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Anthropology and the Anthropocene: Criticisms, Experiments, and Collaborations

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Abstract

The Anthropocene, a proposed name for a geological epoch marked by human impacts on global ecosystems, has inspired anthropologists to critique, to engage in theoretical and methodological experimentation, and to develop new forms of collaboration. Critics are concerned that the term Anthropocene overemphasizes human mastery or erases differential human responsibilities, including imperialism, capitalism, and racism, and new forms of technocratic governance. Others find the term helpful in drawing attention to disastrous environmental change, inspiring a reinvigorated attention to the ontological unruliness of the world, to multiple temporal scales, and to intertwined social and natural histories. New forms of noticing can be linked to systems analytics, including capitalist world systems, structural comparisons of patchy landscapes, infrastructures and ecological models, emerging sociotechnical assemblages, and spirits. Rather than a historical epoch defined by geologists, the Anthropocene is a problem that is pulling anthropologists into new forms of noticing and analysis, and into experiments and collaborations beyond anthropology.

INTRODUCTION

The term Anthropocene came into being from an unlikely collaboration between an atmospheric chemist and a freshwater biologist (Crutzen 2002, Crutzen & Stoermer 2000). They sought a word that could describe how the impact of human activities on global ecosystems had extended to biogeochemical cycles and was leaving a geological signature. It was a word whose time had certainly come. Similar terms had failed to gain traction in preceding decades, including Antonio Stoppani's "anthropozoic" (in 1873) and Andrew Revkin's "anthrocene" (in 1992) (Palsson et al. 2013). Since 2000, the Anthropocene has inspired numerous conferences and publications across the natural sciences, social sciences, humanities, and arts (Swanson et al. 2015). By now, this effervescence of creativity and collaboration exceeds a comprehensive review: Even within the discipline of anthropology (capaciously defined), the range of responses to the Anthropocene has proliferated beyond the capacity of a single reader. In what follows, therefore, I seek to provide not an exhaustive review, but a cartography of the main responses and the theoretical and methodological innovations that the term has inspired in the published English language literature, as well as in work in French, Spanish, and Italian.

Many scholars agree that awareness of a specifically global environment (and the possibility of its degradation) is a response to the emergence of climate change science and systems modeling after World War II (Edwards 2010), to Cold War concerns about the circulation of radionuclides as fallout from atmospheric nuclear tests (Masco 2010), and to images of the Earth from space that helped people visualize a planetary ecosystem (Jasanoff 2004). While recognizing nineteenth-century antecedents, Hamilton argues that the Anthropocene concept is quite new and arose in response to Earth systems modeling in the 1980s (Hamilton & Grinevald 2015). The capacity to perceive global environmental change, like our conception of the "global" (Tsing 2005), required political and scientific work.

The Anthropocene has not, as yet, become an analytic concept that is widespread in published work by scholars from the Global South (Baviskar 2015, Garcia Acosta 2017), with the prominent exceptions of Eduardo Viveiros de Castro and Deborah Danowski in Brazil (Danowski & Viveiros de Castro 2016). A recent review of engagement with the Anthropocene by anthropologists and political ecologists in Latin America, for example, finds that they are as yet more concerned with socioenvironmental conflicts around natural resources, territory, environmental justice, and non-Western ontologies (Garcia Acosta 2017, Ulloa 2017). Regional or national scales of political/environmental analysis and action remain, for now, more relevant than the global or longue durée scales called for by the Anthropocene. Emerging scholarship on mining in South Africa (Green 2015) and Chile (Tironi et al. 2018) suggests that this focus is already changing, as the geological and hydrological aspects of the Anthropocene become of increasing concern.

Suggestions for the timing of the Anthropocene range widely, including the paleolithic use of fire, Neolithic domestication (Smith & Zeder 2013), the depopulation and forest recovery produced by the Columbian exchange in 1610 (Lewis & Maslin 2015), the late-eighteenth-century Industrial Revolution in Great Britain, or the post–World War II Great Acceleration with the associated J-curves in consumption of multiple natural resources (Lewis & Maslin 2015, Steffen et al. 2007). The Anthropocene of Earth systems science, which focuses on the global-scale impacts of human activities on simulations of the Earth system (Steffen et al. 2007), is quite different from the Anthropocene of geologists. For stratigraphers, the question of the beginning of the Anthropocene depends on whether there is a globally distributed and legible stratigraphic marker that can provide a "golden spike" marking the boundary between the Anthropocene and Holocene epochs (Swanson 2015). In 2019, the Anthropocene Working Group recommended to the International Commission on Stratigraphy that the Anthropocene epoch should be marked by the

post–World War II Great Acceleration, with the nuclear tests of 1945–1963 as leading candidates (Subramanian 2019). In contrast, social scientists and historians are quite comfortable with uneven periodizations, where many processes, starting at different times and places and beyond the usual locations in Europe (Morrison 2015), have produced the environmental impacts that we are now detecting.

In an influential article, historian Dipesh Chakrabarty argues that the modern social sciences emerged during the bubble of fossil fuel–powered imperialism that runs from the early nineteenth century to the late twentieth century and that our key theories might have to be revisited accordingly (Chakrabarty 2009). It would be tempting to follow this suggestion and describe the Anthropocene as a story of modernist rupture, a single event that justifies ignoring or encapsulating earlier scholarship. In this review, however, I trace connections between earlier work on the causes and consequences of capitalism, empire, racism, and settler colonialism, and I argue that, in retrospect, we can see that this scholarship was wrestling with the Anthropocene all along (Mintz 1960, 1985; Wolf 1982). Plantations in the Caribbean depended on imagining enslaved Africans as less than human in order to transform island ecosystems. As Gilroy (2018) points out, the disciplining of enslaved humans "supplied the infrastructure of Atlantic modernity" (p. 5) and helped power the Industrial Revolution in Britain. The increasingly powerful effects of secularization (Asad 1993, Ghosh 2016, Harding 2010), which sustained modern statecraft and scientific knowledge (Shapin & Schaffer 1985), sustained ways of acting and thinking that drove the ever-increasing scale and intensity of human impacts on ecosystems around the world.

In what follows, I take up four main topics. First, I outline critical approaches that examine the Anthropocene as a story of mastery and control that erases or overemphasizes the responsibility of some humans (white, male, Northern) for global environmental destruction, and I describe investigations of the political and technical projects that may be inspired by the Anthropocene concept. Second, I describe how the Anthropocene has inspired new thinking on secular/nonsecular and nature/culture distinctions, on more-than-human relations, and on deep time. Third, I describe how anthropologists have combined their capacity to attend to the scales of human experience with critical attention to the spatial and temporal scales of the Anthropocene as a world-transforming process, including by experiments with natural history, environmental history, and historical ecology. These methodological and theoretical experiments expand the tool kit of anthropology and are bringing anthropologists into uneasy collaborations with other disciplines. Fourth, I describe recent Anthropocene ethnographies that have begun to think about the futures that are made visible by the Anthropocene, including visions of catastrophe and apocalypse, extinction, the decline of modern narratives of development and improvement, and an abandonment of the vision of autonomous and bounded humans.

THE ANTHROPOCENE AS AN OBJECT OF CRITIQUE

Earth systems modelers look at the effect of the human species upon the Earth system and warn of the danger of exceeding critical tipping points (Rockström et al. 2009). Numerous scholars have pointed out that the "Anthropos" in this Anthropocene, with its thinking about species-level impacts, conceals differential responsibilities and vulnerabilities and that particular humans, such as those in the fossil fuel–powered British Empire (Bonneuil & Fressoz 2016, Malm & Hornborg 2014) or those engaged in the sixteenth-century North Atlantic political economy (Moore 2015), are responsible. Other critics of the Anthropocene concept are concerned that it overly emphasizes the power and agency of autonomous human subjects (Haraway 2015), or of some humans in particular (white, male, European), producing a kind of human exceptionalism or Eurocentrism. Reacting to the possibility that the Anthropocene might act as a one-world world (Law 2015)

that seeks to define a single, authoritative version of reality, de la Cadena argues for attention to the "anthropo-not-seen, entities that ignore the separation between nature and culture" (de la Cadena 2010, 2015). Shiho Satsuka argues, alternatively, that different ontologies can be negotiated even when they are only partially sensed (Satsuka 2018). As Harding (2019) points out, perhaps we should focus on the political conflicts that make some ontologies prevail over others.

In 2006, Crutzen (2006) suggested that the failure to reduce global greenhouse gas emissions could make climate engineering necessary. Since then, solar radiation management has gone from being a forbidden topic to the subject of research and policy conversation (Lawrence & Crutzen 2017). Although solar radiation management is not yet fully formed either as technology or as policy, this is recognizably a technocratic Anthropocene that seeks to govern the world in the name of the kind of knowledge that emerges from Earth systems modeling (Rockström et al. 2009, Steffen et al. 2011). Examples of this type of technocratic Anthropocene include the proposals of the ecomodernist Breakthrough Institute, which has called for an embrace of climate engineering (Asafu-Adjaye et al. 2015). Within the United Nations Framework Convention on Climate Change (UNFCC) process, speculative technologies of bioenergy with carbon capture and storage (BECCS) have come to be necessary assumptions in order to sustain the credibility of emissions reductions policies (Mander et al. 2017).

This technocratic Earth systems Anthropocene, with its erasure of power and inequality, can be analyzed as an ideological project that justifies climate engineering or as a distraction from the political and economic processes that are causing environmental destruction in the first place (Demos 2017, Malm & Hornborg 2014). Drawing on the political ecology research tradition of linking ecological processes with political economy, Ogden and colleagues (2013) propose a research agenda that focuses on the governmental and technical assemblages that seek to govern the Earth system in the Anthropocene. Studies such as these complement ethnographic accounts of the scientific and diplomatic forms conjured by the Antarctic Treaty system (O'Reilly 2017) and build on insights about the power of depoliticization in development organizations (Ferguson 1994) or environmental bureaucracies (Mathews 2011).

Infrastructure, an analytic term drawn from science and technology studies (STS), has been helpfully applied to connect people's lived experience with large-scale systems effects, including the landscape transformations produced by the Anthropocene (Hetherington 2019). A particularly productive engagement between the anthropology of infrastructure and the Anthropocene comes from Carse's (2014) study of the Panama Canal Watershed, in which Carse argues that the landscape itself can be thought of as an infrastructure. This perspective stands in helpful distinction from formulations of infrastructure as an information network.

THE ANTHROPOCENE AS A STIMULUS FOR THINKING DIFFERENTLY

Many scholars have pointed out that the Anthropocene undoes the nature/culture separation, which has been foundational to Western culture and to the discipline of anthropology (Latour 2017a). The dissolution of the nature/culture binary produces a kind of temporal dislocation, where natural scientists are forced to think historically about the socionatures that they study (Danowski & Viveiros de Castro 2016). Furthermore, the effort of the natural sciences to disenchant the world fails when Earth systems modeling reveals the self-organizing capacities of life called Gaia (Latour 2017b). As systems modeling undoes the possibility of modernist prediction, it also undoes the modern project of secularization and the banishment of sorcery, witchcraft, and spirits to the domain of belief (Asad 1993). Other entities and forms of explanation have become possible, including spirits (Bubandt 2017). Szerszynski (2017) identifies emerging "geospiritual

formations," what he calls "high gods," which explain Earth transformations, contrasting these with "low spirits" of place. How do scholars handle such theoretical formulations in research practice? For Keck (2019), writing about bird watching in Hong Kong, wild birds act as sentinels for the ghosts of birds that had been killed to prevent the spread of disease. Harding (2020) suggests strategies of bracketing within the realist genres of journalism and ethnography, where supernatural beings can be acknowledged without being re-excluded as "beliefs." In "Golden Snail Opera," experiments with genre make it possible to include ghosts along with rice farmers in Taiwan (Tsai et al. 2016).

Multispecies anthropology and feminist science studies move beyond the nature/culture divide, drawing on human capacities to notice relations with plants, animals, and soils. These approaches can be expanded to nonliving beings such as stones (Reinert 2016), or to invisible nonsecular beings (Fernando 2017), rejecting the boundary between life and nonlife as the distinction that matters (Povinelli 2016). Native American and other indigenous conceptions of reciprocal relations with plants, animals, rocks, and spirits (Kimmerer 2013, Rose 2004, Viveiros de Castro 2019) are clearly neither secular nor linked to modern ideas of progress. The denial of relations of responsibility toward humans and nonhumans is increasingly seen as critical to the world-transforming ecological changes of the Anthropocene from the North Atlantic slave trade (Gilroy 2018, Vergès 2017) to settler colonialism in Australia (Rose 2011b). Native American scholars have pointed out that for them the Anthropocene is a continuing experience of dispossession, genocide, ecological domination, and environmental transformation (Davis & Todd 2017), with ongoing disruption of interdependent relations and reciprocities with plants, animals, spirits, elements, or places (Kimmerer 2013, Whyte 2018). The theme of responsibility and relationality with nonhumans is also a feature of anthropologies of settler colonialism in Australia (Rose 2011b), feminist science studies (Haraway 2008), and feminist anthropology (Tsing 2015). If the forms of relationality and ethical responsibility toward nonhumans are a key feature of accounting for Anthropocene landscape transformations, the challenge is to follow how these relationships have large-scale consequences.

With its call for thinking about deep time and global-scale environmental change (Chakrabarty 2009), the Anthropocene challenges anthropologists to rediscover or invent analytics that allow them to link human and natural history and to move nimbly across scales in time and space. This task is not as alien as it might first appear. Fernand Braudel (Braudel 1972) coined the terms *evenement*, *conjuncture*, and *longue durée* to juxtapose the long-term endurance of the rhythms of daily life, the shorter-term decadal scales of *conjunctures*, and the dramatic *evenements* of political history. John McPhee combined the inhuman scales of geological time with capitalist processes of mining and the lived experience of earthquakes (McPhee 1994). Science fiction writer N.K. Jemisin juxtaposes geology and race in her *Broken Earth* trilogy (Jemisin 2015). Within anthropology, the theme of contrasting different temporalities was present in Evans-Pritchard's *The Nuer*, which combined an account of the seasonal movements of pastoralists who followed cattle across the landscape with the structural time of lineages (Evans-Pritchard 1940). Through skilled storytelling and analytic choices, all these authors are able to link humans' experiences of their environments with other scales and temporalities.

The efforts of global environmental historians to link the scale of human experience with global-scale processes such as the international guano trade (Cushman 2014) or cotton cultivation powered by imperialism (Beckert 2014) are of increasing interest for anthropologists of the Anthropocene. Historians often find unintended consequences and surprises, as actions taken at a particular time and place are revealed, in retrospect, to have had disastrous long-term effects. The sugar plantations of the seventeenth- and eighteenth-century European empires in the Caribbean reconfigured hydrologies, making landscapes suitable for disease-carrying mosquitos

(McNeill 2010). Carbon dioxide emitted by the Industrial Revolution was later revealed to cause climate change, deltas around the world are now threatened by sediment capture by upstream dam building during the twentieth century (Morita & Suzuki 2019), and plant pathogen epidemics are caused by international trade (Brasier 2000). Unintended landscape transformations emerge, with a greater or lesser delay, as feral effects of modular and replicable projects, such as plantation monocultures, industrial agriculture, and international trade (Tsing et al. 2019).

Cattle spread by Europeans in the New World spread beyond the intentions of colonial rulers to transform landscapes from New England to Panama (Anderson 1994, Ficek 2019). The botanical legacies of African smallholders who produced the food that made the plantation system possible (Carney & Rosomoff 2010) are present in contemporary New World landscapes. The expanding scale and intensity of plantation agriculture around the world (Li 2017) are currently producing ecological consequences such as the coffee rust fungus epidemic in Central America (Perfecto et al. 2019). Studies of industrial agriculture find similarly unintended ecological and biological transformations, as in Blanchette's account of the microbial ecologies that emerge in industrial pig farms in the American West (Blanchette 2015) or the bird flu that emerges in industrial chicken farms in China (Keck 2019). Expanding cities can unleash unintended ecological consequences, as in the emerging urban ecologies of human/stork relations in waste dumps in Kampala, Uganda (Doherty 2019), or the unintended ecologies of ruins in Berlin (Stoetzer 2018).

RESPONDING TO THE CHALLENGES OF A CHANGED WORLD

A major challenge is to figure out analytic categories that anthropologists can use to trace the effects of human and more-than-human relations at larger spatial and temporal scales. Earlier work on globalization suggests strategies for following how particular interactions come to be taken as being of large-scale significance (Tsing 2005). Rather than choosing one or another "-cene" (Anthro-unseen, Capitalocene, Plantationocene, etc.), Tsing et al. (2019) follow Haraway (2016) in arguing that multiple analytics are necessary. We have proposed a revisiting of the classic anthropological category of structure as it emerges through comparison of landscape patches such as a plantation, a city, or a nearby smallholder farm. Landscape patches are analytically uniform while containing internal heterogeneity: We can learn to notice patches through practices of observation that lead to gradual attunement to the morphologies and histories of beings within patches. Other analytics include systems accounts such as political economy, ecological modeling, and spirits. Each of these systems accounts projects from the scale of human phenomenological experience to give accounts of larger scales in time and space or perhaps of other cosmopolitical formations.

The global infrastructure of measurement, which sustains global climate measurement, is good to think with here (Edwards 2010). Climate scientists know it takes great effort to add new entities to be measured by weather stations and modeled in computers. Something is lost by this necessary simplification, but the capacity to see global climate change becomes possible. Systems thinking is adequate as long as we see these as "models of," which increase understanding, rather than "models for," which can inform uncritical state projects of social and landscape transformation (Viveiros de Castro 2019). Thinking about systems in this way makes visible the particular value of anthropologists' capacity to notice morphology, metamorphosis, disaster, and sudden change. With our capacity to be open to the "ontological anarchy" of the world (Viveiros de Castro 2019), we can wonder if a tree is a spirit, a source of firewood, or something else. Thinking of systems as a projection or a sketch that emerges from observation helps us imagine other modes of analysis and representation, such as line drawings of tree morphology and diagrams of ecological transects

and landscape structures (Mathews 2018), diagrams of coordination between different temporal processes in forests (Gan & Tsing 2018), or fish population estimates as aggregates of more-than-human relations (Swanson 2019). The diagrams produced in Latour's collaboration with critical zone scientists (Arènes et al. 2018) or in the collaboration between anthropologists and landscape architect Feifei Zhou in Tsing's *Feral Atlas: The More-than-Human Anthropocene* (Tsing et al. 2020) are nonrealist representations that capture some aspect of the processes of interest, while explicitly relegating to the background what remains indeterminate or unknown.

Experiments with new kinds of research methods and collaborations are a feature of recent work on the Anthropocene. Tsing's *Feral Atlas* project (Tsing et al. 2020) brings together anthropologists, scientists, artists, and humanists to describe the feral effects of infrastructures such as dams or oil rigs that stimulate invasive species, pathogens, and toxicities. Feral effects emerge through relations among people, plants, soils, and microbes in particular landscape patches. Scholars in the Aarhus University Research on the Anthropocene (AURA) research group, also led by Tsing, have explored the landscapes of brown coal extraction in Denmark. Focusing on contingent histories of encounter among people, soils, and plants, these researchers describe "social and natural histories to show the emergence of unintended anthropogenic effects" (Bubandt & Tsing 2018, Forssman & Root-Bernstein 2018, Gan et al. 2018, Hoag et al. 2018). Although their approaches are in conversation with multispecies ethnography (Kirksey & Helmreich 2010), the authors are concerned with more than the living, tracing for example how sandy soils become social through histories of mining that produce collapses (Højrup & Swanson 2018). Precisely because so many Anthropocene processes are unintentional consequences of past events, traditional methods of participant observation and ethnographic interview need to be expanded to include attention to the traces of the past in present-day landscapes. Anthropologists must move beyond talking to others and learn to trust their own senses and observations. These "arts of noticing" are attuned to the details of intertwined ecological and social processes (Tsing et al. 2017). In my own work in Italy, the relations among people, soils, plants, and diseases are recorded in the morphologies of trees and in landscape form (Mathews 2017, 2018). Attending to morphology is a way of stepping outside the present and attending to longue durée Anthropocene phenomena and of attending to the slow violence of toxicity and disaster, as in Nixon's (2009) account of the environmental picaresque. Similarly, historian Kate Brown uses arts of noticing to detect the morphological impacts of radioactivity on plants and human bodies in post-Chernobyl landscapes (Brown 2019).

A shared commitment to following the different temporalities of environmental processes has made the empirical findings of historians and anthropologists of increasing interest to natural scientists. As Latour (2017a) points out, natural scientists of ecological processes can no longer assume a nature unaffected by human presence. In this situation, scientists can and do think historically, as do the climate change scientists in Amazonia described by Rojas (2016), who see themselves as embedded in socioenvironmental landscape transformations. This interest in environmental history and historical ecology (Crumley 2017) has opened a possibility for collaborations among researchers in the humanities, the social sciences, Earth systems science, and scenario modeling (van der Leeuw et al. 2011). Examples of transdisciplinary collaborations include the work of the AURA group and the *Feral Atlas* project, the participation of archaeologist Carole Crumley in the IHOPE (Integrated History and Future of People on Earth) project, the Rivers of the Anthropocene project at Indiana University–Purdue University (Kelly et al. 2018) and the Plantationocene project at the University of Wisconsin (Moore et al. 2019). There are many other such projects. At least for now, the Anthropocene is a term that inspires collaborations among natural scientists, social scientists, humanities scholars, and artists. Collaborations or group research projects require difficult conversations and active listening across epistemic, ontological, and theoretical differences, as in Haraway's collaboration with biologist Michael

Hadfield (Hadfield & Haraway 2019). Geographer Noel Castree reports that there are openings for engagement with the geosciences that are concerned with the Anthropocene, but that humanists and social scientists will have to invest time and energy to join in these conversations (Castree 2014). Many younger anthropologists have sought training in the natural sciences relevant to their fields of study in order to understand and collaborate with natural scientists and to go beyond the more usual anthropological roles of critic or analyst.

RECENT ANTHROPOCENE ETHNOGRAPHIES

Thinking about the Anthropocene draws scholars into thinking about the future and often into imagining our present from the point of view of the future. Zalasiewicz (2008) imagines the geological traces that humans will leave in the remote future, while historians Oreskes & Conway (2013) narrate our present environmental crisis as written by historians some centuries from now. A key feature of Anthropocene scholarship, therefore, is a reconsideration of our ethical and political relation to the future. The long lives of the toxic products of present-day human activities demand research practices that trace the long-term effects of human products, from plastic in the bodies of seabirds (Liboiron 2015) to radioactivity in the Chernobyl exclusion zone (Brown 2019). For Liboiron, the material properties of plastics demand other forms of representation, perhaps as a miasma or a cloud, demonstrating an enduring toxicity that escapes analyses of the Anthropocene as a narrative of human control (Liboiron 2015). Radioactivity, with its ultra longue durée consequences, draws anthropologists to study how messages are left for the future, as in the warning signs that might be left outside long-term toxic waste depositories (Hecht 2018). Ethical relationships to the ancestors and to the future also emerge in relation to the extinction of species, what Rose calls "double death" in her study of the settler colonial landscape transformations that threaten the Australian dingo (Rose 2011b) and the flying fox (Rose 2011a). Native American and feminist scholars lead the way in showing how caring for damaged landscapes may be one way of reaching to the future, as in Kimmerer's description of care for mosses (Kimmerer 2013) or Tsing's argument that we are currently making a living in the ruins of capitalist landscape transformations (Tsing 2015). Life in the ruins is attentive to relations with nonhumans and to histories of capitalist and settler colonial landscape transformation, and it leads to a much humbler kind of hope than the autonomous human subjects and dreams of wealth and progress that have driven global environmental change. Tsai finds such hope in the laborious practices through which small farmers weed out invasive golden apple snails in Taiwan (Tsai 2019). This hope comes from being attentive to practices and ecological relations rather than to the grand narratives of development (Escobar 1995), progress, and control that contributed to the Anthropocene in the first place.

Anthropocene futures encounter a dense field of thinking about and acting in the name of the environmental futures (Mathews & Barnes 2016). For Masco (2015), the slow disasters of the Anthropocene might destabilize the technomilitary formulations of a future nuclear apocalypse that have prevented political mobilization or social change in the United States. He suggests that building and caring for infrastructure could demand a collective political response "embracing middle and deep futures as a collective security project," bypassing the apocalyptic thinking that has underpinned the post–World War II Great Acceleration (Masco 2015). Environmental futures look very different when the separation between nature and culture is no longer tenable. Conservationists struggle to care for present-day landscapes while simulating the future movements of plants, animals, and diseases in response to climate change and social transformation, and they worry about the risk of abandoning still charismatic categories such as "nature." Urban natures, networks of connected nature areas, and rewilding projects that seek to bring back former species, or even

extinct species, are practices of Anthropocene conservation (Lorimer 2015), as are simulations that use big data to imagine the possible impacts of climate change on ecosystems (Hare 2015).

One effect of the Anthropocene is that ecosystems are changing so rapidly that the past is no longer a guide to the future. Ethnographies of fire scientists and fire managers, for example, find that increasing droughts and heat waves are destabilizing people's capacities to predict how forest fires will behave in California (Petryna 2018) and in Australia (Nyquist 2019). Action in relation to such uncertain futures requires a kind of speculative commitment to a conceptual horizon (Petryna) or regime (Nyquist) that fire managers can link to their experience of fire and landscape. Concepts such as regimes or horizons build on phenomenological approaches to human experience of the environment (Ingold 2011a,c) but seek analytic categories that are farther from phenomenological experience, as in Zee's description of moving sand dunes and desertification in China that inspire multiple imagined futures (Zee 2017).

A rich crop of specifically Anthropocene ethnographies is beginning to emerge. For Boyer (2019), "energopower" animates the legal and political lives of wind energy in Mexico, while Howe (2019) addresses the material textures of wind power itself, as it gathers trucks and windmills and threatens the lives of birds and animals. Their duography combines the political, discursive, and institutional life of wind power, with its relational and more-than-human effects. For historian Gabrielle Hecht (2018), radioactivity itself is an "interscalar vehicle" that she follows across the deep time of natural nuclear reactors, the spaces of metropolitan France, the landscape of colonized Gabon, and the deep futures of long-term nuclear waste storage.

Infrastructure is the systems category in two accounts of the destruction and care of coastal mangroves. Bond (2017) describes how the imperial energy infrastructure of oil refineries in the Caribbean caused the death of mangroves in Saint Croix and how this destruction gave rise to scientific knowledge and popular awareness of the need to care for mangroves. Sarah Vaughn (2017) follows efforts to respond to climate change by restoring mangroves in Guyana. Scientists struggle to treat these plants as a manageable infrastructure, models fail, and mangroves pull experts into collaborations with other people (Vaughn 2017). For both scholars, it is the larger-scale properties of infrastructure (oil refineries, coastal embankments) that allow them to connect mangroves to the Anthropocene.

A more traditional large-scale analytic is the discourse or imaginary. Two recent ethnographies engage explicitly with the Anthropocene as a discursive formation. Although Kawa's recent ethnography of human relations with plants and soils in Amazonia is critical of the Eurocentric aspects of the Anthropocene narrative, he finds the term helpful as a way to think about environmental crisis and calls for a renewed attention to noticing and caring for the ecological relations on which all humans depend (Kawa 2016). In her study of tourism in the Bahamas, Moore (2019), in contrast, gives less weight to ecological relations, focusing instead on the selective histories of the colonial plantation and global environmental change that animate tourist imaginaries.

In studies of chemical, nuclear, and other forms of toxic waste, larger-scale and longer-term stories come from the power of the state to classify some landscapes as waste and the ability of waste itself to move, transform, and escape these classifications. Klinger (2017) describes the confluence between the geopolitical goals of nation-states and the toxic environmental consequences of rare earth mining and processing, causing mining to take place on distant frontiers inhabited by racially marked Others. Anthropologists of North America have a particularly important role in investigating the post–World War II Great Acceleration, which propagated American consumer lifestyles around the world. During the Cold War, the white nuclear family form was linked to racialized landscapes of safety and sacrifice (Ebron & Tsing 2017). Voyles (2015), for example, shows how Navajo land in the U.S. Southwest was considered waste land, suitable for uranium and coal mining, which produced toxic landscapes that affected the health

of Native American people. Masco shows how the possibility of destruction by nuclear war underpinned the political and economic stability of the Cold War state (Masco 2008), while mining and processing of uranium produced toxic landscapes in the U.S. Southwest (Masco 2006). The failure of modernist structures of control in the face of the mobility of radioactivity is the theme of historian Kate Brown's (2013) study of nuclear wastelands and nuclear cities in the United States and Soviet Russia. Hird (2015) similarly describes modern practices of waste management in Canada, comparing the long lives of toxic wastes with the bureaucratic fiction of "waste management." Indigenous people in Nunavut, in contrast, understand that it is better to see waste than to pretend that it does not exist (Hird 2015). Toxicities may enter and transform bodies, as in Agard-Jones's (2013) work on the impact of the pesticide chlordecone on bodies in the Caribbean island of Martinique. Following the long lives and uncertain destinies of waste pulls anthropologists beyond systems of bureaucratic classification and into an alertness to other processes, from structures of affect (Masco 2008), to formations of kinship, family, or gender (Ebron & Tsing 2017, Voyles 2015), to engagement with the more-than-human effects of toxicity.

American environmental justice scholars were leaders in combining epidemiological and quantitative evidence of air and water pollution with spatial analysis of where people of color lived (Bullard et al. 2007) and with linking these findings to longer-term historical processes of racial injustice. The increasingly visible effects of climate change and natural disaster caused Bullard & Wright (2009a,b) to turn their attention to describing the differential vulnerability of black New Orleans residents during and after Hurricane Katrina. Colonial and postreconstruction histories of racialized housing and infrastructure building have located poor blacks in backswamps that are below sea level and white residents at higher elevations that are less likely to flood (Bullard & Wright 2009a,b). This racial Anthropocene is unevenly experienced; historical processes have produced the conjunctures experienced in present-day disasters that are often made worse by official disaster responses (Ranganathan & Bratman 2019).

The international climate justice movement has challenged the monocausal and technocratic aspects of climate change policies, emphasizing the "climate debt" of industrialized countries who are responsible for climate change (Martínez-Alier 2012) (see also O'Reilly et al. 2020, this volume). Climate justice movements redirect attention from climate change alone to focus on a broad range of environmental distribution conflicts, including natural resource extractivism, food sovereignty, and indigenous sovereignty (Martinez-Alier et al. 2016). With their focus on the multiple historical causes and consequences of environmental degradation, the international climate justice and environmental justice movements resonate with the multiple Anthropocenes that I describe in this article. There is, however, a structural tension between the urgencies of focusing on a particular mine, dam, or toxic waste site and a longue durée anthropological analysis of the processes that have produced environmental degradation and social deprivation. Similarly, while study of the Anthropocene may dilute technocratic approaches to climate change, it might also make it harder to focus on climate change as the most pressing environmental problem. This tension between long-term change and the urgencies of policy or politics is both productive and problematic.

CONCLUSION

Anthropological responses to the Anthropocene are marked by a concern with the dangers of the narrative of human mastery or Eurocentrism and of the risk of antipolitical concealment of the differential harms that global environmental change poses to the poor, to people of color, and to residents of the Global South. While some have found that these are reasons for rejecting the term entirely, many anthropologists find that the Anthropocene remains a helpful concept, because of

its promise for animating attention to disastrous global environmental change, and an inspiration to broadening researchers' methodological and theoretical tool kits. This broadening includes a reinvigorated attention to our senses, experimentation with ways of describing and writing about supernatural beings, and a reengagement with systems thinking of various kinds (see also Orr et al. 2015). Systems analytics include familiar capitalist world systems, structural comparisons of patchy landscapes, infrastructures and ecological models, emerging sociotechnical assemblages, and the reemergence of spirits in the reenchanted world that is modernity's ruins. Emerging Anthropocene anthropology is temporally and empirically nimble and focuses on intertwined human and natural histories. Anthropologists' capacity to notice the unfolding ontological unruliness of the world, both in the present and through historical research, has inspired collaborations with natural scientists, humanists, and artists. Anthropologists retain their commitment to noticing the details of human experience but are increasingly adding to this their capacity to notice more-than-human relations and experimenting with analytics through which they can extend empirical observations to other spatial and temporal scales and to other cosmopolitical registers. It may be better to think of the Anthropocene not as a historical epoch defined by geologists but as a problem that is pulling anthropologists into new forms of noticing and analysis and into experiments and collaborations beyond anthropology.

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Annual Review of Anthropology
Volume 49, 2020

Contents

Anthropology of Language and Communicative Practices

Sociocultural Anthropology

Theme I: Anthropocene

Theme II: Race

Indexes

Errata

An online log of corrections to *Annual Review of Anthropology* articles may be found at http://www.annualreviews.org/errata/anthro