
17 **MAYA CITIES, PEOPLE AND PLACE: COMPARATIVE PERSPECTIVES FROM EL PERU AND TIKAL**

Damien Marken and Timothy Murtha

Urbanism continues to be a contentious topic when discussing the lowland Maya. This is mostly due to the neo-evolutionary and overly demographic models that have been applied as archaeological tests. Examining two Petén sub-regions and the cities that evolved in them, Tikal and El Peru, we describe how city form and structure reflects core information about the regional landscape and natural systems. For Tikal, emerging regional data offer a complex and nuanced perspective of settlement counter to earlier models that described the city of Tikal as a tightly bounded, both politically and ecologically. Overlapping networks of settlement densities and hierarchies, along with evidence for past agricultural production are best described as a coupled natural and human mosaic. Emergent research at El Peru, evidences a similarly complex expression of a city on the landscape. The escarpment, pocket bajos and variable availability of water clearly influence regional settlement patterns and city form. Combined, the information from Tikal and El Peru offer a new perspective on Maya cities, not grounded on demographic reconstructions. Maya cities and settlements are complex expressions of history, human agency, climate, environment and perhaps most importantly, region.

Introduction

Archaeologists in the Maya lowlands have spent the last five decades investigating the shape, form and structural density of Classic Maya sites, testing neo-evolutionary models and conceptualizations of urban. Because of this, Maya cities, clearly structured as low-density urban places, are often considered anthropological and cross-cultural anomalies, i.e., functionally urban places thriving in an otherwise challenging environment. This paper offers a different perspective on the design and planning of Maya cities, by emphasizing the role of household, region, and ecology to understanding Classic Maya urbanism, or simply, a coupled natural and human study of Maya cities. To do so, we examine two Petén sub-regions and the cities that evolved in them (Figure 1), thereby introducing how urban theory could be better integrated within archaeological research.

First, we examine the structure and distribution of settlement at Tikal as it compares to evidence for past agrarian activities through stable carbon isotope analysis of soils and hydrological surveys. Second, we describe results from recent settlement survey and hinterland excavations at El Peru-*Waka'* that suggest hinterland households were relatively well-provisioned materially and engaged in a variety of economic activities. This comparative examination indicates that the development and evolution of Maya cities were place-based regional processes, best understood, at least at

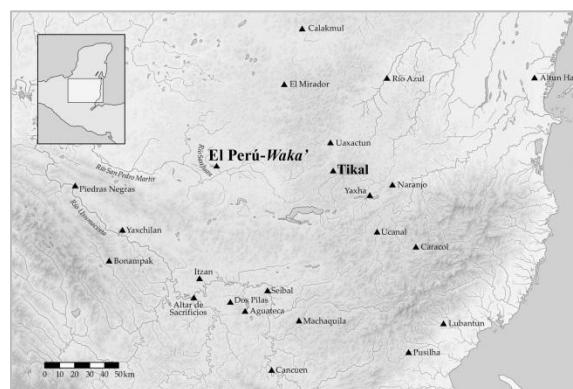


Figure 1. Map of the Southern Maya Lowlands highlighting sites discussed in the text.

first, from the bottom up. Methodologically, we emphasize that such efforts are bolstered by intensive settlement pattern studies, integrated with household and landscape archaeology.

Tikal, Guatemala

Tikal is located in the Central Petén, north of the modern cities of Flores and Santa Elena, Guatemala. The city center is composed of thousands of structures, including palaces, ball courts, reservoirs and temples. Thanks to Haviland (1963) and Puleston (1983) and later research by Ford (1986), a regional perspective for Tikal has always been present. It has however been overshadowed by a *tightly bounded urban, engineered and centrally administered* model percolating from the sheer monumentality of epicentral Tikal, along with some observations about settlement patterns

limited in spatial scope. Simply put, many archaeologists perceived Tikal to be a tightly bounded polity, as defined by Haviland (1981:89, see also Culbert et al. 1990) thirty-five years ago:

[Tikal] was bounded on the east and west by *bajo* and on the north and south by artificially constructed earthworks running between the *bajos*. There is a direct and significant correlation between these two boundaries and settlement density.

This tightly bounded urban model led to increasingly formal urban expectations, likely driven by competitive comparisons to urban counterparts in the highlands (i.e., Teotihuacan). What we came to expect from Tikal was an urban core with decreasing densities of populations along with limited agrarian landscapes within the core. Beyond the urban boundaries, expectations for shifting cultivation, broad open agrarian landscapes, and low densities predominated.

Beginning in 2003, a Penn State project focused on re-studying Tikal's region from both a cultural and ecological perspective, relying on traditional settlement pattern survey, soil sampling and analysis, coupled to forest monitoring and hydrological modeling. Some of our observations about Tikal's region follows:

Settlement and Households at Tikal

Settlement beyond the center is not evenly dispersed in a continuum from the center, but fragmented and clustered around upland soils and *bajo* margins (Murtha 2015). Household remains are distributed in fragmented clusters throughout the Tikal region. There are small spaces immediately surrounding each household, but the spatial patterning leaves large tracts of uninhabited and prime agricultural areas interspersed between settlement clusters (Murtha 2015). Larger regional sites are often spatially adjacent to high densities of households, indicating important intra-regional variation in settlement densities, scale and intensity. The earthwork as described by Haviland attempts to define the boundaries of Tikal, but exhibits significant variability in form and completeness from place to place (Puleston and Callendar

1967; Webster et al. 2004, 2007, 2008). Construction was unfinished, and while perhaps centrally planned, the feature was implemented locally. Additionally, in contrast to early observations correlating the earthwork to settlement density, there is no consistent drop off in settlement density outside of the earthwork (Webster et al. 2004, 2007, 2008). Based on settlement and the earthworks, Tikal's landscape can only be described as a regionally negotiated space where clear boundaries between the beginning and ending of the polity were not static and where the line between residential areas and agrarian areas was not clearly defined. Moreover, the scale and intensity of integration clearly varied temporally in addition to the observed spatial variability.

Agriculture and Land Use at Tikal

The agrarian landscape was described early and often by formal models of in-fields and out-fields, but also exhibits regional variation and is best described as an agrarian mosaic. Despite substantial evidence of erosion, there is no evidence of terracing at Tikal. In fact, it was through erosion that the earliest residents of the Tikal region had the most significant impact on their landscape. This transformation shifted a rather well distributed natural resource (productive upland soil) to large contiguous tracts of productive land at *bajo* margins, footslopes and toeslopes (Balzotti et al. 2013). At Tikal the Classic Period was spent managing this anthropogenic regional landscape.

Recent carbon isotope studies led by Richard Terry further demonstrate a complex arrangement of agricultural land surrounding Tikal. Similar to ethnographically observed lowland agricultural systems, the regional agrarian landscape was not monolithic, but carefully cultivated responding to local topography, annual changes in precipitation and demographic needs. As an example, for many years, Tikal's *bajos* were perceived as either unproductive or potentially the proverbial breadbasket that Tikal's urban center relied upon. Not surprisingly, the system was more complex. Not only do we have evidence for some past maize production in Tikal's *bajos*, but also we tested dozens of other pocket *bajos*, which show similar evidence of past production,

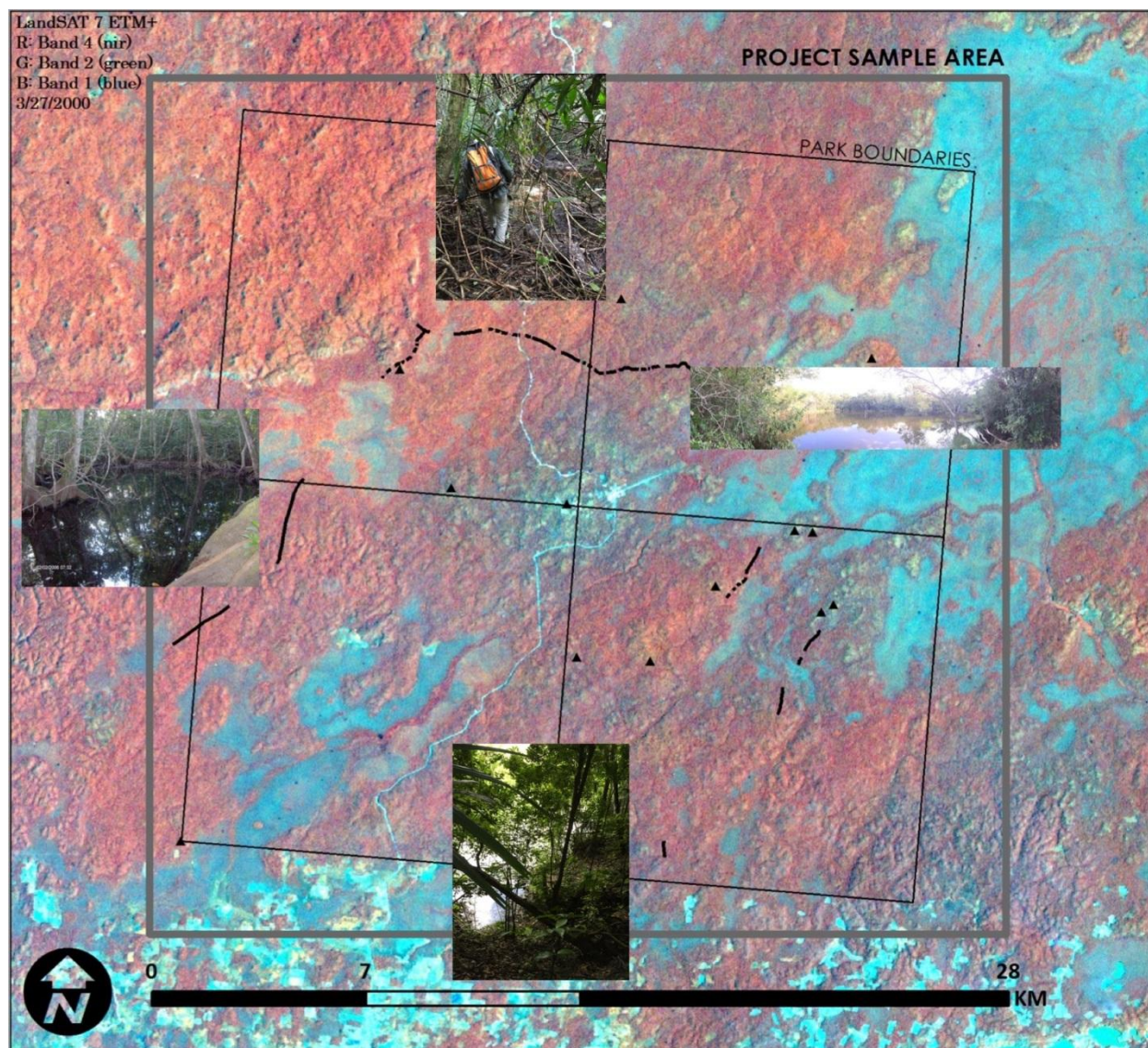


Figure 2. Map of Tikal National Park illustrating the locations of regional sites (black triangles), the earthwork (black line), and the locations and photographs of significant natural water sources.

especially on their margins and in all probability responding to receding water based on annual precipitation (Parker 2015).

Water and Hydrology at Tikal

Recent studies of Tikal's reservoirs and water are fascinating, but regionally incomplete. They demonstrate how Tikal's reservoirs were designed to capture and store runoff near the site center and perhaps even influence water flow from the center to the Santa Fe *Bajo*. But even these exceptional studies of Tikal's reservoirs are limited by central Tikal observations and a

tightly bounded model. When viewed at the site scale (essentially the central 16km² or 1% of the Tikal region), it is easy to see how urban models 'fit' Tikal. But when viewed at the scale of the region (784 km² or 99% of the Tikal region) a more complex pattern emerges. Moreover, questions of power and authority that are reasonably simple and clean to perceive in the central 16 km² are messy and fuzzy in the context of the region. Regional water surveys from 2015 coupled to hydrologic modeling suggest a diverse availability of water throughout Tikal's landscape (Figure 2).

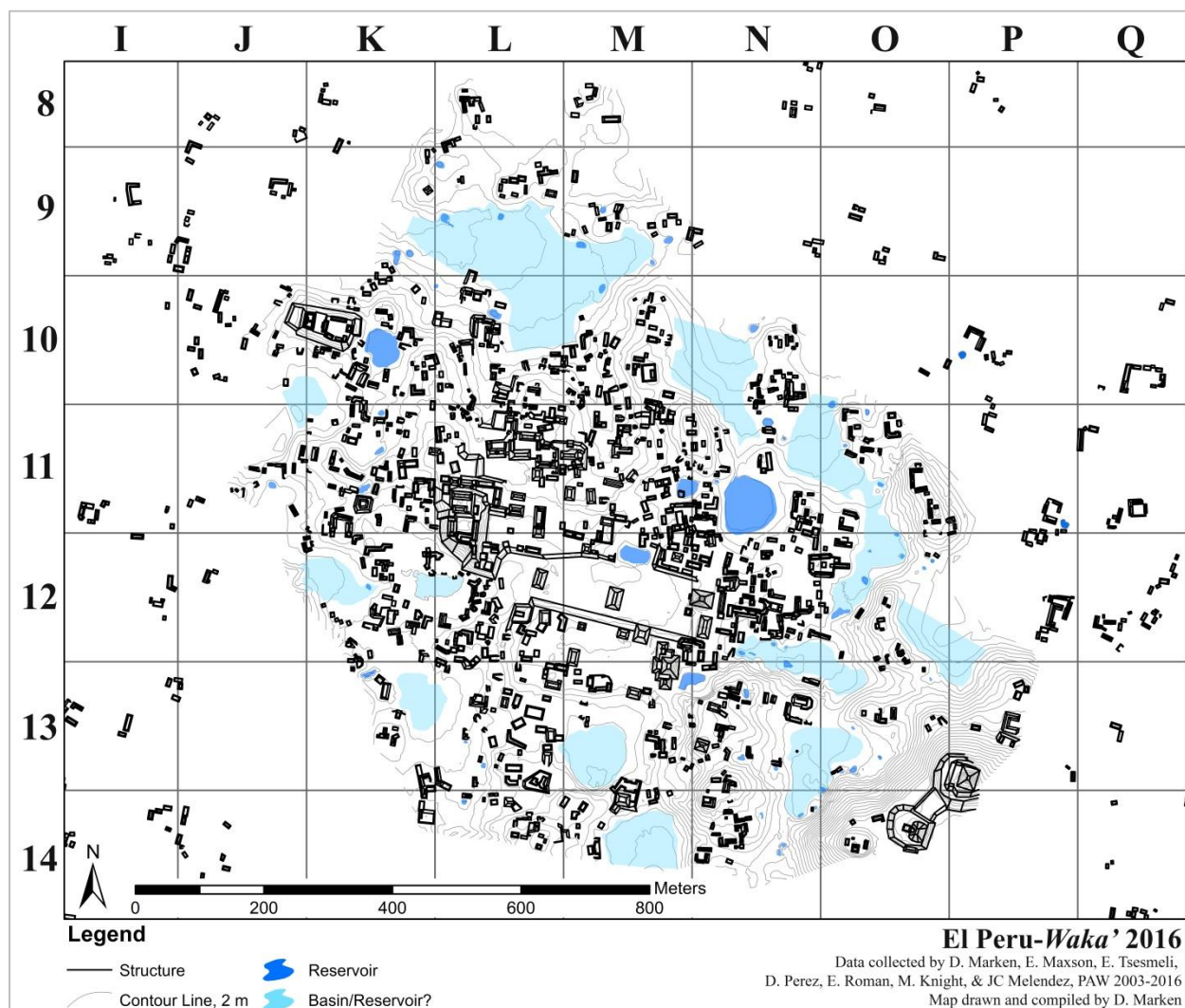


Figure 3. Map of the El Perú-Waka' urban core.

Summary of Tikal

Whether it is the earthworks, densities of households or natural features like the *bajos* the regional Tikal data now reveals a highly dynamic and complex system (or network) of households, past land use and ecological patterns influencing the form and structure of Tikal as a city.

El Perú-Waka'

Since 2003, archaeologists of the *Waka'* Archaeological Project (PAW, formerly the El Perú-Waka' Regional Archaeological Project), have been investigating the ruins of the Classic Maya city of *Waka'*, also referred to as El Perú, the name given to it by oil prospectors in the

1960s. Project research has focused on connecting architectural and dynastic history, predominantly through monumental excavations, reconstructing the local and inter-regional political economy through epicentral household excavations and materials analysis, and the structure and organization of the urban landscape, primarily through settlement surveys and test excavations.

The site core itself is located in the southwestern corner of the Classic Maya heartland, with its urban core perched at the edge of the escarpment that forms the southern and western limits of the Petén Karst Plateau (Marken 2011). Its defensible location on top of a 80m high escarpment, and advantageous

position near the juncture of the San Pedro River and its tributary San Juan River likely fostered the city's role in both east-west and north-south overland trade (Eppich et al. 2012). This combination of geographic factors may have also contributed to the historical importance of the city as one of the first places visited by Siyah K'ak' in the Early Classic and whose dynastic loyalty was highly contested during the Late Classic regional conflicts between the dynasties of Tikal and Calakmul (Freidel & Escobedo 2014; Freidel et al. 2007).

Features reflecting patterns of land-use within the core are varied, and include the four public plazas, many massive monumental complexes, a few medium-sized reservoirs, and several "natural" canals that diverted water to the urban peripheries (and to several interconnected basins that potentially served as reservoirs and/or urban gardens along the way) (Figure 3). The most striking aspect of the *Waka'* urban settlement, however, is the packed nature of its "residential" surface remains; few Classic Maya sites (Copan, Palenque) exhibit such a high structure density (Marken, Maxson, & Pérez 2016). Surrounding this highly nucleated urban core is not a swath of "dispersed" rural settlement as seen at many Maya monumental centers; it is instead ringed by a still rather dense, multi-purpose, 'periurban' zone (Marken 2015). As identified by archaeological survey and mapping, a variety of landscape features spill out from the urban core and clearly integrate the city's hinterlands into the urban fabric of El Perú-*Waka'*. Beyond the core, the PAW survey team has conducted over 12km² of full-coverage pedestrian survey and settlement mapping since 2007 (Figure 4; Marken 2008, 2009, 2010, 2013a, 2013b). Limited mapping and reconnaissance outside this 12km² indicates that ancient Maya settlement was continuous both to the north and south, extending at least to the minor centers of *Yala*, 18km to the east, and *El Burrul*, 10km to the north (Marken & Castaneda 2014).

Settlement chronologies derived from the analysis of ceramics recovered from 220 test excavations indicate that hinterland settlement began in the Late Preclassic, coeval with the earliest construction evidence from the ceremonial center. Hinterland settlement was

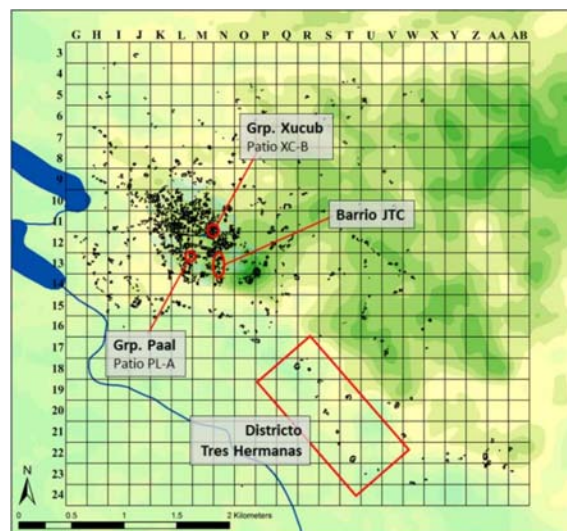


Figure 4. Map of the El Perú-*Waka'* hinterlands.

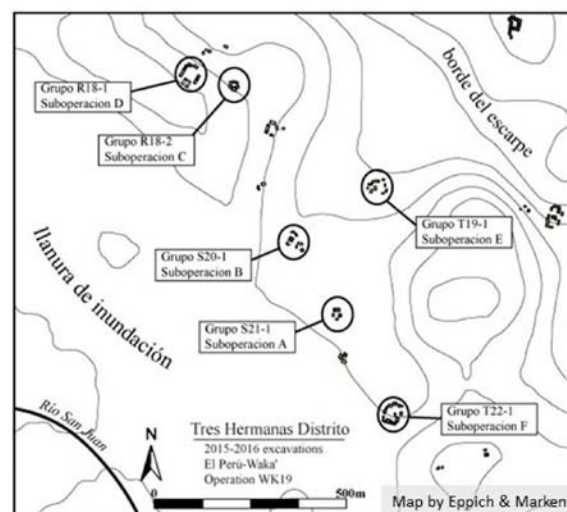


Figure 5. Map of the Tres Hermanas District, El Perú-*Waka'*.

continually shifting, however, with patios being founded, occupied, abandoned, and reoccupied throughout the Classic period. Beginning in the Terminal Classic, widespread abandonment of hinterland groups effectively caused occupation to nucleate within the urban core, within the context of an overall population decline (Marken 2015).

Settlement and Households at El Perú-*Waka'*

To date, three localities within the *Waka'* urban core have been subject to horizontal investigation (Arroyave 2006; Eppich 2007, 2009, 2011), as have six in the Tres Hermanas District of its hinterlands (Figure 5). Artifacts

from horizontal and test excavations in the Tres Hermanas indicate that the inhabitants of these groups engaged in a variety of economic activities during the Late Classic, including craft manufacturing on at least a limited scale.

The Tres Hermanas District, also sometimes referred to as the Southeast Tintal Margin District (Marken 2011, 2015), lies approximately 2km southeast of the central urban plazas and consists of 65 structures organized in 11 patio groups occupying a 1.2km stretch of uplands between the escarpment and the edge of the large tintal *bajo* that straddles the San Juan River. The district is marked by a set of three roughly equidistant temple patios aligned to Maya north (Grps. R18-1, S20-1, and T22-1, see Marken 2014 for discussion of the implications of this orientation). The temple patio groups are situated half a kilometer apart, each occupying topographic grades extending into the tintal *bajo* margin from the escarpment. District settlement structure and group layouts, as well as test and horizontal excavation chronologies, suggest that rural pyramid construction and use were linked to Late Classic resettlement of the area and possible efforts to incorporate its inhabitants' participation into urban-based political and ritual networks (Eppich et al. 2016; Marken 2015).

The Tres Hermanas settlements are of additional interest as the locations of, at least limited, craft activities as evidenced by the artifacts recovered from excavations. Other hinterland groups exhibit similarly strong evidence of lithic tool refurbishing (and possible production), but artifacts recovered from certain Tres Hermanas groups also indicate the occurrence of craft activities not often evidenced at El Perú-*Waka'*. Besides various chert bifaces and a high quantity of chert debitage, obsidian blades and blade fragments, and a "bark beater" (to make bark paper), a set of four bead polishing stones and a handful of quartzite fragments were recovered from Grp. T22-1. Test excavations at Grp. T19-1 also documented substantial quantities of chert debitage and obsidian blade fragments, as well as high concentration of worked shell and debitage, and two spindle whorls, one of which broke during manufacture. The more recent, more intensive investigations of T19-1 recovered a bead

polishing stone similar to the set from T22-1, as well as a bark beater and numerous additional chert bifaces and tools and substantial quantities of shell debitage. Damaris Menéndez also discovered a limestone quarry in the vicinity of T19-1, consisting of 5 individual borrow pits.

Additional craft activities suggested by the hinterland test data include paper making, as well as widespread subsistence-oriented unifacial (chert) tool production and grinding stone surface rejuvenation. In contrast to the specialized production artifacts from T22-1 and T19-1 which hint at some form of participation in a wider "penny economy," several hinterland lithic assemblages, such as that from the horizontal excavations at S21-1, suggest that many hinterland residents instead primarily produced stone tools for their own consumption (Eppich & Austin 2016). Overall, the material evidence from the *Waka'* hinterland settlement indicates that peripheral households engaged in a variety of economic activities besides farming that were likely enacted through multiple socioeconomic networks.

Water Management at El Perú-*Waka'*

GIS analyses of the hydrology of El Perú-*Waka'* have been carried out at the city, local and regional scales. During the 2016 field season, a program of reservoir investigation was initiated by Marken and Matthew Ricker of Bloomsburg University. These investigations included the description of 87 soil core augers and two 2m+ deep excavation units within a single hydrological system and an additional reservoir within the city core. Although soil samples have yet to be analyzed and the sub-surface data remains to be plotted out, the GIS analyses and geomorphological investigations, combined with observations collected during survey and mapping, enable preliminary classification of water catchment features (ie. reservoirs) across the urban landscape, which may have similar implications as the three-tiered hierarchy in the management of irrigation systems in Arequipa, Peru as described by Ersten (2010).

Living atop the escarpment, the ancient Maya inhabitants of the *Waka'* urban core had limited access to water resources and therefore focused much of their efforts to direct and store

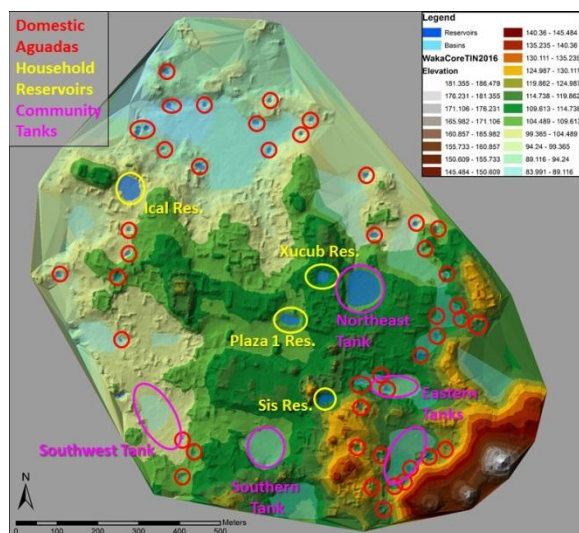


Figure 6. Water storage features at El Perú-Waka'.

rainwater for consumption. While certain management features, such as channels and potential canals, served to also direct water to potential agricultural areas, all the investigated water storage features at *Waka'* would have likely been managed as artificial ponds, where a variety of plant and animal life, such as water-lilies, fish, and turtles would have been cultivated to sustain the drinkable quality of collected surface water. At present, the observed water storage features at *Waka'* include (Figure 6):

1) Household *aguadas*, which are small, pool-sized depressions that remain to be investigated beyond mapping, but are ubiquitous with residential groups within the urban core and across the surveyed hinterlands. These have small capacities and many appear to have originated as borrow pits for household construction. Some of these small depressions may have functioned as silting pools, as hypothesized by Scarborough and colleagues (Scarborough, Dunning et al. 2012; Scarborough & Grazioso 2015) at Tikal, as many often ring the edges of larger basins and/or pocket *bajos*.

2) Larger household reservoirs, such as the Xucub, Ical, and M13-1 Reservoirs are often spatially associated with elite groups or neighborhoods, although some functioned as parts of larger hydrological systems. Individually, these reservoirs exhibit medium-sized capacities, based on surface data, but soil coring of the Xucub Reservoir demonstrates that

pond management included periodic dredging and the maintenance of a fill-and-sherd layer above the bottom which likely served to anchor plant roots, such as water-lilies. The Xucub Reservoir also contained a corner platform to facilitate access to water as levels fluctuated seasonally.

3) Community or district tanks, which have higher capacities and form critical nodes within larger pond and drainage systems. While several potential district tanks have been identified by mapping and hydrological analyses, only the Northeast Tank has been investigated more intensively.

The Northeast Tank is part of an interconnected system of water storage features referred to as the Northeast Basin Hydrological System (Figure 7). This west to east to north flowing system consists of the Xucub Reservoir, a small sluice way, and the Northeast Tank, as well as an outlet from which excess water could be released to the north. Within the north outlet a large limestone boulder in its center and two smaller boulders on its east and west sides may have functioned as the frame for wooden slats to directly control water flow. While we are still reconstructing its formation and construction history, we can say that the Northeast Tank itself was highly engineered to store a certain kind of water. Today, ground water seasonally rises within the Tank, although it barely reaches the surface. This ground water, however, is not potable as it contains high concentrations of gypsum salts. In order to prevent the local ground water from contaminating their clean surface water, city inhabitants laid limestone slabs across the tank floor and maintained a fill-and-sherd layer atop that slab base. A “retaining wall” was also constructed along the eastern edge of the tank, where gypsum concentrations increase (gypsum is absent from the Xucub Reservoir and sluice way soils to the west). Finally, a series of low “terraces” were constructed around the footslopes of the tank to ease access during times of lower water levels. The positioning of these terraces suggests that the inhabitants of all the groups surrounding the pond were allowed access to its water.

Lastly, the Plaza 1 Reservoir appears to have primarily served to collect runoff from Plazas 1 and 2, as indicated by the flow

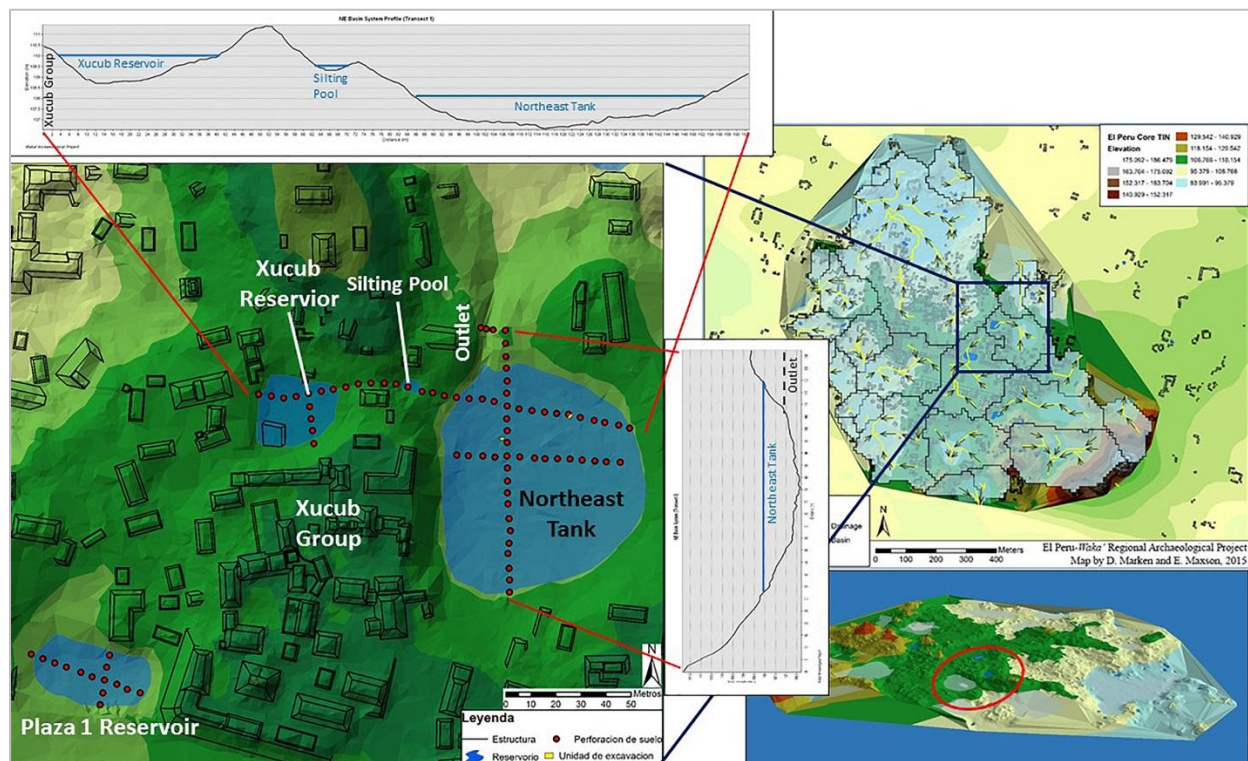


Figure 7. The Northeast Hydraulic System.

accumulation analysis of the site core. Soil core augers within the reservoir only recovered washed-in fill and artifacts to a depth of over 2 m, suggesting that the reservoir continues to serve a similar purpose today.

The preliminary findings from the recent hydrological and soil auger coring investigations at *Waka'* indicate that even when part of a larger water management system, each tank within the core was different, engineered and managed to meet local specific requirements and challenges. This highlights the fact that while some infrastructural landscape features within Classic Maya cities may have, at times, been regulated by “centralized” authorities, many others were built and managed, in practice, by households and local communities who maintained and managed their own resources.

Discussion and Summary

Recent evaluations of Classic Maya urbanism features and variability have tended to emphasize those characteristics that appear to denote “centralization,” whether of political, economic, or social power. However, as Foias

& Emery (2012:10) note, the use of the term “centralization” is often varied. From a strict neo-evolutionary perspective such as that of Flannery (e.g. 1998) and Marcus (e.g. Marcus & Feinman 1998), “centralization” refers to the consolidation of decision-making in the hands of fewer individuals, which they directly connect to regional settlement hierarchies (see also Spencer & Redmond 2004). For others, “centralization” carries connotations of sociopolitical integration. This meaning is evident in Fletcher’s (2009, 2012) conception of low-density, agrarian urbanism and can be simplistically be illustrated by the perceived differences between a “strong” vs. a “weak” state (e.g. Chase & Chase 1996; Fox et al. 1996). While a centralized decision-making administration can correlate with a highly integrated socioeconomic system, these two variables are not necessarily linked. For example modern dictatorships are highly autocratic in terms of decision-making, but that extremely centralized government apparatus often heads poorly integrated administrative and/or socioeconomic systems (Foias & Emery 2012).

When uncoupled from previous epicenter-focused models of functional urbanism and viewed from a regional perspective, the settlement and land-use data from Tikal reveal a much more varied, and likely intersecting and overlapping, set of networks of social interaction and resource management. The less mature data sets from El Perú-*Waka'*, which were explicitly collected to eventually form a regional perspective, support this viewpoint. Classic Maya cities were not simply the expressions of dynastic authority, although that was certainly one of their probable functions. Instead Classic Maya urban landscapes exhibit highly varied patterns of land-use and resource management tightly linked to settlement and that were organized and distributed at multiple social and spatial scales, all the way from the household to the region.

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References

- Arroyave Prera, Ana Lucía
2006 Paal, un Grupo Residencial en el Centro del Sitio El Perú, Petén: Una Aproximación a su Desarrollo durante el Periodo Clásico. Unpublished Licenciatura thesis, Universidad de San Carlos de Guatemala, Guatemala City.
- Balzotti, Chris S., David L. Webster, Timothy M. Murtha, Steven L. Petersen, Richard L. Burnett, and Richard E. Terry
2013 Modeling the Ancient Maize Agricultural Potential of Landforms in Tikal National Park, Guatemala. *International Journal of Remote Sensing* 34(16):5868-5891.
- Chase, Arlen F. and Diane Z. Chase
1996 More Than Kin and King: Centralized Political Organization among the Late Classic Maya. *Current Anthropology* 37:803-830.
- Culbert, T. Patrick, Laura J. Kosakowsky, Robert E. Fry, and William A. Haviland
1990 The Population of Tikal, Guatemala. In *Precolumbian Population History in the Maya Lowlands*, edited by T. Patrick Culbert & Don S. Rice, pp. 103-121. University of New Mexico Press, Albuquerque.
- Eppich, E. Keith
2007 Death and Veneration at El Perú-*Waka'*: Structure M14-15 as Ancestor Shrine. *PARI Journal* VIII(1):1-16.
2009 Feast and Sacrifice at El Perú-*Waka'*: The N14-2 Deposit as Dedication. *PARI Journal* X(2):1-19.
2011 Lineage and State at El Perú-*Waka'*: Ceramic and Architectural Perspectives on the Classic Maya Social Dynamic. Unpublished Ph.D. dissertation, Southern Methodist University, Dallas, TX.
- Eppich, E. Keith y Haley Austin
2016 WK-19: Excavaciones en los Grupos de Patio en el Distrito del Margen Sureste. In *Proyecto Arqueológico El Perú-*Waka'*: Informe No. 13, Temporada 2015*, edited by Juan Carlos Pérez, Griselda Pérez, & David A. Freidel, pp. 43-119. Fundación de Investigación Arqueológica *Waka'*, Guatemala City.
- Eppich, E. Keith, David A. Freidel, Stanley Guenter, David Lee, Damien B. Marken, Olivia Navarro-Farr, and Michelle Rich
2012 The Flag Follows Trade? Material Correlates from El Perú-*Waka'* Indicating Political and Economic Interaction in Classic-Era Western Petén. Paper presented at the 77th Annual SAA Meeting, Memphis, TN.
- Eppich, E. Keith, Elsa Damaris Menéndez, Damien B. Marken, Haley Austin, Savannah Dakos, Sarah Van Oss, Kristi Gift, Emily Haney, Zachary Cooper
2016 Cambio de las Comunidades Urbanas de las Ciudades Mayas del Siglo 8 y 9: Recientes Excavaciones El Perú-*Waka'*. Paper presented at the XXX Simposio de Investigaciones Arqueológicas en Guatemala. Guatemala City. July 18-22, 2016.

- Ersten, Maurits Willem
2010 Structuring Properties of Irrigation Systems: Understanding Relations between Humans and Hydraulics through Modeling. *Water History* 2:165-183.
- Flannery, Kent V.
1998 The Ground Plans of Archaic States. In *Archaic States*, edited by Gray M. Feinman & Joyce Marcus, pp. 15-58. School of American Research Press, Santa Fe, NM.
- Fletcher, Roland
2009 Low-Density, Agrarian-Based Urbanism: A Comparative View. *Insights* 2(4):2-19.

2012 Low-Density, Agrarian-Based Urbanism: Scale, Power, and Ecology. In *The Comparative Archaeology of Complex Societies*, edited by Michael E. Smith, pp. 285-320. Cambridge University Press, Cambridge.
- Foias, Antonia E. and Kitty F. Emery
2012 Politics and Economics: Theoretical Perspectives of the Motul de San José Project. In *Motul de San José: Politics, History, and Economy in a Classic Maya Polity*, edited by Antonia E. Foias & Kitty E. Emery, pp. 1-29. University Press of Florida, Gainesville.
- Ford, Anabel
1986 *Population Growth and Social Complexity: An Examination of Settlement and Environment in the Central Maya Lowlands*. Arizona State University Anthropological Research Papers No. 35, Tempe.
- Fox, John W., Garrett W. Cook, Arlen F. Chase, and Diane Z. Chase
1996 Questions of Political and Economic Integration: Segmentary versus Centralized States among the Ancient Maya. *Current Anthropology* 37(5):795-801.
- Freidel, David A. and Héctor L. Escobedo
2014 Stelae, Buildings, and People: Reflections on Ritual in the Archaeological Record at El Perú-Waka'. In *Archaeology at El Perú-Waka': Performances of Ritual, Memory and Power*, edited by Olivia Navarro-Farr & Michelle Rich, pp. 18-33. University of Arizona Press, Tucson.
- Freidel, David A., Héctor L. Escobedo and Stanley Guenter
2007 A Crossroads of Conquerors. In *Gordon R. Willey and American Archaeology: Contemporary Perspectives*, edited by Jeremy A. Sabloff & William L. Fash, pp. 187-208. University of Oklahoma Press, Norman.
- Haviland, William A.
1963 Excavation of Small Structures in the Northeast Quadrant of Tikal, Guatemala. Unpublished Ph.D. dissertation, University of Pennsylvania, Philadelphia.
- 1981 Dower Houses and Minor Centers at Tikal, Guatemala: An Investigation into the Identification of Valid Units in Settlement Hierarchies. In *Lowland Maya Settlement Patterns*, edited by Wendy Ashmore, pp. 89-120. School of American Research, University of New Mexico Press, Albuquerque.
- Marcus, Joyce and Gary M. Feinman
1998 Introduction. In *Archaic States*, edited by Gray M. Feinman & Joyce Marcus, pp. 3-14. School of American Research Press, Santa Fe, NM.
- Marken, Damien B.
2008 Reconocimiento Regional en El Perú-Waka', 2007: Investigando los Patrones de Asentamiento en el Sector Sur del Parque Nacional Laguna del Tigre. In *Proyecto Arqueológico El Perú-Waka': Informe No. 5, Temporada 2007*, edited by Héctor L. Escobedo, Juan Carlos Meléndez & David A. Freidel, pp. 5-72. Southern Methodist University, Guatemala City.
- 2009 Reconocimiento Regional 2008 en El Perú: Investigación Sobre los Patrones de Asentamiento al Sur del Parque Nacional Laguna del Tigre. In *Proyecto Arqueológico El Perú-Waka': Informe No. 6, Temporada 2008*, edited by David A. Freidel & Juan Carlos Meléndez, pp. 145-246. Southern Methodist University, Guatemala City.
- 2010 Reconocimiento Regional en El Perú-Waka', 2009: Investigando los Patrones de Asentamiento en el Sur del Parque Nacional Laguna del Tigre. In *Proyecto Arqueológico El Perú-Waka': Informe No. 7, Temporada 2009*, edited by Mary Jane Acuña & Jennifer Piehl, pp. 127-187. Waka' Foundation, Guatemala City.
- 2011 City and State: Urbanism, Rural Settlement, and Polity in the Classic Maya Lowlands. Unpublished dissertation, Southern Methodist University, Dallas, TX.
- 2013a Reconocimiento en el Área de Influencia de El Perú-Waka', 2012: Levantando el Mapa de la Periferia Oeste. In *Proyecto Arqueológico El Perú-Waka': Informe No. 10, Temporada 2012*, edited by Juan Carlos Pérez, Olivia Navarro-Farr, & David A. Freidel, pp. 133-151. Fundación de Investigación Arqueológica Waka', Guatemala City.
- 2013b Reconocimiento 2013: La Periferia Oriental y El Bural. In *Proyecto Arqueológico El Perú-Waka': Informe No. 11, Temporada 2013*, edited by Juan Carlos Pérez & David A. Freidel, pp. 96-115. Fundación de Investigación Arqueológica Waka', Guatemala City.

- 2014 Sansamal Performance: Variability in Ritual Contexts at El Perú-Waka'. In *Archaeology at El Perú-Waka': Performances of Ritual, Memory and Power*, edited by Olivia Navarro-Farr & Michelle Rich, pp. 134-146. University of Arizona Press, Tucson.
 - 2015 Conceptualizing the Spatial Dimensions of Classic Maya States: Polity and Urbanism at El Perú-Waka', Petén. In *Classic Maya Politics of the Southern Lowlands*, edited by Damien B. Marken and James Fitzsimmons, pp. 123-166. University of Colorado Press, Boulder.
- Marken, Damien B. and Francisco Castañeda
- 2014 Sitios Satelitales en la Región de El Perú-Waka'. *XXVII Simposio de Investigaciones Arqueológicas en Guatemala, 2013*, edited by Bárbara Arroyo, Luis Méndez Salinas, Andrea Rojas, pp. 733-742. IDEAH, Guatemala City.
- Marken, Damien B., Erika Maxson, and Duglas Pérez
- 2016 Mapeo Topográfico en El Perú-Waka', 2015: Documentando la Transición Centro-Periferia. In *Proyecto Arqueológico El Perú-Waka': Informe No. 13, Temporada 2015*, edited by Juan Carlos Pérez, Griselda Pérez, & David A. Freidel. Fundación de Investigación Arqueológica Waka', Guatemala City.
- Parker, Adam
- 2015 Evidence of Ancient Maya Agriculture in the Bajos Surrounding Tikal, Guatemala. Unpublished Masters thesis, Brigham Young University, Provo, UT.
- Puleston, Dennis E.
- 1983 *The Settlement Survey of Tikal*. Tikal Report 13. University Museum Monograph 48, University of Pennsylvania, Philadelphia.
- Puleston, Dennis E. and Donald W. Callender Jr.
- 1967 Defensive Earthworks at Tikal. *Expedition* 9(30): 40-48.
- Sanders, William T.
- 1962 Cultural Ecology of the Maya Lowlands, Part 1. *Estudios de la Cultura Maya* II:79-121.
 - 1981 Classic Maya Settlement Patterns and Ethnographic Analogy. In *Lowland Maya Settlement Patterns*, edited by Wendy Ashmore, pp. 351-369. University of New Mexico Press, Albuquerque.
- Scarborough, Vernon L., Arlen F. Chase, and Diane Z. Chase
- 2012 Low-Density Urbanism, Sustainability, and IHOPE-Maya: Can the Past Provide More than History? *UGEC Viewpoints* 8:20-24.
- Scarborough, Vernon L., Nicholas P. Dunning, Kenneth B. Tankersley, Christopher Carr, Eric Weaver, Liwy Grazioso, Brian Lane, John G. Jones, Palma Buttles, Fred Valdez, and David Lentz
- 2012 Water and Sustainable Land-Use at the Ancient Tropical City of Tikal, Guatemala. *Proceedings of the National Academy of Sciences* 109(31):12408-12413.
- Scarborough, Vernon L. and Liwy Grazioso Sierra
- 2015 The Evolution of an Ancient Waterworks System at Tikal. In *Tikal: Paleoecology of and Ancient Maya City*, edited by David L. Lentz, Nicholas P. Dunning, & Vernon L. Scarborough, pp. 16-45. Cambridge University Press, New York.
- Spencer, Charles S. and Elsa M. Redmond
- 2004 Primary State Formation in Mesoamerica. *Annual Reviews in Anthropology* 33:173-199.
- Webster, David, Timothy M. Murtha, Kirk D. Straight, Jay Silverstein, Horacio Martínez, Richard E. Terry, and Richard Burnett
- 2007 The Great Tikal Earthwork Revisited. *Journal of Field Archaeology* 32(1):41-64.
- Webster, David, Jay Silverstein, Timothy Murtha, Horacio Martínez, and Kirk Straight
- 2004 *The Tikal Earthworks Revisited*. Occasional Paper in Anthropology No. 28, Pennsylvania State University, University Park.
 - 2008 Political Ecology of the Tikal Earthworks: A Maya Altepetl Boundary? In *Urbanism in Mesoamerica, vol. 2*, edited by Alba Guadalupe Mastache, Robert H. Cobean, Angel Garcia Cook, and Kenneth G. Hirth, pp. 349-375. Instituto Nacional de Antropología e Historia, Mexico City.