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# Climate Change and Place

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Climate change has been called the defining issue of the twenty-first century, and it is undoubtedly one of the supreme challenges for environmental designers. A multitude of scientific studies now report that its disruptive effects will be felt worldwide in terms of both dramatic weather events and more gradual shifts in rainfall, temperature, and species habitat.

Most acute among its effects—already tragically felt in some places—will be the displacement of human communities by more frequent and intense storms and prolonged droughts. But gradual shifts will also be powerful agents of social change. Rising sea levels may flood coastal settlements and infrastructure; water shortages and higher temperatures will endanger agriculture and public health.

As populations are displaced, global economic and political destabilization may result, catapulting environmental concern from a perceived luxury of the rich to a vital concern for all. The impacts of climate change will be felt everywhere: by those inland and on the coasts, in urban

as well as rural areas, and in the developed and developing worlds. But it will be the poorest populations, in both rural and urban areas, who will be most at risk. This disparity raises important concerns for social equity and responsibility, because the effects of climate change have been largely brought about by the greenhouse gas-emitting actions of wealthy nations.

What responsibility does the developed world have to the developing world? How might planners and designers help address this inequity?

The effects of climate change will also be felt soonest at the extremes and on the edges. In the far northern and southern latitudes dramatically warmer winter temperatures are already melting glaciers and ice sheets. In Earth's driest and wettest regions, changes in precipitation are altering conditions of survival for sensitive species. And at higher elevations rare, endemic species are being threatened with extinction.

Historic patterns and practices are no longer reli-

## The Scientific Consensus

*Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level. And most of the warming is very likely due to anthropogenic emissions of greenhouse gases.*

— IPCC, 2007

The Intergovernmental Panel on Climate Change (IPCC) provides a powerful synthesis of research on both current and long-term climate changes. The following are some findings from its recent report AR4 WG I SPM 2007.

Scientists agree that greenhouse gas emissions will continue to increase over the next few decades. The temperature, too, will increase, in the next two decades at about two-tenths of a degree centigrade per decade, with expected higher than average warming in North America. Even if concentrations of greenhouse gases were maintained constant at year-2000 levels, a further warming of about one-tenth of a degree centigrade per decade would be expected because of carbon dioxide that will remain in the atmosphere.

Sea level has been estimated to rise between 0.59 and 1.8 meters depending on various emission scenarios. These, however, exclude uncertain climate-carbon cycle feedbacks and the effects of rapid changes in ice-sheet flows. Average mean precipitation is very likely to increase in high latitudes and likely to decrease in most subtropical land regions. Snow cover is also expected to contract. Climate extremes, particularly high temperatures, heat waves, and heavy precipitation events, are expected to increase. Tropical cyclone intensity is also expected to increase.

Climate changes are expected to affect environmental and human health in different ways. Major effects on ecosystems include species extinctions and increasing species range shifts and wildfire. Climate changes will also affect water availability and deprive hundreds of millions of people of water. Food security will also be threatened because of reduced yields and damage to crops.

Significant changes to coastal cities and communities are expected as a result of increasing floods and storms. Losses of land, buildings, and infrastructure due to sea level rise are also expected to disrupt the activities of city residents. Human health will be further affected by malnutrition; by diarrheal, cardio-respiratory, and infectious diseases; and by increased morbidity and mortality caused by heat waves, floods, and droughts.

able informants of possible remedies. Permanent loss of species—predicted to be 20 to 30 percent worldwide, at an accelerated rate far exceeding the norm during Earth’s history—will remove potential resources for human benefit and erase organisms that have taken millions of years to evolve. Within human societies, these same organisms are often crucial to establishing place-identity, through either their rarity or commonness.

### Challenge and Opportunity

A new challenge is presenting itself to environmental designers. Our professions are predicated on being able to control to a certain extent the shape and nature of future environments. How do we respond to a course of change that, we are told, is past the point of control? And yet, precisely because we have developed the skills and awareness to envision the future, we may be in the best position to offer solutions. How do we cope with this new set of problems, still largely invisible?

The emerging responses—mitigation through reducing emissions of greenhouse gases and adaptation to minimize effects on human settlements—call for planners and designers to lead the scientific and policy communities toward solutions that avoid the worst-impact scenarios.

Most research and practice so far has focused on developing mitigation strategies. A range of initiatives, from the scale of individual buildings to regions, have been proposed (and some undertaken) to reduce the human carbon footprint. But it is also clear that even if greenhouse gas emissions were to be maintained at year-2000 levels, the climate would continue to change because of lag effects related to slow changes in ocean temperature. Adaptation to changes in temperature, sea level, precipitation, and the frequency of extreme weather events will be inevitable, and

**Opposite:** Computer rendering of the effect of a three-meter rise in sea level on Boston and surrounding cities. Image courtesy of Architecture 2030.



will require creative solutions and new approaches.

Climate change is simultaneously a challenge and an opportunity for designers and planners. It demands that we abandon the old equilibrium paradigm—the assumption that, after perturbations, the system will eventually return to a steady state. And it challenges our disciplines to understand that urban environments are multi-equilibria systems. What are the implications of designing structures and formulating policies with such an awareness?

Designers and planners will need to fully acknowledge that environmental variability and uncertainty are intrinsic, and cannot be eliminated without driving the system to collapse. Designing for uncertainty requires a paradigm shift and calls for new principles. It requires appreciation that design and construction are only part of what drives our sense of built function and performance. Both these qualities emerge as the result of interaction between structures and natural processes. What role then will designers and planners need to play?

### Multiple Perspectives

*Envisioning Radical Futures.* The severity of climate-change impacts are sure to mandate profound changes to design thinking. The first group of articles in this theme section of *Places* imagines bold changes in to respond to future conditions. First, Guy Nordenson's Latrobe Prize team considers the problems of rising water around New York. To address storm surge, the team proposes replacing the hardened coastal structures of the New York-New Jersey Upper Bay with soft, resilient shorelines, changing its underlying bathymetrics and creating protective island archipelagos. Next, Architectural Research Office's prize-

winning proposal offers a typological response to an anticipated 36-inch rise in the waters around Manhattan by the end of the century based on a new infrastructure of “vanes” and water-circulation towers. A third article, by Kiel Moe, steps back to discuss how contemporary fictional narratives present scenarios of post-Risk Societies, and suggests that we adopt a philosophy of radical engagement.

*Adaptation, Mitigation, and Uncertainty.* To stem the severity of impacts, it will be necessary to arrive at solutions and advance ways to build that will reduce greenhouse gas emissions in the short term. The shaping of metropolitan regions will be key, with overall population impacts and carbon footprints typically smaller in dense cities. But, cities may be where climate change impacts are felt most dramatically—through heat-island effects, coastal flooding, and food and water shortages. Cities will need to be more socially and physically resilient, better able to survive hotter, wetter, and colder weather, and better equipped to provide adequate supplies of food and water.

Cities, and the places within them, are also part of larger patterns, and we must strive to create distributed infrastructures that solve multiple problems simultaneously. Might we also be able to build in ways that go even further to regenerate natural systems and resources?

The second group of articles discusses adaptive urban planning and design solutions. Cynthia Girling documents the case of a dense Vancouver community planned to be carbon neutral within five years. Taking into account the importance of vegetation to community and individual sense of place, the ecologist and landscape architect Mary Carol Hunter offers detailed guidelines for resilient plant palettes. Using Bangkok as an example of low-lying cities worldwide, Danai Thaitakoo and Brian McGrath propose a shift of perception that embraces new forms of water-based urbanism. Finally, the award-winning project by Chicago Urban Lab illustrates a multifunctional, regenerative approach to “growing water” in Chicago through urban green infrastructure.

*Loss of Cherished Places.* The sense of public and private loss caused by climate change is already upon us.

The third set of articles expresses manifestations of this dismay, particularly in terms of endemic, defining qualities of place. David Myers reflects upon change in his home state, Maryland, as evident at its margins in changes to the treasured natural environments that help define a common middle. Virginia Matzek and Peter Kareiva make a similar point in their article about the impact of climate change on Central California's majestic oaks, whose loss signals profound changes in the identity of and livelihoods in com-

munities there. In another study, Ray Green documents the perceptions of residents in settlements along the Great Ocean Road in southern Australia, where change from rising sea levels is compounded by the tide of inappropriate development.

*Calls to Action.* A sense of urgency is beginning to enter design discourse, but a further upwelling of awareness, concern, and creativity will be needed to frame a new era of policy, planning, and design. Existing initiatives include the commitments of more than eight hundred U.S. mayors, who have signed the Mayors' Climate Agreement; Ed Mazria and Architecture 2030's "2010 Imperative" and "2030 Challenge"; the U.S. Green Building Council's "Living Building and Living Infrastructure Challenge"; and the Brookings Institution's mandate for federal policy in support of compact communities, transit choices, and location-efficient decisions. Al Gore has proposed that the United States convert to 100 percent carbon-free fuels in the next decade, a challenge he equates to landing a human on the moon.

In the fourth section we augment these appeals. The first article, by David Matthews, is a fictional retrospect praising the future actions of Seattle residents. Harrison Fraker then reports on a recent workshop of scientists, which called for mobilization of national resources on a scale not seen since World War II, and he appeals for designers to adopt a new whole-systems approach and support ACSA's proposal for a National Academy for Environmental Planning and Design. In Britain, the Commission on Architecture and the Built Environment is working with municipalities to strengthen the mandate for climate-responsive planning, and Paula Vandergert reports on the first of a series of climate-change festivals, which took place this past summer.

The section concludes with a more sober presentation of climate-related disaster planning and reconstruction, by Pablo Suarez and several other representatives of humanitarian agencies. They offer a set of principles and opportunities for planners and designers to collaborate with service organizations to reduce the heart-wrenching consequences of the carbon society's destabilization of the the global climate.

### Sharpening the Debate

A common emotional response to climate change might be one of helplessness—despair over the inevitable loss of cherished places and environments, coupled with a sense of bewilderment: what can we, as design and planning practitioners, do? With climate-change scientists continually



revising their estimates of impacts upward, can we make a difference? Can we stave off such crises as the inundation of low-lying cities? What will it take to cope and adapt?

Currently, uncertainty permeates our thinking and sets our heads spinning. Without a body of literature to inform interventions, let alone serve as a basis for testing and evaluating them—or offer some sense of future processes or conditions—we will have difficulty proceeding with confidence. How do we work in the space between predictability and uncertainty? How might we be guided to respond to the idiosyncrasies of places and the climate impacts particular to them, so that their richness and diversity will be perpetuated rather than diluted?

We hope the views expressed here will establish a forum for continued discourse on these issues. We hope they will shape a clearer perspective and lead to principles that provide firmer ground for the design community as we engage this era-defining challenge.

**Opposite:** As Pablo Suarez and his fellow contributors report, adaptive strategies to climate change may require only imagination. For example, some Bangladeshi women have adopted a simple, clever way to deal with the death of poultry from the increased frequency of flooding: replace chickens with ducks. Photo by Angie Dazé/CARE.

**Above:** As Virginia Matzek and Peter Kareiva report, the oaks that provide relief in the flat, agricultural valleys of central California are doomed in current climate change scenarios. Photo by Virginia Matzek.