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UBC Press
University of British Columbia
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Ancient Maya Use of Wetlands in Northern Quintana Roo, Mexico

Scott L. Fedick

The ancient Maya of southern Mexico and Central America are perceived as perhaps the most advanced civilization to arise in the Americas during pre-Columbian times (Figure 1) (see Sharer 1994). Archaeologists have found evidence of the emergence of Maya culture about 1200 BC, with complex social organization developing during the Late Preclassic period, from about 400 BC to AD 250. The Classic period, approximately AD 250 to AD 900, witnessed the height of Maya achievements, curtailed by the disruption of the so-called Classic Maya collapse in the southern lowlands. The Postclassic period, from about the beginning of the tenth century to the time of Spanish contact in the early sixteenth century, witnessed a shift of political power and cultural achievement from the southern to the northern lowlands.

The Maya are renowned for their art, architecture, and intellectual achievements in mathematics, calendrics, and astronomy. Scholars have made many advances in recent years, revealing details of ancient Maya political organization, warfare, population levels, and religion, yet we still know relatively little about how the Maya satisfied their basic subsistence needs in the tropical lowland environment in which they flourished. Until the 1970s, it was generally believed that the environment of the Maya Lowlands could not support dense population levels and that the only viable form of agriculture for the region was the slash-and-burn system of *milpa* (maize field) cultivation that was described in modern ethnographies. Since the 1970s, as an increasing body of data on ancient Maya settlement patterns became available, it has been clear that the new picture of Maya population – high regional densities and urban centres – does not fit the model of extensive slash-and-burn cultivation. A variety of alternative or supplementary crops and cultivation systems have been suggested for the ancient Maya, and a growing appreciation for the diversity of both the natural landscape and Maya agricultural practices is emerging (see Fedick 1996). Along with advances in our knowledge of ancient Maya agriculture has come much debate, particularly over the use and management of wetlands for agricultural production.

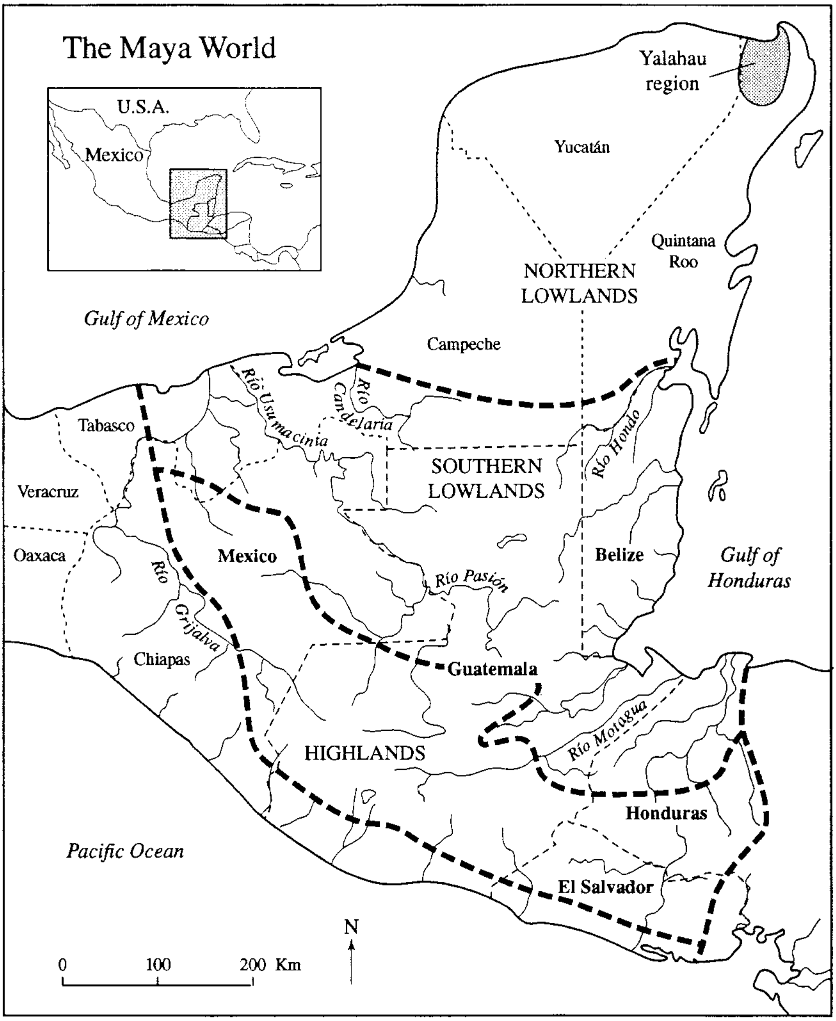

Figure 1. The Maya area of southern Mexico and Central America.

It was not until geographer Alfred Siemens' recognition of patterned ground in the wetlands of Campeche, Mexico, in 1968, and the joint investigations conducted in the early 1970s by Siemens and archaeologist Dennis Puleston, that evidence for ancient Maya use of wetlands was first brought to the attention of the world (Siemens and Puleston 1972; Pohl 1990). Researchers in the 1970s examined evidence for wetland cultivation along the Candelaria River of Campeche, along the Río Hondo of northern Belize, and in Pulltrouser Swamp, also located in northern Belize (Pohl, ed. 1990; Puleston 1977, 1978; Siemens 1978; Siemens and Puleston 1972; Turner and Harrison 1983). By the early 1980s, some archaeologists were assuming the perspective that virtually all wetlands of the Maya Lowlands were of similar agricultural development potential, representing the breadbaskets of ancient Maya subsistence (e.g., Adams 1980). Under these assumptions, vast areas of wetlands were drained by canals and transformed into intensive agricultural plots through the laborious construction of raised planting platforms similar to the Aztec *chinampas* of the Basin of Mexico (but more extensive in scale by a factor of 10 or 20).

Recently, researchers have begun to recognize the heterogeneity of wetland ecosystems in the Maya Lowlands and the diversity of local strategies employed by the Maya to exploit these varied resources. Wetlands of the region vary tremendously in hydrologic regimes and soils, and there is no single technology that the Maya could have used to bring all the wetlands under cultivation. Some types of wetlands may not have been cultivated at all. In other cases, cultivation may have been limited to exploitation of seasonal flooding cycles, without any human modification of the landscape. Channelizing the margins of wetlands may have been a more commonly used technique than previously recognized, whereas the construction of raised fields may actually have been very restricted (see Dunning 1996; Fedick and Ford 1990; Pope and Dahlin 1989; Siemens 1996). There is also growing evidence that the suitability of wetlands for agricultural development has changed through time in response to natural changes in climate and groundwater levels, as well as to human impact on the environment (e.g., Curtis et al. 1996; Hodell et al. 1995; Leyden et al. 1996; Pohl, ed. 1990; Pohl and Bloom 1996; Pope et al. 1996). As archaeologist T. Patrick Culbert has pointed out (Culbert et al. 1990), there were probably as many strategies of wetland cultivation as there were varieties of wetlands. It is with the explicit recognition of wetland heterogeneity that I present the findings of initial investigations into ancient use of wetlands in the Yalahau region of northern Quintana Roo, Mexico.

The Yalahau Region

Environmental Setting

Wetlands of the Maya region are concentrated in the southern lowlands (Figure 1), where up to 40 percent of the landscape is represented by various forms of wetlands. In contrast, the northern lowlands are generally characterized as arid and rocky, with water restricted to natural wells, or *cenotes,* that dot the landscape. The Yalahau region (Figure 1) stands in sharp contrast to these generalizations of northern lowland environment. This northeast corner of the Yucatán Peninsula receives more rainfall than the rest of the northern lowlands due to a pronounced climatic anomaly apparently associated with a "sea breeze convergence effect" that results in average annual rainfall of nearly 2,000 mm, comparable with rainfall of the southern lowlands (Isphording 1975).

The high rainfall of the northeastern peninsula has contributed to the development of a series of elongated karst depressions, or solution features,

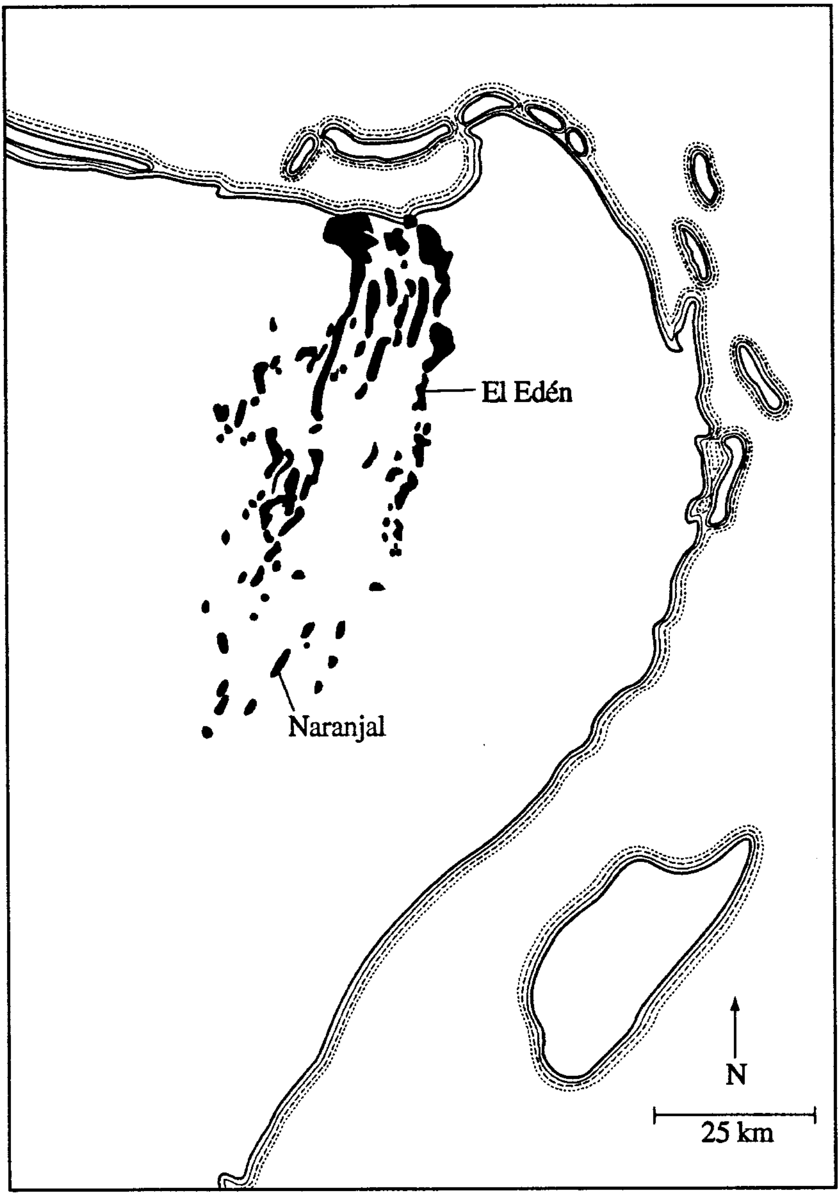

Figure 2. The Yalahau region, with the wetlands of the Holbox fracture zone indicated in solid black.

that apparently follow an underlying fault system, although the underlying structural geology is unknown (see Tulaczyk 1993). This lineament system of north-northeast-trending elongated depressions and aligned swales is referred to geologically as the Holbox fracture zone, as first characterized by geologist A.E. Weidie (1982, 1985). The Holbox fracture zone extends in well-developed form from the north coast to approximately 50 km south, with a maximum width of about 50 km east-west. Analysis of remote-sensing data by Scott Southworth (1985) proposed that the Holbox fracture zone extends, in less dramatic form, for another 50 km to the south, terminating at approximately N20°30' latitude in a concentration of karst terrain and *cenotes* just north of the ancient Maya centre of Cobá. The elongated depressions of the Holbox fracture zone contain a series of wetlands, referred to locally as *sabanas,* that remain saturated or inundated throughout the year (Figure 2). Recent investigations by geologist Slavomir Tulaczyk (1993) suggest that the wetlands were formed when the descending karst solution-corridors met the water table. Thus, the seasonal hydrological regime of the wetlands, as well as long-term fluctuations in the water table, are linked directly to groundwater levels.

The northern area of the Holbox fracture zone, where the wetlands are most prevalent, is referred to as the Yalahau region (Figure 3). Initial investigations by ecologists and biologists suggest that this wetland zone is characterized by perhaps the greatest biodiversity, and contains the highest number of endemic plant and animal species, in the Yucatán Peninsula (Lazcano-Barrero 1995; Snedaker et al. 1991). The core of the Yalahau region is for the most part uninhabited, although there are growing communities along the western and southern margins of the wetland zone, and the huge resort community of Cancún, only a short distance to the east, is currently spurring tremendous population growth in northern Quintana Roo. Two new "protected areas" have recently been established in the Yalahau region (Figure 4) to preserve the diverse ecosystems found in this unique area of the Yucatán Peninsula (Gómez-Pompa and Dirzo 1995). The Yum Balam Protected Area, established in 1994, covers 154,052 ha of land and encompasses much of the northern wetland area. The El Edén Ecological Reserve, on a privately owned tract of 1,492 ha, was established in 1990 just outside the southeast corner of the larger Yum Balam Protected Area. There has been little information available on the wetland ecosystems or the archaeology of the Yalahau region, but archaeological investigations undertaken since 1993 have produced some tantalizing results (Fedick and Taube 1995; Fedick and Taube, eds. 1995).

Archaeological Setting

The Yalahau region has been the subject of sporadic archaeological studies and visits over the years (see Andrews 1985). In 1937, Alberto Escalona Ramos

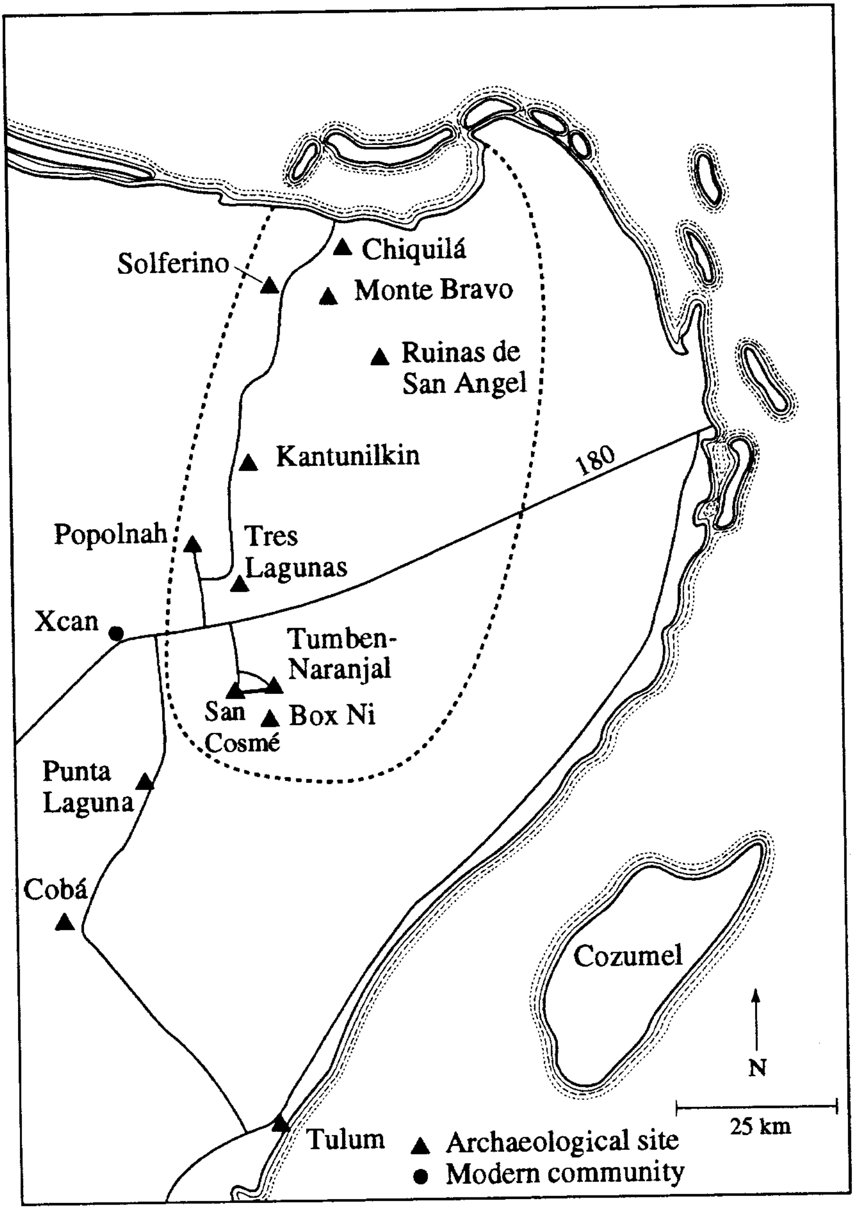

Figure 3. The Yalahau region (defined by dotted line), with locations of ancient centres indicated.

(1946) visited Kantunilkin and other sites in the vicinity (Figure 3). In 1954, William Sanders (1955, 1960) engaged in exploration and limited excavation near the communities of Kantunilkin, Solferino, Monte Bravo, and Chiquilá, all situated along the northwestern margin of the Yalahau region.

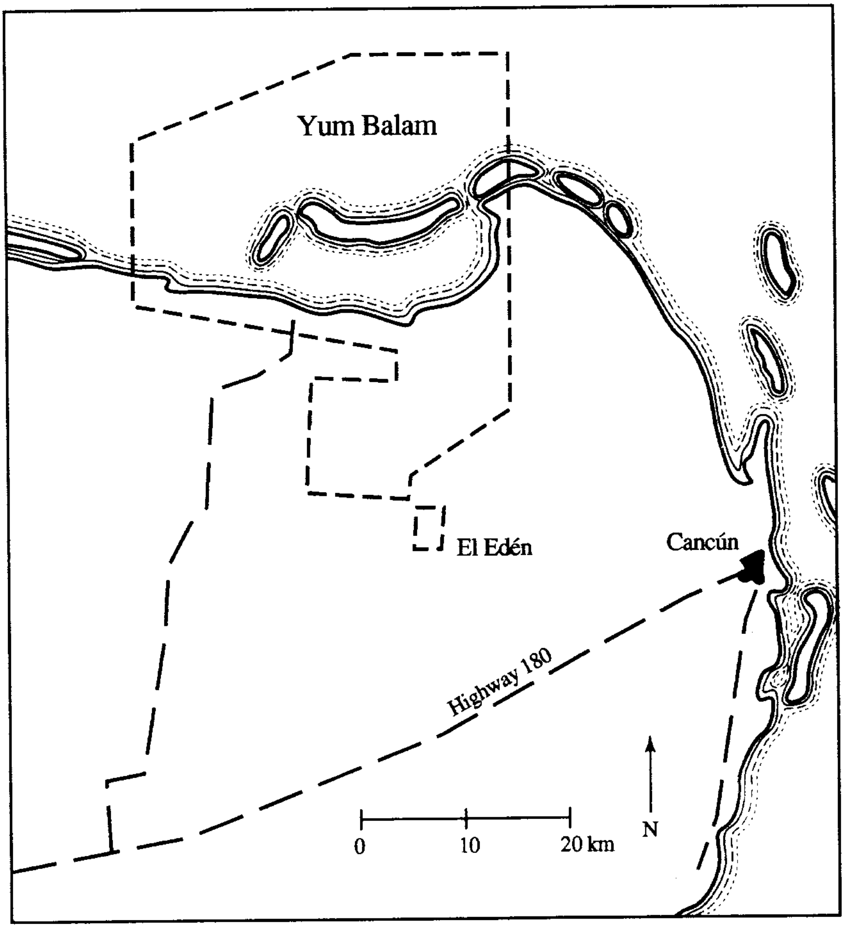

Figure 4. Protected areas in northern Quintana Roo.

In the 1980s, the sites of San Angel and Tumben-Naranjal were first recorded and investigated by archaeologists Karl Taube, Edward Kurjack, Ruben Maldonado, and Sonia Lombardo (Lombardo 1987:116-117, 150-151, 156-159; Taube and Gallareta 1989).

In 1993, the Yalahau Regional Human Ecology Project was initiated by Scott Fedick and Karl Taube, with the first season of field investigations focusing on the site located at the modern village of Naranjal. The site has been known by the village name of Naranjal and, more recently, as Tumben-Naranjal (Figure 3) (Fedick and Taube 1995; Fedick and Taube, eds. 1995). The Yalahau Project documented architectural relationships between the Late Preclassic/Early Classic site of Tumben-Naranjal and those of the northwestern peninsula such as Izamal and Aké (Taube 1995), developed data on the Postclassic reuse of earlier monumental structures (Lorenzen 1995), recorded settlement patterns associated with the site of Tumben-Naranjal and the adjacent Naranjal wetland (Fedick and Hovey 1995), investigated ancient use of wells in the area (Winzler and Fedick 1995), and mapped numerous ancient sites and roadways (Fedick and Taube 1995; Fedick and Taube, eds. 1995; Fedick et al. 1995; Mathews 1995; Reid 1995). Subsequent visits to the El Edén Ecological Reserve have resulted in the identification of numerous ancient settlements in the vicinity (1994-1996 field observations by Scott Fedick, Arturo Gómez-Pompa, and Marco Lazcano-Barrero). Archaeological evidence suggests that the Yalahau region was densely occupied during Late Preclassic/Early Classic times (ca. 100 BC to AD 400), and again during the Late Postclassic period (ca. AD 1250 to AD 1520). The high population density of the Yalahau region during ancient times makes the possibility of agricultural use of wetlands in the region particularly pertinent to our understanding of human use of the area in antiquity.

Investigations at the Naranjal Wetland

The site of Tumben-Naranjal and the village of Naranjal are at the southern end of a wetland within the southern area of the Yalahau region (Figures 2 and 3). The Naranjal wetland extends approximately 2.5 km north-south by 250 m east-west. It contains water throughout the year, with some seasonal variation in water level resulting in annual inundation along the narrow wetland floodplain (Figure 5). The terrain surrounding this wetland is relatively steep, and there are deep deposits of clays and dark, organic hydrosols within the wetland.

A systematic archaeological settlement survey was undertaken at Tumben-Naranjal in 1993 (Fedick and Hovey 1995), with one survey area located to the north of the site centre, along the southwest margin of the wetland, and a second survey area situated to the south of the site centre. Surveyors mapped a total of 70 ancient structures, as well as a variety of other features, including rock alignments, retaining walls, small stone enclosures, wells, and *sascabera* (quarry) pits. Information on terrain, forest cover, and soils was also recorded. Soils were identified according to local Maya classification with the assistance of residents from the modern village of Naranjal. The results of the systematic settlement survey reveal that large residential structures cluster on high ground around the margins of the wetland, whereas those structures situated at greater distances from the wetland tend to be much smaller and less elaborate. In addition to the systematic survey, a reconnaissance-level survey was conducted during 1993 and 1996 along the southeast side of the wetland, recording numerous large residential structures similar to those on the western side of the wetland. Reconnaissance was also conducted within the Naranjal wetland to potentially identify raised planting platforms or other features that might be currently submerged beneath the surface of the water. No constructed features were identified

Figure 5. The wetland at Naranjal (from western margin looking east).

within the main body of the wetland, although our preliminary examination cannot rule out their existence.

Of particular interest here are rock alignments and other features recorded along the margins of the wetland. The alignments consist of a nearly continuous line of single boulders stretching for approximately 50 m north-south, with two shorter segments running east-west for approximately 20 m and 12 m. The alignments are situated within the narrow floodplain on the southwest margin of the wetland: they were fully exposed on dry land during the dry season, but were submerged beneath about 10 cm of water with the onset of the rains in June. A retaining wall or embankment constructed of cobbles and boulders stretches for approximately 200 m along the southeast margin of the wetland, forming a band of relatively level terrain between the wetland and the settlement area.

Surface collection of ceramics in 1993 and test excavations undertaken in 1996 indicate a major occupation at Tumben-Naranjal during the later part of the Late Preclassic period and the early part of the Early Classic period, between approximately 100 BC and AD 400. There is scant indication of Late Classic occupation (ca. AD 600 to AD 900) and ample evidence of a Late Postclassic reoccupation (ca. AD 1250 to AD 1520).

Further reconnaissance was undertaken to the north of Naranjal, where 19 cleared and burned agricultural fields were checked along approximately 18 km of road running from the village of San Angel to the east and then

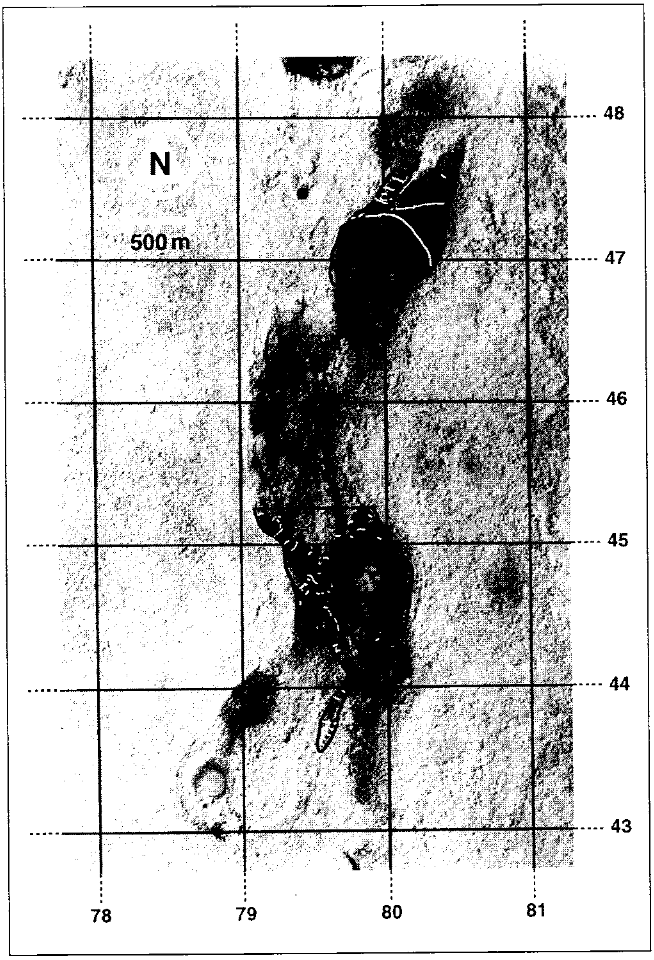

Figure 6. Aerial photograph (1980) of the El Edén wetland. The 1-km grid represents the Universal Transverse Mercator divisions as indicated on the 1:50,000 topographic map (F16C49). Areas enclosed by black lines indicate areas surveyed in 1996. White lines indicate locations of recorded rock-alignment features.

the northeast. Five of the 19 checked fields contained the remains of ancient residential settlements, and all the fields with structures were within 500 m of a wetland.

Investigations at the El Edén Wetland

The El Edén Ecological Reserve is dominated by a wetland situated within a large shallow karstic depression measuring approximately 5.5 km north-

Figure 7. Rock-alignment feature within the west-central area of the El Edén wetland (now designated as feature 96 A-22).

south by 0.8 km east-west (Figures 2, 4, and 6). Only a small area of the El Edén wetland contains standing water throughout the year, with most of the depression being subject to varying degrees of seasonal inundation. The terrain surrounding the wetland is relatively flat, apparently rising no more than 2 m above the margin of the depression within a radius of several kilometres.

In the spring of 1994, botanist Arturo Gómez-Pompa described to me a rock alignment he had discovered well within the wetland at the El Edén reserve. I visited the reserve in August 1994 and was shown this feature by Dr. Gómez-Pompa (Figure 7). During my inspection, I noted that there is actually a series of these rock alignments oriented perpendicular to the length of the wetland and running from one side to the other side of a channel that can be distinguished within the larger wetland. Four alignments were noted, approximately 80 m apart; two are distinct and two are partially exposed. Each alignment consists of one or two rows of unshaped, upstanding limestone slabs measuring up to 70 cm in length. The alignments are very sinuous, stretching for about 70 m between bedrock outcrops on opposite sides of the wetland channel. These bedrock exposures mark a slight transition in terrain between the lower portion of the wetland, with vegetation associations dominated by various mixes of cattail (*Typha latifolia*), sawgrass (*Cladium jamaisense*), and water lily (*Nyphaea* spp.), and the slightly elevated transition zone dominated by the logwood, or *palo tinto,* tree (*Haematoxylon campechianum*). The moist soils spanned by the alignments are only about 10 cm to 20 cm thick over limestone bedrock. The southernmost alignment was approximately 10 m north of standing water. The entire lower area of the wetland depression floods during the rainy season and would normally have been inundated by early August, except for the unusually dry conditions of 1994.

I participated in an environmental reconnaissance at El Edén during the summer of 1995 and noted many more rock alignments within the wetland (Fedick 1995). In 1996, I began a project to systematically record and study

Figure 8. Segment of an approximately 700-m-long rock alignment (feature 96 A-41) at the north end of the El Edén wetland.

the wetland features of El Edén and the associated ancient settlement. During the 1996 season we surveyed approximately half of the wetland and recorded 52 rock-alignment features within its main body (Figure 6). We plan to complete the survey and conduct excavations at a sample of these features in 1997. A study of ancient settlements associated with the El Edén wetland is being conducted by graduate student Bethany Morrison. Limited test excavations conducted in 1996 by Morrison at residential sites associated with the wetland indicate occupation during part of the Late Preclassic period (ca. 100 BC to AD 400), and no evidence of a Late Postclassic occupation, as is the case at Tumben-Naranjal. The dating of these residential sites is based on ceramics analyzed by Sylviane Boucher of the Instituto Nacional de Antropología e Historia, with the assistance of Sara Dzul G.

The rock alignments within the El Edén wetland vary in form in accordance with the local topographic setting and hydrology. The most prominent feature noted consists of an alignment of limestone slabs and boulders at the north end of the wetland, stretching for a distance of nearly 700 m between the west and east margins (Figure 8). The alignment traverses seasonally inundated land dominated by sawgrass and tasiste palm (*Paurotis wrightii*), crossing some areas containing calabash trees (*Crescentia cujete*). Boulders range from approximately 40 cm to 70 cm in diameter, and slabs average about 15 cm in thickness, with maximum diameters up to 115 cm. The rocks are arranged in single to double rows, with several segments of slabs remaining in upright positions, supported on one or both sides by smaller boulders (Figure 9). The rocks apparently rest on the limestone

Figure 9. Detail of an intact section of rock alignment 96 A-41.

bedrock, with immediately surrounding soils varying from 5 cm to 25 cm in depth. It is estimated that the alignment consists of over 2,000 large boulders and slabs, representing a substantial investment of labour.

North of the long alignment, as well as at the south end of the wetland, is a series of smaller alignments associated with the margins of natural depressions (10 m to 20 m in diameter) that are within the courses of shallow channels. The depressions and channels are dominated by various mixes of cattail, sawgrass, and water lily. The alignments are generally situated so as to block the lowest terrain along the depression margin (Figure 10). These alignments are constructed of limestone boulders averaging about 30 cm to 40 cm in diameter, in single to double rows, occasionally reaching two or three courses in height. Alignments also run perpendicular across the shallow channels in areas lacking depressions. These cross-channel alignments vary in width from 10 m to 66 m and are constructed of limestone boulders or slabs, ranging from about 40 cm to 70 cm in diameter.

A few alignments were recorded within swamp-forest vegetation dominated by logwood, with other trees, including black chechem (*Metopium brownei*), ya'axnik (*Vitex gaumeri*), and a wild relative of the coca tree (*Erythroxylon campechianum*). These alignments run between slightly higher bedrock outcrops and tend to be constructed of smaller rocks, averaging about 20 cm to 30 cm in diameter.

Variability of Wetlands in the Yalahau Region

Naranjal and El Edén represent two distinctly different varieties of wetlands. The Naranjal wetland rests within a relatively deep depression and is surrounded by hilly terrain, whereas the El Edén wetland is in a shallow depression that is surrounded by relatively flat terrain. As a result of the terrain, the El Edén wetland is subject to extreme fluctuations in the extent of surface area that is seasonally inundated. The narrow margin of the Naranjal wetland is seasonally inundated, but the majority of the depression remains flooded throughout the year. Correspondingly, the soils and vegetation are also strikingly different in these two wetlands. The Naranjal and El Edén wetlands represent examples along a continuum of wetland varieties present within the Yalahau region. In addition to the wetlands' inherent interest to wetland ecologists, their variety would have offered an intriguing range of possibilities, as well as challenges, to ancient Maya farmers.

Initial Suggestions for Possible Ancient Use of Wetlands in the Yalahau Region

How might the wetlands of the Yalahau region have been used by the ancient Maya? The two examples discussed here, the wetlands at Naranjal and at El Edén, indicate management strategies different from those that have been suggested for other lowland Maya wetland sites. Investigations of

Figure 10. Rock alignment (feature 96 A-42) situated so as to block the lowest terrain along the margin of a natural depression.

wetlands in the southern lowlands suggest that the most common form of wetland manipulation was channelization of the seasonally inundated margins of wetlands, with perhaps some construction of raised planting beds within permanently flooded zones. So far, neither of these management strategies is evident in the study area. In the Yalahau region, channelization of the wetland margins to facilitate cultivation would not have been practical, as the margins were for the most part either exposed bedrock or very thin soil. No raised platforms have been identified in the Yalahau wetlands, although their existence cannot yet be ruled out. The only possible agricultural features identified in the region so far are the rock alignments along the margin of the Naranjal wetland and those found throughout much of the El Edén wetland.

I suggest two possibilities for the agricultural use of wetlands in the Yalahau region. These suggestions are not mutually exclusive, and they are directed only at the conditions evident at the Naranjal and El Edén wetlands.

The first hypothetical use can be characterized as an intensive form of water-recessional cultivation. Various forms of water-recessional cultivation are known ethnographically for the Maya Lowlands (Carter 1969; Culbert 1978; Gliessman 1991; Wilk 1985). Under these cultivation systems, farmers plant in the moist soils that are exposed as waters recede along the margins of rivers or wetlands during the dry season. None of the ethnographic examples mentions intensification through the construction of rock alignments. As an intensified variation of water-recessional cultivation, the construction of rock alignments could have functioned to help retain soils and moisture, thereby increasing the productivity of the naturally thin soils and lengthening the growing season. At the El Edén wetland, crops could have been planted in sequence behind the alignments as the waters receded. According to this hypothesis, the use of wetlands at El Edén would represent an intensified form of an ethnographically known cultivation system. It should be noted, however, that unlike the extensive area of seasonally flooded land at El Edén, the relatively narrow flood-margin at Naranjal is not particularly conductive to water-recessional cultivation.

The second hypothetical use of wetlands in the Yalahau region can be termed the "fertilizer factory" method of cultivation. In 1993, several local farmers in the Naranjal area mentioned to me how people sometimes haul truckloads of muck and soil from the wetlands and deposit them in their home gardens. The wetland soils were said to be very fertile. Although I saw this as a technique that could have been used by the ancient Maya (minus the pick-up trucks), it was not until I talked with Dr. Ana Luisa Anaya, professor of chemical ecology at the National Autonomous University of Mexico, that I realized the potential significance of wetlands as sources of fertilizer. Dr. Anaya had collected and analyzed samples of periphyton from the El Edén wetland. Periphyton are complex communities of microbiota that are attached to substratums of either organic or inorganic materials. Periphyton communities consist of algae, bacteria, fungi, and animals, along with organic and inorganic detritus (see Wetzel 1983). Periphyton represent a vital component of freshwater wetland ecosystems, providing the main source of food for many grazing herbivores, and contribute significantly to the cycling of nutrients, particularly nitrogen and phosphorus (see Batzer and Resh 1991; Doyle and Fisher 1994; Grimshaw et al. 1993; Lamberti et al. 1989; Lane 1991; Marks and Lowe 1989; Mulholland et al. 1994). Dr. Anaya's (1995) analyses indicate very high levels of phosphorus, nitrogen, and organic matter, as well as a high cation exchange capacity – all indicators of high fertility from the perspective of plant growth. Moreover, phosphorus is the primary limiting nutrient for agriculture in the Yucatán Peninsula. Thus, the periphyton may represent a formerly unrecognized (by modern researchers) source of natural agricultural fertilizer that may have been exploited by the ancient Maya. The extensive, thick, and fast-growing periphyton could have been harvested as the waters receded and transported to nearby intensively cultivated gardens. The rock alignments at El Edén could have functioned to retain water longer into the dry season, thereby increasing periphyton growth and facilitating its collection from behind the rock-alignment dikes. The alignments around the margin of the Naranjal wetland could have functioned in a similar manner, and the thick organic deposits within that wetland may prove to be comparably high in nutrients. If periphyton and associated soils were transported to upland gardens, I would anticipate that these gardens would be nearby.

Suggestions for Testing the Hypotheses

How can these two hypotheses be tested archaeologically? Pollen and phytolith samples from the wetlands may provide some support for intensified water-recessional cultivation, but there is always the possibility that such plant materials were washed down into the wetlands from fields and gardens in the surrounding uplands. Cultivation experiments may at least test the plausibility of the water-recessional cultivation hypothesis. There is, however, a direct way to test the fertilizer-factory hypothesis. Wetlands contain assemblages of small freshwater organisms that would not live in well-drained upland environments and are unlikely to be transported from the wetlands into upland settings except if humans were to move wetland soils for fertilizer. These wetland organisms include ostracodes (minute crustaceans), small molluscs (snails and clams), and charaphytes (green algae that produce calcium carbonate shells). Remains of these organisms preserve in the archaeological record (e.g., Miksicek 1989; Palacios-Fest 1989), and, if recovered from upland home-garden contexts, may indicate ancient transport of periphyton or wetland soils.

Other Possible Uses of the Wetlands

In addition to the potential agricultural uses of the wetlands, the recorded features may be related to the management of a number of edible wetland resources. The most abundant of these resources are cattails, blue-green algae, and apple snails (*Pomacea flagellata*). The cattails that grow abundantly within the deeper areas of the wetlands represent a potentially significant food source. Cattails are referred to as "probably the most famous of all the edible plants of the Northern Hemisphere" (Harrington 1967:220); virtually all parts of the common cattail are edible and are used as food in many parts of the world (Morton 1975). The cattail rootstock or rhizome in particular is highly nutritious, containing as much protein as maize and more carbohydrates than the potato (Morton 1975:23). Blue-green algae, a major component of the periphyton of the Yalahau wetlands, is another potential food source worth considering. A number of blue-green algae species are known to have been used as a food by the Aztec and Inca peoples of the Americas (Coe 1994:100-101, 186). The apple snail, a large, edible, freshwater snail, is abundant in the Yalahau wetlands and is known to have been a significant food source to the ancient Maya (e.g., Andrews 1969; Moholy-Nagy 1978). All these resources – cattail, blue-green algae, and apple snails – are responsive to varying hydrologic regimes. Manipulation of hydro-period and water depth may have been accomplished through construction of features such as those found in the Yalahau wetlands.

Conclusion

The extensive wetlands of the Yalahau region represent a unique and potentially significant resource zone that may have been significant to ancient Maya subsistence. So far, only two of the dozens of wetlands of the region have been investigated, and both of these have evidence of ancient Maya manipulation. Field research currently underway will help clarify the use and dating of the rock alignment features that have been recorded in the Naranjal and El Edén wetlands. Field investigations so far suggest that occupation of the Yalahau region, and use of the wetlands, dates primarily from the Late Preclassic to Early Classic periods, about 100 BC to AD 400. At Tumben-Naranjal, occupation and possible use of the wetland is also evident for the Late Postclassic period, about AD 1250 to AD 1520. Several potential uses of the wetland have been suggested, including cultivation of domestic crops, harvesting of periphyton for fertilizer, and manipulation of wetland microenvironments to increase production of naturally occurring edible resources.

In conclusion, I reiterate that we will understand ancient Maya wetland cultivation systems only when we strive also to understand the complex and varied ecosystems of the region's wetlands. The wetlands of the Yalahau region are not like the riverine-associated swamps of northern Belize or the *bajos* of the Petén in Guatemala. Nor are wetlands within the Yalahau region alike; a great deal of ecosystem heterogeneity is evident. The true accomplishment of ancient Maya agriculture lies not in a uniform, monolithic system of cultivation but in the local agricultural variations within a complex and varied landscape.

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