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from multiple perspectives within and beyond the academy.

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The cover image is a view of the Chixoy River, Guatemala. Image courtesy of Brent K. S. Woodfill.

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INTRODUCTION

INTRODUCTION TO ISSUE FOURTEEN

By Patrick Nunnally, Editor

Climate change has virtually exploded as a subject of news reports, scientific analysis, and advocacy attention in the past six months. In November, the United States Global Change Research Program released its Fourth National Climate Assessment. And this spring, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) released its finding that a million species are threatened with extinction. These attention-grabbing headlines have overshadowed the long-standing debates about the relative importance of mitigation and adaptation.

What has been missing, though, is a systematic look at how human societies have adapted themselves to living in a particular place over a very long period of time—centuries, if not millennia. Archaeologists, scientists trained to discern

patterns of past cultural life from extant material fragmentary evidence, have unique windows into how societies such as the Maya or the groups that peopled Southeast Asia lived with, adapted to, and even altered the biological and physical systems of a particular region.

As it happens, we at *Open Rivers* know some archaeologists who were very agreeable to guest editing this issue of the journal on Climate, Change & People. We wanted to bring to the fore questions of how people have adapted to changes in their environment over a long duration of time. The guest editors' introduction, written by Lewis C. Messenger Jr. and Brent K. S. Woodfill, contains a clear description of what they intend with the various components of the journal. No single volume or collection can be comprehensive, of course, and this issue makes no pretense to very



From “Libraries Burning,” this issue. The settlement of Kangeq in Southwest Greenland was abandoned in the 1970s. The site has been occupied for thousands of years. Photographer Jørgen Hollesen, National Museum of Denmark. Used with permission.

broad coverage of adaptation strategies or even an inclusive regional sensibility that addresses all parts of the inhabited earth. We hope that readers interested in these subjects will pursue their own leads.

One piece in this issue falls outside the Messenger/Woodfill purview, which addresses climate change directly, but we thought it complemented the issue's other pieces by centering artistic expressions in response to the landscape. We republish an exhibit review of *Desert River Sea: Portraits of the Kimberley* that describes and illustrates a number of stunning works of

art that come from deeply intimate engagement with the landscapes of northwestern Australia. Although climate change is not explicitly mentioned in the review, changing patterns of biological and physical systems, and human adaptation to them, are ever-present in these works.

I am convinced that climate change, and the impacts it brings, will be part of our culture for the foreseeable future. I hope we can learn from the examples of people who have lived in place for time periods we can only imagine.

Happy reading.

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About the Author

Patrick Nunnally coordinates the River Life Program in the Institute for Advanced Study at the University of Minnesota. He serves as editor for *Open Rivers* and was one of the lead scholars for the University's John E. Sawyer Seminar, "Making the Mississippi: Formulating New Water Narratives for the 21st Century and Beyond," funded by the Andrew W. Mellon Foundation.

INTRODUCTION

GUEST EDITORS' INTRODUCTION TO ISSUE FOURTEEN : CLIMATE, CHANGE & PEOPLE

By Lewis C. Messenger Jr. and Brent K. S. Woodfill

Thinking about Climate Change in the Past and Present

Archaeologists, by definition, are interested in using various techniques to learn about the human experience in diverse places, from ancient through contemporary times. Understanding the past environments that humans shared has

meant that archaeologists must integrate fields such as geology, botany, paleoecology, and so on. Increasingly, recognition of the importance of incorporation of Indigenous voices has led to their inclusion in archaeological projects. A



View of the Chixoy River, the Tortugas salt dome, and the Nueve Cerros ridge in 2018. This part of Guatemala was covered in lush forest for over a millennium between the Classic collapse and the land initiatives of the 1980s. Image courtesy of Brent K. S. Woodfill.

common theme throughout all of this integration has been understanding human adaptation to diverse environmental and climatic changes over time, and for archaeologists, the long arc of human existence refers to at least around three million years.

Throughout much of the history of the discipline of archaeology, and the broader one of anthropology as well, it has been primarily centered on academia. The editors of this introduction are both archaeologists and have witnessed an increasing awareness within the academic community of the realities of the impact of global climate change. Messenger was instrumental in developing a session at a major national archaeological conference focusing on bringing perspectives on climate, human societies, and adaptability to changing environments into college classrooms. Woodfill was one of the discussants of that session, and a number of the contributors to this issue of *Open Rivers* were also presenters.

The Articles in this Issue

We handpicked the authors of this special issue and received an impressive array of perspectives and regions that coalesce among three primary topics. The first focuses on the ability of scientific research—archaeological and beyond—to reveal just how different the world has been at different

Advances in Scientific Knowledge

Several columns and features focus on the ways that advances in technology and science offer new insights into the ancient world and climate change, then and now.

Lewis Messenger's illustrated feature, "Uncovering Amazonia," forces the reader to rethink the Amazon, which for centuries has defined "untouched wilderness" in the Western mind. Instead, archaeologists have given credit to ancient Amazonians and early explorers alike,

Global climate change has been a known fact for scientists for a very long time. Understanding the subtleties of it, the detailed mapping of it over time, and especially the causal dynamics of it, is something that only relatively recently we have come to appreciate more closely. The relationship between us, *Homo sapiens*, and those dynamics, has only quite recently become part of global conversations, ones that are often quite contentious.

Today, among the global community of scientists, we see that those conversations have taken a new turn from a recognition of global change to accelerated global warming, and the primary causal agent turns out to be us. In terms of the scientific community, it no longer is a contentious debate (even though there are yet some who would deny that). It is happening, and those gathered together have brought "to this table"—for this issue of *Open Rivers*—a number of diverse perspectives that can help us understand how we know what we know, and why we might want to care.

times in history. The second concerns approaches to spreading our knowledge and models to the larger public, and the last is focused on understanding other approaches to environmental conditions and dealing with the effects of climate change globally and locally.

detailing a vast swath of the South American continent that humans transformed to accommodate a series of complex societies that survived and luckily were witnessed by explorers at the beginning of the early colonial period. Messenger aims to inform a broad audience about the ancient past of the region and to address some of the generalizations and misunderstandings about it as well, ranging from the original discovery by Europeans to issues of understanding of future sustainability for the region. While it is true that

there may be many people who still think that the Amazon, and hence its Indigenous peoples, could never have developed anything even close to what most would call “civilization,” there is a considerable academic community that thinks otherwise. There are now many academic institutions in Amazonia, speaking Portuguese, Spanish, French, and a few who speak English, conducting research and publishing to that effect. The Amazonian drainage system goes beyond the boundaries of Brazil. Its geography is vast, internally varied, has intriguing histories, and hopefully this feature will whet your intellectual appetite a bit.

New visualization techniques have revolutionized contemporary understanding of the ancient world. At the same time, they have created an avalanche of new data that will take years for us to fully understand. Lidar (Light Detection and Ranging) uses lasers that can pierce dense forest canopies to scan the surface of the earth, and as such has been used to great success in the Maya world. The piece by Mary Jane Acuña and Carlos R. Chiriboga shows how the new visualization techniques that lidar makes possible can provide us with a glimpse into a radically different environment. Although today the southern lowlands are a muggy swampland, during the apogee of El Tintal, Guatemala, the area was full of lakes providing a rich bounty of water and other resources that disappeared around the 3rd century A.D.

We will return to Alexander E. Rivas and William G. B. Odum’s piece below, but the authors weave

Scholarly Outreach to the Public

Brent Woodfill and Patrick Nunnally both take on different sides of the same issue—how to bring knowledge out of the academy and inform discussions about human-caused climate change. As is evinced by the articles discussed above, archaeologists spend a lot of time discussing human modifications of and adaptations to the environment, and modern climate change is a

together cutting edge archaeological research into water management strategies by the ancient Maya of Salinas de los Nueve Cerros, Guatemala with a nuanced investigation into those of the contemporary Q’eqchi’ living and farming in the ruins of the city. Regardless of the time period, the residents of the Nueve Cerros area live on a complex and ever-changing hydrological system that includes countless fresh water and brine springs and swamps. The area is crosscut by a segment of the largest river in Mesoamerica that regularly rises and falls over 10m, as does the water table. The ancient inhabitants were dependent on a stable source of water for drinking, agriculture, cooking, and myriad economic activities, and they were able to buffer against this instability through the construction of a complex water catchment system, some of which is still in use today.

In the Geographies column, “Libraries Burning,” Phyllis Mauch Messenger looks at the impact of climate change on archaeological and heritage sites in the Arctic region. Just as new analysis techniques are providing increasingly rich results and evidence from archaeological sites is becoming recognized as a “distributed observing network of the past,” the sites themselves are being destroyed by melting permafrost, flooding, and increasingly violent storms. Archaeologists and other scientists, realizing the extent and urgency of the threat, liken it to the burning of multiple libraries of Alexandria.

massive elephant in the room. We suggest that archaeology offers a way to think critically about the past and present, without dividing them into two separate cognitive frameworks.

Woodfill follows up on this point by expressing his frustration with the term “Anthropocene” that has become popular in acknowledging the central

role of human action in driving global climate change. He does not deny human causality, but points out that humans have long had significant local and global environmental effects, beginning at least with the agricultural revolutions that blossomed in the Old and New Worlds. The term Anthropocene is, thus, erroneous, and perpetuates a sense in the West that we are both the pinnacle of human society and a stand-in for the species as a whole. As a result, he argues for the term “Capitalocene,” which is both more honest and less nihilistic, since the problem is not the species but the proliferation of a specific economic system throughout the globe.

Indigenous Perspectives on the Environment

Water management and the disproportionate impact of climate change and industrialization on Indigenous communities is woven throughout the three articles that focus on Indigenous perspectives of the environment. Tianna M. Odegard documents multiple generations of her Dakota community’s adaptations to survive in a landscape hovering on catastrophe. Both the members of Upper Sioux Community, Minnesota (discussed by Odegard) and the Q’eqchi’ Maya of the Lachua Ecoregion, Guatemala (discussed by Rivas and Odum) are located in marginalized, highly polluted regions subject to extreme flooding, illnesses caused by *E. coli*, pesticides, and other toxins. This has spurred profound transformations in the way Indigenous people in these places live their lives and interact with their respective environments.

However, as both of these pieces make clear, these damaged landscapes were able to support thriving populations as recently as a few generations ago. While both North American Indians (through traditional spearfishing) and the Q’eqchi’ (through slash-and-burn agriculture) have been vilified for their role in environmental change and species endangerment, the root of the problems lies not in techniques that have proved sustainable over centuries of successful

Nunnally’s Teaching and Practice column considers the value of using social media in the classroom. Focusing on recent floods on the Mississippi River, Nunnally offers a strategy for creating a connection between critical thinking and public conversations through Twitter. Students tweet about the flooding as a way to ask provocative questions and demonstrate how experience, critical thinking about global climate change, and public engagement can be drawn together for innovative learning.

practice but in local and global problems caused by the Industrial Revolution and its seeping into nearly every aspect of the human experience. Or, as Odegard’s maternal grandfather put it, “it’s a white man’s world; we better get used to living in it.”

Like Odum and Rivas, Rebecca Bria and Doris Walter combine archaeology and ethnography to great effect. In their piece, ancient and contemporary climate change in the Andes becomes a springboard to considering how these drastic transformations are understood by the societies who are living through them. Just like the endless debate over the causes of climate change that splashes nightly over television screens throughout the West, the Quechua-speaking residents of the Cordillera Blanca, Peru look to religion, cursory scientific knowledge, and visible signs of human activity to explain receding glaciers and unpredictable temperatures and rainfall. As the climate continues to change today, new crops are becoming popular, brought in many cases by some of the same transnational corporations that are adding to the problems they are facing. This focus—apparently unconscious—on short-term adaptation dovetails nicely with the ancient Recuay who inhabited the same region between A.D. 1 and 800, who survived through 800 years

of living in a region that fluctuated between allowing agriculture and camelid grazing due to regional and global climatic shifts.

Climate change is predicted to alter nearly every aspect of how we live on earth. If these massive structural changes are to be managed to reduce harm for as many people as possible, and to point the ways toward a more sustainable way of living

on a finite planet, we will need perspectives like those represented here: good, detailed science (by which we include specialized scholarly and professional knowledge more broadly), and clear connections between that specialized knowledge and the concerns of a broader public. Above all, we must include more, and more diverse voices; we must learn with and from people we have not (yet) been listening to closely.

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About the Authors

Lewis C. "Skip" Messenger Jr. is a Professor Emeritus from Hamline University in Saint Paul, Minnesota. His passion is teaching and introducing students to other cultures through his numerous study abroad courses in Latin America and Southeast Asia. His practice was anthropological archaeology with regional interests in Mesoamerica, primarily the ancient Maya, but also in the origins and developments of complex societies in moist ecosystems in other parts of the world. These interests were influential in his early recognition of the role climate changes may have played as sources of stress on the development of ancient civilizations. This expanded his regional focus to include Southeast Asia, the Andes and Amazonia, and elsewhere. He began research on climate change and human affairs in the late 1970s and published in the journal *Ancient Mesoamerica* (Ancient Winds of Change—Climatic setting and prehistoric complexity in ancient Mesoamerica [1990]; Los Mayas y El Niño—Paleoclimatic correlations, environmental dynamics and cultural implications for the ancient Maya [2002]). Later he began introducing his students to these concepts and included them in his research. He is proud of his record of having integrated climate change with anthropological archaeology for more than three decades with his Hamline students.

Brent K. S. Woodfill is an Assistant Professor at Winthrop University, a Research Associate at the Smithsonian Institution, and an Affiliated Scholar at the Institute for Advanced Study at the University of Minnesota. He is currently directing research focusing on Maya salt production, sacred places, and interregional exchange in central Guatemala and southeastern Mexico.

FEATURE

MULTIPLE WAYS OF UNDERSTANDING PERU'S CHANGING CLIMATE

By Rebecca Bria and Doris Walter

Archaeologies of climate change have long been interdisciplinary in practice, with paleoenvironmental reconstruction studies providing the principal methods—from ice cores to pollen and soil analyses—through which ancient climates can be known and considered against the broader record of materials ancient humans left behind. Archaeology is unique among the

disciplines that examine climate change, particularly during the past twelve thousand years known as the Holocene, because it can reveal the many ways humans have responded to climate shifts, such as by constructing new settlements, inventing new technologies, reorganizing political systems, and reshaping environments.



Archaeological site of Aukispukio in a now uninhabited area of the Cordillera Blanca mountain range. Image courtesy of Rebecca Bria.

In this article, we consider how the perspectives and experiences of contemporary people facing climate change can enrich our archaeological interpretations of climate change in the past. In particular, we present an ethnographic study from highland Peru that highlights the complex and varied ways people are responding to environmental uncertainty, and explore how their perspectives and responses have led us to question and expand the narratives we construct about ancient people. Such ethnographic data, we argue, help move us beyond solely defining what happened in the past—for example, identifying a period of increased drought that led to crop failure and house abandonment—to also think broadly about human agency in moments of widespread social and environmental change. Rather than painting past human experience with broad strokes, an attention to contemporary responses to climate change challenges us to consider the complex mosaic of individual perceptions and actions that collectively come to define “the past” for a group of people. For instance, we can inquire into how someone’s ability or perceived ability to act—that is, their agency—is linked to their relationship to and perception of the places they inhabit. This gets us to a fundamental question we explore here: how do ontological understandings of the nature of the world, for instance, the logics of cause and effect, influence how people respond to climate-based uncertainty? With this question in mind, how can we employ ethnographic data to consider new possibilities for how ancient humans responded to a shifting climate?

We reflect upon these questions by interlinking our data and insights from ethnographic and archaeological research in highland Peru’s Cordillera Blanca, a glaciated tropical mountain range in the region of Ancash that is experiencing rapid deglaciation due to global warming (Glas et al. 2018). Doris Walter, an ethnographer fluent in Quechua, has conducted research in the Cordillera Blanca for decades, focusing much of her work on how Indigenous Quechua speakers

conceptualize and engage with their environment. In part through a collaboration with Rebecca Bria on a major climate change impact study led by geoscientist John All, Walter’s recent ethnographic research presented here examined how Indigenous people in the Cordillera Blanca perceive the causes and effects of climate change, as well as how climate change is affecting the choices they make in response to these perceived changes. Since 2009, Rebecca Bria has carried out archaeological fieldwork in the Cordillera Blanca to expose how ancient people established and renewed a sense of place and community as they shaped local ecologies. Bria applies insights from Walter’s research and her own work living and working with people in the Cordillera to how she teaches the archaeology of climate change. In particular, her instruction combines archeological and paleoenvironmental evidence with insights from ethnographic data that are further enhanced by using phenomenological techniques whereby students directly experience the landscapes and ecological niches they study. This “classroom” is the PIARA archaeological field school at Hualcayán. PIARA provides instruction in archaeological field methods while engaging students as participants in research on Hualcayán’s social and ecological transformations over a period of nearly 4000 years, between 2400 B.C. and A.D. 1450. Teaching is important to our discussion here because it is a setting in which the boundaries of archaeological epistemology are defined, by both the professor and the student, and are thus rich contexts for exploring how to incorporate ethnographic perspectives into archaeology and to reflect upon what insights such activities may generate.

In short, we explore how the diverse kinds of knowledge that ethnography, archaeology, phenomenology, and paleoclimatology produce, and the multiple ways of knowing the world that each provides, are each essential to consider when studying and teaching about ancient climate change. We argue this is because they collectively bring human perceptions, logics,

and decision-making processes in times of climate change in conversation with the material evidence for practices in the present and the past.

We contend that this array of data and perspectives can lead to new insights about how ancient humans may have experienced a changing world.

Archaeology, Ethnography, and Climate Change

In recent decades, cultural anthropologists have entered the scholarly discourse on climate change by documenting how contemporary societies are confronting a transforming world, building on a long tradition of “climate and culture” studies in archaeology (Crate 2011; Roncoli et al. 2009). Despite the new and growing potential for incorporating ethnographic insights on climate change into archaeological analyses of the ancient past, many archaeologists have yet to robustly consider them. Even ethnoarchaeology, which is the ethnographic study of contemporary practices to identify the materials they leave behind and their relationships to the non-material dimensions of social life, has yet to focus on climate change, such as how people are responding to the increasingly severe weather patterns, dwindling water availability, and other dramatic events that impact their livelihoods. Such ethnoarchaeological studies could nonetheless have a profound impact by bringing archaeology’s unique expertise on the long-term social processes of collapse and resilience into the discussion of contemporary climate change, which is threatening the social fabric of communities and nations across the world today by contributing to mass migrations, hunger, political unrest, and warfare (for example, the recent events in Syria; Abel et al. 2019).

Recent ethnoarchaeologies of agricultural and pastoral economies have nonetheless generated insights into how people are responding to various climate-related crises, as global warming has left few such lifeways untouched (Metheny 2017: 239). Yet even so, the goals and aims of ethnoarchaeology too often focus narrowly on generating models for identifying what people did in the past at the expense of recognizing the ontological frameworks and epistemologies that inform and give logic to these practices (Gosselain 2016; Holbraad 2009; McNiven 2016). A theoretical archaeology that makes room for multiple cultural logics can help circumvent potentially ethnocentric interpretations (such as by using “rational actor” models taken from Western economic theory and indiscriminately applying them to Indigenous people worldwide and through time) for how ancient people responded to a changing climate, while opening up new conceptual frames for interpreting the past, including peoples’ distinct relationships to local environments, their variable regimes of value, and their distinct definitions of who or what (e.g., mountains) can act (Marciniak and Yalman 2013; Politis 2015).

Researching and Teaching Climate Change and Archaeology in Peru

The Andean Highlands is an extreme, vertical environment with many different, but closely-juxtaposed, ecological zones and microclimates (Pulgar Vidal 1981). In the steeper, more ecologically compact areas, one can traverse several

ecozones, from the high *puna* grazing lands to the valley floor, within a few hours or less. Human social and economic adaptations to climate shifts in this vertical landscape are thus inextricably linked to how local communities take advantage

of these ecological zones through agriculture, animal husbandry, foraging, and hunting. These practices often involve resource sharing between communities or within different sectors of a community who live or labor in different ecozones (Brush 1976; Oberem 1976; Yamamoto 1985). In this extreme vertical environment, these practices are likely to have had great antiquity in the Andes, which produce systems of ecological complementarity that can reduce risk vis-à-vis the diversification of food, practices, and even settlement locations (e.g., Stanish 1989).

Much attention on ancient climate change in the Andes has focused on the coastal Andes, where prehistoric peoples experienced ongoing and often catastrophic climate oscillations due to El Niño (Moore 1991; Sandweiss et al. 2001)—patterns that continue and appear to be increasing today, leading to landslides and flooding. Such coastal climate shifts impacted weather patterns in the highland Andes as well, though to a lesser degree, causing ancient peoples to center much of their local ecological concerns on the need to stabilize a dynamic landscape that was geologically active due to heavy seasonal rains and earthquakes. They often did this through landscape engineering, such as terrace and canal construction. Nonetheless, ice core data from mountain glaciers, including from Peru's highest peak called Huascarán in the Cordillera Blanca, indicate that there were significant cooling and warming periods that correspond to wetter or drier conditions and which led to a variety of social and cultural shifts (Thompson et al. 1995; Thompson et al. 2000). These shifts range from minor to major. Perhaps the most consequential was the stabilization of the climate and environment after the last major ice age, which led to modern temperature and vegetation patterns by around 3000 B.C. This correlates to the emergence of Andean complex mound-building societies, such as Hualcayán, in both the coastal and highland Andes (Markgraf 1989; Thompson et al. 1995; see also Contreras 2010).

In highland Ancash, archaeologist George Lau (2011: 33–34) matches the paleoclimatic trends evidenced through glacial ice cores (Thompson et al. 1995) with the radiocarbon-dated settlement patterns and social trends of the Recuay culture, which flourished between A.D. 1 and 800. In particular, he notes that many Recuay polities flourished near the upper limits of agriculture during a warmer and wetter period between A.D. 400 and 500, and then came to their demise when temperatures plunged in a colder and drier climate between A.D. 500 and 800. While resource and food sharing systems operating under a system of ecological complementarity can protect from some of these fluctuations if short-lived, the dramatically plunging temperatures experienced at this time would have definitively lowered the upper limits of agricultural production. As an agro-pastoral society, the Recuay had long valued settlement locations at the ecotone between the upper limits of agriculture and the lower limits of prime camelid grazing lands in the high *puna*. The dramatic climate shift would have likely made it difficult to continue agricultural production near established Recuay settlements, perhaps straining the Recuay way of life that was long attached to its prosperity, eventually leading to the disaggregation of Recuay societies, and according to our recent skeletal analysis, warfare (Sharp n.d.; Sharp and Bria 2015).

This example serves to illustrate the kinds of paleoclimatic and archaeological data that field school students learn about when studying Ancash prehistory. Though scholarly articles and pictures can bring analyses of these dramatic landscapes to life for students in the classroom, the students who attend the PIARA archaeological field school at Hualcayán have the opportunity to experience the Cordillera landscape for themselves and imagine how climate shifts would have affected people living in that same landscape. That is, they can tangibly imagine the ancient landscape of the Recuay as they look across and traverse the vertical environment, as they feel the noticeably thinner, cooler air near the upper

reaches of agriculture above the field site, as they ponder the many abandoned settlements within immediate view in the narrow, steep, and circumscribed valley, and as they walk along the many refurbished and abandoned canals that cut across the mountainside, which are drawn from the glacial lagoons above. They also observe how contemporary people travel to different fields and elevations to tend their crops and animals each day, or experience unseasonal frosts that cover the ground on many mornings, both conditions causing them to consider the ways in which even slight climate fluctuations can be disruptive in this steep, high-elevation terrain. The interplay between climatic, ecological, and geological dynamics thus becomes perceptible for students, providing a foundation upon which to build

concepts of shifting ancient climates in an often extreme tropical mountain environment.

Second, the Recuay example suggests that while we can correlate the end of Recuay with a colder and drier environment, we cannot adequately access the perceptions of Recuay individuals as they fought to maintain their society and understand a changing world. Certainly, ongoing research is enlightening us about how Recuay communities began shifting their system of beliefs during the final centuries. But even with a studied knowledge of Recuay ideology, worldview, and ecology, we are limited in knowing or imagining the ways in which people socially and conceptually responded in times of dramatic climate change. Students today have



The Hualcayán landscape (center left), situated in the Cordillera Blanca mountain range. Image courtesy of Rebecca Bria.

an intimate experience growing up in a time of climate change. Yet as students primarily from non-indigenous communities in North America or Europe, we should not expect their own largely Western/scientific view of global climate systems to match the perceptions of other groups of people, especially when considering the many alternative ontologies in which the world operates according to different chains of cause and effect. Following from this, we should also not expect human responses to climate change to fit neatly into a set of climate-response models. Engaging students in these alternative perceptions through

explorations of ethnographic accounts can be an effective way to open students to how and why people may have chosen distinct paths in the face of a changing climate, strengthening their ability to link anthropological and scientific concepts. Perhaps the most effective way to communicate these ideas is by presenting and discussing ethnographic data that has been collected from people currently inhabiting the same landscapes that are of archaeological interest. How might these contemporary Indigenous perspectives inform how we understand the archaeological record more broadly?



Glacial retreat is advancing rapidly in the Cordillera Blanca. Image courtesy of Marc Anger.

Ethnographic Research in the Cordillera Blanca

In the tropical Andes, and particularly in the Cordillera Blanca of Peru, the impacts of global warming on glaciers are accelerating. Since 1962, glacier mass has decreased by 38 percent causing considerable concern among scientists, who predict significant changes affecting water availability, ecosystems, and rural livelihoods, as well as an increase in risks of natural disasters, such as avalanches and glacial lake outburst floods (GLOFs), which are floods that occur when a high altitude lake suddenly overflows or breaks a natural dam of ice or soil in rising temperatures.

Such events can cause devastating landslides known locally as *huaycos*.

But how do local people perceive the current changes? Here we review how people living below the snow-capped peaks of the Cordillera Blanca perceive the effects of glacier recession and climate change, as well as their causes. This ethnographic research was undertaken by Walter in various Indigenous, Quechua-speaking communities within the mountain range.



A dried-up quenoal tree standing above a shrinking bog. Image courtesy of Marc Masconi.

The Effects of Climate Change and Glacier Recession

The local inhabitants all agree that the glaciers are shrinking. They also mention an increase in temperature extremes: it is much warmer during the day and colder at night, with increased risks of frost. In addition, the alternation of the dry and wet season is more irregular, and the rain patterns less predictable. These factors negatively affect the crops as well as animal husbandry. Nevertheless, in some areas the fact that maize now grows at higher altitudes than before—due to warmer temperatures—is mentioned as being something positive.

Other inhabitants indicate certain effects on ecology: for example, shrinking wetlands, the disappearance of certain plant and animal species, and an increase in disease. Weather

extremes, such as heat and frost, harm not only crops but also important high altitude plants, such as *quenoal* trees (*Polylepis* sp.). As for water availability, in some valleys of the Cordillera Blanca, water from glacial discharge has already begun to decrease due to glacier recession, creating sometimes-severe tensions between users. In other areas where the glacial mass is more important, water shortages have not yet become a subject of worry for the local inhabitants.

If almost everyone agrees on the effects of climate change in the Cordillera Blanca, the causes attributed to these changes vary according to the individuals and the immediate environment they live in.

The Different Causes Attributed to Climate Change

Although many rural communities have access to the media (radio, TV, or sometimes the internet), its influence on their comprehension of climate change is either superficial or reinterpreted according to cultural values and traditional beliefs. If the local people hear about global warming through the media, they do not understand the notion, and the causes of climate change are viewed as local, and by no means global.

The different causes can be classified in two main categories: those that depend on cosmic, natural, or divine elements, and those that are directly related to human behavior. Some people (usually elderly folks) simply state that the earth is old (*el mundo está viejo*), thereby explaining why the glaciers are shrinking and gradually disappearing. A particularly frequent explanation is that the sun's position in the sky has changed. The sun has come closer to the earth, therefore, its rays are much stronger. Others assert that the sun is ill: the "skin" that envelops it is full of holes, like

a sieve, and lets out the heat. This appears to be an obvious reinterpretation of holes in the ozone. The holes, they say, are caused by smoke from fires—the burning of garbage and toxic materials.

Another cause derives from traditional myths. In Andean thought, where space and time are linked, there is a cyclical succession of different eras, each era being annihilated by a cataclysmic event, or *pachakuti*. For example, these myths recall how the pagan era, preceding the present era, was destroyed when God ordered a cosmic flood, which filled the earth with water like in a giant pot. He then sent two suns out into the sky; as the water began to boil, all of the pre-Hispanic ancestors were burned to death. The inhabitants of the Cordillera often refer to these myths, stating that a new cataclysm is probably underway and that they will similarly be burned by the sun.

Many informants in the Cordillera Blanca also mention that the mountains, which are sacred and considered as living ancestors, become angry

when human behavior is inappropriate or disrespectful. As a punishment, they cause avalanches and icefalls, reducing the ice mass. On the other hand, many Catholics and members of evangelical religious congregations believe that the current climate changes are God's punishment because there are too many sinners. Apart from these cosmic, mythological, and divine explanations, in certain valleys of the Cordillera Blanca frequented by foreign mountain climbers and trekkers, the foreigners are often held responsible for glacier recession. This is mainly because their expeditions are said to pollute or harm the ice, but also because they might be irritating the mountain deities along the way.

In rural communities located near cities or towns, modern ways of life (traffic, industries, pesticides, etc.) are incriminated for contaminating the air, which in turn affects and poisons the glaciers. Mines and metal extraction are also implicated. In more remote communities, the reflections of

plastic bottles and aluminum foil thrown on the ground, along with modern corrugated iron roofs, act like mirrors that direct the sun, and are thus believed to have a direct impact on melting the glaciers. In short, the inhabitants relate climate change to their immediate environment and do not perceive it as a global phenomenon.

When asked if the situation worries them, Indigenous people usually give the following type of answer: "Yes of course we're worried, but for the time being, we're not in lack of water. When that happens, we will all die." Some people suggested this lack of water would become a reality in 20 years while others suggested up to 200 years. Many informants stated that up to now, there are no major changes either in their lives or in the ecosystem. At the same time, people perceive an overall feeling of helplessness and resignation in the face of destiny.



In Quechua-speaking Indigenous communities, mountains are often perceived as agents and deities. Image courtesy of Marc Anger.

Challenging Assumptions: Bridging Archaeologies and Ethnographies of Climate Change

The resignation to fate that Indigenous people in the Cordillera Blanca express reflects the concept of *pachakuti*. *Pachakuti* is both a modern and an ancient concept, documented during the early Spanish colonial period by first generation *mestizo* historian Garcilaso de la Vega (1979 [1616]). *Pachakuti* is the “termination and reversal of an established order,” or a moment in which the world dies and is reborn anew (MacCormack 1988: 961; MacCormack 1993: 961). *Pachakutis* exist as myth (such as in creation stories about the formation of the Andean landscape when giants roamed and turned into mountains), but they also exemplify a deeply rooted social memory of the various epochs and ages of Andean history (separating the pre-Inka from Inka times, or the Inka from the Spanish colonial period), as well as of the moments marked by environmental catastrophes and their aftermaths. As an inevitable and periodic process of the world, *pachakuti* and similar concepts have been used as a political tool for uprising—such as the Taki Onkoy Indigenous revitalization movement against Christianity in the mid 16th century (see MacCormack 1998: 983). Or, as is apparent through the modern-day perceptions explored in this paper, *pachakuti* is equally a way to acknowledge and accept the inevitable traumas of history. *Pachakuti* thus embodies the past, present, and future (MacCormack 1988) and is thus a lens through which a person can understand the course of history and conceptualize their position and agency within the world during times of widespread transformation.

In the traditional highland Andean ontology, many landscape features, particularly water sources and mountain peaks (notably the features also affected by climate change), are personified social actors (Allen 2002; de la Cadena 2015). The recent disappearance of their most vibrant

qualities, such as the glacial caps from which essential waters flow, is seen by many to reflect their aging, existing much like any other living thing in the world (Roncoli et al. 2001). There is often a perceived causality between the modern world’s tarnished morality and the disappearance of glaciers—sinners bring insult to these beings who in turn dwindle in potency. The evangelically Christianized may alternatively see these sins as bringing insults to their god, who can unleash natural disasters at will. In either sense, the Andean landscape is full of agentive forces.[1]

The perceptions and actions of people living in the Cordillera Blanca today reveal what many climate change studies are beginning to point to: that people rarely perceive climate change in uniform or predictable ways, and that inaction, rather than reaction, is a common response to increasingly extreme climate variability during the early decades of a major climate shift. These ethnographic insights clearly have broad implications for understanding non-Western ontologies and shaping informed policies that can help mitigate the impacts of climate change. The principal archaeological interest in the ethnographic data, however, was to elucidate how the perceptions of climate change inform new kinds of social and ecological practices as people adjust to a variable climate. However, the question was not *whether* people were changing their daily practices in response to climate change. The assumption was that people were already adapting to climate shifts in measurable ways, as people in highland Ancash communities commonly expressed concern over weather, water, and frost. In many ways, this oversight is indicative of an archaeological mode of inquiry that is used to considering patterns of change across hundreds or even thousands of years, in which punctuated changes are obvious, but

short-term processes are not. Moreover, the common feelings of resignation and decisions made *not to act* in the face of a dwindling water supply flies in the face of theories that assume ancient social actors are perpetually self-interested agents who will always work to maximize their profit and minimize their labor at any given moment. People are constrained by their sociopolitical conditions, their daily routines (*habitus*), and their connection to place. It seems that, in the case of the Cordillera Blanca, the abundance of water has—for the moment—provided a buffer from some of the climate extremes that others in Peru are experiencing, especially those living through frequent flooding and landslides on the desert coast. But this doesn't change the fact that

all local inhabitants have long recognized the rapid disappearance of the water sources—the mountaintop glaciers—and foresee their eventual demise.

Though people living in the Cordillera Blanca do not claim to have transformed their practices in response to climate disruptions, at least not in measurable ways, there are a few notable changes in food production that may be related to mitigating an increasingly unpredictable climate. Specifically, some communities have introduced new crops, such as *yana mashwa*, a native tuber, or sugar snap and snow peas, European crops that were brought in by a European export agriculture company seven years ago. Local



Water is still abundant in many high-altitude valleys. Image courtesy of Marc Masconi.

people describe the introduction of these crops as their response to shifting market demands, not a shifting climate. For example, *yana mashwa* is gaining culinary popularity in the region, and there is both national and international interest in sugar snap and snow peas. It is nonetheless difficult to ignore how both economic demands and greater agricultural uncertainty due to climate change are together influencing these shifts in practice: the recent difficulties in agricultural production are a common topic of conversation, as people are not only concerned with the flow of water to their fields but also with the unpredictable and unseasonable frosts that ravage their crops. Moreover, the introduction of sugar snap and snow peas for export in farmlands located in rural Peruvian Indigenous and peasant communities (*comunidades campesinas*) alone reveals much about how the global economy is transforming the world in response to climate change. That a Belgian agricultural export company arrived at the rural village of Hualcayán to convince local people to grow sugar snap and snow peas in the first place is due, quite plainly, to the fact that Hualcayán, for the moment, has paradoxically more reliable water than previously relied upon sites of production elsewhere in the

world. Equally, as potato farming becomes less reliable with increasing evening frosts that can easily kill the crop (Condori et al. 2014), sugar snap and snow peas, which are more frost tolerant, are a desirable replacement for local farmers. Community members have steadily increased the production of sugar snap and snow peas over the past seven years, transitioning away from a fairly diverse multicropping economy of native foods (potatoes, beans, maize) to one that heavily relies on the production of sugar snap and snow peas composing more than 70 percent of local yields. Placing so much attention on this crop is a way to reduce risk in these uncertain times—that is, by producing foods for which there is a fixed price for export—even if the decision to invest in sugar snap and snow peas is not explicitly linked to climate change. The lesson here, of course, is that such changes in food production during a time of climate change cannot be understood as a simple effect of the climate alone. Instead, these illustrate the messy links and disjunctures in the decision-making process between belief (i.e., that there is no reason to react to climate change) and practice (i.e., that the adoption of foreign frost-resistant crops is purely for economic benefit).

Conclusion: Interdisciplinary Perspectives in the Study of Climate Change Adaptations

This paper has argued that archaeological interpretations of climate change can be expanded through a consideration of ethnographic evidence for how people are experiencing, perceiving, and responding to climate change in distinct places. Our data raise issues about the links between ontology—or ideas about how the world works—and agency—or decisions and actions based in whether anything can be, should be, or is being done about a changing climate. Ethnographic examples like ours from the Cordillera Blanca complicate the sometimes overly-tidy models that many archaeologists apply to their interpretations

of the past. Ethnographic research, if attended to, can lead archaeologists to check their assumptions about the motivations of ancient people, and refine their interpretations about how and why humans do what they do, which can only serve to strengthen any rendering of the past.

Finally, these observations have implications for teaching climate change—a theme which will undoubtedly shape countless aspects of our students' lived experiences as they move into the future, regardless of whether they become archaeologists or anthropologists. By teaching an

ethnographically-informed archaeology of climate change, we have an opportunity to not only teach students about what happened during periods of prehistoric climate change, and how we go about studying these events through both direct and

proxy data, but also teach them to consider the diverse and unexpected ways that ancient people may have conceptualized these changes and how they creatively responded—or how they did not.

Footnotes

[1] For evangelical Christians, the world is full of potentially agentive forces, enacted by the will of an omnipresent and omnipotent god.

References

- Abel, Guy J., et al. 2019. Climate, conflict and forced migration. *Global Environmental Change* 54: 239-249.
- Allen, Catherine J. 2002. *The Hold Life Has: Coca and Cultural Identity in an Andean Community*. Washington, D.C.: Smithsonian Institution Press.
- Brush, Stephen B. 1976. Man's Use of an Andean Ecosystem. *Human Ecology* 4 (2): 147-166.
- Condori, Bruno, et al. 2014. Managing potato biodiversity to cope with frost risk in the high Andes: a modeling perspective. *PloS one* 9 (1): e81510-e81510.
- Contreras, Daniel A. 2010. Landscape and Environment: Insights from the Prehispanic Central Andes. *Journal of Archaeological Research* 18 (3): 241-288.
- Crate, Susan A. 2011. Climate and culture: anthropology in the era of contemporary climate change. *Annual Review of Anthropology* 40: 175-194.
- de la Cadena, Marisol. 2015. *Earth Beings: Ecologies of Practice Across Andean Worlds*. Durham: Duke University Press.
- de la Vega, Garcilaso. 1979 [1616]. *Commentarios Reales de los Incas*. Translated by M. Jolas. Lima: Librerías ABC.
- Glas, Robin, et al. 2018. A review of the current state of knowledge of proglacial hydrogeology in the Cordillera Blanca, Peru. *Wiley Interdisciplinary Reviews: Water* 5 (5): e1299.
- Gosselain, Olivier P. 2016. To hell with ethnoarchaeology! *Archaeological Dialogues* 23 (2): 215-228.
- Holbraad, Martin. 2009. Ontology, Ethnography, Archaeology: an Afterword on the Ontography of Things. *Cambridge Archaeological Journal* 19 (3): 431-441.
- Lau, George F. 2011. *Andean Expressions: Art and Archaeology of the Recuay Culture*. Iowa City, IA: University of Iowa Press.

- MacCormack, Sabine. 1988. Pachacuti: Miracles, Punishments, and Last Judgment: Visionary Past and Prophetic Future in Early Colonial Peru. *The American Historical Review* 93 (4): 960-1006.
- . 1993. *Religion in the Andes: vision and imagination in early colonial Peru*. Princeton: Princeton University Press.
- Marciniak, Arkadiusz, and Nurcan Yalman. 2013. Non-anglophone Ethnoarchaeologies in the Past and Today: An Introduction. In *Contesting Ethnoarchaeologies: Traditions, Theories, Prospects*, edited by A. Marciniak and N. Yalman, 1-13. New York: Springer.
- Markgraf, Vera. 1989. Palaeoclimates in Central and South America since 18,000 B.P. based on pollen and lake-level records. *Quaternary Science Reviews* 8: 1-24.
- McNiven, Ian J. 2016. Ethnoarchaeology, epistemology, ethics. *World Archaeology* 48 (5): 683-686.
- Metheny, Karen Bescherer. 2017. Experimental Archaeology, Ethnoarchaeology, and the Application of Archaeological Data to the Study of Subsistence, Diet, and Nutrition. In *Food Research: Nutritional Anthropology and Archaeological Method*, edited by Janet Chrzan and John A. Brett. New York: Berghahn Books.
- Moore, Jerry D. 1991. Cultural responses to environmental catastrophes: post-El Niño subsistence on the prehistoric north coast of Peru. *Latin American Antiquity* 2 (1): 27-47.
- Oberem, Udo. 1976. El acceso a recursos naturales de diferentes ecologías en la sierra ecuatoriana (siglo XVI). Volume Paper presented at the 42nd Congrès International des Américanistes, Paris: Fondation Singer-Polignac.
- Politis, Gustavo Gabriel. 2015. Reflections on contemporary ethnoarchaeology. *PYRENAE* 46 (1): 41-83.
- Pulgar Vidal, Javier. 1981. *Geografía del Perú: las ocho regiones naturales del Perú*. Lima: Editorial Universo.
- Roncoli, Carla, Keith Ingram, and Paul Kirshen. 2001. The costs and risks of coping with drought: livelihood impacts and farmers' responses in Burkina Faso. *Climate Research* 19 (2): 119-132.
- Roncoli, Carla, Todd Crane, and Ben Orlove. 2009. Fielding climate change in cultural anthropology. In *Anthropology and Climate Change: From Encounters to Actions*, edited by Susan A. Crate and Mark Nuttall, 87-115. New York: Routledge.
- Sandweiss, Daniel H, et al. 2001. Variation in Holocene El Niño frequencies: Climate records and cultural consequences in ancient Peru. *Geology* 29 (7): 603-606.
- Sharp, Emily A. n.d. Political Bodies: Violence and Power in the Prehispanic North-Central Andes. Unpublished Ph.D. dissertation, in progress, Department of Anthropology, Arizona State University.
- Sharp, Emily A., and Rebecca E. Bria. 2015. Trauma and Trepanation during the Early Intermediate Period and Middle Horizon in the Callejón de Huaylas. In The 43rd Annual Midwest Conference on Andean and Amazonian Archaeology and Ethnohistory, Nashville, TN.

Stanish, Charles S. 1989. Household Archaeology: Testing models of zonal complementarity in the south central Andes. *American Anthropologist* 91: 7-24.

Thompson, Lonnie G, et al. 1995. Late glacial stage and Holocene ice core records from Huascarán, Peru. *Science* 269: 46-50.

Thompson, Lonnie G., Ellen Mosley-Thompson, and K. A. Henderson. 2000. Ice-core palaeoclimate records in tropical South America since the Last Glacial Maximum. *Journal of Quaternary Science* 15: 377-394.

Yamamoto, Norio. 1985. The Ecological Complementarity of Agro-Pastoralism: Some Comments. In *Andean Ecology and Civilization: An Interdisciplinary Perspective on Andean Ecological Complementarity*, edited by S. Masuda, I. Shimada, and C. Morris, 85-100. Tokyo: University of Tokyo Press.

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About the Authors

Rebecca Bria is an anthropological archaeologist whose research in the Peruvian Andes examines how communities emerge and transform through human-environment interactions. She is also deeply invested in issues of culture heritage, and she works with Indigenous Andean communities to co-create heritage events and programs that explore how people in the Andean countryside perceive and value their past and landscape. Rebecca received her Ph.D. in 2017 from Vanderbilt University and is currently a lecturer at Boston University.

Doris Walter is a French anthropologist. Having first traveled to South America in 1987 as a trekker and mountain climber, she was fascinated by the Andes and especially by the Cordillera Blanca range in north-central Peru. While hiking and climbing with the local people (donkey drivers, porters, and guides), she discovered their beliefs on nature related to the upper mountain valleys and glacial peaks. Her Ph.D., earned at the University of Paris (Institut des Hautes Etudes de l'Amérique Latine) in 2002, analyzes the concept of nature through local myths, beliefs, and practices (hunting, plant gathering, and the rearing of livestock). Her study also examines how the local people perceive two outside actors, who interfere with nature: Huascarán National Park, established in the area in 1975, and foreign mountain climbers, who seasonally flock to the high valleys and mountain peaks for recreational purposes. Ever since, she has pursued her investigations in the Cordillera Blanca as an independent researcher, on themes related to nature, ethnobotany, as well as climate change. She also organizes cultural treks in the area.

FEATURE

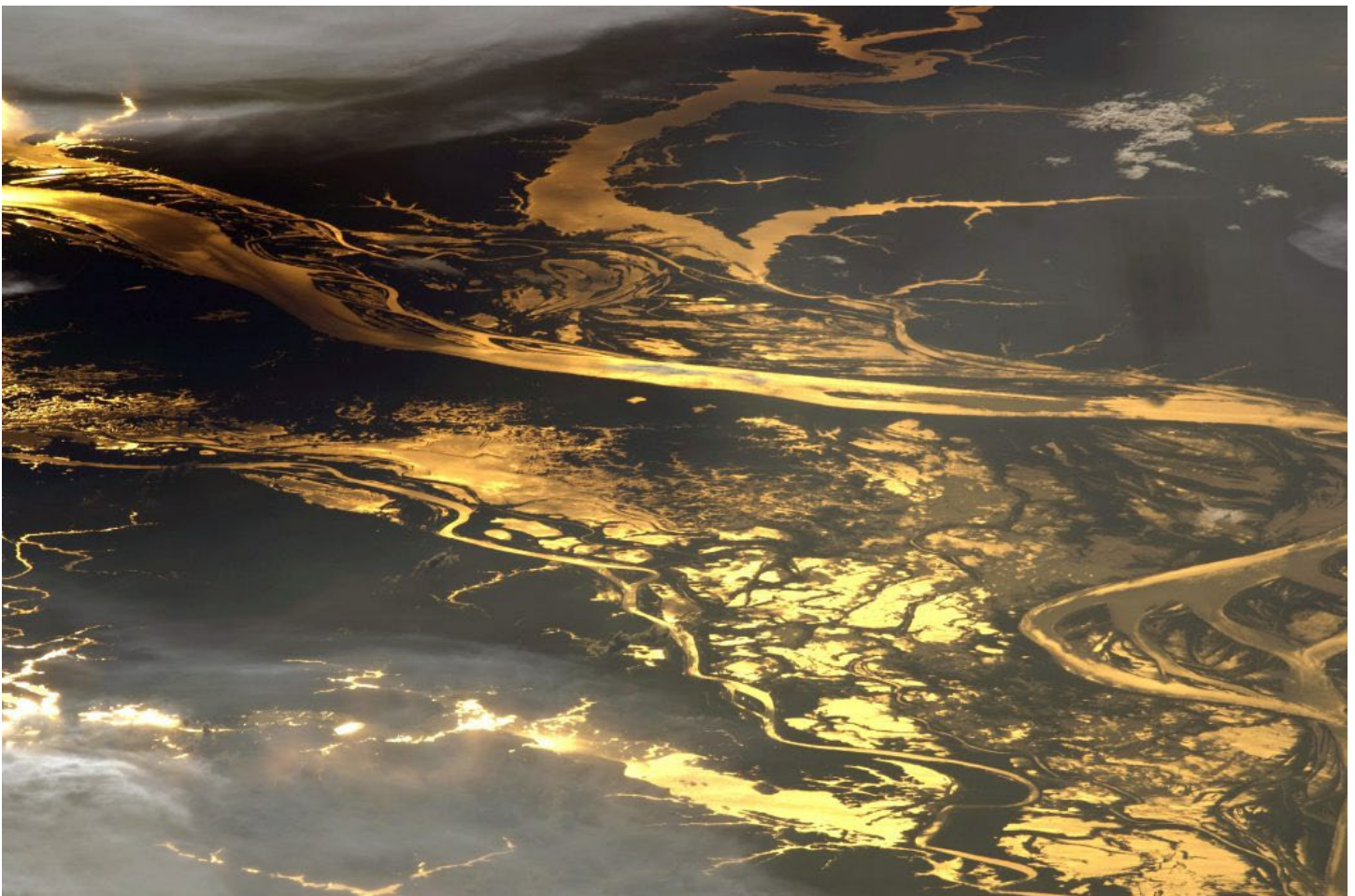
UNCOVERING AMAZONIA

By Lewis C. Messenger Jr.

“Amazonia”—the word alone can conjure up a lot of images, some accurate and some wildly not. In truth, it has many definitions, ranging from a specific drainage basin to a tropical ecological world. For most of my childhood, such kinds of tropical “jungles” were places of peril to be avoided. The very word “Amazon” conjured up Joseph Conrad’s images from *Heart of Darkness* ([1899] 2015), albeit that book was about the Congo in Africa. The tropical world itself was essentially a place to be avoided because of potential disease and predators large and

small, ranging from jaguars to leeches, to even some human groups who might try to attack you during the night while you slept.

As an anthropological archaeologist who has spent much of my life studying the tropical world and its cultures, I have come to realize that the environmental determinists who wrote off the tropics as inherently incapable of sustaining complex cultures were wrong. I have been drawn to a number of comparative questions about moist ecosystems around the globe. This began



Sun reflecting off the Amazon. Via NASA.

with my focus on the ancient Maya of Mexico and Central America, then the cultures of Southeast Asia, and in more recent years, Amazonia.

In this article we will explore the geographic and geological context of Amazonia, its role in the peopling of South America, and what we can learn from peoples of the region, both past and

present. We will look into tropical landscapes, both as they affected and reflected past cultural activities, but also as we are coming to realize, as they were increasingly the result of sophisticated human activities that left their indelible imprints ranging from soil chemistry to vast patterns of regular geometry. We will delve further into these questions in this piece.

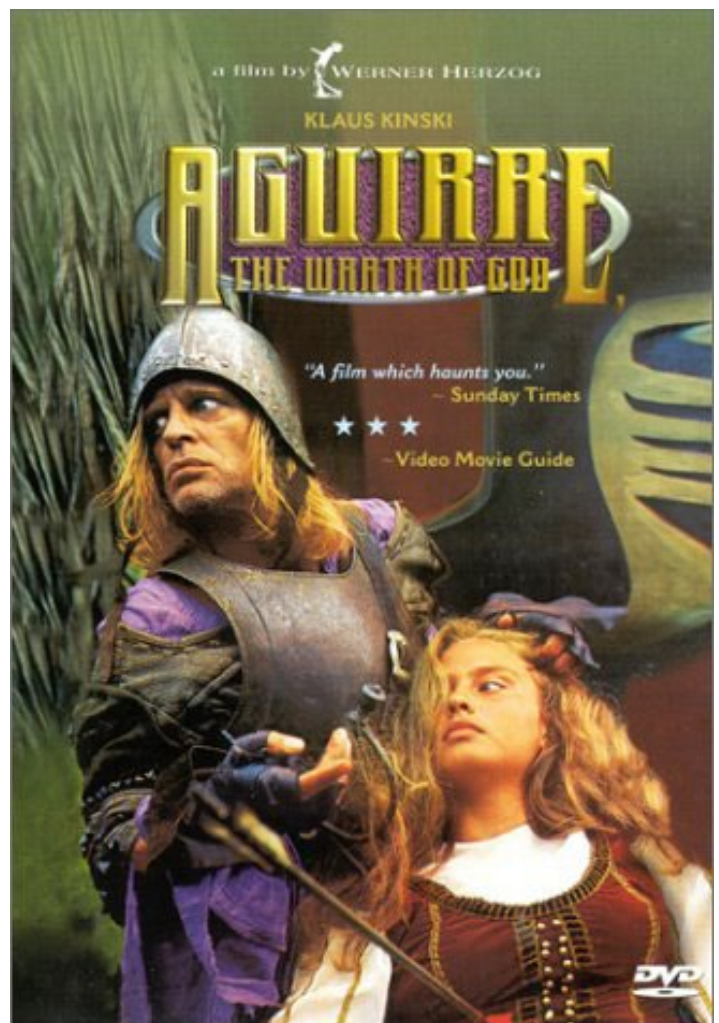
What piqued my interest in Amazonia?

I was intrigued by the first account of a trip down the Amazon River, as written in *The Discovery Of The Amazon: According To The Account Of Friar Gaspar De Carvajal And Other Documents* (Medina 1939). My initial exposure to Carvajal occurred in a BBC video, *The Search for El Dorado* (Horizon 2002), which included a number of images as flashbacks to the original voyage under Captain Francisco de Orellana. It was quite an adventure and was clearly inspirational for Werner Herzog's film, *Aguirre: The Wrath of God* (Herzog 1972).

More recently, I acquired a reprint of the English version of the original account, written by the priest of the voyage, Gaspar de Carvajal, in 1541–1542 (Medina 1939). It presented descriptions of an Amazonian journey beginning along the Ecuadorian Napo River, a tributary, and then descending down to the main Amazon itself. Orellana's crew encounters both hostility and generosity from those peoples along the river. Luckily, Captain Orellana must have had considerable linguistic abilities because he was often able to communicate to the leaders of groups he found. This quote gives a sense of the kinds of landscapes the Spaniards were encountering.

From this village there went out many roads, and fine highways [they were], to the inland country: the Captain wished to find out where they led to, and for this purpose he took with him Cristobal Maldonado and the Lieutenant and some other companions, and

started to follow them [i.e. the roads], and he had not gone half a league when the roads became more like royal highways and wider; and, when the Captain had perceived this, he decided to turn back, because he saw that



Aguirre, the Wrath of God (1972).

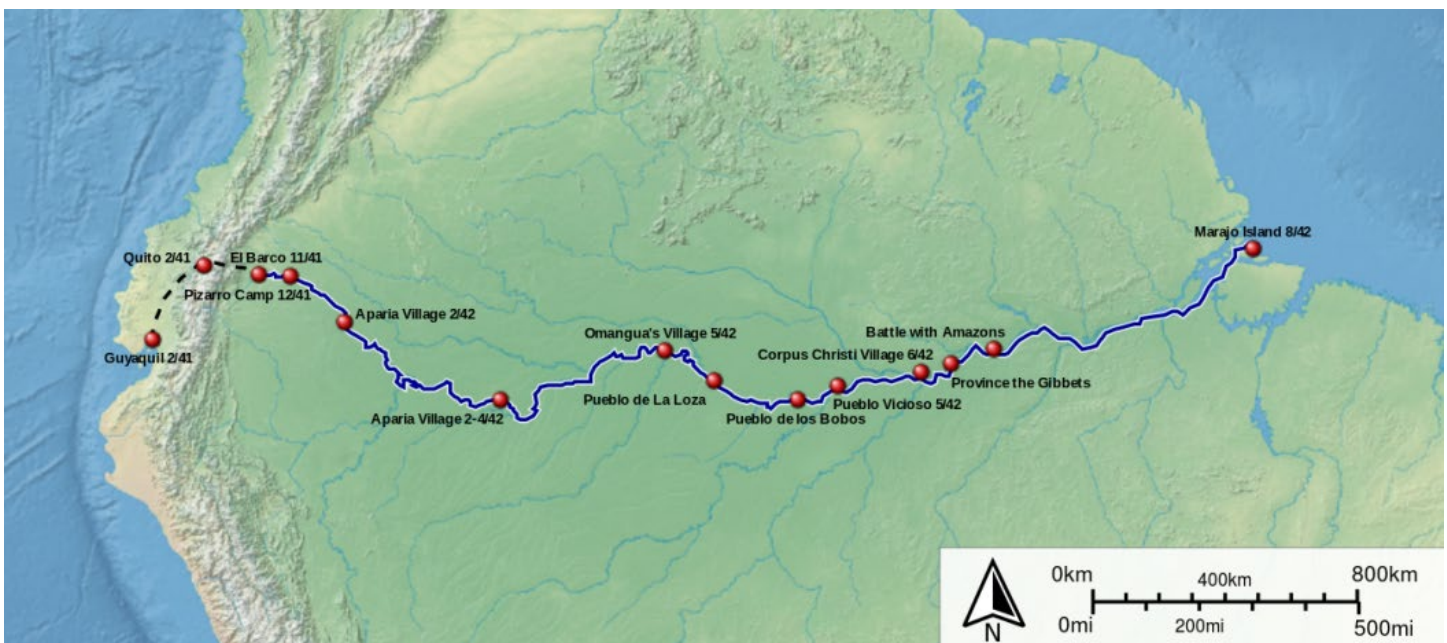
it was not prudent to go on any farther; and so he did return to where the brigantines were, and when he got back the sun was now going down, and the Captain said to the companions that it would be well to depart at once from there, because it was not wise to sleep at night in a land so thickly populated, and [he gave orders] that all embark at once; and thus it was that, with the food and all [the men] on board the brigantines, we began to move on when it was now night, and all that night we continued to pass by numerous and very large villages, until the day came, when we had journeyed more than twenty leagues, for in order to get away from the inhabited country our companions did nothing but row, and the farther we went, the more thickly populated and the better did we find the land. (Medina 1939:202; bracketed comments are as published in Medina)

Later, Carvajal talks about traveling down the river and encountering other countries with their own large villages and roads. One village was described as being two leagues long, some being continuous and less than a bow shot distance

between. One other was described as being gleaming white in the distance.

When the remainder of Orellana’s crew and Carvajal himself finally made it back to the Spanish Caribbean, they were not welcomed with open arms. On the contrary, they were treated as traitors, and Carvajal’s descriptions of the vast interior of Amazonia with its huge populations, extensive roads, powerful rulers, beautiful artwork, essentially a well-worked and productive landscape, were treated as falsehoods made up to try to cover their traitorous, mutinous activity.

It was almost a generation later that the next major Spanish explorations were undertaken down the tributaries leading to the Amazon, as well as leading up from the Portuguese territories along the Atlantic. In the sixteenth century, a German soldier and adventurer, Hans Staden, was captured by the Tupinamba, most likely somewhere along the coast of present-day Maranhão state of Brazil. He managed to avoid being killed and eaten, and later escaped and wrote an account of his experiences that became quite popular (Staden 1557, 2008). This was one



Francisco de Orellana’s Amazon River voyage (1541-1542) Based on Medelin, 1934, via ShareMap.org. (CC BY-SA 3.0).

of the initial bits of “evidence” that entered the popular media at that time and established a reputation of savagery for the Indians of tropical South America.

The issue of whether there was Indigenous American Indian savagery or not has existed for centuries, and Von Staden’s account is exemplary of the kind of approach taken to legitimize their subjugation. Beginning in the sixteenth century, accounts such as his were argued up to the Papal Courts against others, such as Bartolome de las Casas (las Casas 1566), who presented examples

of highly civilized faces of American Indian cultures. Eventually these cases resulted in Pope Paul III issuing the Papal Bull of 1537, *Sublimis Deus*, which legitimized the status of humanity for the Indians (Pope Paul III 1537).

Since the arrival of the Spaniards, there had been issues between the Church and the *encomenderos*, those *conquistadores* who had received land, and all that was on it, including resources above and below the ground, plants, animals, and the Indians, who, they argued, did not have souls and could be killed, tortured, and worked, to produce



Cannibalism in Brazil as described by Hans Staden (c. 1515–c. 1576). From “Americae Tertia Pars,” by Theodor de Bry (1592).

for the owner. *Encomienda* was a system of royal patronage granted throughout Spanish Latin America in the initial times of conquest. Along with this came the charge that Christianity had to be spread throughout those conquered lands. As hard as it is to believe today, the argument supported by the *encomendaros* was that the Indians had no souls, therefore the Church had no business trying to assert its influence or hold tracts of land.

By the time people returned to where Carvajal had made his great observations, all that was there along the banks of the great river was tropical forest and only a few beleaguered small villages. Why had this allegedly once populous landscape transformed so dramatically? Most likely smallpox and possibly other pathogens came along with the early Spanish group under Carvajal himself. Along with that, most likely came knowledge and fear of the ever-encroaching Spanish and Portuguese slavers. Whatever the causes, it seemed to be the case that by the latter sixteenth century, Amazonia lacked evidence of cultural complexity. This was in contrast to the high cultures of Mesoamerica and the Andes, for which individuals like Bartolome de las Casas could argue some degree of civilization in Papal courts. Many areas in the rest of the Americas, as well as other parts of the colonized world,

never received even this kind of advocacy until centuries later.

The apparent absence of evidence for the emergence of ancient cultural complexity has continued well into the twentieth century. American Indians throughout their homelands have been given a bum rap, and this is no less true in Greater Amazonia, where Indigenous peoples often were on the margins, but also generally marginalized from centralized national economies from the contact period onward.

Pronounced boom and bust cycles have occurred throughout Amazonia, perhaps most notably the Amazon Rubber Boom of 1879-1912. During this period, some of the cities along the central Amazon became extremely wealthy and were able to build opera houses, have electric trolleys, and become internationally “respectable.” While on the other end of the spectrum, Indian people were used to harvest the rubber on plantations, as shackled slaves in many instances. Foreign observers often wrote of their outrage at the conditions they saw and at how the Indians were treated (Hemming 2008: 212–217). Eventually all of this changed when Henry Wickham smuggled rubber tree seeds to England that eventually were sent to India, Ceylon, and finally, where they became most profitable, Southeast Asia (Hemming 2008: 195). Brazil no longer had the monopoly, and shortly thereafter, the bust ensued.

The geographic and geological context of Amazonia

When we stop to think about the activities of all of the players we have been talking about—the Spanish and Portuguese, let alone the French, Dutch, and English who also were involved at least peripherally in the northeastern corner of Greater Amazonia (the three Guianas)—the immensity of the area begins to become apparent. Greater Amazonia, or the Amazon drainage, is huge, comprising 2,722,020 sq. mi. (7,050,000 sq km), and includes parts of nine different

contemporary South American nations. Brazil alone is the fifth largest country in the world and is larger than the lower 48 of the United States. Virtually all of the countries that border on Brazil have extensive areas that are their own tropical lowland “Amazonas.” Close to one-third of Peru is tropical and Amazonian, both in its drainage and its biological makeup. Iquitos, the largest city in the Peruvian Amazonas province, is not linked by highway to the outside world; however, it receives

deep-water ships from the Atlantic. This attests to the depth and width of the Amazon that far into the continent from the ocean itself.

There is considerable topographical diversity within what we call “the Amazon.” Within this huge area there are indeed vast portions of tropical forest, but there also are areas of ranges of hills, variations in rainfall, and places where rivers make intrusions that are flanked by fingers of the Brazilian Highlands, such as the Xingu. The entire easternmost part of Brazil, referred to as their Northeast, is mostly desert, and

ecologically opposite to what one would expect of the Amazon. Therefore, one must be careful about overgeneralizing about things like weather throughout the entirety of Brazil, let alone all of the area the Amazon drainage comprises.

What was the region we now consider the Amazonian drainage like before the Andes Mountains emerged? Geologically, the Andes are similar to the Rockies in that they are being formed by the meeting of two continental plates, the Nazca Plate and the South American Plate, with the former subducting under the latter.



Map of Brazil overlaid on a map of North America, by The World Factbook.

Massive tectonic forces began to raise the Andes Mountains that we are familiar with today during the Cretaceous, about 145–65 million years ago. Essentially, this collision of major plates is producing the massive and tectonically active Andes

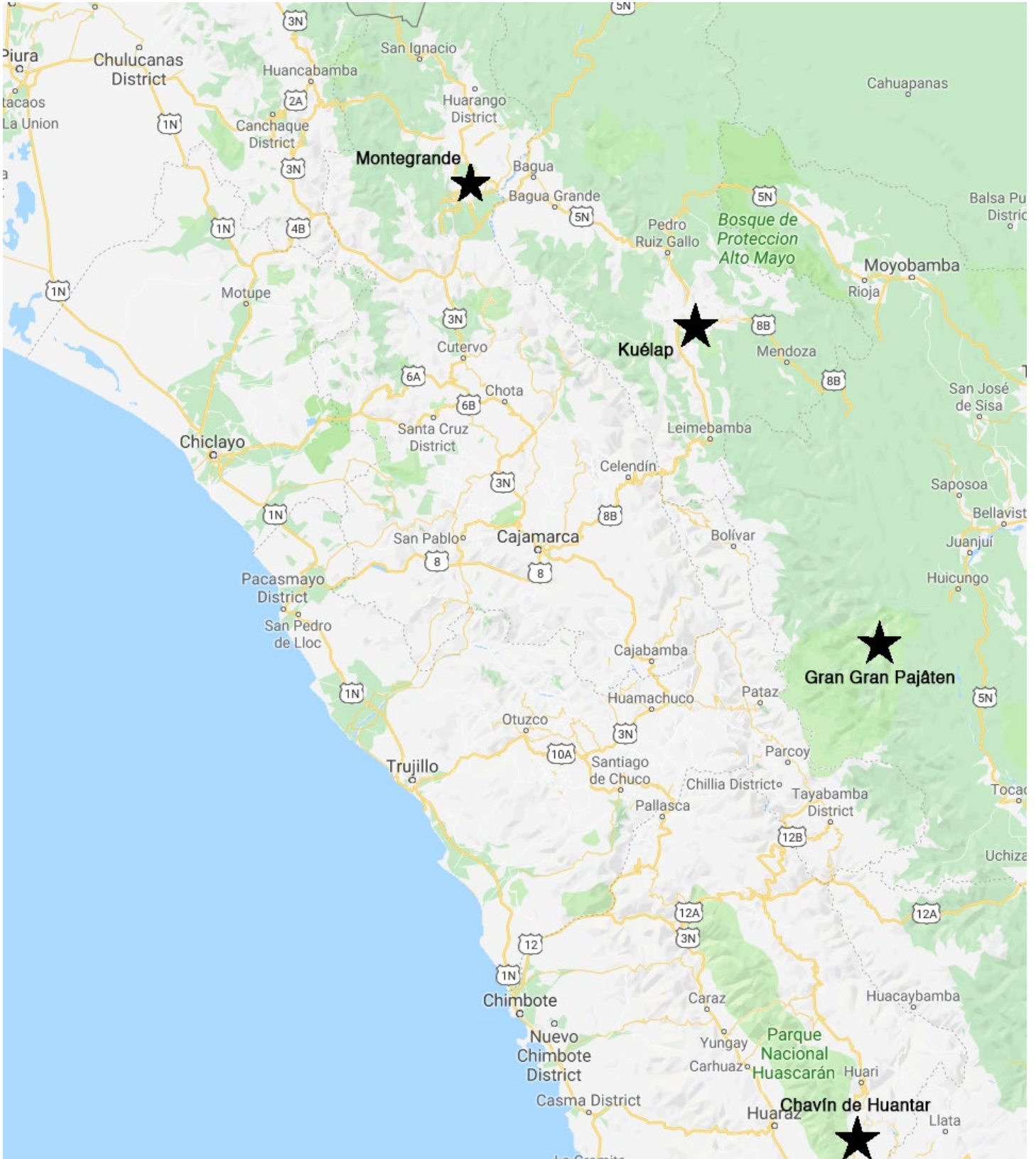
Mountains. The iconic fifteenth-century Inca site of Machu Picchu is typical of the mountainous part of the eastern Andes—the beginnings of the warm country leading toward the lowlands. The Urubamba River at the base of the hills flows



Amazon River drainage basin. By Kmusser via Wikimedia Commons, (CC BY-SA 3.0).



Note the Brazilian highlands on this topographic map of South America. Via NASA.



Relative locations of the sites in Peru. Map data © Google, 2019.

north and then east, becoming part of the Ucayali River. On a map, Machu Picchu, just northwest of Cuzco, is extremely close to the Amazonian lowlands.

Prior to these massive tectonic shifts, according to geologist Russell Mapes (2009) and others (Caputo and Soares 2019), there were hills where the current Amazon delta is today. By doing comparative studies of waterborne mid-Cretaceous zircon sand samples from eastern upland and western Pacific sites, Mapes deduced that the river flowed from the east toward the west, and

ostensibly, the Pacific Ocean, passing through an area where the Andes ranges had yet to form.

Why might it be important to know that once the Amazon flowed west, into the Pacific Ocean? Actually, if one looks at the Andean chain and where there are the lowest spots, there is a dip directly west of the westernmost part of the end of the Amazon and the modern city of Iquitos, Peru. From there, many of the Peruvian tributaries of the Amazon, such as the Ucayali and Marañon, make a hard turn to the south. Understanding topography is central to clarifying



*Spiral temple at Montegrando. Image by JOEL 20001
via Wikimedia Commons (CC BY-SA 4.0)*

the processes of development that took place, particularly in this peripheral area. It is no wonder, then, that archaeological sites, such as the upland site Chavín de Huantar, along one of these rivers should contain tropical imagery—felines, crocodilians, vegetation, and the like—when none of these things are found in the higher elevations.

Another of these upland, intermediary sites is Kuélap, perhaps the largest of the Chachapoya archaeological sites that exists. The Chachapoya people lived in the cloud forested, hilly region of what is now the Amazonas region of Peru.

Their main site of Kuélap can be reached by first going to Cajamarca on a bumpy twelve-hour bus ride from the coastal city of Chiclayo. This trip from the Pacific coast traces a trade route that would have been made often millennia and centuries ago. From the Chachapoya area, trade would have then gone on to and from Amazonia itself. Given such trading potential, the fact that the Chachapoya were a highly independent and powerful culture comes as no surprise. They were among the last sovereign groups to be incorporated into *Tahuantinsuyo*, the Land of the Four Quarters (or better known today as the Inca



Gran-Pajâten with feathered dancers. Image courtesy PromPeru, via Peru Telegraph.

Empire), in the fifteenth century during the reign of Topa Inca (Church and von Hagen 2018: 916).

With time, we are finding more and more sites in this peripheral zone linking Amazonia and the Andean world. The newly discovered site of Montegrande, near the present-day city of Jaen, further reinforces the concept that processes of cultural transformation were occurring between the Andean and Amazonian cultures in this transitional zone. Culturally, this site does not seem to fit with either the Peruvian highland cultures or the Amazonian lowland ones, yet there are suggestions that it may have been an

intermediary. What is striking is that the primary structure is a mound with a spiral stone structure.

Round structures have been noted at Chachapoya sites such as Kuêlap. At Gran Pajâten, another site further to the south, they often took the form of round wedding cake–style pyramids, most likely bases for other perishable structures. What was striking about these round structures was their embedded geometric designs; some were decorated with a frieze of plumed dancers all facing outward—all done in a stone-mosaic fashion.



Gran-Pajâten with feathered dancers. Image courtesy PromPeru, via Peru Telegraph.

Where does ancient Amazonia fit into the picture of the original peopling of South America?

Since this article focuses on relationships between human beings and Amazonia, to more fully contextualize how human beings first began living in this landscape, we will jump back in time to the Pleistocene. The Pleistocene is that period in the Earth's history marked by advances and recessions of polar and mountain ice fields creating ice ages interspersed by interglacial periods. It began a bit longer than two and a half million years ago and ended around 11,700 years ago. In other words, we currently live in an interglacial period that had its beginning around 11,700 years ago. What was it like during the ice ages in the vast lowlands of Amazonia, and then,

for those people who were experiencing it for the first time?

The story of the peopling of the Americas is being revised on an almost weekly basis. North American Archaeology class textbooks up until the 1990s presented the argument that the fluctuations of global climate during the Pleistocene made possible the arrival of the first Americans via the Bering Land Bridge. There were low global sea levels due to global moisture budgets "banking" their water in glaciers on continents and in mountain glaciers. These lowered sea levels exposed continental shelves, one of which



Pictograms from Serra da Capivara. By Vitor 1234 via Wikimedia Commons (CC BY-SA 3.0).

essentially made North America an extension of Asia via a broad tundra between Siberia and the Yukon. People and animals could cross, and the conventional wisdom was that this happened for humans only during the last major global cold period, bringing people here around twelve thousand years ago. They were great hunters, spreading quickly because the Pleistocene megafauna had no experience with humans as dangerous predators, so were easily slaughtered. This, essentially, is the Paul S. Martin Hypothesis (Martin 1973) of why the Pleistocene megafauna went extinct. The basic idea was that these Clovis hunters from about 12,000 years ago, armed with their chipped-stone fluted lance points, successfully spread out from the southern end of the ice-free corridor that formed east of the formerly glacier-bound Cordilleran Rockies, and west of the massive Laurentide ice sheet, much like a valve that had opened up from the north.

Where does Amazonia fit in all of this? Actually, until relatively recently, it was rather peripheral to Pleistocene discussions. Textbooks dealing with the original peopling of the New World pretty much ignored South America and even the idea that people could have arrived earlier than the last glaciation. Eventually, research at the site of Monte Verde in the western foothills of the south-central Chilean Andes was accepted as proof that American Indians had comfortably established themselves that far south already by the time that the Paul S. Martin Hypothesis would have them just arriving in central North America (Dillehay 1989). This was the first of what we now recognize as a number of “Pre-Clovis” sites in South America, and its dates have been pushed back even further than the Clovis (Dillehay et al. 2015). People were crossing the Bering Land Bridge, but doing it earlier, and some going south along various routes, it seems, some along the

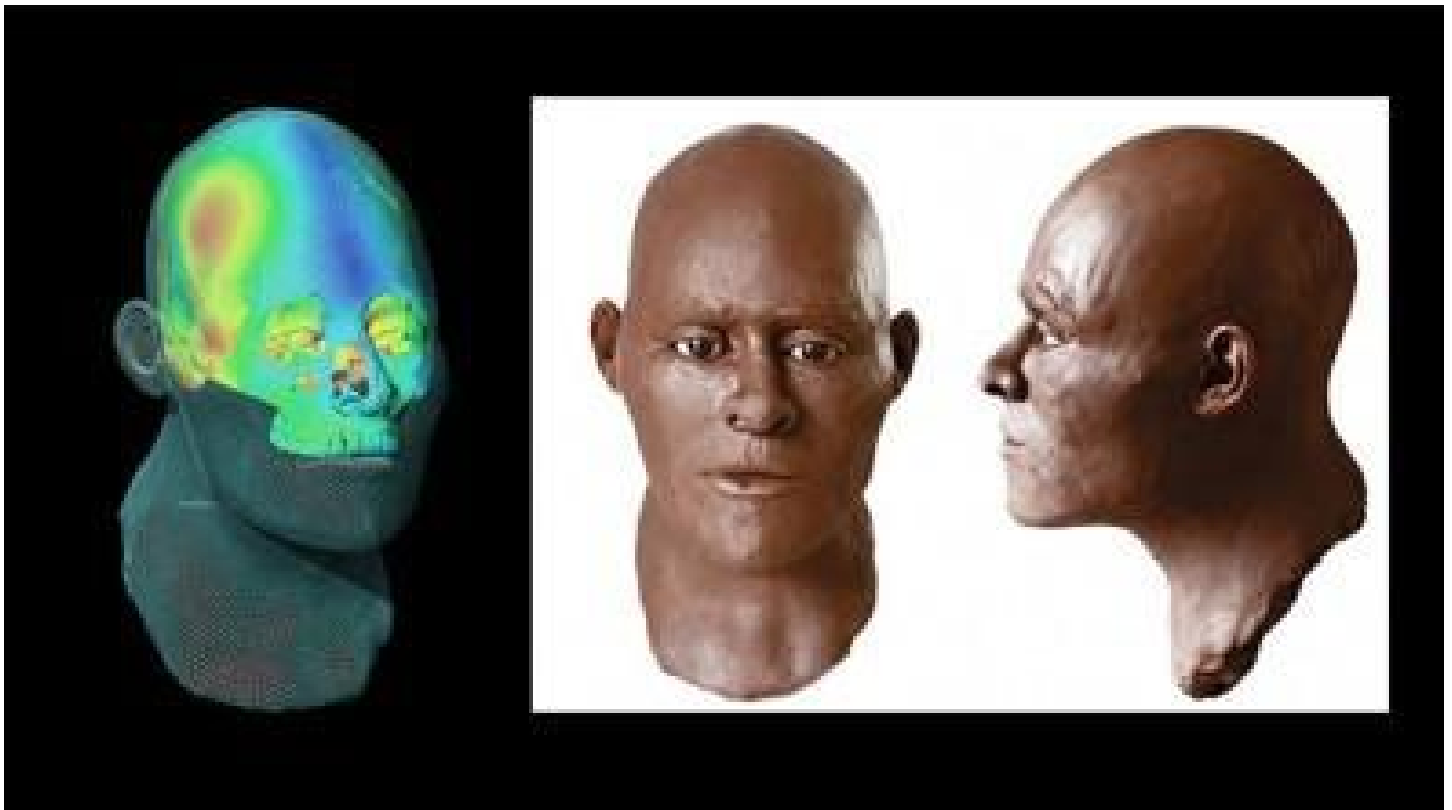
Pacific coast, while others broke off once they arrived south of Middle America.

It was only relatively recently that scientists realized that the ecosystems that characterize Amazonia today were not what they would have been like during the various Ice Ages. We now know that what we consider as the characteristic high tropical forest was in fact found only in small refugia, small areas with sufficient rainfall to maintain them, further toward the west in the foothills of the Andes. In fact, most of Amazonia during the peak of the Pleistocene glacial advances was grassland savanna with large areas of what we might prefer to call temperate grassland. Further south and along the Andes themselves, one would have encountered glaciers in abundance. For example, all of modern Patagonia would have been glaciated. Put another way, the Pleistocene landscapes of Amazonia—the “stages,” if you will, that were set for the arrival of

the first humans—were quite different than those that exist in those same diverse regions today.

So, imagine that an early human has made it as far south as what we now call Panama. Probably they cannot see gleaming white glaciers yet, but their choices are essentially to follow the Pacific coastline south, or to take an easterly route toward the Guyana Shield. Just before that, they might go directly south of it, toward what is now the Colombian lowlands, or up and over the Guyana Highlands and then to the east and to the mouth of the Amazon itself. From there, some of their relatives can head on down the river; others might continue further on down the coast.

Amazonia did indeed become a significant area of ancient migration movement during Pleistocene times, and it is shown both in osteological records and in cave art. The Serra da Capivera, in the Brazilian state of Piauí, is the largest rock-art site

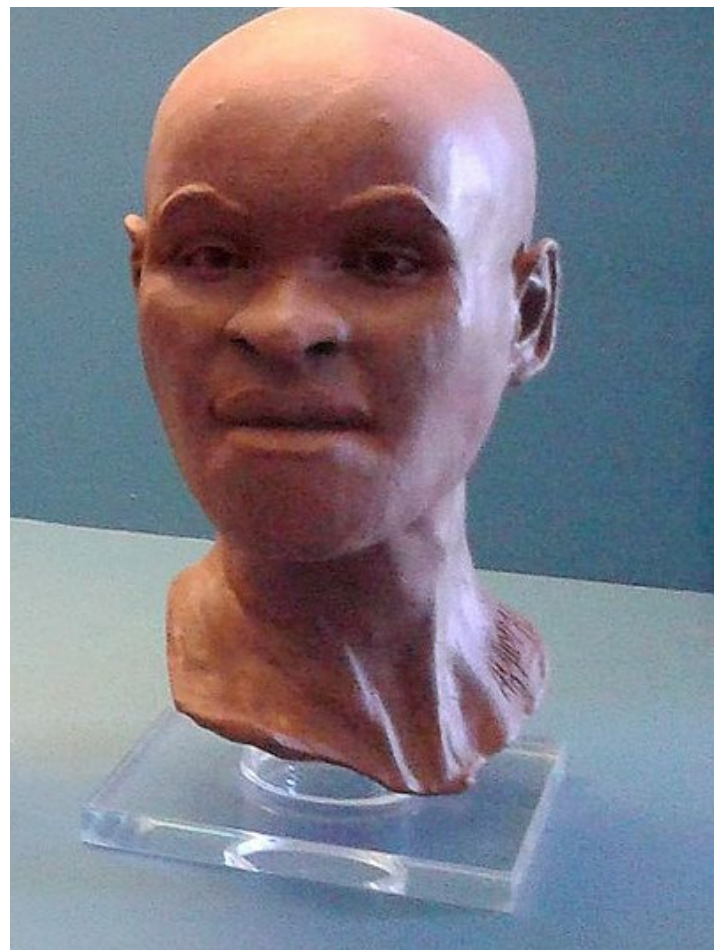


See Luzia’s original reconstruction via the article “Reconstructing the Deep Population History of Central and South America” (Posth et al.) [cell.com/cell/fulltext/S0092-8674\(18\)31380-1](http://cell.com/cell/fulltext/S0092-8674(18)31380-1) via FAPESP Agency (CC-BY-NC-ND)

in the world. Now designated a World Heritage Site, its abundant rock art shows people and Pleistocene animals. Nearby sites are dated back to as early as 20000 B.C. (Lahaye et al. 2013). The site of Santa Elina, situated in the center of South America, was recently dated to 21170 B.C. (23120±260 B.P.) for its earliest occupation, making it by far one of the earliest archaeological sites in the Western Hemisphere (Vialou et al. 2017).

Paleoanthropologists, those interested in understanding and learning about past human lifeways from what has survived from the remains of ancient individuals, have learned much about the ancestors of the contemporary Indigenous peoples of the region. There have been surprises in interpretation, with the discovery of one cranium, later named “Luzia,” in particular. She was found and painstakingly excavated, then underwent a forensic reconstruction by Richard Neave of Manchester University. According to that analysis, she seemed to have features incorporating characteristics of some western Oceanic peoples.

Then, in 2018, following the disastrous burning of the National Museum in Rio de Janeiro where the cranium of Luzia was housed, her burned remains were recovered and carefully removed. A new archaeogenetic technique allowed researchers to find out more about Luzia’s ancestral links. While Luzia was originally depicted as having facial characteristics that would have set her as remarkably distinct from the majority of Amerindian peoples, a different forensic expert now indicates her appearance to have been more Amerindian (as seen in the revised forensic reconstruction). A new type of DNA analysis strongly indicates that she was indeed closely linked to the main Amerindian group.



This is Luzia’s revised reconstruction. Image by Dornicke via Wikimedia Commons (CC BY-SA 4.0).



Marajoa Urn. Image by Wagner Souza e Silva, used with permission.

What is the nature of the evidence for or against the emergence of cultural complexity in ancient Amazonia?

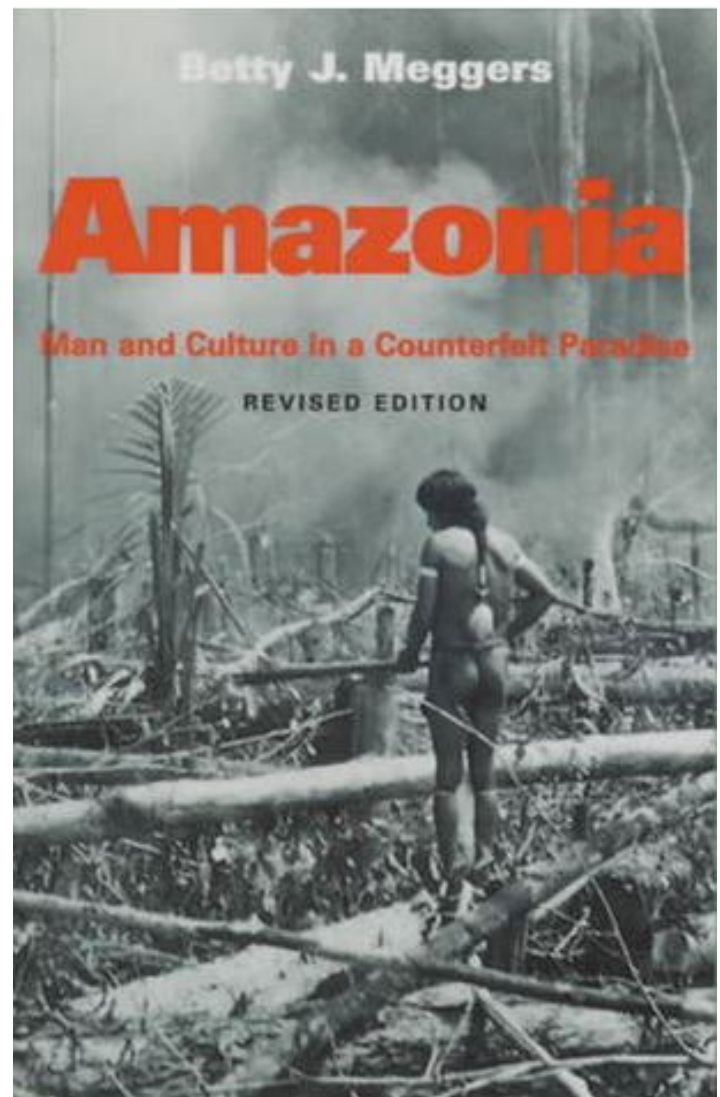
Now that we have established that the original migrants into the vast lowlands of the Amazonian drainage have settled, that they have been here for a much longer period than we had imagined, and that they became quite adept at mastering the various ecological subsets (and even recorded their impressions on rock walls), we can now look at how complex societies developed in Amazonia.

For many years it was conventional wisdom that the moist tropical world was somehow antithetical to the emergence of complex civilizations, or even hostile to ones coming from other areas. Even renowned researchers followed this line of reasoning. For example, the husband-wife team of Betty Meggers and Clifford Evans were major pioneers in South American, and in particular Amazonian, archaeology. Betty Meggers was one of the first to excavate on Marajo, the huge island at the mouth of the Amazon. There she found evidence of a culture that produced exquisitely decorated urns. She wrote the book *Amazonia: Man and Culture in a Counterfeit Paradise* (1996) wherein she argued that the tropical forest was inherently unable to support complex societies because of the poor quality of soils found under tropical forests.

Personally, as one who has dedicated his life to studying complex civilizations in such settings (in particular the Maya), I found her idea that tropical ecosystems were somehow antithetical to complex societies—civilizations—to be fundamentally absurd. The very rise and florescence of Maya civilization itself was testimony to that, let alone the achievement of similarly complex societies in other parts of the world, such as ancient Southeast Asia and India.

I was fortunate to have studied under University of Minnesota Professor Dennis Puleston whose work at the Maya site of Tikal led us to think

about the Maya as having been extremely numerous there, western notions of urbanism notwithstanding. Mayanists tended to look to other areas of the world for cultural analogs that might help them interpret the archaeological patterns they were finding, and often they found them in tropical West Africa. I remember him showing me aerial photos of a large West African city (probably Ibadan, Nigeria) in the 1970s. It was a densely packed urban area with houses



Amazonia, Man and Culture in a Counterfeit Paradise, by Betty J. Meggers (1996).

surrounded by trees. I was really surprised when he told me that almost all of the homes in that photo represented primary food producers. Each house was surrounded by a kitchen garden and pretty much everything needed for the family's subsistence was directly accessible. This was the norm in this large, densely-packed, traditional community in West Africa. For Puleston, this was something to consider when trying to understand what archaeological indicators for densely-packed

settlements around Tikal and other Maya sites were beginning to show.

Puleston was providing good “thinking out of the box” archaeologically, something that is also helpful in rethinking the question of cultural complexity in Amazonia. Clearly, the description by Francisco de Carvajal, on the first trip by Europeans down the Amazon, suggested that the Indigenous peoples there had done much better than Betty Meggers ever would have imagined.



Santarem-style bottleneck-style vessel (Vaso de gargalo). Via [SciELO](#) (CC BY 4.0).

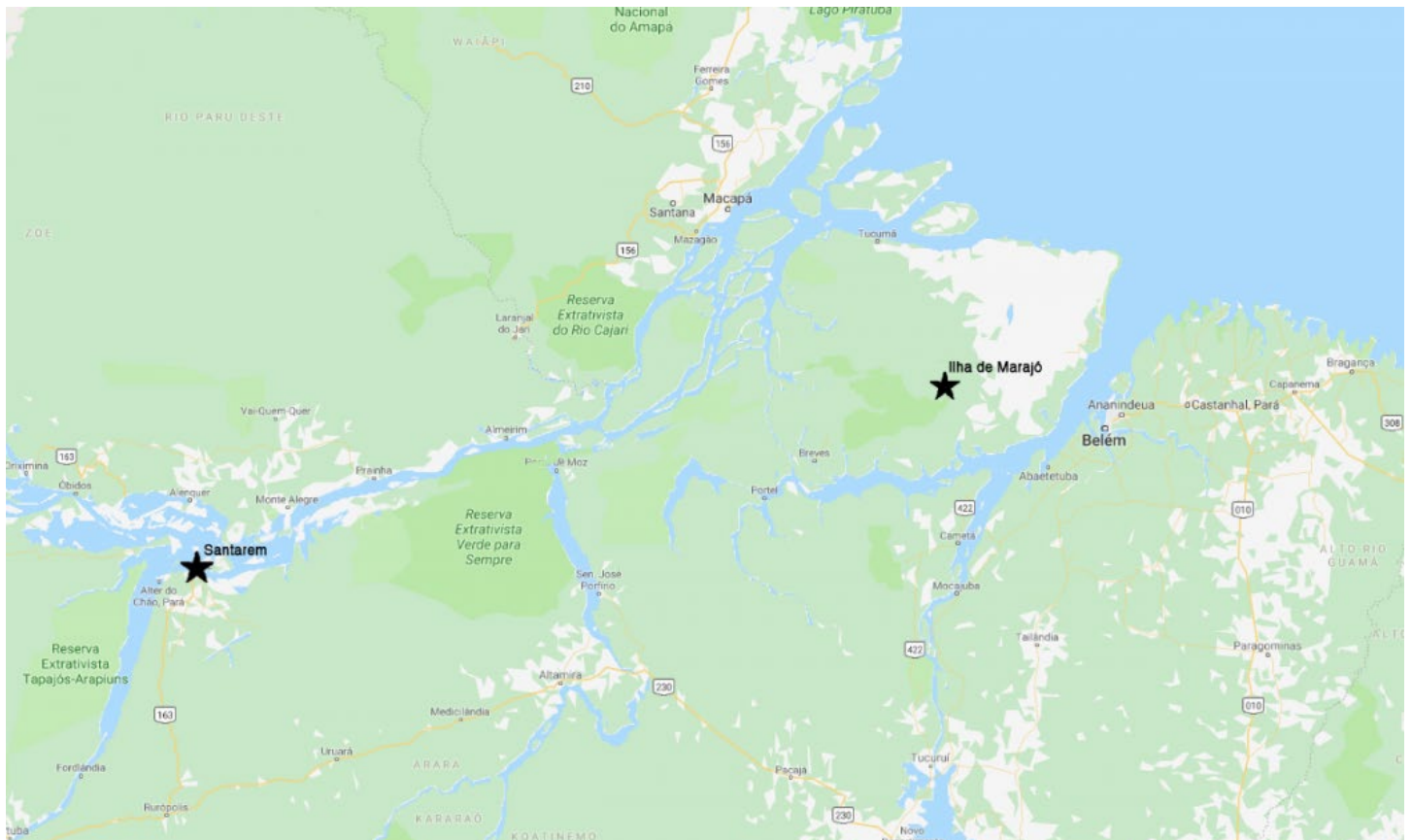
In fact, she would have denied his claims along with the Spanish courts. Yet archaeologically, we are beginning to gather evidence of great antiquity for human presence in South America and in the Amazonian area itself (Vialou 2017). A human presence over at least such a long time

period easily would have allowed for familiarization with, and adjustments and modifications made to, Amazonian species and landscapes, leading to domestication and increasing levels of complexity.

What new archaeological evidence has been emerging about ancient Amazonia?

Prior to the advent of sophisticated aerial and satellite remote-sensing technologies, much of the Amazonian landscape remained environmental and archaeological *terra incognita*. With extensive deforestation, especially in southwestern Amazonia in the Brazilian state of Acre, regular geometry began to become visible, and there they were named “geoglyphs.”

Geoglyphs generally take the form of ditch enclosures in the shape of circles or rectangles, and sometimes combinations of the two. As clearing progressed and as aerial reconnaissance then became more formal and sophisticated, the numbers of these landscape modifications increased to the multiples of hundreds. The area still under tropical forest is immense, and there are some



Map of the Amazon basin, showing the relative locations of Santarem and Ilha de Marajo. Map data © Google, 2019.

more sophisticated reconnaissance techniques being employed—among them lidar—right in the center of the area where Carvajal claimed there to have been extensive areas of settlement (Stenborg et al. 2018). This is the area famous archaeologically for its almost-baroque, elaborate, Santarem-style pottery vessels (Lopes-Alves 2018).

Parsons and Denevan did pioneering archaeological work there, noting regular geometry in a number of places in lowland South America (Parsons and Denevan 1967). Clark Erickson later worked in the Beni area of the Bolivian lowlands, furthering the observations that Parsons and Denevan had documented. Erickson elaborated upon what he viewed as the extensive nature of landscape modifications humans had made in this region, going beyond the geometry of the ridged fields to the series of forested “islands” that themselves turned out to be anthropogenic; their connected causeways with their adjacent canals provided for transport both during the dry seasons and flooded rainy seasons. Erickson’s scenario for pre-Columbian life in the region

would have been quite remarkable because he proposed having numerous people living on these artificial terraced “forest islands” and raising abundant crops (Erickson 2006). Archaeological research continues in the lowlands of Bolivia, adjacent southern Brazil, and Peru.

Farther to the east along the Xingu River, Michael Heckenberger, both an archaeologist and a cultural ethnographer, has been working with the Kuikuro people for decades. His research substantiates that the ancestors of the present-day people there had been much more numerous and had lived in much larger settlements than those found in the region today. As indicated by the archaeological record, people there had gardens, fields, and orchards, and lived in circular communities that were much larger than those lived in by the present-day Kuikuro. The communities were interconnected by extensive road systems. Today the Kuikuro live in an Indigenous reserve and their environment has been allowed to return more to a tropical forest (Heckenberger 2009).

What have we learned from the ancient, Indigenous peoples of Amazonia that has been powerfully transformative to the entire world?

When I was teaching and I had an opportunity to talk about the American culinary debt to the rest of the world, I usually began with manioc and asked how many of the students had ever eaten it. Unless I just happened to have someone from the region, it’s extremely rare that I got a “yes.” I then went on to say that most likely just about everyone in the room has had it at least once. Students usually showed doubtful curiosity. “How many of you have had tapioca? OK, now, how about cashews?” (from the Indigenous Tupi, *caxu*). I remember as a kid there were always nuts to crack at Christmas, and the hardest were always the toe-shaped Brazil nuts. It was Brazil wood

that first brought Europeans to that part of the world, and not just the Portuguese, but Dutch, English, French, and Spanish.

This is just the beginning, but manioc is quite significant as it is one of the main staples now around the world, not just for humans but also for livestock. It is also used extensively in various kinds of East and Southeast Asian dishes. There are also many fruits endemic to the Amazonian forest that are recognizable across the globe, such as passion fruit, avocado, and varieties of cacao, but increasingly the region is most famous for invasive species. Probably the most famous of

these invasive species is coffee, but there are also other commercial crops like soybeans.

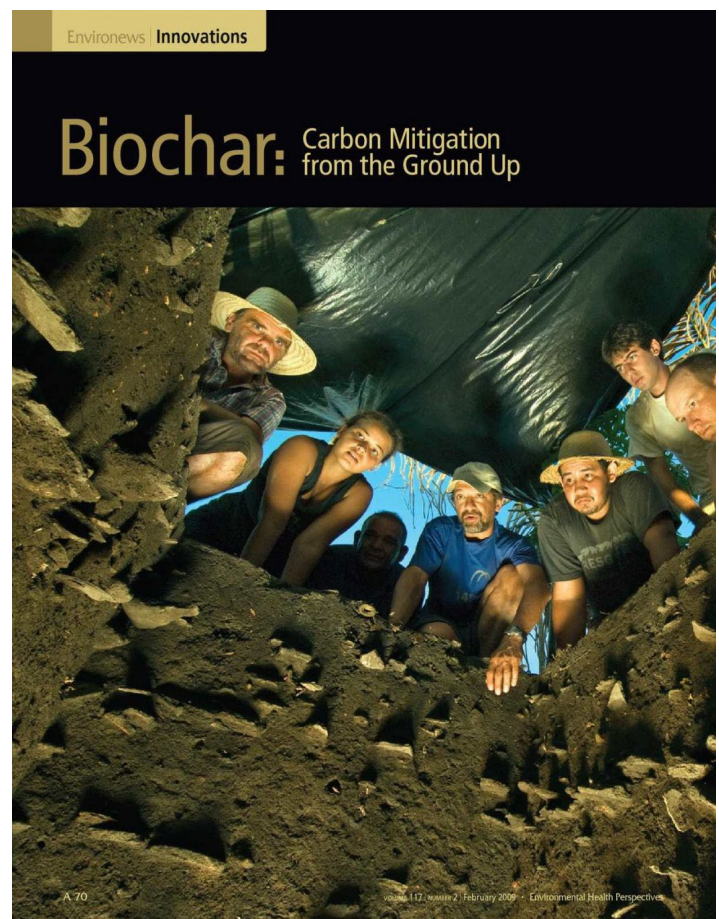
One of the initial recognitions of there having been dense human occupation in the very center of Amazonia was found in areas where even today one finds the best soil to grow gardens, the *terra preta do indio*—the “black earth of the Indians.” When I first was made aware of it years ago, the thing that I was most amazed about was that it veritably bristled with ceramics.

Until recently the implications of this *terra preta* have been largely unrecognized. Now it is tied to an interest in biochar as an augmentation to horticulture not only in the tropical world but the temperate one as well. Betty Meggers, the former Smithsonian Institution archaeologist, contended that the Amazon forest tropical soils were unable to support complex societies, but that argument now appears to be in disfavor. I hope some of what has been presented above has helped shed some light on work related to that.

Clearly, many people had lived in what had been once viewed as “unsustainable,” poor tropical-soil lands. They produced vast amounts of pottery and left it in soil that was definitely quite different from what was “normal” for that found beneath tropical forests. These new soils were rich and black and could sustain crops.

Today, soil scientists in other areas of the world have begun to look at biochar, a charcoal made from a biomass being smoldered or from an incomplete burning process. For example, in Minnesota people now employ things like organic permaculture teas produced from biochar processes as fertilizer, and the University of Minnesota is carrying out research on the applications of biochar (Nooker 2014). Perhaps it is best put by saying that new research is just “discovering” old patterns after all.

Muito obrigado. Many thanks to the ancient Indigenous people of Amazonia!



Biochar: Carbon Mitigation from the Ground Up.

What of the future of Amazonia?

The Amazon has always been ecologically dynamic, having changed over time with glacial and interglacial periods, now followed by our own period of increasing global warming. In the Amazon region this has led to a number of years of drought during the rainy season. It also has led to interesting uncertainties during their winter. For example, in August 2010 there was one time when there were seventeen cities with snow falling on the ground, sometimes interrupting traffic. Normally, there are two to three cities that might get a trace of snow in a year. These snowfalls occurred in cities in various locations in the Brazilian Highlands, a significant portion of southern and eastern Brazil. While not the hot, moist, tropical forest, these areas affect them and are also impacted by them.

Amazonia has had its share of wet and dry years and more drought years recently. Large swaths of it have been transformed to farmland. In portions of Brazil, rivers have been aggressively dammed. Traditional, scheduled, fallow-based systems of slash-and-burn agriculture have often been replaced by more destructive ones introduced by poor settlers from large cities—people encouraged to come into the region in search of livelihoods (much like our own Homestead Acts in

the U.S. in the past). Brazil alone has the fourth largest economy in the world and most likely will continue and grow, but at what cost?

There are other models that we can begin to discern that have been employed to adapt to the same ecosystems without the kinds of destructive outcomes that we are seeing in the end of the twentieth and beginning of the twenty-first century.

We are continuing to learn how interesting Amazonia's prehistory is. The same is true if we look at the region geologically, biologically, and historically. We all are deeply invested in the success of the region whether we like it or not because every breath we take contains some oxygen produced by the abundant forests that still remain there. It is worthwhile to try to understand how Indigenous peoples of Amazonia managed to coexist with their environmental conditions in the past, and do so in ways that allowed them to develop different kinds of complexities, different kinds of tropical urbanisms. The vastness of Amazonia encourages the broadest enquiring minds! Below are some suggestions for using some of the portals and spreadsheets often not used by English speakers, but that nonetheless will have sources useful for all.

Finding archaeological information about ancient Amazonia

Archaeological work in Amazonia has been going on for a number of years with much of it published in Portuguese, Spanish, and French. There are a number of international search engines that can be used specifically for South America. *SciELO* (Scientific Electronic Library Online) began in Brazil in 1997 and now includes 19 other countries. It is one of the best. Also, there is *Redalyc* (Red de Revistas Científicas de América Latina y el Caribe), a database of

scientific journals and other publications for Latin America and the Caribbean. *Latindex* is a regional cooperative online information system for scholarly journals from Latin America, the Caribbean, Spain, and Portugal. There are 30 countries represented and 17,000 journals. In addition, there is *Persée*. This is a French database that includes journals related to archaeology of Latin America, often including Amazonia. A quick search there using words like “archeologie,

Amazon” quickly pulled up a few thousand titles, including one by Anna Roosevelt on her work on Marajo Island. The complete *Proceedings* of the Société des Américanistes (Society of Americanists) are found there.

Currently, one of the foremost institutions doing this is the Universidade de São Paulo, Museu de Arqueologia e Etnologia and close to the mouth of the Amazon itself, the Museu Paraense Emílio Goeldi, now celebrating 150 years.[1]

They publish a *Boletim do Museu Paraense Emílio Goeldi Ciências Humanas*, a quarterly journal that often includes articles in English on, or related to, archaeology.[2] In addition, the Museu also has its own set of digital book-length publications.[3] Also, there is an active Brazilian Archaeological Society (Sociedade de Arqueologia Brasileira)[4] with its own scholarly journal, *Revista de Arqueologia*, that comes out once, and sometimes twice, a year.

Further Reading

Heckenberger, Michael J. 2005. *The Ecology of Power: Culture, Place, and Personhood in the Southern Amazon, A.D. 1000-2000*. New York: Routledge.

Hemming, John. 2008. *Tree of Rivers: The Story of the Amazon*. New York: Thames & Hudson.

Mann, Charles C. 2011. *1491: New Revelations of the Americas Before Columbus*. New York: Vintage.

McEwan, Colin, Cristiana Barreto, and Eduardo Neves, Eds. 2001. *Unknown Amazon: Culture in Nature in Ancient Brazil*. London: The British Museum Press.

Medina, Jose Toribio. 1939. *The Discovery Of The Amazon: According To The Account Of Friar Gaspar De Carvajal And Other Documents*. Edited by H. C. Heaton. Translated by Bertram T. Lee. First published in 1894. American Geographical Society Special Publications, No. 17. Edited by W. L. G. Joerg. New York: American Geographical Society. Reprinted Whitefish, MT: Kessinger Publishing’s Rare Reprints, 2010.

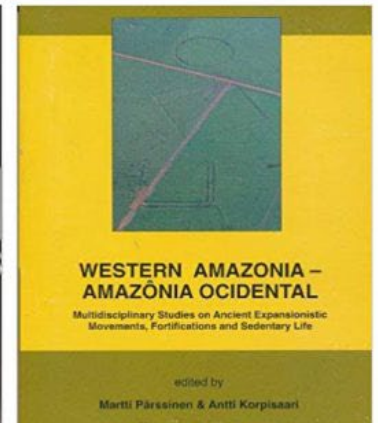
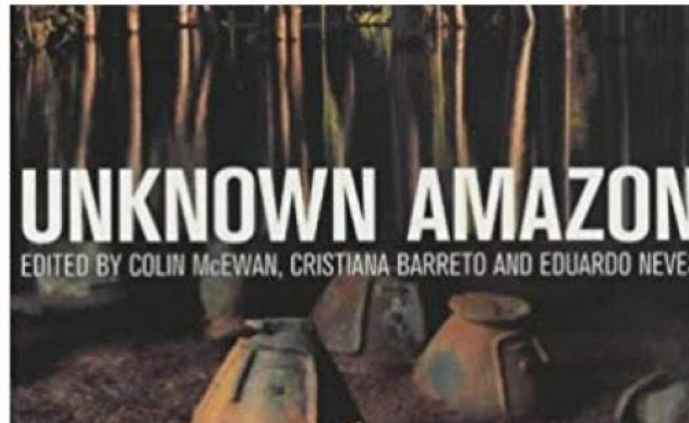
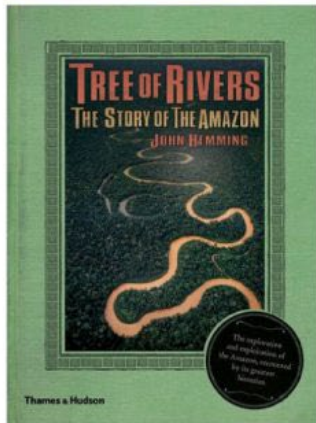
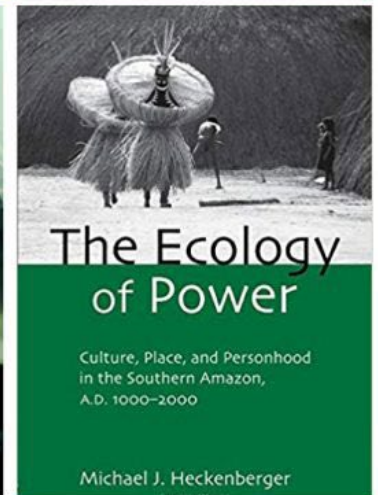
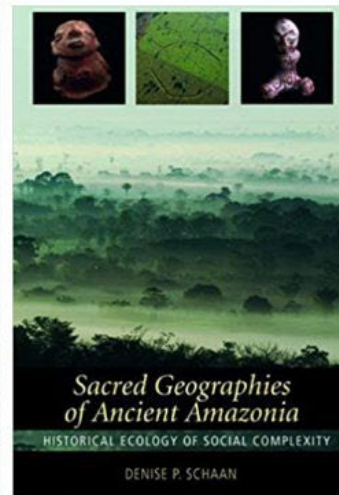
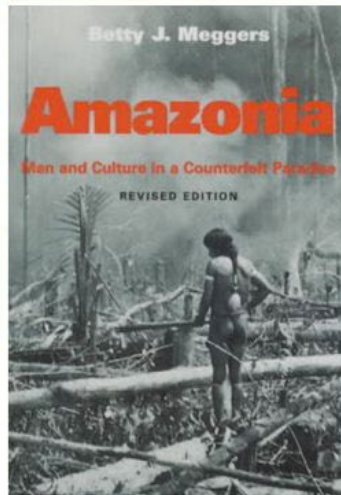
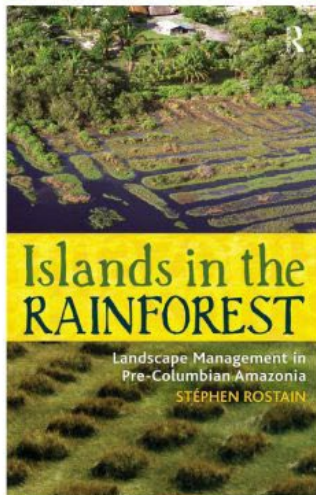
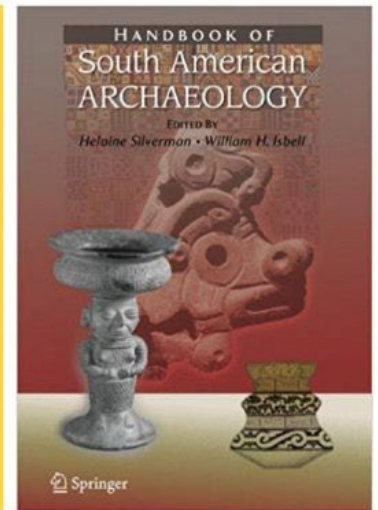
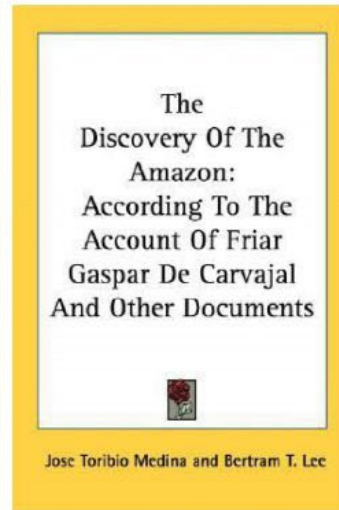
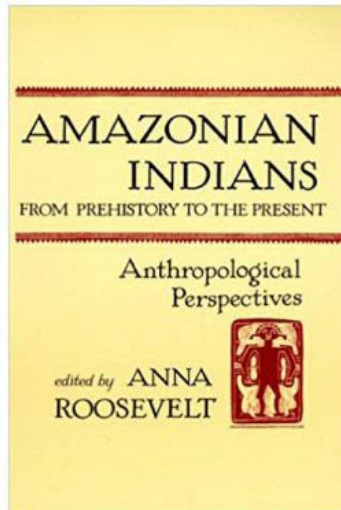
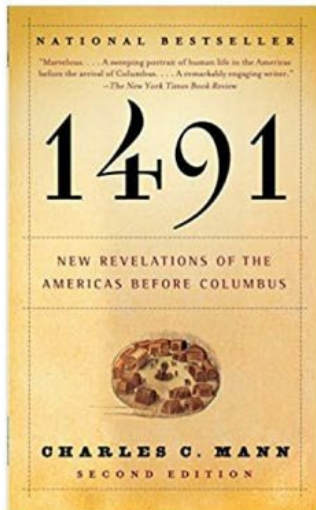
Meggers, Betty. 1996. *Amazonia: Man and Culture in a Counterfeit Paradise*. Washington, D.C.: Smithsonian Institution.

Pärssinen, Martti, and Antti Korpijarvi, Eds. 2003. *Western Amazonia—Amazônia Ocidental: Multidisciplinary Studies on Ancient Expansionistic Movements, Fortifications and Sedentary Life*. Helsinki: Renvall Institute Publications, University of Helsinki.

Roosevelt, Anna C., Ed. 1994. *Amazonian Indians: From Prehistory to the Present, Anthropological Perspectives*. Tucson: University of Arizona Press.

Rostain, Stéphen. 2013. *Islands in the Rainforest: Landscape Management in Pre-Columbian Amazonia*. Walnut Creek, CA: Left Coast Press.

Schaan, Denise. 2013. *Sacred Geographies of Ancient Amazonia: Historical Ecology of Social Complexity*. Walnut Creek, CA: Left Coast Press.



A selection of book covers of further reading titles.

References Cited

- Aimola, G., C. Andrade, L. Mota, and F. Parenti. 2014. Final Pleistocene and Early Holocene at Sitio do Meio, Piauí—Brazil: stratigraphy and comparison with Pedra Furada. *Journal of Lithic Studies* 1 (2): 5-24. doi: 10.2218/JLS.V1I2.1125.
- Barreto, Cristiana. 2013. Beyond Pots and Pans: Ceramic Record and Context in Pre-Colonial Amazonia. Paper presented at the 78th Annual Meeting of the Society for American Archaeology, April 4, 2013, Honolulu, HI.
- Bush, Mark B., Crystal H. McMichael, Dolores R. Piperno, Miles R. Silman, Jos Barlow, Carlos A. Peres, Mitchell Power, and Michael W. Palace. 2015. Anthropogenic influence on Amazonian forests in pre-history: An ecological perspective. *Journal of Biogeography* 42 (12): 2277-2288. doi: 10.1111/jbi.12638.
- Caputo, Mario Vicente, and Emilio Alberto Amaral Soares. 2016. Eustatic and tectonic change effects in the reversion of the transcontinental Amazon River drainage system / Efeitos de mudanças eustáticas e tectônicas na reversão do sistema de drenagem do Rio Amazonas transcontinental. *Brazilian Journal of Geology* 46 (2): 301-328. doi: 10.1590/2317-4889201620160066.
- Church, Warren B., and Adroamma Von Hagen. 2008. Chachapoyas: Cultural Development at an Andean Cloud Forest Crossroads. In *Handbook of South American Archaeology*, edited by Helaine Silverman and William H. Isbell, 903-926. New York: Springer.
- Conrad, Joseph. (1899) 2015. *Heart of Darkness*. New York: CreateSpace Independent Publishing Platform.
- Derewicz, Mark. 2007. A River Runs Backward. *Endeavors: Research and creative activity at UNC-Chapel Hill*. Chapel Hill, NC: UNC Research. Monday, January 1.
- Dillehay, Tom D. 1989. *Monte Verde: A late Pleistocene settlement in Chile*. Washington, D.C.: Smithsonian Institution Press.
- Dillehay, Tom D., Carlos Ocampo, José Saavedra, Andre Oliveira Sawakuchi, Rodrigo M. Vega, Mario Pino, Michael B. Collins, Linda Scott Cummings, et al. 2015. New Archaeological Evidence for an Early Human Presence at Monte Verde, Chile. *PLoS ONE* 10 (11): e0141923. doi: 10.1371/journal.pone.0141923.
- Erickson, Clark L. 2006. The Domesticated Landscapes of the Bolivian Amazon. In *Time and Complexity in Historical Ecology: Studies in the Neotropical Lowlands*, edited by William Balée and Clark Erickson, 235-278. New York: Columbia University Press.
- . 2010. The Transformation of Environment into Landscape: The Historical Ecology of Monumental Earthwork Construction in the Bolivian Amazon. *Diversity* 2: 618-652.

Glaser, Bruno, and Jonathan Birk. 2012. State of the scientific knowledge on properties and genesis of Anthropogenic Dark Earths in Central Amazonia (terra preta de Índio). *Geochimica et Cosmochimica Acta* 82 (April): 39-51. doi: 10.1016/j.gca. 2010.11.029.

Gregorio de Souza, Jonas, Denise Pahl Schaan, Mark Robinson, Antonia Damasceno Barbosa, Luiz E. O. C. Aragão, Ben Hur Marimon Jr., Beatriz Schwantes Marimon, et al. 2018. Pre-Columbian earth-builders settled along the entire southern rim of the Amazon. *Nature Communications* 9 (1 March). doi: 10.1038/s41467-018-03510-7.

Heckenberger, Michael J. 2009. Lost Cities of the Amazon: The Amazon tropical forest is not as wild as it looks. *Scientific American* 301 (4, October): 64-71. Stable URL: stable/26001557.

Hemming, John. 2008. *Tree of Rivers: The Story of the Amazon*. New York: Thames & Hudson.

Herzog, Werner, dir. 1972. *Aguirre: The Wrath of God*. Written, directed, and produced by Werner Herzog, featuring Klaus Kinski, Helena Rojo, Ruy Guerra. Starz / Anchor Bay Studio. Production company Werner Herzog Filmproduktion, Hessischer Rundfunk. Distributed by Filmverlag der Autoren. <https://www.youtube.com/watch?v=RIOCyVeRmjo>.

Ippolito J. A., A. Donnelly, and J. Grob. 2015. Anatomy of a Field Trial: Wood-based Biochar and Compost Influences a Pacific Northwest Soil. *The Biochar Journal*. 15 June. Arbaz, Switzerland. ISSN 2297-1114. <http://www.biochar-journal.org/en/ct/62>. Accessed, January 1, 2019.

Jaimés Betancourt, Carla. 2017. Diferencias Cronológicas, Funcionales y Culturales en la Cerámica de los Llanos de Mojos, Beni-Bolivia. In *Arqueología de la vertiente oriental Surandina. Interacción macro-regional, materialidades, economía y ritualidad*, edited by Beatriz N. Ventura, Gabriela Ortiz and María Beatriz Cremonte, 25-50. Buenos Aires, Argentina: Sociedad Argentina de Antropología.

Khan, S., L. Aragão, and J. Iriarte. 2017. A UAV–lidar System to Map Amazonian Rainforest and its Ancient Landscape Transformations. *International Journal of Remote Sensing* 38 (8-10): 2313-2330. doi: 10.1080/01431161.2017.1295486.

Lahaye, Christelle, Marion Hernandez, Eric Boëda, Gisele D.Felice, Niède Guidon, Sirlei Hoeltz, Antoine Lourdeau, et al. 2013. Human occupation in South America by 20,000 BC: the Toca da Tira Peia site, Piauí, Brazil. *Journal of Archaeological Science* 40 (6): 2840-2847. doi: 10.1016/j.jas.2013.02.019.

las Casas, Fray Bartolomé de. 1566. *Apologética historia sumaria*. La Fundacion El Libro Total. Online Spanish <https://www.ellibrototal.com/ltotal/?t=1&d=4072>.

Levis, Carolina, Bernardo M. Flores, Priscila A. Moreira, Bruno G. Luize, Rubana P. Alves, Juliano Franco-Moraes, Juliana Lins, et al. 2018. How People Domesticated Amazonian Forests. *Frontiers in Ecology and Evolution* 5 (171). doi: 10.3389/fevo.2017.00171.

Levis, C. F., R. C. Costa, F. Bongers, M. Peña-Claros, C. R. Clement, A. B. Junqueira, E. G. Neves, et al. 2017. Persistent effects of pre-Columbian plant domestication on Amazonian forest composition. *Science* 355 (6328): 925-931. doi: 10.1126/science.aal0157.

Lima, Helena Pinto, Eduardo Goes Neves, and James B. Peterson. 2008. A fase Açutuba: um novo complexo cerâmica na Amazônia Central. *Arqueología Suramericana/Arqueologia Sul-americana* 2: 26-52.

Lombardo, Umberto, Sebastian Deniera, Jan-Hendrik May, Leonor Rodrigues, and Heinz Veita. 2013. Human-environment interactions in pre-Columbian Amazonia: The case of the Llanos de Moxos, Bolivia. *Quaternary International* 312 (October): 109-119. doi: 10.1016/j.quaint.2013.01.007.

Lopes-Alves, Marcony. 2018. Para além de Santarém: os vasos de gargalo na bacia do rio Trombetas (Beyond Santarém: 'necked vessels' in the Trombetas River basin). *Boletim do Museu Paraense Emílio Goeldi. Ciências Humanas* 13 (1, jan.-abr.): 11-36. doi: 10.1590/1981.81222018000100002.

Mann, Charles C. 2011. *1491: New Revelations of the Americas Before Columbus*. New York: Vintage.

Mapes, Russell W. 2009. Past and Present Provenance of the Amazon River. Ph.D. dissertation, Department of Geological Sciences, University of North Carolina at Chapel Hill.

Martin, Paul S. 1973. The Discovery of America. *Science, New Series* 179 (4077): 469-974.

McMichael, C. H., M. W. Palace, M. B. Bush, B. Braswell, S. Hagen, E. G. Neves, M. R. Silman, E. K. Tamanaha, and C. Czarnecki. 2014. Predicting pre-Columbian anthropogenic soils in Amazonia. *Proceedings of the Royal Society B: Biological Sciences* 281 (1777). doi: 10.1098/rspb.2013.2475.

Medina, Jose Toribio. 1939. *The Discovery Of The Amazon: According To The Account Of Friar Gaspar De Carvajal And Other Documents*. Edited by H. C. Heaton. Translated by Bertram T. Lee. First published in 1894. American Geographical Society Special Publications, No. 17. Edited by W. L. G. Joerg. New York: American Geographical Society. Reprinted Whitefish, MT: Kessinger Publishing's Rare Reprints, 2010.

Meggers, Betty. 1996. *Amazonia: Man and Culture in a Counterfeit Paradise*. Washington, D.C.: Smithsonian Institution.

Nooker, Eric Paul. 2014. Impact of management practices on Minnesota's specialty crop production: From biochar to tillage practices. M.A. thesis, University of Minnesota.

Novotny, Etelvino H., Michael H. B. Hayes, Beáta E. Madari, Tito J. Bonagamba, Eduardo R. de Azevedo, André A. de Souza, Guixue Song, Christine M. Nogueira, and Antonio S. Mangrich. 2009. Lessons from the Terra Preta de Índios of the Amazon region for the utilisation of charcoal for soil amendment. *Journal of the Brazilian Chemical Society* 20 (6): 1003-1010. doi: 10.1590/S0103-50532009000600002.

Parsons, James and William M. Denevan. 1967. Pre-Columbian Ridged Fields. *Scientific American* 217 (1, July): 92-100. doi:10.1038/scientificamerican0767-92.

Phys.org. 2017. Ancient peoples shaped the Amazon rainforest. *Phys.Org*, March 2, Naturalis Biodiversity Center. <https://phys.org/news/2017-03-ancient-peoples-amazon-rainforest.html>. Accessed December 14, 2018.

Phys.Org. 2015. Amazonian natives had little impact on land, new research finds. *Phys.Org*, October 28, Florida Institute of Technology. <https://phys.org/news/2015-10-amazonian-natives-impact.html#nRly>. Accessed December 14, 2018.

Pope Paul III. 1537. *Sublimus Dei*, On the Enslavement and Evangelization of Indians. Papal Encyclicals Online. [Dated: May 29, 1537]. Online English translation, <https://www.papalencyclicals.net/paulo3/p3subli.htm>.

Posth, C., Nathan Nakatsuka, Iosif Lazaridis, Pontus Skoglund, Swapan Mallick, Thiseas C. Lamnidis, Nadin Rohland, et al. 2018. Reconstructing the Deep Population History of Central and South America. *Cell* 175 (November 15): 1185-1197, e22. doi: 10.1016/j.cell.2018.10.027.

Rostain, Stéphen. 2013. *Islands in the Rainforest: Landscape Management in Pre-Columbian Amazonia*. Walnut Creek, CA: Left Coast Press.

Rozas-Davila, Angela A., Bryan G. Valencia, and Mark B. Bush. 2016. The functional extinction of Andean megafauna. *Ecology* 97 (10): 2533-2539. doi: 10.1002/ecy.1531.

Saunaluoma, Sanna. 2012. Geometric Earthworks in the State of Acre, Brazil: Excavations at the Fazenda Atlântica and Quinauá Sites. *Latin American Antiquity* 23 (4). doi: 10.7183/1045-6635.23.4.565.

Schaan, Denise. 2013. *Sacred Geographies of Ancient Amazonia: Historical Ecology of Social Complexity*. Walnut Creek, CA: Left Coast Press.

Staden, Hans. 1557. *Warhaftige Historia und beschreibung eyner Landtschafft der Wilden Nacketen, Grimmigen Menschfresser-Leuthen in der Newenwelt America gelegen*. Kolb: Marburg. (Original German edition, 1557 available at: <https://archive.org/details/staden/page/n1>.)

Staden, Hans. 2008. *Hans Staden's True History: An Account of Cannibal Captivity in Brazil*. Edited and translated by Neil L Whitehead and Michael Herbsmeier. Durham, NC: Duke University Press. doi: 10.1215/9780822389293-002.

Stenborg, Per, Denise P. Schaan, and Camila G. Figueiredo. 2018. Contours of the Past: LiDAR Data Expands the Limits of Late Pre-Columbian Human Settlement in the Santarém Region, Lower Amazon. *Journal of Field Archaeology* 43 (1): 44-57.

Strauss, André, Rodrigo Elias Oliveira, Marina Gratão, Amelie da Costa, Emílio Fogaça, and Eric Boëda. 2018. Chapter 7. Human skeletal remains from Serra da Capivara, Brazil: Review of the available evidence and report on new findings. In *New Perspectives on the Peopling of the Americas*, edited by Katerina Harvati, Gerhard Jäger, and Hugo Reyes-Centeno, 153-171. Words, Bones, Genes, Tools: DFG Center for Advanced Studies Series. Tübingen: Kerns Verlag. ISBN: 978-3-935751.

UNESCO. ND. Serra da Capivara National Park. UNESCO World Heritage Centre. <http://whc.unesco.org/en/list/606>. Accessed January 2, 2019.

Vialou, D., M. Benabdelhadi, J. Feathers, M. Fontugne, and A. Vialou. 2017. Peopling South America's centre: The late Pleistocene site of Santa Elina. *Antiquity* 91 (358): 865-884. doi:10.15184/aqy.2017.101.

Watling, Jennifer, José Iriarte, Francis E. Mayle, Denise Schaan, Luiz C. R. Pessenda, Neil J. Loader, F. Alayne Street-Perrott, Ruth E. Dickau, Antonia Damasceno, and Alceu Ranzi. 2017. Impact of geoglyph builders on Amazonian forests. *Proceedings of the National Academy of Sciences*. 114 (8): 1868-1873. doi: 10.1073/pnas.1614359114.

Watling, Jennifer, Myrtle P. Shock, Guilherme Z. Mongeló, Fernando O. Almeida, Thiago Kater, Paulo E. De Oliveira, and Eduardo G. Neves. 2018. Direct archaeological evidence for Southwestern Amazonia as an early plant domestication and food production centre. *PLoS ONE* 13 (7): e0199868. doi: 10.1371/journal.pone.0199868.

Wikipedia contributors. 2019. Amazon River. In *Wikipedia, The Free Encyclopedia*. https://en.wikipedia.org/w/index.php?title=Amazon_River&oldid=877516439. Accessed 22:19, January 9, 2019.

Wikipedia contributors. 2018. SciELO. In *Wikipedia, The Free Encyclopedia*. <https://en.wikipedia.org/w/index.php?title=SciELO&oldid=874618690>. Accessed 00:00, January 10, 2019.

Footnotes

[1] This was taken from the current Home page for the Museu Paraense Emílio Goldi at <https://www.museu-goeldi.br/>, accessed January 8, 2019.

[2] Homepage for their Human Sciences bulletin at <http://editora.museu-goeldi.br/humanas/>.

[3] Digital books with some in English (Livros digitais) at <https://www.museu-goeldi.br/assuntos/publicacao/livros-digitais>.

[4] The Brazilian Archaeological Society home page (Portuguese) is at <https://www.sabnet.com.br/>.

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About the Author

Lewis C. "Skip" Messenger Jr. is a Professor Emeritus from Hamline University in Saint Paul, Minnesota. His passion is teaching and introducing students to other cultures through his numerous study abroad courses in Latin America and Southeast Asia. His practice was anthropological archaeology with regional interests in Mesoamerica, primarily the ancient Maya, but also in the origins and developments of complex societies in moist ecosystems in other parts of the world. These interests were influential in his early recognition of the role climate changes may have played as sources of stress on the development of ancient civilizations. This expanded his regional focus to include Southeast Asia, the Andes and Amazonia, and elsewhere. He began research on climate change and human affairs in

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the late 1970s and published in the journal *Ancient Mesoamerica* (Ancient Winds of Change—Climatic setting and prehistoric complexity in ancient Mesoamerica [1990]; Los Mayas y El Niño—Paleoclimatic correlations, environmental dynamics and cultural implications for the ancient Maya [2002]). Later he began introducing his students to these concepts and included them in his research. He is proud of his record of having integrated climate change with anthropological archaeology for more than three decades with his Hamline students.

FEATURE

WHAT'S IN MY BACKYARD? EMPOWERING INDIGENOUS VOICES ON FIREFLY CREEK AT BLUE'S BOTTOM

By Tianna M. Odegard

Introduction

All of us, regardless if we are Native or non-native, hold a specific location near and dear to our hearts. In this article, I focus on a place near and dear to my heart, exploring the history of my

family's cul-de-sac area known to my family, and much of the surrounding community, as Blue's Bottom. To do this, I share oral accountings from two Elders and my cousin from the Blue family. I



Firefly Creek. Image courtesy of Tracy Blue.

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also explore water resources in the area by presenting an oral accounting from a tribal member that holds an impressive and dedicated passion for teaching history to the Native American youth at Upper Sioux Community. Many readers here may be reminded of a water dwelling toward which they hold unwavering love and to which they devote a warm memory; I hope these memories reinvigorate how we view the landscape and areas near us and open up the question of “what’s in your backyard?”

What’s in my backyard? Since I was a child, growing up in the 1990s and 2000s, I have spent the majority of my life surrounded by family, by members of Upper Sioux Community, by the City of Granite Falls community, by agriculture, and by various bodies of water in Minnesota. While physical access to these resources has not been a barrier, there have been, and continue to be, times when the extent of our use of the creek is limited due to the pollution in the water; sometimes the water could still be used but with



The sump pump that was pumping water out of my basement during the spring 2010 flooding. Firefly Creek, shown in the background, had risen approximately seven feet from the usual water level. I recall our household having to leave the sump pump going 24-7 for about two weeks. Image courtesy of Tianna M. Odegard.

extreme caution, or at our own risk, as communicated to us by the Environmental Department at Upper Sioux Community. I distinctly recall being told by my mother, aunts, and uncles that my cousins and I should not go into the creek on certain days because the *E. coli* levels were too high. We also had consistent Minnesota Department of Natural Resources (DNR) reports cautioning that we could not eat many fish out of the creek nor the Minnesota River. Now the act of fishing has become a sport rather than a practice of subsistence intended to feed a family, and fish are practically eliminated from our diets. I have also experienced the terror and devastation of floods, and the indigenous plants that once

flourished in these watersheds are significantly reduced or gone.

In the absence of obvious physical indications to teach us how to live here, my family and I rely on stories and oral histories. These stories have been challenged throughout time by Western ideology but more Indigenous authors and scholars, such as presented in this article, practice recovering story as a form of learning. A significant number of stories and oral historical accountings have been lost just between my grandparents' generation and my mother's generation in part because it was particularly challenging to be Native American from 1900 into the 1970s. During that



An agricultural field on the Blue's Bottom property that is surrounded by wooded areas in addition to the residential landscape. Image courtesy of Tianna M. Odegard.

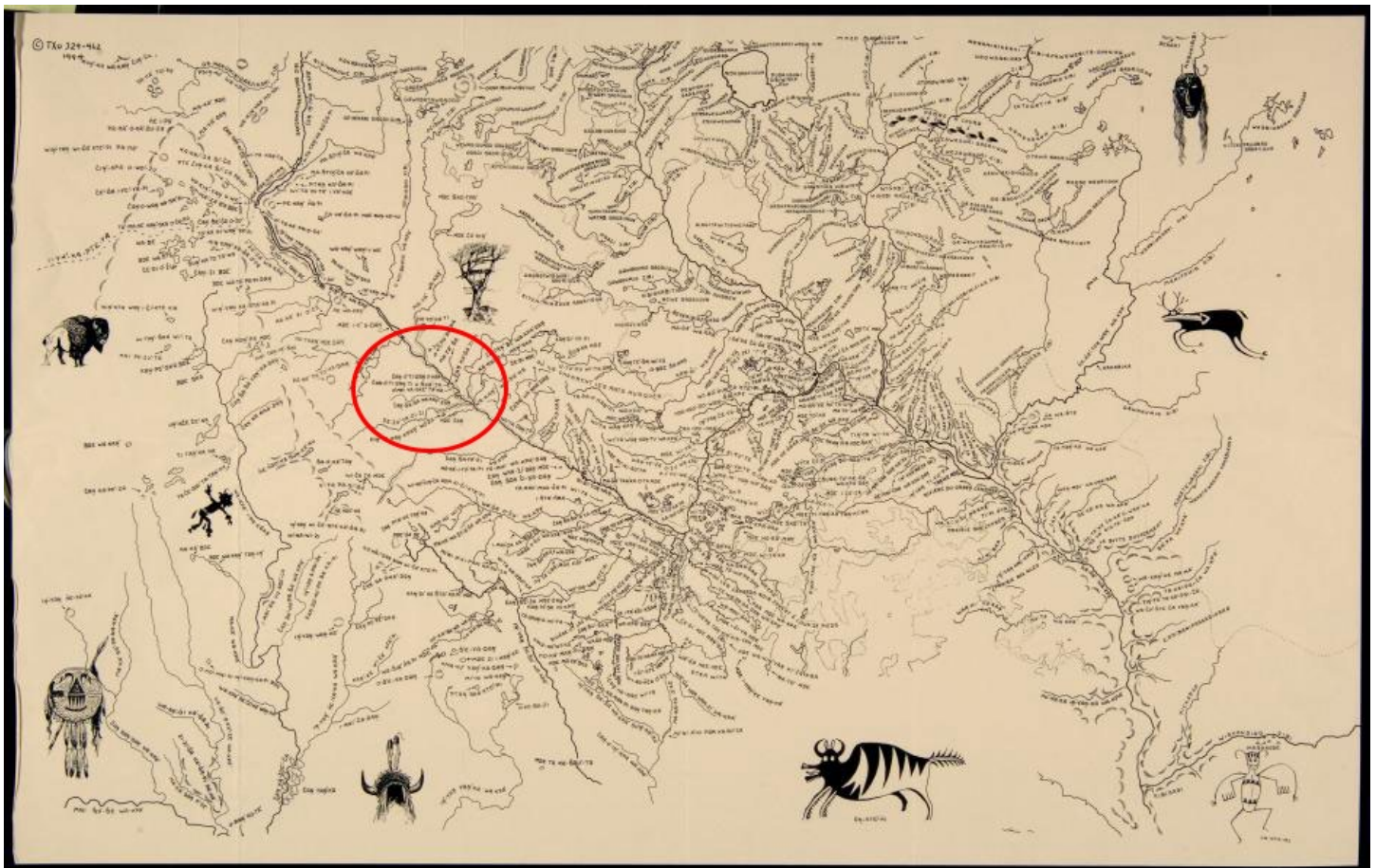
time, drawing attention to yourself or your family as a Native American or your traditional practices was ill advised and survival was key. One of the most repeated quotes my mother heard from her father, Larry Blue, was, “It’s a white man’s world; we better get used to living in it.” This simple, straightforward quote set the tone for the conditions in which my mother and her siblings grew up. They grew up in a time when their parents were trying to get food on the table and practicing their culture as Native American people was illegal. To me, it is therefore clear why I am

without vital information about how to use the land like we did over one hundred years ago, why I am not fluent in my language, and why it took me until my midtwenties to begin researching, reclaiming, and revitalizing lost or locked away narratives. I am not alone in this situation, which means my generation of Native people have a lot of work ahead of us; reaching into the past to understand the present and to change the future is a difficult task to ask of anyone. So where do we even begin?

Background

Pejuhutazizi Kapi (the place where they dig for yellow medicine) has been the homeland of the Dakota *Oyate* (people) for thousands of years.

The Dakota people originally resided throughout Minnesota and parts of neighboring states throughout the 1700s (Savariego 2018). All the



‘Okizu Wakpa’ (Where the Waters Gather and the Rivers Meet: An Atlas of the Eastern Sioux) by Paul Durand. Red circle indicates the specific area discussed here. (CC BY-NC-SA).

Dakota people are part of a larger network of tribes called the *Oceti Sakowin* (oh-che-tee sha-ko-ween, or “Seven Council Fires”). As the name implies, there are seven council fires in total that include the Nakota, Lakota, and Dakota. The Dakota make up four of the fires with the Nakota and Lakota making up the other three. The Dakota council fires are *Bdewakatonwan* (bdeh-wah-khaṅ-too-wahṅ, “Dwellers by Mystic Lake”), *Wahpekute* (wah’-peh-koo-the, “Shooters of the Leaves”), *Wahpetunwan* (wah’-peh-too-wahṅ, “Dwellers Among the Leaves”), and lastly *Sisituwan* (seh-see-too-wahṅ, “Dwellers by the Fish Campground”). The description that coincides with each of the council fires is not the focus of this paper. However, this brief background demonstrates how oral history and oral traditions are applied and connected to the land.

Pezihutazizi Kapi Oyate (pejuh-hoota-zeezee ka-pee ohya-tay) was founded under unique circumstances under the Indian Reorganization Act of 1934 (also known as the Wheeler-Howard Act). This act was part of Franklin D. Roosevelt’s New Deal attempt to revitalize the American Indian. Today the formal government name for Pezihutazizi Kapi is Upper Sioux Community (Savariago 2018). Through this act, in 1938, 746 acres of original Dakota Lands were returned and Upper Sioux Community was established.

Since 746 acres is a considerable amount of land, I have decided to focus on a section of that acreage that is known in the community as Blue’s Bottom. Blue’s Bottom, as it stands today, is just a little over 30 acres. The land originally started out closer to about 80 acres and was a resource for the community because Firefly Creek and the Minnesota River run through it. However,

over the past half century, these resources have become problematic politically as well as environmentally. Due to the attractiveness of the land, the governing Tribal Council at Upper Sioux decided to repurpose portions of it to accommodate the *Wacipi* (powwow) grounds in 2009 as well as parceling and allocating land for another family to own.

Firefly Creek flows about twenty-one miles from west to east with a few branches and hundreds of miles of field tile lines joining it. Only a couple miles upstream of the reservation does the creek resume flow within the natural meandering channel. The creek covers a significant distance across the cultural landscape and runs through county property, private property, and tribal community property so it should be no surprise that many people with cultural differences call the same creek by a different name. The names depend on who is using the land and creek, so the farmers and the county refer to the creek as County Ditch 9; to them it is seen almost as a burden to the land because it takes away agricultural space and farmers have to be considerate of the pollution level in the watershed. Many private landowners and the general public call it Hazel Creek because of where the creek passes and based on their personal naming of the land. The Indigenous people of the land refer to the creek in Dakota as *Wanyeca* (won-yet-cha) which can be translated to Firefly Creek. Dakota people describe places with physical attributes, traditional stories, or how the land is utilized and, as the name implies, there is an extraordinary number of fireflies in the area during the warm months. Firefly Creek is so important to the community at Upper Sioux that the first casino built on the reservation was called Firefly Creek Casino.

Framework

I hold my home close to my heart. Because of that, I wanted to do research and produce work that connected to my home. This work thus provided me with personal growth while also educating me about areas of concern in Minnesota. I wanted to demonstrate that we do not need to look far and wide to see the challenges of climate change that need to be addressed; instead, we can find many environmental issues within miles of where we live.

This article contains eyewitness accounts that reflect environmental change from people who have lived on the Upper Sioux Community tribal lands. I gathered oral history accountings from my mother, my uncle, my aunt, my cousin, and a young adult community member who I grew up with. The reason I have decided to focus on my family is quite simple; I want to further my own knowledge about my family, to document their experiences and stories, and to continue educating the next generation of our family. To be clear, the perspectives I present here are not representative of the community at Upper Sioux or Dakota people as a whole. The perspectives presented are from individuals and reflect their own experiences. Every community member at Upper Sioux has valuable oral histories and knowledge to share.

I have been told that a good interview should feel like a conversation rather than feeling so formal and I agree with this. Thus, the interviews I have

completed are in an organic, conversational style with questions that prompt discussion instead of leading it. This style of interviewing makes the voices of the people who utilize and are knowledgeable about the land the primary voices of this article. As such, I use direct quotes and I transcribed the conversations with all of the people I interviewed for this article so that their views are at the forefront. However, since the interviews are quite extensive only select topics are covered here. This methodology highlights two qualities of central importance: first, it means to bring the value of everyday actions and lifestyle choices to light to aid the continuation of cultural practices and environmentally conscious views; and second, it also presents the idea that Indigenous people have unique, thoughtful, critical, and valid views that may not always be recognized by academia. As a result, this work aims to demonstrate that Native people and non-native people have more in common than we may sometimes be led to believe. Given the history of hiding discussed earlier, of whispering our traditions in the shadows, this article demonstrates a resilience that allows us to define ourselves in a multitude of ways in the contemporary era. The next sections share the rich perspectives of my collaborators and their definitions of people and place.

Adam Savariego Interview and Perspective

Adam Savariego [AS] is an Upper Sioux tribal community member. He currently works as a Community Cultural Liaison at Yellow Medicine East High School in Granite Falls, Minnesota. He obtained his B.A. in history from Southwest Minnesota State University where his undergraduate thesis focused on Upper Sioux history with the title *Pezihutazizi Kapi Oyate: The Founding of Upper Sioux Community from the Beginning of Minnesota to the Indian Reorganization*

Act. He also obtained his M.Ed. in youth development leadership from the University of Minnesota School of Social Work. He has called Upper Sioux Community and Granite Falls, Minnesota home for 25 years—his entire life—and holds many areas at Upper Sioux Community and Granite Falls, as well as Minnesota as a whole, in high regard. Adam has led educational programs for elementary school students to high school students during the summer months and school



Adam catching a 38-pound flathead catfish (“Howasapa”—Dakota translation) caught at the Public Access mentioned in his interview. Image courtesy of Adam Savariego.

months, which aim to teach the youth treaty rights, sacred sites, and telling history through an Indigenous lens. Adam has also given presentations in the local Granite Falls area school district for faculty members.

The personal interview conducted with Adam occurred on October 18, 2018.

[Tianna M. Odegard – TMO] What kinds of activities did you do on the land and with the water resources close to you?

[AS] A lot of fishing and swimming even though I probably shouldn't have. I actually spent a lot of time in the woods by the Dyke Road [which runs along the Minnesota River inside the city limits of Granite Falls], making rafts with my friends of course by the [Minnesota] river.

[TMO] Were you ever cautioned about the conditions of the water, like “you can't go in there because it's polluted”?

[AS] Not particularly. As I grew older and more aware, I saw DNR reports and that's when I started questioning the water, eating [only] one fish a month out of the Minnesota River.

[TMO] Were family teachings taught to you? Or were you just curious and started asking questions?

[AS] Didn't really come much from my family, more outer family and other community members and my interest grew as I got older, that's for sure. Especially interest for the stories in the places of how our community was before [it was] an official Community in 1938.

[TMO] Did you think education and how we were brought up in the public school system at Granite Falls kind of aided in that questioning of who we were?

[AS] Oh yeah definitely, I think the education system as a whole is like that.

[TMO] When we were growing up, we were taught in general that polluting and littering is bad but yet we had fellow classmates that were farmers. We weren't specifically told about how runoff from these agricultural system practices and other contributing attributes impact the land and resources around us. What are your thoughts or ideas on this?

[AS] I like to bring up Governor Dayton's buffer law that is meant to prevent runoff, whether it helps or not. Truth is, it is a patch in a boat full of holes because it is a systemic problem, the runoff, that started as soon as we got colonized with three main things I point to.

[First,] they drained all the wetlands. The wetlands were our natural buffers. So they start draining them, right? This also ties into *Sistuwān*—that word means people from the marshy grounds because we are in the upper Minnesota River valley where it was mostly sloughs. I just heard the other day that between Monte [Montevideo, Minnesota] and Granite [Granite Falls, Minnesota] used to be straight slough. You could barely travel Monte to Granite before they started irrigating all the wetlands out. Where the school (both high school and elementary school) is right now there used to be a slough. To give you an exact date, I am not sure, but that is why they built the Dyke Road—to protect that side of Granite. So our Dakota people already knew where we lived was a marshy place and *Sistuwān* people of the fish or marsh campground, whatever interpretation, it points to mushy ground and I think that is the part that is missed. Now what wetlands are there, besides random wetlands that are preserved ones here and there?

[TMO] And for what? So more people could populate that area?

[AS] Yes.

[TMO] And people think the land was like this for forever and forever.

[AS] I believe this occurred just around a hundred years ago.

[TMO] People that live here now, in this contemporary era, identify with that area being their home and [it] was created for all of us to occupy but simultaneously impacted *Sisituwan* stories and places of identity as they were forced out.

[AS] Identity and stories are tied to place.

[TMO] Exactly, so we have current identity stories at the expense of somebody else's.

[AS] It's like if your friend's grandparents stole your grandparents' house, remodeled it, and now you want it back. Well, it's not even your house anymore; it's a remodeled house. It's not even home.

[The] second piece is about rivers running into the Minnesota River, all the little creeks. Water has a natural curvature to it and so part of that

Expanding on Fishing

[AS] This is like five or six years ago they took out the dam below Granite Falls for better fish flow, for better fishing. It's kind of like a neopositivism idea, to maximize economic benefit. It is not inherently good, rather is economically based. I won the fishing contest because the purpose was for better fish flow into Granite more. Before that dam was taken down, you couldn't catch a flathead catfish above that dam. I was catching baby catfish by the walking bridge which is about two, three miles up from where they took the dam out meaning flatheads went up and spawned and went back down.

curvature prevents sediment runoff 'cause when it turns on the banks, the sediments will run up on the banks but part of what farmers did was straighten them out, made canals, irrigation. So now when it rains of course it's going to flood, it's going to run, too, because there is no buffer, no natural buffer anymore. Second, there is no wetlands to the extent of [what they] used to be because they acted as sponges. When it flooded, wetlands would fill up and when it was drought, it would seep out the water slowly. Now you take that away and now you have what your mom references back in the '60s and '70s. Yeah, this is still a new phenomenon, floods weren't a normal thing; now it's normal because wetlands are gone for the most part so now when it floods it really floods and when it droughts we have extreme drought.

[Third] now you have tiling, which creates more runoff not particularly from farm sites but from the manure, PCBs. [PCBs are polychlorinated biphenyls—a group of artificial chemicals historically used in paints, plastics, rubbers, dyes, and electrical equipment and now found in fish in polluted waters; PCBs are harmful to humans if consumed.]

[TMO] You believe this was a good thing?

[AS] Yes, it's a good thing for better fish life. Just a couple years ago behind city hall someone caught a paddlefish which is extremely rare in the Minnesota River in general, but apparently before the dams they were pretty common from what I've heard other people say. If they wouldn't have taken out that dam he would have never caught that fish there.

[TMO] You currently work with the youth and are active in the community. So what is your teaching style? How are you teaching kids now? We are seeing people with educational backgrounds with an ability to teach at a much younger age and be respected at a much younger age so how do you influence and relate to them now to teach them these things early and get them on the right track? Because that is something we didn't have.

[AS] I think this relates to my summer program a lot. I can't dictate what someone wants to be or who they want to be, but at the very minimum what I can do is provide them with opportunity to learn about a side of themselves they had no chance to learn of because of colonization; that history is lost in their own family, and that history is not in school particularly, so they don't even have access to it. I had this realization in Croatia that, for example, when I was teaching my summer program about Dakota

history in Granite Falls, particularly when I bring up *Bdote* which is our Garden of Eden if you will, I had to use the Garden of Eden to conceptualize what *Bdote* means for the kids because they already knew [about that] for the embeddedness of Christianity in the institutions we go to, like school, work, or whatever you want to call it, for them to understand what it meant for Dakota spiritual people. So even with Dakota language we are learning it from English to Dakota not Dakota to English so these words have no meaning other than a rigid straight definition of the word. So these place names, these words to describe everything, are spiritual meanings from our ancestors of how they felt and what they saw at these places. It is spiritual people having spiritual expression of the place they are connected to. So I get perpetually sad that we won't ever get that back—in pieces, but not in a holistic way like it used to be.



The Minnesota River running along the left side of the hilltop and the Yellow Medicine River running along the right side of the hilltop. Image courtesy of Adam Savariego.

[TMO] Now it's just history, but for me I am like, "No it can't be because that is who I am!" I just can't close that door; it just can't be shut for me. I still want to get some of those things back.

[AS] This all connects to kids. My point of view, whether it is right or wrong, is to teach them the story of their own people and they can attribute themselves to that. It's up to them to do the rest because I at least provided the opportunity to learn about themselves; it's not my job to tell them, "Oh you are Dakota and that is all you are," because we live a very conflicted identity thing now. That is kind of my point of view. Me working with them is like working with myself when I was their age, as I went through the same thing they are. Maybe they don't think as deeply as I did or not, but at the very least I didn't have the opportunity except pieces here and there. I had to search [for] these things, like the whole paper I wrote is me search[ing for] it. The paper for me was piec[ing] together the story particularly because I didn't have grandparents growing up.

[TMO] Do you feel this burden or pressure because we are in a different time now? What do you believe are the responsibilities of our generation?

[AS] If you decided to do this, then yeah, you have an ethical responsibility to do something with the knowledge you obtain. If you are just collecting knowledge for the sake of collect[ing] knowledge then what are you really doing? You better act on it. I shouldn't say someone should be coerced into doing something, like coming from a certain community, but if you are going to put your position on behalf of your community, your people, or your family in general, yeah, then you do have a responsibility. Like everyone has a choice to see or not see and when you do see, well, then you better act on that too.

TMO: So you are acting on your responsibility everyday right now?

[AS] It's a struggle everyday though, but yeah. Between being selfish, what do I give back and how do I try to be reciprocal and how does that push back.

[TMO] When you are teaching do you like to go to these physical places?

[AS] Yes, you have to. That was the premise of my summer program: discuss it for a day or two, then on the third or fourth day take the trip out there to apply what we learned in the classroom.

[TMO] Is this something that you would like to turn into something more permanent for teaching?

[AS] I am working on that now. I am working with a grant [and] the premise of it is revitalizing culture and stories while canoeing on the water with the Upper Sioux Community, Lower Sioux Community, and Micronesian communities in Milan, Minnesota. For me this is my next step; I want to take a two-day camping trip to share the stories on the river, specifically the Minnesota River. Stop at each community campground, hear stories and songs, eat; that creates an experience that then becomes reality. Then when you are on the river, hopefully kids and community members are able to attach themselves to that and feel more empowered about who they are and not just [feel] ashamed anymore. Learning all these stories needs to be made real through experiential learning. That way it's whole: mind, body, spirit, physical place are connected. It is just not words in a text or words coming out of my mouth. It's the individual being in that place, being connected to these places with the stories and the knowledge that we would all experience in a holistic approach, in my opinion.

Like I say, the Western view is to make lines and boxes. Dakota views make circles because that is more holistic and includes everything. Now this is where I am: how do I recreate the circle based off pieces we still have to create a new circle, to recreate what we feel Dakota is now?

[TMO] Have you been told how your family utilized the area?

[AS] Well my mom said back in the day—she was born in 1972 so when she was a child— they were still able to swim in the river and there wasn't warnings. That is about the extent of what I am familiar with as far as my family, but I can relay other stories from other community members and elders that have been told to me. The PA (Public Access) is by the old church grounds. So from all the stories I hear, that was the gathering place for Dakota kids because it wasn't too far from both the village sites. I reference these village sites in my paper as one being above the hill and the other is around the riverbend—*Gahmita* (gah-mee-ta) and *He Kute*

Water Treatment Facility

[AS] What I have heard from [tribal leadership] is that what we have is a state-of-the-art water treatment facility on the Minnesota River. Each community along the Minnesota River is given wastewater credits and what happened is these credits turned into a commodity where Upper Sioux would have to buy the leftover credits from Granite just so we could use our wastewater. These credits are for leakage that naturally occurs; no system is flawless. Upper Sioux felt this was unfair because we were basically being disenfranchised. Practicing our tribal sovereignty, we went to the federal level and asked to apply for a grant or for a permit for our own water treatment facility. Now when the Minnesota River runs through us at Upper Sioux it isn't getting any dirtier. At the very least, we can be proud that Dakota people are taking care of the land we have still; this is on the federal level, which means the standards are held higher for us than at the state level.

[TMO] What do you believe the differences and similarities are between the way Native people view the land versus non-native people?

Gahmita (heh-koo-tay gah-mee-ta). I would imagine that the PA served as a good middle point for gathering. *Kunsi* (grandma in Dakota language) Carrie, everybody has stories about this place; someone has even died at this place. In this place specifically—[I know] because I fish there—the water is shallow and you walk up and then it gets deep. Swimming to the deep end was kind of like a dare back in the day. On the left-hand side, there is a little creek that comes in from the hillside and as *Kunsi* Carrie used to describe to me, they used to drink from that because that was like literally spring water, but not now. They would swim there, fish there, and play ice hockey on the river there. This remained the gathering spot throughout the '50s, '60s, and '70s for the rez kids because what else is there to do?

[AS] I would say the differences right away are almost purely economic. The City of Granite Falls wants to clean the water to make nice trails and commercial place so more people will come. I would say that Upper Sioux's perspective very generally in my point of view is [we] should preserve nature, raise nature, whatever you want to call it, for its inherent value, not to give value because it has all the value it needs; we just destroy that value as people. Farmers will say they are stewards of the land, but if you look at a farm field, how many animals do you see on a farm field? If this was a natural area of the woods, there would be animals and bugs everywhere, but these are literally poison zones so farm fields become our constructed reality.

[TMO] Any more comments about the past, present, or future?

[AS] Whenever Dakota people do something they have the past and future in mind. That is another European point of view that you're old, you're old or you're young, you're young but Dakota view is like no, we are all in this together because us, right now, we are in the middle between our

Elders who are connected in past far more than us, and we have learned from them, that is our connection to the past. Then our age or kids younger than us, all that knowledge transposes down and then we are connected to the future

to the seven generations as well. We are in the middle of that. We don't see the past, the future; we see what's now is the future of now. It is all relevant.

Blue Family Interview and Perspective

I sat down with my uncle, Alex Blue [AB], and his wife, Tracy Blue [TB], my mother, Laurie Blue-Pooler [LBP], and my first cousin (Alex's daughter), Sophia Blue [SB], on October 20, 2018. I decided to do a group interview with these members of my family. I have arranged the conversations we had into main topic areas and provide direct quotes. Alex and Tracy are exemplary stewards of the land for they care for their garden, orchard, chickens, geese, bees, and other wildlife that come to thrive off their land. They are eager to share their story of how they got to be where they are and why they do what they do.

Laurie Blue-Pooler and Alex Blue are siblings and they were raised on the same area of Blue's Bottom. The oldest currently standing house at Blue's Bottom is one of my childhood homes that my older brother currently owns. Laurie has lived and called the area at Blue's Bottom home for over fifty years. She has countless childhood stories about doing chores and about the recreational activities she did when she was younger as well as into her adult years. She has lived through many floods and raised a family in the same house her son owns today. Laurie and her husband just recently moved into a home in



Laurie Blue-Pooler (left), Tracy Blue (center), and Alex Blue (right). Image courtesy of Cody Odegard.

the city of Granite Falls. She currently works as a Native American liaison at the local elementary school in Granite Falls.

Sophia Blue currently works as a youth specialist for the Social Services Department at Upper Sioux Community Tribal Operations. Sophia and I are close in age and grew up together at

Blue's Bottom. After our grandmother, Sara Blue, passed away, Sophia was awarded the home and land. Sophia's home continues to serve as my grandmother's did—as the main gathering spot for family holiday get-togethers because the home is big enough to accommodate our large family. She holds fond memories of the home and the areas that surround her.

Life Growing Up and Activities Done Today at Blue's Bottom

[AB] Well, the creek is named Firefly Creek because of all the fireflies that hangout down there; we used to catch fireflies down there all the time.

We, my family, used to use the creek and water the garden when we were kids. Literally, we had a wagon and two five-gallon pails. We all basically learned how to swim in there.

[LBP] And skate.

[AB] I used to fish minnows in there and get frogs from the creek then go fish at the mouth of the creek; I thought there was more game because of that mouth of the creek than just being part of the river.

[TB] But then prior to that you grew up with stories from your dad who literally grew up right on the Minnesota River. So when the flood came in '97, your dad couldn't believe the water would come up that high due to the fact of living on the river, because their natural wetlands [used to exist] and the drain tiles didn't exist.

[SB] I remember walking around and taking pictures together. It was fun to just hop on a tube in the creek and go exploring down the creek and stop at your house on our way or just keep going. We could be outside for hours.

[TMO] I remember Charles, Sophia, and I would go into the woods here and take picnics sometimes and just walk around the area. Our only

words of caution were basically don't drown and wear something bright so you don't get shot.

[TMO] Where did the nickname for this land—Blue's Bottom—come from?

[AB] I think it just started out as a place where everybody came down to swim at the river or [have] a party at Blue's. Blue's Bottom kind of came about in the '70s. The majority of the people that came down here came down here to swim; there were people that came here to fish, but mostly to swim.

[LBP] And before that was volleyball by the Roundhouse at the Community Center that is now used as the courthouse.

[AB] Yeah Laurie, that was when day camp was there.

We used to play hockey on that creek growing up. We used to build bonfires along the creek with the LaBatte boys. We wouldn't shovel; the banks would be full of snow and the creek was too, until we would go up to the beaver dam. One year, we figured this out that hey, we knock a hole in the beaver dam and shove a piece of wood in there, water would come shooting out onto the creek. So we just flooded the creek and let the water run all night. Next day, we would pull that piece of wood out and it would stop; then we would let it freeze and by the next day, it would be glare ice all the way down the river. We used to build fires along the creek—Roy, Reggie, Arlen and James and I—we would light those fires all along

the creek and they'd stay lit half the night. Then you could see almost all the way down the creek because it was so lit up. We were either sledding or skating all winter. That's what we did. There was no video games, and sometimes on weekends we would come home at three in the morning from Cavender Hill and the LaBatte's.

We used to go tubing in the summertime. The whole family would be down there hanging out. The year before I went to work we were in the creek literally four, five days a week.

[LBP] The thing I remember when I was younger with my mom and family was we would go back

in the creek with our lawn chairs and sit in there to cool off.

[LBP] Say, we used to get a good-sized fish here once in a while. Does that still happen?

[AB] We see minnows. We used to eat them when we were young if we got hungry while we were out fishing.

[TB] Yes, we still see fish. We see snapping turtles—they come up here to lay their eggs in our gardens.

[AB] I'm sure the older Indians would watch for that and get the eggs for food or the turtles



*Alex Blue in Firefly Creek.
Image courtesy of Tracy Blue.*



*Snapping turtle at Blue's Bottom.
Image courtesy of Tracy Blue.*

themselves. I remember my great-grandmother making turtle soup several times. But I remember the first snapper I ever got was with Grandpa Alec. We were just beyond our old barn here and we had a trap for it there. Of course we had sticks so it couldn't get at us. Grandpa Alec had a little fatter stick and stuck it into the turtle's mouth and it snapped onto it. He basically picked it up like that and took off walking. We got back to the house and put it on the table. He said if it ever snaps onto you it will never let go unless you take something like this straw here and put it up his nose and it'll let go. They will snap you so don't think you're going to be fast enough.

[AB] I used to catch fish with minnows and a willow stick; then I started buying hooks. When I first started doing that, I used frog tongue to catch the minnows because grandpa told us that's how we used to do it. So you would slap the frog tongue in the water and all the minnows would come up and grab it; well the frog tongue has those little burs in it so you could snag them out of there but you could never get the big ones. So for the big ones I would get a little hook and put frog guts on them and that's how I'd get them.

Water Quality and Flooding

[TB] Drain tiles in all these farm fields rush water off the fields instead of letting the water seep down into the soil. Eventually, it's going to rush into a river or a creek. The Minnesota River has filled up with silt because of all this erosion from fields that are bare. The earth wants to be covered, Mother Earth wants to be covered. If you have a bare spot of dirt, weeds are going to grow there; it needs to be covered. It is frightening to have to live with the consequences of what others are doing around you and watching these waters rise like they do now.

Grandpa Bud used to take me fishing and told me that when he was a kid, his grandpa would take him fishing. His grandpa would make them take their shoes off about a quarter mile down from the river and [he] couldn't be noisy, otherwise he couldn't go with. His grandpa wanted to catch the big ones.

We used to catch fish out of the creek. Some of the Indian women wanted a big carp. I used to catch for Harriet and some other Indian women and they would ask for as big a carp as I could get.

[SB] Remember we used to hangout in the creek with Sabrina and Kailey? We used to sit in the sun with our chairs. Then all our friends would come down here and we would have bonfires. We'd just hang out by the creek for hours and do things like skip rocks.

[TMO] I want to show everyone that water isn't just for ceremonial use or just sacred, that these waters are also used daily for everyday life as a way of being.

[AB] I have also done prayers down there too.

[TB] I think anyone who lives down here feels like everything is sacred.

We have an *E. coli* bacteria problem in the creek due to large numbers of livestock upstream and also agricultural field runoff. We pump that same water to water our gardens. Because of the bacteria, we have to be careful to never splash this water on our plants. We can only set the hose on the soil. We can take our poisoned water that is full of *E. coli* and put it into Mother Earth to water our plants, and the soil Mother Earth has provided will filter out the poison. I can grow healthy food that doesn't make us sick as long as I don't splash any of that poisoned water on my plants themselves, but she can only take so

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much. Recreationally, we use Firefly Creek in the summer and we have to be very careful to not get water near our mouths, eyes, and ears.

[AB] We try to just water the roots so we don't get sick.

[LBP] Why are farmers doing this? For money?

[AB] The more yield the more dollars.

[TB] This is the first time I have lived this close to a river, so it was scary to watch how fast the water rises. Now, like this fall having water being this high going into winter, it makes you nervous because if you get a lot of snow and the grounds are still saturated come spring from this fall, yeah, so hopefully we have a lot of dry weather.

[SB] This summer didn't we get, what, ten inches of rain in one night?

[TB] Yeah we did.

[SB] Then just a couple of years ago the water crept up a couple of inches to this parking lot and Tracy told me to tell your mom to move her car because the water was rising.

[AB] The only story we remember of a flood was in the '60s [and it] was a flash flood. Now, we have experienced severe flooding in '97 and 2001. We have also experienced less severe [floods] over the years as well. This is why the hundred-year flood numbers from FEMA [Federal Emergency Management Agency] can pretty much be thrown out the window. We believe the farmers have changed the way we are able to live comfortably and safely.



Sara Blue's house before flooding in 1997. Image courtesy of Alex Blue.

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[LBP] We were told after that '60s flood hit that we weren't supposed to receive any flooding for the next fifty years. Then the '97 came.

[In order for Alex and Tracy to build a home at Blue's Bottom they had to build their dirt foundation high enough to be up to code because they were building in a floodplain. They were required to use FEMA flood levels recorded in the past for the area for the required height.]

[TB] So with Alex growing up here and knowing what it's like to be this close to the water to then the '90's and now when we built here ten years ago he knew what happened in '97 and we needed the number from FEMA which was 887 [feet above sea level] because we live in a floodplain.

With global warming and these rain events seriously these 100-year flood levels can literally be thrown out the window. Now we feel like we need to mitigate even more even though we are built up high.

[AB] I believe that the chemicals produced by runoff with herbicides, pesticides, and some of the animal waste is being deposited into the creek, is deforming some of the wildlife that lives along the creek.

The creek has just gotten more polluted over time. The chemical use is what concerns us. This chemical that is considered "safe" to the government doesn't seem safe to us because we have seen deformed frogs. And thinking about



Sara Blue's house during the flood of 1997. Image courtesy of Alex Blue.

the increase in learning disorder behaviors like autism in our community—that is growing.

[TB] Don't rely on technology to fix everything; to us it's like it has ill effects. We think nature can take care of itself and us if we let it. We can't just ignore the effects we are having on the earth and water. We all have to be aware of our part. Technology includes those drain tiles and Monsanto's seeds and Roundup herbicides. I can rely on the soil to filter the bacteria out and yet children's cereal has Roundup herbicides in it. I trust nature; I don't trust technology.

[LBP] The worst flood I experienced was the flood in April of '97 because we lost everything. Our clothing, furniture, sentimental items. My mom, Sara Blue, lost her piano. We had that piano since we were kids, and we had to throw it away. We cried for that piano because that piano was a fixture in our home and held so many memories for us. Yes, it was a material item and we still had each other, but those kinds of losses matter too. I don't know how many artificial Christmas trees I've had to replace—they are just trees for a holiday but that means something when you lose these items to flooding. Items you imagined you would hold onto forever, make memories with, and then pass those memories on to the next generation, then just like that, it's all gone. We weren't prepared because we never imagined a flood like this would happen. Don't mess with nature because this impacts real people—those people that change the landscape or try to mold the land to be something it's not supposed to be—these types of tragedies and devastation happen to people.

[AB] Another thing that I never got over was when the water was rising in the city of Lac qui Parle [Minnesota], they released the locks on the dam, and in one night, the water in the areas rose eight feet. I'll never understand why they did that.

[LBP] It happened overnight basically. One minute the water is flowing fine and then it was coming.

[TB] I have been told by Alex that when you see the creek rise, there is concern but you don't have to worry about a disastrous flood unless the current of the creek stops flowing. When the creek stops running, that is when we all have to worry.

[LBP] Yes, we were taught this because when it stops flowing that means it is backing up and can't flow into the Minnesota River. So for the night that the flood of '97 came, they opened up the Lac qui Parle river dam and the water rushed into the Minnesota River, and all of us living at Blue's Bottom at the time watched the creek stop running because it was backing up. The water came up through our backyard and mom's (Sara Blue's) field. After the flood, everyone devastated by the flood was required to mitigate and raise our houses six feet to be in an accordance with hundred-year floodplain levels. Since then, we have been prepared for future flooding that has occurred [in] 2010 and 2012. The 2001 [flood] wasn't as disastrous as the '97 flood but it lingered for weeks. Unlike the '97 flood that came and went in a matter of a day or so. Now, instead of catastrophic flooding that would have us out of our houses for a year, we are able to sump pump and wait it out instead of losing everything.

[TMO] Did you struggle that year in '97 when we had to be relocated until we were able to go back home?

[LBP] We, those that were impacted by the flood, were offered \$25,000 for our home because our community did not like us living in the floodplain. We all declined the offer from Tribal Council because this area is our home and the flood wouldn't last forever. What I am saying is no amount of money or natural disasters could have

made me turn away from this area down here. We called this place home. I always have. I am an air force veteran and I traveled many places but

I always felt the need to go home. I could have lived a different life elsewhere but this place is my home.



The Blue siblings James Blue (left), Alex Blue (center), and Laurie Blue (right, playing the piano). The piano in question was one of many sentimental items lost in the flood as described in Laurie's interview. Image courtesy of Alex Blue.

More Photos of the 1997 Flood Taken at Blue's Bottom



The flooded driveway to get to Blue's Bottom. Image courtesy of Alex Blue.



Flooding of Laurie's home—the oldest house at this location—as well as a vehicle that was not able to be taken out before the flooding. Image courtesy of Alex Blue.



Close-up photo of the flood waters in the vehicle. Image courtesy of Alex Blue.



Chicken coop in floodwaters. The chicken coop was torn down a few years after this. The ice on the trees indicates where the floodwaters were just a day before. Image courtesy of Alex Blue.

Wildlife, Plant Life, Habitat, and Cultural Implications

[AB] I don't think people know how much wildlife and habitat thrive off that creek, I mean all these bird species, squirrels, our chickens, all these little rodents around here. When everything drinks from Firefly Creek, all sorts of life are connected to the water. I believe these habitats have really been affected by the agricultural methods. The tiling of all the farm fields just runs off the field, as well as the animals' waste being too close to the water like our creek, which just pollutes the waters more. The water belongs to all of us.

[AB] You know we used to watch the wildlife when we were growing up down there. There was beaver, mink, deer; once in a while you would see a [raccoon].

[LBP] And woodchucks

[AB] Oh yeah, that's right Laurie. What else is there?

[TB] Pheasants, cranes.



A hawk at Blue's Bottom. Image courtesy of Tracy Blue.



*The songbirds that have become accustomed to the nourishment Tracy and Alex Blue provide.
Image courtesy of Tracy Blue.*

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[AB] Blue heron, cranes, coyotes.

[SB] Frogs.

[LBP] Turtles.

[AB] Opossums, skunk, hawks, eagles, all sorts of bird life here.

[TB] So when we are talking about the toxic water, *E. coli* is toxic. We still go in there and have to be worried about [the toxins] but if this keeps up, we've got chickens, geese, dogs, us, all the songbirds that come to our yard, the honey bees are in the gravel drinking out of the creek all the time. I mean when you are talking about what lives off that creek it's frightening to think of it getting worse and possibly deadly.

[AB] This includes all of those species of wildlife that we have named in that list and many more rely on that creek.

[TB] And of course we use that water from the Firefly Creek to water our garden.

[AB] Like we did forty-nine years ago.

[TB] And we have to be very careful to never sprinkle our yard or splash onto the plants themselves. We have to just take the hose and set it on the ground without having the water splash up. The soil filters the garden so we are able to eat from our garden.

[AB] Everything we planted up here has been watered by that creek. You name it, from all the grass, garden, orchards, and perennials.

[TB] Remember those little green frogs? The banks of the creek would just be solid; now you hardly see frogs anymore, just within ten years.

[AB] All these beekeepers from across the world were losing their bee colonies. This happened in the 2000s due to pesticides. We need the bees.



Hamline archaeology field school as invited guests at Blue's Bottom in 2015. Image courtesy of Tianna Odegard.

[TB] Right now, people are selling trees that are systematically treated with pesticides, which means if we plant this tree with this toxin, the bees don't know that tree is poison to them.

[AB] I think a lot of things in nature try to tell us what's wrong, like the bees. We need to pay attention. We don't pay attention to them. We, as beekeepers, have learned to respect and open our eyes to live a more natural life.

Education about the Water and Lands and Continuation of Restoration

[TMO] You have collaborated with many people and have hosted many groups on your property to educate and show how you use the land and creek. Could you tell me how those experiences were?

[AB] Those were great. We really enjoyed having them and we learned a lot from of them too. We learned a lot about the rocks and fossils we have found in Firefly Creek.

[LBP] I think any person that comes down here finds something uplifting or something they take interest in, like a cool-looking rock.

[TB] We have planted as much native plants, animal food, medicine for us, medicine for the animals. We have a bunch of elderberry, black currant bushes, aronias, chokecherries, red willow, plum trees, and apple trees. These plants are perennial and are going to be here year after year to come. Long after we are gone.

Everything we have planted here has attracted a lot of wildlife like the birds, hummingbirds, and butterflies.



Hamline faculty members and students as invited guests at Blue's Bottom in 2016. Image courtesy of Tianna M. Odegard.

Cultural Implications to Consider in Closing

To help move forward, I am now trying to bring awareness to the current state of urgency at Blue's Bottom and to keep these stories alive even if the creek is not safe to use. As long as the creek exists, the stories of its importance will carry on. Once those narratives about Firefly Creek are gone, there will be no meaning and there will just be a creek in my backyard. The Upper Sioux Community Tribal Reservation runs along Highway 67 in Granite Falls, Minnesota for about a fifteen-mile stretch. This land holds countless place-identity memories for me as well as the generations of relatives that came before me. This

land is considered sacred, environmentally rich, and home. It should be no surprise, then, that when I entered into the academic realm, I held my home close to my heart and continue to place it at the forefront of everything I do. The creek is brought to life by the collective narratives and place-identity of my family and fellow community members.

There are strong oral historical accountings of creation stories at the confluence of the Minnesota River and Mississippi River, known to Dakota people as *Bdote*, as well as sacred



Changing fall leaves in Firefly Creek. Image courtesy of Tianna Odegard.

teachings at other water locations across Minnesota. These places are vital to Dakota identity and there are revitalization efforts to reclaim the narratives in these crucial areas, to bring awareness of the importance of continued historical accountings, and to demonstrate honor and care. To strengthen the conversation surrounding important areas of Minnesota, I wanted to bring forward another view of a body of water that is not as known to many, but holds a significance to my family and others within the community. I bring these stories to light with the intention that these, at first sight smaller, stories are a part of overarching ideas about place, identity, and water protection as well as cleaner, healthier water.

We share many of these areas and lands today, but we often overlook or undervalue the nature that surrounds us. Colonialism has altered many aspects of the Dakota peoples' way of living and caring for the land. However, the unbreakable bond that has guided people back to nature is still very much alive in Native American teachings

today. Time can only tell what lies next for the generations that follow us, which compels me to ask the question: What is in *your* backyard? Taking the time to answer this question may provide you with a deeper understanding of your identity in the particular area you are in, regardless of whether you are in a rural area or a city. Attempting to answer this question for me is a lifelong journey. Learning about Dakota values and teachings takes time and reciprocity with those you love and care for, so one article cannot begin to uncover the multitude of stories and connections to water that we all share. Listening to the stories and experiences of others has provided me with the opportunity to add meaning to the physical landscapes around me, why they are the way they are, and how they came to be that way. I believe each individual person—Native American and non-native alike—can explore the everyday wonder of nature and can physically see the importance of continuing the stories that go along with a place, no matter how difficult the history is to tell.

Epilogue: Flooding at Blue's Bottom, Spring 2019

In spring 2019, Minnesota experienced extraordinary flooding again, including at Blue's Bottom which once again affected the people who live there.

All images this section courtesy of the author unless otherwise noted.







In contrast to the previous image taken in the exact same spot (see Adam's interview), this image shows flooding in late March, 2019. Adam tells us that the flooding didn't recede until the end of May and that this is unprecedented in his experience. The Minnesota River runs along the left side of the hilltop and the Yellow Medicine River runs along the right side of the hilltop. Image courtesy of Adam Savariego.

References

- Blue, Alex. 2018. Interview by author, conducted at the home of Alex and Tracy Blue. October 20.
- Blue, Sophia. 2018. Interview by author, conducted at the home of Alex and Tracy Blue. October 20.
- Blue, Tracy. 2018. Interview by author, conducted at the home of Alex and Tracy Blue. October 20.
- Blue-Pooler, Laurie. 2018. Interview by author, conducted at the home of Alex and Tracy Blue. October 20.
- Riggs, Stephen Return. 1892. *A Dakota-English dictionary*. Vol. 7. Washington, D.C.: US Government Printing Office.
- Riggs, Stephen Return, and James Owen Dorsey. (1893) 2004. *Dakota grammar: With texts and ethnography*. St. Paul, MN: Minnesota Historical Society Press.
- Savariego, Adam. 2016. "Pezihutazizi Kapi Oyate: The Founding Of Upper Sioux Community from the Beginning of Minnesota to the Indian Reorganization Act." Undergraduate Thesis. Southwest Minnesota State University, Minnesota.
- . 2018. Interview by author, conducted at a Wilde Café & Spirits. October 18.
- Walley, Christine J. 2013. *Exit zero: Family and class in postindustrial Chicago*. Chicago: University of Chicago Press.

Material Referenced in Personal Communications

Upper Sioux Community Water Treatment Facility

<http://www.granitefallsnews.com/article/20140218/News/140219543>

<https://www.epa.gov/sites/production/files/2018-01/documents/mn0075001-2fnlper.pdf>

<http://www.granitefallsnews.com/article/20120809/NEWS/308099944>

Flooding

<http://www.granitefallsnews.com/news/20170413/flood-of-97-leaves-wake-of-memories>

http://news.minnesota.publicradio.org/features/199704/07_steilm_granite-m/

<https://www.kare11.com/article/news/land-shifts-close-highway-67-near-granite-falls-into-2020/89-22352f92-9fa2-4491-819f-377eb6c090b1>

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About the Author

Tianna M. Odegard is a member of Upper Sioux Community, one of four federally recognized Dakota tribal nations in Minnesota. Tianna was raised in the area known in the Dakota language as *Pe-juhutazizi Kapi* or "the place where they dig for yellow medicine." Tianna descends from Indigenous peoples on her mother's side and from European peoples from both her parents. On her father's side, she has relatives in Georgia that she cherishes and enjoys visiting when she can. She embraces and loves all of the history and heritage that make up her family tree. She has lived on and off the reservation in Granite Falls, Minnesota, which has provided her with different perspectives for the use and respect for the land around her.

Tianna earned a bachelor's degree at Hamline University majoring in anthropology with a specialized interest in archaeology and is currently a graduate student in the archaeological heritage track of the Heritage Studies and Public History program at the University of Minnesota Twin Cities. As she moves forward in her professional endeavors in cultural resource management, she hopes to continue engaging the public with a range of diverse backgrounds to take note of the history of the people and the lands we are surrounded by, privileging the life experiences and knowledge sets that are not traditionally validated by academic settings.

FEATURE

ETHNOGRAPHY AND ARCHAEOLOGY OF WATER IN THE MAYA LOWLANDS

By Alexander E. Rivas and William G. B. Odum

Procurring potable water is an important factor for daily life in the semitropics, especially for contemporary populations in rural Guatemala. Seasonal subsistence practices are crucial for survival, especially regarding agriculture, droughts, and flooding. This article focuses on the Salinas de los Nueve Cerros region in Alta Verapaz, Guatemala to highlight contemporary

land-use practices among the Q'eqchi' Maya, their adaptations to flooding, droughts, and uses of different water resources. It then uses these data to better hypothesize how the ancient Maya inhabitants may have used these resources in the same landscape. Additionally, this research offers an account of how the site's contemporary residents imagine the terrain in relation to its



A modern groundwater well in an ancient depression. Q'eqchi' farmers are taking advantage of ancient landscape practices for their own subsistence. Image courtesy of Alexander Rivas.

historical inhabitants, and how this influences their current subsistence patterns. In understanding how ancient and current populations interacted with and modified their landscapes,

Introduction

Water is an essential resource for sustaining society, communities, and ecology. Many ancient societies emerged and urbanized in areas with natural water resources, which elites took advantage of to control hydraulic systems and exact tribute from local populations. Water in the Maya Lowlands, comprising parts of Mexico and upper Central America (Figure 1), was historically scarce during the dry season, lasting from late May through December and receiving less than ten percent of the annual rainfall. The region is largely a karst environment, which means that water quickly flows through to the groundwater system with limited surface accessibility due to the porous nature of the limestone bedrock. Water in swamps, ponds, or karst aquifers is prone to contamination and salinity. Despite these issues, the success of ancient communities rested on hydraulic systems. This drove ancient Maya populations to not only use the naturally available water resources, such as rivers, streams, ponds, and the sea, but also to construct their own water catchment features, such as water reservoirs, wells, and canals.

For archaeologists, recording the location of water catchment areas and other water resources, including rivers, streams, lakes, and swamps, is just as important as their excavation and laboratory analyses. Spatial analyses of these locations can provide information on settlement patterns, which is important for understanding decision-making and resource availability in the past. Using the location of water catchment areas and settlements, archaeologists can try to determine how different parts of a site were used. The use of GIS (geographic information systems) can aid with the settlement pattern research by creating

our research highlights the potential for solving issues of water scarcity and potability through the creativity and agency of the local population for a direct applied result of collaborative work.

distinct watershed views, looking at drainage patterns, and creating 3-D models of such archaeological features (Weaver et al. 2015). Field excavations of canals, wells, and water reservoirs also provide insights into the formation of these catchments, their size, and their relationship to the surrounding archaeological features.

Many ancient Maya cities were able to control and exploit natural resources for over a millennium, even in times of uncertainty, while others collapsed. These conditions allow us to consider multiple research questions pertinent to the analysis of the riverine settlement at Salinas de los Nueve Cerros. How did the ancient Maya control their water resources at the site? How did seasonality affect resource exploitation? What systems of water procurement allowed the inhabitants of Salinas de los Nueve Cerros, meaning “Saltworks of the Nine Hills” (now referred to simply as Nueve Cerros), to adapt to seasonal droughts and political collapse? To answer these questions, we took a dual ethnographic and archaeological approach, using ethnographic data on current Q’eqchi’ land-use practices and understandings of seasonality, topography, and water, as well as archaeological GIS data providing spatial information on the multiple water resources located within Nueve Cerros. We argue that the ancient Nueve Cerros inhabitants most likely developed a decentralized system of water control, with groundwater providing potable water for most of the ancient population as it does for the Q’eqchi’ today. This greatly contrasts with the system of water procurement elsewhere in the ancient Maya Lowlands. This study explains how a multi-disciplinary approach using GIS/remote sensing modeling and ethnographic investigation can

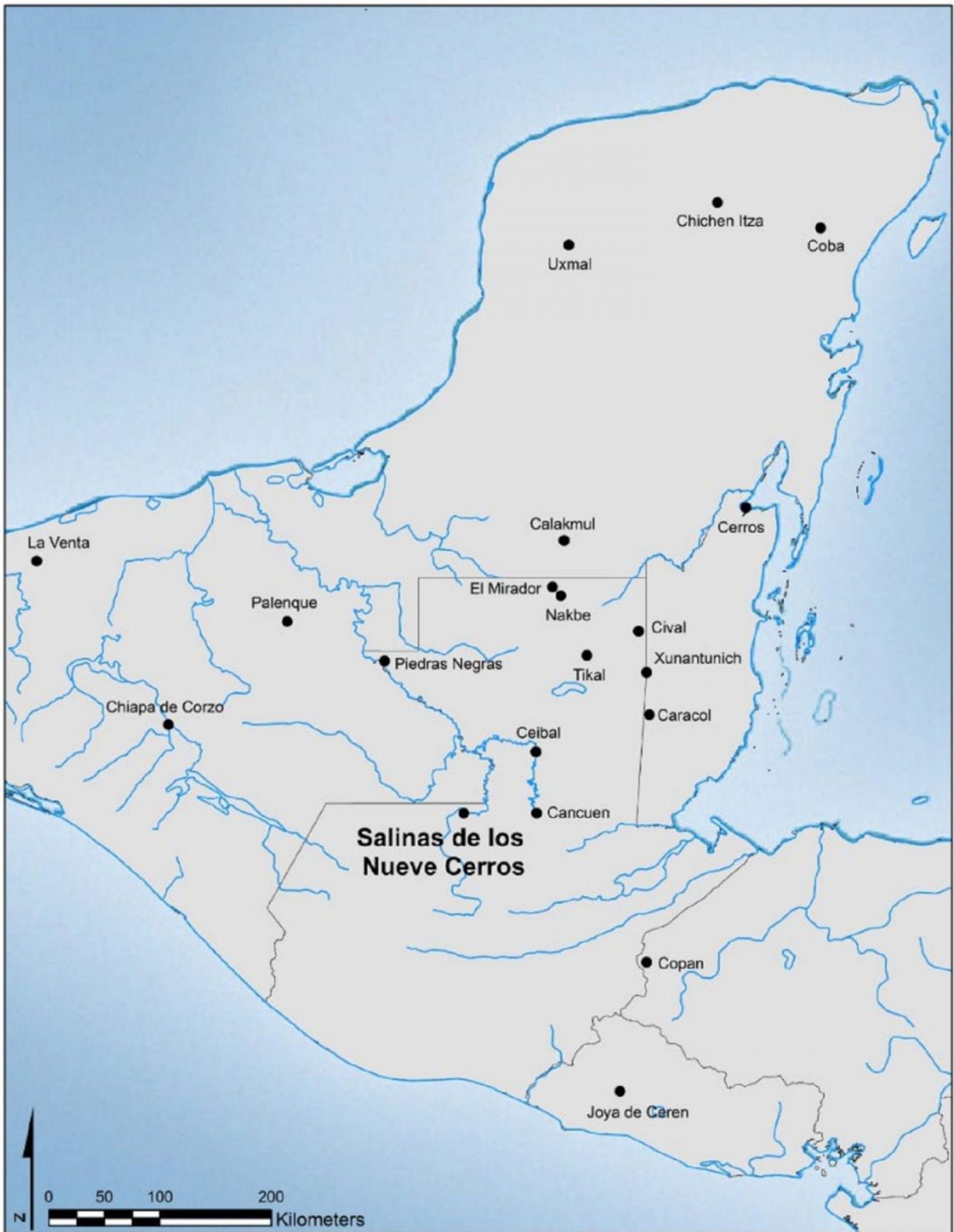


Figure 1. Map of the Maya region with locations of major archaeological sites. Map courtesy of Alexander E. Rivas.

bring new perspectives into ancient Maya water management. In addition, this article considers how the relationship between contemporary populations and ancient water-use practices can inform approaches to modern issues with water scarcity and potability.

Our aim is to outline the relational analogies that can be made between current Q'eqchi' inhabitants of Nueve Cerros and the ancient Maya population that lived in this region. In relational analogies (as described by Wylie 2002 and Lane 2008), similarities between ancient and modern practices are justified either by close cultural continuity between archaeological and ethnographic cases, or through similarities in cultural forms. We outline how landscape management practices

and opportunistic strategies of water collection today may have been similar among the ancient inhabitants. The authors recognize that current practices by Q'eqchi' have been heavily influenced by a multitude of factors. Wartime and post-war conditions and the growing prevalence of cattle farms and African palm oil production have displaced communities. Additionally, modern property law, debt, and ownership systems define people's relationship—often precarious—with the land (Grandia 2012, Ybarra 2018, Woodfill 2019). However, the analogies being made here will focus on aspects of the daily water management practices that the Q'eqchi' and ancient Nueve Cerros peoples faced living on the very same terrain.

The Ancient Maya

The earliest evidence of people inhabiting the Maya Lowlands began in what is considered the Paleoindian and Archaic Periods, ranging from about 12000 to 2000 B.C. Archaeological remains such as spearpoints and mammoth bones during this period show strong similarities to other Archaic Period artifacts across the Americas. These groups of peoples included nomadic hunter-gatherers and territory based foragers, as well as people inhabiting small villages. The cultural identity of what we consider Maya peoples did not appear until after the archaic, in the Preclassic Period (1000 B.C.–A.D. 250). The three major cultural developments that occurred during this period were the beginnings of agriculture with maize as a staple crop, the adoption of ceramic technology, and the rise of sedentism and ceremonial centers (Inomata et al. 2013). Many large Maya cities began to emerge toward the end of the Preclassic, ushering in new political systems and long-distance networks of exchange between people in different areas of the Maya Lowlands. Termed the Classic Period (A.D. 250–900), this florescence of Maya culture was marked by the development of hieroglyphic

writing, the establishment of divine kingships, and large-scale landscape modifications (Sharer and Traxler 2006). However, by A.D. 900 many cities experienced rapid depopulation and political collapses. Most hieroglyphic inscriptions in Classic Maya cities ceased by A.D. 900. The reasons for the collapse are uncertain, but scientific evidence suggests that there were a series of major droughts between A.D. 800 and 900. The restructuring of Maya culture can be seen by a rise in large political centers located in the northern Lowlands in what is termed the Postclassic Period (A.D. 900–1521). These final Maya cities persisted until the arrival of Spanish conquistadors in 1521. The Classic Period collapse and the arrival of the Spanish did not result in a total population collapse, however, and there are many indigenous Maya populations currently inhabiting Central America and Mexico.

With the chronology of the Maya region in mind, Maya archaeologists strive to understand the specifics of Maya culture. Research topics range from plant/animal relations with the Maya, to the chronology of dynastic rulerships as recorded

on stelae, or standing stone monuments, to broadening our understanding of the full landscape management by Maya settlers (Chinchilla Mazariegos 2017; Coe and Houston 2015). For

our research questions, we focused on a specific Maya site to understand the water management practices of the people who lived on the site, past and present.

Salinas de los Nueve Cerros

Salinas de los Nueve Cerros is located in the Guatemalan department of Alta Verapaz, near the border of El Quiche, Guatemala and Chiapas, Mexico. The site is defined by multiple dramatic topographic features (see Figure 2). The Nueve Cerros Ridge is 21 km long and forms the western border of the site. The Tortugas salt dome is approximately 3 sq km and forms the southeastern limit and central part of the city. The Chixoy River forms the northern and north-eastern boundary of the site, and serves as an artery for trade. The hydrological features at the site are very complex, with streams leading into the Chixoy River from springs around the site, a perennial brine stream leading from the hills to the Chixoy River, and seasonal swamps located near the southern portion of the site (Woodfill et al. 2015). The salt flats surrounding the brine stream have 1,500 metric tons of salt available on the surface at any given time. In fact, salt was a critical economic stimulus for Nueve Cerros as it was produced and traded for nearly 2000 years (Woodfill et al. 2015).

Nueve Cerros has a long history of occupation beginning in the Middle Preclassic (1000 B.C.) and continuing until the early Postclassic Period (A.D. 900–1200). Currently the northern area of the site, the Tierra Blanca zone, is the earliest architectural group at the site and also has the longest occupational history from the Preclassic to the early Postclassic. Southern Lowland style ceramics, usually characterized by a deep red slip, are the primary ceramic groups recovered in Preclassic contexts, suggesting strong early ties to other Southern Lowland sites. There was also evidence of heavy mound construction around the brine stream, or the Salt Production zone, in

the Late Preclassic Period. Overall, by the end of the Preclassic most of the site was occupied and consisted of one contiguous zone.

During the Classic Period, function and economic roles of the areas of the site became much clearer. The Salt Production zone became the economic center, and the epicenter, which is the location of large monumental elite architecture, became the administrative center. The Tierra Blanca area to the north most likely served as the port to the city. Triadic structures, plaza groups, monuments, and the ballcourt, which are all architectural representations of a prosperous Maya city, were constructed during the Classic Period. By the end of the Classic Period, the artifacts at Nueve Cerros became much more diverse, showing more styles than just that of the Southern Lowlands.

During the Terminal Classic Period, the Southern Maya Lowland elites began to experience a collapse in their political economy. The Highlands, on the other hand, experienced a florescence, and the inhabitants of Nueve Cerros gained from their successes. By the Early Postclassic, all of the material was Highland in style, with evidence of zoomorphic-footed plates, hourglass incense burners, and a plumbate bowl, all of which are related to the Northern Highlands. This evidence of Postclassic ceramics suggests the Nueve Cerros center survived the Classic Maya collapse and continued for approximately 400 years after the series of droughts and political turmoil seen at other Southern Lowland Maya cities. There is no Late Postclassic artifactual evidence at Nueve Cerros after A.D. 1200, outside of a single cave in the Nueve Cerros Ridge (Woodfill 2019).

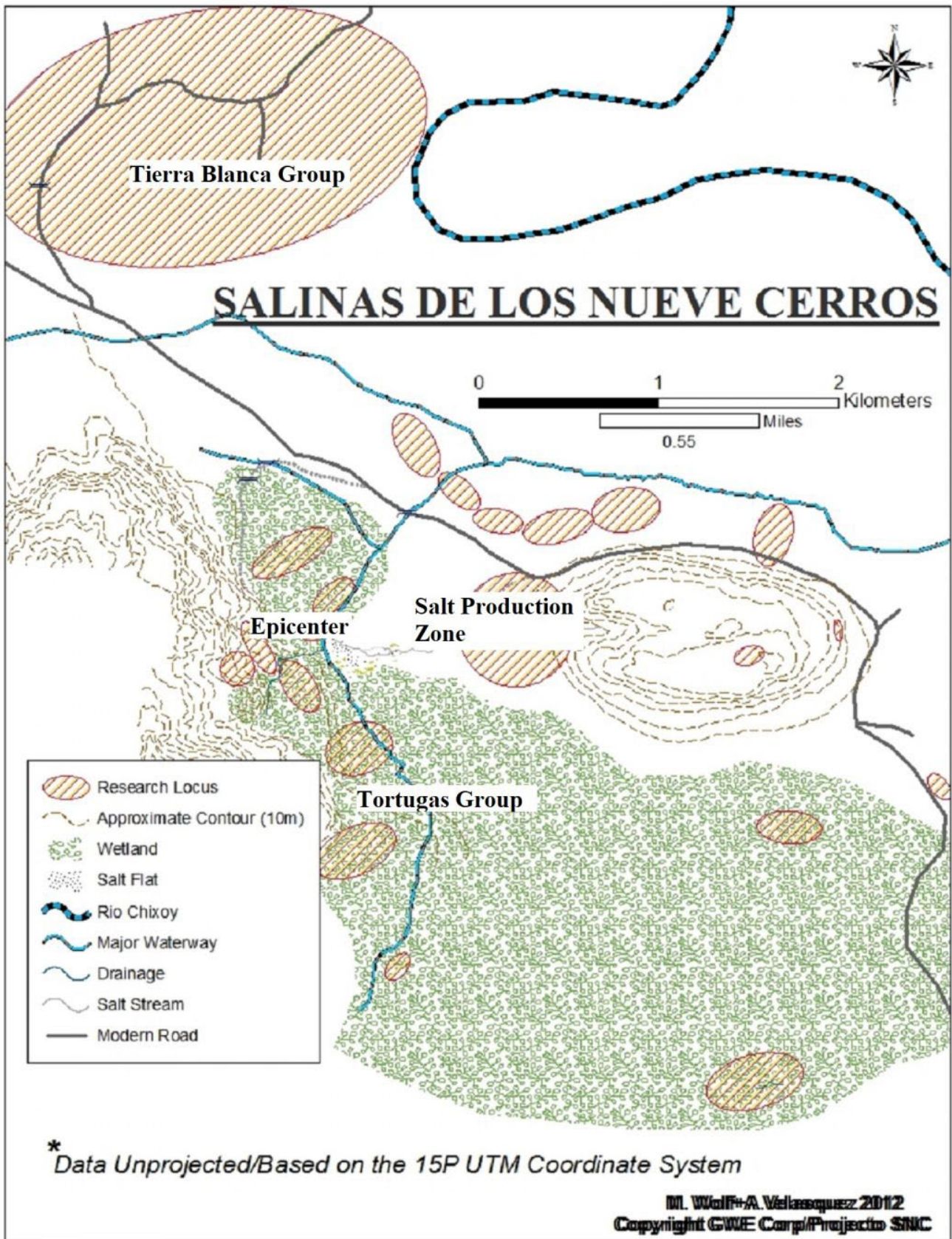


Figure 2. Map of Salinas de los Nueve Cerros with associated ancient architectural groups. Map courtesy of Brent K. S. Woodfill, modified by Alexander E. Rivas.

As previously stated, Nueve Cerros had clear economic importance during the Late Classic (A.D. 600–900) when the inhabitants of the site had the potential to sustainably produce 10,000 metric tons of salt per year (Woodfill et al. 2015). The ancient Maya's ability to produce salt at this site allowed them to participate in major

exchange networks throughout the Lowlands and Highlands. Elite rulers were buried near the salt production zone during the Classic Period, directly associating themselves with salt production and suggesting the importance of salt production to the rulers of Nueve Cerros.

Ancient Maya Water Management Systems

To contextualize Nueve Cerros in the larger framework of ancient Maya society, it is necessary to understand the history of water management in the Maya Lowlands.

To alleviate water shortages during the dry season, the Maya built reservoirs and containment systems. In the Late Preclassic, Maya living in large cities took advantage of depressions in the natural landscape by constructing concave watershed systems. Preclassic Maya centers, such as El Mirador and Cerros, followed this format of settlement organization. Scarborough (1998: 139) defines the Preclassic adaptation as a “passive form of water management” in which the early communities made use of the natural depressions and basins in their surroundings.

At the Preclassic coastal center of Cerros, Belize, Scarborough also identifies “basin canals” in which water was conserved during the dry season through the manipulation of sills and dams. The site itself was carefully selected for its mosaic of environmental features, and the settlement throughout time focused on adapting to this landscape. Scarborough's research showed that the earliest Maya may have focused their settlements near streams and riverine settings, but by the Late Preclassic, the landscape was altered for reservoirs and diversion features that allowed settlements to develop in more varied geographies, with settlement size influenced by water storage capacity.

Eventually, Classic Maya cities began to have much greater reliance on constructed reservoirs, with water systems growing across different centers (see Figure 3 for a simplified schematic). When new, large Classic Period Maya centers emerged, water systems were controlled and released in the city centers and managed throughout the peripheries. Reservoirs, dams, channels, sluices, and filtration systems can be seen at many Classic Period sites (Scarborough 2003). Importantly, during the dry season, this system allowed for water to continuously be diverted into agricultural fields and holding ponds, which could be used for other economic purposes such as fishing, ceramic production, and architecture construction (Lucero et al. 2014). In order to keep some of this water potable and free of diseases, they would add water lilies as well as other marine organisms to purify water through the removal of excess phosphorus and nitrogen (Conrad 1905). People living in riverine systems also constructed artificial reservoirs and water retention systems. Rivers may not have always been safe for drinking water, with low rivers having murky waters and heavy rains during the rainy season depositing sediments.

By the Classic Period, many regional Maya capitals, such as Tikal and Calakmul, were located in regions without permanent water sources but were surrounded by swamps or seasonal swamps. The interior lowlands also had more fertile soils than those along the coasts, but with very little surface water. The dry season, from January through May, was particularly problematic

with little to no rainfall for months, and with an increase in temperature and humidity. Little agriculture was practiced during the dry season, but potable water was clearly still a necessity. In the tropics, people can lose up to 10 liters of water per day through perspiration, causing a need for more water than those living in temperate climates (Bacus and Lucero 1999). The rainy season also potentially posed problems, with too much water accumulating and flooding. Water quality is also an issue, with standing water allowing for waterborne diseases.

By the end of the Classic Period, artificial reservoirs were not sufficient in the Southern Lowlands due to frequent long-lasting droughts.

Many centers were becoming abandoned, leading to the Maya collapse. While the ruling elite and major polities ceased, many people continued to live in the Southern Lowlands; small communities continued to occupy these mostly abandoned cities after the collapse. However, most of the people settled along or near rivers and lakes or in the coastal areas where wetland agriculture could still take place. Most of the inhabitants however moved away from the interior Southern Lowlands to the Northern Lowlands. Overexploitation of natural resources was also evident in the Southern Maya Lowlands. Soils were eroded (Dunning et al. 2015), and many cities were already reaching their carrying capacity and were unsustainable (Lentz et al. 2014).

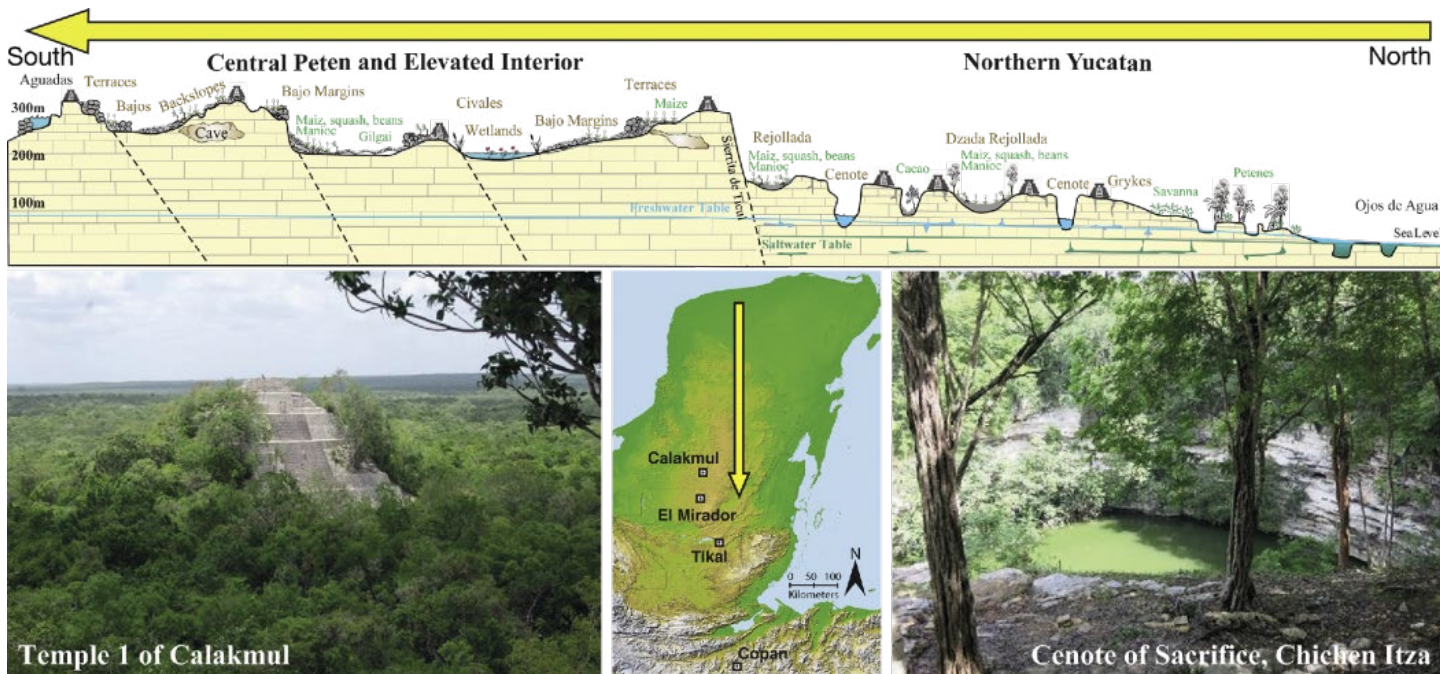


Figure 3. A simplified schematic of the hydrological systems across the Maya Lowlands. Figure from Luzzadder-Beach et al. 2016 (<https://doi.org/10.22498/pages.24.2.66>). (CC BY 4.0).

The Current Landscape at Nueve Cerros: The Northern Transversal Strip

Geographically, Nueve Cerros is today part of the Northern Transversal Strip, a region in Guatemala that runs from east to west, delimiting the northern Peten Lowlands and the southern Highlands. In post-World War II Guatemala, the population of the Highlands experienced high population pressure, forcing families to move further north in Alta Verapaz, Guatemala, along the shores of the Chixoy River. By the 1970s, an oil pipeline was being built along the Northern Transversal Strip, through which the exploitation of oil sources became easier, along with the construction of a highway (Grandia 2012). This coincided with the Civil War (1960-1996) and thus with a great increase in military presence and revolutionary forces. By 1990, the Northern Transversal Strip received an increased number of migrants including subsistence farmers, cattle ranchers, and laborers for exploiting the oil resources (Smith 1990). Many of these migrants

were taking advantage of resettlement programs or fleeing violence from their homelands. More specifically at Nueve Cerros, the site area has been occupied by multiple groups. The salt works were controlled by the Akalah Ch'ol, the cultural descendants of the urban Maya of the Classic Period Southern Lowlands, at the time of Spanish arrival but have since been under control by Highland Maya populations, Spanish priests and soldiers, ladino landowners, urban municipalities, and foreign oil companies (Woodfill 2019). After heavy exploitation by the oil, maize, and beef industries, the landscape today is primarily settled by Q'eqchi' *milpa* (horticultural corn) farmers who came from the Highlands, African palm industries, and cattle ranchers. Because of this, much of the land is cleared and deforested, with the salt dome and nearby hills being the few remaining forested areas left.

Collecting Ethnographic Data: Q'eqchi' Farmers at Nueve Cerros

Odum's work at Nueve Cerros has focused on the current landscape and ethnographic research among the communities in this region. Specifically, Odum conducted multiple interviews with *milpa* farmers in the Tierra Blanca region of Nueve Cerros between 2017 and 2018. These interviews were conducted to understand current water management practices, specifically potability, waste, and access. In addition, from May 2017 to the present, William Odum has served as community development coordinator and cultural anthropologist for the Salinas de los Nueve Cerros project, specifically working with Q'eqchi'

communities in the area. The ethnographic work is applied in nature and is aimed at aiding and advising sustainable development initiatives among the communities in the region. This work has consisted mainly of research on issues pertaining to water and health, building community wells, and collaboratively engaging with other infrastructural and daily necessities. Odum conducts this research and labor through his position as an advisor for a locally run NGO, ADAWA, that is dedicated to the general development of the region's communities and has been partnered with the Nueve Cerros project since its early

years. Odum's community development work also included extensive participant-observation with *milpa* farmers on evaluating the current state of water management of the region. Odum has worked with 29 different communities

assessing general themes of well-being, but has gravitated toward a focus on the most pressing issues: water contamination, management, and access.[1]

Ethnographic Results

The results of this initial study to understand current water management practices at Nueve Cerros showed a strong analogical relationship between Q'eqchi' land-use practices and ancient Maya settlement decisions and modifications. As we will explain in the following sections, the use of groundwater as the primary source of potable freshwater for the majority of the population is prioritized among the Q'eqchi' and was highly valued in the past, based on the locations of many small depressions in the north. In addition, usage of springs and seasonal streams in the deep river valley also plays a role in opportunistic fish procurement.

Currently, the situation in the region is bleak, with approximately half of the families lacking access to a well or a reliable water source. Furthermore, many families' wells dry up during the dry season, which lasts approximately two months. The wells that do maintain low water levels during the dry season are mostly filled with surface water that is contaminated by latrines and other sources of pollution. Those without access to these wells often use nearby streams in the forest, stagnant collection pools in *milpa* fields, or various sources in the surrounding communities. Although there are plenty of streams around Nueve Cerros, many of them are polluted with trash, dead animals, pesticides, and other pollutants. Communities near two of the

major rivers, the Chixoy and the Icbolay, acquire water from these sources even though they know about the high level of contamination. Although some families do use this water for consumption, usually boiling it, many just use it for gray water purposes such as washing clothes and dishes and bathing. Nonetheless, this water causes harmful effects to the population including dish contamination and rashes from the clothing. In response to these issues, Odum has worked with the local NGO to increase awareness of water filters. Families with access to well water are healthier and have an easier time carrying out household labor such as cooking and washing clothes and dishes. In a demonstration sponsored by the project, Odum brought a bucket-sized water filter to the excavation site for the workers to expand awareness of water filtration. After filtering and drinking water from the improvised wells constructed out of the depressions, the residents became excited at the possibility to expand their innovation beyond graywater purposes. This marked an enthusiasm and level of engagement that is necessary for collaborative and sustainable solutions to issues such as water contamination. The use of these ancient depressions creates a situation unique to this village. Thus, locating water features, ancient or current, helps our ethnographic goals and aids our archaeological research questions.

Collecting Archaeological Data: Surveying the Current Nueve Cerros Landscape

While Odum's focus has been on community development and the ethnography of water and the Q'eqchi', Rivas focused on the *watery* landscape of Nueve Cerros. Between 2015 and 2018, Rivas carried out field surveys to look for water features within Nueve Cerros. Specifically, we searched for water features that may be closely associated with the architectural mounds found at the site, and natural features that the Q'eqchi' may use. We used a Trimble GeoX (6000 series) GPS to map depressions, streams, and springs. Rivas undertook the reconnaissance at the site with local Q'eqchi' Maya, assisting in finding water features. The Trimble allows data to be collected as points, lines, or polygons. Most features were mapped using the line feature, which allows users to map the area while walking. Points were also

used to complement the line data. Photographs of different features, including streams, wells, and small depressions, were also taken. In addition to field surveys, during the 2018 summer field season, project director Brent Woodfill and Rivas conducted drone surveys and processing of the Tierra Blanca region, as well as other important areas of the archaeological site including the epicenter and the salt production zone. The survey was conducted using a DJI Inspire 2 drone, with a Zenmuse X5S camera for aerial photography. All photographs were processed using Agisoft Photoscan Professional, which converts the aerial images into a point cloud, digital elevation model (DEM), and ortho-mosaiced photographs (Figure 4).

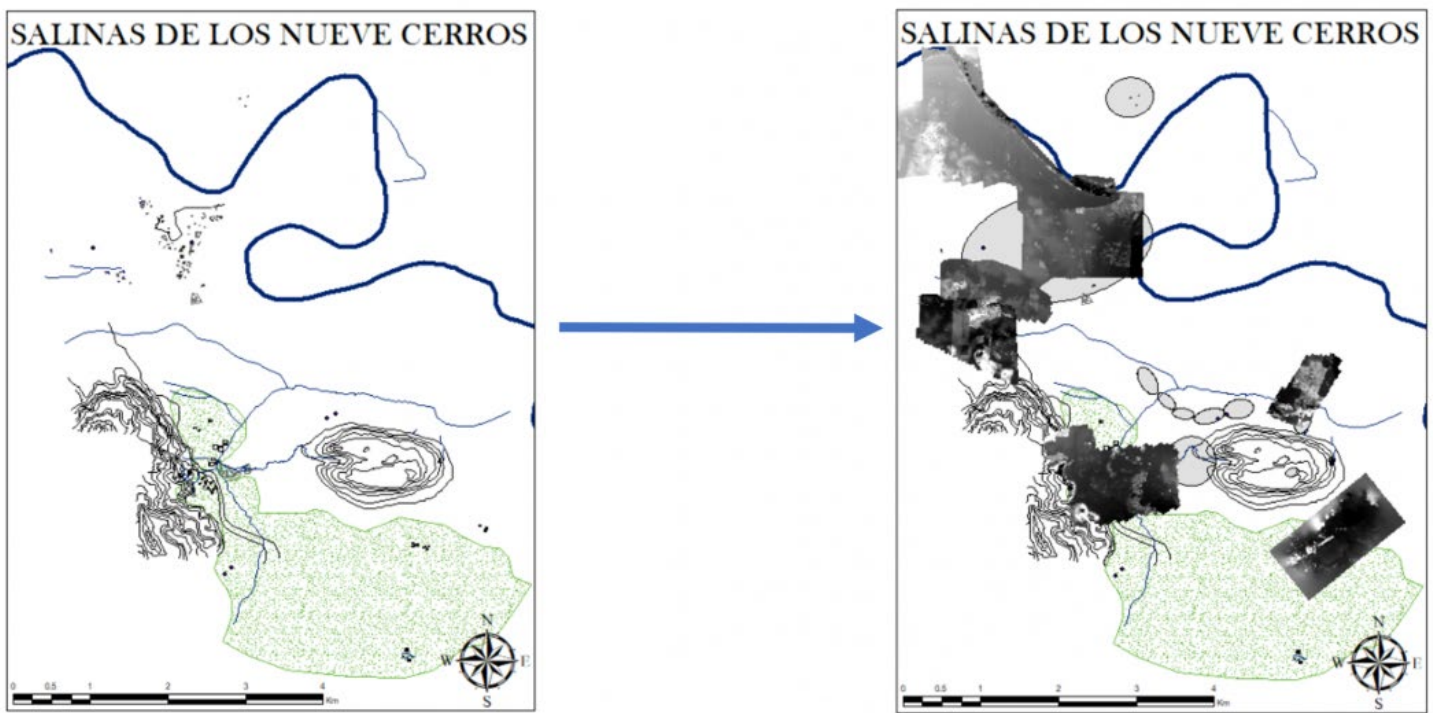


Figure 4. Original map of Nueve Cerros (right) and overlaid drone images (left). Map courtesy of Alexander E. Rivas.

Discoveries from the Field Surveys: Ancient and Modern Landscape Management

Depressions and ancient reservoirs were found through field surveys and aerial photography throughout the Nueve Cerros region, and many more were revealed through drone surveys. However, on-the-ground mapping was crucial in understanding current uses of depressions and streams in the region.

In the southwest area of the Tierra Blanca region, many current farmers have built wells for their

personal family use. Three of these wells were in fact small depressions in the landscape in areas next to archaeological mounds and features. When we asked the farmers who made these wells and how they designed them, they told us they had noted water collection here and had assumed it was created or used by ancient populations. Indeed, these depressions were probably used as groundwater wells in the past, with groundwater flowing through year-round. Today, these wells



Figure 5. Reuse of ancient depressions or wells with a trench dug connecting the two wells and evidence of a filtration system set up. Image courtesy of William G. B. Odum.

are minimally constructed, with one of them modified for a filtration system. In this case, one of the farmers dug out two depressions that were near each other enough for groundwater seepage to occur. A trench was dug connecting the two, leading water from the higher elevation to the well at the lower elevation. In addition, the water was filtered through a wooden plank held in place by stones along the sides. This wooden plank acts as a sluice gate and as a preventative measure to avoid silting and running dry too quickly, to direct gray water runoff, and to act as a constructed berm (Figure 5). This system replicates a much smaller-scale and simplified version of a reservoir filtration system at the ancient site of Tikal, Guatemala (Scarborough et al. 2012). In the Tikal case, siltation tanks and sluice gates were used for the control of water resources in the epicenter of the large polity.

Currently, the landscape at Nueve Cerros, especially the Tierra Blanca zone, is dominated by *milpa* farming of maize. Many of the ancient mounds are not covered by forest overgrowth, but rather by corn plants. With corn crops as their main form of income, the Q'eqchi' exploit as much of the land as possible, planting in all areas surrounding them, excluding the modern roads and the immediate surroundings of their houses. The only areas that are not used for planting corn are in the drainage areas such as the swamps, in the springs, and in the streams. The streams are seasonal but many retain enough water during the dry season to obstruct *milpa* farming. However, even in some low-lying swampy areas, many farmers dig trenches to deal with run-off and to keep crops from flooding.

During August, between the end of the dry season and the start of the rainy season, these

streams begin to fill with water and start to meet with the Chixoy River more frequently. Higher water levels allow for fish and aquatic animals to disperse, which makes it more difficult to fish. For this reason, people fish more during the dry season. However, the erratic weather patterns cause the streams to fill up one day and begin to dry out the next. This causes an abundance of in-stream fish, and possibly other aquatic animals, to enter the streams and become trapped for days or possibly weeks in people's backyards. This is even marked by a large increase in vultures along floodplains and swamps where fish are caught in dried-up streams. The Q'eqchi' here often take full advantage of this situation. Dozens of people can be seen grabbing fish and depositing them into 10 kg sacks along the streams after a heavy rain. These are seasonal streams that act almost as natural fish weirs, with receding water coming from the changes in the weather and the seasons and with fish channeling to dried locations.

Currently, during the rainy season it is too difficult to canoe the Chixoy River. The waters are too erratic and strong to allow paddling. However, during this season, smaller peripheral streams are filled and water reaches to the confluences of the Chixoy. The streams become navigable, with enough width and depth for canoes to easily go through. During flooding and on rainy days, the current inhabitants in the area use the streams—sometimes with no other option—to travel to different plots of land as an alternative to traversing through the *milpa*. These alternative routes suggest that canoe travel like this could have been employed during the Classic Period as well, with the Maya using streams as intra-site routes during floods and rainstorms.

The Aerial Landscape Perspective of Nueve Cerros

The ancient site of Nueve Cerros probably covered over 50 sq km including extensive areas to the north of the Chixoy River. Thus far, we have collected 8.2 sq km of aerial photographs, with many of the images coming from the northern Tierra Blanca zone. Although we still do not have a full picture of the broad built Nueve Cerros landscape, these preliminary results allow us to look at land-use and settlement strategies of the ancient commercial population and some current Q'eqchi' farmscapes in Tierra Blanca.

In one of the ancient architectural groups, at least 10 depressions were detected, one large water tank, a probable pond, two probable low swampy areas, and at least 21 mounds or architectural features. This specific group is situated along an elevated, fossilized levee with two rather large streams located to the south. Small depressions and wells have been studied elsewhere in the Maya Lowlands and are often interpreted as possible locations for potable water extraction for ancient communities (Weiss-Krejci and Sabbas

2002; Johnston 2004; Brewer 2018). Excavations of a few of these depressions showed stratigraphic evidence of a high water table that in fact currently fills with water during the rainy season. Contemporary farmers who own these parcels have told us that before the intensive *milpa* farming, when these areas were forested, water would stay in some of the larger depressions year-round. In addition using the ancient depressions as their own wells, Q'eqchi' farmers also dammed one of the streams and dug for welled water, using only planks of wood to regulate flow and more efficiently retain water (Figure 6).

It is likely that during the Classic Period the Maya were not conducting slash-and-burn farming at an intensive level, with farming being relegated to specific sections of the site. Currently, the cornfields are planted over much of the ancient mound architecture, which surely would not have been the case in the past. The water catchment strategies, however, may have been very similar. The presence of multiple depressions in the

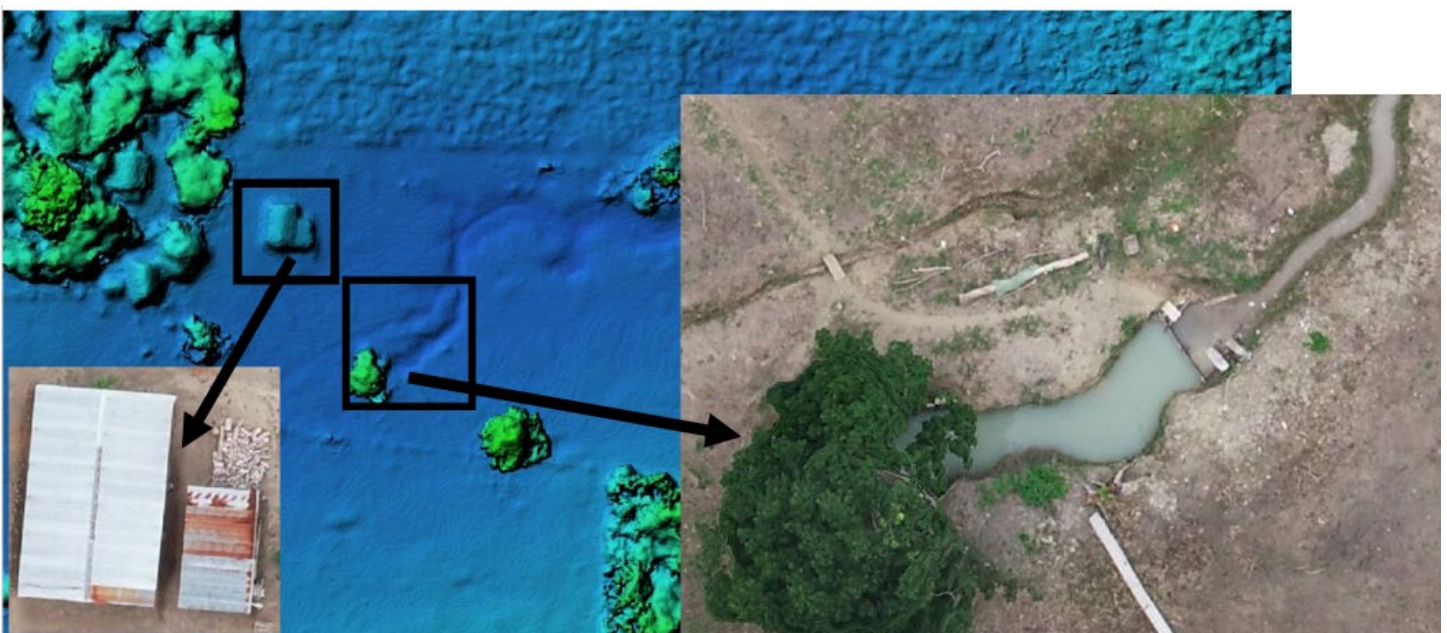


Figure 6. DEM and Orthophoto images of modern Q'eqchi' houses and storage areas and evidence of a dammed seasonal stream. Figure courtesy of Alexander Rivas.

northern Tierra Blanca zone, near residential architecture, suggests that inhabitants at the site may have primarily used dug wells for groundwater usage. The prolonged droughts were a factor

in the Lowland collapse of major Maya polities, but with alternative access to groundwater, ancient Nueve Cerros was able to persist.

Conclusion

Combining ethnographic and archaeological methods has proven useful in the Transversal region of the Southern Maya Lowlands and will continue to have potential with research on contemporary and ancient water management. Employing applied ethnographic methods in the context of archaeological investigation stands to benefit both subfields and the communities that are involved. The changing adaptive strategies of the Q'eqchi' Maya during both the dry season and rainy season have potential implications for how the ancient Maya may have utilized their landscapes. The transition between the two seasons is also of importance for the opportunistic strategies that become available to the Q'eqchi'. Hypothetical considerations such as these must be anchored in ethnographic investigation to accurately assess the potential for and extent of analogy between contemporary and ancient water management practices.

Conversely, the knowledge of these practices has also served to be useful in the project's applied initiative to aid in the region's struggle for expanding access to potable water by influencing plans to assess the issue. Introducing bucket-sized water filters to purify graywater in these re-opened depressions as we've described offers a solution that stands to be as resilient and effective as it is distinct because of how it is rooted in the imagination, creativity, and agency of community members.

These data were recorded in the context of an archaeological project. The original focus of

this project was to understand the purposes of the ancient depressions. Combined with ethnographic research by Odum, this led to further discovery of how residents imagine and interact with their surroundings, which in turn opened new possibilities for integrated, community-led solutions to major water issues between the local residents and us, the researchers. This was only possible due to the focus of the archaeological survey on water features across the landscape. This study stands as a testament to the potential for mutual benefit between researchers and the local populace.

Water management studies in the Maya Lowlands have a long history of research. They have been multidisciplinary, ranging from focuses on iconography and epigraphy, paleo-environment, artifact analysis, and increasingly to a spatial, landscape, and GIS focus. This article provides a multi-scalar approach to the strategies developed by the ancient Maya as well as by the current Q'eqchi' Maya at Nueve Cerros. Our methods have the potential to provide new insights into Maya planning and sustainable practices that could have accounted for the thriving of a long-term population. In addition, this combination has proven to offer new perspectives and approaches that can help applied anthropological research to engage with its participants and informants and geographical context differently. This study is an example of how local populations and researchers can simultaneously work together and lead to higher efficacy and more discoveries for everyone involved.

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Footnotes

[1] The ethnographic data collected by William Odum has Institutional Review Board (IRB) approval, which is necessary for conducting research involving human subjects.

References

- Bacus, Elisabeth A., and Lisa J. Lucero. 1999. Introduction: Issues in the Archaeology of Tropical Polities. In *Complex Polities in the Ancient Tropical World*, edited by E.A. Bacus and L.J. Lucero, pp 1-11. American Anthropological Association, Arlington.
- Brewer, Jeffrey L. 2018. Household as Water Managers: A Comparison of Domestic-Scale Water Management Practices from Two Central Maya Lowland Sites. *Ancient Mesoamerica* 29 (1): 197-217.
- Coe, Michael D., and Stephen Houston. 2015. *The Maya*, 9th ed. Thames and Hudson, London and New York.
- Conrad, Henry S. 1905. *The Waterlilies: A Monograph of the Genus Nymphaea*. Carnegie Institute of Washington Publication, 4. Carnegie Institute, Washington, DC.
- Dunning, Nicholas P., Robert E. Griffin, John G. Jones, Richard E. Terry, Zachary Larsen, and Christopher Carr. 2015. Life on the Edge: Tikal in a Bajo Landscape. In *Tikal: Paleoecology of an Ancient Maya City*, edited by David L. Lentz, Nicholas P. Dunning, and Vernon L. Scarborough, pp. 95-123. Cambridge University Press, Cambridge.
- Grandia, Liza. 2012. *Enclosed: Conservation, Cattle, and Commerce Among the Qeqchi Maya Lowlanders*. University of Washington Press, Seattle.
- Inomata, Takeshi, Daniela Triadan, Kazuo Aoyama, Victor Castillo, and Hitoshi Yonenobu. 2013. Early Ceremonial Constructions at Ceibal, Guatemala, and the Origins of Lowland Maya Civilization. *Science* 340: 467-471.
- Johnston, Kevin J. 2004. The "Invisible" Maya: Minimally Mounded Residential Settlement at Itzan, Peten, Guatemala. *Latin American Antiquity* 15 (2): 145-175.

Lane, Paul J. 2008. The Use of Ethnography in Landscape Archaeology. In *Handbook of Landscape Archaeology*, edited by Bruno David and Julian Thomas, pp. 237-244. Left Coast Press, Walnut Creek.

Lentz David L., Nicholas P. Dunning, Vernon L. Scarborough, Kevin S. Magee, Kim M. Thompson, Eric Weaver, Christopher Carr, Richard E. Terry, Gerald Islebe, Kenneth B. Tankersley, Liwy Grazioso Sierra, John G. Jones, Palma Buttles, Fred Valdez, and Carmen E. Ramos Hernandez. 2014. Forests, Fields, and the Edge of Sustainability at the Ancient Maya City of Tikal. *Proceedings of the National Academy of Sciences of the United States of America* 111 (52): 18513-18518.

Lucero, Lisa J., Scott L. Fedick, Nicholas P. Dunning, David L. Lentz, and Vernon L. Scarborough. 2014. Water and Landscape: Ancient Maya Settlement Decisions. *Archeological Papers of the American Anthropological Association* 24 (1): 30-42.

Luzzadder-Beach, Sheryl, Timothy Beach, Scott Hutson, and Samantha Krause. 2016. Sky-Earth, Lake-Sea: Climate and Water in Maya History and Landscape. *Antiquity* 90 (350): 426-442.

Mazariegos, Oswaldo Chinchilla. 2017. *Art and Myth of the Ancient Maya*. Yale University Press, New Haven.

Scarborough, Vernon L. 1998. Ecology and Ritual: Water Management and the Maya. *Latin American Antiquity* 9 (2): 135-159.

———. 2003. *The Flow of Power: Ancient Water Systems and Landscapes*. School for Advanced Research, Santa Fe.

Scarborough, Vernon L., and Liwy Grazioso Sierra. 2015. The Evolution of an Ancient Waterworks System at Tikal. In *Tikal: Paleoecology of an Ancient Maya City*, edited by David L. Lentz, Nicholas P. Dunning, and Vernon L. Scarborough, pp. 16-45. Cambridge University Press, Cambridge.

Sharer, Robert J., and Loa P. Traxler. 2006. *The Ancient Maya*, 6th ed. Stanford University Press, Stanford.

Smith, Carol A. (ed). 1990. *Guatemalan Indians and the State, 1540-1988*. University of Texas Press, Austin.

Weaver, Eric, Christopher Carr, Nicholas P. Dunning, Lee Florea, and Vernon L. Scarborough. 2015. Examining Landscape Modifications for Water Management at Tikal Using Three-Dimensional Modeling with ArcGIS. In *Tikal: Paleoecology of an Ancient Maya City*, edited by David L. Lentz, Nicholas P. Dunning, and Vernon L. Scarborough, pp. 87-95. Cambridge University Press, Cambridge.

Weiss-Krejci, Estella, and Thomas Sabbas. 2002. The Potential Role of Small Depressions as Water Storage in the Central Maya Lowlands. *Ancient Mesoamerica* 13 (3): 343-357.

Woodfill, Brent K.S. 2019. *War in the Land of True Peace: The Battle for Maya Sacred Places*. University of Oklahoma Press, Norman.

Woodfill, Brent K.S., Brian D. Dillon, Marc Wolf, Carlos Avendaño, and Ronald Canter. 2015. Salinas de los Nueve Cerros, Guatemala: A Major Economic Center in the Southern Maya Lowlands. *Latin American Antiquity* 26 (2): 162-179.

Wylie, Alison. 2002. *Thinking from Things: Essays in the Philosophy of Archaeology*. University of California Press, Berkeley.

Ybarra, Megan. 2018. *Green Wars: Conservation and Decolonization in the Maya Forest*. University of California Press, Oakland.

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GEOGRAPHIES

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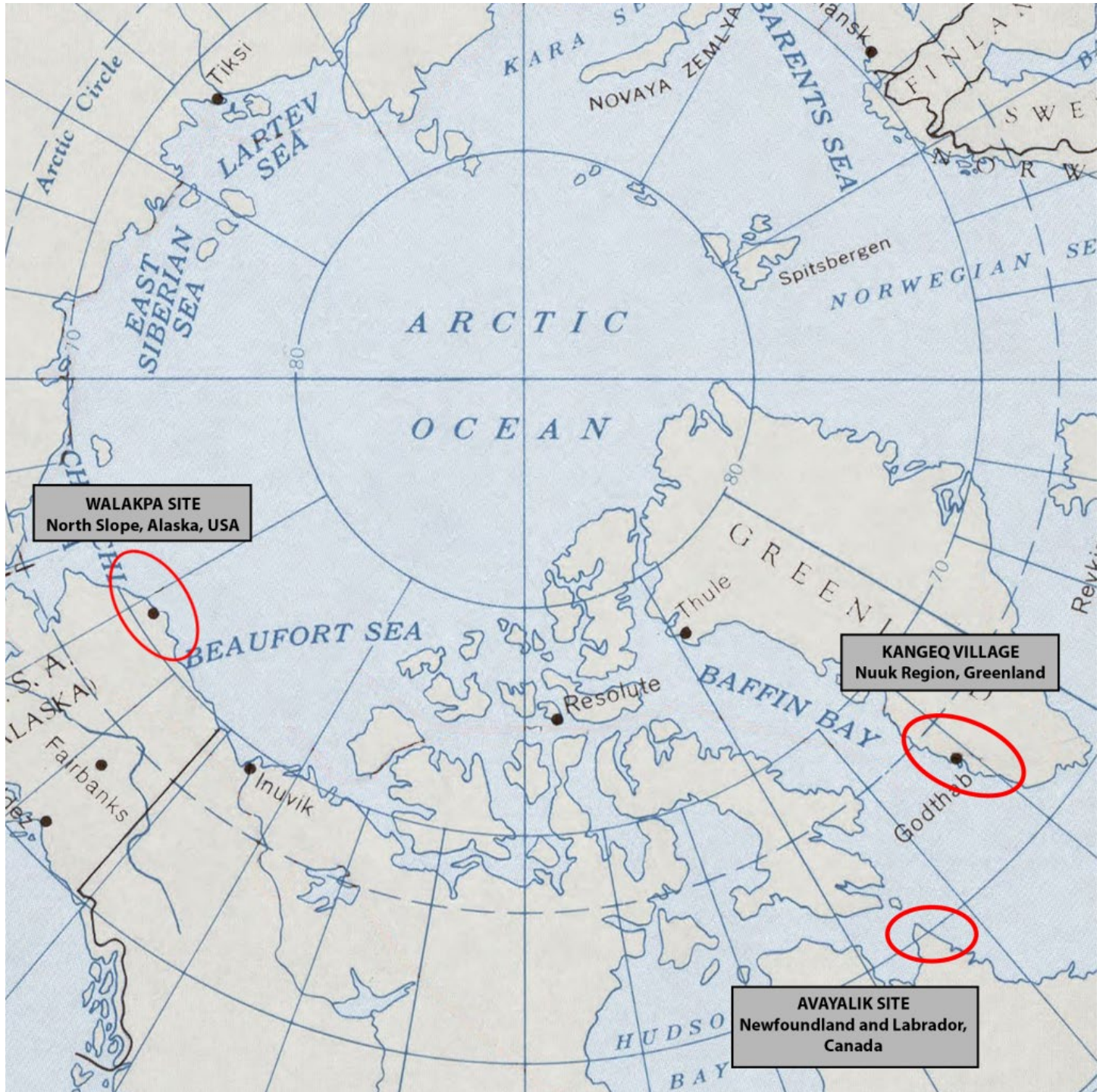
By Phyllis Mauch Messenger

The impact of climate change on archaeological and heritage sites in the Arctic region is devastating. New techniques of research and analysis are providing increasingly rich data about the long history of humans in the environment. Evidence from archaeological sites, which has long contributed to this story, is becoming recognized as a “distributed long term observing network of the past” (Sandweiss and Kelley 2012). Just as the value of these sites is being recognized more fully, the sites themselves are

being destroyed by thawing permafrost, rising sea levels, and increasingly violent storms. Nowhere is this being felt more intensely than in the Arctic, which is warming two to three times as fast as the rest of the planet (Hoag 2019). In addition to increased threats from insects, extreme weather, wildfires, and the release of long-buried pathogens, this rapid warming is destroying the archaeological record (Holleisen et al. 2018). These environmental changes are destroying invaluable and irreplaceable evidence of human history.



Crew excavating eroding house at Walakpa in 2017. Image courtesy of the Walakpa Archaeological Salvage Project.



This map shows the regions of the three Arctic research sites highlighted in this piece: the Walakpa site, the Avayalik site, and the Kangeq village.

Archaeologists and other scientists, realizing the extent and urgency of the threat not just in the Arctic but globally, liken it to the burning of the ancient libraries of Alexandria, multiplied many times over (McGovern 2017).

For many years, in situ preservation in the Arctic and elsewhere worked very well. Now researchers from universities, museums, and government agencies, working with Indigenous and descendant communities, are scrambling to collect materials before they degrade and disappear. Researchers declare that this may be the last generation to be able to recover even a fraction of the record of the archaeological global recording network. Analysis can come later.

In some cases, forward-thinking scholars and sponsors have managed to cobble together funding and teams to gather ice cores to be stored for future analysis. Similar efforts are being mounted at archaeological sites, with the recognition that only a fraction of known sites can be sampled.

In the 2017 Society for American Archaeology (SAA) President's Forum, the opening session of

Global Initiatives

The urgency of this situation has led to new initiatives to share resources and to identify and disseminate best practices. One such example is the *Integrated History and Future of People on Earth* (IHOPE 2015). This global network of researchers and research projects uses integrative frameworks and long-term, human-scale perspectives to combine earth system science (which focuses on the operation of the whole earth, including the basic elements of air, water, land, and life) with the social sciences, the humanities, and communities of practice.

One of IHOPE's teams focuses on threats to heritage and the distributed observing network of the past. This team includes archaeological

the 82nd Annual Meeting, SAA President Diane Gifford-Gonzalez described how global climate change is affecting archaeological and heritage sites "at a scale and rate unprecedented in the experience of archaeologists over the last 150 years" (Gifford-Gonzalez 2017). Panelists in the session discussed the need to monitor and document sites along coasts from Alaska to Greenland and Northern Europe. They described innovative strategies to engage local communities in protecting threatened sites and in documenting those that will be lost.

According to organizers of another 2017 SAA symposium on environmental impacts on heritage, "This generation will see the destruction of thousands of sites—some already famous and of recognized heritage value and others that are exposed by one storm only to be destroyed by the next. At the same time, archaeology is increasingly recognized as a global-change science that is making significant contributions to resource management, environmental conservation, and more effective scenario building for a genuinely sustainable future" (McGovern 2017).

fieldworkers, biologists, and modern resources managers working closely with citizen scientists and local communities. They face a dilemma of epic proportions. They have access to new analysis tools that promise to revolutionize what we can learn about the past of humankind, so they must try to collect as much data as possible before it is gone. Yet, for the most part, they do not have strategies in place to document which sites are most at risk or to make decisions about which sites to focus on and which to let go. They must also deal with funding agencies that are used to supporting hypothesis-based research, not quick-turnaround salvage recovery. There are a host of other bureaucratic and logistical hurdles facing these researchers.

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Another innovative collaboration that seeks to overcome disciplinary and institutional barriers is the Resilience Alliance (RA). Established in 1999, the RA is an international, multidisciplinary research organization that explores the dynamics of social-ecological systems. RA members collaborate across disciplines and with local communities on issues of resilience, adaptive capacity, and transformation of societies and ecosystems. They participate in many international projects, including the International Panel on Climate Change.

The RA carries out comparative research and synthesis at a global scale, rooted in local and regional context-specific studies (see, for example, a [video on scenario planning](#) for Arctic sustainability in 2050). The organization's online journal, *Ecology and Society*, serves as a resource for other organizations and programs around the world.

What follows is a glimpse of the issues and opportunities currently facing archaeologists who work in the Arctic, using sites in Alaska, Greenland, and Labrador as proxies for the ancient stories in a region that is rapidly thawing and eroding away.



Ancient Walakpa wooden structure slumping into the sea. Image courtesy of the Walakpa Archaeological Salvage Project.

Loss of Sites in Alaska

University of Alaska archaeologist Anne Jensen studies endangered sites in coastal Alaska. She works in close collaboration with recognized Native communities on the North Slope and is the senior scientist for the Ukpeaġvik Iñupiat Corporation. The Walakpa site on the North Slope of Alaska is an example of an iconic site with “spectacular preservation” that began eroding rapidly in 2013 (Jensen 2018). This sudden degradation is due to multiple forces: permafrost thawing, freeze-thaw cycles, and wave

action during storms. At Walakpa, well-preserved wooden structures and 11 meters of stratified deposits dating back over 3,000 years of history of semi-nomadic Alaska Natives are now slumping into the sea.

Until just a few years ago, this house (above) had stood literally frozen in time. It held not only millenia-old cultural data, but biological data, as well: basic zooarchaeological data, stable isotopes, ancient DNA^[1], cortico steroids, and trace



Walakpa house with overhang gone. Image courtesy of Anne Jensen.



Walakpa slump block strata showing remains of a storage pit or ice cellar (reddish layer) and possible earlier abandoned ice cellar below (ice lenses separated by soil). A baleen (whalebone) bucket is visible in the lowest ice lens, just to the right of the post. Image courtesy of the Walakpa Archaeological Salvage Project.

elements. All these can be analyzed for ecosystem reconstruction and change, climate and habitat reconstruction, evidence of extinctions and bottlenecks, and species response to specific types of change (Jensen 2012, 2015, 2017). Jensen calls this a “tissue archive,” similar to the samples of frozen animal tissue that biologists have been collecting for the past 30 to 40 years, but holding thousands of years of data rather than decades. Proto-Inuit peoples hunted animals and plants from land and sea, sampling large areas and bringing these needed resources back to their villages. The preserved remains have the potential to show climatic cycles over these millennia, something that current biological sampling cannot do.

See video: [Threatened Heritage and Community Archaeology on Alaska’s North Slope](#)

After a fall 2014 storm uncovered Walakpa, international volunteer efforts to salvage data from the site began in 2015, with support from the landowner (an Alaska Native village corporation) and many individuals (Jensen 2018). Another storm in 2017 nearly destroyed the site, exposing human remains and more cultural and biological materials. The urgency of the situation and the need to move quickly to begin recovery (including the appropriate handling of human remains) outpaced traditional funding cycles for such a project—exemplifying one of the many challenges facing researchers in the Arctic zone.



Crew excavating eroding house at Walakpa in 2017. Image courtesy of the Walakpa Archaeological Salvage Project.

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Things are different now because of climate change, says Jensen (2015). There is an urgency to collecting data, rather than doing hypothesis-driven research. Sites often aren't on federal land, so federal agencies do not have oversight or responsibilities. Reviewers of proposals for funding often don't understand the need for immediate funding, before the next storm hits. In short, funding cycles aren't geared toward this crisis mode.

At another North Slope site, Nuvuk, or Point Barrow, local residents sounded the alarm when

eroding coastal bluffs began exposing human remains and cultural materials several decades ago. This was a village site with a long history that had been relocated more than once due to erosion (Krus et al. 2019). Excavations showed that human occupation there had stretched back not decades but over a thousand years, predating when the Thule, or ancestral Inuit, lived there, making Nuvuk a key site for understanding the Thule migration across the North American Arctic to Greenland over the next several centuries (Jensen 2017; see also, Krus et al. 2019, Tackney and Raff 2019).^[2]



3000 years of cultural deposits all over the beach at Walakpa. Image courtesy of Anne Jensen.

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Current research on hunter-gatherer burial practices at Point Hope, Alaska by Justice and Temple (2019) makes use of materials and research reports from the 1940s, as well as recently uncovered material. These researchers, too, are sounding the alarm about both ancient sites and modern villages: “As permafrost continues to thaw because of human-induced climate change, coastal areas are eroding, placing villages and communities at risk of complete loss” (Melvin et al. 2017 in Justice and Temple 2019, 237).

For more on Walkapa and Nuvuk, visit <https://iceandtime.net/>. See also https://www.youtube.com/watch?v=hh_KEQ-ayBI for excavation of a seventeenth-century village in Quinhagak, Alaska, which began eroding away in 2009. Referring to the imminent danger to organic materials normally seen only in museum collections, project director Rick Knecht described the situation as “like museums on fire, libraries.”



Ipiutak paddle in situ at Nuvuk. Image courtesy of the Nuvuk Archaeological Project.

Melting Middens in Greenland

The largest island in the world, Greenland lies east of the Canadian Arctic Archipelago between the Arctic and Atlantic Oceans. Greenland is an autonomous constituent country within the Kingdom of Denmark, though geographically it is part of the continent of North America. The island's 57,000 inhabitants are clustered on shorelines, especially in Greenland's many fjords. Three quarters of the island is covered by a permanent ice sheet. Thus the melting of Arctic ice has a direct effect on Greenland's towns and villages, both past and present. Add increasing coastal erosion to this scenario, and the need to

identify sites and remains most at risk becomes urgent.

Researchers face the task of salvaging what they can of the remains from 4,000 years of human occupation in coastal settlements. Until the late twentieth century, these data have been preserved in middens protected by permafrost; they were veritable time capsules of material culture to be added to the stories passed down through generations: how people lived, what they ate, the tools they used, patterns of trade and migration. Over the last several decades, archaeological



During the REMAINS of Greenland project, scientists have visited 14 different archaeological sites in the Nuuk region. Here the state of preservation is being evaluated at the heavily eroded site of Nuugaarsuk. Image courtesy of Roberto Fortuna, National Museum of Denmark.

surveys have identified hundreds of midden sites throughout the fjords and archipelagos of western Greenland. Material remains range from wood, bones, and feathers to animal dung and even human hair. However, fluctuating weather patterns are leading to thawing permafrost and accelerating decomposition of the contents of these middens.

Archaeologists and local heritage managers in Greenland are working to understand patterns and rates of deterioration, what sites are most at risk, and how to engage local communities in documentation of annual changes at archaeological sites. One of the projects designed to carry out this work is REMAINS (Research

and Management of Archaeological sites IN a changing environment and Society; see Harmsen, Hollesen, Matthiesen, et al. 2017; Harmsen, Hollesen, Madsen, et al. 2018, Hollesen et al. 2019). Computer modeling suggests accelerated permafrost thaw may lead to higher internal heat production, thus exacerbating the impact of climate change on such sites (Hollesen et al. 2016).

The REMAINS project is carrying out a regional risk assessment for sites in the Nuuk region related to current and future climatic conditions.

One study is assessing current preservation conditions and processes in a kitchen midden in



Researchers from REMAINS team are discussing how to evaluate the archaeological state of preservation, the preservation conditions, and asset value of organic deposits. The work of the project has led to the development of a standardized field protocol for site description and risk assessment. Image courtesy of Roberto Fortuna, National Museum of Denmark.

western Greenland and estimating the impact of future conditions (Hollesen et al. 2017). Currently the site is well preserved, with low ground temperatures, permafrost, and a high water/ice content. Extrapolation of data to the end of the twenty-first century, however, suggests that there will be substantial loss of archaeological evidence due to erosion and oxygen exposure.

A well-known example of site deterioration is the village of Kangeq on an island in the Nuuk Fjord, a twenty-minute boat ride from Nuuk, Greenland's capital.

Kangeq was occupied for some two millennia. Residents adapted their hunting and food gathering to seasonal availability of resources

on both land and water. Kangeq was a nexus on important trade routes, and served as an official trading station for the Royal Greenland Trade Department for centuries (Harmsen 2017; Ivanov 2017). It was abandoned in the 1970s, in part due to an effort by the government to consolidate social services.

Boarded-up houses and an abandoned church still remain at Kangeq. A pool of sludge on the water's edge greets researchers coming to assess the site (see Harmsen 2017). Giant whale ribs, wood, glass, and rusting metal stick out of the pool; it is surrounded by a thick layer of compressed turf, which is actually a midden filled with the bones of what the residents of Kangeq were eating over the centuries.



The settlement of Kangeq in Southwest Greenland was abandoned in the 1970s. The site had been occupied for thousands of years. Image courtesy of Jørgen Hollesen, National Museum of Denmark.

“People were living here for thousands of years, and then suddenly the whole town was deserted,” said REMAINS project leader Jørgen Hollesen. “There’s so much evidence of human activity—you can still see the playground where the kids used to play” (REMAINS of Greenland <https://www.youtube.com/watch?v=xBJlhiP6P6s&t=266s>).

Deposits such as those at Kangeq hold rich secrets to Greenland’s deep human past. For

example, the Saqqaq peoples, who inhabited the area from approximately 2400 B.C. to 800/500 B.C., were part of a broad techno-cultural tradition (Arctic Small Tool tradition or ASTt) and genetically related to ancient populations that originated in the Western Arctic (Siberia/Alaska). Archaeologically, in addition to the Saqqaq, these ancient groups are represented in Greenland by the Independence I (ca. 2400–1300 B.C.) and Greenlandic Dorset (ca. 800 B.C.–A.D. 1) (Grønnow & Sørensen 2006).



Remains of the village of Kangeq as seen from the air. Image courtesy of Jørgen Hollesen, National Museum of Denmark.

Following the Greenland Dorset, the island remained devoid of people for approximately 700 years until the arrival of the Late Dorset (ca. A.D. 700–1300), the last Paleo-Inuit group to settle in Greenland. They probably overlapped briefly with the Greenlandic Norse, whose colonies lasted only a few hundred years. The standard story of the Norse disappearance was that their society collapsed as a result of their failure to adapt to Greenland's climate. But newer evidence paints a much more complex picture of their withdrawal from Greenland, including “demographic pressures, changing social relationships, a lessened demand in European markets for Greenlandic

exports such as walrus ivory and skins, and microshifts in seasonal weather and the annual returns of harvests,” according to archaeologist Christian Koch Madsen, curator at the Greenland National Museum (Harmsen 2017).

The next wave of settlers was the Thule, who eventually became the modern Inuit Greenlanders. Their attention to seasonal rhythms along the coasts and fjords of Greenland is echoed in the remains of Kangeq. There is much to learn from these ancient cultures, especially with the new tools of analysis available to researchers, but the evidence is disappearing faster than it can be gathered.



Archaeological middens in Greenland often contain large amounts of very well-preserved organic materials. The midden at Kangeq is no exception; here large amounts of wood and bone have survived for centuries. Image courtesy of Roberto Fortuna, National Museum of Denmark.

Site Deterioration in Labrador

Similar problems with site deterioration due to thawing permafrost are ubiquitous in north-eastern Canada, including in the province of Newfoundland and Labrador. In 2016, a team of researchers sailed to Avayalik Island 25 miles south of the northern tip of Labrador to study the current condition of important Paleoeskimo sites that had been studied in 1978. In particular, they set out to determine the state of cultural deposits that were frozen and well preserved in 1978 (Kaplan et al. 2017). One such example is Avayalik-1, a Late Dorset house with multiple structures and middens, walrus caches, and other

cultural materials. Under the house were a frozen Middle Dorset house and midden containing organic artifacts and faunal remains, including hundreds of wooden artifacts, strands of musk ox cordage, objects made from baleen or whalebone, and even pieces of worked hide. Analysis of these materials had allowed researchers to begin to develop an understanding of the ecology of the North Atlantic before European whalers removed large numbers of baleen whales resulting in a cascade of changes in the ecosystem. Researchers speculated on trade routes that might have brought non-native materials to the region. They



Avayalik-1, House 1 in 2016, view looking south. Backfilled site was well sodded over. Photograph taken after archaeologists re-gridded the area in preparation for opening sample excavation units in the structure. Image courtesy of Susan A. Kaplan.

hypothesized that other Middle Dorset sites in Labrador, which had yielded mostly chipped stone tools and other nonperishable materials, likely would have had similar assemblages had preservation been as good.

Today, with the myriad of analytical techniques available to researchers, the information that might be gleaned from a site like Avayalik-1 is much greater than it was in 1978. That is, if it still exists and has not slumped into the sea or melted into an indecipherable mass. In the 1970s, archaeologists gathered “only tangible, visible, culturally associated materials” (Kaplan et al. 2017, 139). Today they gather soil and organic samples and faunal remains for aDNA testing,

identification of collagen-based materials, and paleo-environmental reconstructions that help us understand how people were using the resources available to them.

Thus it was the growing concern about the effects of global warming on Avayalik-1 that sent researchers back to Avayalik Island. They carried out limited excavations at the site to collect wood and charcoal samples to establish a chronology, gather soil samples and faunal remains for archaeometric analysis (unknown in 1978), and assess the stability of Avayalik-1 and other sites in the area. They documented areas that were thawing and eroding. “The dried-out deposits on the edges of the terrace are actively



Profile of 2016 excavation unit in Avayalik 1, House 1. Lower portion of the cultural deposit visible in the north wall of 2N/8E shows faunal remains, a piece of cordage, and a piece of fur protruding from the wall. The light-colored deposit at the bottom of the photograph is sterile deposit. Image courtesy of Susan A. Kaplan.

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tumbling downslope, scattering lithic materials once contained in the deposits and displacing structural rocks. Whatever organics were once in the deposits have deteriorated due primarily to the thawing and drying out of the soil” (Kaplan et al. 2017, 145). They placed stakes to document erosion and photographed the landscape to create a baseline for future studies of coastal erosion.

The analysis of materials recovered from this site in 2016 will no doubt provide a more robust

picture of what life was like some 1,500 years ago, in an ecologically rich area accessible to groups living as far away as Baffin Island and Hudson Bay. Perhaps it was even a central gathering place or an important stop on a vast trade route. Time is running out for researchers to gather the fragile organic materials that hold the clues to this and other stories in the Arctic.



Aerial view of Avayalik-1 taken in 2016 using a drone. The 1978 excavation is visible in the top left quadrant of the photograph. The small cove southwest of the excavation showing active erosion is at the top of the photograph. Dark green areas in the center section of the image are where melting permafrost is pooling. Image courtesy of Jamie Brake.

Conclusion

This column has focused on the rapidly deteriorating condition of representative sites in the Arctic region. These repositories of irreplaceable data—these libraries—are burning around the world. Coastal sites from the U.S. to Scotland to Southeast Asia and South America are eroding into the sea due to rising tides and more violent storms.

Researchers have been sounding the alarm and mobilizing for several decades, with increasing urgency. They have joined forces in such international and interdisciplinary collaborations as IHOPE, the Resilience Alliance, and the REMAINS project. Archaeologists are raising awareness among their peers in conference sessions, calling for coordination and collaboration across sectors and geographic

regions to share resources, pool expertise, and identify and disseminate best practices. They are working with local communities, training them to observe changing conditions and carry out salvage projects. They are developing protocols for documenting which sites are most in danger or most necessary to save, given their potential to help tell the stories of human migrations and ecological-human relations. They are seeking funds to triage sites accordingly.

Researchers who work at these ancient repositories of biological and environmental data know they are nodes in long-term ecological observing networks. The alarm bells are ringing; the question is, how much can be saved before it is too late?

Footnotes

[1] For an overview of ancient DNA, or aDNA, see Hofman and Warinner 2019. For a discussion of collaboration between genetic researchers and Alaska Native communities on the North Slope, including best practices for projects involving ancestral remains or living peoples, see Tackney and Raff 2019.

[2] For discussions of recent research on the Thule migration and Inuit expansion east across North America, see Gulløv and McGee 2017 and Friesen and Arnold 2008.

References

- Friesen, T. Max, and Charles D. Arnold. 2008. The Timing of the Thule Migration: New Dates from the Western Canadian Arctic. *American Antiquity* 73 (3): 527–538. doi: 10.1017/S0002731600046850.
- Gifford-Gonzalez, Diane. 2017. President’s Forum: Climate Change, Archaeology, and Community Engagements. Symposium at the 82nd Annual Meeting of the Society for American Archaeology, Vancouver.
- Grønnow, Bjarne, and Mikkel Sørensen. 2006. Palaeo-Eskimo Migrations into Greenland: The Canadian Connection. *Nationalmuseet*, January 2006: 59-74. https://www.researchgate.net/publication/265763366_Palaeo-Eskimo_Migrations_into_Greenland_The_Canadian_Connection.
- Gulløv, Hans Christian, and Robert McGhee. 2017. Did Bering Strait People Initiate the Thule Migration? *Alaska Journal of Anthropology* 4 (1–2): 54–63. http://www.alaskaanthropology.org/wp-content/uploads/2017/08/Vol_4_1-2-Article-4-Gullov-McGhee.pdf.
- Harmsen, H. 2017. The Ghosts of Kangeq: The Race to Save Greenland’s Arctic Coastal Heritage from a Shifting Climate. *Archaeology Magazine* May/June: 55–64.
- Harmsen, H., J. Hollesen, H. Matthiesen, B. Elberling, R. Fenger-Nielsen, E. Alexander Sherman Andersen and C. K. Madsen. 2018. Climate Change and the Accelerated Loss of Organic Deposits in West Greenland. CCSAR Session, “Burning Libraries: Environmental Impacts on Heritage and Science,” 83rd Annual Meeting of the Society for American Archaeology, Washington, D.C.
- Harmsen, Hans, Jørgen Hollesen, Christian Koch Madsen, Bo Albrechtsen, Mikkel Myrup & Henning Matthiesen. 2018. A Ticking Clock? Preservation and Management of Greenland’s Archaeological Heritage in the Twenty-First Century. *Conservation and Management of Archaeological Sites* 20 (4): 175–198. doi: 10.1080/13505033.2018.1513303. <https://www.tandfonline.com/doi/full/10.1080/13505033.2018.1513303>.
- Hoag, Hannah. 2019. Arctic Browning. *Science News* 195 (7): 16–20.
- Hofman, Courtney A., and Christina Warinner. 2019. Ancient DNA 101: An Introductory Guide in the Era of High-throughput Sequencing. *Bones and Chromosomes: The Ancient DNA Revolution in Archaeology (Part 1)*. *The SAA archaeological record* 19 (1): 18–25.
- Hollesen, Jørgen, Henning Matthiesen, Anders Bjørn Møller, Andreas Westergaard-Nielsen, and Bo Elberling. 2016. Climate Change and the Loss of Organic Archaeological Deposits in the Arctic. *Scientific Reports* 6: article number 28690. <https://www.nature.com/articles/srep28690>.
- Hollesen, Jørgen, Henning Matthiesen, and B. Elberling. 2017. The Impact of Climate Change on an Archaeological Site in the Arctic. *Archaeometry* June 14. <https://doi.org/10.1111/arcm.12319>.

Hollesen, Jørgen, Henning Mattheisen, Rasmus Fenger-Nielsen, Jabok Abermann, Andreas Westergaard-Nielsen, and Bo Elberling. 2019. Predicting the Loss of Organic Archaeological Deposits at a Regional Scale in Greenland. *Scientific Reports* 9: article number 9097. <https://rdcu.be/bJNUo>.

IHOPE (Integrated History and Future of Peoples on Earth). 2015. Global Threats to Heritage. <http://ihopenet.org/global-threats-to-heritage/>.

Ivanov, Bojan. 2017. Abandoned Greenland: Three Old Settlements that Became Ghost Towns. *Abandoned Spaces*. June 5. <https://www.abandonedspaces.com/uncategorized/abandoned-greenland.html>.

Jensen, Anne M. 2012. Culture and Change: Learning from the Past through Community Archaeology on the North Slope. *Polar Geography* 35 (3-4): 211–227.

———. 2015. Nuvuk, Birnirk, Utquiaġvik, Walakpa and Beyond: All Those Sites Will Soon Be Gone. Paper presented at the 80th Annual Meeting of the Society for American Archaeology, San Francisco.

———. 2017. Threatened Heritage and Community Archaeology on Alaska's North Slope. In *Public Archaeology and Climate Change*, edited by Tom Dawson, Courtney Nimura, Elías López-Romero, and Marie-Yvane Daire, 126-137. Oxford: Oxbow Books.

———. 2018. Salvaging Heritage and Data from Walakpa: A Case Study of the Walakpa Archaeological Salvage Project (WASP). Paper presented in Burning Libraries: Environmental Threats to Heritage and Science Symposium at the 83rd Annual Meeting of the Society for American Archaeology, Washington, D.C.

Justice, Lauryn C., and Daniel H. Temple. 2019. Bioarchaeological Evidence for Social Maturation in the Mortuary Ritual of Ipiutak and Tigara Hunter-Gatherers: Lifespan Perspectives on the Emergence of Personhood at Point Hope, Alaska. *American Antiquity* 84 (2): 234–251.

Kaplan, Susan A., Moira McCaffrey, and Jamie Brake. 2017. Assessment of Archaeology Sites on Avayalik Island, TMNP. *Provincial Archaeology Office 2016 Archaeology Review* 15: 136–147. <https://www.tcii.gov.nl.ca/pao/newsletters/pdf/Vol%2015%20-%202016.pdf>.

Krus, Anthony M. Anne M. Jensen, W. Derek Hamilton, and Kerry Sayle. 2019. A Context-Appropriate Approach to Marine ¹⁴C Calibration: Δr and Bayesian Framework for the Nuvuk Cemetery, Point Barrow, Alaska.

McGovern, Thomas H. 2017. Burning Libraries: Environmental Impacts on Heritage and Science. Symposium at the 82nd Annual Meeting of the Society for American Archaeology, Vancouver.

Melvin, April M., Peter Larsen, Brent Boehlert, James E. Neumann, Paul Chinkowsky, Xavier Espinet, et al. 2017. Climate Change Damages to Alaska Public Infrastructure and the Economics of Proactive Adaptation. *Proceedings of the National Academy of Sciences of the United States of America* 114: E122–E131.

Sandweiss, D., and A.R. Kelley. 2012. The Archaeological Record as a Paleoclimatic and Paleoenvironmental Archive. *Annual Review of Anthropology* 21: 371–409.

Tackney, Justin C., and Jennifer A. Raff. 2019. A Different Way: Perspectives on Human Genetic Research from the Arctic. *Bones and Chromosomes: The Ancient DNA Revolution in Archaeology (Part 2)*. *The SAA archaeological record* 19 (2): 20–25.

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IN REVIEW

DESERT RIVER SEA IS A VIBRANT, COMPELLING TOUR OF THE KIMBERLEY

By Ted Snell

For the past century, the curator has been the deciding factor in what is shown by museums and galleries, reassuring audiences of the importance of what they are seeing. While acknowledging other commercial and audience drivers, the centrality of curatorial decision-making has been sacrosanct.

But when the curatorial team from the Art Gallery of Western Australia embarked on an epic quest to document the art of the Kimberley region in the state's north west, they abandoned this idea of a single authorial voice in favor of a new model of partnership and exchange. Artists and art centers in the Kimberley were invited to help shape the *Desert River Sea* project.



Garry Sibosado, Aalingoon (Rainbow Serpent), 2018, ochre pigment on engraved pearl shell, detail. Courtesy the artist.

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This is, after all, an area with a 50,000-year history of continuous cultural engagement, made up of over 200 communities and 30 language groups. Since the 1980s, it has been an important hub for contemporary art.

Through centres such as Mangkaja Arts Resource Agency at Fitzroy Crossing, (which opened in 1981), the Goolarabooloo Aboriginal Arts & Crafts Centre, Broome (which opened in 1985) and the East Kimberley Waringarri Aboriginal Arts Centre, founded in Kununurra in 1988, a world-wide audience had been created for the region's art.

These centres have nurtured and showcased artists such as Rover Thomas, Paddy Bedford, Janangoo Butcher Cherel, Queenie Garagarag Mckenzie, Jimmy Pike and Freddy Timms. Many

have acquired art star status, acknowledged nationally and internationally.

So what has the Desert River Sea project achieved and how does it differ from other survey exhibitions of Aboriginal art that have populated galleries in Australia, North America, and Europe?

After six years of travel, conversations and exchange, curators Carly Lane and Emelia Galatis have overseen a massive project that culminated with eight major commissions.

Some communities used the commissioning funds to revive ceremonies and teach younger members the correct protocols for "painting up" before rituals. Garry and Darrell Sibosado from Lombadina, created a stunning Rainbow Serpent (Aalingoon) from carved and incised pearl shell.



Ngarralja Tommy May with his art work Untitled, synthetic polymer and paint pen on sheep hide, 2018. Courtesy Mangkaja Arts Resource Agency.



Shirley Purdie, Goorralg-Goorralg: Storm Bird and Willy Wagtail, natural ochre and pigment on canvas, 2018. Courtesy Warnum Art Centre.

At the Kira Kiro Art Centre in Kalumburu, the focus was on showcasing the works of Betty Bundamurra and the late Mrs. Taylor. These two elders document their country with an expressive armoury of lively dots and brush marks in a rich, ochre palette.

The final celebration of what has been achieved by the 40 artists within the parameters of these commissions, is presented in a compelling and vibrant exhibition, on show as part of the Perth Festival. It is a highly condensed tour through the vast landscape of the northwest, literally from the sea, through the rivers and into the desert.

Each commission has its own area in the expansive gallery. But through multiple lines of sight, many enchanting connections are made and some surprising juxtapositions are encountered.

From Eva Nargoodah's bush clothes fabricated from Dingo Flour bags, past Mrs. Taylor's array of scintillating dots and shapes evoking fruitful abundance and onto Mervyn Street's extraordinary carved and painted cow hides, it is an exhilarating journey that encapsulates the diversity of approaches to recording life in the Kimberley.



*Mrs Taylor, Aru, ochre pigments on paper, 2018.
Courtesy the artist's family and Kira Koro Art Centre.*

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The hides that Street carefully shaves and then paints to describe the heifers and bulls he knows so well from years of mustering and branding are a stand out example of the synthesis between people and place this show encapsulates.

“I have been around a lot of places, and these memories are all in my head,” he explains. “I use art to tell my history ... I have to keep it in my mind and share it for young generations”.

Several of the communities have created film-based works that both describe the landscape and chronicle important cultural protocols. These videos are documents of empowerment that speak eloquently about a deep connection to country and the need to maintain cultural practices as communities seek to regain sovereignty over their land.



*Mervyn Street, Droving cattle in the summertime, 2018 (detail) shaved and etched cow hide
195.5 x 217.5 cm. Courtesy Mangkaja Arts Resource Agency.*

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Daniel Walbidi from Bidyadanga has created an installation depicting Wirnpa, a creation being. Constructed within the gallery, it echoes a similar work he made on the shoreline of a salt lake that was slowly swallowed up by the advancing waters. The large scale video work chronicling that process is screened on the back wall, completing the loop that links his country with this city environment.

One of the most arresting series of works are the sumptuous glass panels made by the Warlayirti Artists from Balgo. These nine artists have

documented the abundance of bush tucker found on country using beads, rods and sheets of coloured glass. Fused together, they form luminous panels and glow magically in the gallery.

The vibrancy of the works on show and the integrity of the outcome has only been possible because of the courageous decision to rethink the curatorial parameters of this project, allowing multiple voices to shape the outcome. Both the Gallery and its partner Rio Tinto are to be congratulated on this initiative.



*Joey Tjungurrayi Wangkartu, Wangkartu, Helicopter, kiln fired glass, 2017.
Courtesy Warlayirti Artists.*

Desert River Sea: Portraits of the Kimberley, was at the Art Gallery of Western Australia, until 27 May, 2019.

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PERSPECTIVES

AN ARCHAEOLOGIST WRITES AGAINST THE ANTHROPOCENE

By Brent K. S. Woodfill

Much of what archaeologists do is study how humans adapt to the environment. After Gordon Willey's (1953) groundbreaking investigation into the entire history of occupation of a

small valley in Peru, understanding how humans lived in and modified their environment became commonplace. Indeed, the "New Archeology" that took the American academy by storm in the 1960s



Sunrise at El Mirador, Guatemala. This was one of the largest cities in the Americas about 2000 years ago. Now it's located in one of the largest "virgin" forests in Central America.

Image courtesy of the author.

and strove to make the discipline more scientific made human-environment interactions and the understanding of human-environmental relations one of its central goals (e.g., Binford and Binford 1966, Flannery 1967). Our culture and technology have allowed us to live in jarringly different environments throughout history, and this has been the case for longer than *Homo sapiens* has existed as a species. Our *Homo erectus* ancestors, for example, lived as far afield as South Africa, France, and Indonesia, living in and traveling through deserts, jungles, high mountains, and plains (Van Arsdale 2013).

While academics are comfortable with discussing human adaptation to the environment, the extent of our species' ecological footprint has been largely overlooked until recently. When Svante Arrhenius (1896) proposed at the end of the nineteenth century that the massive spike of carbon dioxide in the atmosphere due to the Industrial Revolution could cause global warming, no one took him seriously—how could one species with around 1.5 billion members, only a small number of whom were participating in the Industrial Revolution, transform something as vast as the earth itself?



Springs feeding waterfalls at the headwaters of the Icbolay River in Guatemala. The area is a village reserve that is being maintained by local Poqomchi' Maya who emigrated to the region during the Guatemalan civil war. Image courtesy of the author.

Eventually, of course, other scientists came around to his perspective. Technological advances allowed scientists to measure parts per million of specific gases in the atmosphere. Weather stations spread across the planet during the waning years of European colonization. This proliferation continued through the Cold War, and a handful of nations sent satellites into the heavens that allowed us to monitor the extent of ice and water blanketing the earth's surface. By 1988, enough evidence had been gathered to inspire the World Meteorological Organization and the United Nations to create the Intergovernmental Panel on Climate Change, which was tasked with assessing the human impact on world climate and formulating responses.

As anthropogenic (human-caused) climate change has become a larger part of our scientific paradigm, there has been a push to rename the current geologic period to something that better reflects our role. The most popular term is the "Anthropocene," which was coined by biologist Eugene Stoermer in the 1980s and popularized in an article he co-authored at the end of the last millennium with Nobel Laureate Paul Crutzen (Crutzen and Stoermer 2000, see also Revkin 2011). By naming this new geological epoch following the Industrial Revolution after humans (*anthropos*), geologists, biologists, ecologists, meteorologists, and other scientists firmly place the blame for rising temperatures and meteorological instability on Arrhenius's original culprit.



Abandoned church on the banks of the Chixoy River, Guatemala. The original location of the village was abandoned after several hurricanes destroyed most of the dwellings. Now families live on Maya ruins that stay above the floodline, even during the worst floods.

Image courtesy of the author.



View of the Chixoy River, the Tortugas salt dome, and the Nueve Cerros ridge in 2018. This part of Guatemala was covered in lush forest for over a millennium between the Classic collapse and the land initiatives of the 1980s. Image courtesy of the author.

The term “climate change” has now firmly entered the mainstream, and the Anthropocene has come with it, making headlines in everything from *The Guardian* (Maddocks 2019) and the *New York Times* (Revkin 2011, Yang 2017) to the *Manitoba Co-Operator* (2019). The industrialized (and industrializing) world does not seem to be able to kick its chemical dependence on oil, coal, and other environmentally catastrophic fuel sources that produce climate change. However, as with any other addiction, the first step towards recovery is to admit that there’s a problem.

This article is not about the future, though, but about our insistence on earmarking the past with Western exceptionalism. The label Anthropocene is one such example. The term has always left me a bit queasy, since we humans have been affecting the global environment for thousands of years. I fear that by using the term Anthropocene we are simply continuing the long-term intellectual trend of conflating white Europeans and Americans with the pinnacles of human achievement, especially when misleadingly using nuclear weapons testing in the early 1950s as the Anthropocene period’s diagnostic signal.

As other authors have shown in this issue of *Open Rivers*, humans have profoundly transformed the environment since well before the nuclear age. The Amazon forest and the great American wilderness were dramatically transformed through human intervention (see, for example, Mann 2005) and the great civilizations of the world—both in Europe and far from it—changed local ecologies and global climate in ways we are just beginning to understand. Just one example is the Little Ice Age that reached its pinnacle in the sixteenth–nineteenth centuries. This lines up with the American genocide caused by European colonization. Since trees are a carbon dioxide sink, the rebirth of the New World forests, which had been kept at bay by local cultures, began to reclaim most of the hemisphere after the *entradas* of Columbus, Cortés, and their ilk. One recent study estimated that around 55 million

Americans died after the European *entrada*, resulting in the reforestation of around 56 million hectares (around 216,000 square miles), enough to explain the worldwide drop in temperature (Koch *et al.* 2019).

Even keeping these facts in mind, of course, our experience in the late twentieth and early twenty-first centuries is obviously at a different scale than that of our ancestors. Still, using the term Anthropocene draws a fake line between the modern West and everyone else and conflates Western culture with that of all of humanity.

I’m not the first to grumble about this problem. Other terms that have been proposed are interesting but have had little staying power. Donna Haraway (2016: 101) tries out a new term in her most recent book, *Staying with the Trouble: Making Kin in the Chthulucene* (which, she notes, is not related to the “misogynist racial-nightmare monster Cthulhu”). Here, she emphasizes the tentacular interconnectivity of regions, species, and social processes. I prefer the term “Capitalocene” (e.g. Moore 2016, 2017) since the root of much of the environmental degradation and climate change we are concerned with can be more directly blamed on global capitalist processes rather than just humans. The modern capitalist system involves Godzilla-like stomping of large chunks of the planet’s surface, replaces indigenous environments (and Indigenous knowledge of environmental management) with industrial monocropping, and focuses on short-term financial profits for corporate shareholders at the expense of long-term global stability. Local environmental degradation creates problems that need to be addressed by new interventions, such as developing more intensive chemical fertilizers, constructing ever deeper and more powerful pumps to extract water from ancient aquifers, or transporting bee colonies across continents to aid pollination. When the environment is damaged to the point that not even applied industrial science can fix it, corporations can simply move operations to a similar climatic niche, leaving local

residents—be they human or other animal, plant, and fungal species—to pick up the pieces.

The term Capitalocene addresses a few problems that are folded into the “Anthropocene.” Its use can springboard into a larger discussion about multiple issues that are essential to have a real dialogue about the state of the environment in the twenty-first century and how to effect real change. These include:

1. The specific causes of climate change beyond people, fossil fuels, greenhouse gases, or pollution (i.e., systems and behaviors instead of nouns)
2. The deep history of anthropogenic climate change that predates (and exists alongside) the European colonization of the world
3. The acknowledgment that even if we do modify the local and global environment, it doesn't have to be as extreme as it is now and it can actually lead to a remarkable degree of stability if done correctly
4. The acknowledgement that other cultures have important insights into environmental management that are as worthy of serious consideration as the Western scientific perspective, while at the same time not Othering them or turning them into exotic, mystical keepers of forgotten, magical wisdom
5. The subconscious assumption that Westerners—even those of us who are into cultural relativism and global inclusivity—still perpetuate the belief that our scientific objectivity is a better fit for reality or that Westerners can stand in effectively for something universal

Fundamentally, I believe that the archaeological perspective is important for understanding climate change. We do have access to deep history and can combat many of the unconscious assumptions we make about human nature, our place in the world, and how many environmental management strategies and ontological systems existed before the global ubiquity of Western capitalism. This economic system, like our carbon footprint and atomic radiation, is infused in nearly all contemporary societies and ecologies.

I feel like this more nuanced, long-term approach to understanding climate change is essential for students, the public, politicians, and other scientists to hear. I realize that I'm echoing earlier evangelists of the New Archeology, but archaeology does have access to a sizeable compendium of evidence about the history of the human species. As our understanding of local and global climate processes is dovetailed with our understanding of human environmental exploitation and management, archaeology will continue to be important to issues of anthropogenic climate change. By getting archaeological findings out beyond academia, maybe we'll be able to influence future politicians who can replace the corporate shells who continue to fight for profit over planet.

Works Cited

- Arrhenius, Svante. 1896. On the Influence of Carbonic Acid in the Air upon the Temperature of the Ground. *Philosophical Magazine and Journal of Science* Series 5, Volume 41: 237-276.
- Binford, Lewis R. and Sally R. Binford. 1966. A Preliminary Analysis of Functional Variability in the Mousterian of Levallois Facies. *American Anthropologist* 68(2): 238-95.
- Crutzen, Paul J., and Eugene F. Stoermer. 2000. The 'Anthropocene.' *Global Change Newsletter* 41: 17-18.
- Flannery, Kent V. 1967. Archaeological Systems Theory and Early Mesoamerica. *Anthropological Archaeology in the Americas*, edited by Betty Meggers, pp. 67-87. Anthropological Society of Washington, Washington, D.C.
- Haraway, Donna J. 2016. *Staying with the Trouble: Making Kin in the Chthulucene*. Duke University Press, Durham.
- Koch, Alexander, Chris Brierley, Mark M. Masin, and Simon L. Lewis. 2019. Earth System Impacts of the European Arrival and Great Dying in the Americas after 1492. *Quaternary Science Reviews* 207: 13-36.
- Maddocks, Fiona. 2019. The Week in Classical: Anthropocene; Die Walküre Review—Ice and Fire. *The Guardian* February 3. <https://www.theguardian.com/music/2019/feb/03/anthropocene-review-stuart-macrae-louise-welsh-scottish-opera-arctic-lpo-jurowski-die-walkure>.
- Manitoba Co-operator*. 2019. Chickens Herald of the Anthropocene Era. January 2. <https://www.manitobacooperator.ca/news-opinion/news/branding-consumption-of-modern-broiler-chickens-mark-anthropocene-era/>.
- Mann, Charles C. 2005. *1491: New Revelations of the Americas before Columbus*. Knopf, New York.
- Moore, Jason W., ed. 2016. *Anthropocene or Capitalocene? Nature, History, and the Crisis of Capitalism*. PM Press, Oakland.
- . 2017. The Capitalocene, Part I: On the Nature and Origins of our Ecological Crisis. *The Journal of Peasant Studies* 44(3): 594-630.
- Revkin, Andrew C. 2011. Confronting the 'Anthropocene.' *New York Times* Opinion Pages, May 11, 2011. <https://dotearth.blogs.nytimes.com/2011/05/11/confronting-the-anthropocene/>.
- Van Arsdale, Adam P. 2013. Homo erectus: A Bigger, Smarter, Faster Hominin Lineage. *Nature Education Knowledge* 4(1): 2. <https://www.nature.com/scitable/knowledge/library/homo-erectus-a-bigger-smarter-97879043>.

Willey, Gordon R. 1953. *Prehistoric Settlement Patterns in the Virú Valley, Peru*. Bureau of American Ethnology Bulletin 155. Smithsonian Institution, Washington, D.C.

Yang, Wesley. 2017. Is the ‘Anthropocene’ Epoch a Condemnation of Human Interferences—or a Call for More? *The New York Times Magazine*, February 14. <https://www.nytimes.com/2017/02/14/magazine/is-the-anthropocene-era-a-condemnation-of-human-interference-or-a-call-for-more.html>.

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PRIMARY SOURCES

WATER AND THE PRECLASSIC MAYA AT EL TINTAL, PETÉN, GUATEMALA

By Mary Jane Acuña and Carlos R. Chiriboga

Introduction

As part of the 1931 Carnegie Institution of Washington's Uaxactun expedition, geologist C.W. Cooke (1931: 286) noted, "If the *bajos* were restored to their former condition, the Petén would be a region of many beautiful lakes. Travel in it would be easy, for one could go from place to place by boat, with only short journeys overland, from one lake to another, across country that offers little impediment to travel at any season." These *bajos* mentioned by Cooke, low-lying swampy areas prone to flooding, are spread throughout most of the northern lowlands of Petén, Guatemala, characterizing the region with seasonal and perennial wetland systems. Ancient Maya settlement that dates back roughly to 800 B.C. through A.D. 1000, varying depending on the specific area, is also spread densely throughout the entire region on the slightly higher, non-flooding topographic promontories.

Explaining the development of the Maya civilization in a world of beautiful lakes is appealing, and we believe that, at least to some degree, this might be possible.

Burgeoning archaeological investigations, coupled with increased interdisciplinary research and significant advances in technology are making headway in our understanding of the relationship between the ancient Maya and the lowland environment in which they flourished. As a result, our knowledge on the environmental and climatic contexts in which the Maya civilization arose in a subtropical rainforest with presumed limited potential for intensive agriculture continues to evolve (c.f. Dahlin and Dahlin 1994; Dunning et al. 1998; Lundell 1938; Meggers 1954; Pohl et al. 1996). One notable contribution to this rapidly developing perspective is the application of Light



Panoramic photograph of Nacimiento. Photograph courtesy of C. R. Chiriboga.

Detection and Ranging, or lidar, technology to survey large swaths of land and acquire precise topographic surface models that reveal natural features and cultural modifications to the landscape (Fernandez-Diaz et al. 2014). The method employs a small aircraft to fly over targeted areas and collect elevation data using laser pulses which bounce back from a variety of targets, providing accurate distance and georeferenced coordinate information for the surface they hit. As a result, it is a much faster way of acquiring accurate maps in comparison with traditional pedestrian, or on-the-ground, surveys.

It is very difficult to really appreciate the intricacies of how an ancient settlement was integrated with the natural landscape from walking on the ground today. Equally challenging is being able to contextualize the features we do see within a broader scope, thus we risk often missing their significance entirely. Lidar changes that by providing a digital, high-resolution image of the integrated landscape with all its features so we

can better appreciate their context. As a tool, lidar complements archaeological and environmental data, contributing directly to our interpretations about the cultural and natural past.

Although lidar has been used in the Maya region before, Proyecto Arqueológico El Tintal (PAET) only gained access to lidar coverage around El Tintal, the site where we conduct research (Figures 1 and 2) in 2017 as a result of our participation in the Pacunam Lidar Initiative (PLI). The PLI survey encompassed about 2,100 square kilometers of noncontiguous area in Petén, and analysis has produced evidence for very dense settlement, communication routes, terracing, and wetland agricultural and defensive features among other characteristics that reveal the sophisticated knowledge the Maya population had of their environment and geography (Canuto et al. 2018; Garrison et al. 2019). Our project received 97 square kilometers of lidar survey around El Tintal, exposing a complex, integrated cultural landscape. Among various

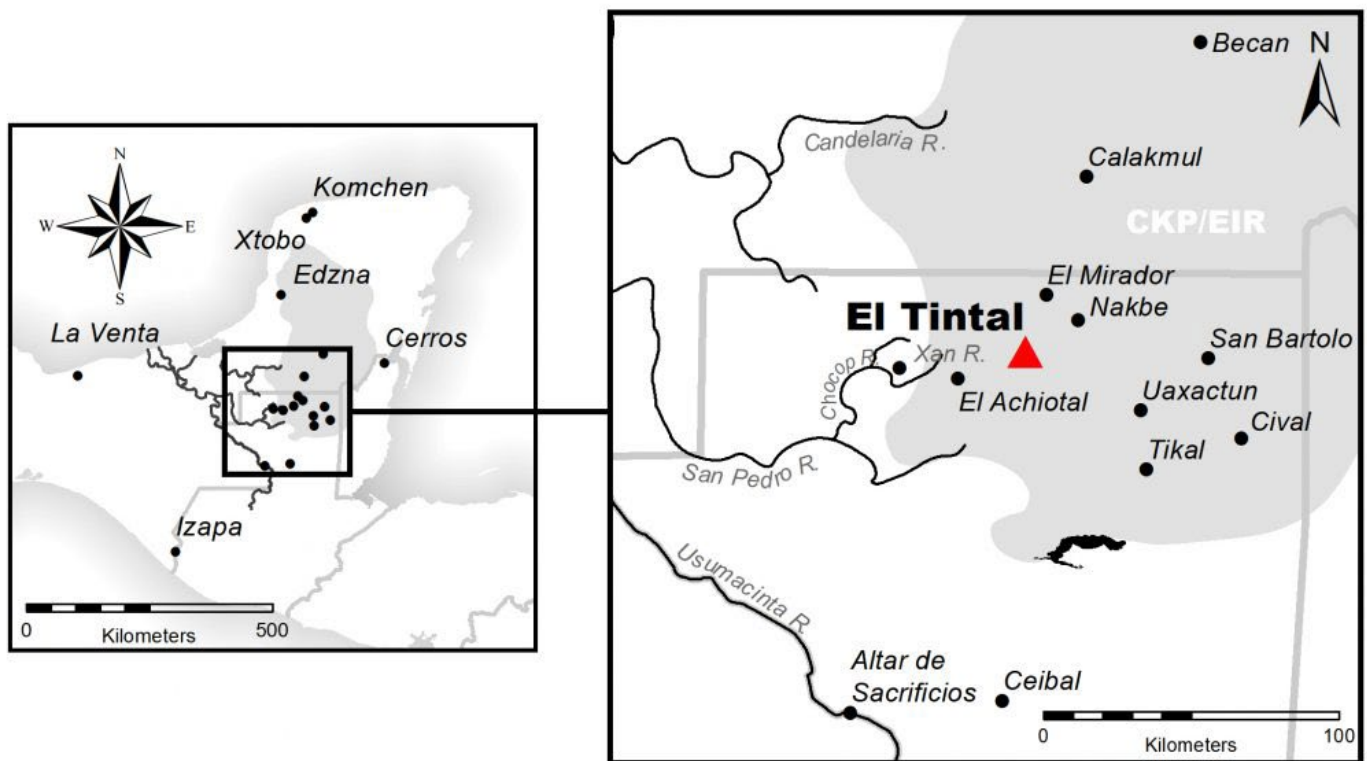


Figure 1. Location of El Tintal in the Maya lowlands of northern Petén, Guatemala. Map by C.R. Chiriboga/PAET.



Figure 2. Map of the Central Karstic Uplands of Petén, Guatemala, showing location of El Tintal. Map by C.R. Chiriboga/PAET.

features, such as buildings, causeways, potential bridge embankments, terraces, and quarries, what has stood out the most at El Tintal are the complex hydraulic features. Most striking was the discovery that El Tintal was settled around a well-defined natural depression that we propose was an ancient lagoon, not unlike what Cooke had imagined for the region.

Archaeology and lidar-derived evidence from El Tintal support the premise of a wetter environment in northern Petén, already suggested by paleoenvironmental studies, which significantly changes our understanding of the cultural processes that favored the emergence and development of socio-political complexity. For example, this offers a different understanding of how

people moved across the landscape or why they would choose to settle in a specific location. The data is of particular significance for the period between 400 B.C. and A.D. 200 during which there was increased humidity as well as a notable growth in cultural manifestations in the region of northern Petén. Evidence from paleoenvironmental studies, archaeological excavation, and lidar more recently, have provided multiple lines of evidence suggestive of a wetter environment at the apogee of the large cities in northern Petén during the Preclassic Period. This has significant impacts in the field of Maya archaeology as it requires a reevaluation of previous models that have struggled, to different extents, in providing a coherent explanation for how the population thrived in such an environment.

El Tintal, brief introduction and timeline

The archaeological site of El Tintal is an extensive, ancient Maya city that spreads over an area of approximately 11.6 sq km. With the aid of lidar, Chiriboga has identified and mapped over 2,000 structures that comprised the settlement (Figure 3). These structures, along with numerous other archaeological features, represent an accumulation of cultural activity spanning a bit over a millennium of human occupation. As part of a team of researchers working at El Tintal, our excavations (Figure 4) have revealed the earliest construction activities at the site dating to between the first and third centuries B.C., although there is some evidence indicating a human presence in the area as early as the fourth century B.C. At the beginning, the population used the natural bedrock as surface in many parts of the site, and we have found evidence to suggest it was cleared, used, and quarried in the early periods of the city's occupation (Figure 5), then later covered by subsequent layers of stone and rubble construction. We do not know the size of the population that first settled, or even how gradual its growth was, but by the Late Preclassic Period (300/250 B.C.–A.D. 250), the population

had built pyramidal-style structures rising high above the forest canopy (Figure 6). The size and monumentality of these construction efforts suggest the presence of a large population that was socially and politically organized by that time. Large pyramids such as these were typically associated with ritual and political significance in Preclassic Maya society, and were characteristically early in northern Petén at sites like El Tintal and its neighbors to the north, El Mirador and Nakbe, among others. While these pyramids dominate the constructed landscape at El Tintal, the settlement is also dotted with residential compounds, administrative buildings, as well as other features such as causeways and canals. The material culture, city layout, and management features indicate that during the Late Preclassic Period, El Tintal was a fluid and bustling city with regional connections.

Coinciding with paleoenvironmental data that suggests the beginning of a dry period that began around A.D. 200, cultural activity at El Tintal also appears to have waned considerably, a decline that is recognized in the site's archaeology. The

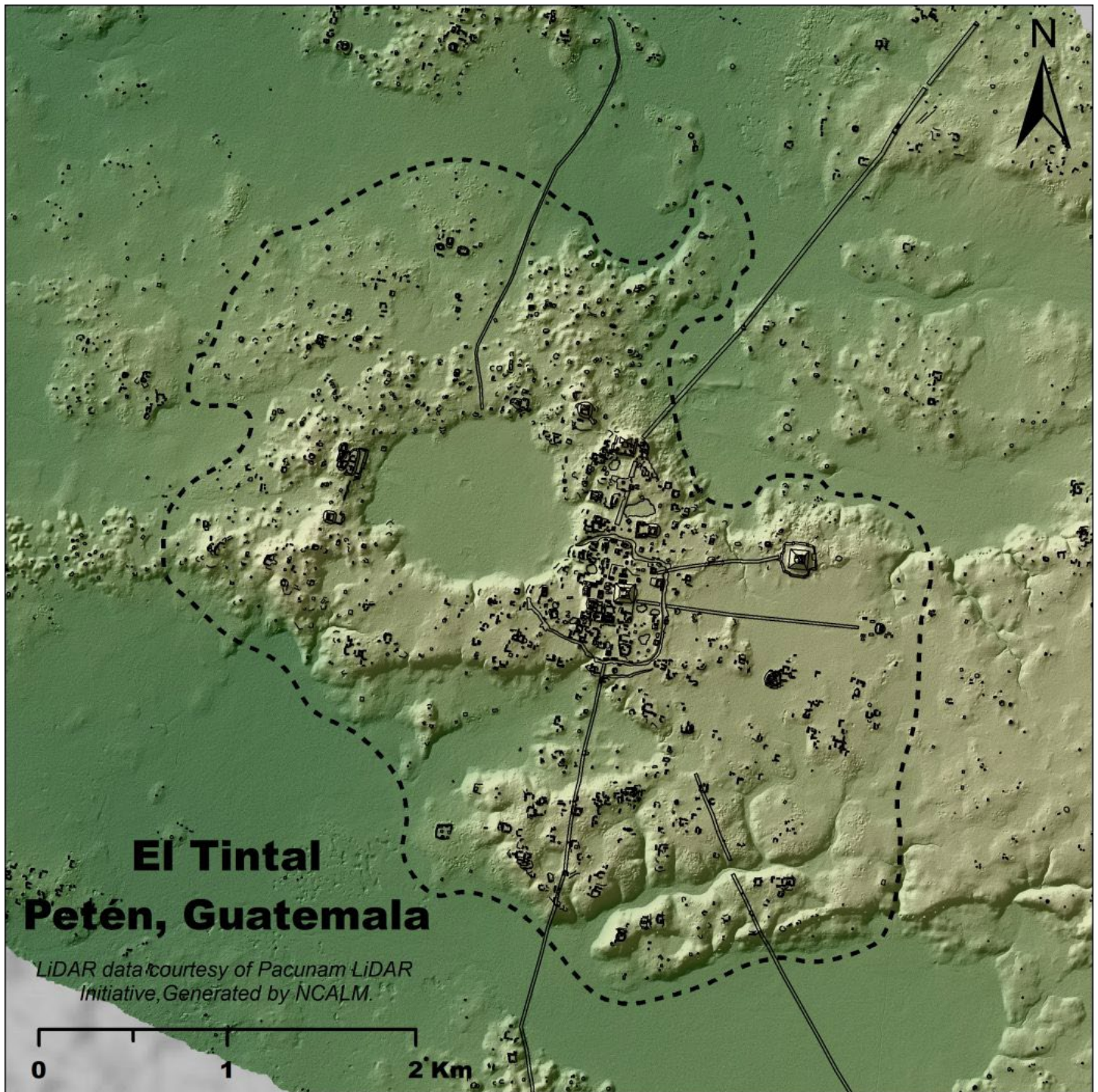
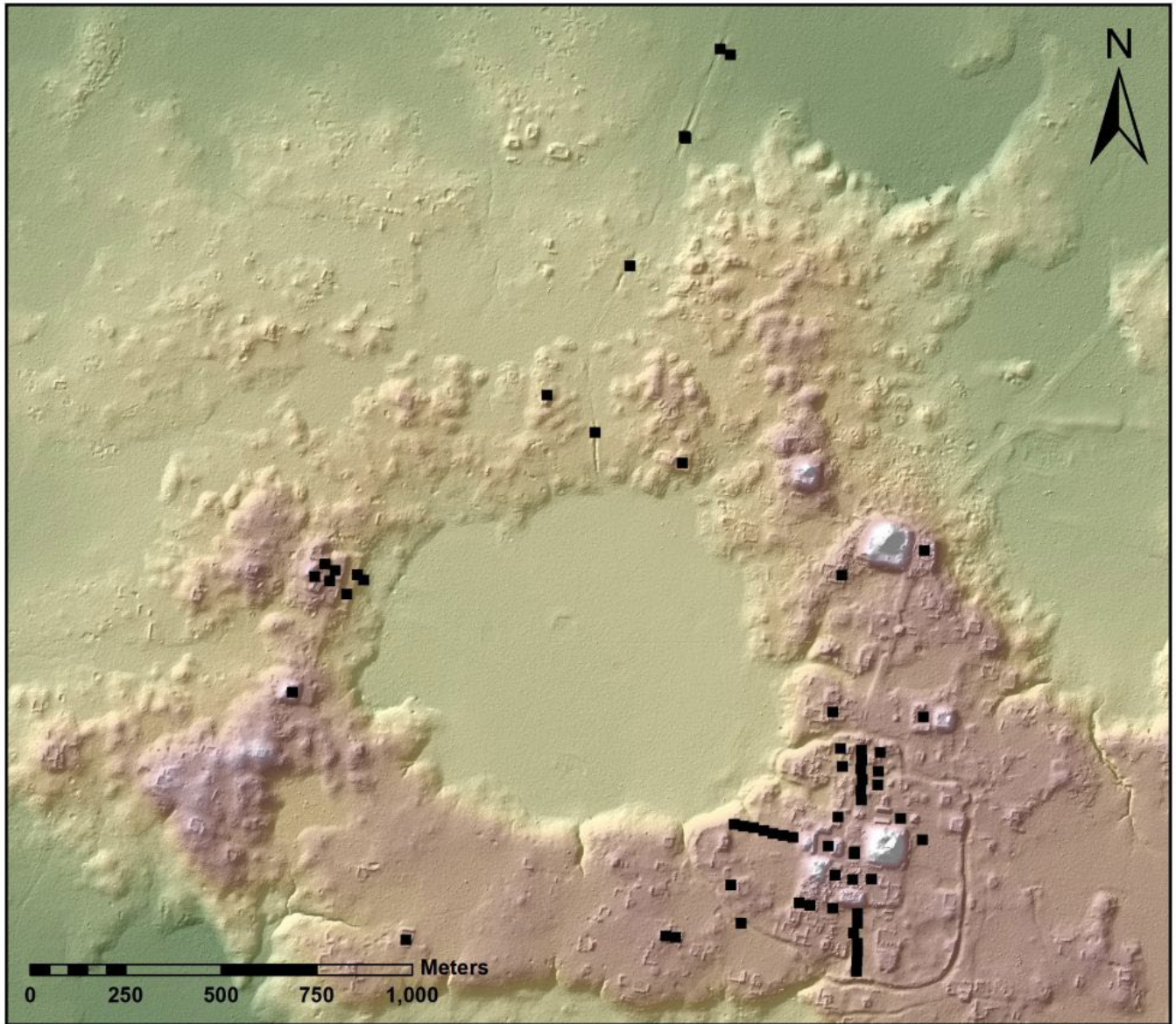


Figure 3. Map of El Tintal delineating 11.6 km² of settlement. Map by C.R. Chiriboga/PAET.



**Test-Pitting Program
Ops. TIN-500A-D
El Tintal, Guatemala**

■ Test Units

Scale 1:20,000
True North
LiDAR data courtesy of Pacuman
LiDAR Initiative, Generated by NCALM.

Proyecto Arqueológico El Tintal (PAET), 2018
Surveyed and prepared by: CR Chiriboga

Figure 4. Map of the central zone of El Tintal showing the location of test-pits excavated since 2014. Map by C.R. Chiriboga/PAET.



Figure 5. Example of a unit with shallow stratigraphy and exposure of bedrock. Photograph by M.J. Acuña/PAET.

Early Classic (A.D. 250–550/600) is the period of which we know the least about the population and settlement at El Tintal. Towards the end of the sixth century there is another shift toward population growth, settlement expansion, and a renewal of cultural manifestations in portable materials such as pottery and stone tools. This Classic Period (A.D. 550/600–900/1000) occupation blanketed the earlier settlement, reaching its maximum extension over the landscape.

During both the Preclassic and Classic Periods, the settlement and population of El Tintal experienced great cultural achievements that were geopolitically significant within the broader Maya civilization. Yet each period was significant

within distinct sociopolitical contexts that require exploring individually. The Preclassic Period was important because it was a critical moment in time when the Maya were developing complex social, political, and economic forms of organization. Our research at El Tintal is shedding light on some of the cultural processes that took place in order for that organizational shift to occur. It was not in a vacuum and there are regional conditions that play key roles, but for this article we wish to highlight some of our recent findings that illustrate what made El Tintal such a significant settlement in the Late Preclassic Period and how it is of consequence for the broader study of early Maya settlements in northern Petén as they increased in complexity.

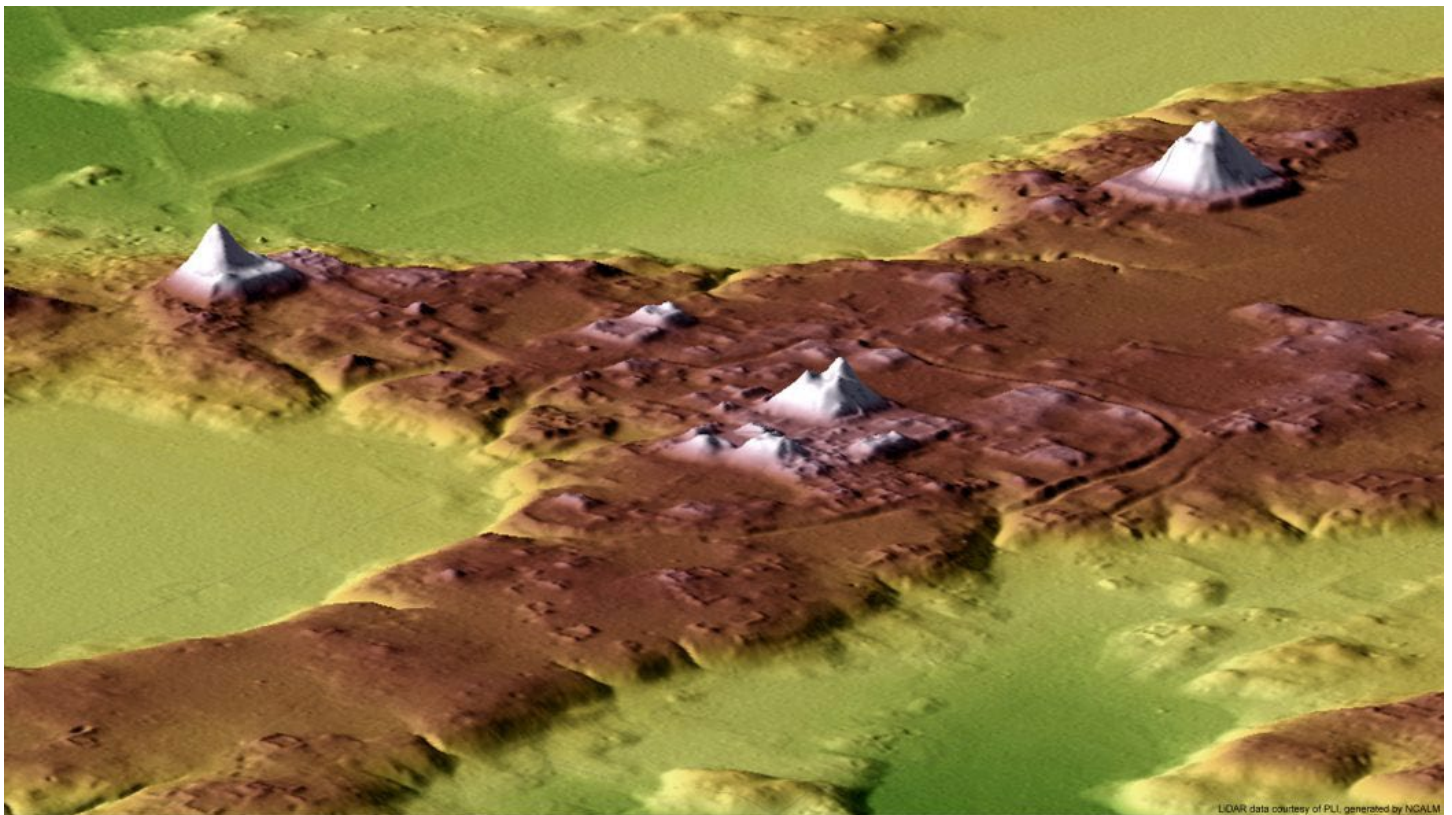


Figure 6. Northeasterly 3D view of El Tintal's central zone. Map by C.R. Chiriboga/PAET.

Environment and climate

It is important to review some of the geological conditions of the area that can help us appreciate the landscape being discussed. While climate can fluctuate more frequently, the geology changes at a much slower pace and can provide valuable insights.

As part of the Yucatan Peninsula, the geology of northern Petén consists of limestones, dolomites, and evaporites overlaying igneous and metamorphic rocks, and is considered one of the most extensive karst aquifers on the planet (Bauer-Gottwein et al. 2011: 507-508). More specifically, northern Petén is located in the area of what is known as the Central Karst Uplands (Reese-Taylor et al. 2011), also known as the Petén Karst Plateau (Dunning et al. 1998), at the southern end of the Elevated Interior Region (Dunning et al. 2013; Dunning et al. 2012) roughly in the center of the Yucatan Peninsula (Figure 2). The uplands are characterized by a raised relief of karst hills that are well drained, interspaced with *bajos* (Dunning et al. 1998). Groundwater dominates as a source of water in general, but the southern area of the peninsula benefits from a lot more surface water than the northern half given the dominance of evaporites (Dunning et al. 1998: 88; Gondwe et al. 2010). The regional geology suggests the presence of perched and confined aquifers (Bauer-Gottwein et al. 2011; Gondwe et al. 2010), which can also be inferred by the occurrence of sinking streams, swallow holes, blind valleys, and *bajos*, among other features of karsts. As a result, 40 percent to 60 percent of the southern and central Maya lowlands are covered in wetlands and *bajos* (Dunning et al. 2002: 269; Hansen et al. 2002: 290; Wahl, Schreiner et al. 2007: 214). The southern limit of the Yucatan Peninsula is also framed by large lakes and some rivers that acted as major communication routes between the coastlines and the interior ancient Maya sites

in Petén (Bauer-Gottwein et al. 2011). El Tintal is located in the region of the central karst uplands of Petén, far away from modern rivers and lakes (Figure 2). Today, the area is characterized by *bajos* with vertisol soils that can flood six to seven months out of a year, making movement across the terrain very challenging. Visitors traveling through the area must walk in knee- to waist-deep water and marsh as they traverse the many kilometers-long *bajos* in the rainy season.

It was assumed at one point in time that climate had remained stable throughout the Preclassic (1000 B.C.–A.D. 250) and Classic (A.D. 250–900/1000) Periods in the Maya lowlands (Dahlin 1983). However, in the 1970s, Maya archaeologists began taking earnest interest in the impact of climate on past cultural development (Gunn et al. 2002: 81), leading to numerous investigations that evolved into interdisciplinary approaches to try to explain the past environment in which the Maya civilization developed. In the area of northern Petén, some of the results of paleoenvironmental studies indicated that there were fluctuating periods of wetness and dryness, many of which we have been able to correlate with cultural peaks and declines using archaeological data. At Lake Puerto Arturo, located about 20 km west-southwest from El Tintal, coring provided data that suggested there were wetter regimes in the Late Preclassic (300 B.C. – A.D. 250) and Postclassic (A.D. 900/1000–ca. 1450) Periods, with a moderate regime in the Classic Period (Wahl et al. 2014; Wahl et al. 2006; Wahl, Byrne et al. 2007). The study carried out with data from Lake Puerto Arturo by Wahl et al. (2014: 22-23) reflected wetter conditions in the area around 3000 B.P. (1050 B.C.) and then transitioning to dryer conditions once again around 1750 B.P. (A.D. 200). This period of wetness coincides with the emergence and development of major cities in northern Petén, including El Tintal.

Lidar

The lidar survey acquired for El Tintal and its immediate surroundings (Canuto et al. 2018) revealed a regional settlement much more dense and continuous than previously known. As expected though, regional settlement, including El Tintal, follows a pattern observed elsewhere in the Maya lowlands with most building construction concentrated on elevated terrain due to the extensive system of natural drainages and *bajos* that remain as seasonally inundated areas. This settlement pattern is suggestive of similar flood zones in the past, although we

currently lack the data to compare seasonal or annual variations between time periods.

The core settlement of El Tintal emerged and developed around a natural depression typical of the regional geology and which is currently known as Bajo El Juleque. El Tintal's pioneering Preclassic population designed and built formal architecture characterized by large supporting platforms, structures of various types, and elevated causeways that helped shape its ceremonial center. Additionally, El Tintal's early planning

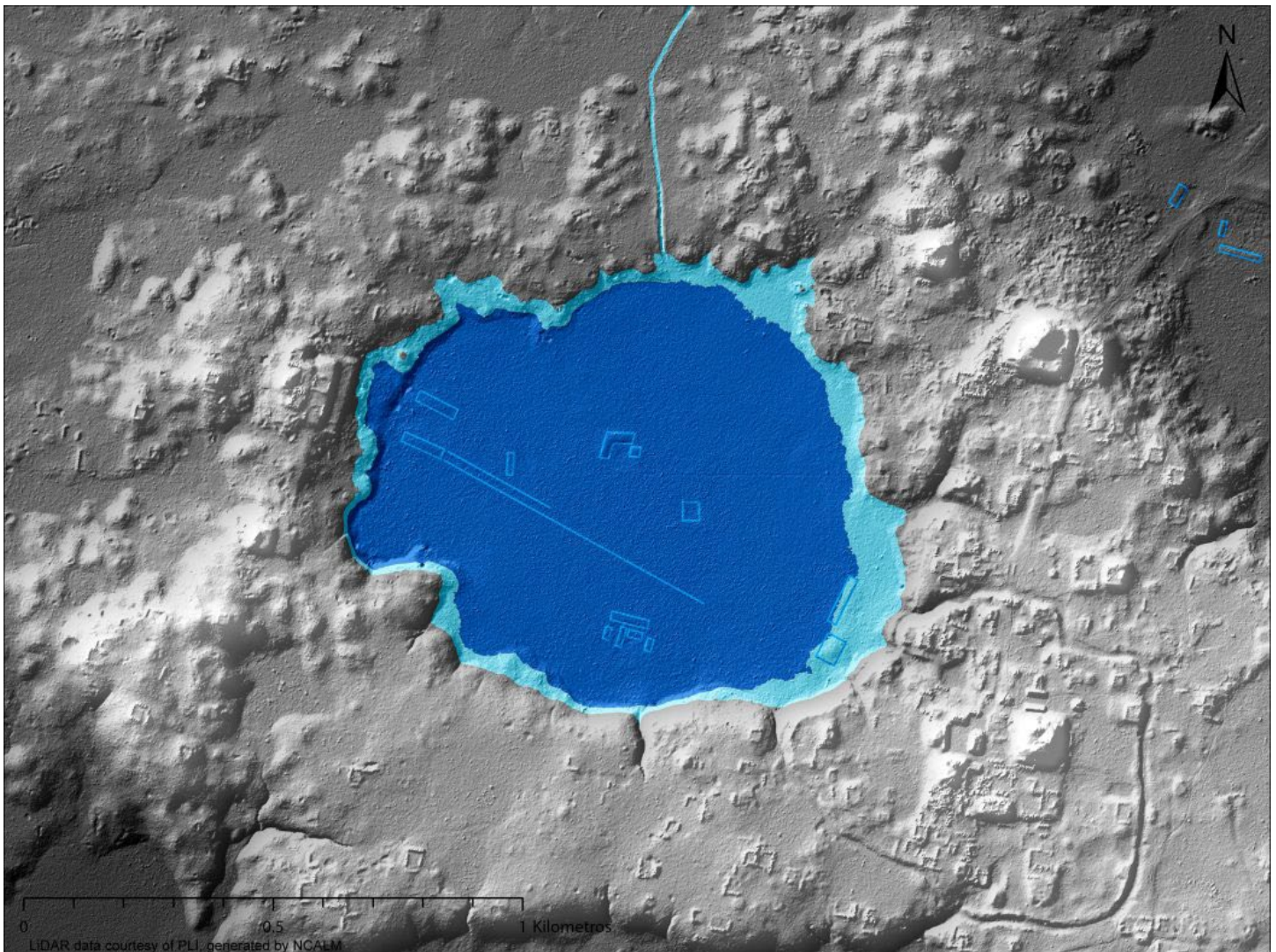


Figure 7. El Tintal's core settlement around Chacamut Lagoon. Map by C.R. Chiriboga/PAET.

and construction also included several hydraulic features, such as canals, reservoirs, and a lagoon. Several of these features were known to us from reconnaissance and previous maps that covered parts of the settlement. But lidar has provided us with a regional perspective of how all these features are integrated into the cultural and natural landscapes. In particular, the discoveries made with lidar images highlight the significant role water played in shaping the Preclassic settlement of El Tintal.

Using lidar data corroborated with archaeological research and verification of features in the field, we recently proposed that Bajo El Juleque had been, at least during the site's early occupation, a permanent waterbody that we dubbed Chacamat Lagoon in order to differentiate this ancient water feature from its current analogue (Figure 7). We propose that this lagoon was what likely attracted the population to settle in this location sometime between the fourth and third centuries B.C. Our

preliminary hydrological modeling shows that the lagoon would have covered an area of 0.85 sq km, with an average depth of just under 6 meters and reaching a maximum depth of 9.5 meters in its southwestern side. The modeled ancient water levels in Chacamat correspond with the location of structures and terraces along its edges. Targeted field survey has been able to verify the absence of structures built below this inferred waterline. The main architectural group of El Juleque Complex, located on the western edge of the lagoon, has wide terraces that descend to the proposed waterline (Figure 8). Recent excavations revealed that the southern sections of the terraces were carved out of bedrock, while the northern part was constructed with thick muck likely extracted from the *bajos*, all of which was subsequently covered in plaster. We hypothesized that these terraces might have functioned as a place to dock canoes. At this time we do not have physical evidence of canoes at El Tintal and our hypothesis is based on circumstantial evidence,

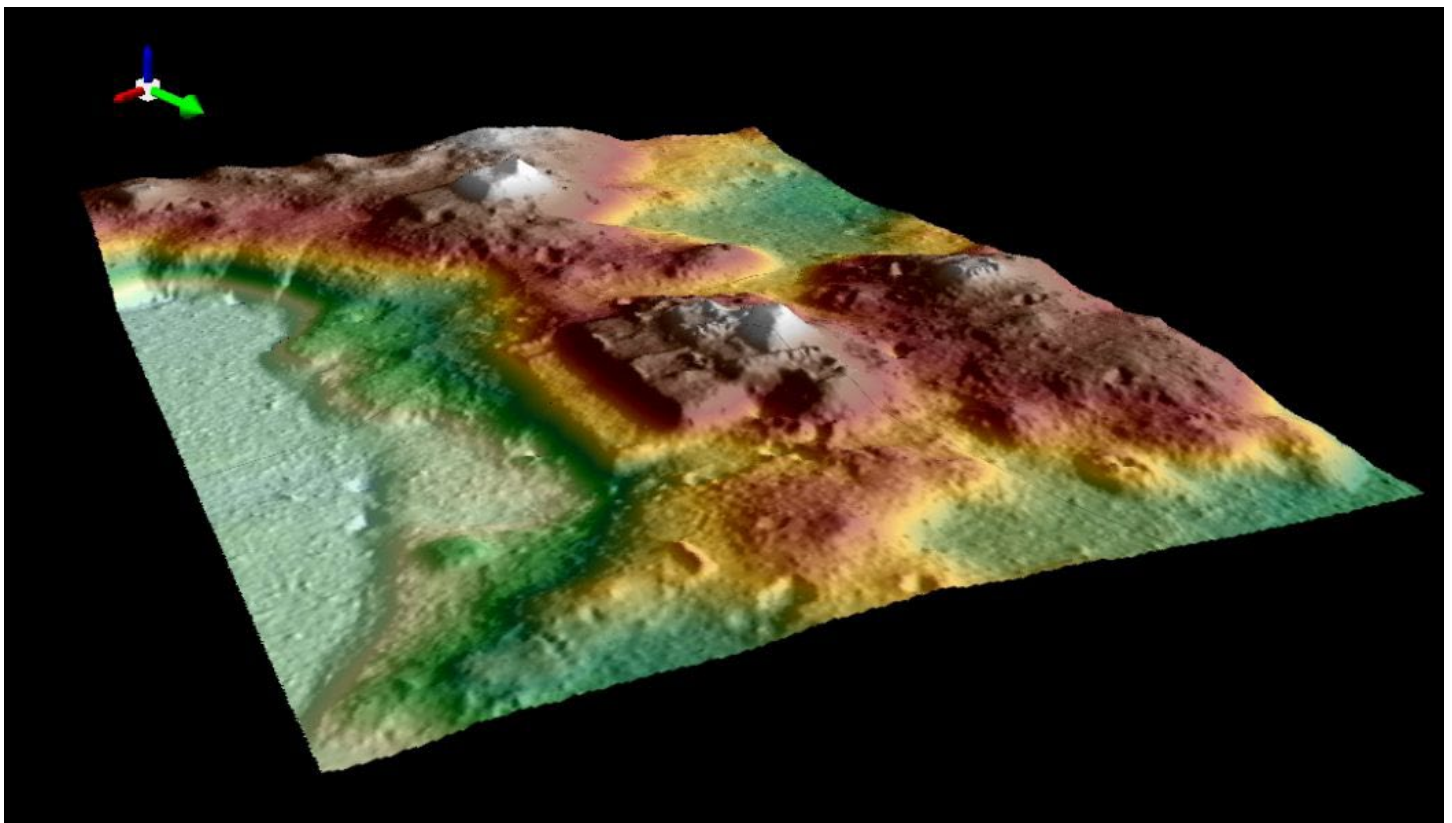


Figure 8. Perspective of the El Juleque Complex on the west side of Chacamat and view of its terraces descending to inferred water level. Map by C.R. Chiriboga/PAET.

but it is a question still under investigation as part of our ongoing research.

Other hydraulic features at the site include a previously known network of canals enclosing the city-center that was preliminarily studied by the

Mirador Basin Project (López 2015; López and Schreiner 2014), and is still undergoing investigation by our project. This network consists of three segments of varying lengths, referred to as the perimetric canal (Figure 9). Analysis of lidar data suggests that these canals channeled water

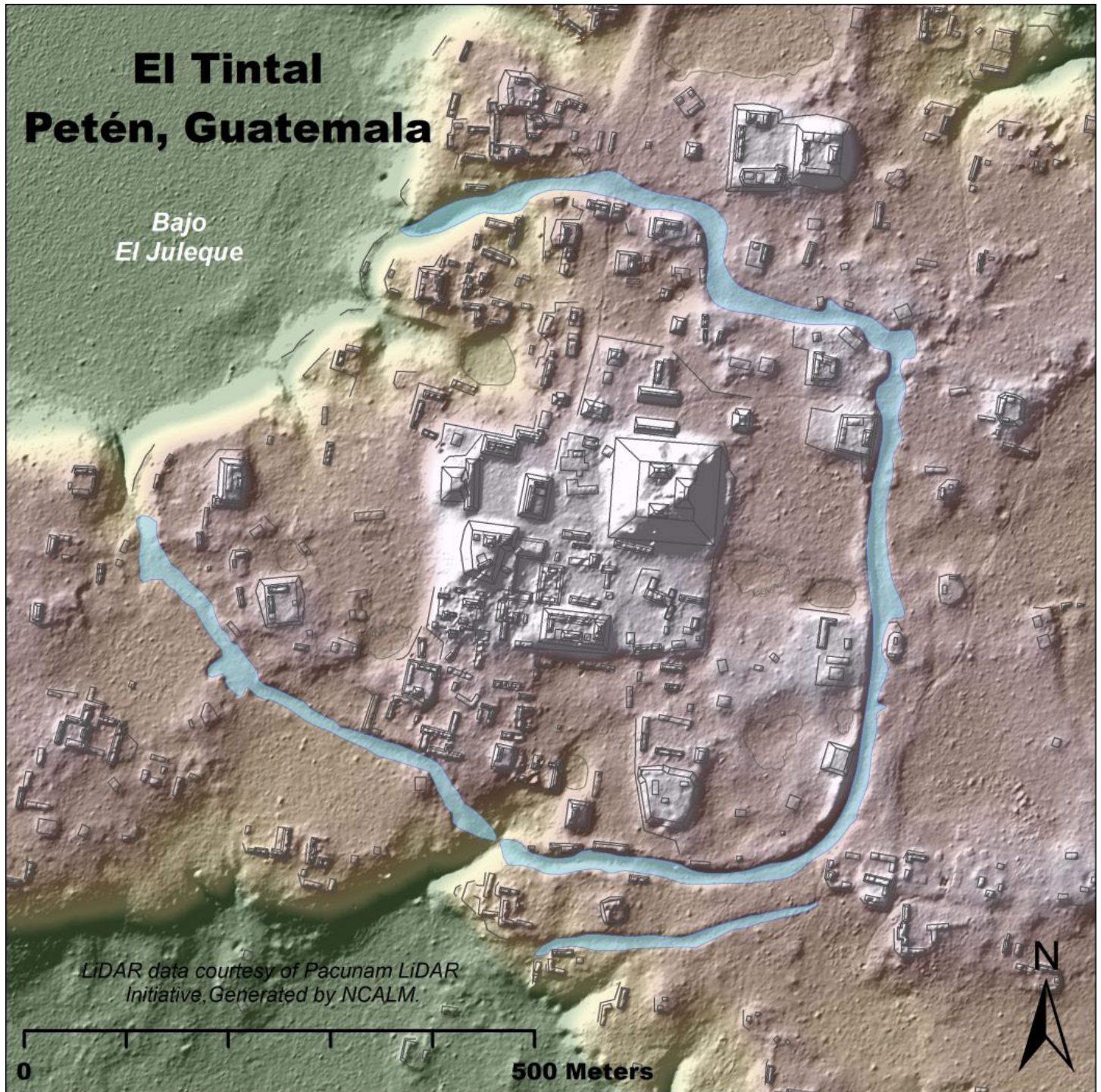


Figure 9. Network of canals surrounding El Tintal's main ritual and administrative settlement. Map by C.R. Chiriboga/PAET.

toward the *bajos* and lagoon. The perimetric canal is still under investigation in order to understand its chronology and function over time as it is possible that in dryer periods, rather than channel water, it might have held a defensive purpose.

Our research in the southwestern canal segment suggests the bottom of this feature lies almost two meters below modern surface, over which are layers of silt and post-use sediment accumulation. We took soil samples from different depths in this excavation to perform palynological analysis—that is, to look for and identify plant pollen and spore remains. Knowing the kinds of plants that were present at different depths (which

correlate with time), we can have a better idea of the environment and determine if the feature held water and functioned as a canal. This study was carried out in collaboration with Leonel Hernández and the final results will be published in the project's 2018 report, thus we will only summarize those that are relevant to our discussion. In the deepest level of the excavation unit, dated to the Preclassic Period, we found evidence for freshwater algae (class Bacillariophyceae) mixed with an abundance of cyanobacteria (class Cyanophyceae). Both of these classes are indicators of the presence of standing bodies of water, such as lakes or lagoons. These results support the hypothesis that Bajo El Juleque was a lagoon and the canal feature where this excavation

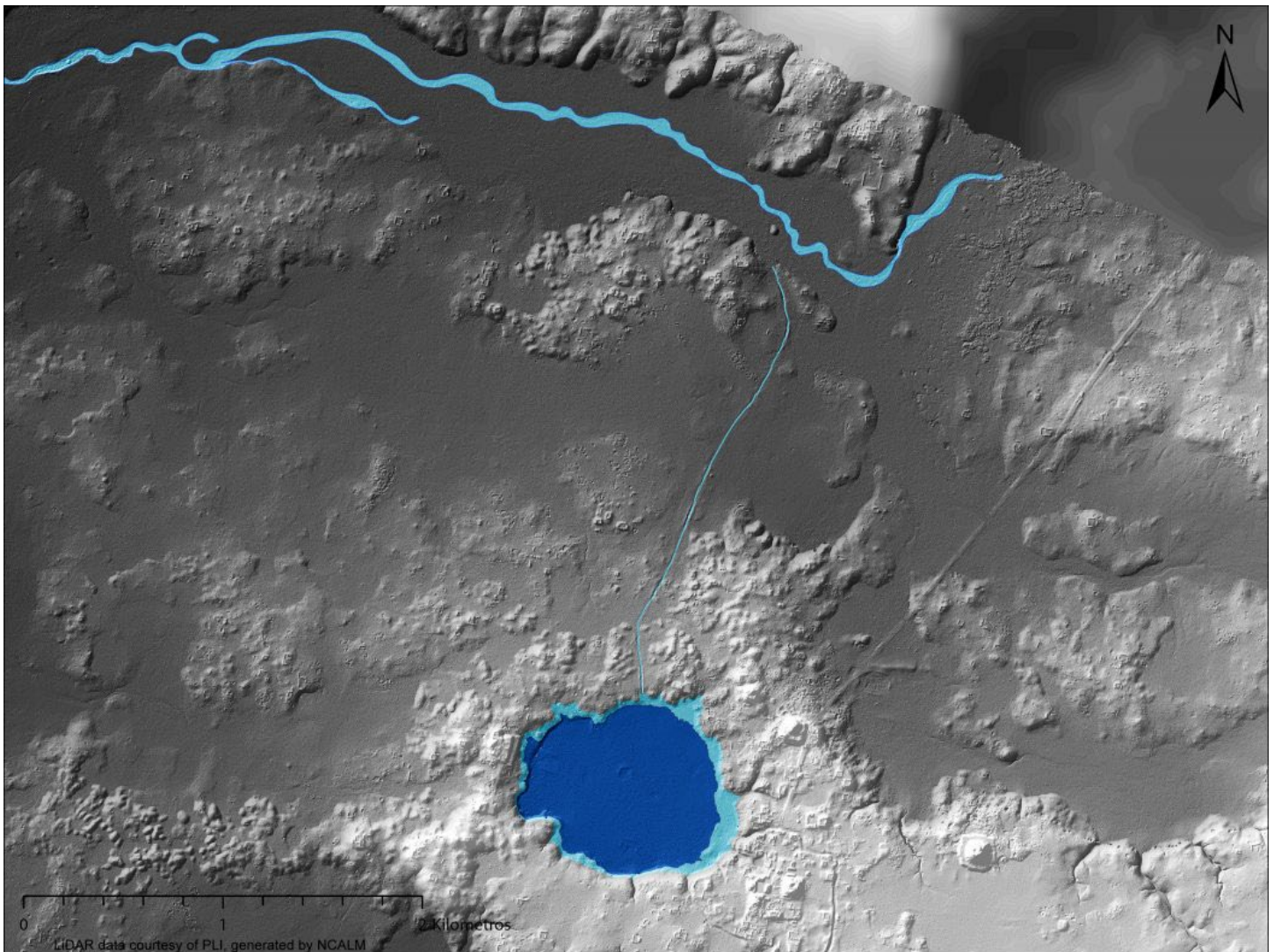


Figure 10. El Tintal's North Canal connecting Chacamat and the city center with a broader drainage system. Map by C.R. Chiriboga/PAET.

took place likely held water and functioned as a canal. We also found a grain of pollen pertaining to *Cecropia peltata*, a plant that indicates environmental disturbances resulting from anthropic activities and that commonly appears in areas of vegetation recovery. In the level immediately above that, we found pollen pertaining to the species *Euphorbia graminea*, a plant which is commonly found in shrubs and altered forests also resulting from anthropic activities. These remains found in the sedimentation of the canal are indicative of the kind of changing environment caused by cultural activities. As we moved closer to the surface, we encountered more samples of algae typical of bodies of water with ecological disturbances followed by a sample pertaining to the Selaginellaceae family, which grow in humid areas no longer perennially flooded, like modern-day *bajos*. Finally, the more superficial layers contained samples from the Asteraceae family, pollen of the species *Euphorbia graminea*, *Acalypha costaricensis* Kuntze, and *Piper psilorhachis* C., all of which grow in secondary forests and would naturally be found in the post-abandonment strata. The stratigraphic sequence of botanical samples in the canal context supports the corresponding cultural evidence for the presence of standing water but also begins to shed light on the effects cultural activities

A new vision

The data from El Tintal allow us to envision what Cooke idealized for the past environment in the Maya lowlands: a region with lakes. Perhaps the region was not as inhospitable as today's environment alludes. Growing paleoenvironmental and climatic data indicate periods of increased humidity, suggesting the northern Petén likely had many more waterbodies and perennial wetlands than we previously thought. As described above, preliminary results from palynology at El Tintal also support the existence of bodies of water during the Late Preclassic Period. Archaeological evidence from settlement pattern studies and

had over time on the environment. In this case, we found evidence for a wet environment that coincided with El Tintal's early settlement and development and that later changed toward dryer conditions and eventual abandonment.

Lidar also revealed the presence of a 2.4 km-long canal that runs north from Chacamat lagoon (Figure 10). Topographic analysis of the North Canal's trajectory showed that it probably functioned by draining the overflow of the lagoon into a larger, regional drainage network that eventually connects with the San Pedro Mártir River, one of the major flows of water that limits the southern border of the Yucatan Peninsula (Bauer-Gottwein et al. 2011; Freidel et al. 2015). Archaeological exploration of parts of the canal place its construction and use during the Late Preclassic Period, coinciding with the wetter conditions in the area as revealed by paleoclimatic data from the immediate region (Wahl et al. 2014). As a canal that drained water north, it also reveals that the lagoon was recharged with rainwater, surface runoff, and groundwater, likely a feature of the natural aquifer that characterizes the Yucatan Peninsula as described above. The Maya of El Tintal built the canal to connect the city with a broader regional fluvial communication network during a time of wetter climate.

excavations reflect population growth and the emergence of cultural complexity in the same humid period.

Lidar has facilitated how we approach the study of cultural landscapes in the past. In the case of El Tintal specifically, lidar revealed the presence of a canal that appears to connect with a broader regional drainage system, which traditional, on-the-ground foot survey would have likely missed. It also enabled us to determine that settlement was restricted to higher ground, away from flood zones.

All the datasets briefly discussed—archaeological, lidar-derived, paleoenvironmental, geographical, and climatic—point us in the direction of a reimagined environment in which the Preclassic Maya civilization developed in northern Petén. The more extensive and perennial water features suggest we need to consider other sociocultural patterns that shaped those populations and settlements, including the use of canoes. Previous models cautiously relied on the notion that the populations of northern Petén depended on foot porters for regional interaction. The cultural implications that result from the new convergence of evidence are significant for how we explain the rise of sociopolitical complexity

in the region, for how we approach the study of settlement patterns, and for how we understand regional interactions.

The North Canal at El Tintal flowed into what today is called Nacimiento and then into the San Juan drainage that flowed into the larger San Pedro Mártir River. At its simplest level, this evidence suggests the presence of a long-distance fluvial route. The possible use of canoes changes the social, cultural, political, and economic dynamics completely; we must consider new ways that people moved over the landscape, transported larger quantities of materials and bulk items for construction, subsisted, and even

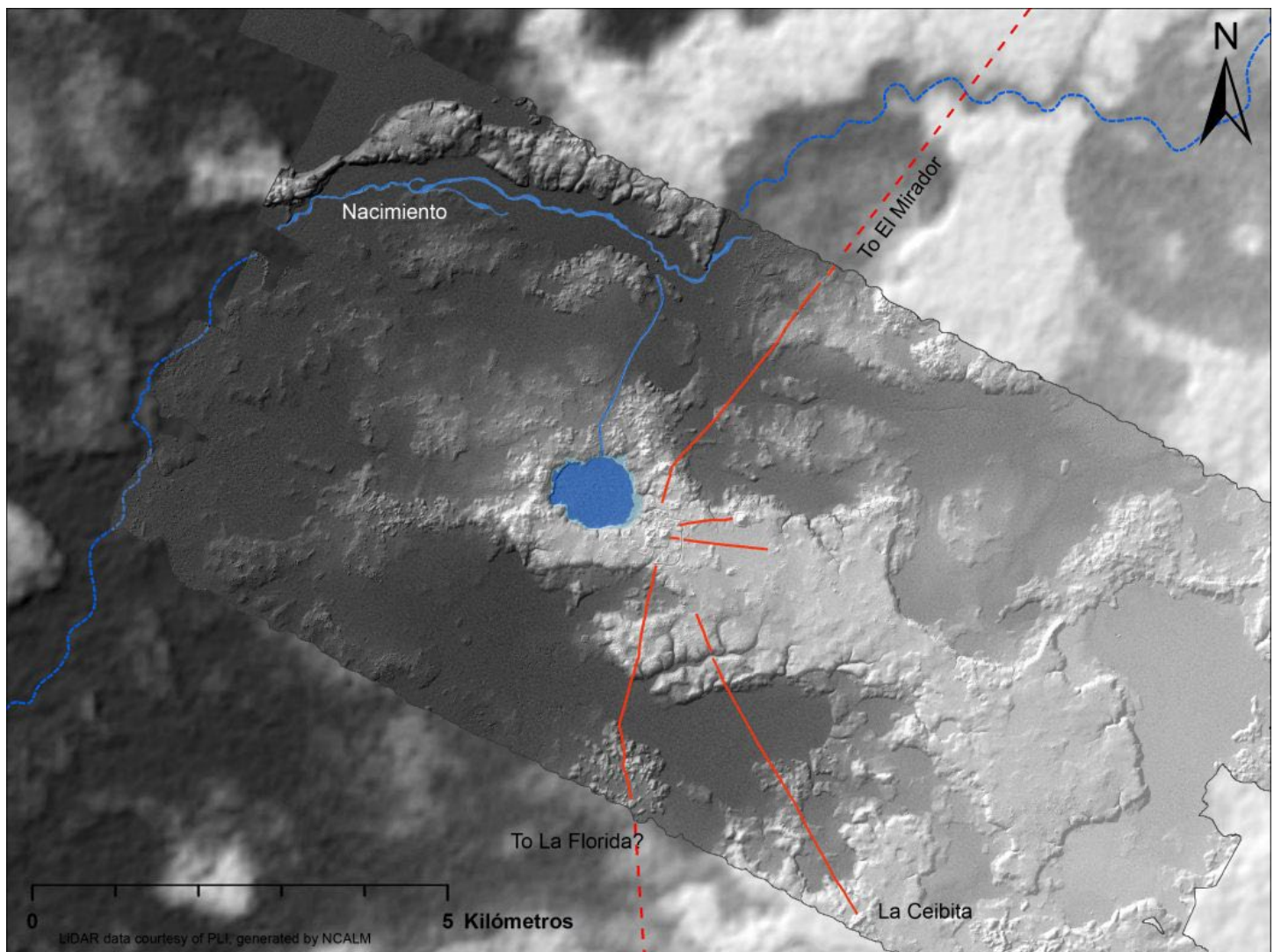


Figure 11. Regional view of El Tintal with causeways in red and the North Canal in blue flowing into the Nacimiento drainage. Map by C.R. Chiriboga/PAET.

created a growing market economy. At this time, we cannot confirm that canoe transport between the San Pedro Mártir River and El Tintal was possible without sections of portage. In fact, there were likely many parts along the way that required transfers and portages as a result of the westward gradient of the landscape with sections of exposed escarpment, the climate driven fluctuations in water levels, and the elevated ground separating lagoons. Nonetheless, we must entertain the possibility of canoe transportation as a variable when explaining the emergence and organization of populations settling in northern Petén.

The people who founded El Tintal were likely drawn to that location because of the existence of abundant fresh water in Chacamat lagoon, its proximity and accessibility to a broader communication network by water and land, and because of the elevated terrain on which they could plan and build their city. Based on the hydraulic features briefly discussed and the series of causeways radiating outward towards El Mirador to the north, La Ceibita to the southeast, and possibly to La Florida to the south, we envision El Tintal as a regional nexus (Figure 11). Between the fourth century B.C. and the second A.D., the settlement flourished into a major political center with



Figure 12. Photograph looking north from the top of Henequén Pyramid at El Tintal. The large buildings of El Mirador and Nakbe rise above the horizon. Photo by M.J. Acuña/PAET.

civic and ceremonial architecture, as well as an extensive residential area. The urban landscape was dominated by three very large pyramids from which you can see far into the horizon, as far as the contemporaneous centers of El Mirador and Nakbe, for instance (Figure 12). As a hallmark of ancient Maya ritual architecture, the Triadic Group was built in the center of the city, surrounded by the perimetric canal and facing west onto Chacamat lagoon.

We cannot know the decadal fluctuations of climate in the past, but major events that are recognizable in the paleoclimatic record indicate the onset of drier conditions at the beginning of the third century (A.D. 200) (Wahl et al. 2014). We also cannot yet determine the speed in which the lagoon and other water sources dried up, but preliminary archaeological evidence in the North Canal does corroborate that its usage ceased sometime in the third century, based on pottery offerings found on the interior surface that were subsequently covered by post-abandonment sedimentation. Some features visible in the lidar image for Chacamat also indicate potential attempts by the population to divert water to the deeper end through the construction of ramparts, which will be part of our upcoming investigations.

Previously, scholars have suggested that large sites like El Tintal, El Mirador, Nakbe, among others in northern Petén were abandoned at this time as a result of this major change in climate (Dahlin 1983; Hansen 2012). Although El Tintal was not abandoned completely, our investigations have produced evidence that indicates a significant reduction in construction activities in the center. We do perceive changes in the archaeological record that reflect effects on the social and political fabric during the Early Classic Period (AD 250–550/600), which cannot be explained clearly with current

evidence. Interestingly, recent excavations have discovered higher concentrations of Early Classic pottery on the western side of the lagoon, the area which would have held water up through its final desiccation, and where water could have been maintained through the construction of water diversion features. In fact, a section on the western side still retains water today when the rest of the lagoon is dry. Paleoenvironmental data indicate that dry conditions persisted through the ninth century; however, in the late sixth century, archaeological evidence and settlement patterns indicate a growth in population over the next three centuries in which sites like El Tintal reached their maximum extent. While the North Canal does not appear to have ever been used after the Preclassic Period, other types of regional networks were clearly established, along with increased social, political, and economic affairs that brought life back to El Tintal and that persisted through the final abandonment in the Terminal Classic Period sometime during or after the ninth century.

To conclude, our investigations at El Tintal have highlighted the essential role water played in the development of that settlement, as well as the significant impact these data have on the broader interpretations made about the Preclassic Maya of northern Petén. Individually, none of the lines of evidence discussed here would have enabled us to draw these conclusions. We have demonstrated the benefit and success of integrating different sources of evidence that complement each other. In doing so, we have been able to illustrate a more holistic perspective of the integration of the cultural and natural landscapes by the ancient Maya when establishing and developing a major city and regional nexus.

All maps and images courtesy of the authors.

References Cited

- Bauer-Gottwein, Peter, Bibi R. N. Gondwe, G. Charvet, Luis E. Marín, Mario Rebolledo-Vieyra, and Gonzalo Merediz-Alonso. 2011. Review: The Yucatán Peninsula Karst Aquifer, Mexico. *Hydrogeology Journal* 19(3): 507-524.
- Canuto, Marcello A., Francisco Estrada-Belli, Thomas G. Garrison, Stephen D. Houston, Mary Jane Acuña, Milan Kováč, Damien Marken, Philippe Nondédéo, Luke Auld-Thomas, Cyril Castanet, David Chatelain, Carlos R. Chiriboga, Tomáš Drápela, Tibor Leskovský, Alexandre Tokovinine, Antolín Velasquez, Juan Carlos Fernández-Díaz, and Ramesh L. Shrestha. 2018. Ancient lowland Maya complexity as revealed by airborne laser scanning of northern Guatemala. *Science* 361.
- Cooke, C. Wythe. 1931. Why the Mayan cities of the Petén District, Guatemala, were abandoned. *Journal of the Washington Academy of Sciences* 21(13): 283-287.
- Dahlin, Bruce H. 1983. Climate and Prehistory on the Yucatan Peninsula. *Climatic Change* 5(3): 245-263.
- Dahlin, Bruce H., and Andrea Dahlin. 1994. Platforms in the Akalche at El Mirador, Petén, Guatemala and Their Implications. *Geoarchaeology* 9(3): 203-237.
- Dunning, Nicholas, Timothy Beach, Pat Farrell, and Sheryl Luzzadder-Beach. 1998. Prehispanic Agrosystems and Adaptive Regions in the Maya Lowlands. *Culture & Agriculture* 20(2/3): 87-101.
- Dunning, Nicholas P., Timothy P. Beach, L. Grasiozo Sierra, J.H. Jones, David L. Lentz, Sheryl Luzzadder-Beach, Vernon L. Scarborough, and M.P. Smyth. 2013. A Tale of Two Collapses: Environmental Variability and Cultural Disruption in the Maya Lowlands. *Diálogo Andino* 41: 171-183.
- Dunning, Nicholas P., Timothy P. Beach, and Sheryl Luzzadder-Beach. 2012. Kax and kol: Collapse and resilience in lowland Maya civilization. *Proceedings of the National Academy of Sciences* 109(10): 3652-3657.
- Dunning, Nicholas P., Sheryl Luzzadder-Beach, Timothy Beach, John G. Jones, Vernon Scarborough, and Patrick Culbert. 2002. Arising from the Bajos: The Evolution of a Neotropical Landscape and the Rise of Maya Civilization. *Annals of the Association of American Geographers* 92(2): 267-283.
- Fernandez-Diaz, Juan Carlos, William E. Carter, Ramesh L. Shrestha, and Graig L. Glennie. 2014. Now You See It... Now You Don't: Understanding Airborne Mapping LiDAR Collection and Data Production Generation for Archaeological Research in Mesoamerica. *Remote Sensing* 6: 9951-10001.
- Freidel, David A., Carlos R. Chiriboga, and Mary Jane Acuña. 2015. Inland Ports in Northwestern Petén, Guatemala: A preliminary assessment. 80th Annual Meeting of the Society for American Archaeology, San Francisco, CA.
- Garrison, Thomas G., Stephen Houston, and Omar Alcover Firpi. 2019. Recentering the rural: Lidar and articulated landscapes among the Maya. *Journal of Anthropological Archaeology* 53: 133-146.

Gondwe, Bibi R.N., Simon Stisen, Mario Rebolledo-Vieyra, Peter Bauer-Gottwein, Sara Lerer, Luis Marín, and Gonzalo Merediz-Alonso. 2010. Hydrogeology of the south-eastern Yucatan Peninsula: New insights from water level measurements, geochemistry, geophysics and remote sensing. *Journal of Hydrology* 389: 1-17.

Gunn, Joel D., Ray T. Matheny, and William J. Folan. 2002. Climate-Change Studies in the Maya Area. *Ancient Mesoamerica* 13: 79-84.

Hansen, Richard D. 2012. The Beginning of the End: Consumption and Environmental Impact of the Preclassic Lowland Maya. In *An Archaeological Legacy: Essays in Honor of Ray T. Matheny*, edited by Deanne G. Matheny, Joel C. Janetski and Glenna Nielsen, pp. 241-285. Brigham Young University, Provo.

Hansen, Richard D., Steven Bozarth, John Jacob, David Wahl, and Thomas Schreiner. 2002. Climatic and Environmental Variability in the Rise of the Maya Civilization: A preliminary perspective from northern Peten. *Ancient Mesoamerica* 13(02): 273-295.

López, Francisco. 2015. Excavaciones en el sitio arqueológico “Tintal.” Temporada 2014. In *Proyecto Cuenca Mirador: Investigaciones en la Cuenca Mirador, Temporada 2014. Tomo II*, edited by Richard Hansen and Edgar Suyuc, pp. 556-582. Report submitted to the Dirección General del Patrimonio Cultural y Natural, Guatemala.

López, Francisco, and Thomas Schreiner. 2014. Excavaciones de Sondeo en el Sitio de Tintal, Proyecto Cuenca Mirador Temporada de Campo 2013. In *Investigaciones Arqueológicas en la Cuenca Mirador: Informe Final de Temporada 2013, Proyecto Arqueológico Cuenca Mirador*, edited by Richard D. Hansen and Edgar Suyuc, pp. 412-423. Report submitted to Dirección General del Patrimonio Cultural y Natural, Guatemala.

Lundell, Cyrus Longworth. 1938. Plants Probably Utilized by the Old Empire Maya of Peten and Adjacent Lowlands, Vol. 24, pp. 37-56. Papers of the Michigan Academy of Science Arts and Letters.

Meggers, Betty J. 1954. Environmental Limitation on the Development of Culture. *American Anthropologist* 56(5): 801-824.

Pohl, Mary D., Kevin O. Pope, John G. Jones, John Jacob, Dolores Piperno, Susan D. deFrance, David Lentz, John A. Gifford, Marie E. Danforth, and J. Kathryn Josserand. 1996. Early Agriculture in the Maya Lowlands. *Latin American Antiquity* 7(4): 355-372.

Reese-Taylor, Kathryn, Mary Jane Acuña, and Marcello A. Canuto. 2011. Introducción, 25 Años de Investigaciones Arqueológicas sobre el Preclásico en la Meseta Cárstica Central, Paper presented in the XXV Simposio de Investigaciones Arqueológicas en Guatemala, July 18-22, Guatemala City.

Wahl, David, Roger Byrne, and Lysanna Anderson. 2014. An 8700 year paleoclimate reconstruction from the southern Maya lowlands. *Quaternary Science Reviews* 103:19-25.

Wahl, David, Roger Byrne, Thomas Schreiner, and Richard Hansen. 2006. Holocene vegetation change in the northern Peten and its implications for Maya prehistory. *Quaternary Research* 65: 380-389.

———. 2007. Palaeolimnological evidence of late-Holocene settlement and abandonment in the Mirador Basin, Peten, Guatemala. *The Holocene* 17(6): 813-820.

Wahl, David, Thomas Schreiner, Roger Byrne, and Richard Hansen. 2007. A Paleoecological Record from a Late Classic Maya Reservoir in the North Petén. *Latin American Antiquity* 18(2): 212-222.

Recommended Citation

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TEACHING AND PRACTICE

THE PERILS AND PROMISE OF USING SHORT-TERM MEDIA TO TEACH LONG-TERM CLIMATE PATTERNS

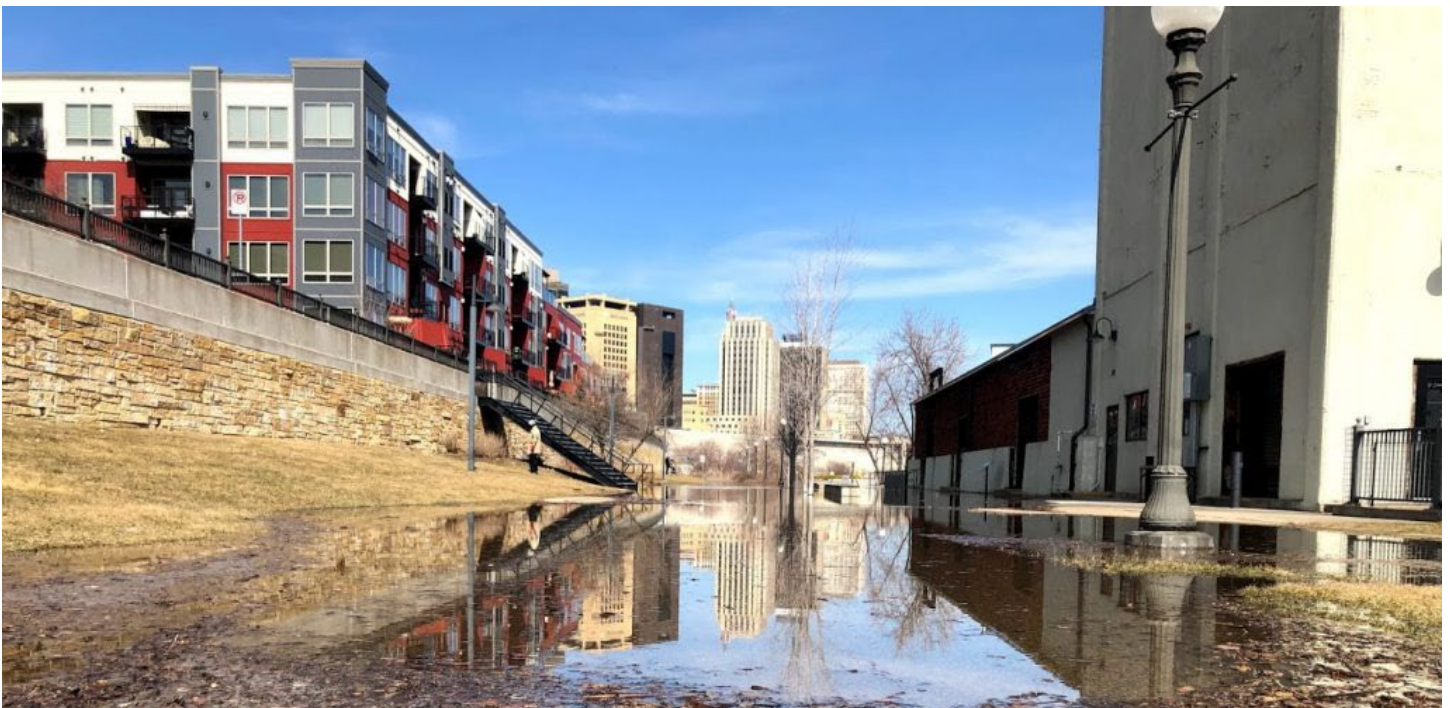
By Patrick Nunnally

A concern for climate change has burst onto the national media, scientific literatures, and other discourses over the past year. As someone who teaches in design- and natural resource-oriented fields, I feel an obligation to equip my students with critical awarenesses of the patterns, as well as a sense of what they can do, professionally and personally, to face this crisis.

For me, teaching starts with place: Where are we and, knowing that, what are our responsibilities to the place, to others who live here, to ourselves?

For the past 17 years, I have taught a course in the spring semester on the Mississippi River in the Twin Cities. In three of those years—2011, 2014, and 2019—the region has seen a “hundred-year flood.” Yes, I know, that means these occur more than once every hundred years; that’s the subject of another article.

A word on location: the Mississippi River bisects the University of Minnesota’s Minneapolis campus (the St. Paul campus, where colleges relating to agriculture and natural resources and



*Flooding at the Upper Landing in St. Paul, Minnesota, March 2019.
Image courtesy of Joanne Richardson.*

biology are located, is situated to the northeast, upstream). Thousands of students pass daily across the river on the Washington Avenue Bridge, only occasionally, perhaps, looking down at the water 54 feet below (Weeks 2016). Most of the Minneapolis campus is located within the boundaries of the Mississippi National River and Recreation Area, a unit of the National Park system. All of the campus is Dakota homeland.

Higher education, of course, is organized by academic disciplines, colleges, and other siloed patterns of knowledge. A challenge of teaching place-based classes is to reflect the immediacy of the land- and waterscape around us, using the river as it passes through the campus as a “teaching lab” for the concepts we discuss, while at the same time staying somewhat recognizable as a discipline that students are familiar with and expect. For classes in landscape architecture, students are tasked with devising interventions in the physical space of the river corridor, proposing both a program and goals for their work as well as envisioning specifically what they would change. For students in natural resources, the challenges are more oriented to resource management and environmental education than to landscape intervention. Finally, for interdisciplinary seminars in the University Honors Program, students are asked to envision future relationships with the land and water of the river corridor by using the knowledge and experiences they bring to the course. In all cases, students examine land, water, and human societies as systems that impose stresses, limitations, and changes on each other. Given the river corridor’s proximity, classes like these (I am not the only one at the University who does this work) offer great opportunities for students to engage in community-engaged, experiential education that directly addresses professional and academic interests.

Most recently, the course I co-teach in Environmental Science, Policy, and Management on the Mississippi River corridor has included a strong theme of a changing climate. The class, “People, Land, and Water: Systems Under

Stress,” naturally lends itself to a discussion of climate change as a stressor for people, land, and water. For my students who work in natural resources, planning, design, engineering, or pretty much any profession that intersects the environment, climate change will be a reality of their career. When I co-teach with a scientist, we are able to work with students to address specifics of how the climate is changing. Without scientific expertise in the room, the changing climate is addressed through readings that are more journalistic in nature. In either case, our teaching addresses questions of how reliable the knowledge is we are discussing; that is, how do we know what we think we are learning is valid? Given the controversial nature of climate change policies, these are important questions and discussions to have.

In spring 2011, I asked all the students in my “Making the Mississippi” landscape architecture class to post tweets about the current flooding on the Mississippi or its local tributary rivers, the Minnesota or St. Croix. The flooding was dramatic and getting a lot of media attention. At the time, Twitter was a relatively new social media platform, and students had to be walked through the processes of setting up an account, having my program account follow them, and following the program in turn to establish a more robust dialogue on the flood topics. Students participated well, for the most part, perhaps because this assignment replaced one of the more substantive field exercises they would have been asked to do (and which was impossible because the field sites were under water anyway).

In spring 2019, my co-teacher and I agreed that students could earn bonus credit for posting tweets about that season’s floods. Very few students bothered to earn these points; we suspect that the assignment was just too far outside of standard academic practices for them since many did the more conventional task, which was to make an independent visit to a field site and write up their response. As with the 2011 experiment, strict guidelines were put in place to ensure that

students were engaged with the course issues. We gave full credit for a tweet that made a statement, that linked to an article from online, and that included one of their own photos of the space being described. The photo is important as a confirmation that the student actually went into the field. The link is important as a confirmation that the student is connecting their observations and reflections to something being reported more broadly. The tweet’s text itself is important to confirm that the student is actually thinking critically about these connections, not just finding someone else’s perspective from a link.

For example, in early April, soon after the assignment began, a student wrote a tweet that referenced a state legislative committee which had earlier held hearings on climate change impacts in Minnesota. The student’s question and link pivoted to local master planning work that was being undertaken for one of the river-adjacent park properties. Another student took a more historical approach, noting that the logs and other detritus that had lodged against one of the islands in St. Paul resembled the timber jams that were common occurrences when the river carried millions of board feet a year to sawmills. The student’s link was to a local news report about how the current logjam was getting large enough to have dangerous impacts on nearby river-adjacent properties.

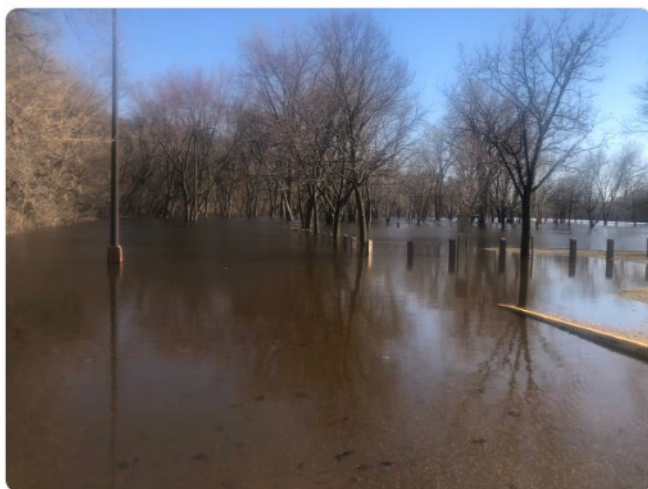
Matthew Wosje
@WosjeMatthew



Matthew Wosje
@WosjeMatthew

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@RiverLifeUMN I wonder what the Minnesota House of Representatives Energy and Climate Finance and Policy Division thinks of all this flooding? Will flooding measures be included in Hidden Falls master plan at some point? Here is the current master plan: stpaul.gov/departments/pa ...



7:37 PM - 4 Apr 2019

Brooke Bahner
@BrookeBahner



Brooke Bahner
@BrookeBahner

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Recent flooding in St. Paul has put parts of Raspberry Island underwater. Yet these fast-moving waters prevent expensive timber jams that often occur in the area. In the late 19th century this flooding would be ideal for lumber industries. minnesota.cbslocal.com/2013/06/29/st- ... @RiverLifeUMN



7:59 AM - 18 Apr 2019

Brooke Bahner @BrookeBahner



Brooke Bahner
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Flooding at St. Anthony Falls generates hydropower for Xcel Energy. However, many people argue to remove the dams to restore natural river flow. This would help fish populations, eliminate costly repairs and safety risks, and prevents sediment buildup.

startribune.com/st-anthony-fal ...



12:33 PM - 29 Apr 2019

1 Retweet 5 Likes



What did we learn? Three things come to mind:

First, the immediacy of flooding circumstances matters. The two years when I offered a Twitter assignment were 2011 and 2019, both years in which the river flooded and the flooding was regularly in the news. It's much more difficult for students to find interesting and important things to say when the river is behaving "normally" (we'll leave aside the question of "normal" for rivers in an era of climate change). These assignment responses are snapshots and capture immediate circumstances without the longitudinal study that would be needed to make assessments

about climate change. To use a common figure of speech, students are tweeting the weather, not climate.

The second lesson follows from the first. If there were to be developed enough "snapshot" tweet records to begin to tell a longitudinal story of change over time, then a department, college, or program would have to commit to this project as a multiyear effort. Moreover, the sponsoring entity would have to figure out data curation, storage, and presentation, perhaps through a long-term StoryMap platform or something similar. Finally, the challenge of providing necessary context for what might easily end up as thousands of impressions is formidable. What are the conditions of the river that contributed to flooding in a particular year, and how have those conditions changed from year to year? These are just a couple of the connected scientific and sociocultural questions that such a long-term project raises.

Finally, a third lesson learned had to do with one of the benefits of exposing students to the social media world as professionals, regardless of how durable those impressions are. The work of my 2019 students was retweeted and liked by water and climate professionals, some of whom are not previously known to my program. When I told the students about this pattern, they were surprised that their work, which they had envisioned as routine coursework, had in fact put them into a larger professional conversation.

I think it's this final point that resonates most strongly with me. If I can find ways for students to begin to see their work as part of professional practices that extend beyond the confines of the classroom and campus, then that achieves one of my largest goals as a teacher. "Tweeting the floods," which might morph into a "tweet the river" series of assignments, offers that opportunity to enrich students' learning experiences, despite the apparent incongruity of doing social media for class.

References

Bahner, Brooke (@BrookeBahner). 2019. Twitter, April 2019.

Weeks, John A., III. 2016. "Washington Avenue Bridge." *John A. Weeks III*. <https://www.johnweeks.com/bridges/pages/ms14.html>. Accessed July 5, 2019.

Wosje, Matthew (@WosjeMatthew). 2019. Twitter, April 2019.

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