# Introduction

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Climate change and related anthropogenic influences are increasingly apparent worldwide, as reflected by mounting scientific evidence and peoples' local experiences. The effects of Earth's changing climate are being experienced at unprecedented scales and across varying landscapes and bioregions. These impacts include acute shifts and changes in local food production and global supply chains, escalating disaster and mitigation efforts, and increased emergency health concerns. While climate change is a global phenomenon, the 2022 IPCC assessment report has underscored the importance of understanding and mitigating regional impacts, adaptations, and vulnerabilities. Included in the report, and noted elsewhere, are the rippling impacts of climate change on peoples' lived experiences, livelihoods, and homelands, which are most apparent at local scales (Batterbury 2008; Wolverton et al. 2014).

In the last two decades, there has been increased attention on Indigenous and local populations whose livelihoods and subsistence practices are closely tied to their landscapes. People are often keenly aware of local effects from climate change, such as altered weather patterns, seasonal irregularities, melting glaciers, flooding and drought, and other challenges that impact their communities and livelihoods. Climate change impacts are also exacerbated in communities where excessive resource extraction and colonial legacies have increased vulnerability to punctuated changes (Douglass and Cooper 2020). Despite this, Indigenous and local peoples disproportionately manage some of the most biologically diverse and intact landscapes on earth (Garnett et al. 2018; Fa et al. 2020). Responses to climate change challenges have drawn on longstanding (e.g., centennial and millennial) experiences with climatic variability, shifts in fluctuating social–ecological relations, and responses to ecological imperialism and colonization (Adamson et al. 2018; Kaptijn 2018). Such strategies include intensive land-based monitoring (Salick and Ross 2009), continued implementation of traditional ecological knowledge and management systems (Gómez-Baggethun et al. 2013; Pearce et al. 2015), carbon-negative livelihoods (Walker et al. 2020), and the co-production of knowledge with climate scientists (Riseth et al. 2011; Reyes-Garcia et al. 2019).

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The relationships between people and their inhabited landscapes are formative and ripe for interdisciplinary research in relation to climatic and ecological changes through time. Historical ecology is especially well-positioned to provide a practical and theoretical framework for understanding long-term social–ecological patterns and processes in the context of our current climate crises (Balée 1998, 2006, 2013; Balée and Erickson 2006; Crumley 1994, 2017, 2018, 2021; Crumley et al. 2017; Odonne and Molino 2021). For example, across South, Central, and North America, historical ecologists have shown how societies have altered local environments to produce "cultural forests" (Armstrong 2021; Armstrong et al. 2021; Balée 2013; see Crumley 2017, 2021) and "domesticated landscapes" (Erickson 2006). Through applied practices of landscape transformation, (e.g., raised fields, earthworks, midden engineering, plant translocations, and Amazonian Dark Earths), environmental challenges have been addressed over centuries and even millennia (Balée 2010; Crumley et al. 2017; Graham 2006; Rostain 2008a, 2010).

Anthropologists and archaeologists, working within a historical–ecological framework have assessed climate variability, climate change, and related impacts by centering their research on human–landscape interactions over explicit and controlled timespans (Rick and Sandweiss 2020; Stephens et al. 2019). Concepts of resilience and sustainability are inherently temporal in their application and assessment. However, temporal scales, which affect observations and analyses, are sometimes insufficiently considered or poorly implemented in climate change research (Lane 2015). As such, we seek to demonstrate the generative intersection of localized and Indigenous knowledge and historical–ecological timescales as a means to better understanding and working towards climate change mitigation efforts. With contributions from specialists throughout the Americas, this edited volume will comparatively examine experiences and responses to climate change and related environmental changes across South, Central, and North America. We foreground historical ecology as a primary framework for understanding human engagements with climate change through time and analyze how the global crisis is experienced and dealt with in localized contexts.

## Historical Ecology, Climate Change, and Indigenous Knowledge

Over forty percent of the globe is considered vulnerable to climate change impacts and the sixth IPCC assessment report suggests that global-scale technological and bioengineering solutions will not be sufficient to address the climate crisis. Thus, strategies that include culturally-relevant mitigation to reduce vulnerability will be increasingly important in coming years. Anthropologists and archaeologists are uniquely situated to this task (Crumley 2021). Although not initially forthcoming, leading to the criticism that anthropologists were "*fiddling while the globe warms*" (Rayner 1989),

anthropological engagements with climate change have increased in pace and volume during the last two decades. Anthropologists have now produced numerous books and edited volumes (Baer and Singer 2018; Barnes and Dove 2015; Crate and Nuttall 2009; Crate and Nuttall 2016; Strauss and Orlove 2003; Welch-Devine et al. 2020), special issues in peer reviewed journals (Lahsen 2010; McCarthy et al. 2014; Magistro and Roncoli 2001; Salick and Ross 2009; Pisor and Jones 2021), and broad literature reviews (Brown 1999; Crate 2011; Jorgenson et al. 2019) concerning climate change. Archaeologists have also contributed important volumes on ancient human land-use and impacts to changing environments (Braje et al. 2021; Chambers 2012; Dawson et al. 2017; Isendahl and Stump 2019; Redman 1999; Stump 2010). These contributions have come from around the world and have zeroed in on integral connections between long-term changes in weather patterns and ecological events, like flooding and drought, as they relate to more traditional anthropological concerns, such as social and cultural practices and Indigenous and local knowledge (Batterbury 2008).

Previous contributions have been geographically and topically wide-ranging. For example, in two groundbreaking edited volumes which remain foundational to the anthropology of climate change, Crate and Nuttall (2009, 2016) present chapter-length ethnographic engagements with climate change topics ranging from the Andes (Bolin 2009; Paerregaard 2016), to the Arctic (Henshaw 2009, 2016), to South Asia (Finan 2009; Finan and Rahman 2016), to Oceania (Jacka 2009, 2016). More recently, research has focused on how local perceptions and knowledge of climatic and ecological changes emerge and become embedded within peoples' everyday lives (Sillitoe 2021; Welch-Devine et al. 2020). Despite a growing literature on climate change, anthropological interventions into the climate crisis have struggled to link the global with the local and have had difficulty articulating a theoretical framework capable of providing a broad comparative scope. As a result, some researchers have called for a more integrative approach with the goal of coordinating scalability between place-based and localized climate change research, on the one hand, with globally-focused climate change research and policy agendas, on the other (Reyes-Garcia et al. 2019).

Although anthropology is critically situated to connect local experiences of climate change with larger-scale processes and changes (Crumley 1994; Whitaker 2020a; Wolverton et al. 2014), many edited compilations on climate change have perhaps – at least until recently (see Crumley 2017) – prematurely reached for a global scale of comparison at the expense of mid-level regional accounts. As Crumley et al. (2017: 1) write, climate change and related contemporary crises *"require attention, both locally, where global changes impact communities, and globally, where local practices influence global change."* Without the latter, fine-grained climate ethnographies often become disjointed from their globally oriented theoretical frameworks. However, the global emphasis has come at a cost to the local "on the

ground" perspectives that constitute anthropology's primary and best contribution to climate change research. In other words, there is often a disconnection between the high-resolution localized documentation of experiences, perspectives, and challenges of people concerning contemporary climatic and ecological change, and the global comparative scale within which they are theoretically positioned. For example, in these contexts, Indigenous knowledge and practices, for example, traditional ecological knowledge and traditional environmental and resource management, are sometimes extracted for outsiders' goals without benefiting the communities sharing that knowledge (McAlvay et al. 2021). Uncritically scaled-up research often results in Indigenous and local peoples' knowledge being removed from the contexts within which it successfully operates, e.g., at a landscape-scale. Johnson (2010) calls these rudimentary studies "TEK bites": the fragmentary pieces of knowledge removed from peoples' lived realities, governance structures, and other social institutions in which such knowledge is both situated and successful (see also Berkes 2012).

While calls to include "people" as important agents of climatic and environmental change and mitigation have raised the profile of research in the field of evolutionary and biological anthropology (Pisor and Jones 2021), as well as human behavioral ecology, these tend to deemphasize local scale understandings and ontologies of the landscape in favor of adaptationist models. Throughout this volume, we acknowledge peoples' ability to adapt to environmental change, but we focus on human understandings, ontologies, and practices as important mediating and transformative factors that influence sustainability and resilience. We critically interrogate the adaptationist approach for understanding human–environment interactions, while focusing on ongoing relationships between people, biota, and biophysical processes, where human agency and action are essential to the structure of the landscape (Balée 2006; Armstrong et al. 2019). Both biophysical and anthropogenic processes are necessary to our understandings of the landscape (see Szabó 2015). While past forms of cultural ecology emphasized peoples' adaptation to the environment in a fixed context, historical ecology emphasizes diachronic interpretations of landscape change and the ways that landscapes have been transformed and modified by humans (Crumley et al. 2017; Rostain 2008a, 2008b, 2010).

The chapters in this volume bridge the theoretical and cross-cultural challenges faced by many research engagements with climate change by focusing on historical ecology as a research programme capable of articulating diverse ecological and ontological domains through the central concept and scale of the *landscape*. Although archaeologists and ethnographers have made recent progress in this area (see Oba 2016), localized understandings of climate change (as the 2022 IPCC assessment report outlines) and localized scales of study seems to have had limited engagement with historical ecology as a central framework (but see McIntosh et al. 2000). This volume aims to address this lack of engagement.

Although the challenge of climate change is global, regional comparisons provide a productive scale and avoid the seeming incommensurability of cultural and ecological variables at a global scale. A geographical focus on "regions" has also been comparatively emphasized by historical ecologists (Crumley et al. 2017). By emphasizing a nested regional scale within settler states in the Americas, rather than a global one, we aim to balance the local and global scales for comparative and applied analyses.

Despite the growing literature on climate change, ethnographic engagements with local experiences remains geographically uneven. For example, Kawa (2016: 23) has written of an "*overlooked anthropos*" in relation to climate change and the broader Anthropocene in Amazonia, which has received less attention from climate change ethnographers than might be expected considering the critical role of the Amazon rainforest in absorbing and sequestering atmospheric greenhouse gasses (Baer and Singer 2014; Brondizio and Moran 2008; Whitaker 2020a). Similarly, temperate rain forests in western North America are under severe threats from logging, catastrophic wildfires, and other climate change impacts (Price et al. 2020), but there is limited research on the role of Indigenous peoples in shaping the structure and productivity of biologically diverse forested landscapes (Deur and Turner 2005; Turner 2014; Armstrong et al. 2021). Historical–ecological research that highlights Indigenous land-use and landscape management as a cornerstone of climate change mitigation has not previously overlapped in the literature spanning North, Central, and South America. This volume addresses the gap and provides a broad comparative scope of applicable research across these regions.

Historical ecology's emphasis on human–landscape dynamics ameliorates one of the main comparative challenges of anthropological research on climate change. The challenge is that different societies have diverse ideas and ontologies concerning concepts such as "weather," "climate," "stewardship," and "change," which do not always fit into Western languages and conceptual frameworks (Rosengren 2018, 2021; Whitaker 2020a; see Byg and Salick 2009: 163; Rudiak-Gould 2014; Schnegg et al. 2021), making geographically wide-ranging accounts difficult to compare (see also Reyes-Garcia 2019). With historical ecology, such differences are highlighted using a landscape-scale approach which is then featured in the broader contexts of peoples' social–ecological interactions, practices, and knowledge. The comparative framework and scalar approach of historical ecology facilitates an enhanced understanding of peoples' unique responses to real-life threats and challenges stemming from climate change (Armstrong et al. 2017; Crumley et al. 2017). By focusing on people's historical relationships with their local landscapes, historical ecology does more than broaden research engagements with peoples' responses to climatic and ecological vulnerabilities. It also engages with changing landscapes, applications of Indigenous and local knowledge (Crumley 2017), and questions about the continuity

or discontinuity of "nature" and "culture" that perdure at the very heart of interdisciplinary research enquiries (Balée 1998, 2006).

## Chapter Themes

This edited volume brings together anthropological and archaeological perspectives that broaden our understanding of change across both recent and deep-time cultural landscapes. In the first three chapters, archaeology and paleoecology are mobilized to understand sociocultural and demographic shifts at a broad scale over millennia. Stéphen Rostain and Jonas Gregorio da Souza examine the influence of pre-Columbian climate change in Lowland South America through a historical–ecological lens. They reposition the relationship between climate and people, focusing on sociocultural variables, such as demography, mobility, and settlement patterns, spanning thousands of years and across continental-scales. The second chapter by Anabel Ford investigates Maya forest gardens using novel methodological approaches to critically scrutinize the consilience of ethnographic, archaeological, and paleoecological records in Central America. In the third chapter, Torben Rick, Gabriel Sanchez, and Shannon Tushingham highlight the value of a historical–ecological framework for evaluating thousands of years of human–environment interactions across coastal California. With an emphasis on environmental change and the increasing need to meet the challenges of severe drought and wildfires faced by Californians today, the authors offer an enlightened perspective on preparing for future climate instability while promoting equity and social justice.

The following chapters examine long-term human–environment interactions that have resulted in complex biocultural landscapes, and which are currently targeted as pathways toward mitigating climate change. Chapters 4 and 5 engage with smaller scale human–landscape interactions while examining landscape management by Indigenous peoples in the Americas over thousands of years of documented climate variability and environmental change. Natalie Mueller examines paleoecological data and shows how Indigenous peoples in eastern North America have resisted ecological changes in prairies and pyrophytic forests, which include many of the valuable resources that underpin longstanding cultural traditions. The fifth chapter, by Christopher Roos, Thomas Swetnam, and Christopher Guiterman, shows how generations of Ancestral Pueblo and Apache peoples have managed conifer forests throughout the American Southwest, improving fire resilience in their lived landscape. The result of these millennial-scale interactions, particularly in local pine forests, has been shown to reduce severe risks from wildfires under current climatic changes.

In the sixth chapter, Ana Ladio and Mauricio Sedrez dos Reis use relational models (RMs) within the context of conserving pewen forests (*Araucaria araucana*), a cultural keystone species for Mapuche people in Argentina and Chile. The authors focus on the cultural and environmental

significance of human-pewen forests through time, and their role in promoting food system resilience and conservation. The seventh chapter, by Chelsey Geralda Armstrong, Sara Wickham, and Kalina Hunter, considers the role of Ts'msyen, Haíłzaqv, and Wuikinuxv people in shaping the structure and function of forests across the Pacific Northwest. Specifically, peoples' traditional management of forest garden systems has resulted in an increase in local biodiversity and functional diversity, as well as improvement of overall soil quality in various regions. The authors contemplate the scientific, legal, and applied outcomes of this research, focusing on restoration and reclamation in an uncertain future. Moving from forests into the intertidal, in Chapter 8, Dana Lepofsky and Anne Salomon describe how Indigenous peoples throughout the Pacific Northwest Coast constructed intertidal rock-walled terraces called clam gardens and managed them amidst climatic and ecological changes over millennia. These unique cultural landscapes have been the cornerstone of food sovereignty initiatives for many coastal First Nations, and the authors highlight key aspects of this long-term research program that braids together a novel intersection of scientific and Indigenous knowledge. Isabel Rivera-Collazo focuses on Central America in Chapter 9, where she examines the importance of centering local peoples' perspectives in understanding past climatic crises on islands in the Caribbean. With a focus on palaeoecological, climatic, and archaeological data, she brings forth invaluable lessons for researchers seeking to contribute more critically to climate change research, centering issues of food and habitat security.

The last three chapters emphasize local perspectives and ontologies concerning climate change and responses to environmental change over time in Lowland South America. Chapter 10, by Marquisar Jean-Jacques, Marianne Palisse, Martijn M. van den Bel, Antoine Gardel, and Edward Anthony, provocatively asks, whose "climate change" are we are really talking about anyway? They examine Kali'na understandings of long-term climatic, ecological, and historical changes in the Maroni River to broaden discourses of both "climate" and "change." In Chapter 11, Pirjo Kristiina Virtanen, Álvaro Férnandez-Llamazares, and Francisco Apurinã examine relationships between oral histories and memories in relation to changing landscapes among the Apurinã and Tsimane' peoples of Amazonia. In the twelfth and final chapter, James Andrew Whitaker compares Makushi and Akawaio perceptions and encounters involving weather and climate change in Guyana. He shows how Makushi and Akawaio people today often interpret changing weather and climate variation using recently introduced discourses of "climate change" and how they position these observations within ontologies centered around the historical–ecological landscape.

## The Nexus of Global Change And Historical Ecology

The themes, observations, and data examined throughout this volume lie at the cutting edge of historical–ecological research and hold continuing

relevance within both academic and applied contexts. Although often without sufficient engagement in existing scholarship, collisions between conservationists, policy makers, and local and Indigenous peoples continue to play out in dramatic and often tragic ways across the Americas. The urgency of climate change can exacerbate these conflicts when perceived through a lens which continues to separate "nature" and people. Historical ecology can help to clarify issues of legal, ethical, and scientific inquiry by making relevant Indigenous and local land-use histories and ecologies.

Our collective studies in North, Central, and South America illustrate the significance of historical ecology for probing and better understanding how people transform their landscapes through local knowledge, ontological frameworks, and practices. As demonstrated throughout this volume, these aspects of historical ecology often bely modern conservation approaches and neo-colonial practices, which continue to reproduce outdated views on ecological and technological supremacy in the face of climate change.

Current conservation projects in Lowland South America often aim to separate Indigenous peoples from their local territories based on the demonstrably false premise that peoples' environmental impacts are inherently detrimental to terrestrial, marine, and riverine landscapes (see Balée 1998, 2006). Such "coercive conservation" measures sometimes involve removing local people from their land base or restricting local use and subsistence practices (Peluso 1993). For example, the Iwokrama International Centre in Guyana reportedly restricts hunting, fishing, and farming in traditional Makushi territories (Whitaker 2020a, 2020b). In yet other regional scenarios, hydroelectric and similar large-scale projects aim or result in the dislocation of local peoples from their landscapes. Some governmental policies have led to a radical shift in Indigenous peoples' practices. For example, in French Guiana, Indigenous peoples have been encouraged to settle into perennial villages, but are now restricted from following their traditionally mobile and semi-sedentary way of life, leading to egregious conflicts over land rights. In the Pacific Northwest, where Indigenous peoples have never ceded rights and title to their territories, conflicts over intensive resource extraction continue to operate under the assumption that people simply do not "use" their lands sufficiently (Daly 2005; Martindale and Armstrong 2019). This has led to concerted research efforts involving clam gardens, forest gardens, orchards, and other traditional land-use practices, which may help communities assert sovereignty to their lands and waterways, resulting in more locally-relevant climate change mitigation strategies.

Despite scholarly research and the assertion of local and Indigenous peoples, the separation of "nature" and people persists in legal, commercial, and non-profit contexts. Historical–ecological scholarship has provided scholarly and legal language that shows what Indigenous peoples have always known: that the management of local landscapes – intentionally, sustainably, and flexibly – has mitigated, buffered, and imparted valuable lessons in relation to long-term and short-term ecological variability and climate change. Although recognition

of local and Indigenous peoples has been more apparent in matters of conservation and biodiversity, they are often tokenized or only valued when tested against Western science (Tormos-Aponte 2021). As a result, many peoples' longstanding sustainable and resilient practices, in relation to climatic, ecological, geomorphological, and broader global changes, have yet to be fully integrated into the design and implementation of climate change action and research. With a view to local Indigenous knowledge, ontologies, and practices over explicit temporal scales, this volume shows that understanding the past is an important and just strategy to building a better future.

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