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Climate Change: Expanding Anthropological Possibilities

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Keywords

Abstract

Climate anthropology has broadened over the past decade from predominately locally focused studies on climate impacts to encompass new approaches to climate science, mitigation, sustainability transformations, risks, and resilience. We examine how theoretical positionings, including from actor–network theory, new materialisms, ontologies, and cosmopolitics, have helped expand anthropological climate research, particularly in three key interrelated areas. First, we investigate ethnographic approaches to climate science knowledge production, particularly around epistemic authority, visioning of futures, and engagements with the material world. Second, we consider climate adaptation studies that critically examine discourses and activities surrounding concepts of vulnerability, subjectivities, and resilience. Third, we analyze climate mitigation, including energy transitions, technological optimism, market-based solutions, and other ways of living in a carbon-constrained world. We conclude that anthropological approaches provide novel perspectives, made possible through engagements with our uniquely situated research partners, as well as opportunities for opening up diverse solutions and possible transformative futures.

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INTRODUCTION

Climate change is an existentially urgent yet often conceptually abstract problem. It stretches the bounds of knowable facts, yet it is grounded in material realities of melting ice, burning forests, and people fleeing rising seas. In just the past year, increasingly emphatic voices are emerging from movements such as Extinction Rebellion, the Sunrise Movement, and Fridays for Future, bringing new politics and social organizations into view and foregrounding the notion of a contemporary emergency we have, as of yet, failed to address. We describe the recent contributions of anthropology to confront this crisis, particularly by broadening inclusion and drawing on a wider range of perspectives and possibilities than commonly used (Schroeder & McDermott 2014, McElwee 2016, Fiske et al. 2018). But doing so hinges on our ability to expand our own view of the anthropological subject beyond localized experiences of climate change to consider diverse ontologies in knowledge production, to address the various scales and values manifested in lived climate change experiences, and to explore possibilities of pluralism in our responses and politics.

Our contribution seeks to broadly investigate the state of climate knowledge and action within anthropology as the discipline enters into conversation with geopolitical arrangements and scientific assessments of our changing planet. It also seeks to contribute, in our distinctive anthropological manner, to consideration of both mainstream and alternative approaches and interventions. These undertakings require critical consideration of existing frameworks, analysis of counternarratives, and the construction of new ways to think about climate change that draw on the diverse scholarship of climate anthropologists and the unique perspectives of our interlocutors.[1]

Our review opens by tracking the key theoretical concerns that animate our contribution and that have inspired our call to broaden scholarly and popular perspective on both the problem and potential solutions. We then explore three domains within recent anthropological literatures, giving particular attention to the ways that climate anthropology has expanded over the course of the last decade: the anthropology of climate science, knowledge, and practices; the human subjectivities in relation to vulnerability, adaptive capacity, and resilience; and mitigation broadly construed. These three domains roughly map onto the three Working Groups of the Intergovernmental Panel on Climate Change (IPCC), which regularly assess the state of climate science, adaptation, and mitigation. We seek to push on, stretch, and broaden institutional knowledge devices such as the IPCC by illustrating how anthropology can help to open new possibilities for what might be included as climate knowledge, adaptation, and mitigation.

THEORETICAL SIGNPOSTS IN CLIMATE ANTHROPOLOGY

Many of anthropology's earliest contributions to climate studies illustrate how people in particular social and geographical locations understand and experience climatic change. As we review the current state of climate anthropology and its growth over the last decade, perhaps what stands out the most is a movement in both theory and method, beyond the local and the particular, but also beyond the purely anthropocentric and phenomenological approaches that have long characterized our discipline. Recent theoretical approaches to environmental crises, including climate change, question the centrality and privileging of human knowledge and systems of valuation. They instead offer new approaches to generative politics based on this expansion of perspectives, particularly among social relations between humans and nonhumans. Although these approaches are not without controversy or critique, and can risk de-emphasizing human culpability when

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[1]We owe a debt of gratitude to earlier forays into scoping climate anthropology, including Batterbury (2008), Crate (2011), Barnes et al. (2013), Hastrup (2013), Fiske et al. (2014), Barnes & Dove (2015), Crate & Nutall (2016), Whitington (2016), and Baer & Singer (2018).

taken to an extreme, we argue that they represent a new horizon of possibility as they ask us to decenter our own interests in forming climatic solutions. The broadening of perspective will become increasingly important as we collectively confront the urgency of climate change and the failure of narrow, technocratic, human-centric ecomodernist solutions that have dominated climate mitigation efforts to date.

Several theoretical traditions have helped to remake the purely anthropocentric approach to climate studies. Theoretical touchstones in anthropology, science studies, and philosophy of science have clear indigenous antecedents (Todd 2016). Inspired by work in environmental humanities and science and technology studies, many anthropologists have developed a greater appreciation for the relational networks that shape human worlds and futures. Actor–network theory (ANT), for example, has shown how knowing subjects interact with objects in the world, exchanging or transferring material and semiotic elements among multiple assembled actants [Latour 2004 (1999)]. Latour's contributions to ANT refuse to prioritize the distinction between the human and the nonhuman, the living and the nonliving, arguing that humans are not the only actants with agency. His seminal book *We Have Never Been Modern* (Latour 1993) advances the idea that nature–society distinctions are an ideological prop for modernity (Hornborg 2016). Theoretical touchstones in the philosophy of science have clear indigenous antecedents (Todd 2016). Feminist science studies scholar Haraway (2003) encourages us to think through and against the nature–culture dichotomies that have enabled climate violence in the name of human exceptionalism. Povinelli (2016) suggests alternative possibilities in her illumination of the dominant ideological distinction between life and nonlife and the corresponding governance structures of geontopower, which have rationalized extractive capitalism and the contemporary crises of late liberalism.

The message in these perspectives, as Boyer (2014) writes, "is the necessity of constituting new worldviews and modes of action appropriate to the recognition of ecological interdependency and interresponsibility" (p. 319). Anthropologists have adopted concepts of "assemblage" to describe these sets of actors who are engaged in relational networks, particularly through affinities in processes of globalization (Ong & Collier 2005). For example, McElwee (2016) examines how assemblages of international environmentalists, measurement devices, carbon molecules, and trees interact to co-constitute policies for climate mitigation in Vietnam. Consideration of these more-than-human networks has helped climate anthropologists to resituate the co-constitution and power dynamics of nonhuman and human interactions.

Growing recognition of the ways that human communities shape and are shaped by nonhuman actants has also inspired increased interest in new materialisms, in which the substance of things constitutes meaning, and resource materialism, which examines how material objects and conditions shape social relations. These material entities respond to, make visible, adapt to, and resist environmental change, whereas knowledge practices engaging with these objects illuminate patterns of global change. Anthropologists working with materials such as ice (Hastrup 2012), air (Choy 2011, Choy & Zee 2015), wind (Howe 2015b), rain (Radonic 2019), sand (Zee 2017), and forests (Mathews 2018) show how human meaning is entangled with materiality and how people ally with the interests and intentions of our physical world.

The ontological turn has similarly challenged the distinction between knowing subjects and known objects by rejecting the separation between humans, who are subjects with capacities for consciousness, language, and representation, and things, which exist out in the world. Much of the ontological turn has sought to rethink ecology through nonmodern ontological perspectives. Ontology "as the study of 'reality'—one that encompasses but is not limited to humanly constructed worlds" has been characterized as posthumanist precisely because it removes humans from a privileged position (Kohn 2015, p. 312). For example, de la Cadena & Blaser (2018) have developed

a discussion of "a world of many worlds," or a "pluriverse," in which assemblages can interact and coexist, sometimes in conflict, particularly as the problems and solutions of climate change are both borne, in large part, in marginalized bodies, communities, environments, and regions. They underscore the political dimension of the interaction of worlds, emphasizing their wish to explore "the critical space opened by the tension between the scholarly and political recognition of the ecological crisis that threatens to eradicate life on Earth and the obstinate demands for existence presented by worlds whose disappearance was assumed at the outset of the Anthropocene [especially Indigenous peoples]" (Blaser & de la Cadena 2018, p. 2). This perspective has guided a consideration of projects in the Anthropocene, such as community design projects in Popayán, Colombia (Escobar 2018) and the engagement of disenfranchised South Africans in projects to restore native vegetation in threatened coastal dune landscapes (Stengers 2018).

Directing our attention to long timeframes, the notion of hyperobjects, defined as "things...massively distributed in time and space relative to humans" (Morton 2013, p. 1), helps us explore new possibilities of coexistence between people and objects. The characteristics of hyperobjects make them elusive—they cannot be contained or fully understood—but also viscous, as they stick to everything with which they come into contact; thus, they become both material and discursive, with a history and a present, and contain immanent and projected futures. As a hyperobject, climate change renders vulnerability as the tangible human experience of environmental degradation and destabilizes our sense of existence, challenging human-scale understandings of personhood, planetary existence, and cognition in general (Boulton 2016, p. 781). This position can be seen as expressing humility and humiliation, in which people must concede to "more democratic modes of coexistence between humans and with nonhumans" (Morton 2013, p. 121). Where assemblages might be considered linked, sustained engagements, hyperobjects reveal limits to interactions—the affect, the emotional fatigue, and the despair. Petryna's (2018) study of wildfires in the western United States shows them as hyperobjects, given the limits of knowability of individual fires, of fire regimes, and of their trajectories; she finds that the people who seek to reduce fire risk have an "inadequate foothold in changing realities[,]" which "can itself degrade knowledge about the future and the existential threats that are being brought forth" (p. 588).

Stengers's (2005) "The Cosmopolitical Proposal" suggests that the interactions between humans and other entities entail some level of reciprocal recognition, rather than merely mutual influence, and that these recognitions lead to the possibility of politics and, through such politics, to the active construction of future shared worlds. When seen as cosmopolitics, particular worlds within the larger cosmos do not simply exist, but rather are built up through encounters: If the hyperobject is a kind of state, cosmopolitics is a kind of process, opening up the important question of temporality within climate change anthropology. As Mathews (2020) discusses elsewhere in this *Annual Review of Anthropology* volume, the concept of Anthropocene posits a long time frame, in which climate change is one expression of economic, political, and cultural systems that have been dominant for centuries. Cosmopolitics, by contrast, can proceed at different rates in different places, from crisis and emergency, and cascading risks and tipping points, to future planetary realignments. Stensrud's (2016) discussion of rituals that express concern over water to mountain deities in indigenous Peruvian communities, Vaughn's (2017) account of coastal mangroves in Guyana that are harmed by sea-level rise, Greenleaf's (2019) discussion of carbon valuation in the Brazilian Amazon, and Battaglia's (2017) examination of people, plants, and water in hydroponics projects in the United States and Papua New Guinea all share a cosmopolitical recognition of mutual concerns.

While we agree with Boyer (2014), that it is important not to lose sight of human perspective and systems of evaluation, and with Hornborg (2016), who cautions us not to abandon critique of

hegemonic systems in the name of ontological pluralism, together these theoretical approaches open up the boundaries of both the discipline and human thought related to climate change. Like Boyer (2014) and Whitington (2016), we recognize that our failure to adequately address the climate emergency to date necessitates the engagement of all our analytical traditions and an acceptance of ontological pluralism that can suggest the possibility of different futures.

EXAMINING CLIMATE CHANGE: KNOWLEDGE, SCIENCE, AND THE PRODUCTION OF PROBLEMS

Anthropologists have increasingly engaged in an exploration of climate knowledge—through scientific practices, as well as in conversation with people in places that scientists seek to study— framing our ability to think through problems and imagine solutions. The work of science produces the climate problem in a comprehensible way, as knowledge is world-making. Climate models, for example, attempt to represent the geophysical processes of the entire planet, rendering the scale of climate change global (Tsing 2005), whereas other observations and experiments build their own worlds when translated from scientific terminology into environmentalist parlance, such as "fingerprint" or "bellwether" (Whitington 2013), or geological epochs (Salazar 2018). Thus, the natural and physical sciences are specific, contextual reflections of nature.

Understanding past, present, and future climate change requires holistic knowledge about how the planet works as a system. This knowledge work, far-flung and reliant on disciplinary sets of expertise, requires specialized training that is often accessible only to a privileged few scientists but that is also vulnerable to charges of bias and uncertainty owing to presumptions that the practices and findings of these scientists are somehow unmoored from human values and cultures. Anthropologists have acknowledged more realistic and accountable relationships among scientists, publics, and decision makers (Jasanoff 2010), as well as the explicit and implicit biases of scientists and their engagements with climate skeptics (Lahsen 2008). How scientists choose to engage (or not) with people and groups who seek to discredit their work raises questions about the privileging of scientific knowledge as well as the challenges to truth claims under particular political conditions.

Scientific knowledge entails developing senses of observation beyond the human scale (Simonetti 2019), skills differently and compellingly cultivated among indigenous people. Long-term observations of complex systems, considered a hallmark of Western science, are also well documented among indigenous knowledge systems, including around climate (Ingold 2002, Cruikshank 2007, Therrell & Trotter 2011, Lazrus 2015, Lempert 2018). Local people may resist "expert" advice in light of their own ontological and political commitments (Lipset 2011, Khan 2014). Attempts to enfold indigenous climate knowledge into dominant epistemic institutions such as the IPCC are increasing, though partial and awkward (Ford et al. 2016). For example, the IPCC has invited contributing authors and drafted guidance notes to help authors include indigenous knowledge in assessment reports, a domain historically populated only with specific types and sources of knowledge. This positioning of climate knowledge—both in indigenous knowledge and in Western science—as authoritative creates radically different forms and contents, often encompassing conflicting visions of the future.

Climate models are emblematic of another sort of conflict of visions. While considered definitive tools for projecting the planet's response to human activity, climate models are burdened by the very complexity that modelers seek to represent. Climate modeling is, at its heart, an attempt to pull together sets of equations about physical parameters to reflect how the earth's systems work in concert and then to run various carbon emission scenarios into the future to predict change. These models are complex science and policy-relevant, highly charismatic tools, bundling together

cultural practices of technology, hierarchies of knowledge, and methodological attempts to work with and to depict uncertainty (Hastrup & Skrydstrup 2013). Researchers building the models are often frank critics of models' limitations and gaps (O'Reilly et al. 2012), whereas people more removed from the messy work of model building are more likely to be seduced by the neat results that emerge from model runs (Lahsen 2005). In addition to anthropological investigations of the practice of climate modeling and modelers' interactions with their work, anthropological knowledge could contribute to designing more realistic prototypes, particularly in building the scenarios and pathways that underpin socioeconomic models (Roscoe 2014).

Climate knowledge is not simply expert and cerebral; it is embodied and material. Climate has a substance to it that flavors the experiences of and solutions to climate change (Dalsgaard 2013, O'Reilly 2018). In a tangible sense, ice has become an actor in environmental negotiations at regional (Orlove et al. 2019) and global scales (Bjørst 2010). Take carbon dioxide (CO_2) as another example, whose state as an atmospheric gas matters, as does its role in animal respiration and plant photosynthesis. Making CO_2 figure into anthropogenic climate change requires conceptual maneuvers that transform molecules of CO_2 into a commodity capable of interacting meaningfully with carbon capture and storage technologies (Günel 2016) or into a fetishized object tradable in international markets (Machaqueiro 2017, Greenleaf 2019). The atmosphere itself takes on an interactive materiality as people cultivate it or rewild it; conversely, the weather can resist human efforts to manage it (Hulme 2015, p. 242).

Scientific knowledge mobilizes political action in the name of environmental governance and policy (Jasanoff & Martello 2004, Pettenger 2007, Oppenheimer et al. 2019). Translating expert knowledge into responses is imperfect, even when evidence-based decision making is the coin of the realm, as in the Antarctic Treaty System (O'Reilly 2017). Expert knowledge of Guyana's mangroves, for example, is not simply about generating information about these difficult-to-know systems, but also about expert awareness of the limitations of their knowledge, making mangroves not just evidence but epistemic tools (Vaughn 2017). Similarly, the ways climate change is altering animal–human relationships shows the danger of treating only socioecological outcomes and not holistic cosmologies of relations (Cassidy 2012). Institutions also collaborate: Graeter (2017) demonstrates such collaboration in her ethnography of a partnership between environmental scientists and the Catholic Church, as the local bishop in Peru's Mantaro Valley utilizes long-standing Catholic notions of social justice and accompaniment in the interest of helping life flourish among environmental degradation.

Anthropology offers an expansive view of human possibility and imagination, owing to our work with the broad diversity of knowledge systems and cultural orientations. Despite a great deal of evidence to suggest the value of traditional, local, and indigenous knowledge for addressing climate change (Orecho et al. 2016, Shawoo & Thornton 2019), these contributions are regularly ignored by policy makers. Similarly, suggestions for steady-state economies or degrowth are often described as impractical (Paulson 2017, Kallis et al. 2018), and alternative emissions accounting proposals, designed in the interest of equity and capability, are dismissed as politically infeasible (Isenhour 2019). Despite these limitations, as described above, anthropologists are increasingly interested in ontological pluralism, "for they are concerned with the possibility of different worlds" (Whitington 2016, p. 8). This concern permits anthropologists to breach conventional knowledge flows in which scientific expertise filters into technocratic decision making, bringing more and varied perspectives to bear on our climate crisis. Yet there remain many gaps in the anthropology of climate science, including further delineations between deconstruction and realism, the ethnography of climate science and policy interactions, and climate modeling and the field sciences—and, relatedly, in the rich conversations between observational scientists and those making future projections.

LIVING WITH CLIMATE CHANGE: COMMUNITIES, ADAPTATION, AND CHANGING SUBJECTIVITIES

Expanding on the discipline's interest in the creation of knowledge, anthropologists have examined the importance of weather and climate in shaping societal concepts (Strauss & Orlove 2003), expanding on long-standing research on disasters, which has established that environmental changes can spark cultural crises. Preexisting vulnerabilities, community structures, and sociocultural capital all shape disaster responses and long-term resilience (Dirks 1980, Oliver-Smith 1996); such studies have obvious analogs with climate change impacts (Oliver-Smith 2013) and have raised questions for anthropologists about how climate hazards instigate cultural responses at different temporal and spatial scales (Crook & Rudiak-Gould 2018). For example, cultural framings of risk, such as those emerging from Mary Douglas's work (Douglas & Wildavsky 1982), have been used to explain both vulnerability and adaptation barriers (Hulme 2009, McNeely & Lazrus 2014).

Increasingly noticeable climate changes are perceptible among many different local populations, as anthropologists have shown (Jacka 2009, Shaffer & Naiene 2011, McNamara & Prasad 2014), often grounding their observations in the experiences of indigenous peoples (Green & Raygorodetsky 2010, Leduc 2010). For example, climate change is altering culturally specific resource use practices, including travel on and use of sea ice (Krupnik et al. 2010), traditional "country" foods [including hunted animals (Lynn et al. 2013)], and irrigation practices as glaciers melt (Orlove et al. 2019). Accordingly, changes in cosmology, cognition, emotion, and belief may be required for local communities to make sense of these rapid climate variations (Crate 2008). These include shifting affect in reciprocal relations with nature (Johnson 2014), reinterpreting change through the framing of taboo violation or interference with sacred landscapes (Byg & Salick 2009), and experiences of blame and guilt (Rudiak-Gould 2014).

Much of the early literature on defining climate vulnerability came not from anthropologists, but from human geographers (Adger et al. 2005). Notions of vulnerability as a function of exposure, sensitivity, and adaptive capacity have been enshrined in IPCC reports, and this framing remains the most common approach to vulnerability studies. Anthropologists have been at the forefront in pointing out that climate change is a threat multiplier of existing risks, including histories of colonialism and resource extraction, which have shaped such vulnerabilities (Cameron 2012, Thomas et al. 2019). Critical examinations of the subjectivities of those people and communities labeled as vulnerable or in need of adaptative capacity have noted that how people come to see themselves as affected by climate occurs in many different ways (Vásquez-León 2009, Rudiak-Gould 2012). On the other hand, Hughes's (2013) work on "the victim slot" points out how the politics of vulnerability allows perpetrators (e.g., oil-producing nations) to take on new labels, casting themselves as fellow sufferers of climate change.

The concept of adaptation has a long history in cultural anthropology, through an interest in how communities and cultures interact with their environments, dating back to Julian Steward and Roy Rappaport (Nelson et al. 2009, Orlove 2009). A range of actions long of topical interest in anthropology, such as mobility, exchange, rationing, pooling, diversification, intensification, innovation, and revitalization, are increasingly important in climate change adaptation research (Thornton & Manasfi 2010). Nature–culture relations and attachment to place are two further important aspects of local lifeways that have long been foci of anthropological research and that now shape adaptation responses (Brugger & Crimmins 2013).

Anthropologists have also been critical in presenting more nuanced explanations of the relationships between climate change and migration, presenting it alternatively as a potential adaptation response in some cases and as a culturally unacceptable solution in others (Mortreux & Barnett 2009). In cases where community-wide relocation may become necessary, anthropologists

have highlighted the need for inclusion of underrepresented perspectives and voices in these decisions, with attention to well-known cases such as Shishmaref, Alaska (Marino 2015). The political ramifications of loss and damage are also engaging anthropologists, such as in discussions of culturally appropriate redress mechanisms and in conversations over quantifying noneconomic losses (Orlove et al. 2014, Barnett et al. 2016).

Anthropology has also highlighted the tensions between identifying the specific vulnerability that many communities face and reifying notions of Otherness. The endangered other or "eco-colonial" view of vulnerability, which assumes an isolation unlikely after decades of colonialism and global environmental change, has been posited as limiting political responses from those considered to be at risk from these crisis narratives (Farbotko 2010). Many communities held up as "climate refugees," for example, do not themselves use this term, and it may serve more as a barometer of Western concepts of threat and risk than as a representation of real migration patterns (Farbotko & Lazrus 2012, Lazrus 2012). Furthermore, in what Orlove et al. (2014) have called the "recognizability" of impacts, the attention to Arctic and Pacific peoples in climate discourse is likely due not only to extremes of temperature or sea-level rise, but also to the savviness and political action of actors in these places, such as through the Alliance of Small Island States (AOSIS) and the Inuit Circumpolar Council, which have engaged anthropologists both as participants and as observers (Ford et al. 2010, Moore 2016).

Given that global climate changes are often experienced at the local level, although with highly variable impacts, anthropology will no doubt continue to be at the forefront of vulnerability and adaptation research (Ford 2009, Brugger & Crimmins 2013, Fiske et al. 2018). Future research foci are likely to include pointed critiques of buzzwords such as vulnerability, adaptive capacity, and resilience and of intellectually loaded concepts such as climate refugees and climate security (Cons 2018, Thomas & Warner 2019). Increased attention to the political nature of climate solutions, and how transformative such actions should be in order to enable just futures for both humans and the nonhuman world, is also key, as the next section shows.

MITIGATING THE CRISIS

One of anthropology's most significant contributions to understanding climate mitigation emerges from the literature on energy and energy transitions. Several collections draw our attention to the ethical nature of questions about what types of energy people think "ought to fuel spiraling demand" (Smith & High 2017), processes of "socializing emission reduction and climate stability into energy policy" (Goodman & Marshall 2018), and the need for anthropologists to explore the significant tensions between interests in energy sovereignty, climate change, and a growing strain on energy resources (Howe 2015a).

Anthropological scholarship on energy transitions has drawn attention to the tendency of the sociotechnical transitions literature to neglect consideration of equity and justice (Howe 2015a, Jenkins et al. 2018, Boyer 2019, Cross 2019). Anthropologists have examined the historical construction and contingencies of links between global social organization, finance, and "cheap energy resources controlled" (Sager 2016, p. 32; see also Mitchell 2011, Smith-Nonini 2016). Smith & High (2017) argue that energy transitions open up spaces to question ideologies, assumptions, and institutions that are simply taken for granted as we transition to low-carbon futures. Mitcham & Rolston (2013) encourage us to think carefully about a fundamental divide in energy ethics: Ethics of technological optimism take energy production and consumption as a fundamental good, necessary for human well-being, whereas a fundamentally different ethic rejects the idea of a linear relationship between energy production and progress and instead gauges the success of mitigation efforts on issues of justice and equity.

Together, these provocations compel anthropology to consider that our dominant mitigation logics are linked to technological optimism and progress. Günel (2016) illustrates this connection through examination of carbon capture and storage technologies, arguing that these projects "build on the relentless growth drive that characterized industrial production in the twentieth century, clinging to the vision that the fossil-fuel-driven economy is infinitely expandable" (p. 37). She argues that this optimism has deepened reliance on cheap coal, which is seen as particularly well suited for developing countries facing energy insecurity and poverty. Similarly, Isenhour (2016) traces the technological optimism embedded in mitigation logics with an analysis of "An Ecomodernist Manifesto,"[2] outlining the processes through which technological improvements in one locale can lead to emissions leakage, an increase in total global emissions, and a shift in ecological burdens to developing countries without the political and economic power to resist.

Anthropologists have also invested significant intellectual effort to document, theorize, and critique the development of market-based, or neoliberal, environmental governance (Büscher et al. 2012, Peterson & Isenhour 2014). Shifting responsibility for environmental welfare toward private and voluntary actors, market-based climate solutions favor capital investments and individual responsibility rather than coordinated action. From an economic perspective, climate change is envisioned as a market failure (Zhang 2017), one that can be mitigated with improved education of rational consumers (Isenhour 2010, Sahakian & Dobigny 2019), with investments in alternative technologies, such as low-carbon transport (Gaither et al. 2016), and with the manipulation of prices via internalization of externalized costs, as in the case of carbon pricing (Machaqueiro 2017).

This market-based logic has increasingly penetrated mitigation efforts at multiple scales, including the United Nations Framework Convention on Climate Change (UNFCCC) (Ciplet & Roberts 2017), where market mechanisms have been an integral component since the Kyoto Protocol, which allowed emissions trading schemes through the Clean Development Mechanism (CDM) and the Joint Implementation Mechanism. These mechanisms are often understood as reciprocal and fair market exchanges of technological assistance for carbon credits, but several scholars have encouraged anthropologists to unravel these relations. Dalsgaard (2013) explores the tensions between commodification and the logic of the gift, while Hornborg (2009) argues that market-based exchanges such as those associated with CDM are often understood as reciprocal but that "fundamental to these arrangements is that the exploited are led to believe that they should be grateful to their exploiters" (p. 243). Indeed, a significant literature suggests that CDM projects and other offset projects have been riddled with concerns about unintended incentives and consequences, including key questions about the effectiveness of market-based initiatives, rebound effects, and the perpetuation of ecologically unequal exchange (Isenhour & Feng 2016, Fiske et al. 2018).

Despite these challenges, carbon markets and the financialization of mitigation projects continue apace. Günel (2016) documents the European Emissions Trading System, launched in 2005, which operates in 31 countries and covers about 45% of the European Union's emissions, while Tripathy (2017) explores the proliferation of the global green bond markets and the general growth of climate finance. Both describe the processes by which earnings are expanded through the commodification of the environment and ecosystem services. Variously linked to capital's search for profit-making ventures in the context of stagnating opportunities for production-based investments (Hornborg 2016) or the expanded use of finance as a social medium for organizing

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[2]An Ecomodernist Manifesto" was published by a collaboration of scholars associated with the Breakthrough Institute. The document can be found here: **http://www.ecomodernism.org/**.

society (Pitluck et al. 2018), the increased financialization of carbon mitigation projects reflects a long "genealogy of exchangeable nature" (Igoe 2017, p. 25).

This approach to commodification and mitigation through the market has recently been observed in another realm, separate from energy but also related to mitigation—namely, the capacity of ecosystems to absorb carbon—through a wide range of payment for ecosystem services (PES) projects. Covering the gamut of PES schemes, anthropologists have studied efforts designed to incentivize communities to protect the carbon sequestration services provided by local forests (Leach & Scoones 2015, McElwee 2016, Paladino & Fiske 2017), marine or coastal environments (Lau 2013), and agricultural soils (Jørgensen & Termansen 2016), although there have been questions about just how market-based and neoliberal PES actually is and whether it can also open up opportunities for cosmopolitical engagement (McElwee et al. 2020).

REDD+ (Reducing Emissions from Deforestation and Forest Degradation to foster forest conservation) programs have received a significant amount of attention from anthropologists. While the intent of these programs was, in part, to empower local communities to be key partners in conservation, development, and climate mitigation, "these expectations are inconsistent with reality" (Kohler & Brondizio 2017, p. 245) and can instead seek to govern people and their social relations under the guise of environmental policy (McElwee 2016). For example, Lunstrum (2016) examines how a conservation initiative in Mozambique "sheds light on how conservation, agricultural extraction and climate change mitigation—all forms of land acquisitions that incite dislocation—come together to produce novel patterns of environmental displacement, placing profound pressures on rural communities and their abilities to occupy space and access resources, including labor opportunities" (p. 142). Some REDD+ projects can move practitioners past notions of repair and remediation and take as a starting point and end point that coping with loss will also be partial and imperfect (Rojas 2016). Conversely, other REDD+ programs have raised a whole host of concerns about efficacy as well as issues of consent, participation, equity, human rights, and other issues of distributional and procedural justice (Paladino & Fiske 2017).

Market-based mitigation techniques rely on rational choice models of behavior that assume aware and informed consumers or businesses will freely and voluntarily make green choices for the environment, but a wide array of scholarship has demonstrated that, in reality, more sustainable patterns of consumption have failed to emerge (Sahakian & Dobigny 2019). Well-documented research instead suggests that attitudes and knowledge do not always translate into actions when consumption decisions are embedded in social logics and that even the efforts of green consumers can result in significant rebound effects when savings are reallocated to more carbon-intensive expenditures (Csutora 2012). Indeed, even the most well-intentioned corporations, individual consumers, farmers, or policy makers often run into significant structural barriers when trying to mitigate their emissions, a problem that is linked to the very nature of voluntary participation and uncoordinated action in a neoliberal era. Businesses and individuals alike are hesitant to make investments in less carbon-intensive endeavors, for fear of undermining competitiveness or risking social ostracism when their social peers and competitors choose not to or are unable to participate (Isenhour 2010).

Looking to decarbonization beyond energy transformations and carbon sinks in ecosystems, anthropologists have also documented significant resistance to the imposition of value systems and restrictions across a wide array of geographical and cultural contexts, including urban communities displaced by market-based low-carbon and green development (Checker 2015, Patel 2015); men and women forging new, less carbon-intensive solutions, including alternative means of living and networks of production and consumption (Lockyer & Veteto 2015); and indigenous communities that have rejected the monetary logics associated with the commodification of

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nature or that have struggled for power in negotiations to ensure greater equity and inclusion (Doane 2014). Anthropologists are also increasingly participating in activist research and social movements designed to confront climate change (Lindisfarne & Rayner 2016), including movements centered on alternative economies and degrowth (Demmer & Hummel 2017, Paulson 2017), on more participatory and equitable mitigation programs (Hicks et al. 2016), and on climate justice (Walker-Crawford 2017).

CONCLUSIONS

Climate anthropology intersects with long-standing concerns in anthropology generally: an interest in human relationships with the environment, attention to inequality and cultural difference, and working through how people define, understand, mediate, and solve problems. Anthropological research can show how people adapt to rapidly changing environments and point out diverse notions of value and knowledge that can help us understand and respond to the climate crises in more just and effective ways. We have shown the rapidly expanding anthropological attention to climate change beyond locally based ethnographic examples into the domains of climate science, adaptation, and mitigation. These categories help sort anthropological endeavors into the epistemic frameworks of the IPCC and the political work of the UNFCCC. However, anthropological knowledge tends to be sidelined in these institutions, when it is included at all. Exclusion of this literature is a lost opportunity, as our review has traced the multiple dynamic, critical, and grounded anthropological works that can help us expand climate knowledge and solutions more broadly.

In addition, we have sought to identify knowledge gaps alongside the burgeoning body of research conducted in climate anthropology. These gaps indicate opportunities for research as well as limits in contemporary climate knowledge that can be addressed, in part, by cultural anthropologists. However, the most significant gap in climate research is a failure to attend to the climate emergency as such, in our research, our engagement, and our everyday lives. Humanity's efforts to respond to climate change have, to date, been woefully insufficient, leaving us with very little time to address this shared and equally urgent crisis (IPCC 2018).

In some ways, calls for more research suggest that additional knowledge is needed before making decisions to reduce carbon emissions and transition away from fossil-fuel combustion. Yet we already know enough about climate change—and have for some time—to know that an energy transition toward low-carbon sources should already be happening and that our failure to insist on this transition is a failure of knowledge, of politics, and of the systems we have built around ourselves. Perhaps one of the greatest assets of our disciplinary approach is the broadening of perspective and opening of diverse solutions and possible transformative futures—made possible through the generously shared ontological orientations of our uniquely situated research partners. Rigorous consideration of equity, injustice, culture, nature, and meaning alongside immediate, urgent, international climate action is a charge that many anthropologists are taking up, as it is in this moment that our discipline can lead the call to radically rethink currently dominant and all-too-often unjust climate solutions and to reimagine the future of human–atmosphere relations.

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