GUEST EDITOR'S INTRODUCTION

Climate Change: Adaptation, Mitigation, and Critical Infrastructures

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On October 22, 2012, an African easterly wave formed in the Caribbean Sea and quickly grew into a tropical storm with frightening potential. It was the hottest year in recorded human history (though that record has subsequently been shattered), and the seawater was unusually warm. Strong winds whipped the wet Caribbean air into a frenzy as the storm moved north and west, and by October 24 the system had become a hurricane. Meteorologists named it Sandy and predicted it would sweep through the Caribbean islands and make landfall somewhere on the eastern seaboard of the United States.

Sandy turned out to be more dangerous than anyone initially anticipated. The "superstorm" intensified and grew as it moved across the Caribbean, ultimately covering an area more than one thousand miles in diameter, making it one of the largest hurricanes in American history. Its winds were punishingly severe, yet the weather system was painfully slow, and the steady, relentless storm seemed to pause so that it could inflict extra damage on nearly everything in its path. Sandy hit the Atlantic coast on October 29—the worst possible moment. Not only was there a full moon with high tides, but there was also an early winter storm with arctic air moving into the northeastern region from the other direction, and the two systems collided to form what journalists called a hybrid "Frankenstorm."

As the primary target of the attacks on September 11, 2001, New York City had spent billions of dollars over the course of the following decade shoring up its security systems and preparing for a catastrophe. Terrorism was not its only con-

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cern. Under Mayor Michael R. Bloomberg, the city also became a leader in planning for climate change, issuing high-profile reports about adaptation and mitigation and beginning the process of making the city more weather-resistant. In August 2011, New York City braced itself for the arrival of a severe storm system, Hurricane Irene, but was largely spared when the storm spun off to the north and west. The experience was something like a dress rehearsal for city officials and emergency managers, but it also gave residents a false sense of security and only bolstered the collective confidence that has historically served Gotham so well.

Sandy laid waste to New York City's spirit of invulnerability and to much of the city's vital infrastructure as well. The storm surge, which reached fourteen feet, toppled the city's flood protection systems. Subways filled up like bathtubs. The sewage system flooded and 11 billion gallons of soiled waters overflowed into rivers and streets. The communications system broke down, leaving more than 1 million residents and businesses without phone or Internet service. The power grid failed, massively, with outages lasting nearly a week in Lower Manhattan and much longer in parts of Brooklyn, Staten Island, and Queens. Several hospitals and nursing homes were evacuated. Tens of thousands of residents were displaced from their homes, some permanently. Officials estimated the economic toll at around $60 billion. Miraculously, in the United States fewer than one hundred people died.

I had been doing research and writing about extreme weather events in cities for nearly two decades when Sandy hit. This current period, which a growing number of scholars are calling the "age of extremes," has been punctuated by significant disasters that change the way we understand risk, vulnerability, and the future of cities. Superstorm Sandy was neither the deadliest nor the most expensive catastrophe in recent US history, and in global terms its impact was far less severe than other twenty-first-century disasters, from the Indian Ocean tsunami in 2004 (which killed more than two hundred thousand people) to the pan-European heat wave of 2003 (which killed around seventy thousand people). Yet Sandy is important for other reasons: not only did it reveal the surprisingly fragile physical and social infrastructure of one of the world's wealthiest and best-protected metropolitan areas; it also directly affected the political, economic, and media elite of the United States, where the fossil fuel industry has had its greatest success promoting climate change denial and policy stagnation on all variety of environmental matters. Today a wide range of people and institutions that have the capacity to shape public opinion, social policy, and urban planning see the world differently than they did before Sandy hit. They are looking for new ideas—about how to reduce greenhouse gas emissions, how to protect vulnerable people and

places, and how to rebuild cities, communities, and critical infrastructures so that the systems we depend upon don't fall apart when we need them most.

The research articles in this issue, all published here for the first time, were developed through a multiyear ethnographic research project on climate change adaptation and mitigation, around the world, conducted by some of the most innovative scholars working on climate, culture, and cities today. The hypothesis that guided our project was that the best techniques for safeguarding cities and critical infrastructure systems from the threats related to climate change have multiple benefits, strengthening the networks that promote health and prosperity during ordinary times as well as mitigating disaster damage. Our research involved a blend of fieldwork, interviews, photography, and policy analysis. Some of the articles aim to assess whether the emerging models for adaptation work as well in practice as they do in theory and to identify challenges for importing different strategies to different parts of the world; others step back from immediate policy debates to analyze the underlying cultural and political ecological dynamics that shape the ways we make sense of emerging climate concerns.

The geographical scope of the articles here is wide, but they focus on a few major themes. Energy production—past, present, and future—is at the heart of global warming, so we feature several articles about emerging systems that planners, policy makers, and private corporations are introducing as substitutes for coal and oil. In an ethnographic study conducted in Mexico, anthropologists Cymene Howe and Dominic Boyer track the messy politics of a large-scale project to harness wind power as a source of renewable energy, showing how the project's champions ignored local social inequities and the political grievances of the people whose lives would be immediately affected by the new system. "We cannot fail to use energy transitions as opportunities to rethink dominant political, economic, and social institutions" (217–18), they argue. "To ignore this dimension is to imperil our ability to dislodge carbon's dominion and the many inequalities that carbon modernity helped to cement between the global North and South and between metropoles and resource-rich hinterlands" (218).

In an exciting collaborative essay, sociologist Colin Jerolmack and photographer Nina Berman go to Pennsylvania to document the ways that fracking—which policy makers around the world have positioned as a bridge from oil and gas to renewable energy—fragments the body politic, undermining the sense of common purpose and shared vulnerability required to address climate change. And in a short essay, Valeria Procupez chronicles a series of lengthy blackouts in Buenos Aires, where rapid urban development and rising energy consumption has taxed the local power grid beyond its capacities, rendering much of the city susceptible

to outages in all weather, but particularly during its frequent summer hot spells. Neither in Buenos Aires nor at the national level, she shows, is there a coherent policy in place for updating the energy system; instead, a number of discrete entities take up independent projects, and the state's stated objectives—reducing emissions, developing renewable energy, establishing rational use protocols, and limiting consumption—are little more than rhetoric.

If converting energy systems is the main challenge of climate change mitigation, coping with extremes of water—sometimes too much, sometimes too little—is perhaps the most vexing problem of climate change adaptation. In a polemical but persuasive article, ethnographer Liz Koslov maps out the implications of sea level rise for the billion or so people who live in flood zones and urges scholars and policy makers to begin planning for the inevitable: a massive retreat from low-lying coastal and riverine regions. Although her fieldwork is in Staten Island, New York, where thousands of residents are asking the state to subsidize their relocation to higher ground and return their former neighborhoods to Mother Nature, Koslov provides a global tour of sites where inhabited land may soon prove uninhabitable. In another essay, the political ecologist Daniel Aldana Cohen takes us inside the fight over water management and rationing in São Paulo, identifies reasons why climate justice projects have not fit well into traditional campaigns for public goods, and speculates about how that might change as water becomes scarce. And, drawing on fieldwork on the other side of the planet, Gökçe Günel takes a critical look at another extreme: fantasies of infinite water produced through new technologies and desalination facilities in the Arabian Peninsula.

Global warming means that future states and societies will have to change more than their power and energy systems; in coming decades they'll also have to update the critical infrastructures that make urban settlements possible, from transit networks to food supply chains and climate security systems that protect against heat waves, hurricanes, and floods. This issue includes articles on urban infrastructure adaptation in a range of settings. In Bogotá, Austin Zeiderman introduces the concept of "adaptive publics" to signal the emerging constituency clamoring for policies to cope with climate change in the city. Like Cohen, Zeiderman is interested in how entrenched progressive political actors with redistributive economic agendas integrate technical adaptation projects into a broad program of social inclusion. He charts the rise of "metrological citizenship," whereby citizens demand both an assessment of their ecological vulnerability and a set of social infrastructure developments that will protect them.

In Singapore, Jerome Whitington observes a different version of climate politics at work. Water management, flood control, and coastal protection have always

been vital to the welfare of the island city-state. In recent years, Whitington argues, government officials have framed conventional population security policies as climate change adaptation strategies but have failed to plan for the kinds of large-scale ecological transformations that, to use his term, "pluripotential climate futures"—nonlinear transformations that arise in the conjunction of human and nonhuman systems—could bring (417).

Andrew Lakoff is also interested in the ways that global warming alters the relationship between ecosystems and human-built systems. Drawing on new research in California, Lakoff chronicles the fascinating role of the delta smelt, a two- to three-inch translucent fish with a lifespan of roughly one year, in political fights over water management and new infrastructure in the parched state. His essay tracks the two-decade-long struggle, conducted by an alliance of fishery biologists, sport fishermen, and environmental advocacy groups, to protect the delta smelt and other native fish populations as policy makers attempt to circulate water to different constituencies. The negotiations Lakoff analyzes take up difficult questions: "What values are at play in efforts to sustain the existence of nonhuman life in a setting of intense competition over a diminishing and essential resource? What forms of knowledge are developed to gauge the health of threatened species, and what techniques are used to regulate the provision of water in the name of species protection?" (239–40). But they also reveal the ways that climate change adaptation policies necessarily intersect with other political concerns and interest groups, and even small, nonhuman actors can play powerful roles in shaping designs for vital systems work.

After Sandy, the Rebuild by Design competition became an important source of ideas for these projects, in the United States and throughout the world. An initiative of President Barack Obama's Hurricane Sandy Rebuilding Task Force, the competition attracted 148 entries from multidisciplinary, international teams that included architects, landscape architects, engineers, climate scientists, social scientists, and community organizers, among others. The federal government selected ten finalists, and after a nine-month process of research and extensive outreach, each team partnered with local stakeholders (governments as well as civic groups) and submitted formal proposals to a jury. There were six winning projects, all of which received federal funds for support and are currently in various stages of development. I was the research director for the competition, and part of our work involved assembling an international network of distinguished experts on the politics of designing for the climate changes to come. The group includes Fernando de Mello Franco, secretary for urban development, City of São Paulo; Mindy Thompson Fullilove, professor of clinical psychiatry and public

health at Columbia University; Maarten Hajer, chief curator of the 2016 International Architecture Biennale Rotterdam; Henk Ovink, principal of Rebuild by Design and special envoy for international water affairs for the Netherlands; and Edgar Pieterse, South African Research Chair in Urban Policy and director of the African Center for Cities. For this issue, each of them talked to Cohen about their experiences with design. I'm excited to publish these conversations here.

Collectively, the articles and interviews in this issue help establish a research agenda for the social study of climate change adaptation, one that focuses on struggles over infrastructure provision, on the problems of forced migration and resettlement, on the politics of design, on the relationship between extant and emerging social movements, on the cultural consequences of new energy projects and public policies, and on the thorny questions of whose vulnerability and security will matter as cities, nations, and international agencies face up to the challenge of global warming That reckoning is inevitable; the only question is when it will begin. We hope this special issue of *Public Culture* advances the conversation.