

Sustainability and Water Management
in the Maya World and Beyond

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Sustainability and Water Management
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EDITED BY

JEAN T. LARMON, LISA J. LUCERO, AND FRED VALDEZ JR.

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To Vernon Scarborough, who has inspired us all

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Introduction to a Path to Sustainability

The Past and Future Role of Water Management

Jean T. Larmon, Lisa J. Lucero, and Fred Valdez Jr.

This volume covers the intersection of sustainability and water management; because of their inevitable relationship with climate change, it, too, must be considered. Discussions of the changing climate must strike a tenuous balance—how lessons from past societal strategies for dealing with climate change inform our future, while still accentuating the uniqueness of our current condition. Humans have been confronting a changing climate sustainably for millennia and have adapted to these periods of flux in a variety of ways, but we have never confronted a changing climate under the pressures of our present globalized world. While this volume stresses how lessons from the past offer invaluable insight into current approaches of adaptation, we move forward with the recognition that our time is different. With this in mind, our collective goal is to make those inevitable discrepancies between past and present climate change less daunting, and to emphasize the sustainable negotiations between humans and their surroundings that have been mediated by the changing climate for millennia. This volume investigates climate change and sustainability through time, particularly as it was mediated with diverse methods of water management and

through diverse ideological conceptions of water. We build off of and focus upon earlier investigations of the global diversity of water management systems and the successes and failures of their employment (e.g., Scarborough 2003), while applying a multitude of perspectives on sustainability.

By the year 2050, over half of the world's population will rely upon the resources of the tropical forest (Roberts et al. 2017). The changing climate and increased pressure from the movement of human populations into these ecosystems make them some of the most endangered. For this reason, we focus much of the volume on the ancient Maya, who lived and adapted within the neotropical system for millennia, particularly during the emergence of urbanization in the region. Through the Maya world and timeline, control of and access to water have played a pivotal role in social and political shifts and developments. The wealth of the archaeological record offers rich data for exploring past politics of climate change, while the epigraphic and ethnographic data show how integrated the ideological, political, and environmental worlds of the Maya were. In the ancient Maya world, water bodies, caves, and sinkholes (all openings in the earth) were portals to the underworld (Bassie-Sweet 1996). It was within these portals that ancestors and deities resided and through these portals that Maya communicated with ancestors and deities (Brown and Emery 2008, 300). Water was not only essential for subsistence, but for the spiritual sustenance of daily life. The Maya's relationship with water, then, offers valuable insights into sustainability in the tropical ecosystem.

Here, we explore the ways in which political control of water sources, the maintenance or degradation of sustainable systems, ideological relationships with water, and fluctuations between the extremes of water availability have impacted or been impacted by social change. To do so, however, without delving into the diachronic and synchronic pertinence of climate change, would do a disservice to its global nature. Throughout the volume, we have three chapters that unhinge *different* aspects of sustainability and water management—water management's sway on the unfolding and downfall of Angkor and its role in contemporary social policy development, as well as how past behaviors unfold in the present. In our critical approach to past water management and sustainability, these chapters allow us to move to the present and beyond so we can structure this volume around a hopeful and informed future.

The 2014 Intergovernmental Panel on Climate Change (IPCC 2014) rightfully continues to place humans as a prime mover in climate change, but it also promotes adaptation and moves away from the idea that we can “fix” the damage already done. Perhaps the most important recognition is that we exist in an ever-changing climatic context and, as has always been the case, to adapt is to persevere. The increasing intensity of the processes of globalization, by which time/space are seemingly compressed to make great distances feel less

(Jennings 2011) and people more intimately connect with those on the other side of the globe, changes our understanding of and approach to the climate. With the recognition that climate change is largely centered on the impacts of humans on their environments comes the understanding that without informed and intentional change climate change will intensify. What is sustainable at present may not be possible as climate change continues, requiring diverse and flexible adaptation strategies.

This necessary change has been accomplished by past peoples as evidenced in the archaeological record. Today, however, is set apart from the past by scale; we now have the ability to study climate change on a global scale, which is just as well because it is a global problem. While archaeological examples tend to focus on a single region or society, our current context is worldwide. We have climate information from Antarctic ice cores that informs our understanding of fluctuating temperatures (Kawamura et al. 2017) around the world, and we can access data that explore how people in Brazil (Bretan and Engle 2017) and Iran (Gohari, Mirchi, and Madani 2017) have adjusted to their shifting local climates. Such interconnectivity both is a representation of how humans have encouraged the current climate condition, and highlights our unique ability to identify, explore, and ultimately ease tensions between local and global. In this tension lies a goal of this volume: we will explore localized examples of relationships with water and water management, as well as how they contributed to sustainability in the Maya region and elsewhere.

The passing of centuries has afforded us the ability to explore how these archaeological examples, which in the past were perhaps only visible on a myopic scale, integrate into the more global archaeological context, ultimately better simulating today's highly integrated condition. Here, we reduce any scalar hindrance—both geographical and temporal—in order to problematize concepts of “past” and “present,” “local” and “global.” The integrative approach helps us to break through dichotomies that lessen the impact of climate change discourse and ultimately promote a singularly modern and “Western” perspective. Instead, this volume will culminate in a discussion of water and sustainability that considers all boundaries (scalar and temporal) permeable.

Vernon Scarborough eloquently outlines the essential role of water in discussions of sustainability:

Water for life is a biological given; a construction that is both inalienable and immutable on our green-blue planet. From a cultural perspective, water is foundational for our societal institutions; the rules and norms that direct and influence its access and allocation, strongly affect all other raw and refined resources. Its scarcity or abundance to a region significantly dictates the kinds of social organizational adaptations we have made as a species. Our health and longevity depend

on its availability; how it is delivered, who accesses it, and its quality and quantity identify levels of well-being. (2016, 4)

The labor and time investment devoted to managing water systems, accessing water, and maintaining water quality in the past espouse a sustainability discourse with a continuous theme of water throughout. This volume centers water—in plentitude and in absence—in the discussion of sustainability.

Some definitions are necessary before moving forward. In this volume, three concepts are at the forefront of our discussion: climate change, sustainability, and water management. Starting with the broadest concept, climate change is defined simply as a noticeable change in regional or global climate patterns: “the magnitude of seasonal weather pattern changes that persistently interfered with the food and water supplies necessary to support growing populations and infrastructural systems” (Lucero, Fletcher, and Coningham 2015, 1139). It is most readily applied to changes occurring since the twentieth century but has been impacting humans for millennia (Fiske et al. 2015). Of late, sustainability, or “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Brundtland, World Commission on Environment and Development 1992) has frequented discourse on climate change. For this volume, we employ a broad definition of sustainability to allow the contributing authors freedom to include diverse understandings of the concept. Christian Isendahl problematizes this definition in the volume’s conclusion. Promoting a sustainable lifestyle, specifically one that avoids the depletion of endangered natural resources over the long term, has been a means of adapting the increasingly inevitable impacts of climate change. Fluctuations in precipitation levels are a frequently cited impact—too much or too little rain. Consequently, water management systems are often employed to sustain water supplies. Water management is the manipulation of constructed and natural water bodies and precipitation to either decrease damage or increase the benefits of the fluctuations.

Stemming from the work of Scarborough (e.g., 1998, 2003, 2009; Scarborough and Burnside 2010; Scarborough and Lucero 2010), the contributing authors both investigate singular cases of water management and sustainability efforts, as well as consider syntheses of larger data sets, ultimately allowing for a juxtaposition that highlights cultural, environmental, and diachronic diversity. This volume presents a timely political and environmental perspective that not only encourages archaeological and anthropological discussion, but also promotes readers outside of the discipline to think critically about the intended and unintended consequences of environmental policy. Understanding our cultural spheres as a rhizome (e.g., Deleuze and Guattari 1983) in which all threads are interwoven, we can better conceptualize the mutually molding tendencies of our multifaceted world.

ORGANIZATION OF VOLUME

This volume is divided into two parts. In the first, the authors discuss Maya perspectives on water and water management. In these chapters, the authors detail land and water use strategies, and the ideological and political importance of water. They also explore how the methods of land and water use, as well as water's ideological importance, are integrated. The second part contains three studies from geographically and temporally diverse contexts to make clear the pervasiveness, through time and space, of water's role in sustainability. Each author offers a unique theoretical, methodological, or conceptual perspective that both contrasts and bolsters each other. The volume ends with a synthesis and discussion chapter by Christian Isendahl. The complexity of the volume's perspectives mirrors the reality of academic and political understandings of sustainability and water management and is explicitly concerned with the direction of our, at times, inundated and desiccated planet.

In the first part, the contributors introduce the details of methods employed by the ancient Maya to sustainably live and flourish within their environments, including both land management and water management, two practices that are intimately related. In chapter 2, Nicholas Dunning and coauthors explore how inhabitants of the Elevated Interior Region (EIR) of the Maya lowlands first adapted methods of water collection and storage—methods that were maintained and adjusted from the Middle Preclassic period (ca. 800 BCE) and throughout their entire occupation. The authors follow the development of water management systems in the EIR, which varied interregionally, identifying which storage techniques allowed for more sustainable living in the naturally arid region, particularly as conditions became increasingly dry. In chapter 3, David Lentz and colleagues shift gears to look more critically at the ways in which land management systems impacted lowland Maya agricultural intensification. In particular, they investigate how land use strategies allowed for urbanization in the EIR of the Maya lowlands. The increasing density of settlement populations during the Classic period (300–800 CE) required an increase in food production, and the Maya employed a variety of agricultural techniques to account for seasonal fluctuations in rainfall. Lentz and colleagues present data suggesting that these adaptations were ultimately unsustainable, encouraging major social transformations during the Terminal Classic period (800–900 CE).

The previous chapters outline Maya efforts of sustainability in regard to specific methods employed in the EIR, though these and other methods of land and water management were prevalent across the Maya region. Water also was vital for sustenance, agriculture, and spiritual needs of the Maya. In chapter 4, Wendy Ashmore presents a theoretical exploration and summary of the role that water and water imagery plays in Maya cosmology. Her chapter

emphasizes a primary point of this volume—*water is life*. Although her primary focus is how this sentiment rings true for the Maya, she poignantly connects it to additional archaeological and present-day examples. In this, Ashmore calls attention to how water is inherently and unforgivingly political. Chapters 5, 6, and 7 focus on case studies exploring how methods of water and land management were integrated with the political and ideological world of the Maya.

In chapter 5, Joel D. Gunn introduces methods of water management that were less constructed than those employed in earlier chapters, such as using riverine networks for site planning and to dictate trade routes. He discusses the transition of water management techniques from those that utilized the natural landscape to those that were based on constructed watersheds and basins. Through an exploration of watery origins, tropical footprints, and “water cities,” Gunn looks at the intersection of population intensification and sustainable social organization for cities in the Maya lowlands, the crux of which hinges on the manipulation of access to water. Just as Gunn discusses the exploitation of natural waterways, in chapter 6, David Freidel and colleagues revisit unconstructed water management in the form of water trails, exploited to link regions throughout the southern Maya lowlands and centralize three centers in the lowlands of Guatemala: El Tintal, El Achiotal, and El Perú-Waka’. Freidel and colleagues place water at the heart of the economic and political power of these three centers and explore how “water mountains” worked to integrate the political and ideological world of the ancient Maya, ultimately linking Maya relationships and management of water systems to integrated and thriving Maya communities. In the final chapter of this part, chapter 7, Arlen F. Chase and colleagues present a comparative case study of Tikal, Guatemala, and Caracol, Belize. In an exploration of the diversity of relationships shared between humans and their environment, they compare the ways in which Maya living at Tikal and at Caracol differently shaped their landscapes and access to water storage. Ultimately, they differentiate between centralized and decentralized control of water management systems and natural resources, an analysis akin to Sylvia Rodríguez’s (chapter 10) discussion of acequias in New Mexico.

In chapter 8, Sander van der Leeuw ushers us into the next part of the volume. Following the work of Vernon Scarborough, van der Leeuw offers insight into how we might today make use of archaeological data from the Yucatán Peninsula. He considers the intersection of social organization and water management, examining how practices of water management (in concert with cognitive, technological, and societal developments) were integral to the emergence of complex societies. In viewing societies as “collective information-processing organizations,” van der Leeuw highlights the unintended consequences of “solutions” and their impact within a vast spatial-temporal sphere. Such a perspective necessitates *informed* forward thinking in terms of sustainability. While

his discussion focuses on the Maya, it can be easily applied to the final chapters, especially since he argues that to understand the complex dynamics of the present, we have to argue from the past.

Chapter 9 takes us to Southeast Asia, where Dan Penny and Roland Fletcher use sedimentation as a proxy for sustainability; they suggest that contrary to some previous hypotheses, Angkor's suburb agricultural practices were sufficient for maintaining soil content and productivity. Instead, they propose that the extensive erosion and sedimentation evidenced in soil profiles originated from within the large-scale channelized water system, irreversibly damaging the water management system, rather than from practices impacting topsoil. Their analysis of previous theoretical approaches to studying the human and environment negotiations at Angkor is critical; it addresses the consequence of the development of one of the world's largest preindustrial settlements and the impact of that development on the surrounding tropical forests. Their results show that it was the deluge of water impacting Angkor's extensive channelized systems that produced detrimental erosion. This case further highlights the necessity of identifying local solutions for local problems—as opposed to drought, it was too much water that halted the sustainability of this system.

In chapter 10, Sylvia Rodríguez explores the politics of water today through many of the concepts already discussed in the volume that apply to archaeological cases. Through a lens of acequias in Taos, Rodríguez explores the morals of sustainability governance and puts forth the question, “Can acequias survive”? Rodríguez exemplifies how these locally managed systems of water management link human and natural systems—as Deleuze and Guattari's (1983) rhizome did—in a way that encourages mutualism. Resilience of the natural system is resilience of the human system. Her chapter stands apart in that it centers upon an ethnographic example of community and water management, though she does draw from diverse temporal and geographic examples. Such a divergence from the remainder of the volume is necessary. The themes woven throughout the archaeological examples remain in this powerful ethnographic example. Her discussion allows the reader to imagine how archaeology as a discipline, and scientific inquiry as a collective, might start to approach research in a way that does justice to keeping hold of the daily while appreciating and paying credence to the long term. As in the Chase et al. chapter, Rodríguez explores the benefits, but also problems, with locally managed practices of sustainability.

In the concluding chapter, Christian Isendahl interrogates the idea of sustainability that we introduce here. In doing so, he offers a narrower definition of sustainability originally posed by Herman Daly (2006, 39): “The entropic physical flow from nature's sources through the economy and back to nature's sinks, is to be nondeclining.” Isendahl suggests that most archaeological studies, including some of those in this volume, do not adhere to this definition of sustainability;

it is with this definition, however, that we might gain better insight into how the intended and unintended consequences, and, in some cases the tradeoffs, of human behavior leave “landscape legacies,” or past impacts on the environment that are visible in today’s landscapes. Isendahl argues that it is in understanding these landscape legacies and their causes—intended and not—that archaeologists might best contribute to conversations of sustainability. He points out, as many chapters in this volume exemplify, that archaeology is uniquely suited to undertake this study because of the discipline’s long-term and case-study-based approach, ultimately leaving us with the final goal of contributing, even slightly, to a response to the question, “How do we get out of this mess?”

CONCLUDING REMARKS

As the global water crisis continues to worsen in the face of climate change and exponential population growth, an anthropological perspective of water management practices and sustainability offers a diachronic and synchronic understanding of how access to natural resources, specifically a dearth and/or plethora of water, has impacted people in the past and still does today. Because water management systems have been key components of sustainability, they have been well studied by anthropologists and archaeologists. This volume builds upon earlier investigations of the global diversity of water management systems and the successes *and* failures of their employment (e.g., Scarborough 2003), while applying a multitude of perspectives on sustainability. Here, contributors explore the ways in which political control of water sources, the maintenance or degradation of sustainable systems, and fluctuations between the extremes of water availability have impacted, or been impacted by, culture change. Rather than focusing efforts upon a single geographical or historical example, this volume pays credence to the complexity of human and environment interactions and the mediating role of culture.

In September 2015, the United Nations (UN) introduced a global initiative—the “2030 Agenda for Sustainable Development” (UN 2015). This program mobilizes the induction of global sustainable development, with its seventeen goals addressing poverty, inequality, and *climate change*. Seven of these goals address sustainability efforts and the other ten, in their political and inequality confronting nature, are intimately tied to such efforts. The present volume speaks directly to this agenda; at a time when global climate initiatives are many and inevitably tested, a view into the diverse and locally intricate approaches to sustainability is essential. This perspective will contribute to an understanding of how the UN 2030 Agenda can be mobilized *on the ground* at local, regional, and national levels.

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