



AGRICULTURAL INTENSIFICATION, WATER, AND POLITICAL POWER IN THE SOUTHERN MAYA LOWLANDS

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Ancient tropical societies, such as the Maya, are often relegated to the unknown or mysterious or, worse yet, are seen as a result of outside influences because of the traditional bias in anthropology of largely focusing on civilizations in temperate areas. Wittfogel, for example, in his classic *Oriental Despotism* (1957), argued that complex societies are underwritten by an agricultural base supported by irrigation. Because the Maya are not known to have built large-scale irrigation systems, he claimed that the Maya were a “marginal agrarian” (Wittfogel 1957:182) despotic society since the karstic topography of the Maya lowlands is “unsuitable for irrigation agriculture” (Wittfogel 1957:184). In another classic piece, Meggers (1954) presented a model of environmental determinism in which she categorized tropical zones as not suitable to support civilizations because of poor agricultural soils. Meggers based this assumption on her studies in the Amazon jungle, where many areas of tropical forests are poorly suited for intensive agriculture (though recent scholarship indicates otherwise; see Erickson 2003). Consequently, Maya civilization arose as the result of outside influences and “did not last” but witnessed “700 years of decline” (Meggers 1954:819) because conditions were not suitable to support a complex society. As recently as 1998, Meggers was still “struck by the seeming contradiction between the complexity of Maya culture and the relatively low agricultural potential of their environment” (Meggers 1998: xii). In fact, the southern Maya lowlands have a high percentage of mollisols, which are “considered by agronomists to be among the world’s most important, naturally productive soils, with yields unsurpassed by other unirrigated areas” (Fedick 1988:106). Only 1 percent of the world’s tropical soils are mollisols, yet they are the dominant soil type in the southern Maya lowlands, albeit in

a relatively dispersed manner. The distribution of good agricultural land, in turn, affected settlement decisions and political histories.

There is no doubt, however, that tropical settings present unique conditions when compared with temperate regions, especially when attempting to account for sociopolitical complexity. “Limitations” in tropical areas include some or all of the following: endemic diseases (e.g., hepatic schistosomiasis—check spelling), seasonal water quality problems, and the lack of beasts of burden and roads. Other parasites and bacteria also pose problems, as well as parasite-ridden flies and malaria-bearing mosquitoes that “flourish in environments disturbed by humans” (Miksic 1999:173). Standing, stagnant water provides ideal conditions for parasites, water-borne diseases (e.g., diarrhea and cholera), and pests to proliferate. Temperature variation throughout the year in the tropics is not extreme enough to kill off many pests. As a matter of fact, the more densely settled a tropical area is by humans, the more insects and other diseases spread and multiply. The increased reliance on intensive agriculture exacerbates this situation because land clearing creates conditions (open areas) for stagnant water to collect. Water quality issues are somewhat ironic in the humid tropics because people can lose 8 to 10 liters per day sweating and as a consequence need to drink more water than people living in temperate zones (Bacus and Lucero 1999). Because of these and other factors, Miksic goes so far as to suggest that “the unique problems connected with maintaining healthy drinking water supplies in a tropical environment help to explain why early urbanization in Indonesia, and in the tropical areas of the world in general, is relatively rare” (Miksic 1999:171).

Despite these challenging conditions, or because of them, two factors stand out when attempting to illuminate the development of sociopolitical complexity in tropical settings: (1) seasonal water issues are critical in tropical areas like the southern Maya lowlands; and (2) as with almost anywhere else that complex societies emerge, plentiful agricultural land is necessary to feed people and fund the political economy. How did these factors articulate in Classic Maya political histories (c. AD 250–950)? I attempt to address these issues in the remainder of this chapter. A major assumption with which I begin is that although there are numerous material and social conditions worldwide, there exist only a limited number of political responses or choices (Friedman and Rowlands 1978:241). In tandem with increasing political complexity is the need for surplus to fund an expanding political economy and feed people. As the papers in this volume indicate, in many cases, if not most, agricultural intensification provides the means for surplus production, which in turn provides the material basis for wealth differentiation. Political power—the ability to exact tribute—is another matter entirely. Agricultural intensification in and of itself is inadequate to account for the emergence of political centralization

(see Erickson, this volume), at least in the Maya case. Other factors need to be taken into consideration, a few of which I focus on here: the distribution of people across the landscape, subsistence technology (e.g., reservoirs), means of transporting staples, and storage. I explore these factors in the southern Maya lowlands and discuss the relationship of agricultural intensification, water issues, and Classic Maya political power.

CLASSIC MAYA FARMING LIFE

In brief, Classic (c. AD 250–950) Maya farmers were rainfall dependent, dispersed across the landscape near centers and in hinterland areas, and largely economically self-sufficient at the community level (Lucero 2001). The Maya relied on scattered and small-scale subsistence systems because resources were diverse and dispersed due to variability in soil and rainfall. They did not have beasts of burden and lacked extensive road systems. As Shaw (2001) demonstrates, nearly all *sacbeob* (raised roads) in the southern Maya lowlands are 1 km or less in extent and are located within centers to connect architectural complexes. Folan, Marcus, and Miller (1995), however, note what may appear to be *sacbeob* between the regional center of Calakmul, Mexico, and outliers. *Sacbeob* extend c. 10 km from both El Mirador and Calakmul toward each other (c. 38 km distant), though the remainder of the connecting *sacbe*, if it exists, is not readily apparent. A *sacbe* also may connect El Mirador and Nakbe, located c. 13 km apart. Beyond these two cases, Caracol is the only southern Maya site with a noticeable road system; *sacbeob* up to c. 8 km link the site core with outlying building complexes (Chase and Chase 1994). Basically, the Maya built *sacbeob* within centers and seldom otherwise. Consequently, the transportation of bulky staples and goods over long distances was not feasible in areas lacking rivers (e.g., Tikal, Caracol, Calakmul, and others), especially since Maya bearers could not travel more than a few days without eating all the food they were carrying (Drennan 1984). The transport of small luxury items, however, was feasible (e.g., manufactured jade and obsidian items). People living in centers near rivers faced problems as well; raging rivers in the rainy season and low and murky waters in the dry season undoubtedly affected canoe travel.

SEASONAL LANDSCAPE AND SETTLEMENT

The southern Maya lowlands encompass a mosaic of resources and political histories. The distribution of people across the landscape is important because where people live affects the ability of political leaders to communicate with potential contributors and to organize the building of public works (Roscoe 1993). Densely settled and nucleated farmers are much easier to reach

(Carneiro 1970; Gilman 1981) than dispersed people. Where people live has to do, of course, with the location and nature of resources crucial for daily survival—land and water. Before detailing the significance of land and water, I want to briefly address prehispanic population size. Several scholars estimate high population numbers and densities, especially in the Late Classic period (c. AD 550–850) (see Rice and Culbert 1990). Scarborough et al. (2003:xvi), based on this assumption, “suggest that absolute village autonomy during the Classic period was not an option.” As I have discussed and summarized elsewhere (Lucero 1999a), however, evaluating prehispanic population size and density is a challenge for several reasons (Ford 1991b). First, there is the lack of precise chronologies. We also need to take into account seasonal mobility and migration (discussed below) and structure function—that is, percentage of domiciles versus specialized buildings including workshops, kitchens, storage facilities, religious structures, sweat houses, field houses, and administrative buildings. Further complicating matters are “invisible” mounds, which are difficult to identify in the archaeological record (Johnston 2004; Pyburn 1997). Whatever the actual numbers of prehispanic Maya, there is little doubt that the Late Classic period witnessed the highest population size and density (Rice and Culbert 1990) and that the largest number of Maya lived near fertile land (Fedick and Ford 1990).

The best agricultural soils are found throughout the southern lowlands but in a mosaic pattern (Fedick 1988, 1996; Fedick and Ford 1990; Ford 1986, 1991a, 1996; Sanders 1977). Soil variability relates to soil parent material, soil fertility, workability, root zone, drainage, slope, erosion factors, and other features (Fedick 1995). Based on these factors, Fedick (1988, 1996) has developed a hand-cultivation land-capability classification system consisting of five soil classes where “I” is the best and “V” is the worst. He found the highest residential density on Class II soils, followed by Class I alluvium along rivers. Interestingly, alluvial soils (Class I) are not the most densely settled, as they typically are in temperate regions. Because of the varied distribution of water and land, many Maya farmers lived dispersed across the hinterland (de Montmollin 1995; Fedick 1988, 1995, 1996; Ford 1986; Lucero 2001; Puleston 1983). Consequently, hinterland settlement consists largely of relatively scattered solitary mounds and patio groups, or farmsteads (Ashmore 1995; Gonlin 1994). Settlement maps also show homesteads clustered near centers (Fedick 1988; Ford 1986; Puleston 1983). Drennan (1988) and Killion (1990) suggest that this settlement pattern indicates intensive agriculture where farmers lived dispersed and separated by intensively utilized fields (Robin 2002).

Rainfall also varies throughout the southern lowlands and can range anywhere from 1,300 to 3,700 mm per year. Further, the beginning of the rainy season can vary up to five months in any given area, and rainfall patterns vary

year to year (Gunn et al. 2002), both of which affect agricultural schedules. For example, if the rainy season starts later than usual, the seeds that have been planted in anticipation of timely rain will rot. If rains come sooner than predicted, seeds will not germinate. Also, if the rains start even earlier, farmers would not have burned their *milpas* (fields), which they cannot do if brush is wet. The annual wet-dry seasonal round also affected agricultural practices and settlement patterns, especially if dry season water needs resulted in farmers moving, at least temporarily, near water (e.g., artificial reservoirs in centers) (Lucero 1999b). During the annual six- to seven-month rainy season there was plenty of water for everyone, which was just as well since many agricultural tasks occur during this time (Atran 1993). The dry season was another matter. For all intents and purposes many parts of the southern Maya lowlands are transformed into a green desert during the dry season; temperatures and humidity are high, and it does not rain for four months. Access to water at such times was critical, even though it was the agricultural downtime. Many Maya congregated at water sources, both natural and artificial, at centers. This situation provided just the means the politically ambitious needed to acquire power over others, as I have described elsewhere (Lucero 1999b, in press) and will briefly summarize below. The point is that the location of agricultural land indeed was critical, but potable water was as or even more critical, at least seasonally, and influenced where people lived and to what degree and when they interacted with each other.

Subsistence practices, along with seasonal water issues and soil variability, also impacted residential and seasonal mobility (de Montmollin 1995:189; Ford 1996; Lucero 1999b; Webster 1997; Webster and Kirker 1995). For example, Reina (1967), based on his ethnographic work among Maya farmers at Lake Petén Itzá, Guatemala, describes how farmers abandon their residences every three to four years to find new land. Farmers also may have used field houses during the height of the agricultural season, when they needed to weed, protect their fields from pests, harvest their crops, and store their foodstuffs (Atran 1993). Faust (1998:56–57) found this to be the case in her account of Maya farmers of Pich, in southeastern Yucatán, Mexico, where each family has rights to several *rancherías*. Prehispanic Maya also probably practiced residential and seasonal mobility (Webster 1997). Finally, several Maya archaeologists, based on household and community research, suggest that ancient Maya farmsteads were basically economically self-sufficient (Freter 1994; Hayden 1994; Lucero 2001), a factor that needs to be taken into account when discussing political systems. In other words, families were likely mobile and had all the resources necessary to survive without outside (elite or royal) interference—land, water, and raw materials for manufacturing farming tools, ceramic vessels, and other items. Something, then, had to bring people to centers where kings could tap

their surplus labor and goods, which I argue was both water and ritual. I have detailed the role of ritual elsewhere (Lucero 1999b, 2002, 2003, in press), as have others (Marcus, this volume; Scarborough 1998, 2003). Here I focus on water and other material factors.

Seasonal water was the linchpin in the development and success of Maya kings (Lucero 1999b, 2003, in press). Consequently, even if rulers owned or controlled productive land, they likely only could monitor land in the vicinity of centers. Outside the immediate area it would have been difficult to control access to land and extract payment for its use, whether or not they owned it. For land they owned or controlled beyond center environs, they probably had to grant laborers a portion of the crop as payment for working their land rather than with *corvée* labor. Hinterland farmers were also out of reach of the political net and could not easily be coerced to contribute to political coffers unless there was a way to bring farmers to royal centers.

SUBSISTENCE TECHNOLOGY

Different environmental settings are suitable for varied kinds of subsistence technology, most of which is handled at the household or community level (Johnson and Earle 2000). However, even if this is the case, if people are tied to the land because of subsistence technology, they are less likely to leave if faced with the choice of leaving or paying tribute—and they often have no choice but to do the latter (Gilman 1981). Consequently, households and/or communities can be relatively socially and economically self-sufficient; but if it is difficult to leave behind their means of support (e.g., plowed fields, fish ponds, canals, dams, terraces, and storage facilities), they are more accessible and more susceptible to political machinations. Political leaders, in other words, can interact with subjects since people are tied to the land; farmers would lose all if they chose independence and left their holdings rather than remain and pay tribute.

In the Maya area, agricultural and water systems are scattered, mirroring the distribution of resources and homesteads, and are largely small-scale with some exceptions. Maya farmers used several subsistence strategies including intensive house gardening, short-fallow infield (intensive) and long-fallow outfield (extensive) farming, terraces, dams, canals, raised fields, and drainage systems (Dunning et al. 1998; Fedick 1994; Flannery 1982; Harrison and Turner 1978; Killion 1990). Some intensive agricultural strategies might not have left obvious evidence. For example, to date archaeologists have not found any evidence for subsistence systems (terraces, dams, and so forth) near Tikal, the largest Maya center (Harrison 1993). At least two crops a year provided for families year-round. Average farmers either used storage bins near their fields or collected

corn every few days from their fields when needed, as do the Lacandon farmers of Chiapas at present (McGee 1990:36). They turn the ears of corn downward to prevent damage from rain and pests such as birds. The most common and obvious large-scale subsistence technology was for water storage during the annual drought (4–6 months) (Lucero 1999b, 2002; Scarborough 1993, 1996). The Maya built well-engineered reservoirs with channels and drainage ditches (Scarborough 2003; Scarborough and Gallopín 1991).

Finally, the Maya also had access to diverse flora and fauna. Unlike their counterparts in temperate zones, the lack of large nucleated settlements meant that uninhabited jungles interspersed among farmsteads and centers were not necessarily denuded of wild animals, nuts, berries, medicinal flora, and fruits (Bacus and Lucero 1999).

MEANS OF TRANSPORTING STAPLES AND STORAGE

The means of transporting staples is another critical factor to take into account when attempting to understand political centralization. Surplus goods are only useful if they can reach political coffers, be stored (D’Altroy and Earle 1985), and be distributed. The same goes for labor in that the political elite have to be able to reach people to appropriate their surplus labor and goods.

Without beasts of burden, extensive road systems, and wheeled carts in the southern Maya lowlands, staples (maize, beans, and squash) had to be transported by human bearers. As mentioned earlier, this meant that Maya bearers could not travel more than a few days without eating all the food they were carrying (Drennan 1984). Maya in all probability, however, participated in exchange at *local* markets (Scarborough and Valdez 2003). In areas without lakes and rivers, travelers had to know the location of *aguadas* (rain-fed natural sinkholes), though water in most *aguadas* would have evaporated during the course of the dry season (Scarborough 1996). And travel is really only logistically feasible during the dry season. In the rainy season foot travel is difficult (Lucero n.d.): sloping terrain can be slippery and dangerous because of saturated soils, clay, and wet ground cover (leaves and debris); low-lying areas tend to be inundated and swamplike. Some goods could have been transported on rivers via canoes. However, only people near rivers would benefit and not during the height of the rainy season (turbulent) or dry season (low waters). For example, Houston (1998) describes the Usumacinta River at Piedras Negras, Guatemala, during the rainy season as dangerous and during the dry season as low, murky, and disease-ridden. Taken together, these conditions suggest that staples were largely grown and eaten in the vicinity of the fields in which they were grown. Prestige goods (cacao beans, jade, obsidian, feathers, cotton mantas, and others), though, were exchanged farther afield.

In addition, there is a lack of large-scale centralized storage facilities at Maya centers. Small-scale storage existed (*chultuns*), but it clustered at elite and royal residences and likely provided food only for household members. Chultuns typically are shoe-shaped chambers dug into the relatively soft and porous limestone bedrock. Puleston (1971) conducted an experiment to determine if they could store foods; they are too porous for water storage in the southern Maya lowlands unless sufficiently lined to prevent seepage, and most are not. He found that they would not store foods long because of the heat and humidity. However, dried or smoked maize and other staples can be stored longer (Reina and Hill 1980). Dahlin and Litzinger (1986) suggest that chultuns instead were used for fermenting alcoholic beverages or for pickling. They also note that the inconsistent distribution of chultuns indicates a specialized function rather than a purely economic and domestic one (e.g., for feasts and ceremonies). For example, Ford (1991b:Table 1) has noted that the highest density of chultuns is near or at centers, especially at elite residences. The lack of large-scale storage facilities indicates that rulers would not have been much help in a crisis caused by, for example, crop failures and food shortages. However, since crops were grown dispersed throughout the landscape, so, too, were the risks.

While it is likely that Classic Maya rulers could not amass large amounts of food to feed people for any length of time, they could still integrate them through sponsoring key ceremonies (e.g., water rites) and feasts, at which time they could distribute exotic wealth items to favored underlings, such as obsidian items, jade objects, and polychrome ceramics, most of which were acquired via long-distance exchange (Rice 1987). And even if Maya kings relied on wealth finance, they still had to acquire and distribute goods, which they accomplished at the local level. There is no clear evidence for markets “in which the tribute goods used as state payment are sold for subsistence goods” (D’Altroy and Earle 1985:188), though as mentioned earlier, local markets probably were used. Transportation issues, however, would still have limited the type and amount of items exchanged. Consequently, while intensive agriculture provided a surplus to fund the political economy, only the fruits of land in the immediate vicinity of centers were readily available. Agricultural surplus, together with seasonal water issues (royal water rites and centrally located reservoirs), however, provided the key means to support Maya rulership.

POLITICAL POWER IN THE SOUTHERN MAYA LOWLANDS

In this section I focus on the role that various resources and concomitant intensive agricultural strategies played in Classic Maya politics. Of course other factors were critical, such as religious and social mechanisms; here I focus on material features.

Table 11.1. Late Classic Maya centers (c. AD 550–850).

Scale	Minor Center	Secondary Center	River Regional Center	Nonriver Regional Center
Distribution of resources	River, extensive alluvium	River, uplands with small pockets of dispersed agricultural soils	River, concentrated alluvium	No rivers or lakes, uplands with large tracts of dispersed agricultural land and reservoirs
Political economy	No tribute	Some tribute	Tribute	Tribute
Annual rainfall (mm) ^a	2,160	2,200–2,850	Copán: 1,300 Palenque: 3,700	1,670–2,100
Seasonal water issues	Annual inundation and recession	Varies	Noticeable	Noticeable
Subsistence systems	None	Small-scale	Large-scale	Large-scale
Settlement patterns and density	Relatively dispersed and low settlement density; 100–150 ^b str/sq km	Slightly higher center density than hinterlands; 275 ^c vs. up to 145 str/sq km	High center density vs. hinterlands; 1,440 ^d vs. 28–99 str/sq km	High center and hinterland density; 235–557 ^e vs. 39–313 str/sq km
Means of transportation	River and human bearers	River and human bearers	River and human bearers	Human bearers
Means of distribution	Interpersonal, local ritual events, local markets	Interpersonal, secondary royal events, local markets	Interpersonal, primary royal events, local markets	Interpersonal, primary royal events, local markets
Storage	None	Small-scale	Small-scale	Small-scale
Examples	Saturday Creek, Barton Ramie	Lamanai, Yalbac, Piedras Negras, Quiriguá, Seibal, Yaxchilan, Xunantunich, Cuello, Bonampak	Copán, Palenque	Tikal, Caracol, Calakmul

^aNeiman 1997: Table 15.1.

^bLucero et al. 2004; Rice and Culbert 1990: Table 1.1.

^cAshmore 1990; Loten 1985; Rice and Culbert 1990: Table 1.1; Tourtellot 1990.

^dRice and Culbert 1990: Table 1.1; Webster and Freter 1990.

^eCulbert et al. 1990; Folan, Marcus, Pincemin, et al. 1995. Bajo (seasonal swamps) settlement likely accounts for lower densities.

The concept of environmental heterogeneity has been bandied about for decades (Sanders 1977). It is only relatively recently, however, that archaeologists have considered this diversity when attempting to explain the rise of complexity in the Maya lowlands (Dunning 1995; Dunning et al. 1998; Fedick and Ford 1990; Lucero 2003). This variability is reflected in the varied political systems and histories. I particularly focus on the Late Classic period (c. AD 550–850) because this was the period when Maya rulers attained their height of power. As Table 11.1 illustrates, the scale and degree of political power vary and are influenced by resource and settlement distribution and seasonal water issues and needs. I have defined these center types in greater detail elsewhere (Lucero 2002, 2003, in press). I briefly summarize the key factors of each center type—minor, secondary, and regional—and add additional features that relate more directly to the topic of this chapter (means of transportation, distribution of goods, and storage). Not all centers fit neatly, of course, but in most cases when they do not, their political stories can be explained by local and historical circumstances (e.g., Dos Pilas, Uaxactun, El Mirador, and others).

Minor Centers

Barton Ramie and Saturday Creek are located on the Belize River on the relatively broad alluvium (1–2 km wide) on the eastern periphery of the southern Maya lowlands (Figure 11.1). Annual rainfall at Saturday Creek is 2,160 mm, similar to that of Barton Ramie (Figure 11.2). The rich river terrace soils are excellently suited for cash crops like cacao and cotton, not to mention maize, beans, and squash. Cacao and cotton require specific conditions and cannot grow in rocky upland soils but require saturated or moist soils (Gómez-Pompa et al. 1990). The Maya would have had plenty of water to last throughout the year, especially since they benefited from annual runoff from Guatemala and western Belize. The downside is that runoff also resulted in flooding and the deposition of clayey soils, which can remain saturated for most of the year. These communities comprised relatively low densities of dispersed farmsteads (e.g., 100–151 structures per sq. km).¹ Elites, or wealthy landowners, were unable to collect much tribute, if any, because they could not restrict extensive alluvium and politically integrate dispersed farmers. Farmers did not build conspicuous subsistence systems because water was plentiful but instead relied on the annual flooding and subsiding of rivers for agriculture (recession agriculture). Elites sponsored local small-scale public rituals and feasts at small temples and plazas and organized the construction of public works to promote solidarity (Arie 2001; Lucero et al. 2004).

The Maya in these areas could travel the rivers, except during the height of the rainy season, when water was too turbulent. Because the Belize River is



Figure 11.1. The Maya area.

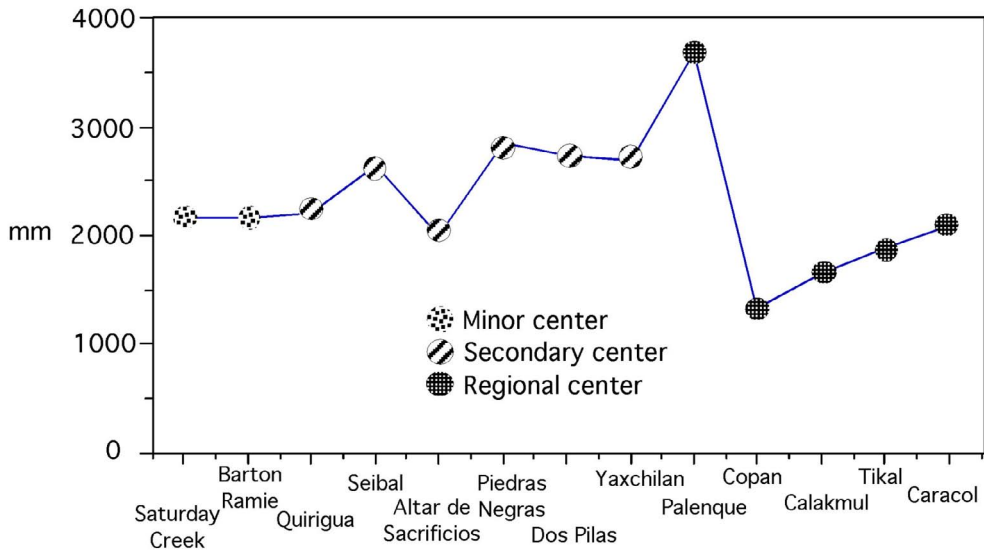


Figure 11.2. Annual rainfall in the southern Maya lowlands.

a major water catchment, the Maya could travel downriver toward the coast during the dry season. Elites could afford to obtain prestige items through their participation in the elite interaction sphere (long-distance exchange), some of which they gave as gifts to non-elites at local ceremonies for services rendered such as working their land. Storage facilities are nonexistent; the limestone bedrock is buried deeply under silt deposits, making chultun construction impractical. The rich alluvium, however, likely allowed farmers to plant crops throughout the year, as Mennonite farmers do at present, to offset the lack of storage facilities.² This also meant that farmers were more self-sufficient than their counterparts elsewhere because they did not rely on royal stores of water or capital to maintain subsistence systems since they had access to food and water the entire year.

Secondary Centers

Centers including Lamanai, Yalbac, Seibal, Yaxchilán, Quiriguá, Bonampak, Cuello, Piedras Negras, Xunantunich, and others are found along rivers in upland areas with limited or dispersed pockets of agricultural land.³ Annual rainfall ranges from 2,220 to more than 2,800 mm. At most secondary centers, residents lived above rivers on ridges and hills, which meant that during the rainy season saturated hillsides influenced building decisions and agricultural

practices (Turner 1974). Because of the dispersed pockets of agricultural land, Maya farmers relied on scattered small-scale subsistence systems including aguadas, dams, canals, and drainage ditches (Dunning et al. 1997; Fedick 1994). Settlement is typically dense near centers (e.g., up to 275 structures/km²) and less so in hinterland areas (e.g., 145 structures/km²). The uneven distribution of subsistence systems suggests their lesser political role. Maya kings, however, likely monopolized river trade routes (e.g., by controlling access to harbors and canoes) and acquired and distributed exotics such as obsidian and jade. Rulers could not exact as much tribute from subjects as primary rulers, because they could not completely control access to relatively small and dispersed pockets of agricultural land and small-scale water systems, not to mention relatively scattered farmers. Kings, however, may have provided the means to repair subsistence features damaged by rain in the immediate center environs and conducted integrative events (e.g., ceremonies and feasts) to acquire what tribute they could. They also participated in the royal interactions sphere (e.g., intercenter alliances, marriage, visitations, and warfare, and the adoption of writing, royal dynastic rites, and in some cases, the use of emblem glyphs) (Marcus 2003).

Similar to minor centers, the Maya in these areas could travel the rivers, except during the height of the dry and rainy seasons (Houston 1998). In addition to elites handing out exotics in exchange for services rendered by commoners, kings performed royal rites and showered gifts on lower-level elites and commoners. Storage facilities (chultuns) are small-scale and typically found only at elite and royal residences. Their size and distribution suggest that they could not supply much more beyond the immediate household.

RIVER REGIONAL CENTERS

The river centers of Palenque and Copán are located along rivers with concentrated alluvium, more in line with archaic states in temperate areas (e.g., China, Egypt, Mesopotamia, and western Andean South America) (Marcus 1998). For example, alluvial soils surrounding Copán are found within a 24-km² area (Webster 1999). Rulers collected tribute from densely settled farmers because of their ability to monopolize nearby concentrated resources. Kings also likely dominated trade with highland areas for jade and obsidian (Fash 1991). Annual rainfall is both above and below that found at nonriver regional centers—1,300 mm at Copán and 3,700 mm at Palenque. Copán's occupants, because of low annual rainfall, built reservoirs, which were managed and controlled by rulers (Fash 2005; Fash and Davis-Salazar n.d.). Inhabitants of Palenque lived in a hilly area overlooking fertile plains to the north. They built aqueducts and canals to drain water away from the center—a not-too-surprising fact given the

high annual rainfall and the presence of more than 50 springs and streams in the site core (French 2002). Farmers also constructed terraces on the hillsides and possibly irrigation canals on the plains (Barnhart 2001:101). Settlement is typically dense around centers (1,449 structures/km² at Copán and 643 structures/km² at Palenque) and noticeably less dense in areas beyond the alluvium (28–99 structures/km² in rural Copán) (Barnhart 2001:Table 3.1; Rice and Culbert 1990:Table 1). At both centers the reliance on larger-scale subsistence systems suggests a greater need for capital—royal funds—to maintain them or at least rebuild them when they were damaged by heavy rains, flooding, or hurricanes (Lucero in press).

Similar to secondary centers, Maya in these areas could travel the rivers, except during the height of the dry and rainy seasons. Again, exotics were given as gifts in exchange for services rendered by commoners and lower-level elites in large-scale royal ceremonies at open plazas at the foot of temples and palaces as part of the political legitimation process. As at secondary centers, storage facilities were small-scale and largely concentrated at elite and royal residences.

Nonriver Regional Centers

Regional centers such as Tikal, Calakmul, and Caracol are similar in scale to regional river centers but differ in several significant ways. They are located in upland areas with large pockets of dispersed fertile land but without permanent water sources (lakes and rivers). Figure 11.3 illustrates the fact that some of the largest Maya centers are not located near lakes or rivers. The rich land, however, supported many people, as well as political institutions. To deal with the lack of water, rulers organized the construction of large-scale and sophisticated reservoirs that collected enough water during the rainy season to last through the four-to-six-month dry season (Scarborough and Gallopin 1991). Reservoirs are located next to temples and palaces, making it easier to conduct large and public water rites to attract supporters, control their access, and highlight the prosperity of the king. The need for an adequate water supply is particularly crucial in these areas since rainfall is typically less than at secondary and regional river centers. For example, annual rainfall at secondary centers ranges from 2,200 to more than 2,800 mm; at Tikal it is just under 1,900 mm, at Calakmul just under 1,700 mm, and at Caracol 2,100 mm (see Figure 11.2). Rulers collected tribute from thirsty farmers in exchange for access to artificial reservoirs during the dry season, particularly from January through April or May (Folan, Marcus, Pincemin, et al. 1995; Ford 1996; Lucero 1999b; Scarborough 1993, 1996; Scarborough and Gallopin 1991). Maya kings were responsible for providing enough potable water to last through the dry season, not only through organizing the continual maintenance to keep

the reservoirs clean (Ford 1996) but also for performing rites necessary to propitiate key ancestors and deities such as Chac, the rain god (Scarborough 1998). Consequently, rulers were able to draw in farmers from hinterland areas (Lucero 1999b). This strategy was critical for political survival since in the immediate areas beyond center environs, people lived scattered throughout the landscape, making it challenging for rulers to organize work parties, feasts, and ceremonial events and extract surplus. Settlement, however, is relatively dense both around centers (e.g., 235–557 structures/km²) and hinterland areas (e.g., up to 313 structures/km²) (Rice and Culbert 1990:Table 1), likely reflecting a more mobile dry-season settlement pattern whereby farmers had more than one residence—near both hinterland fields and centers.⁴



Figure 11.3. Southern lowland Maya centers in relation to lakes and rivers.

The lack of major rivers resulted in a reliance on human bearers to bring in exotics; plentiful fertile land, though, provided for inhabitants. Rulers, however, funded large-scale rituals in public plazas and temples to attract and integrate farmers from the immediate area and beyond, at which they distributed exotics to underlings and supporters. Storage facilities are small-scale and cluster at elite and royal residences.

DISCUSSION AND CONCLUDING REMARKS

D'Altroy and Earle (1985) discuss the crucial significance of central storage in political centralization. This was the case for the Maya. Rather than the storage of agricultural surplus or other goods, however, some of the most powerful Maya rulers stored water, particularly during annual drought—or, in the case of Palenque, provided “stored” capital to repair damaged subsistence systems and agricultural fields. Agricultural surplus was still important, however, to support royals and their retinue of family members, retainers, military and religious specialists, and artisans, all who lived in centers surrounded by fertile land. The stored food, though, likely came from land they owned in the vicinity of their grand homes. Kings in areas with dispersed agricultural land (e.g., Tikal) attracted additional people during the dry season when farmers needed water for everyday purposes—not to mention the opportunity to gather for feasts, ceremonies, ball games, social interaction, and exchange. In return Maya commoners contributed tribute in the form of labor necessary to build the royal temples, palaces, and ball courts; to transport exotics long distances; and to manufacture utilitarian and craft items.

We do not find evidence for political power at minor centers because water and land was plentiful. As a result, farmers were largely self-sufficient year-round rather than only seasonally as in other areas (i.e., those with kings). As members of a larger society, however, they participated in integrative social and religious events at centers sponsored and organized by wealthier landowners. As noted earlier, alluvial soils are less densely settled than those in temperate areas of the world. It is possible that these areas served as large, private, and/or royal estates (de Montmollin 1989:203). However, the question of whether or not Maya farmers had the option to leave has to be addressed. Unlike in many temperate zones where farmers had little option but to stay (Gilman 1981), I think some Maya did have choices. They could flee into foothill and upland areas away from rivers near small aguadas, springs, and streams. This fact might account for low settlement densities in alluvial areas rather than the estate model; in other words, they comprised independent and self-sufficient communities. Of course, eventually in many areas options became increasingly limited as time passed and the agricultural mosaic landscape filled up to

the point that small-scale subsistence systems became inadequate to supply the growing numbers of people. They then began to rely more on large-scale systems (e.g., artificial reservoirs).

At secondary centers the relatively scattered subsistence systems and food storage facilities were small-scale, as was their political power. Kings at regional centers centralized labor and goods because of what they provided in return—dry-season water or capital to offset weather damage. Clearly, it was only in areas with the greatest seasonal water issues and with the largest amounts of fertile land (dispersed or concentrated) that the most powerful polities emerged.

In response to those who have claimed that the Maya area is unsuitable to support political and social complexity because of the lack of major irrigation systems (Wittfogel) and fertile land (Meggers), I think the evidence speaks for itself. The Maya, like everyone else, adopted subsistence practices and technologies that best suited their needs in a tropical setting.

To conclude, I again pose the question -- How did water and agricultural surplus factor in Classic Maya political histories (c. AD 250–950)? Agricultural intensification provided a surplus. To be used for political purposes, however, it has to be acquired from people and harnessed to expand the political economy. Surplus is moot if its providers—farmers—are difficult to reach. In this situation means are necessary to bring people to rulers. The tropics, with all their unique traits, offered a way—seasonal water needs. Providing water during annual drought and conducting key water ceremonies furnished the means for the majority of rulers to draw farmers into centers, not to mention into their political folds. In return rulers made sure everyone had enough water when jungles became, for a time, green deserts.

NOTES

1. Because of the contentious issue of estimating population size and density, I use structure densities, a relative measure. Structure densities are also easier to compare among sites.

2. To quote a modernized Mennonite in Creole (in 1988), “Da Maya, de smarter dan we” (The Maya, they are smarter than we). Mennonite farmers only buy or lease land with a noticeable presence of Maya mounds because they know the ancient Maya lived on or near the best agricultural soils.

3. Yaxchilán, Piedras Negras, and perhaps other secondary centers, may in the future be defined as regional centers.

4. I do not claim that all farmers nucleated at centers during the dry season *per se*, but that many did. Some hinterland aguadas may have had enough water to last through the dry spell but, in most cases, not for many people. As mentioned, water in smaller aguadas likely evaporated long before the end of the dry season (Scarborough 1996).

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