient Space*, edited by Eleanor M. King, 1–32. Tucson: University of Arizona Press.
- Landa, Diego de. 2013 *Yucatán at the Time of the Spanish Encounter/Relación de las Cosas de Yucatán*. Translated and edited by Louis E. V. Nevaer. Coral Gables, FL: Hispanic Economics, Inc.
- Laporte, Juan Pedro, and Juan E. Chocón. 2008. "Será un Palacio? ... No! Será una Acrópolis? ... No!: Un Complejo de Funcion Desconcertante en el Centro de Pueblito, Peten." In *Simposio de investigaciones Arqueológicas en Guatemala, 2007*, edited by J. P. LaPorte, B. Arroyo, and H. E. Mejía, 696–712. Guatemala: Museum Nacional de Arqueología y Ethnología.
- Masson, Marilyn. 2021. Masson, Marilyn. 2021. "The 'Othering' of Maya Political Economies." In "Urban Commerce in Ancient Mesoamerica," edited by Elizabeth Paris, special issue, *Archaeological Papers of the American Anthropological Association* 32: 109–127.
- Masson, Marilyn, and David A. Freidel. 2012. "An Argument for Classic Era Maya Market Exchange." *Journal of Anthropological Archaeology* 31: 455–84.
- McKillop, Heather. 2002. *Salt: White Gold of the Ancient Maya*. Gainesville: University Press of Florida.
- Minc, Leah. D. 2006. "Monitoring regional Market systems in Prehistory: Models, Methods, and Metrics." *Journal of Anthropological Archaeology* 25 (1): 82–116.
- Murakami, Tatsuya. 2021. "Reconfiguring Market Economy: Dimensions of Exchange and Social Relations at Teotihuacan." In "Urban Commerce in Ancient Mesoamerica," edited by Elizabeth Paris, special issue, *Archaeological Papers of the American Anthropological Association* 32: 26–42.
- Nishitani Masaru, and Nathan Badenoch. 2013. "Why Periodic Markets Are Held: Considering Products, People,

- and Place in the Yunnan-Vietnam Border Area.” *Southeast Asian Studies* 2 (1): 171–92.
- Ossa, Alanna. 2021. “Scaling Centers and Commerce in Preclassic and Late Classic Settlements in South-Central Veracruz.” In “Urban Commerce in Ancient Mesoamerica,” edited by Elizabeth Paris, special issue, *Archaeological Papers of the American Anthropological Association* 32: 66–79.
- Ossa, Alanna, Michael E. Smith, and José Lobo. 2017. “The Size of Plazas in Mesoamerican Cities and Towns: A Quantitative Analysis.” *Latin American Antiquity* 28 (4): 457–475.
- Paris, Elizabeth H. 2021. “Introduction: Urban Commerce in Ancient Mesoamerica.” In “Urban Commerce in Ancient Mesoamerica,” edited by Elizabeth Paris, special issue, *Archaeological Papers of the American Anthropological Association* 32: 7–25.
- Pluckhahn, Thomas J. 2009. “Plazas y mercados en la Mixteca Alta prehispánica.” In *Bases de la Complejidad Social en Oaxaca*, edited by Nelly Robles García, 277–93. Mexico City: Instituto Nacional de Antropología e Historia.
- Reese-Taylor, Kathryn, and Armando Anaya Hernández, eds. 2013. *Proyecto Arqueológico Yaxnohcah, 2011 Informe de la Primera Temporada de Investigaciones*. Report submitted to the Instituto Nacional de Antropología e Historia, Mexico DF: Mesoweb. July 1, 2013. <http://www.mesoweb.com/resources/informes/Yaxnohcah2013.html>.
- Roys, Ralph L. 1943. *The Indian Background of Colonial Yucatan. Publication 548*. Washington, DC: Carnegie Institution of Washington.
- Ruhl, Thomas, Nicholas P. Dunning, and Chris Carr. 2018. “Lidar Reveals Possible Network of Ancient Maya Marketplaces in Southern Campeche, Mexico.” *Mexicon* 40 (3): 83–91.
- Sagebiel, Kerru L. 2005. “Shifting Allegiances at La Milpa, Belize: A Typological, Chronological, and Formal Analysis of the Ceramics.” PhD diss., Department of Anthropology, University of Arizona, Tucson.
- Shaw, Leslie M. 2012. “The Elusive Maya Marketplace: An Archaeological Consideration of the Evidence.” *Journal of Archaeological Research* 20: 117–55.
- Skinner, G. William. 1964. “Marketing and Social Structure in Rural China.” *Journal of Asian Studies* 24 (1–3).
- Stanton, Travis W., and Tomas Gallareta Negrón. 2001. “Warfare, Ceramic Economy, and the Itza: A Reconsideration of the Itza Polity in Ancient Yucatan.” *Ancient Mesoamerica* 12: 229–45.
- Terry, Richard E., Daniel A. Bair, and Eric G. Coronel. 2015. “Soil Chemistry in the Search for Ancient Maya Marketplaces.” In *The Ancient Maya Marketplace: The Archaeology of Transient Space*, edited by Eleanor M. King, 138–67. Tucson: University of Arizona Press.
- Tinkler, Keith J. 1973. “The Topology of Rural Periodic Market Systems.” *Geografiska Annaler. Series B, Human Geography* 55 (2): 121–33.
- Tourtellot, Gair, Jeremy Sabloff, Michael Smyth, L. Whitley, Stanelly Walling, Tomás Gallareta Negrón C. Perez A., G. Andrews, and Nicholas Dunning. 1988. “Mapping Community Patterns at Sayil, Yucatan, Mexico: The 1985 Season.” *Journal of New World Archaeology* 7 (2/3): 1–24.
- Vázquez López, Verónica. A., Armando Anaya Hernández, and Kathryn Reese-Taylor, eds. 2019. *Proyecto Arqueológico Yaxnohcah, Informe de las 2017–18 Temporadas de Investigaciones*. Report submitted to the Instituto Nacional de Antropología e Historia, Mexico DF.
- Wells, Eric Christian. 2003. “Artisans, Chiefs, and Feasts: Classic Period Social Dynamics at El Coyote, Honduras.” PhD diss., Department of Anthropology, Arizona State University, Phoenix.
- West, Georgia. 2002. “Ceramic Exchange in the Late Classic and Postclassic Maya Lowlands: A Diachronic Approach.” In *Ancient Maya Political Economies*, edited by Marilyn A. Masson and David A. Freidel, 41–86. Walnut Creek: AltaMira Press.
- Wright, Lori. 2005. “Identifying Immigrants to Tikal, Guatemala: Defining Local Variability in Strontium

- Isotope Ratios of Human Tooth Enamel.” *Journal of Archaeological Science* 32: 555–66.
- Wurtzburg, Susan J. 1991. “Sayil, Investigations of Urbanism and Economic Organization at an Ancient Maya City.” PhD diss., Department of Anthropology, State University of New York at Albany.
- Yeh, Anthony Gar-On, and Man Hong Chow. 1996. “An Integrated GIS and Location-Allocation Approach to Public Facilities Planning – An Example of Open Space Planning.” *Computers, Environment and Urban Systems* 20 (4-5): 339–50.