
3 **SUSTAINABLE LEGACIES OF THE PRECERAMIC ARCHAIC MAYA: RESILIENCY STRATEGIES FOR ENVIRONMENTAL AND CLIMATIC CHANGE**

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The ancient Maya were masters at modifying landscapes to meet their settlement and subsistence needs. And, while many of the largest-scale adaptations were built during the Formative and Classic Periods, there is growing evidence to suggest that preceramic Archaic Maya populations also shaped their physical surroundings on a large but sustainable scale to achieve particular goals. In this paper, we highlight new research carried out by the Belize River East Archaeology (BREA) project indicating that not only were Archaic hunter-gatherer-fisher groups constructing and maintaining large-scale fish trapping structures in seasonal wetland environments, but they were also targeting so-called marginal landscapes like scrub forest, savanna, and pine ridge for a number of lucrative food and non-food resources. Part of this more intensive engagement with the landscape appears to have been catalyzed by increasingly dry conditions beginning ~4200 BP/2200 BCE and lasting about three centuries. Apart from presenting recent research that is expanding the temporal horizons of the sustainable legacy of the ancient Maya and their predecessors, this paper also problematizes how archaeological research can identify strategies of resilience among assemblages of Archaic Maya hunter-gatherer-fisher-emergent horticulturalists in the face of environmental and climatic change.

Introduction

The topic of sustainability—and more importantly, sustainable practices—is currently of great interest to social science researchers of both present and past communities. Before delving into these considerations, however, we want to establish a few key definitions. As defined by the U.S. Environmental Protection Agency, sustainability refers to the fact that “everything that we need for our survival and well-being depends, either directly or indirectly, on our natural environments. To pursue sustainability is to create and maintain the conditions under which humans and nature can exist in productive harmony to support present and future generations” (United States Environmental Protection Agency 2024). We underscore the nature/culture divide that is inherent in this statement. It juxtaposes us (humans) with the natural environment(s); these are dualisms that may, or may not, have been present in the past.

Resiliency is another term that has recently become popularized in anthropological circles and has been applied to social problems writ large. It has been defined as “the ability to recover from expected and unexpected situations, stresses, or threats in order to sustain, thrive, and to move on” (Eitel 2023). Ten years ago, a set of renowned archaeologists wrote that studies of cultural resilience and persistence (in addition to complexity, mobility, cognition and identity, and human-environmental interactions) were some of the

grandest challenges still facing archaeological study today (Kintigh et al. 2014:879).

We evoke this literature as a caveat to the ensuing argument, which posits that the ancient Maya and their predecessors developed and honed what appear to be sustainable survival strategies. However, we recognize that these past communities had different cosmologies and understandings of their role in world, and how they thought about landscape or environment may be unknowable or inconceivable to us today. Therefore, we must approach any conversation about past sustainability or resiliency strategies carefully and with awareness of these concerns.

Situating the Study in the Challenges of Today

The summer of 2024 challenged Belizean resiliency in unique ways. The month of May was extremely hot and dry, full of smoky skies, roadside fires, and electrical blackouts. The village of Crooked Tree—home base of the Belize River East Archaeology (BREA) project—sustained some fire damage, most notably to cashew trees which are a very important cash crop in the local economy. But that was nothing in comparison to the thousands of acres that burned throughout the country, leading to millions of dollars in lost property, agricultural products, and carbon credit, not to mention the effect of compromised air quality on the health of Belizeans. Wildfires presented a threat to many of Belize’s archaeological parks -- parts of Altun Ha were scorched,

although fire lines prevented the central portion of the reserve from burning. News5Belize reported online that “environmentalists were calling this one of the most severe heatwaves the country had ever experienced” (New5Belize 2024).

Belizeans persevered in the face of these environmental challenges, by rallying to mitigate the effects of fire and drought and assisting neighbors and communities hardest hit. Conversations at local, district, and national scales debated how best to recover, rebuild, replant, and importantly, prepare for future such crises. Prime Minister John Briceno weighed in on the issue, stating “We are examining how to restructure our firefighting efforts from the ground up, emphasizing community-level training and preventative measures such as controlled burning” (Palacio 2024). Merely a month after the worst of the fires, Belize faced a potential direct hit by Hurricane Beryl that, while ultimately shifting course, showcases the variability and rapidity with which these weather-related threats emerge, and the high degree of flexibility required of inhabitants to prepare and adapt.

The conditions of last summer highlighted the resiliency of modern Belizeans and caused us to wonder how people in the past may have dealt with similar weather-related threats. Thus, we now turn our lens backward ~4000 years, to consider some of the sustainability and resiliency strategies practiced by Late Archaic (3400–1200/900 BCE) groups in Belize, in the face of prolonged (~300 year) drought that occurred in the middle of the period (c. 2200–1900 BCE). The impact of this xeric (dry) event has been gathered from various places on the globe, including the Mediterranean Basin, the Levant, Siberia, China, and India (Booth et al. 2005; Rosenswig 2015; Thompson et al. 2002; Weiss 2016; Weiss et al. 2001). Archaeologists have written about the event being a possible catalyst for behavioral change in Mesoamerica: along the coast of Chiapas, scholars (Kennett et al. 2010; Neff et al. 2006a; 2006b) describe elevated levels of charcoal during this period, which may have been caused by an increase in natural forest fires, anthropogenic burning to attract certain species and rejuvenate others, and/or for swidden agriculture. In Northern Belize, Rosenswig (2021:461) proposes that “the so-called 4.2 ka B.P. event was the ultimate cause

of increased sedentism and the first adoption of ceramic containers in a limited number of regions of Mesoamerica.”

Preceramic Resiliency

The Preceramic was a long period upwards of 10,000 years in length, but here we focus on the most recent subperiod, the Late Archaic (3400–1200/900 BCE), which is further subdivided into the Early Preceramic (3400–1900 BCE) and the Late Preceramic (1500–900 BCE; Lohse et al. 2006: Figure 3; Stemp et al. 2021: Figure 2). The people who inhabited northern Belize at this time were mobile, moving their residences multiple times per year (Brouwer Burg and Harrison-Buck 2024; Brouwer Burg et al. 2023). They subsisted on seasonally abundant resources that were either caught or collected, and some people were beginning to experiment with horticulture – growing wild plants in places or times when they might not otherwise grow. In southern Belize, Kennett, Prufer, and colleagues demonstrated through isotopic dietary evidence that maize became a staple component of the diet after 4700/4000 cal BP (~2750–2050 BCE; Kennett et al. 2020:1). In the Freshwater Creek drainage, Rosenswig and colleagues found the starch grains of maize and other domesticated crops (i.e., chili pepper and manioc) on stone tools, dated by association to somewhere between 7000- and 5000-years BP (~5000–3000 BCE; Rosenswig et al. 2014: Table 1). Stemp and others have highlighted a corollary shift in lithic tool production around 2000/1900 BCE, when bifacially worked points like Lowe, Sawmill, and Allspice, along with pointed unifaces and small blades, were exchanged for constricted adzes (Stemp et al. 2021: Figure 2). Microwear studies reveal these adzes were used on wood and soil, indicating they were used in forest clearance and early horticultural activities (Gibson 1991; Iceland 1997, Stemp and Harrison-Buck 2019).

In our study area—situated around the Crooked Tree Wildlife Sanctuary (CTWS) and less than 50 km from the Freshwater Creek drainage—we do not have conclusive evidence of early plant cultivation. What we do have is an abundance of data suggesting that Late Archaic groups made use of the many microenvironments present in this part of Belize, centered around the rich and ecologically diverse wetlands of the CTWS. The area around the CTWS (Figure 1) contains

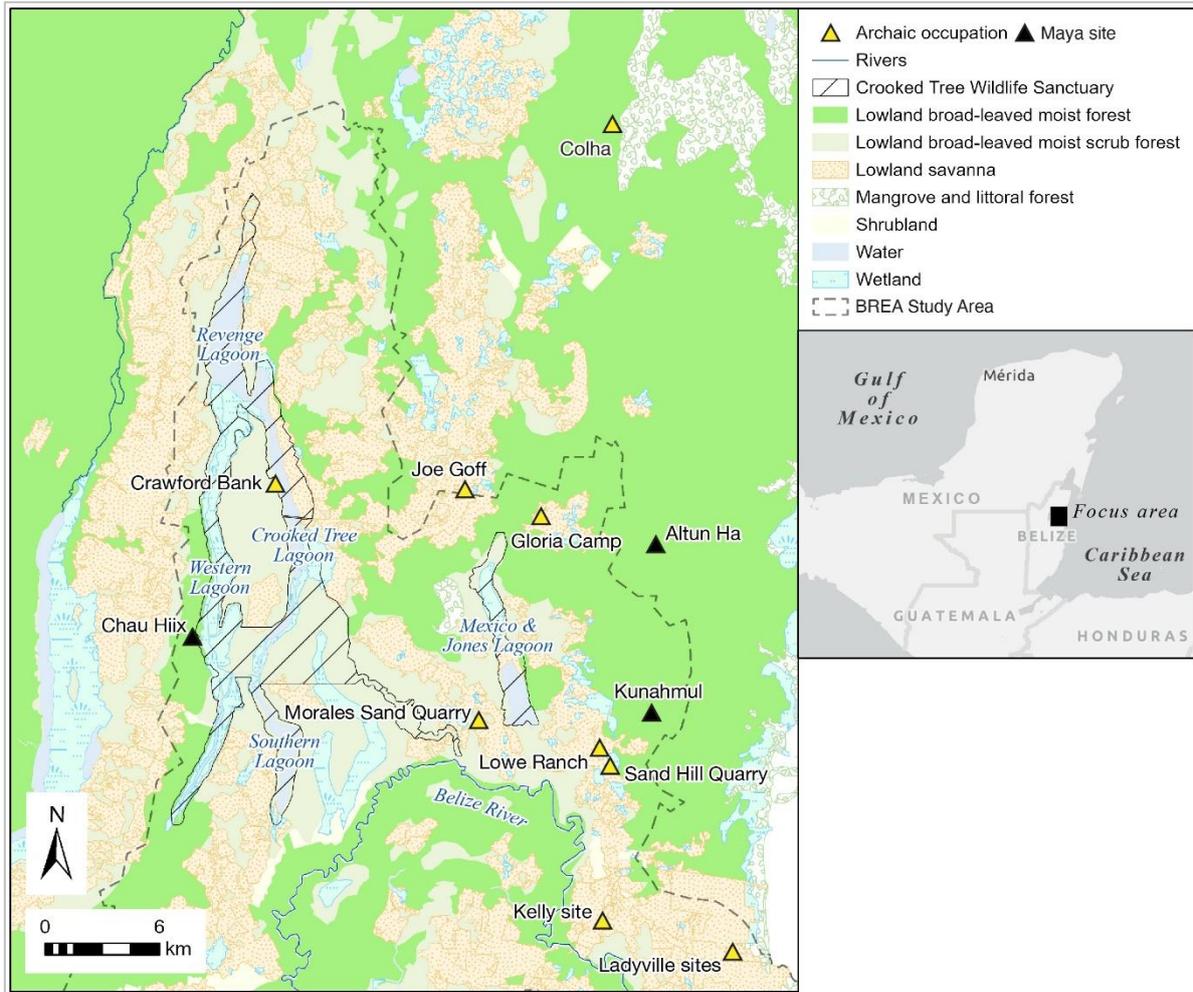


Figure 1. Ecosystems in the vicinity of the Crooked Tree Wildlife Sanctuary. Adapted from Brouwer Burg and Harrison-Buck 2024

or is adjacent to six different ecological zones, including lowland broadleaf forests, savanna, mangrove swamp, shrubland, wetlands and riparian zones, as well as open freshwater systems and coastal systems (Brouwer Burg and Harrison-Buck 2024). We speculate that living within the CTWS would have provided hunting-gathering-fishing-emergent horticultural groups with a plethora of possible locations to gather food and non-food resources. We collated a list of some of the resources available in each of these ecosystems during different times of year (Table 1). What is noticeable is that even in so-called marginal landscapes (e.g., savannas, shrublands, and mangrove swamps), a wealth of resources can be found if you know where to look and how to get those things.

Marginal landscapes, especially savannas, have remained largely underexplored as productive ecosystems—often treated as

terra nullius or ‘no-man’s’ land—either today or by researchers of the past. However, savannas act as wild game refugia in the dry season, and a number of useful woody tree species grow there (such as calabash, craboo, plum, and palmetto). Additionally, amaranth (a pseudocereal, seed producing plant with pretty red and magenta flowers) thrives in savanna heat and is drought resistant, making it heartier than maize (Nowell 2021). This plant, which is indigenous to Mesoamerica, can grow in savannas, as it prefers well-drained, acidic sandy soils. The seeds of amaranth are an excellent source of dietary protein and the leafy green parts can be eaten raw or cooked and supply iron, calcium, beta carotene and vitamin C. Amaranth seeds can also be popped, roasted, flaked, or extruded for consumption (Capriles et al. 2008:H160).

The Aztec and ancient Maya revered amaranth and consequently, Spanish

Table 1. Ecosystems and Associated Resources, Activities, and Seasonal Uses. Adapted from Brouwer Burg and Harrison-Buck 2024

Ecosystem type	Available resources	Activities	Seasonal use
Lowland broadleaf moist forest and Lowland broadleaf moist scrub forest	Deer, tapir, howler monkey, small mammals, rodents, forest fruits/nuts/seeds, medicinal plants, building materials, firewood	Hunting, gathering	Year-round, hunting most fruitful in wet season, especially in elevated locations
Lowland savanna and Shrubland	Deer, small mammals (peccary, gibbon, armadillo, etc.), cohune nut, calabash gourds, craboo, non-food materials like pine and palmetto for building	Hunting, gathering	Year-round, resources fluctuate
Mangrove swamp	Aquatic/wading/shoreline birds, occasional manatee, some small mammals, fish, crustaceans, reptiles (turtles, lizards, eels), amphibians (frogs, toads), mollusks	Limited hunting, fishing, collecting	Year-round, sparingly
Open water (rivers, streams, lakes, ponds, and lagoons)	Various fish species (snook, tarpon, catfish), occasional manatee, mollusks, crustaceans, gastropods, bivalves, water-growing plant species, aquatic/wading/ shoreline birds	Fishing, birding, collecting	Year-round, emphasis on dry season
Wetlands and Riparian (edges of wetlands and water)	Logwood and Guanacaste wood, periodic large and small game, aquatic/wading/shoreline birds, reptiles, amphibians, mollusks, gastropods, bivalves, crustaceans	Birding, collecting aquatic species, procuring hardwoods, shoreline fishing	Year-round, emphasis on dry season

conquistadors outlawed the growing of it. As recently as the Guatemalan civil war (1960s-1990s), many fields of amaranth were burned as a visible warning to rebellious indigenous groups. Even so, people continued to grow the plant and preserved the seeds in secret. Some K'iche' Maya women reportedly stowed amaranth seeds in glass jars under floorboards and in fields for safe keeping (Nowell 2021). Today, amaranth is making a comeback as a sustainable crop that can be easily grown in savannas, especially among small-scale, agricultural co-ops led by women in Guatemala, Mexico, and the United States. To test whether savannas were being used for these kinds of sustainable horticultural practices during the Late Archaic, we constructed a multi-criteria model of Archaic land use and homed in on areas where a number of important resources were available from a savanna landscape, as part of the Northern Belize Archaic Adaptive Strategies—or NBAAS—subproject (see red areas in Figure 2). Perhaps

not coincidentally, a couple of well-known Archaic occupations (Lowe Ranch and Sand Hill Quarry) are also located in such environments. These occupations were investigated in the early '80s by Richard S. MacNeish and colleagues and formed a foundational body of knowledge about the Archaic that we are continuing to build upon (MacNeish 1981, 1982; MacNeish and Nelken-Terner 1983; MacNeish et al. 1980; Zeitlin 1984).

We identified another area of high suitability for savanna living to the west of the northern highway in Gardenia. Our reconnaissance and survey efforts were most fruitful at the Morales Sand Quarry, which has been in operation for the last 30 years. While much of the landscape is pockmarked with former bulldozer scrapes, pits, and sandy outwash, there are still pockets of ground that remain untouched (Figure 2, C). The exposed sand on the left is where mechanical excavation was carried out some 10 years ago. Since then,

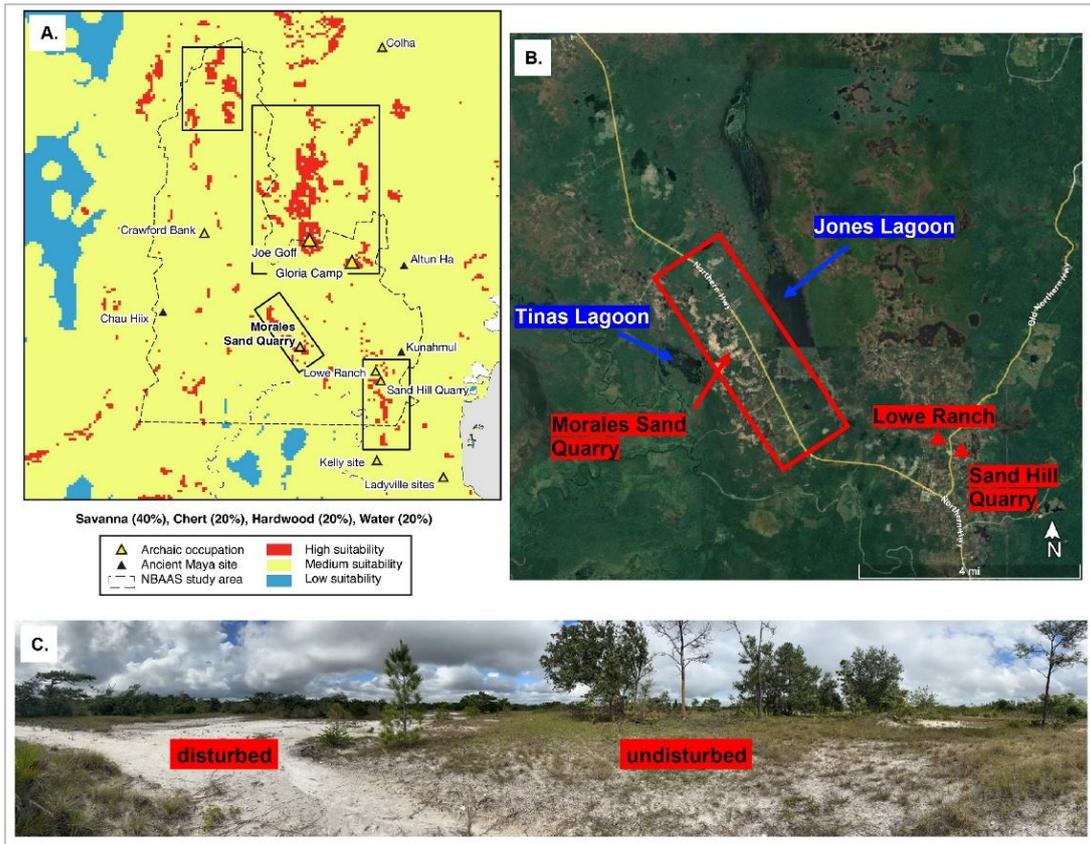


Figure 2. A) Savanna Suitability with Archaic Occupations Indicated; B) Location of Morales Sand Quarry in Relation to Nearby Waterbodies and Late Archaic Sites; C) Panoramic photo of Morales Sand Quarry. Photo by M. Brouwer Burg.



Figure 3. Late Archaic Artifacts from Morales Sand Quarry. A) Ground Stone Bowl Fragment; B) Ground Stone Palette; C) Lowe Point; D) Ground Stone Bowls from Crystal Auto Rental. Photos by M. Brouwer Burg

many heavily patinated chert artifacts have washed out onto the ground surface. To the right of the image is an undisturbed area where mature pine and oak are growing. Since this area appeared to be relatively undisturbed, we carried out a shovel test pit campaign to reveal artifact locations and densities.

A number of Late Archaic-like artifacts have recently been recovered by workers at the Morales Sand Quarry, including a stone bowl fragment, a ground stone slab, and a complete Lowe Point (Figure 3, A–C). While Lowe Points have recently been dated as early as 10,000 cal BCE (see Prufer et al. 2019; cf. Lohse 2020), the co-occurrence of this point with ground stone fragments similar to those identified by MacNeish in the 1980s suggests a robust Early Preceramic (c. 3400–1900 BCE) assemblage.

To better understand the paleoenvironment of this location, we collected geologic sediment cores. The collected sediments are extracted and preliminarily described in our field laboratory, and then exported to the Beach Lab at the University of Texas-Austin where Dr. Samantha Krause will carry out or prepare the sediment for further analysis on isotopes, charcoal, pollen and c-14 dates. These sediments provide evidence about the timing and tempo of wetland formation, and the composition and character of the broader landscape and climate during the Late Archaic period.

During our preliminary investigations at the Morales Sand Quarry this summer, we exposed a dark lens of charcoal, lithic debris, and hardened clay at about 50 cm below surface. The lens was only a few centimeters in thickness, and while we hoped it would return Late Archaic radiocarbon dates, it dated to the Late Classic I (1370 +/- 30 BP or 600-690 cal AD; ICA ID: 14C-8968). While disappointing, the date from this hearth feature indicates that stratified deposits are present in this area and future work will focus on deepening excavations into older layers.

We also identified two intact ground stone bowls—similar in shape to those found at the Morales Sand Quarry—at the Crystal Auto Rental main office in Belize City (Figure 3, D). While the owners could not provide information as to the find location of the bowls, they permitted us to scrape the specimen to extract starch grains. As mentioned above, similar ground stone bowls were found by

MacNeish and team in the early 80s in the vicinity of Ladyville and Sand Hill and were attributed to MacNeish’s Belize Phase (5500–4200 BCE).

In consultation with Dr. Keith Prufer, whose team had extracted starch grains from ground stone tools in southern Belize, and following Piperno and Holst’s (1998) methodology, used deionized water, sterile toothbrushes, pipettes, and vials to collect a handful of samples. We are hoping that some of these samples might return positive residue evidence for amaranth or savanna ground foods like manioc. Amaranth starch grains are readily distinguishable from other starch grains – the seeds are polygonal in shape, tightly packed, and are exceptionally small in size (e.g., from 1–5 micrometers long; Lopez et al. 2014:290). Not much has been published about amaranth starch grains from Latin America archaeological contexts, which may be related to its very small size. Additionally, any processing carried out on the seeds post-harvest (such as grinding or cooking) can lead to modification of its diagnostic features (Lopez et al. 2014:290). Starch grains extracted from hand stones from central Argentina revealed that “the genera were incorporated into the subsistence c. 4700 BP, being cultivated since 3600 BP (Lopez et al. 2014:292).”

Large-Scale Fish Trapping Facilities

The last case study we will discuss here describes evidence of sustainable landscape modifications begun in the Late Archaic and persisting into the Maya period. K. Anne Pyburn observed already in 2003 that the Classic Maya of Chau Hiix created complex hydrological features in the Western Lagoon to modulate water flow in and out of the system (Figure 4). Pyburn mapped a number of what she termed canals, dams, dikes, and wells, and argued that these features “probably functioned to regulate the rate and timing of seasonal inundation and subsequent drainage of the lagoon and adjoining fields (Pyburn 2003:125).” Pyburn’s interpretation of these features were that they functioned primarily to supply water for raised agricultural fields and pot irrigation.

In the last eight years, the BREA team has revisited this area and examined these wetland features using drone-based photogrammetry (Willis and Murata 2018) and satellite imagery (courtesy of Google Earth). To

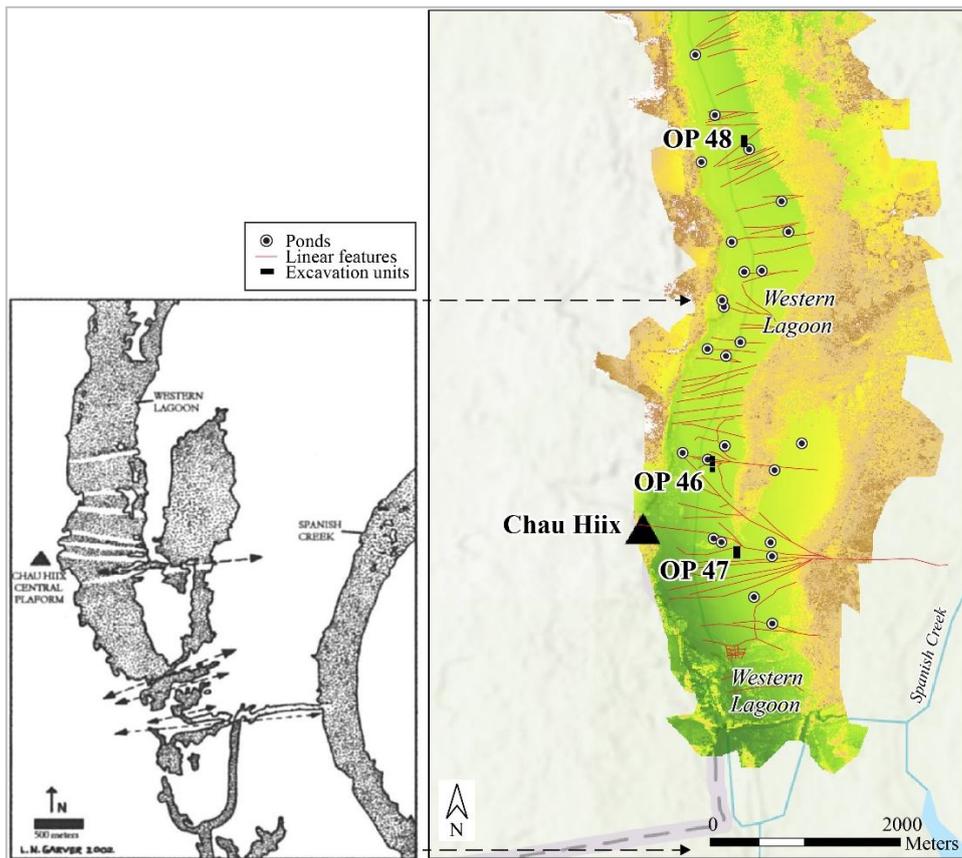


Figure 4. Linear Wetland Features in Western Lagoon. Left: Image from Pyburn 2003:Figure 4. Right: Photogrammetry-derived DEM with Canals and Ponds Overlain on Western Lagoon.



Figure 5. Fish Weir Correlates from A) Zambia; B) the Bolivian Amazon; and C) Western Lagoon. Adapted from Harrison-Buck et al. In Press.

Pyburn's original 11 canals, we have added over 150 additional linear features and have mapped a number of corresponding ponds (Figure 4). The linear, zigzagging features span an area over 40 km². Three test excavations were carried out (operations 46, 47, and 48) and a number of sediment cores have been collected in and around Western Lagoon (Brouwer Burg et al. 2023:45-97; Krause et al. 2020; Krause et al. In Press; Harrison-Buck et al. 2020; Harrison-Buck et al. In Press; Figure 5). A set of 26 radiocarbon dates from stratified contexts have been analyzed, revealing that the initiation of the canals or channels occurred in the Late Archaic (c. 2000 BCE/4000 BP), in the middle of 2200–1900 BCE dry event (see Harrison-Buck et al. In Press:Table 2). It seems, then, that the construction of these channels for fish procurement may have been an important resiliency strategy developed by hunter-gatherer-fishers in this part of northern Belize, in the face of drought and dwindling resources in previously rich ecosystems.

We found two compelling examples for archaeological and ethnographically documented correlates for these kinds of wetlands canals: from present day fish-trapping facilities found in Zambia, Africa (McKey et al. 2016); and from Pre-Colombian fisheries documented in the Bolivian Amazon (Blatrix et al. 2018; Erickson 2000; Figure 5). In both of these cases, wetland canals function to channel biannual flood waters into holding ponds, trapping the fish in the ponds as the flood waters recede. Based on the functional similarities between the Western Lagoon linear features and these examples, we suggest that rather than being used primarily to supply water for agriculture, they were intended instead for fish trapping.

Combined with the radiocarbon dates, this data indicates that the construction of these wetland features—begun during the Late Archaic period, perhaps as a drought-driven resiliency strategy—continued to be used into Preclassic Maya times as a way to secure a reliable, seasonal source of protein in the form of fish and other aquaculture (e.g., turtles, mollusks, etc.). Given the length of the features, we estimate that upwards of one million kg of fish could be produced in this lagoon, which is certainly enough fish to feed the purported population of 25,000 people that inhabited Chau Hiix during its apogee (Harrison-Buck et al. In Press:15). Thus, while

we tend to think of agricultural intensification as a necessary requirement for the development of complex society, this evidence suggests that bulk harvesting of aquatic resources could also have provided the dietary foundation upon which Preclassic populations could flourish. To underscore this point further, pollen collected from the core sediments in Western Lagoon have yielded no evidence of early cultigens like maize or manioc in the vicinity (see Harrison-Buck et al. In Press:Figure 8, Figure S7). What is present in appreciable amounts are grasses, including elevated amounts of *Amaranthaceae* in the Late Archaic.

In conclusion, while the ancient Maya have received much attention for their large-scale landscape management practices, their preceramic, Late Archaic ancestors were also planning, organizing, and executing broad earth moving activities by about 4000 years ago (~2000 BCE). This is not so surprising when we consider that by 900 BCE, multiple millions of tons of cubic sediment were moved in preparation for the construction of the Early Preclassic city of Cival (Estrada-Belli 2011:80). Thus, when thinking about sustainable and resilient ways of dealing with changing climate and landscape, credit must be accorded to the Late Archaic groups living during the 2200–1900 BCE dry event. It was during this time that new landscape modifications were developed at a scale not seen before in this part of the world, setting the scene for greater production of and reliance on aquatic resources. This evidence, paired with that of pre-agricultural cultivation in Northern and Southern Belize, indicates that the period leading up to the emergence of the Early Formative Maya was a time of regional experimentation and technological innovation that would provide a sustainable subsistence foundation for generations to come.

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