HANNAH KNOX

Thinking Like a Climate

GOVERNING A CITY IN TIMES OF ENVIRONMENTAL CHANGE

HANNAH KNOX

THINKING LIKE A CLIMATE

Governing a City in Times of Environmental Change

DUKE UNIVERSITY PRESS · DURHAM AND LONDON · 2020

Printed in the United States of America on acid-free paper ∞
Designed by Matthew Tauch
Typeset in Arno Pro and TheSans C4S by Copperline Books

Library of Congress Cataloging-in-Publication Data
Names: Knox, Hannah, [date] author.
Title: Thinking like a climate : governing a city in times
of environmental change / Hannah Knox.
Description: Durham : Duke University Press, 2020. |
Includes bibliographical references and index.
Identifiers: LCCN 2020006170 (print)
LCCN 2020006171 (ebook)
ISBN 9781478009818 (hardcover)
ISBN 9781478010869 (paperback)
ISBN 9781478012405 (ebook)
Subjects: LCSH: Climatic changes—Government
policy—England—Manchester. | Climatic changes—
Research—England—Manchester.
Classification: LCC QC903.2.G7 K569 2020 (print)
LCC QC903.2.G7 (ebook)
DDC 363.738/745610942733—d C23
LC record available at https://lccn.loc.gov/2020006170
LC ebook record available at https://lccn.loc.gov/2020006171

Cover art: Jesús Perea, *Abstract composition 593*.
Courtesy of the artist.

A lost number in the equation,
A simple, understandable miscalculation.
And what if on the basis of that
The world as we know it changed its matter of fact?

Let me get it right. What if we got it wrong?
What if we weakened ourselves getting strong?
What if we found in the ground a vial of proof?
What if the foundations missed a vital truth?

What if the industrial dream sold us out from within?
What if our impenetrable defence sealed us in?
What if our wanting more was making less?
And what if all of this . . . it wasn't progress?

Let me get it right. What if we got it wrong?

— EXCERPT FROM LEMN SISSAY, "WHAT IF?"

CONTENTS

Abbreviations ix
Preface and Acknowledgments xi

INTRODUCTION · Matter, Politics, and Climate Change 1

PART I | Contact Zones

CLIMATE CHANGE IN MANCHESTER: AN ORIGIN STORY 35

ONE · 41% and the Problem of Proportion 40

HOW THE CLIMATE TAKES SHAPE 63

TWO · The Carbon Life of Buildings 67

FOOTPRINTS AND TRACES, OR LEARNING TO THINK LIKE A CLIMATE 89

THREE · Footprints, Objects, and the Endlessness of Relations 95

WHEN GLOBAL CLIMATE MEETS LOCAL NATURE(S) 122

FOUR · An Irrelevant Apocalypse: Futures, Models, and Scenarios 127

CITIES, MAYORS, AND CLIMATE CHANGE 156

FIVE · Stuck in Strategies 159

PART II | Rematerializing Politics

SIX · Test Houses and Vernacular Engineers 179

SEVEN · Activist Devices and the Art of Politics 205

EIGHT · Symptoms, Diagnoses, and the Politics of the Hack 234

CONCLUSION · "Going Native" in the Anthropocene 259

Notes 273
References 285
Index 305

ABBREVIATIONS

COP	Conference of the Parties
DECC	Department for Energy and Climate Change
DEFRA	Department of Environment, Food and Rural Affairs
EU	European Union
GCM	general circulation model
GVA	gross value added
IT	information technology
IPCC	Intergovernmental Panel on Climate Change
NGO	nongovernmental organization
PPM	planned preventative maintenance

PREFACE / ACKNOWLEDGMENTS

When I began this research on climate change around 2010, I did not come at it with a particular desire to do something about it: my interests were driven by epistemological concerns about engineering, expertise, and materiality rather than a desire for justice or social change. I was first drawn to the possibility of an ethnographic study of climate change mitigation during conversations with an engineer involved in urban modeling for the engineering firm Arup, who reflected on climate change as one of the biggest challenges he thought engineers were going to be working on in the future. At that time this engineer was working on a project to build a digital model of the city of Manchester. One of the ambitions for the model was that it would be capable of measuring, mapping, and visualizing the carbon emissions of all of the city's buildings. Although the model was still in development, those building it had begun to imagine how it might be used: by planners to create decisions about new buildings; by building owners who might be able to influence their employees by having real-time displays of a company's carbon emissions projected on the outside of the building; and by scientists to better understand the opportunities and gaps for climate change mitigation in the city. Here in this modeling work climate change was being made tangible as infrastructure. As an anthropologist of infrastructure and digital technologies, my interest was piqued.

The project began to take shape, a study not so much of climate change as nature, or a form of environmental relating, but of climate change as a modeled and infrastructural phenomenon. I was interested in data, models, and the science of climate not as the explanatory background to contemporary social/environmental relations but as the matter of social work itself. What, I wanted to know, might be happening to social, political, and technological relations when confronted by the modeled and infrastruc-

tural phenomenon of climate change? For the engineer I first spoke to, climate change was a site of opportunity, of learning, and of novelty. But as we know from the study of other engineering projects, even the most laudable and necessary engineering interventions have unforeseen consequences and knock-on social effects. While I was generally sympathetic to the need for greater attention to issues of environmental sustainability, my primary interest was not in intervening or devising methods or insights that would address climate change but in bringing to discussions of climate change an improved sensibility to the effects of the science, and of the politics of climate change and energy, on people and their lives.

However, by entering into the worlds of climate science, climate policy, and climate activism, my academic agnosticism toward the problem of climate change itself has been transformed. Spending time immersed in numbers and calculations about temperatures and carbon dioxide emissions, tracing their capacity to move and travel, their fragility in the face of other ways of knowing, and their intransigence and insistence that a chaotic climatic future awaits, I have come to be affected by what I have learned both from the numbers and from those who translate, communicate, and live those numbers in the ways I recount in this book. This has meant coming to terms with a different kind of relationship with those with whom I spent time doing research—not as the objects or even subjects of research but more as fellow travelers in a process of understanding who have drawn me into the question they too have been compelled to ask: "What can be done about climate change?" This shift in perspective has informed my writing of this book and the conclusions that I come to, requiring me not just to reflect on and attempt to understand the knowledge, practice, and relations of those I met but also to reconsider the approach of the discipline of anthropology to climate change as a problem, its assumptions about its domains and methods of engagement, and the challenge that climate change potentially poses to my own disciplinary practice as an anthropologist. Therefore, it is more than just for reasons of access, friendship, collegiality, time, reflection, conversation, and information that I thank those who helped to bring this book into being and also helped to change me as a scholar and as a person as I began to learn how to think like a climate.

Many people in Manchester and beyond made this book possible, and thanks go to all of them, but some in particular fundamentally changed the direction of the research. Thank you to Richard Sharland for sharing with me reflections on the need for cultural change, for teaching me about the

ins and outs of local politics, and for reminding this anthropologist that in spite of all the critiques of culture that anthropologists have explored, there is still something profoundly cultural about the challenges that climate change poses. This has challenged me to return to the concept of culture and to reconsider representation as part and parcel of what climate change is as a phenomenon. Thank you also to Marc Hudson for helping me navigate the world of climate change in Manchester, for all the introductions, for always being a critical voice, for never letting narratives lie unchallenged, and for many insightful and reflexive conversations. I look forward to many more. I also thank others who opened my eyes to a different way of thinking, doing, and engaging climate change, and whose generosity of time and tolerance for the indiscipline of ethnographic participation helped open new avenues for considering what climate change is and where and how we might research it. Particular thanks go to Jonathan Atkinson, Ben Aylott, Bryan Cosgrove, Simon Guy, Britt Jurgensen, Aleksandra Kazmierchak, Lisa Lingard, Patrick McKendry, Vin Sumner, and Jessica Symons, who helped me navigate and better understand the everyday struggle of trying to act on and for the climate. I also thank the many others whom I interviewed, shadowed, and kept meeting at events, whose work I read, and who let me sit in on their meetings.

Thanks also go to many academic colleagues who read, listened to, and commented on earlier drafts of this book. Thanks in particular to colleagues from the Centre for Research on Social Cultural Change (CRESC): Michelle Bastian, Penny Harvey, Gemma John, Niamh Moore, Damian O'Doherty, Madeleine Reeves, Nick Thoburn, Elizabeth Silva, Sophie Watson, and Kath Woodward, who shaped the fieldwork and informed the early writing; to University College London colleagues Haidy Geismar, Antonia Walford, Ludovic Coupaye, and Chris Rapley for discussions about models, technologies, science, data, and politics; and to those further afield who have engaged with my work and deepened my understanding of environmental politics and technology—including Simone Abram, Kristin Asdal, Dominic Boyer, Steffen Daalsgaard, Rachel Douglas-Jones, Tone Huse, Ingmar Lippert, Maria Salaru, and Brit Ross Winthereik. I am also indebted to the anonymous reviewers of this book, whose invaluable comments have pushed me to clarify and refine my thinking, and to Gisela Fosado and Alejandra Mejía at Duke University Press.

And, finally, thanks to those at home: to the women who did the invisible labor of domestic care without which this book would not have been

possible: Marta Wendrenska, Veronika Farková, Carolina Gracia Lopez, Karen Ashton, and Judith Ferry; to Damian for being with me always as a fellow traveler on this ongoing journey; and to Imogen, Francesca, and Beatrice—this book is for you.

Matter, Politics, and Climate Change

How can we get people more involved in doing something about climate change? This is the question being explored at a meeting of the steering group that has responsibility for managing Manchester's plan to reduce the city's carbon emissions. It is a Tuesday afternoon in June, and about twenty of us are sitting, cabaret style, around tables in the breakout room of a local art-house cinema in Manchester, England. The main agenda item for the day is how to regalvanize Manchester's carbon-reduction plan and get people in the city to somehow rise to the challenge of tackling climate change.

Spread out on the tables are flip-chart pads scattered with thick colored markers—ubiquitous tools of management meetings that have been provided to help us tackle this challenge. On one of the flip charts, the page has been divided into four parts by two perpendicular lines. On the top left-hand side, Linda, who is here in her role as a project manager for an environmental charity, has written "41%"—Manchester's carbon-reduction target. On the right-hand side, she has written "engagement." The group around the table is trying to list examples of engagement under this heading, but it is not clear who engagement should focus on, or what the role of

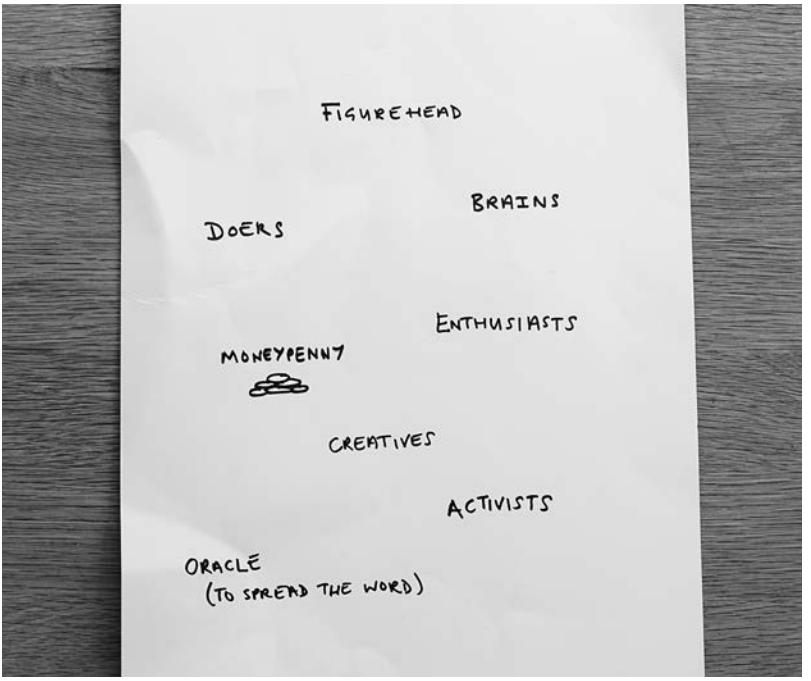

FIGURE 1.1 Diagramming the city.

the steering group should be in generating this engagement. On another flip-chart sheet, the gridded lines have been dispensed with. Instead, in the open space of the page, the group starts to write down the different kinds of people they can think of who need to be engaged. First, Robert, an officer from the council, suggests the need for a figurehead, or leader. Someone else suggests we might need experts. Colin, the director of an ethical marketing company, is trying to get people to think differently about the problem. He suggests we need to call these people "brains," not experts, or maybe even "number crunchers." Creative thinkers emerges as another category, then accountants (translated by Colin as "Moneypenny"). Robert says we also need some doers, and everyone agrees. Then there are also activists, enthusiasts, and oracles.

Colin, Robert, Linda, and I stand around the table looking at the page, trying to make sense of this motley gathering of groups that might hold the key to tackling climate change. Colin says that now we can divide it up and think who might fit into these different groups. The chart is divided up.

The doers end up in the middle with all the other sections partitioned off into their own space. Colin comments that the doers don't have their own section. It is clear that this wasn't intentional, and no one knows if it matters. As we continue talking, there is further confusion—is this a diagram of the steering group or of the city as a whole? Are the doers the people who are ensuring that the plan gets done or the people who are actually doing it? There is a risk here that the doers get turned into the former, and that no one ends up actually doing anything.

Suddenly our deliberations are interrupted by the clattering of hail and a torrential downpour outside. There is a palpable hush in the room as people glance, uneasily, at the rivulets of water streaming down the window and the puddles forming rapidly on the decking outside. Inside the room we are insulated from the storm, and yet the storm is also with us, forcing itself on the proceedings and provoking a febrile atmosphere in the room.

Everyone in that room knows that a rainstorm is not climate change, but there is a sense of an indescribable link between what the group is trying to do and the weather battering at the windows. One person says that maybe the doers should concentrate on building an ark. Another says, "Is this what a postcarbon Manchester will be like?" As the rain comes down, we carry on, glancing occasionally at the windows. Eventually the rain stops, and as it does, the weather is forgotten, and the discussion continues on the question of how to enthuse people into becoming committed to a plan that will ensure that Manchester does its bit for tackling climate change.

This book takes as its starting point this moment when a storm intruded on a bureaucratic gathering in Manchester, England, to open up a discussion about the transgressions that occur when climate change confronts political practice. In Manchester, when the rain clattered down on the steering group meeting, the phenomenological experience of a downpour drew people's attention, in that moment, to a materialized form of weather that rapped at the windows of democratic deliberation. But Manchester is renowned for its rain. So why was this a moment of significant experience, and what did it have to do with the climate? What produced that rainfall as a commentary on climate change as a state of being? For people out on the street passing the room where we sat, that same downpour might have been experienced as awkward, uncomfortable, or inconvenient. For hikers out in the hills in hiking clothes, the rain might have been experienced or remembered as a bracing walk or a memorable encounter with the elements. As it was, in a meeting room surrounded by pens and paper,

flip charts, and vegan salads, during discussions about climate change and ways to do something about it, the weather became something more than weather, raising questions for people about what the rainfall was, what it might mean, and how it might be related to the actions and thoughts of the people in that room.

There are a number of excellent ethnographies that attend to the way in which people's relationships with changing weather affect their social practices.[1] However, surprisingly, there has not been a very established conversation between these studies of local weather matters and a broader anthropology of global climate change as a technological, infrastructural, political-economic phenomenon. Weather is generally seen as the material manifestation of atmospheric conditions in a particular place. Tim Ingold describes the experience of weather as a relationship with our surroundings where "*in this mingling, as we live and breathe, the wind, light, and moisture of the sky bind with the substances of the earth in the continual forging of a way through the tangle of life-lines that comprise the land*" (2007, S19, emphasis added). But what happens when this mingling is experienced as both evidence of and a portent for a future yet to come caused by the social-economic infrastructures of the recent past? If weather is inherently phenomenological, weather-as-climate enters perception by means of scientific instruments of detection and models of projected effects that refract lived worlds through the prism of historical and global processes traced in graphs, charts, and diagrams.

On the flip-chart diagram of the key people involved in tackling climate change in Manchester, the climate science that helps turn weather into climate was indicated by the category "brains." "Brains" were the scientists who provided the steering group with facts about climate change, facts that took the form of prognostic graphs of rising temperatures and hopeful projections of falling greenhouse gas emissions. This science was embodied both in the local climate scientists who worked for the universities in the city and regularly met with city administrators in meetings, workshops, and public events, giving PowerPoint presentations of their findings and those of their colleagues, and in reports produced by organizations like the Intergovernmental Panel on Climate Change (IPCC) and the UK Committee on Climate Change that outlined policy road maps for responding to climate change. Moreover, "the science" was also embodied in the biographies of many people working on climate change in the city. I often found myself in meetings where those with a background in engineering or environmental sciences would wonder whether the general public had an ad-

equate vernacular understanding of the science of climate change that they had expertise in, and how people's fact-based understanding of the climate could be improved.

The thing that needed to be understood as scientific fact through engagement with "brains," then, was climate. *Climate*, unlike *weather*, is a description of general prevailing conditions associated with a particular geographical region. Historical uses of the term *climate* referred not only to weather but also to the agriculture, flora, fauna, ways of living, and even cultural temperament of a particular region (Hulme 2017). The study of climate change is therefore a probabilistic study of general conditions at global and regional scales, not the actual weather in a particular place at a particular moment in time. And yet, confusingly, weather is still the stuff from which climate is derived and an important medium through which it is experienced. If we wish to study the relationship between climate and politics, I therefore suggest that it is not sufficient to study how embodied individuals are relating to changing weather, nor is it sufficient to understand only how people are relating to and understanding scientific models. Rather, studying climate change anthropologically demands that we attend to what happens to people's understanding of themselves and others when confronted with climate as a "techno-nature" (Escobar 1999), as a phenomenon that does not fall neatly into a category of either immediate materiality or abstract representation. If we are to understand the kind of challenge that climate change (as opposed to weather) poses to social relations in different locations and among different groups of people, then I suggest we need an anthropological approach to studying climate change that acknowledges *with* climate scientists that climate is not weather but that is also capable of treating climate as more than symbolic, modeled representations that float free from weather's materiality.

To address what happened in Manchester when climate change forced itself on urban politics, I have had to learn to approach climate change not as a cultural practice with ontological dimensions but as a material process that exhibits epistemological qualities. As climate seeped into the imagination, and as imaginations helped to surface the often undesirable social effects of changing climate systems, I found people were not confronting nature but instead experiencing themselves as entangled in a relational nexus wherein processes of signification—both human and nonhuman—were affecting one another. To capture this ecology of signs where climate seemed to shimmer into view through repetitious traces in computer models, where those models entered into workplaces via online training pack-

ages, where the complexity of ecological relations became smoothed into a curve on a graph, and where that curve on the graph had the capacity to create a knot in the stomach of a person confronted with its implications for their future and for future generations, I use the phrase *thinking like a climate*.[2]

Thinking Like a Climate

My first point of reference for understanding climate as what we might call a "form of thought" comes from a reading of Gregory Bateson, in particular his comments on the notion of the idea. In the opening paragraph to *Steps to an Ecology of Mind*, Bateson writes that the book proposes "a new way of thinking about *ideas* and the aggregates of those ideas which I call 'minds.' This way of thinking I call 'the ecology of mind' or the ecology of ideas" ([1972] 2000, xxiii). He goes on, "At the beginning, let me state my belief that such matters as the bilateral symmetry of an animal, the patterned arrangement of leaves in a plant, the escalation of an armaments race, the processes of courtship, the nature of play, the grammar of a sentence, the mystery of biological evolution and the contemporary crisis in man's relationship to his environment, can only be understood in terms of such an ecology of ideas as I propose" (xxiii).

For Bateson, what is crucial about ideas is not whether they are material or mental but that they are entities that, through their formal properties, communicate with other entities. An idea for Bateson is an arrangement—of letters, cells, or electrical pulses—that interacts with other arrangements and forms. The fundamental question Bateson sets himself to answer is, how do ideas interact? Through a study of this interaction, he proposes to explore how social arrangements and phenomena (an armaments race, processes of courtship) emerge.

One of the key points that Bateson highlights in his approach is the way in which it allows him to work with scientific data. While highly aware of the constructed nature of all data—he writes that "no data are truly 'raw' and every record has been somehow subjected to editing and transformation either by man or his instruments" (xxvi)—Bateson nonetheless stresses that data "are the most reliable source of information and from them the scientists must start. They provide his first inspiration and to them he must return later" (xxvi).

For Bateson, incorporating the data into his analysis qua data and not something to be socially deconstructed is justified by reference to his notion of an ecology of ideas. If we take nature "out there" to be material, and interpretations "in here" to be ideational, then it is necessary to decide at which point the material is transformed into the ideation—when the "raw" becomes "cooked," or when "reality" becomes "data." But if we follow Bateson in concerning ourselves not with the question of whether something is real but with its form, then things *and* data *and* their interpretation by humans or machines can all be addressed on the plane of signs. The task of the analyst thus becomes one of observing the interactions not only of a community of people but of an ecology of ideas of which people and their ideas are just one part.

A similar line of thinking is pursued by Eduardo Kohn in his recent ethnography *How Forests Think* (2013), a study of the village of Ávila in the Ecuadorian Amazon. To understand the way in which the lives of the Runa Puma who live in Ávila are entangled with and produced through interactions with the forest and its beings, Kohn argues that anthropology needs to go beyond its primary concern with human symbolic meaning making and linguistic communication, to study the way in which human worlds are made out of interaction with the sign-producing functions of other life-forms. Moving across the waking and dreaming life of the Runa Puma and his own embodied (and disembodied) experiences as an ethnographer, Kohn shows that it is not only human beings who have a capacity for signification but that human worlds are made through iconic and indexical engagements with other beings that also use representational forms to communicate and interact. Building in particular on the work of the philosopher Charles Sanders Peirce and the more recent work of Terrence Deacon, Kohn argues for what he calls an "anthropology beyond the human." For Kohn, an anthropology beyond the human is an anthropology that is capable of attending to the way that human worlds are made not only through interaction between people but out of what he terms an "ecology of selves." An anthropology beyond the human is not a posthuman anthropology but an attempt to extend anthropology's remit to be able to attend to representational capacities that the modern social sciences have tended to bracket out as not central to human meaning-making processes.

Both Bateson and Kohn, then, deploy the language of signs, ideas, minds, selves, and thought to describe the forms that emerge out of an interplay between entities of which humans are just a part. "Thinking" in

both these cases moves from something that is only the domain of human symbolic meaning making to something that can be considered the sum effect of interactions among signs, selves, and ideas more broadly conceived. Thinking is treated here not as an action but as an effect that has some level of coherence, pattern, and form. It is in this sense that Kohn can claim that "forests think" (2013, 21).[3] By this I take Kohn to mean that the sum of the interactions between the forms of life found in a forest creates patterns and that this patterning has a coherence to it akin to the patterning that occurs when we speak of ideas or describe something as a thought. Bateson makes a similar claim when he writes, "Now, let us consider for a moment, the question of whether a computer thinks. I would state that it does not. What 'thinks' and engages in 'trial and error' is the man *plus* the computer *plus* the environment. And the lines between man, computer and environment are purely artificial, fictitious lines. They are lines *across* the pathways along which information or difference is transmitted. They are not boundaries of the thinking system. What thinks is the total system which engages in trial and error, which is man plus environment" ([1972] 2000, 491).

Just as thoughts can form and dissipate, so can the form of a whirlpool, or the ecosystemic relations of a forest floor, or the interactions between human and machine. To say that forests, or environments, think is not to attribute to them the capacity for symbolic thought but to acknowledge that they are the stabilized effects of interactions among entities that communicate with one another through their significatory capacities, and that these stabilizations matter. They are the difference that makes a difference.

In using the phrase *thinking like a climate*, I propose that it is analytically helpful for the anthropology of climate change to consider climate as a form of thought. Only by approaching climate change in this way have I found myself able to hold in view, ethnographically, the multifarious manifestations of climate in my own research: the materiality of rain battering at the windows, the work of ordering carbon numbers in a spreadsheet, the experience of climate activists taking their collective bodies into the chambers of local government, the affective hope of museum exhibits on loss and the future, and the mundane attention to light bulbs, computer monitors, or plastic straws as efficacious responses to climate problems.

Thinking like a climate is thus proposed as a conceptual tool to assist an exploration of how the material dynamics of climate change—which have become known through the data, visualizations, and computer models that constitute what Paul Edwards (2010) has called the "Vast Machine" of climate science—come to be translated (or not) into the mundane work

of knowing and managing the social order. The central location of the study is Manchester, UK, the birthplace of the Industrial Revolution and a place that self-identifies as the "original modern" city.[4] Where better to look at the questions raised by the challenges of climate change than in the city that defines itself as the place where this whole process began, where coal was extracted and burned to fuel the manufacture of cotton, which heralded the beginning of industrial capitalism?

This book centers on the practices and conversations of a loosely defined group of officials and activists who were, and are, trying to work together to explicitly develop a future for Manchester as both a postindustrial and low-carbon city. The people who appear in this book were linked, either directly through a steering group or indirectly as partners, with a plan for managing the city's carbon emissions that was published in 2009 and given the title *Manchester: A Certain Future*. The story of how this group of people came to be tackling climate change will be told throughout the book, but it is important to note at the outset that the *Manchester: A Certain Future* plan was seen by its participants as very distinctive for the way it displaced responsibility for tackling climate change from the local council to "the city as a whole," the plan being "a plan for everyone." Accordingly, the plan's steering group members came from various organizations including the city council, the three universities in the city, the National Health Service, environmental charities and environmental pressure groups, an engineering firm, a housing association, economic development organizations, and freelancers working in the environmental sector. It was described to me by one participant as akin to a proto–citizen's panel. The members of the steering committee and partner organizations were well educated and established in professional positions in public and private-sector organizations, charities, and environmental nongovernmental organizations (NGOs). Their conversations and practices, and the relationships they were involved in to tackle climate change, form the core focus for this study, allowing us a window onto how climate change emerged in this late-liberal political setting as a mode of questioning and unsettling urban politics as political relations became deformed and reformed around the question of what to do about rising carbon emissions.

My research for this book entailed spending time with this network of people over a period of eight years. Research for this project began slowly in 2011, involved a focused fourteen-month period in 2012–2013, and has continued in short stints since then. The book also draws on additional fieldwork conducted in 2017–2018, during which I looked at how people were

engaging with energy through data and devices. Fieldwork entailed conversing with and interviewing many people involved in the steering group, attending steering group meetings and events, participating in critical fringe events by activist groups, participating in the everyday work of the environmental strategy team at the city council who managed the steering group behind the scenes (during four months of daily ethnographic research), attending public policy meetings, shadowing the work of an environmental manager at a housing association, and exploring the meetings, documents, and daily work of the Manchester-based partners of two projects funded by the European Union (EU) exploring how to use digital technologies to tackle climate change.

Methodologically, the city of Manchester has provided a relationally and spatially appropriate field site through which to analyze broader social, ethical, and epistemological questions that are currently being posed about the relationship between politics and the environment established by climate change.[5] Richard Sharland, who was head of the environmental strategy team at the city council during the time I was doing research, once said to me that the wonderful thing about working at the level of the city is that it gives you the opportunity both to reach up to the global and to reach right down to the people on the ground. This has a similar methodological resonance for me, for doing an ethnography of a project of social transformation in the city provides a way of talking ethnographically about both the global institutions that are so central to climate change politics and also the local practices of those who are devising answers to those problems and are subject to proposed solutions. Researching climate change in the city is not just a matter of studying the ideas of a coherent group of people located in a geographically bounded space but is rather a means of generating a perspective or vantage point from which to describe ideas, concepts, and people who are held together in a shared project across different kinds of social spaces.

The field site for this research was the city of Manchester, UK, then, but it was a field site that also opened up to places beyond the designated boundaries of the city. Some of the other places that this research led to were geographical—meetings in London, Lancaster, Brussels, and Linköping; and stories of experiences people had had in Northern Ireland, South America, the United States, Antarctica, Australia, and China. But perhaps even more significant were the nongeographically defined spaces that the research also led to: the space of documents produced by governmental and intergovernmental organizations; the space of websites, discussion forums, and email exchanges where questions of technique and examples of good

practice were being shared; the space of technological networks: of the energy monitors, solar panels, and statistical models through which the job of attempting to reduce carbon emissions was enacted. And, finally, Manchester was itself not just a geographical context for this research, but as we see in the opening vignette, it, like the climate it was trying to engage, was also a concept, an idea, and a thing that was being reworked in relation to the project of carbon emissions reduction. Part of the challenge of reducing carbon emissions at a city scale was reimagining just what kind of social, environmental, and technical entity the city itself was. As the opening vignette hints, forging a local and situated response to models of rising temperatures, increasing sea levels, and climbing measures of carbon dioxide particles in the atmosphere required people not just to act but to interrogate and re-create the very forms and categories of social organization, like "the city" and "the citizen," that would be necessary to bring about the desired change. Tracing climate change in this city was, to paraphrase Donna Haraway, a matter of getting away from the "god tricks of self-certainty and deathless communion" and paying attention to "counter-intuitive geometries and emergent translations" (2003, 25). Part of that work of translation revolved around the question of just what kind of collective entity would be appropriate to tackling a problem like climate change, and whether the city of Manchester might fulfill that role.

Scientists and Skeptics

With the city providing the scale of analysis, and climate change providing the focus of people's activities, one might imagine that the struggle facing city administrators would be one of convincing a skeptical citizenry of the realities of climate change. But rarely in my research was the nature of climate politics articulated in this way. The only time I heard anyone speak of climate deniers or climate skepticism was during a conversation with a housing-association employee when he mentioned that the director of the housing association did not believe in climate change. Elsewhere, whether the people being engaged by those trying to do something about climate change were building managers or council employees, homeowners or renters of council properties, the question of whether climate change was real or human-made never came up in my ethnographic work.[6]

This was somewhat surprising to me given the very different rendering of the politics of climate that has until recently dominated the popu-

lar and intellectual imagination. During the time of my research, discussions about the politics of climate change in media and policy in the United Kingdom and United States largely focused on a very public struggle between climate science and climate change skepticism. In this public politics of climate change, the central institution that has stood for the science of climate change has been the IPCC, accompanied by a network of laboratories, scientists, and research centers who have contributed to an ever more robust description of the projected transformations in global climate (Weart 2003). In the opposing camp, climate skeptics have been represented by governments such as the current Trump administration in the United States, the fossil fuel industries and their lobbying powers, the right-wing media, and a poorly informed, relatively unengaged general public that has been seen both as uninterested in climate change and as structurally incapable of doing much to respond to it (Hulme 2010; McCright and Dunlap 2011; Tranter and Booth 2015). Those who have explored the epistemological dimensions of this battle between scientists and skeptics have tended to highlight the way in which the position that each group inhabits is sustained by an argument around the validity or robustness of the facts being produced and the terms of their interpretation (Latour 2010; Oreskes and Conway 2010).

Probably the most famous example of this battle over the facts of climate change, at least in the United Kingdom, was what came to be called the Climategate controversy of 2009, when emails between scientists at the Tyndall Centre for Climate Change Research at the University of East Anglia—which raised questions about the meaning and validity of modeled results—were leaked to the press, fueling claims that climate science was weak and that human-made climate change was a conspiracy aimed at undermining capitalist social relations.[7] Other, more recent incidents suggest that the same debates continue to drive public discussions about the politics of climate change. In September 2017, for example, a paper was published in *Nature Geoscience* that argued that there was a greater likelihood than previously thought that global warming could be kept within the 1.5-degree warming ambition set by the IPCC in 2016 (Millar et al. 2017). Using new methods of modeling, the authors suggested that there is a 66% chance that this will be possible, if certain strict conditions are adhered to—a finding that was meant to galvanize efforts to head off global climate change by demonstrating that while politically challenging, it was not "geophysically impossible" (Millar et al. 2017, 741). However, headlines in the *Telegraph* newspaper responded by announcing "Climate Change

Not as Threatening to Planet as Previously Thought, New Research Suggests."[8] Although this was broadly in line with the press release that accompanied the report, some climate scientists I spoke to were horrified at this headline. They were concerned that the message that would be taken from the study was that everyone could relax about climate change, rather than the message being that there is still a slim chance that a climate disaster could be averted if everyone does everything they can to reduce carbon emissions as quickly as possible. The fears of the scientists were confirmed when the study was cited by a politician well known for his skepticism toward climate science (and incidentally the former head of the Manchester City Council), Graham Stringer, in an editorial in the tabloid paper the *Daily Mail*. The headline read: "Now That's an Inconvenient Truth" followed by the subhead "Report shows the world isn't as warm as the green doom-mongers warned. So will energy bills come down? Fat chance, says MP Graham Stringer."[9]

A second incident occurred a few weeks earlier when another politician who is known for his skepticism toward climate science, Lord Nigel Lawson, was interviewed on the BBC *Today* program on Radio 4.[10] In the interview Lawson claimed that global temperatures had not risen over the past decade, a claim that went unchallenged in the interview. If the first incident was a debate over how to interpret the facts of climate science, this second incident revolved around the responsibility of the BBC to provide impartial reporting on climate science. The BBC has, until recently, faced repeated criticism from climate scientists, who have argued that attempts to represent "both sides of the argument" have given undue weight to findings that are not corroborated by most of the climate science community. Again, in this case, the BBC appealed against initial complaints about the interview with Lord Lawson, arguing that "Lawson's stance was 'reflected by the current US administration' and that offering space to 'dissenting voices' was an important aspect of impartiality."[11] However, after the original complaints escalated, the BBC admitted that the facts being reported were erroneous and Lawson should have been challenged by the interviewer.[12] As these examples demonstrate, even the most avowedly neutral media's representation of climate change has to tread carefully in this ongoing debate between scientists and skeptics. The battle here is about whose facts count and how those facts should be interpreted. But this is a rather different politics of climate change from that which I describe as being fought out in the city. Here, instead of facts, what were at stake were methods of bureaucratic organization, techniques of construction, engineering logics, and local so-

cial and political histories, which were being ruptured and reconfigured by the appearance of climate models. By taking as a vantage point not national debate but the situated practices of city administrators, this book offers an alternative description of the politics of climate change. While the details of the political relations I describe are specific to Manchester, the analysis I present offers a means of tracing a reconfiguration of the political in the technological and bureaucratic life of climate change. In doing so it aims to open up the possibility of analyzing how climate comes to be animated or silenced in other bureaucratic and institutional domains where the struggle is also no longer over the basic facts of climate science but over what to do about them.

Climate Change as Ontological Politics

When the problem with climate change is an oppositional politics between believers and nonbelievers, then the answer to the struggle is to convince the nonbelievers that climate change is real. There is hope here that once the communicative message has been conveyed properly and skepticism has been done away with, consensus will lead to effective policies that will reduce carbon emissions. However, this ignores the day-to-day struggle experienced by people like those with whom I did research, who are generally in agreement about the facts of climate change. During the time of my research this struggle rarely made the headlines, but it constitutes, I argue, a much more profound barrier to reducing carbon emissions than climate skepticism or denialism in its strong form. The struggle here is not with a cultural or political adversary who disagrees over whether climate change is happening, or who identifies its causes as natural rather than human, but with the problem of how to deal—bureaucratically, institutionally, and socially—with material processes, evidenced by climate science, that threaten to disrupt what we might call a modern way of being in the world. It is this terrain of politics that this book explores.

When I began this research in 2011, average concentrations of carbon dioxide in the atmosphere stood at 390 parts per million. When I was writing the draft of this manuscript in 2019, they surpassed, for the first time, a measure of 414 parts per million, with an annual average of over 410 parts per million.[13] When we consider that for the thousand years preceding the Industrial Revolution, carbon dioxide concentrations stayed relatively stable at 250 parts per million, the current rate of acceleration of carbon dioxide

concentrations in the atmosphere is alarming. Projections of the effects of this change are also worsening, with the scientific consensus shifting in recent months to a prediction that we are now on course for an average of 3 degrees of global warming by the end of the century (Raftery et al. 2017). This portends sea-level rises of two meters or more, powerful hurricanes, the slowing or cessation of jet streams, droughts, fires, crop failures, wars, and mass migration.[14]

For those climate scientists, concerned citizens, activists, and political actors of different kinds whom I met in and around Manchester, who were all trying to do something about climate change, the appearance of these ever more dire facts and figures about a changing atmosphere seemed unrelenting. These data were indicative not just of the level of change that was necessary to mitigate them. Rather, their ongoing appearance continually re-posed the question of why it is that the conventional means of attending to and responding to these facts about the world appear to prove inadequate when they are mobilized as a response to historical and ongoing climate change (Marshall 2015). Why, people asked, is no one listening to the numbers and acting accordingly? And how could things be different?

One response to this question was to attribute responsibility for a failure to act on climate change to particular groups or individuals. Accusations are frequently made by climate critics that the richest individuals, the biggest companies, the structure of our financial systems, and certain nation-states are the agents that are failing in their duty to respond to the problem of rising greenhouse gas emissions (Swyngedouw 2010a; Szerszynski 2010). In Manchester a critical political engagement with the structural causes of climate change manifested in activities such as the Shell Out! campaign to prevent Royal Dutch Shell from sponsoring an exhibition at the Manchester Museum of Science and Industry, a campaign to get Manchester's pension fund to divest from fossil fuels, and the Energy Democracy Greater Manchester campaign, which aimed to encourage Greater Manchester to establish its own citizen-owned green energy company. Tackling climate change through this kind of critical structural approach was complicated, however, by the realization that even those who were trying to do something about climate change (and who were often part of the privileged groups identified)—climate scientists, activists, public intellectuals—often experienced themselves as unable to make the difference that seemed necessary within their own lives. This inability to change things either individually or structurally was in turn read in the unrelenting rise in concentrations of greenhouse gases in the atmosphere, which suggested that in

spite of all the initiatives, activities, and changes that had been put in place, *no one*, including those who were already attempting to make the necessary changes, was able to do enough. Many I spoke to during my research articulated how they experienced a confrontation with climate change both viscerally and emotionally. Several people told me how, as a result of thinking about and working on climate change, they had been through periodic episodes of depression, how they lived within a generalized sense of doom and felt "extreme despondency," how they had found themselves toying with millenarianism, and how they often experienced feelings of despair. At the same time, an awareness of climate change was also causing people to ask difficult questions of themselves and their peers about their practices and their working lives. For those thinking about climate change in relation to how to make the city responsible for its carbon emissions, this meant asking crucial questions about the relationship between, on the one hand, the forms of accountability that have conventionally driven, justified, and evidenced the effectiveness of governmental action and, on the other, the role of climate science as an alternative arbiter of political effectiveness. Climate change was changing something about the experience and possibility of doing politics. But what exactly was it about climate change that was producing this experience of rupture? And how was the particularity of climate change as a phenomenon affecting how it was being responded to?

Bringing Nature into Politics

One way of understanding this articulation of a change or a challenge is to see it as the outcome of an attempt to reintroduce nature into politics. As I explore in later chapters, for most of the twentieth century, modern governmental practice in urban settings has been framed not by ecological considerations but by what we might call biopolitical concerns (Foucault 1997; Joyce 2003; Rose 1990). This is not to say that the environment (for example, in the form of natural resources) has not been crucial to the constitution of the modern city. As William Cronon (1991) makes clear in *Nature's Metropolis*, and Howard Platt (2005) similarly argues in *Shock Cities*, urban settlements have always depended on natural resources—be that rivers, forests, agricultural crops, or the weather—to exist. Manchester's origin story is often told as a story of weather, a city whose industrial success as a global center for the cotton industry came from its damp climate, which prevented cotton threads from fraying when being woven. However,

in spite of the possibility of telling the history of a city as a tale of political ecology, the actual practice of managing the city as an object of governance has tended, until recently, to operate through attention to urban populations, measures of economic activity, health, and planned urban infrastructures, rather than a direct engagement with the natural resources that lie within or outside city borders or the environmental relations that make certain forms of life and economy possible within the city.[15]

One of the critiques that has thus often been made of modern forms of governing and accounting is that they work by excluding, as externalities, relations between people and "the environment." Marxist analyses, such as Teresa Brennan's (2000) highly insightful work on the problems inherent to the modern economy, demonstrate, for example, how modern forms of social organization that have conceptually bracketed nature out have led to an exhaustion, both metaphorically and literally, of nature.[16] Brennan argues that economic value under capitalism is not created only through labor power but also depends on the unacknowledged exhaustion of both human bodies and natural resources. Similarly, in *The Question concerning Technology* (1977), Martin Heidegger famously points to a peculiarly modern and what he terms "technological" way of relating to nature that frames an inert nature as a "standing reserve," conceptually awaiting human exploitation. With nature externalized as something that human beings can exploit, the metropolis, even when conceived of as political ecology, becomes a performance of human domination over nature, a space that is separated off, both geographically and conceptually, from the rugged or rural locations where nature, as a standing reserve for human use, patiently resides.

In recent years there have been significant moves in urban planning around the world to reframe the place and value of nature in cities and to explicitly bring nature back into urban politics. Utopian, master-planned ecocity projects such as Masdar City in the United Arab Emirates, Tianjin in China, and Songdo in South Korea figure as the spectacular avant-garde for a global conversation about how to bring questions of sustainability into the design of cities. An attention to nature promises a way to balance human needs and ecological processes and to resolve problems ranging from air pollution, to water quality, to carbon reduction, to preparedness for future climatic changes. This newfound attention to nature and sustainability has in turn fueled new directions in urban planning and design. Future cities, it now seems, are green and sustainable cities (Bulkeley et al. 2013; Lovell 2004; Miller 2005; Rademacher 2017; While, Jonas, and Gibbs 2004).

One way of attending to the appearance of climate change as a "matter of concern" impinging on the work of those who plan and manage cities would be to see climate change as another manifestation of this attention to nature in urban settings. Certainly, in Manchester, climate change appeared as a generalized justification for sustainability initiatives such as the encouragement of green roofs on public buildings, the planting of wildflowers along main roads in and out of the city, the placing of beehives on top of municipal buildings, the planting of trees to improve urban drainage, and the creation of linear parks as wildlife corridors along old railway lines. At the same time, these biodiversity projects and green infrastructure projects did not seem to suffer from the same kind of logical incommensurability and epistemic collapse that climate change produced when addressed as a problem of governance.

Although climate change is undeniably part of broader discussions about how to create more sustainable and livable cities, we risk missing something of its particular characteristics if we simply see it as one part of a broader sustainability discourse. Addressing climate change as a problem in its own right, as I do in this book, allows us to approach it as something that may or may not be a matter of nature. As such, this book addresses climate change not as an instance of bringing nature into urban biopolitics but as a particular kind of rupture in biopolitical and, more recently, neoliberal organization. Taking this approach requires that we do not classify climate change too quickly as nature but rather allow its characteristics and dynamics to emerge ethnographically. It requires a starting point that does not assume that climate change is necessarily about sustainability, ecology, and green politics but instead allows the question of what climate change is, and when it is aligned with these other preoccupations, to be discovered as an outcome of the research.

Sustainability is often argued to be an extension of modern bureaucratic and capitalist practice into new domains—a bureaucratization or capitalization of nature. In contrast, I introduce an alternative telling of the cultural life of climate change, attending to the way climate change repeatedly resisted its successful incorporation into the bureaucratic and capitalist practices of Manchester's administrators. Climate change risked fundamentally unsettling methods of contemporary governance that administrators were familiar with—methods that built on imaginaries of the human population, markets, and economies (Mitchell 2002). Centered on the challenge of how to incorporate the description of a changing climate

that had emerged from climate models into existing governmental practice, this was a problem of what I call "thinking like a climate."

Building on a consensus that has emerged among climate scientists about the anthropogenic causes of climate change, Manchester's efforts at tackling climate change have been conversant with other efforts that have been made regionally, nationally, and internationally to genuinely incorporate the findings of science and their ecological implications into policy making and public engagement. My description of how this unfolded in Manchester demonstrates that bringing climate into politics can be a fraught and difficult process. As I show in the coming chapters, climate change demanded nothing less than a reconsideration of the very practices through which knowledge was understood to be produced in science, bureaucracy, activism, and business. Thinking like a climate was thus not solely a matter of inculcating environmental thinking by engaging people in institutional practices oriented to environmental governance, as described by Arun Agrawal (2005) in his description of the production of "environmentality" as a form of thought. Although climate change, like environmentality, is a framing of socionatural relations that is produced by science, economics, and bureaucratic practice, climate change as it appeared in my ethnographic work exceeded the conventions of description and social organization that underpin this form of economic and social governance. By persistently bringing to the fore the entanglement of social worlds and natural systems, climate change undermined any easy stabilization of a world of nature "out there" that might be managed or contained. Rather, what was produced in the act of trying to map and account for the complexities of climate were provisional findings about extensive relations that continually worked to destabilize conventional methods of accounting and that crossed settled institutional boundaries in awkward and often controversial ways.[17]

Anthropocene Anthropology

Key to my interpretation of this struggle is an ongoing debate in anthropology and other social sciences about the now widely circulating concept of the Anthropocene. In anthropology the idea of the Anthropocene has enabled scholars to begin to work in field sites and on empirical objects that were somewhat disavowed by the oppositions between nature and culture

that I am arguing that climate change disrupts. Bruno Latour's recent book *Facing Gaia* (2017) outlines the way in which the Anthropocene, or what he calls Gaia, requires a conceptual move toward a new philosophical understanding of relations. Latour argues that the human/natural entanglements of the Anthropocene mark a new moment when we can no longer work analytically with an opposition between nature and politics. Latour has been hugely influenced by the work of philosopher Michel Serres, so it is perhaps not surprising that Latour's argument evokes the vivid description that Serres (1995) provides of Francisco Goya's painting *Fighting with Cudgels* in the opening to *The Natural Contract*. The frontispiece to the book shows the painting, which depicts two men up to their knees in quicksand, set against a background of swirling clouds and dark rocks, facing one another in a duel. As they fight, Serres imagines their gradual descent into the mud: "The more heated the struggle, the more violent their movements become and the faster they sink in. The belligerents don't notice the abyss they're rushing into; from outside however, we see it clearly" (1995, 1).

Serres's description of the figures of the fighters, engaged in a battle in the human domain but oblivious to their place in a bigger and likely more significant battle with nature, remains one of the most compelling depictions of the philosophical implications of global environmental change and its capacity to unsettle a division between the realm of human politics and the realm of nature. Yet Latour pushes Serres's insights one step further. Serres argues for an incorporation of nature into the affairs of human politics and lawmaking—the creation of a *natural contract*. Recent legal agreements to give natural habitats legal rights, such as the awarding of the status of human personhood to the Whanganui River in New Zealand in May 2017, would seem in line with this philosophical position. However, Latour attempts to push beyond a rights-based understanding of nature. Building on James Lovelock's (1979) concept of Gaia, Latour articulates instead a new kind of settlement where there is no "human" and "nature" but only Gaia, a new kind of geo-being of which humans are themselves a part.

Similar arguments have also been developed by anthropologists, who are increasingly engaging with the concept of the Anthropocene. In this Anthropocenic version of anthropology, attention has moved away from human interpretations and embodied engagements with environmental processes, to shift ecological anthropology into an analysis of ontological, multispecies entanglements that exist between people and plants, animals, rivers, forests, and mountains. Thus, Anna Tsing's (2015) anthropology of the Anthropocene describes the mycorrhizal networks of the matsutake

mushroom, which, in her alluring description, spread through the root systems of plantations but also extend their tendrils into the organization of migrant labor, the buyers and sellers who people global commodity markets, and the olfactory sensibilities of Japanese greengrocers. Eben Kirksey's (2015) description of what he calls "emergent ecologies" similarly uses the concept of the "ontological amphibian" to generate an anthropology of the environment capable of bringing to ethnography the appearance of lifeforms that flourish in postindustrial, blasted landscapes.

In these descriptions there is no longer nature on the one hand and culture on the other; there are only hybrid nature/cultures whose relations can be traced as an unfolding of forms of being that have reached their end point in feral species, contaminated bodies, and biologically hybrid organisms.[18] The idea that nature is a social construct has moved from an epistemological to an ontological claim. Not only is nature a culturally specific idea or a philosophical predisposition; it is also a *thing* that has been made *with* humans as part of a process of mutual generation.[19] This approach thus undermines any pretheoretical separability of something called nature from something called culture where one might be seen to be impacting on the other.

These anthropological analyses of the Anthropocene challenge conventional forms of anthropological theory by collapsing the gap between social description and scientific description, folding scientific articulations of environmental relations into the study of hybrid forms. They do so in order to recover the importance of relations that would previously have been ignored in purely "social" analyses, expanding ethnography's capacity to find "theory" in the field by incorporating the biophysical relations inherent to feral species into their descriptions of emerging worlds.

The idea of the Anthropocene has thus helped to pull scientific understandings of ecological and geological relations into ethnography. *The Anthropocene* was first proposed as a scientific term by geologists Paul Crutzen and Eugene Stoermer in 2000 to describe changes in the earth's stratal record that appeared to be occurring as a result of recent human activities. While geological epochs are usually understood to emerge over very long periods of time, the detection of markers of recent human activity in a wide range geophysical processes has prompted questions about whether there is a need for a new geological epoch—the Anthropocene—to be named. Whether this Anthropocene should be traced back to the appearance of modern humanity, to the emergence of industrial capitalism, or to the beginnings of what has come to be termed the "great acceleration," around the

middle of the twentieth century, has been one focus of these discussions. The Anthropocene Working Group of the Subcommittee on Quaternary Stratigraphy, recommended in 2017 that the term *Anthropocene* should be agreed as a new geological epoch by the International Commission on Stratigraphy (Zalasiewicz et al. 2017).

Anthropocene-focused anthropologists have found in this scientific concept a means of opening up methods of research so as to pay greater attention to sociomaterial relations in social description. This has led to powerful and compelling accounts of relations that go well beyond social constructionism to show how worlds are made out of entanglements of human and nonhuman entities. In attending, as anthropologists, to the material properties of nonhuman forms, there is a risk, however, that scientific descriptions will be taken at face value as the ultimate description of material properties. Tsing (2015), for example, incorporates science-derived descriptions of matsutake mushrooms in her account of hybrid relations, but hers is not a social analysis of science, and thus she does not interrogate the scientific practice, technologies, and techniques that themselves constitute and make visible this knowledge about the mushroom. Similarly, Jane Bennett's (2010) influential work on how politics becomes carried through the properties of materials draws attention to material relations in themselves without attending to the techniques or maneuvers (human or nonhuman) through which those properties come to be known and communicated. As Anthropocene anthropology brings material relations more squarely into analysis, questions of epistemology are sidelined in favor of questions of ontology.

Since the Anthropocene has been taken up in anthropology and social theory, there have been inevitable critiques of the term, ranging from criticism of the colonial overtones of a certain hubris that puts humans at the center of earth processes to a call for more sophisticated analyses of precisely *which* humans should be held responsible for anthropogenic transformations in oceans, atmospheres, and geologies.[20] Critiques like this provide an important reminder of the need to pay close attention to implicit political and philosophical understandings that risk being mistaken for seemingly objective descriptions of relations in the world. This is particularly important when looking at climate change. This is because, unlike mushrooms or amphibians, climate has the uncanny quality of being perceptible *only* through techniques of modeling, visualization, the calculation of probabilities, and the creation of scenarios oriented toward a modeled past and a future that does not yet exist. The hybrid ontological/

epistemological qualities of climate thus raise a crucial challenge when it comes to building on Anthropocene ethnography to think about climate change as a phenomenon that confronts everyday practices of governing.

I treat climate change, then, not as nature or culture but, in line with Bateson and Kohn, as a pattern that is produced out of the interaction among sign-producing entities. Climate change, like the forests that Kohn describes, is the sum effect of interactions among iconic, indexical, and symbolic modes of representation that extend beyond, but also include, the human. In his seminal work *Gaia*, James Lovelock (1979) suggested, polemically at the time, that the geophysical and chemical composition of the earth was kept in equilibrium by the presence of life—that is, by entities that have a capacity for (a Peircian form of) communication and change. Anthropogenic climate change can be read, then, as an unusually rapid rupturing of that equilibrium, a reorganization of the interactions of "ideas" that Kohn describes in a forest setting, which in climate change is detectable in the traces of carbon dioxide molecules (and those of other greenhouse gases) in the atmosphere. This approach also allows us not just to speak of climate change as that which precedes its detection in climate models but also to extend our description of climate change into practices, minds, and activities that ultimately aim to change the climate from within by acting on and in an ecosystem of sign relations.

This approach resonates strongly with the program for ecological urbanism laid out by Mohsen Mostafavi and Gareth Doherty (Mostafavi 2010; Mostafavi and Doherty 2016). Also citing Bateson, alongside Félix Guattari, Chantal Mouffe, and Henri Lefebvre, Mostafavi (2010) makes a plea not just for a more ecological form of urban design but for a fundamental transformation in design thinking that can imagine "an urbanism that is other than the status quo." Mostafavi writes, "We might consider the ecological paradigm not only on ourselves and on our social actions in relation to the environment, but also on the very methods of thinking that we apply to the development of the disciplines that provide the frameworks for shaping those environments" (5). Mostafavi's approach, like that I am advocating in this book, is one that attends to how climate change and the ecological relations of which it is an effect have the capacity to challenge existing ways of thinking, to create new kinds of discipline, and, in his case, to transform the practice of urban design.

To return to Bateson's comments on data, attending to data traces is crucial for an anthropological study of climate change that approaches it in this way because these traces are the *only way* of engaging with a central

aspect of the form of thought—the ecology of ideas—that constitutes a changing climate. One of the advantages of treating climate change as a form of thought, moreover, is that it does not require that the data about climate change be separated off into an ontologically separate realm (the representation) from the climate itself (the real). Rather, these traces can be understood to be a communicative form in their own right with an indexical link to the traces from which they were derived. The question for the anthropologist becomes not what are the "webs of significance" that people are spinning that result in something called the climate, but, instead, what happens when climate change as a form of thought collides with other forms of thought (in my case urban governance in Manchester)? It is a matter of asking, with Bateson, how do ideas interact?

Thinking like a climate is proposed, then, as a description of this interaction between climate change and other forms of thought. It is a means of working beyond an opposition between materiality and representation, and introducing a terminology that destabilizes the usual modes of identifying where the work of patterning, differentiation, interpretation, and intervention occurs. It is put forward as an extension of the Anthropocene ethnographies I have already mentioned, with the aim of pushing ethnographic studies of human-environmental relations to attend more explicitly to the interplay of materials, technologies, inscriptions, and the imagination.[21] Much of the debate about the cultural and political implications of climate change has taken place in an epistemological, social register, with important questions being asked about whose truths count, whose lives matter, and whose perspective gains power. And yet the inexorable march of rising carbon emissions continues. Coining the phrase *thinking like a climate* is an attempt to explore questions of epistemology and belief, while keeping in view climate itself as a form of reality that demands a reframing, both empirically and analytically, of what knowledge is and how it comes to be.

Anthropology and the Climate

Rather than making a universalizing claim about humans or nature in the Anthropocene, it should be clear by now that my specific interest is what *thinking like a climate* is doing to modern ways of knowing and being in the world. Given that anthropology might be argued to be part of the same post-Enlightenment modernity as those with whom I have been doing my

research, my empirical focus necessarily bleeds into the question of how we as anthropologists might learn from those who have been trying to think like a climate, of whether we might have to do anthropology differently in the face of climate change. There has not yet been a sustained conversation about the relationship between anthropological ways of knowing and the implications of climate change. But my experience of trying to do an ethnography of climate change, and the relative paucity of studies within anthropology on climate change as I have characterized it here, suggests that there is something inherent to anthropology as it currently operates that produces a similar challenge in confronting climate change to that experienced by the bureaucrats and activists I worked with.

To gain some sense of the kinds of challenges anthropology might face in addressing climate change through its extant practices and methods of knowledge construction, we can learn from those in other related disciplines who have also begun to ask similar questions of their own disciplinary practice. In relation to the discipline of history, for example, Dipesh Chakrabarty (2009) argues that climate change poses a profound challenge to the way in which history has constructed itself as a discipline concerned with the story of human history, set against a backdrop of environmental transformation that has conventionally been deemed outside historical time. While historians have provided powerful accounts of transformations in the social domain—globalization, colonialism, and postcolonialism—climate change, Chakrabarty argues, posits another kind of human that seems to sit outside history: the human as species. For Chakrabarty, "*climate change poses for us a question of a human collectivity, an us, pointing to a figure of the universal that escapes our capacity to experience the world*" (222, emphasis added). If historical accounts are constructed by attending to human experience, how, Chakrabarty asks, can the history of the human as species—which is by definition nonphenomenological, conceptual, incapable of being experienced—be brought into historical analysis?

The novelist Amitav Ghosh poses a similar set of questions regarding the challenges of thinking like a climate within the field of literary fiction in his recent book *The Great Derangement* (2016). Ghosh argues that the global scale, abstractions, and catastrophic qualities of global climate change challenge the literary conventions of the modern novel that privilege the telling of sweeping social stories through an attention to the everyday and the mundane. How will literature, Ghosh asks, have to change to incorporate climate change into novels in a way that does not recategorize

them as niche—whether gothic, science fiction, or a recent subgenre that points to exactly what Ghosh worries about, the category of climate fiction, or "cli-fi."

In *Thinking Like a Climate* I aim to provide an anthropological complement to these historical and literary explorations by reflecting on the challenges that emerge when one tries to do ethnography in/of climate change. In one respect the perspective of anthropology, the study of human beings, would seem to be absolutely crucial for understanding the implications of the findings of climate science for humanity. But as my ethnographic work with climate scientists and those who are working to respond to the science shows, the humanity invoked in relation to climate science often looks very different from the concept of the human with which most anthropologists work. The methods of climate science that we find described in this book depend on at least two dominant versions of the human. The first is the human as species—the same concept that Chakrabarty worries about for history. This is a designation of humans as a global social collective, a version of humanity as an aggregate of human units, that quickly moves us toward Malthusian arguments about the dangers of excess population. It also has the effect of continually reopening the gap between the human as universal concept and the varieties of human experience that I touched on above.

The second is a version of the human that posits human beings as universally suffering from psychological tendencies that need to be tapped into to change behaviors or treat flaws that make us incapable of comprehending and responding to the problem of climate change adequately. This version of the human opens up a space for psychological solutions, which often provide a bridge between the science and the economics of climate change, producing alluring arguments about human attitudes, values, and beliefs. These use the same language as anthropologists use but are strangely at odds with the concept of the human as it has been deployed and deconstructed within anthropology.

It is troubling to me that a more anthropological understanding of human being—one that would attend to actual social relations, to collective processes of meaning making, to history, social imaginaries, and the ritual and relational dynamics of power—is missing from this bifurcated depiction of climate change that emerges out of climate science. But if climate science is to be taken seriously as a problem with which anthropologists can engage, then it also creates a challenge for anthropology as to how we might do better in responding to the science in ways that can connect our

evidence of human experience, in all its variety and complexity, with the form of being that climate science makes evident. Anthropology as the ethnography of social groups risks becoming irrelevant in relation to discussions about climate change if it remains the study of situated local social practice without also attending to the way in which social worlds are entangled with global ecological processes. If climate scientists are being challenged by the need to attend to the social implications of their science, should we as anthropologists not be equally challenged by the question of how to incorporate evidence of the extended material effects of human activities into our analyses of the making of human social worlds?

Forging an anthropology of climate change requires not only that anthropologists turn their attention to its manifestation in changes in weather or rising sea levels through ethnographies of affected communities. It also requires that we reconsider our own understandings of the way in which human social worlds come into being and how these understandings are being challenged by the dynamics revealed by the science of climate change. I explore this last point in the second half of the book when I introduce a third version of the human that seems to be coming to the fore in the way in which people are responding to the challenges of climate change in urban settings—a version of human being that repositions social experience not as based on normatively sustained cultural ideas but as constituted out of practices of forging what might be seen as an "adequate" response. Rather like the version of human interaction put forward in Bateson's ecology of mind, *Thinking Like a Climate* here surfaces a version of social experience that privileges affective, engaged responses to objects, data, models, and signs. In Manchester this mode of human being was materialized through relations with things as diverse as bees, eco–show homes, weather chambers, Raspberry Pi computers, thermographic images, and data hacks. Such objects and practices were forms that were provoked by climate change and its challenge to modern ways of knowing. They were both local and global in their constitution, both in place but also constituted by relations that invoked faraway places and possible future times.

This responsive version of human being that we find emerging out of the everyday practices of thinking like a climate offers, I suggest, a potentially productive direction for a future anthropology of climate change. Anthropologists, with their training in attending to relations that cut across conventional ways of knowing, are well equipped to take on board the implications of a perplexed, uncertain, responsive lived humanity that seems to

be coming to the fore as people work to think like a climate.[22] Ethnography already has the methods that give primacy to listening, to seeing things differently. However, if we are to really take on board and learn from this responsive humanity that emerges in the face of climate change, we will have to take ethnography beyond established forms of reflexivity that still rest on a form of cultural relativism that privileges a focus on narrative, norms, and beliefs. For what we learn from those who are attempting to find modes of living and acting appropriate to living in a changing climate is a need to see human sociality as something that emerges with, and is shaped by, natural processes, technical devices, and material objects. Crucially, these proxy objects have a central part to play in creating analogies between the relational forms suggested by climate models and the productive possibilities of located action in the world.

This means that rather than seeing the anthropological encounter as existing between ourselves and other people inhabiting a space of culture, the encounter here is between people, on the one hand (that is, both anthropologists and those they spend time with as they are doing research), and materializations of climate in objects and data, on the other. For this reason this has ended up being a book that is as much about the possibilities of an anthropology that is capable of responding to climate change as it is about how "other people" out there are responding. What I advocate by the end of the book is the cultivation of an anthropology of the Anthropocene that must involve listening *with* others to understand how people and things are made out of relations with technological environments, as well as listening *to* them. Here I argue that we need to cultivate new practices as anthropologists, extending ethnography so as to be able to more adequately work with the materials our research participants are working with—in this case graphical representations, data, models, equations, memories, and experiences, as well as experimental collaborative methods. It is not enough to write "about" climate models, climate scientists, or climate activists, as if we were outside them. Creating an anthropology of climate change instead demands that we too try to learn to think like a climate in our work. Only if we do this will we, like others I have been working with, learn to be affected by climate change, and with it learn how to see the world anew. For learning to be affected demands a reconsideration of who we are as anthropologists and what we might want to be. What climate change teaches us is that anthropologists, as much as everyone else, are in climate change ontologically. The question is how to come to be in climate change

epistemologically—that is, how as anthropologists we might learn to think like a climate by recognizing climate change as an idea that has material as much as theoretical dimensions. For anthropology, this material inflection means that reflexivity in the face of climate change will require not only a revision of our ideas in light of the ideas of others but a reconsideration of the human and nonhuman relations through which anthropology has been conducted in the past, and through which it will have to be redesigned in the future.

Summary of the Book

To delve into the nature and effects of thinking like a climate for both those involved in urban governance and those involved in anthropology, the book proceeds in two parts. Part I unravels and explores what happened when a group of people in Manchester were compelled by the findings of climate science to think like a climate, and elaborates on how the forms and patterns of climate were evidenced, presented, and circulated, centering on the practices, technologies, and material agencies through which global climatic processes were made measurable, detectable, and scalable. These chapters focus on the techniques and methods through which local climate futures came to be imagined, the difficulties encountered in localizing modeled climatic change, and the implications of these challenges for the development of an appropriate response to climate change.

Before each chapter I provide a series of stories through which I map out the origins, form, and institutional positioning of climate change in the city. These stories have been compiled out of many conversations I had and offer a series of narratives about the form climate change has come to take in the city of Manchester. For those readers who are interested in understanding some of the detail about how climate change was approached in the city, perhaps to compare it to similar attempts to tackle climate change in other kinds of places, these dialogues offer a way of moving quickly through the text. For those who are more concerned with the theoretical points that the book aims to elaborate, these dialogues can be skipped over or read separately from the chapters, which delve in more depth into how climate change came to manifest in and around Manchester as a form of thought. Here I focus in turn on various qualities of climate change: its globality, its capacity to be apportioned into units of responsibility, its invocation of

extensive material connectivity, and its peculiar futurity. For each of these dimensions of climate thinking, I show how numbers, graphs, and calculations of climate change were made and altered by their confrontation with other modes of producing and enacting social imaginaries of the city.

What the first half of the book illustrates is that the impetus to think like a climate had the effect of posing fundamental questions about the capacity of existing techniques of modern government to tackle entanglements of environmental and social relations. This was made particularly evident in the way climate change seemed to disrupt linear, evidence-based forms of planning for the future. The fundamental relationship between knowledge and action on which practices of governance in Manchester were shown to rely is revealed to be deeply challenged by climatological thinking. Part II departs from this analysis of the challenges of climate thinking for already existing forms of governmental practice to explore how alternative modes of relating to climate have been forged. In particular, the second half of the book focuses on sites where the relationship between knowing and acting has been reworked in the form of experiments, trials, responsiveness, diagnostics, and mimesis. Instantiated in objects and techniques that worked to engage matter in a variety of different ways, these alternative ways of thinking with the climate are explored not just as pragmatic technical responses to climate science but as figurative devices that I suggest might help us to reimagine the social in climatological terms.

This brings us to the conclusion of the book, where I return to the question of how anthropology might equip itself with tools to more adequately address the sociocultural implications of climate change by reflecting on the relationship between ethnographic description and the objects and techniques that are offering people an alternative means of engaging with a changing climate. *Thinking Like a Climate* ends with a discussion of the implications for an anthropology of climate change that stem from the attention to entanglements of meaning and matter described in part II of the book. As Kirsten Hastrup has argued, "to talk across disciplinary boundaries anthropologists need to cultivate a more comprehensive interest in the interpenetration of local and global climate issues and of different registers of knowledge" (Hastrup 2013, 2). The form of humanity, personhood, and relationality highlighted by the objects and techniques introduced in part II point to alternative ways of attending ethnographically to climate change that go beyond filling in the gaps of global abstractions with local detail. The conclusion highlights instead a new direction for an anthropology of extended and ecosystemic relations, producing the grounds for an

engaged anthropology that is not just advocacy, nor even public anthropology, but a materially responsive anthropology that, as it learns to be affected, cultivates new grounds for anthropological inquiry in a climate-changing world.

NOTES

Introduction

1. These have generally taken the form of articles and edited collections rather than full-length ethnographies, although see Callison (2014), Marino (2015), and Orlove (2002) for examples of ethnographic monographs on weather and climate change. For an overview of anthropological research on climate change, see Crate (2011), Crate et al. (2009), and Hulme (2017).

2. For an exploration of the relationship between depression and digestion, see Wilson (2015).

3. We might also put this argument alongside the idea of the extended mind as proposed by Andy Clark and David Chalmers (1998), work inspired by Henri Bergson ([1896] 1988) on the materiality of memory, and the work of medical anthropologists such as Margaret Lock (2013) and Elizabeth Wilson (2015), who have begun to explore how "thinking" is not "located" in the mind of humans but produced out of interactions among the mind, the microbiome, the gut, the genetic code, and wider environmental conditions. If human thought does not take place inside the head, then the possibility emerges that we might extend the notion of thought to nonhuman entities.

4. This term has been used in marketing materials, comes up in public discussions, and was used as the title for a book about the city by public commentator Charles Leadbeater (2009).

5. City authorities have played a prominent role in climate change mitigation since at least the early 2000s, and there are now many networks such as C40 cities and the EU Covenant of Mayors that aim to link cities and their work on climate change. For a more general discussion of cities and climate change, see Bulkeley and Betsill (2004), Bulkeley and Castán Broto (2012), and Bulkeley et al. (2013).

6. This is not to say that no climate deniers exist in Manchester. Comments on the council leader's blog posts and on online discussion forums do occasionally come from climate skeptics. But these tended to be seen as outliers, and dealing with such comments was not deemed a significant part of the challenge of tackling climate change in the city.

7. See Grundmann (2013) for detailed discussion of Climategate and issues it raised about scientific credibility.

8. Henry Bodkin, "Climate Change Not as Threatening to Planet as Previously Thought, New Research Suggests," *Telegraph*, September 18, 2017.

9. Graham Stringer, editorial, *Daily Mail*, September 20, 2017.

10. *The Today Programme*, BBC Radio 4, August 10, 2017.

11. Damian Carrington, "BBC Apologises over Interview with Climate Denier Lord Lawson," *Guardian*, October 24, 2017, https://www.theguardian.com/environment/2017/oct/24/bbc-apologises-over-interview-climate-sceptic-lord-nigel-lawson.

12. Subsequent to this event, in August 2018, fifty-seven scientists and public figures sent a public letter to the BBC stating that they would refuse to be interviewed if they were to be forced to share a platform with a climate skeptic. In September 2018 the BBC sent a briefing to editorial staff warning them to be aware of false balance and stating, "You do not need a denier to balance the debate." Damian Carrington, "BBC Admits 'We Get Climate Change Coverage Wrong Too Often,'" *Guardian*, September 7, 2018, https://www.theguardian.com/environment/2018/sep/07/bbc-we-get-climate-change-coverage-wrong-too-often.

13. Live data on global average carbon emissions can be found at Earth's CO_2 Home Page, accessed February 7, 2020, http://www.co2.earth.

14. These possibilities are discussed in the IPCC's *Climate Change 2014—Impacts, Adaptation and Vulnerability* report (Intergovernmental Panel on Climate Change 2014).

15. On natural resources and the city, see, for example, John Pickstone's (2005) historical work on urban governance in Manchester and more recent studies such as Peck and Ward (2002) and Lewis and Symons (2018).

16. Given that Karl Marx himself was seen to be largely silent on the problem of nature in his writings, much ink has been spilled exploring how nature and natural processes might figure in Marxist analyses of economic relations. While some have critiqued the exteriorization of nature, others working within the Marxist tradition have been accused of themselves reproducing the separation of nature from culture in their descriptions (see Castree 2000 for an overview of this debate).

17. It is for these reasons that within planning literature, climate change is often termed a "wicked problem" or even a "superwicked problem" (Lazarus 2009; Rittel and Webber 1973). Earth scientist Chris Rapley recently referred to climate change as a "mischievous demon" that seems as if it had been deliberately sent to try us in the most difficult ways possible (personal communication, May 18, 2017). More prosaically, talk of the kinds of changes required to tackle climate change, along with a host of other Anthropocenic questions, uses the language of infrastructural lock-in (Unruh 2000), a need for "multi-level transitions" (Geels 2012), or Margaret Atwood's (2015) observation that climate change should really be called "everything change."

18. In this attention to hybridity and blurring of boundaries we can see the powerful influence of much longer discussions in feminist science and technology studies of the politically transgressive and revolutionary potential of cyborgs, technologies, and medicalized bodies (Haraway 1991, 2016; Mol 2003; Rapp 2000; Suchman 1987).

19. Philippe Descola (2013) brilliantly illustrates how nature has been a culturally specific idea in his description of four basic ontologies of nature.

20. Andreas Malm and Alf Hornborg (2014) and Jason Moore (2015) have argued that we should abandon the idea of the Anthropocene for other concepts, such as the Capitalocene, that more accurately describe the causes of global environmental change and the uneven distribution of its effects. Taking a broader and more philosophical stance, Christophe Bonneuil and Jean-Baptiste Fressoz (2017) provide a less partisan but equally powerful critique of the possibilities and limits of the concept of the Anthropocene.

21. Here I build on a number of similar analytical projects often influenced by Peircian analyses of representation that complicate who or what can be an agent of signification or Deleuzian approaches to social/material processes that highlight the patterned or formal qualities of being and becoming. These include the work of Bateson and his proposition for an ecology of mind; the work of anthropologists like Julie Cruikshank (2005) and her question, *Do Glaciers Listen?*; Kohn's (2013) book *How Forests Think*; and Aldo Leopold's (1949) chapter "Thinking Like a Mountain" in *A Sand County Almanac*. It also builds on work that brings together literary and political approaches to environmental processes, such as Cymene Howe and Dominic Boyer's (2015) study of wind power in Mexico.

22. Climate science has also found itself playing the role of a kind of "sentinel device," or what Latour (2017, 47) has called an "alarm." Climate science not only provides an alternative description of the grounds for action but has also figured as an alert, pointing people to the ineffectiveness of their activities in the face of complex, extended, global entanglements of humans and natural processes.

Chapter 1. 41% and the Problem of Proportion

1. European Council, "The 2030 Climate and Energy Framework," accessed February 13, 2020, https://www.consilium.europa.eu/en/policies/climate-change/2030-climate-and-energy-framework/.

2. For ethnographic accounts on responses to a changing climate, see Aporta (2002), Cruikshank (2001), T. Huber and Pedersen (1998), Laidler (2006), and Vedwan and Rhoades (2001).

3. NOAA National Centers for Environmental Information, "State of the Climate: Global Climate Report for April 2017," May 2017, https://www.ncdc.noaa.gov/sotc/global/201704.