1994

Ancient Mesoamerica, 5 (1994), 1-11

THE SIZE OF THE AZTEC CITY OF YAUTEPEC

Urban survey in central Mexico

Michael E. Smith,[a] Cynthia Heath-Smith,[b] Ronald Kohler,[c] Joan Odess,[a]
Sharon Spanogle,[d] and Timothy Sullivan[e]

[a] Department of Anthropology, State University of New York at Albany, Albany, NY 12222, USA
[b] Institute for Mesoamerican Studies, State University of New York at Albany, Albany, NY 12222, USA
[c] Department of Anthropology, Wayne State University, Detroit, MI 48202, USA
[d] Department of Anthropology, University of Michigan, Ann Arbor, MI 48109, USA
[e] Department of Anthropology, University of Kentucky, Lexington, KY 40506, USA

Abstract

In 1992 we conducted an intensive archaeological surface survey in and around the modern town of Yautepec, Morelos, Mexico. Our goals were to determine the size and extent of the Aztec-period city of Yautepec, and to gather data on its spatial organization. This article describes the methods used and the results obtained toward achieving the first goal. Aztec Yautepec covered approximately 209 ha; this area is partly covered by the modern town and partly by open fields. Late Postclassic settlement was clustered around a structure that today is the largest known Aztec palace in central Mexico. We generate ethnohistoric and archaeological population estimates for Yautepec and discuss the city in relation to other Aztec urban settlements in Morelos and the Basin of Mexico.

The Aztec are widely recognized as a heavily urbanized culture, but modern scholars know very little about the nature of Aztec[1] cities and towns outside of the imperial capital Tenochtitlan. Tenochtitlan was described by early Spanish observers (see Calnek 1976; Lombardo de Ruiz 1973; Rojas 1986), but other Aztec settlements received little comment in the written record. The Spanish practice of building colonial towns on top of existing Aztec towns and cities (Gibson 1964; McAndrew 1965) produced a situation where today the remains of nearly all Aztec urban sites lie buried under colonial and modern settlements. As a result, archaeologists can rarely determine the size of Aztec urban settlements, and for all but a few examples, issues such as spatial organization are not amenable to archaeological analysis.

In this article we present preliminary results of a survey designed to investigate the Aztec city of Yautepec, which was located in and around the modern town of the same name in the Mexican state of Morelos (Figure 1). By a combination of still poorly understood historical circumstances, the growth of Yautepec in colonial and modern times has occurred primarily to the north of the Aztec settlement. Consequently, a large part of Aztec Yautepec has been only minimally disturbed. Through a program of intensive surface inspection and systematic surface collection, we are able to trace the size and extent of the Aztec city with a high degree of confidence.

[1] We use the term "Aztec" to designate the Nahuatl-speaking peoples of highland central Mexico in the Late Postclassic period (ca. A.D. 1350–1550). Most of the discussion in this article focuses on the areas of Morelos and the Basin of Mexico.

BACKGROUND

Archaeological Research at Yautepec

Yautepec's status as a Conquest-period settlement is known from references in various early colonial written sources. These sources include Aztec conquest and tribute lists (e.g., the *Codex Mendoza* [Berdan and Anawalt 1992:III:8r, 24r]), works of the chroniclers (e.g., Durán 1967:II:247), and Spanish administrative documents (e.g., descriptions of the encomienda of Hernan Cortés; see Riley 1973). Although Yautepec appears often in

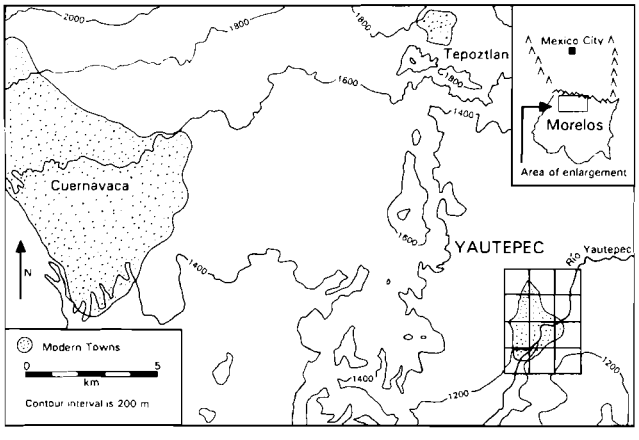

Figure 1. The location of Yautepec in Morelos.

ethnohistoric documents (see Maldonado 1990; Smith 1994), most instances merely mention the city in passing, and descriptions and detailed information are lacking. Reconstructions of the Aztec-period political geography of Morelos by Gerhard (1970) and Smith (1994) suggest that Yautepec was one of six or seven powerful polities in the area, with at least four city-states subject to its lord.

Grove's (1968) catalog of major archaeological sites in Morelos includes a large Late Postclassic mound on the southwest edge of modern Yautepec. When urban development threatened this mound and other nearby archaeological remains, a local citizens' group (the Sociedad Cultural Yautepec) helped arrange for test excavations to be done by archaeologists from the Centro Regional Morelos of the Instituto National de Antropología e Historia. The first season of work in 1989 (de Vega 1989) revealed that the mound is the remains of a large platform measuring approximately 65 × 95 m, with a single stairway on the west side (Figure 2). Most of the excavated ceramics date to the Middle or Late Postclassic periods. A deposit of early colonial, sixteenth-century material is associated with some rooms that were added to the base of the platform after its major period of use. Open fields adjacent to the platform on its west side had abundant Late Postclassic artifacts on the surface, and the remains of some houses were still visible at the time of the survey.[2]

A second season of excavation was carried out by the Centro Regional Morelos in 1991 with the aid of the Patronato Pro-Restauración de la Zona Arqueológica de Yautepec, Morelos. Hortensia de Vega and Pablo Mayer Guala (1991) uncovered a series of rooms, courts, and passages on top of the platform that suggest the structure was a palace rather than a temple. With a surface area of over 6,000 m^2, this is the largest existing Aztec palace in central Mexico by almost an order of magnitude.[3] In 1991 Smith and Heath-Smith planned a multiyear archaeological project at Yautepec to complement the work by the Centro Regional Morelos. The existence of the palace structure together with high Late Postclassic sherd densities in adjacent fields suggested that a portion of the Aztec settlement was available for archaeological study. The survey described in this article was carried out during the first fieldwork season of that project; a subsequent season of excavation in 1993 focused on houses and domestic contexts in Yautepec. The excavations will be described in future publications; here we only mention data from the 1993 season that bear directly on points made in this article.

[2]Based upon discussions with local archaeologists and the 1992 survey, the open fields west of the palace were targeted for intensive house excavations in 1993. The area was invaded by squatters in October, 1992, however, thereby preventing further archaeological study.

[3]Small-scale elite residences or palaces have been excavated at Siguatecpan in the Teotihuacan Valley (Evans 1988) and at Cuexcomate in western Morelos (Smith 1992). The former covers an area of 360 m^2 (550 m^2 including an open courtyard), while the Cuexcomate structure has an area of 540 m^2 (or 850 m^2 including an open courtyard). Although the Yautepec palace with its surface area of approximately 6,100 m^2 (.61 ha) dwarfs these smaller elite residences, it pales in comparison with an ethnohistoric account of Netzahualcoyotl's royal palace in Texcoco (Ixtlilxochitl 1975:II:92-93), which describes a total expanse of some 85 ha, including gardens, storehouses, a ballcourt, and a marketplace (see Hicks [1984:149] for discussion). Evans (1991) provides general information on Aztec palaces.

Figure 2. Photograph of the west (front) façade of the Yautepec palace.

Historic and Modern Yautepec

Modern Yautepec is a town of 29,000 inhabitants (1990 census figures; INEGI 1991) located along the Río Yautepec in the central portion of the state of Morelos (Figure 1). Its spatial layout is unusual for a central Mexican town with early colonial settlement. Most sixteenth-century Spanish towns were laid out on a grid pattern around a central square or *zocalo*, with a church on one side and civic buildings on the other sides of the plaza (Kubler 1948; McAndrew 1965; Stanislawski 1947). Yautepec, on the other hand, has only a small park in the center of town and lacks a common grid pattern of streets. The sixteenth-century church and monastery are located several blocks southwest of the town center. We have not yet located documentary evidence that would explain this unusual layout of early colonial Yautepec, although Martin (1985) provides some leads. It appears that the Spanish town may have originated with two small settlements along major roads and a Dominican monastery; the modern town center was then established from the growth and consolidation of these small settlements (Juan Antonio Siller, personal communication 1992).

Whatever the historical reasons for Yautepec's unusual layout, the result is significant for archaeology. The center of Yautepec today is north of the Aztec site, and modern occupation around the core of the Aztec settlement is not dense. Although most of the Aztec city is indeed covered by modern occupation, land use has not been intensive or destructive in most areas. We had access to areas with visible archaeological remains (primarily Late Postclassic sherds) in almost all parts of town.

Figure 3 depicts modern Yautepec with land classified into six broad classes representing differences in modern disturbance of the archaeological record and archaeological visibility. Although disturbance and visibility are independent variables, they do covary negatively, and we use them to define five ordinal classes of land use. *Category 1* lands are heavily disturbed by colonial and/or modern construction, and there are very few patches of clear ground surface. This category comprises a few blocks of the downtown area that include the park, market, banks, and other commercial and government buildings (Figure 3). *Category 2* consists of areas with dense residential occupation, including limited retail commercial use, but numerous

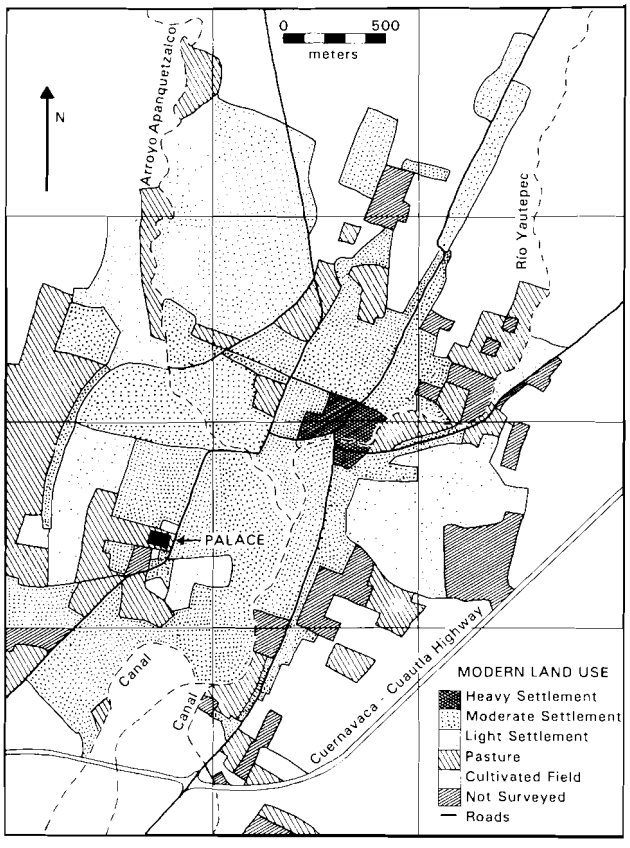

Figure 3. Modern land use in Yautepec.

patches or areas of open ground surface with minimal disturbance are present. Most streets in these areas are paved, and some yards and lots are covered with pavement or lawn. Nevertheless, we were usually able to locate several open, minimally disturbed areas per hectare (e.g., in vacant lots or in houseyards) where we could observe surface artifacts. Most of the residential areas that have been constructed over the past several decades fall into Category 2. The frequent use of construction fill to level yards in these areas was a problem addressed by inspection and interviews with residents.

Category 3 encompasses residential areas with lower structure densities and minimal modern disturbance of the ground surface. Most of this land occurs in two types of neighborhoods: former villages and recent squatter settlements. As the town of Yautepec expanded in the twentieth century, several peasant villages were absorbed, and today these areas maintain a village-like appearance with dispersed adobe or cane houses, large walled lots with house gardens, and dirt streets. Squatter settlements were formerly vacant lots and fields that have been covered recently with small "shantytown" settlements; these have small, simple houses and unpaved streets. In both types of neighborhood, archaeological visibility is quite good.

Category 4 consists of open fields that have not been cultivated in the past two years. Most were little-used vacant plots or else pasture, and both were covered with low grass and an occasional scattered house or other building. Visibility in grassy areas was poor (survey was during the rainy season), and we sought out clear areas or else cleared the grass with machetes. *Category 5* lands are actively cultivated fields or milpas. Most were planted in maize and/or beans and had very good visibility. A few sugarcane fields with poor visibility were encountered, but we were able to monitor the presence of artifacts in and around irrigation ditches.

Category 6 represents those areas where we were denied access to parcels of 1 ha or larger. These include a few areas of industrial use (a quarry, a natural-gas transfer station, and a small factory) and a number of walled lots (*quintas*) belonging to wealthy weekend residents from Mexico City.

SURVEY METHODS

This survey had two goals: (1) to trace the size and extent of Aztec Yautepec, and (2) to investigate the spatial organization of the settlement. Our methods for reaching these goals were conditioned by a number of constraints, including a short field season (six weeks), work during the rainy season, and the logistical problems of survey within a modern town. Local residents were quite helpful, and we were fortunate to have the support of the Patronato Pro-Restauración de la Zona Arqueológica de Yautepec, Morelos, and the Presidencia Municipal. Most people were accommodating to our requests to examine their yards, and our efforts were aided by public-service announcements on a local radio station.

In order to carry out ground inspection systematically, we divided the modern town area into 1-ha grid squares and recorded standardized information on ancient and modern artifacts and land use for each square. We worked from a Mexican government aerial photograph with a scale of 1:10,000 (CCCP 1982). These photos, from a 1982 flight, have a 1-km Universal Transverse Mercator (UTM) grid and 10-m contour lines printed on them. For our purposes, we drew a finer 100-m grid (1-cm squares) on the photos. The modern land-use map (Figure 3) was compiled from the aerial photo and our ground coverage. The 1-km grid is depicted in all of the maps that accompany this article.

We worked in two teams, each consisting of three archaeologists and a local guide. We examined as much of the ground surface as possible, making both systematic and nonsystematic collections of surface artifacts (see below). We began in the open fields west of the palace, where excavations had been planned for 1993. Sherd density was high in this area but dropped off rapidly about 500 m west of the palace to a background level of less than 1 sherd per m^2. The drop-off in artifact density formed a mostly north–south line in this area, and we defined this gradient as the site boundary, probably approximating the edge of dense urban occupation. We then followed this boundary south and counterclockwise around the site, covering both the internal site area and external areas.

We made four types of artifact collections in order to provide data on three issues: dating of surface contexts, objective determinations of artifact densities, and spatial organization within the site. First, we drew a systematic sample of alternating 1-ha squares (a checkerboard pattern), and took one 2- × 2-m surface collection in each of the selected squares. These 135 collections were placed opportunistically in areas where surface artifacts were visible. We did not make collections in grid squares where all observable areas had very low artifact densi-

ties (as determined by inspection); the cutoff density value was approximately 1 sherd per m^2 (see below). Second, we made 30 additional 2- × 2-m collections from significant or problematic areas such as non-Postclassic occupations or areas we suspected included the site boundary. For each 2- × 2-m collection (both the systematic sample and the additional collections), we gathered all visible artifacts equal to or larger than 1 cm^2, except for ground stone, which was noted on the collection forms.

The other two types of collections were nine samples from modern construction trenches and 34 "grab" samples from various parts of the site. Because these collections were taken primarily for dating purposes, we focused on rim sherds, decorated body sherds, and other potentially diagnostic artifacts. Many of these collections were placed in and around the five non-Postclassic sites (see below). We also received nine small collections as donations from Yautepec residents; some of this material will be exhibited soon in the town. Figure 4 shows the locations of all collections except for donations. Data on the numbers of artifacts per collection are summarized in Table 1 (by collection type) and Figure 5.

The limits of the survey coverage (Figure 4) were determined by artifact density and the extent of modern settlement. There is a continuous low-density scatter of Late Postclassic sherds in the Yautepec area, similar to the situation with sherds of the Late Aztec phase in the Basin of Mexico (Sanders et al. 1979). The origin and significance of this background artifact scatter are not clear (see Bintliff and Snodgrass [1988] for a general discussion of the topic), and we plan to pursue this issue in the future. Moving out from the central site area across the site boundaries (see below), we stopped taking collections and filling out forms when artifacts density dropped to a level of around one sherd per m^2. The limits of coverage shown in Figures 4 and 6–10 depict where our collecting and note taking ended.

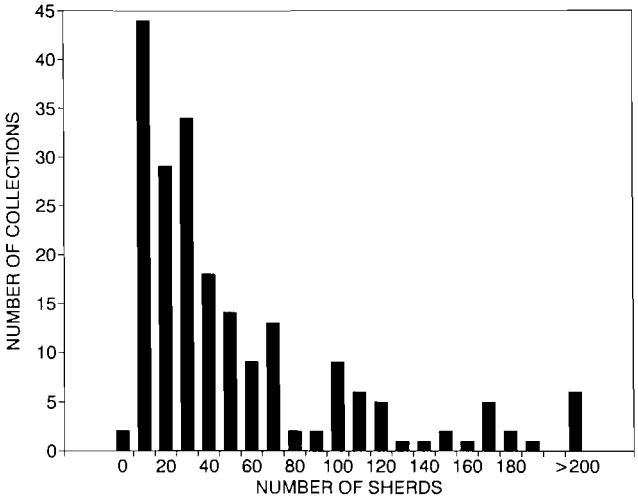

Figure 5. Frequency distribution of collection sizes (numbers of sherds).

We inspected areas outside of these limits up to distances of several hundred to over one thousand meters to ensure that artifact density did not increase again. Inside the modern town we continued the intensive survey considerably beyond the site boundary to check closely areas of dense modern settlement. In this operation, we located three Late Postclassic and three Classic sites north of the main Postclassic city area. We continued the nonintensive surface investigation for over 1 km north of the northern limit of intensive survey, covering most of the land in the northern 3 km^2 shown in Figure 3.

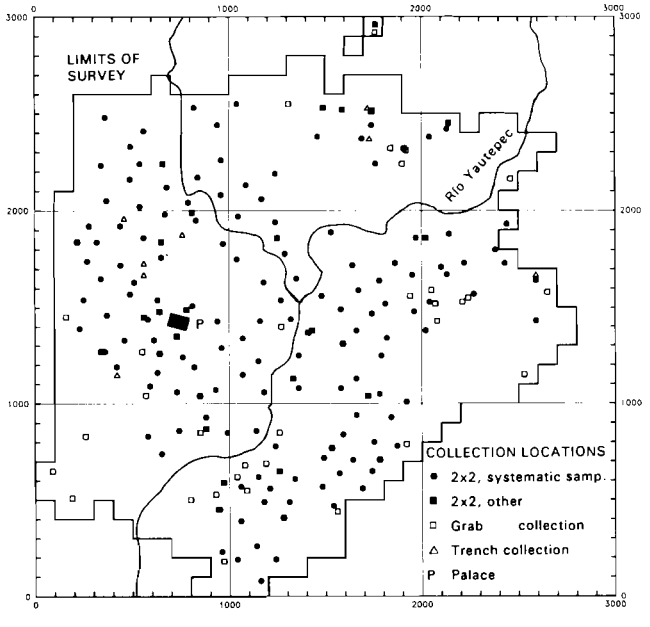

Figure 4. Locations of surface collections. The size of the map is 3,000 × 3,000 m. This 9-km^2 area corresponds to the lower 9 grid squares marked in Figures 1 and 3.

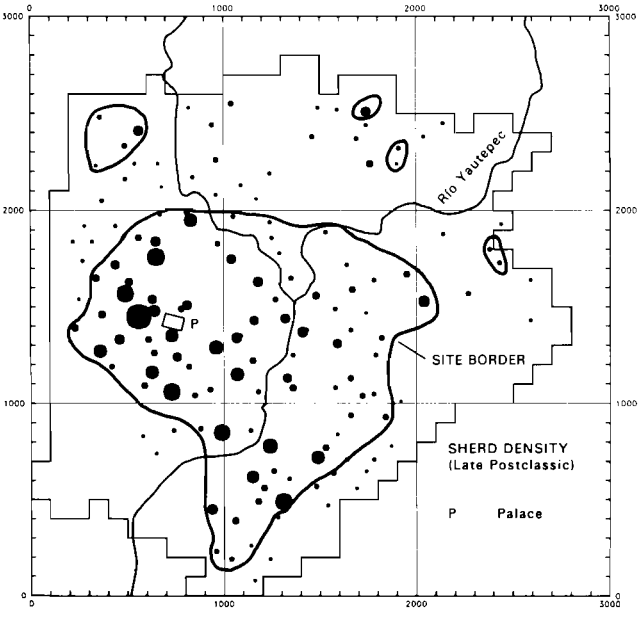

Figure 6. Surface density of Late Postclassic sherds (2- × 2-m collections only), with site boundaries indicated. Circle size is proportional to sherd density: the smallest circles denote densities under 2 sherds per m^2 while the largest circle indicates a density of 87 sherds per m^2. The size of the map is 3,000 × 3,000 m.

Table 1. Artifact collection size

Collection Type	Number	Ceramics Mean	Ceramics Standard Deviation	Lithics Mean	Lithics Standard Deviation
Systematic 2- × 2-m sample	135	51.0	55.4	2.2	3.0
Other 2- × 2-m sample	30	64.4	68.0	4.7	7.1
Construction trench	9	47.0	29.8	1.9	2.3
Grab	34	28.2	33.3	3.9	8.1
Donation	10	-	-	-	-

RESULTS

Site Boundaries

A surprising result of our survey was the discovery of a relatively clear boundary between the central area of high artifact density and surrounding areas of much lower density. This sharp differential in sherd density was observed in the two areas where the site edge occurred in open fields—west of the pyramid and along the southeast boundary of the site. This finding influenced our field methods, and we devoted considerable effort to locating the site boundary in areas with modern occupation. We felt justified in assuming that the Aztec city had an edge which we could locate and plot with accuracy. This was done in two steps.

In the first step toward tracing site boundaries (for the Aztec settlement and earlier sites as well), we used our subjective field judgments based upon observations of artifact density in relation to modern settlement and conditions. After discussion among crew members, Smith drew provisional site boundaries on the aerial photo for all artifact clusters. The second step applied objective data on Late Postclassic artifact densities from the 165 2- × 2-m collections. These data, portrayed in Figures 6–8, were plotted at the same scale as the aerial photo and base map (1:10,000) using SURFER software (Golden Software, Golden, CO). Various density plots were superimposed on the provisional site boundaries, which were then adjusted slightly in light of the densities. Figure 6 shows the ceramic densities of the individual collections and the inferred site boundaries. In Figure 7 these data have been transformed into a contour plot. Figure 8 is a similar contour plot for chipped stone density.[4]

From the above procedure, we determined that Late Postclassic occupation at Yautepec consisted of a large settlement (197.5 ha) around the palace, plus four small discrete clusters or outlying settlements. We consider these five clusters to con-

[4]The contours were generated by the SURFER software, using the inverse distance interpolation technique and a nearest neighbor (or normal) search method. We used a search radius of 500 m, consideration of six nearest points, and a grid size of 60 units for the 3,000- × 3,000-m plot areas.

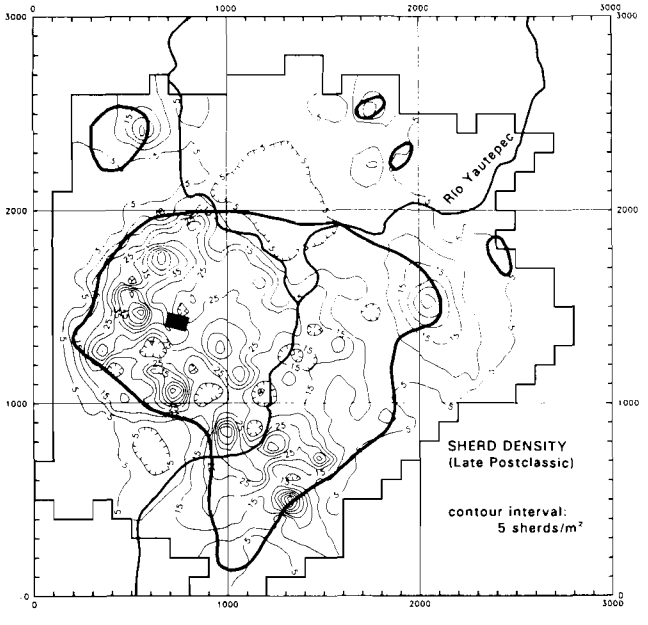

Figure 7. Contour plot of sherd densities. The size of the map is 3,000 × 3,000 m.

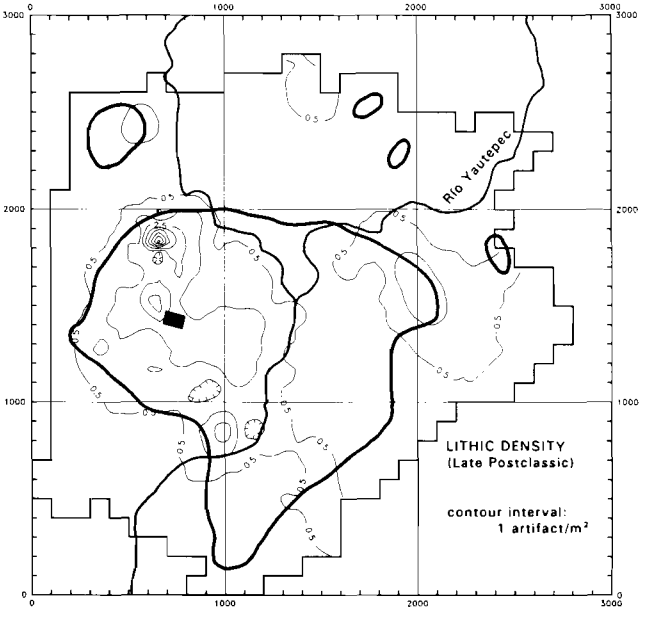

Figure 8. Contour plot of lithic densities. The size of the map is 3,000 × 3,000 m.

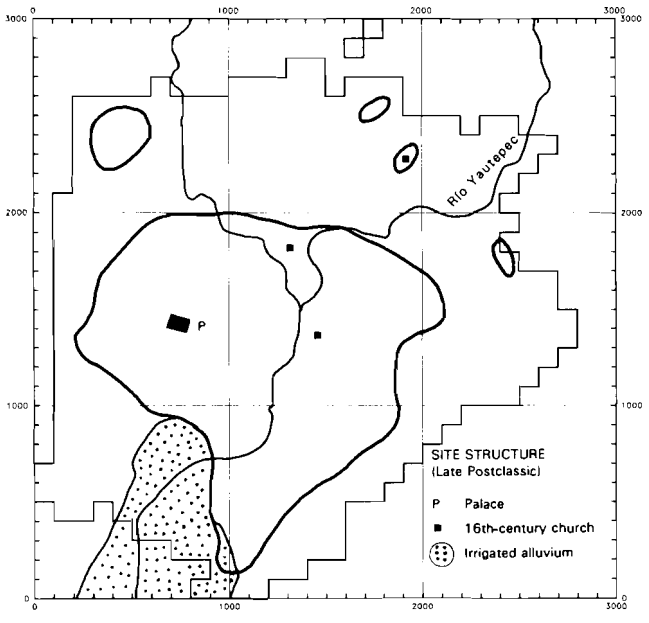

Figure 9. Key features of the spatial organization of Aztec Yautepec. The size of the map is 3,000 × 3,000 m.

stitute the Aztec-period city of Yautepec. During the 1993 excavation season, we tested the site boundary through test pits in two fields immediately outside of the settlement boundary. At the southern tip of the site, excavations uncovered sterile and nearly sterile deposits outside of the site border. In a floodplain area just west of the Río Yautepec, however, the rapid drop-off in surface density appears to be due at least in part to alluvial deposition since the Spanish Conquest (see discussion below).

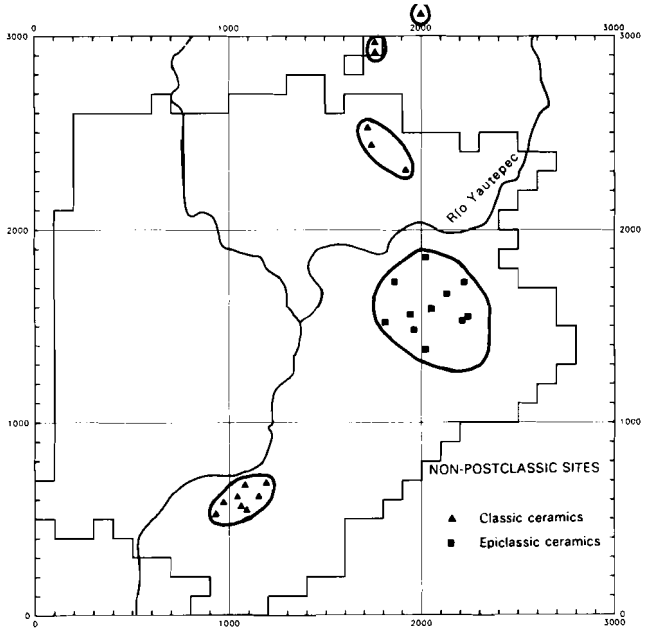

Figure 10. Locations of Classic and Epiclassic sites. The size of the map is 3,000 × 3,000 m.

Population Estimates

The Late Postclassic population of Yautepec can be estimated by application of a density constant to the areas within the cluster boundaries determined above. Areas were measured by AutoCAD software (Autodesk, Inc., Sausalito, CA) after digitizing the site boundaries. Although we acknowledge the considerable room for error in ancient population estimates (e.g., Hassan 1981), we feel that the benefits of population estimation exceed the risks. We employ population-density factors based on research at Capilco and Cuexcomate, sites in western Morelos excavated by Smith (1992). These are the only Late Postclassic sites in central Mexico where populations have been estimated from archaeological data by rigorous procedures based upon house counts, excavations, and a detailed chronology[5] (Smith 1992:335–345). Cuexcomate, the larger and more complex site, is more comparable to Yautepec. In the Early Cuauhnahuac phase (A.D. 1350–1430), Cuexcomate covered 9.9 ha, with a population density of 24 persons/ha; in the Late Cuauhnahuac phase (A.D. 1430–1550), the site covered 14.5 ha, with a density of 55 persons/ha. When these two density constants are applied to Yautepec, the composite estimates for all five Late Postclassic settlements are 5,009 and 11,480 persons (Table 2). Given the pattern of rapid population growth in Middle and Late Postclassic Morelos (Smith 1992:335–345), the higher figure may be more appropriate as an estimate of the Conquest-period population of Yautepec (comparative data from other Aztec urban centers also favor the higher figure; see discussion below).

These archaeologically derived population estimates may be compared to historically derived estimates of Yautepec's urban population presented by Smith (1994). Based upon a 1551 encomienda census (Riley 1973:133), Smith projects figures of 13,300 and 16,800 for the Yautepec urban population in 1519.[6] These estimates are not too different from the higher archaeological estimate (11,480), suggesting that these figures are probably of the correct order of magnitude.

Spatial Organization

Given the wide variation in modern land use and disturbance at Yautepec, we do not feel that intrasite variations in artifact density can be given social or behavioral significance without adjusting the densities for modern conditions. In other words, we do not believe that, within the site itself, areas with denser surface artifacts (see Figures 6–8) were necessarily more densely inhabited or more intensively used than areas with fewer surface remains. On the other hand, it is more reasonable to assume that spatial patterning in the *content* of surface collec-

[5] Archaeological population estimates for Capilco and Cuexcomate were derived as follows (see Smith [1992:335–345] for details). At these sites, nearly all houses are discernable on the ground. Random samples of houses were drawn at each site for test pit operations. Deposits were phased with the chronology described in Smith and Doershuk (1991), and the pattern of house occupations through time was extrapolated from the random samples to the entire sites. Household-size constants from Morelos ethnohistoric documents (5.5 persons per structure for nonelite houses, and 11 persons per structure for elite residences) were then applied to the house counts.

[6] These figures were calculated by application of post-Conquest population decline models to the 1551 census figures. The lower estimate applies Sanders's (1970) constant-decline model for Morelos, and the higher estimate applies Whitmore's (1991, 1992) simulation-based epidemic model. See Smith (1994) for discussion.

Table 2. Population estimates

Settlement Cluster	Area (ha)	Estimate 1	Estimate 2
Late Postclassic Clusters			
A	197.5	4,740	10,863
B	7.5	180	413
C	1.2	29	66
D	1.1	26	61
E	1.4	34	77
Site Total	208.7	5,009	11,480
Classic Sites			
F	.7	17	39
G	.5	12	28
H	4.1	98	226
I	5.3	127	292
Epiclassic Sites			
J	27.2	653	1,496

Note: Estimate 1 uses a density constant of 24 persons per hectare, and Estimate 2 uses 55 persons per hectare. See text for discussion.

tions may reflect actual social or behavioral patterning within the Aztec town. Such spatial analyses are currently underway, and their results will be presented at a future date. Comparable studies of surface collections at other Aztec sites are described by Brumfiel (1980, 1986), Charlton et al. (1991), and Nichols (1994).

We initially thought that the distribution of sixteenth-century churches in Yautepec might provide clues to the spatial organization of the Aztec town. The Spaniards typically built churches on top of the ruins of destroyed native temples (McAndrew 1965:181–186), and all three early churches in Yautepec have Late Postclassic sherds around them. The Dominican church and convent of Yautepec, located on the west bank of the Río Yautepec, was probably built in the 1550s (Gerhard 1972:96; Kubler 1948:333, 535), but the early histories of the two smaller barrio chapels, San Juan and Santiago, are uncertain. The convent and San Juan chapel are within the main Aztec town; the Santiago chapel is located in one of the northern clusters (Figure 9).

The large size of the Yautepec palace (see Note 1) suggests that it was the residence of the *tlatoani* or ruler of Yautepec. If so, then the palace marks the administrative center of the settlement, and we hypothesized that the churches may pinpoint the locations of major outlying temples. Our 1993 excavations around the main church/convent complex and the San Juan chapel failed to uncover evidence of Late Postclassic temples or other major architecture, however. It appears that these churches were built on open land and that any major Late Postclassic temples were located elsewhere.

The absence of a large temple pyramid adjacent to or near the palace is puzzling since other Late Postclassic political centers in Morelos have palaces and temples that face a common public plaza. A low mound (2–3 m in height) immediately north of the palace may have been a temple, but we would expect a taller structure for the central temple in a major urban center. Several smaller city-state capitals in Morelos have temple mounds in the range of 6 m (Coatetelco) to 10 m in height (Cuentepec, Itzamatitlan [data from Smith's unpublished field notes]). Either a large temple near the palace was destroyed (we could find no evidence of this), or the existing low mound served as a temple and Yautepec was unusual for the small size of its temple pyramid.

Another potential factor influencing the spatial organization of Aztec Yautepec is irrigation agriculture. The Río Yautepec is entrenched through much of the modern town but irrigated alluvial deposits are located just below the town. Aztec settlement covers the slopes down to the edge of the alluvium, and then sherd density drops off considerably in the modern irrigated fields. This floodplain is irrigated by two simple canals that take off from a small dam in the river (Figure 9). The technology to irrigate this area was certainly available in Aztec times (Doolittle 1990), and we know that fields along the Río Yautepec upstream from the city were irrigated in the early sixteenth century (Acuña 1985:207; see Smith 1994). It is likely that the floodplain was irrigated in the Late Postclassic period, and for this reason, urban settlement may have avoided these plots. One of the modern canals, located along the upper edge of the alluvium, forms the boundary of the Aztec site in this area (Figure 9).

In the 1993 excavations we placed a trench adjacent to this canal but failed to find any evidence of a pre-Hispanic channel. Test pits in the alluvial area between the canal and the river encountered a low-density Late Postclassic refuse deposit under a nearly sterile layer of alluvial sediment. This suggests that either the settlement extended beyond our border and onto the floodplain here, or else low densities of artifactual material were deposited onto Late Postclassic agricultural fields. Future analyses of these deposits and their artifacts will contribute toward clarification of this issue.

Non-Postclassic Settlement

Five clusters of earlier occupation were encountered in the survey. Four Classic-period sites, labeled F through I, are present; one overlaps the Aztec city, and three are located to the north. An Epiclassic settlement of 27.2 ha covers Cerro Tenayo, a 100-m-high limestone hill on the eastern edge of modern Yautepec. At the summit of the hill, a complex of Epiclassic platforms and structures surrounds the entrance to a deep cave. The locations of these sites and the surface collections used to date them are shown in Figure 10; their sizes are listed in Table 2. In addition to these sites, a Classic-period midden was found buried under approximately 2 m of alluvium in one of the 1993 test pits in the yard of the sixteenth-century chapel of San Juan on the east bank of the river (Figure 9).

THE SIZE OF AZTEC CITIES

How typical was Yautepec compared to other Aztec cities? Discussion of topics such as urban activities and institutions, regional functions, or spatial organization must await further analysis of the surface collections and the results of the excavations. Nevertheless, in the realm of areal extent and population size some conclusions can be drawn. Comparative data on Aztec settlements are assembled in Tables 3 and 4. Most of the ethnohistoric population estimates are derived by extrapolating early colonial census figures back to 1519, and many of the archaeological estimates derive from applying density constants to site areas as estimated from surveys. Although there is much

Table 3. Sizes of Aztec settlements

Settlement	Population[a]	Source[b]	Area (ha)	Density	Reference
Imperial capital					
Tenochtitlan	250,000	1	1,350	185	Rojas (1986:35, 66–68)
Tenochtitlan	175,000	1	1,350	130	Calnek (1976:288)
Major political capitals					
Texcoco	18,500	2	450	40	Parsons (1971:120)
Texcoco	23,000	1	450	50	Hicks (1984:149)
Texcoco	25,000	2	450	55	Hodge (1994)
Texcoco	30,000	?	450	65	Sanders et al. (1979:154)
Cuauhnahuac	36,000	1	–	–	Smith (1994)
Huaxtepec	6,200	1	–	–	Smith (1994)
Yacapitztlan	17,900	1	–	–	Smith (1994)
Yautepec	11,500	2	209	55	this paper
Yautepec	15,100	1	209	70	Smith (1994)
City-state capitals, Basin of Mexico					
Amecameca	7,500	2	400	20	Parsons et al. (1982:162)
Amecameca	10,000	2	400	25	Hodge (1994)
Chalco	9,400	3	250	40	Parsons et al. (1982:192)
Chalco	12,500	2	250	50	Hodge (1994)
Chimalhuacan	9,000	2	260	35	Parsons (1971:144)
Chimalhuacan	12,000	2	260	45	Hodge (1994)
Coatlinchan	8,300	2	210	40	Parsons (1971:139)
Cuitlahuac	3,400	2	90	40	Parsons et al. (1982:214)
Cuitlahuac	4,500	2	90	50	Hodge (1994)
Culhuacan	2,400	2	65	35	Blanton (1972:334)
Culhuacan	4,400	2	65	70	Hodge (1994)
Huexotla	11,300	2	300	40	Brumfiel (1980:461); Parsons (1971:139)
Huexotla	23,000	2	300	75	Hodge (1994)
Ixtapalapa	2,800	1	28	100	Blanton (1972:334); Hodge (1994)
Mixquic	1,700	2	45	40	Parsons et al. (1982:238)
Mixquic	2,300	2	45	50	Hodge (1994)
Otumba	10,700	1	220	50	Charlton and Nichols (1990:2–3)
Tepetlaoztoc	10,100	2	450	25	Parsons (1971:102)
Tepetlaoztoc	13,500	2	450	30	Hodge (1994)
Tlalmanalco	3,000	2	80	40	Parsons et al. (1982:160)
Tlalmanalco	4,000	2	80	50	Hodge (1994)
Xochimilco	8,000	2	214	40	Parsons et al. (1982:238)
Xochimilco	10,700	2	214	50	Hodge (1994)
City-state capitals, Morelos					
Coatlan	800	3	15	55	Mason (1980:54, 173)
Cuauhchichinola	1,800	1	10	180	Smith (1994)
Huitzillan	2,700	1	–	–	Smith (1994)
Molotlan	1,800	1	–	–	Smith (1994)
Panchimalco	2,200	1	–	–	Smith (1994)
Tepoztlan	7,800	1	–	–	Smith (1994)
Other settlements, Basin of Mexico					
Coatepec	2,500	1	–	–	Hodge (1994)
Ixtapaluca	1,200	2	90	15	Blanton (1972:331)
Ixtapaluca	1,600	2	90	20	Hodge (1994)
Siguatecpan	1,100	3	106	10	Evans (1988:23)
Xico	1,900	2	62	30	Parsons et al. (1982:199–200)
Xico	>1,000	2	24	>42	Brumfiel (1986:247)
Other settlements, Morelos					
Capilco	100	3	1	100	Smith (1992:341)
Cuexcomate	800	3	15	55	Smith (1992:341)

[a]These are estimates of urban population size in 1519. Where an individual source provides population ranges or multiple estimates, we list the mean figure here. Population figures are rounded to the nearest 100, areas to the nearest 1 hectare, and densities to the nearest 5 persons per hectare.

[b]Source of population estimate: 1 = ethnohistory; 2 = archaeological estimate calculated as site area multiplied by a density constant; and 3 = other archaeological estimate.

Table 4. Mean size of Aztec settlements by category

Category	Population[a]	Area (ha)	Density
Basin of Mexico			
Tenochtitlan	212,500	1,350	157
Texcoco	24,000	450	54
City-state centers	9,100	203	61
Other settlements	1,600	80	21
Morelos			
Major political centers	18,400	–	–
City-state centers	2,900	13	118
Other settlements	450	8	78

[a]Figures in this table are the means for various categories of settlements listed in Table 3. Settlements with multiple estimates in Table 3 are counted only once, using the mean value for the multiple estimates.

room for error in such procedures (see Sanders 1970; Sanders et al. 1979; Smith 1994; Whitmore 1992), the resulting estimates are probably not too inaccurate.

There are clear distinctions in city size that reflect the Late Postclassic political hierarchy and differences between the Basin of Mexico and Morelos (Table 4). Tenochtitlan was almost an order of magnitude larger than other important political capitals like Texcoco or Cuauhnahuac. These capital cities in turn averaged twice the population of city-state capitals (i.e., *tlatoani* centers) in the Basin of Mexico. The few documented city-state capitals in Morelos were much smaller again. Finally, settlements of lower or uncertain political status tended to be the smallest, with those in the Basin of Mexico larger than settlements in Morelos.

These patterns lend support to the model positing politico-administrative factors as the most important urban functions of Aztec cities (Marcus 1983; Sanders and Webster 1988; Smith 1989). On this basis, we feel justified in designating all Aztec-period capitals (*tlatoani* centers) as urban settlements, with the larger and more complex cases called cities and the smaller, simpler, and less complex examples called towns. Some lower-level nucleated settlements (for example, Cuexcomate and Coatetelco in Morelos) had elite compounds and public religious structures; therefore, these may also be considered towns since they performed various administrative, ritual, and perhaps economic functions for a wider area (Smith 1992). The Late Cuauhnahuac phase population density of Cuexcomate (55) is well within the range of Aztec urban densities (Table 3; see discussion below).

The incomplete nature of Aztec city-size data prevents a formal rank-size analysis, but there is no doubt that Tenochtitlan was a primate city, fitting its preeminent role as the political and economic center of the Aztec empire. Tenochtitlan's urban dominance in the Basin of Mexico may have suppressed the growth of second-level cities like Texcoco, and for this reason, it is not surprising to find that at least one city in the Morelos area—Cuauhnahuac—was larger than Texcoco. The difference in the sizes of city-state capitals in the two areas is striking. Yautepec, the capital of a regional polity with several subordinate city-states, is close to the average size of a city-state capital in the Basin of Mexico.

While urban population size varies greatly with political hierarchies and location (Basin of Mexico vs. Morelos), urban population density is quite consistent for cities and towns outside of Tenochtitlan (Table 3). Most of these settlements had population densities between 40 and 70 persons per hectare (i.e., 4,000–7,000 persons per square kilometer). This consistency may derive from similarities in housing patterns, neighborhood organization, or other factors. Rural Aztec housing was quite variable throughout central Mexico (Evans 1988; Smith 1992), and the 1993 excavations suggest that urban houses also varied considerably. Until more urban houses are excavated, however, it will be difficult to explain the consistency in population density among Aztec cities and towns.

Scholars agree that centrally located royal palaces were the most important administrative institution in Aztec cities and towns (Evans 1991; Marcus 1983; Schroeder 1991; Smith 1989). Hicks (1982, 1984) argues that labor service to these royal palaces was a primary reason for population nucleation around these structures. He discusses the nature of royal labor service in Texcoco, distinguishing between a permanent labor force that inhabited the urban core and a rotational labor force drawn from communities throughout the wider polity of Acolhuacan. Many of the residents of other Aztec cities and towns, such as Yautepec, also probably worked for their royal palace, carrying out various administrative, ritual, and economic duties. The relative sizes and compositions of the administrative and non-administrative sectors of Aztec cities is not known. The non-administrative population must have included farmers, artisans, and merchants, but their relative importance is uncertain. Contrasting models of the prevalence of craft specialization at Huexotla (Brumfiel 1980, 1987) and Otumba (Charlton et al. 1991; Nichols 1994) suggest some degree of variation among Aztec cities, but additional data are needed.

CONCLUSION

Our survey has generated important new data on the size and extent of a major Aztec city. The size and layout of urban settlements are two of the most basic kinds of information in the analysis of ancient urbanism. The paucity of archaeological data on these and other settlement features has held back the study of Aztec cities and towns outside of the highly atypical Tenochtitlan. Recent fieldwork at sites like Huexotla (Brumfiel 1980, 1987), Otumba (Charlton et al. 1991; Nichols 1994), Xaltocan (Brumfiel 1992), and now Yautepec, is building a foundation for a new archaeological understanding of Aztec urbanism. Our ongoing investigation of the spatial structure and socioeconomic organization at Yautepec should contribute to this effort to bring Aztec cities into the realm of modern scholarship.

RESUMEN

En 1992 llevamos a cabo un reconocimiento intensivo en el pueblo actual de Yautepec, Morelos, México, y sus alrededores. Los dos objetivos de la investigación fueron primero, determinar el tamaño y trazado de la ciudad azteca de Yautepec, y segundo, recuperar información sobre la organización espacial de la ciudad. Este artículo describe nuestros métodos y los resultados relacionados al primer objetivo. La ciudad

postclásica tardía de Yautepec cubría un área aproximada de 209 hectáreas. Una parte del sitio está dentro del pueblo actual, y la otra está en los campos abiertos cerca del pueblo. El asentamiento postclásico tardío se concentró alrededor de una estructura que es el más grande palacio azteca conocido hasta ahora en el centro de México. Estimamos también la población de Yautepec, tanto en base a documentos etnohistóricos como a la arqueología, y discutimos la relación entre esta ciudad y otros asentamientos urbanos aztecas en Morelos y la cuenca de México.

ACKNOWLEDGMENTS

The Yautepec survey was funded by the H. John Heinz III Charitable Trust, the National Science Foundation, the National Endowment for the Humanities, and the Patronato Pro-Restauración de la Zona Arqueológica de Yautepec, Morelos. Kohler's participation was funded by grants from the University at Albany Benevolent Association and the Graduate Student Organization. Permits were issued by the Instituto Nacional de Antropología e Historia (INAH). We would like to thank the following institutions and persons for facilitating our research at Yautepec: the Centro Regional Morelos (INAH); the Patronato Pro-Restauración de la Zona Arqueológica de Yautepec, Morelos; the Cuernavaca office of the Instituto Nacional de Estadística, Geografía e Informática; and Hortensia de Vega Nova, Raúl Galindo, Rosa María Galindo, Noberto Gonzáles Crespo, Javier Leguízamo, Maricruz Pailles, Juan Antonio Siller, and the people of Yautepec. Smith would like to thank Elizabeth Brumfiel, Thomas Charlton, and Kenneth Hirth for helpful discussions of survey methods, and Thomas Charlton, Elizabeth Brumfiel, Deborah Nichols, and two anonymous reviewers provided helpful comments on a draft of this article. Marnie DiStefano helped with the data entry and word processing, and the figures were produced by Ronald Kohler, Lisa Cascio, and Michael Smith.

REFERENCES

Acuña, René (editor)
1985 *Relaciones geográficas del siglo XVI: México*, vol. 1. Universidad Nacional Autónoma de México, Mexico.

Berdan, Frances F., and Patricia R. Anawalt (editors)
1992 *Codex Mendoza*. 4 vols. University of California Press, Berkeley.

Bintliff, John, and Anthony Snodgrass
1988 Off-Site Pottery Distributions: A Regional and Interregional Perspective. *Current Anthropology* 29:506–513.

Blanton, Richard E.
1972 *Prehistoric Settlement Patterns of the Ixtapalapa Region, Mexico*. Occasional Papers in Anthropology No. 6. Department of Anthropology, Pennsylvania State University, University Park.

Brumfiel, Elizabeth M.
1980 Specialization, Market Exchange, and the Aztec State: A View from Huexotla. *Current Anthropology* 21:459–478.
1986 The Division of Labor at Xico: The Chipped Stone Industry. In *Economic Aspects of Prehispanic Highland Mexico*, edited by Barry L. Isaac, pp. 245–280. Research in Economic Anthropology, supplement No. 2. JAI Press, Greenwich, CT.
1987 Elite and Utilitarian Crafts in the Aztec State. In *Specialization, Exchange, and Complex Societies*, edited by Elizabeth M. Brumfiel and Timothy K. Earle, pp. 102–118. Cambridge University Press, New York.
1992 Postclassic Xaltocan: Archaeological Research in the Northern Valley of Mexico, 1991 Annual Report. Manuscript on file, Department of Anthropology and Sociology, Albion College, Albion, MI.

CCCP (Comisión de Conurbación del Centro del Pais)
1982 *Yautepec. Fotomapa, 1:10,000*. CCCP, Mexico.

Calnek, Edward E.
1976 The Internal Structure of Tenochtitlan. In *The Valley of Mexico: Studies of Pre-Hispanic Ecology and Society*, edited by Eric R. Wolf, pp. 287–302. University of New Mexico Press, Albuquerque.

Charlton, Thomas H., and Deborah L. Nichols
1990 Introduction. In *Early State Formation Processes: The Aztec City-State of Otumba, Mexico*, vol. 1, pp. 1–7. Research Paper No. 3. Department of Anthropology, University of Iowa, Iowa City.

Charlton, Thomas H., Deborah L. Nichols, and Cynthia Otis Charlton
1991 Aztec Craft Production and Specialization: Archaeological Evidence from the City-State of Otumba, Mexico. *World Archaeology* 23:98–114.

de Vega, Hortensia
1989 *Informe parcial del Proyecto Yautepec, Morelos: Primera temporada, mayo–julio, 1989*. Report submitted to the Instituto Nacional de Antropología e Historia, Mexico.

de Vega, Hortensia, and Pablo Mayer Guala
1991 *Informe parcial del Proyecto Yautepec, Morelos: Segunda temporada de campo (octubre 1990–enero 1991)*. Report submitted to the Instituto Nacional de Antropología e Historia, Mexico.

Doolittle, William E.
1990 *Canal Irrigation in Prehistoric Mexico: The Sequence of Technological Change*. University of Texas Press, Austin.

Durán, Fray Diego
1967 *Historia de las indias de Nueva España e islas de la tierra firme*. 2 vols. Edited by Angel M. Garibay K. Porrúa, Mexico.

Evans, Susan T.
1988 *Excavations at Cihuatecpan, an Aztec Village in the Teotihuacan Valley*. Publications in Anthropology No. 36. Department of Anthropology, Vanderbilt University, Nashville, TN.
1991 Architecture and Authority in an Aztec Village: Form and Function of the Tecpan. In *Land and Politics in the Valley of Mexico*, edited by Herbert H. Harvey, pp. 63–92. University of New Mexico Press, Albuquerque.

Gerhard, Peter
1970 A Method of Reconstructing Pre-Columbian Political Boundaries in Central Mexico. *Journal de la Société des Américanistes de Paris* 59:27–41.
1972 *A Guide to the Political Geography of New Spain*. Cambridge University Press, Cambridge.

Gibson, Charles
1964 *The Aztecs Under Spanish Rule: A History of the Indians of the Valley of Mexico, 1519–1810*. Stanford University Press, Stanford, CA.

Grove, David C.
1968 *The Morelos Preclassic and the Highland Olmec Problem: An Archaeological Study*. Unpublished Ph.D. dissertation, Department of Anthropology, University of California, Los Angeles.

Hassan, Fekri A.
1981 *Demographic Archaeology*. Academic Press, New York.

Hicks, Frederic
1982 Tetzcoco in the Early 16th Century: The State, the City and the Calpolli. *American Ethnologist* 9:230–249.
1984 Rotational Labor and Urban Development in Prehispanic Tetzcoco. In *Explorations in Ethnohistory: Indians of Central Mexico in the Sixteenth Century*, edited by Herbert R. Harvey and Hanns J. Prem, pp. 147–174. University of New Mexico Press, Albuquerque.

Hodge, Mary G.
1994 Documentary and Archaeological Perspectives on Local-level Political and Economic Units in the Aztec Empire. In *Economies and Polities in the Aztec Realm*, edited by Mary G. Hodge and Michael E. Smith. IMS Studies on Culture and Society Series No. 5. Institute for Mesoamerican Studies, State University of New York, Albany, in press.

INEGI (Instituto Nacional de Estadística, Geografía e Informática)
1991 *XI censo general de población y vivienda, 1990. Morelos: Resultados definitivos, datos por localidad*. INEGI, Mexico.

Ixtlilxochitl, Fernando de Alva
1975 *Obras históricas*. 2 vols. Translated by Edmundo O'Gorman. Universidad Nacional Autónoma de México, Mexico.

Kubler, George
1948 *Mexican Architecture of the Sixteenth Century*. 2 vols. Yale University Press, New Haven, CT.
Lombardo de Ruiz, Sonia
1973 *Desarrollo urbana de Mexico-Tenochtitlan según las fuentes históricas*. Instituto Nacional de Antropología e Historia, Mexico.
McAndrew, John
1965 *The Open-Air Churches of Sixteenth-Century Mexico*. Harvard University Press, Cambridge, MA.
Maldonado Jiménez, Druzo
1990 *Cuauhnahuac y Huaxtepec: Tlalhuicas y xochimilcas en el Morelos prehispánico*. Centro Regional de Investigaciones Multidisciplinarias, Universidad Nacional Autónoma de México, Cuernavaca.
Marcus, Joyce
1983 On the Nature of the Mesoamerican City. In *Prehistoric Settlement Patterns: Essays in Honor of Gordon R. Willey*, edited by Evon Z. Vogt and Richard M. Leventhal, pp. 195–242. University of New Mexico Press, Albuquerque.
Martin, Cheryl E.
1985 *Rural Society in Colonial Morelos*. University of New Mexico Press, Albuquerque.
Mason, Roger D.
1980 *Economic and Social Organization of an Aztec Provincial Center: Archaeological Research at Coatlan Viejo, Morelos, Mexico*. Unpublished Ph.D. dissertation, Department of Anthropology, University of Texas, Austin.
Nichols, Deborah L.
1994 The Organization of Provincial Craft Production and the Aztec City-State of Otumba. In *Economies and Polities in the Aztec Realm*, edited by Mary G. Hodge and Michael E. Smith. IMS Studies on Culture and Society Series No. 5. Institute for Mesoamerican Studies, State University of New York, Albany, in press.
Parsons, Jeffrey R.
1971 *Prehistoric Settlement Patterns in the Texcoco Region, Mexico*. Memoirs No. 3. Museum of Anthropology, University of Michigan, Ann Arbor.
Parsons, Jeffrey R., Mary H. Parsons, David J. Wilson, and Elizabeth M. Brumfiel
1982 *Prehispanic Settlement Patterns in the Southern Valley of Mexico: The Chalco-Xochimilco Region*. Memoirs No. 14. Museum of Anthropology, University of Michigan, Ann Arbor.
Riley, G. Micheal
1973 *Fernando Cortés and the Marquesado in Morelos, 1522–1547*. University of New Mexico Press, Albuquerque.
Rojas, José Luis de
1986 *México Tenochtitlan: Economía y sociedad en el siglo XVI*. Fondo de Cultura Económica, Mexico.
Sanders, William T.
1970 The Population of the Teotihuacan Valley, the Basin of Mexico, and the Central Mexican Symbiotic Region in the 16th Century. In *The Teotihuacan Valley Project, Final Report*, vol. 1, edited by William T. Sanders, Anton Kovar, Thomas Charlton, and Richard A. Diehl, pp. 385–452. Occasional Papers in Anthropology No. 3. Department of Anthropology, Pennsylvania State University, University Park.
Sanders, William T., Jeffrey R. Parsons, and Robert S. Santley
1979 *The Basin of Mexico: Ecological Processes in the Evolution of a Civilization*. Academic Press, New York.
Sanders, William T., and David Webster
1988 The Mesoamerican Urban Tradition. *American Anthropologist* 90:521–546.
Schroeder, Susan
1991 *Chimalpahin and the Kingdoms of Chalco*. University of Arizona Press, Tucson.
Smith, Michael E.
1989 Cities, Towns, and Urbanism: Comment on Sanders and Webster. *American Anthropologist* 91:454–461.
1992 *Excavations and Architecture*. Archaeological Research at Aztec-Period Rural Sites in Morelos, Mexico, vol. 1. Monographs in Latin American Archaeology No. 4. University of Pittsburgh, Pittsburgh.
1994 Economies and Polities in Aztec-Period Morelos: Ethnohistoric Introduction. In *Economies and Polities in the Aztec Realm*, edited by Mary G. Hodge and Michael E. Smith. IMS Studies on Culture and Society Series No. 5. Institute for Mesoamerican Studies, State University of New York, Albany, in press.
Smith, Michael E., and John F. Doershuk
1991 Late Postclassic Chronology in Western Morelos, Mexico. *Latin American Antiquity* 2:291–310.
Stanislawski, Dan
1947 Early Spanish Town Planning in the New World. *Geographical Review* 37:97–105.
Whitmore, Thomas M.
1991 A Simulation of the Sixteenth-Century Population Collapse in the Basin of Mexico. *Annals of the Association of American Geographers* 81:464–487.
1992 *Disease and Death in Early Colonial Mexico: Simulating Amerindian Depopulation*. Westview Press, Boulder, CO.