Adapting to water impacts of climate change

Introduction to special issue of *Climatic Change*

Debra Javeline¹ • Nives Dolšak² • Aseem Prakash³

Published online: 9 January 2019

© Springer Nature B.V. 2019

Humans increasingly experience climate change through its influence on water availability, quality, and timing. Droughts threaten the availability of water for drinking, energy, irrigation, and inland navigation, which in turn threaten the food supply, commerce, and industry. Hurricanes and extreme precipitation events threaten homes, infrastructure, fisheries, and local economies. Rising seas compound these threats while encroaching on freshwater aquifers and rendering many long-inhabited areas unlivable. Increased ocean temperatures and acidity threaten seafood availability (the source of 70% of human protein intake), biodiversity, and ecosystem services. Increased humidity magnifies threats from insects and other vectors of disease.

This special issue of *Climatic Change* investigates what, if anything, humans are doing to adapt to a world that at various times and places is both wetter and drier, more hazardous, and less inhabitable. Adaptation is the reduction of the vulnerability of human and natural systems to climate change. It involves changes in business-as-usual practices and policies so that we better protect ourselves. Are humans actually taking such precautions? Of the many water impacts of climate change, those that involve water excess are the focus here: storms, flooding,

This article is part of a Special Issue on BAdapting to Water Impacts of Climate Change^ edited by Debra Javeline, Nives Dolšak, and Aseem Prakash.

✉ Debra Javeline
javeline@nd.edu

Nives Dolšak
nives@u.washington.edu

Aseem Prakash
aseem@u.washington.edu

¹ Department of Political Science, 2060 Jenkins Nanovic Halls, University of Notre Dame, Notre Dame, Indiana 46556, USA

² School of Marine and Environmental Affairs, University of Washington, 3707 Brooklyn Avenue NE, Box 355685, Seattle, WA 98195-5685, USA

³ Department of Political Science and Center for Environmental Politics, University of Washington, 39 Gowen Hall, Box 353530, Seattle, WA 98195-3530, USA

and sea level rise, often in combination with increased wind. Geographically, the focus is on coastal and riverine communities. How are such communities—the individuals that inhabit them and the governments that manage them—reducing their vulnerability to climate-enhanced hazards? To the extent these communities, individuals, and governments are not adapting or even maladapting, what are the reasons?

To date, much of the literature on climate change adaptation focuses on intentions and plans, including “climate adaptation plans,” “National Adaptation Strategies,” or “National Adaptation Programmes of Action” (e.g., Biesbroek et al. 2010; Panic and Ford 2013). Planning occurs at the country, regional, and local levels, particularly by cities, which tend to be on the frontlines of climate impacts. The literature is much thinner on whether these plans and programs are materializing (Javeline 2014). In practice, governments may simply be repackaging existing infrastructure, regulations, and practices as “adaptation,” especially for disaster management, but not meaningfully reducing vulnerability to climate change, or they might be addressing vulnerabilities without labeling their actions as adaptation, due to the politically charged public dialog surrounding climate change (Dolšák and Prakash 2018).

The papers in this special issue thus fill a critical gap in knowledge by addressing important questions about implementation. Are governments, communities, and individuals *acting* to minimize the harm that people and property face from the impacts of climate change? Are policies being implemented and funded, and if so, what are the measurable outputs and outcomes? Have we done anything to make us better protected from water hazards today than we were yesterday?

Adaptations to water impacts of climate change that are analyzed in this special issue include flood insurance, flood zone maps, managed retreat buyouts, homeowner risk reduction, beach nourishment, and cyclone evacuation behavior. The papers are a subset of those presented at a workshop on “Adapting to Climate Change: Actions, Implementations, and Outcomes,” held at the University of Notre Dame on April 28–May 1, 2017. In response to a call for papers advertised widely over multiple listservs, we received 134 submissions from scholars located in 31 countries (including 20 countries outside North America and Western Europe). After careful scrutiny, we accepted 24 papers for the workshop. The special issue draws on 6 of the 24 papers presented.

The special issue is multi-disciplinary, with authors representing a range of disciplines including political science, oceanography, environmental studies, law, engineering, and economics. While each paper focuses on a single country, mostly the United States, the policies, the debates surrounding them, and their outcomes are widely applicable throughout the world. Most nations are wrestling with questions surrounding the insurance of high-risk properties, mapping risk, encouraging homeowner risk reduction, and preparing for emergencies and evacuations.

The papers clearly speak to one another and share an underlying assumption that people and property are currently in harm’s way. Many of the papers offer the pessimistic conclusion that current adaptations to climate change are woefully inadequate, and people and property will remain in harm’s way for the foreseeable future. There is thus an urgency to this topic. As the special 2018 IPCC report¹ notes, even with the optimistic scenario of 1.5 °C temperature increase above the pre-industrial level, adaptation needs are considerable. With the more realistic scenario of 2 °C temperature increase, adaptation needs are substantially higher.

¹ <http://www.ipcc.ch/report/sr15/>. See Summary for Policymakers, pp. 15, 21–22, 25.

However, adaptation is a highly political issue, marked by policy failures and considerable governance challenges (Dolšák and Prakash 2018). As Robin Craig notes in her paper, “Coastal adaptation, insurance, and perverse incentives to stay,” the law, especially in coastal zones, “should be a critical tool in promoting and directing climate change adaptation.” Craig demonstrates how United States law currently operates in quite the opposite direction and impedes adaptation. The near-bankrupt National Flood Insurance Program (NFIP) and state-financed insurance of coastal property owners provide low-premium insurance to repetitive loss and other high-risk properties and thus offer “perverse” incentives for owners to remain in unsafe locations. While she offers some hopeful examples of state policies that incentivize true adaptation and risk reduction, she argues that most policies are reactive, not preemptive, with political leaders attempting to appear responsive to constituent needs in the wake of catastrophes. As the spate of recent hurricanes demonstrate, United States coastal infrastructure is thus in a precarious position. Instead of reacting after catastrophes, governments should acknowledge, as private insurers are already acknowledging, that most coastal development poses substantial financial risks. Craig recommends policy reform to encourage governments to anticipate and respond to catastrophes by incentivizing comprehensive, coordinated “managed retreat” away from coastlines. She dangles the possibility that such managed retreat programs may need to be involuntary, especially for repetitive loss properties that have in essence already been purchased by government insurance payouts above the fair market values of the properties.

Perverse incentives leading to governance failures are also at the heart of the issues discussed by Sarah Pralle in “Drawing Lines: FEMA and the politics of mapping flood zones.” As both Craig and Pralle document, the NFIP can function only if it accurately understands and reflects risk. To achieve this understanding, the law requires the U.S. Federal Emergency Management Agency (FEMA) to identify, map, and rate floodplains for flood insurance. Implicit in this mandate is the idea of flood mapping as a science-based, apolitical process that communicates objective information about flood risk to NFIP actuaries and to vulnerable populations who then act to mitigate and/or adapt to the risk. In practice, flood mapping works quite differently. Based on her case study of Syracuse, New York, Pralle reveals the largely non-scientific, highly politicized drivers of flood zone determinations, as property owners attempt to influence the process in order to minimize their flood insurance premiums and maintain property values. Safety concerns are subordinate to cost concerns. Ultimately, and perversely, both may be unaddressed. Current flood maps designate some properties as safe when they are not and engender high monetary and social costs when vulnerable but undesignated properties are flooded. Additional perverse effects include the inequity of politicized mapping: Owners of more valuable properties have resources to appeal unwanted flood zone designations and therefore frequently escape the designation, whereas impoverished and even middle class residents of designated flood zones are less able to afford insurance but more often required to purchase it.

An alternative adaptation strategy to flood insurance is buyout, or government purchases of high-risk properties accompanied by owner relocation, the focus of A.R. Siders’ “Who stays and who goes? Transparency and social justice in U.S. managed retreat buyout decisions.” Like Craig, Siders sees managed retreat from hazardous coastal and riverine locations as a reasonable strategy to adapt to the water impacts of climate change. Like Pralle, Siders offers a portrait of a politicized process that so far fails to deliver on its promise for adaptation. The U.S. government-funded buyout programs involve decision-making that is often subjective and nontransparent, and like for floodplain mapping, the results are often socially inequitable. Risk reduction and even cost-

effectiveness have been subordinated to other motives for selecting which vulnerable properties to purchase and thus which property owners are encouraged to retreat. Low-income and minority communities often fear a lack of representation in the process and overrepresentation in unwanted and essentially involuntary relocation. Siders recommends, among other things, that future managed retreat buyout decisions rectify these inequities with greater public participation in buyout program deliberations and greater assistance for resettlement.

Thus, in our current world, insurance and buyouts are part of the adaptation portfolio, but by themselves, they are woefully inadequate for the task of reducing vulnerability to the water impacts of climate change. The remaining three articles in this special issue examine how private individuals respond to their vulnerability conundrum, especially individuals residing in hazardous coastal areas, of whom there are tens of millions in the United States alone.

In “Coastal homeowners in a changing climate,” Debra Javeline and Tracy Kijewski-Correa offer a methodology to measure a home’s level of structural vulnerability to hurricanes. They create three new standardized indices to represent home protection, homeowner action to achieve that level of protection, and homeowner intention to mitigate structural vulnerabilities in the near future. Using data from a novel 2017 study of homeowners in New Hanover County, North Carolina, where Hurricane Florence made devastating landfall only a year later, Javeline and Kijewski-Correa find that homes in one of the U.S.’s most frequently exposed coastal communities are minimally protected: Most homes have unaddressed vulnerabilities in their doors, windows, roofs, roof-to-wall connections, and other structural features. Homeowners are doing very little to counteract these vulnerabilities and have very few intentions of taking action in the future. The obvious justification, that home structural mitigations are too expensive, does not sufficiently explain these choices: Perceived costs of structural mitigations were only minimally significant for home protection and homeowner action and played no statistically significant role in homeowner intentions. Given that homeowners in most vulnerable coastal areas are currently not required to upgrade structural features in preparation for intensified climate hazards, identifying motivators of voluntary homeowner risk reduction is critical for coastal adaptation.

In “Paying to save the beach: Effects of local finance decisions on coastal management,” Megan Mullins, Martin Smith, and Dylan McNamara also consider the motivations of property owners to adapt to climate change, specifically with regard to the beaches that buffer their structures from the increasingly hazardous ocean. Beach nourishment, or the rebuilding of an eroded beach with sand imported from another location, is a short-term, costly strategy to reduce the vulnerability of coastal infrastructure to sea level rise and storm surge. Governments fund beach nourishment projects often by differential taxation based on the presumed individual benefit from the project. The logic is that property owners who benefit most should pay higher taxes. Oceanfront property owners may prefer lower taxes and therefore narrower beaches, but their preferences are offset by the preferences of the more numerous inland property owners for wider beaches, so long as the oceanfront property owners pay more for them. Generalizing from beach nourishment to other adaptations to climate change for local public goods, Mullins, Smith, and McNamara argue that, when tax rates reflect unequal benefits, local investment in adaptation should increase.

Unfortunately, even in best case scenarios for coastal homeowners living in structurally mitigated homes on nourished beaches, climate change brings increasing chance of disaster. Saudamini Das discusses disaster management as a climate change adaptation to minimize mortality. Disaster management involves training communities to respond to warnings of impending storms, and it can include improving disaster awareness, rescue training, building better infrastructure, and strengthening civil society. In “Evaluating climate change adaptation through evacuation decisions: A case study of cyclone management in India,” Das investigates

variation in public response to disaster management, specifically evacuation behavior, and emphasizes the important role of socioeconomic factors. Nearly all residents in some districts evacuated and took other appropriate precautions, while as few as 33% of residents in other districts evacuated. Those who did not evacuate were often unemployed, concerned about theft, or concerned about losing livestock to theft or the cyclone. However, the significance of these factors varied between districts, suggesting that regional context matters as well. Das recommends that governments should address the socioeconomic issues that obstruct effective adaptation to extreme storm events and that, in doing so, they pay attention to cross-regional variation, especially given predictions that severe or super cyclones will hit coastal areas with greater intensity as the climate continues to change.

The articles in this special issue paint a grim picture of minimal adaptation to water impacts of climate change in the United States and likely the rest of the world. The various adaptation tools at our disposal include insurance, managed retreat via property buyouts, home structural mitigations, beach nourishment, and evacuation, and implementation of *all* these options is currently inadequate. Insurance is insufficient to cover projected losses while it incentivizes people and property to remain in vulnerable locations. Buyouts are rare and, when they occur, inequitable. Structural mitigations are rare. Beach nourishment is happening but only as a stopgap, expensive measure that could not possibly be implemented at the scale necessary to protect all beaches from climate change impacts. Evacuations are occurring, but the push to evacuate meets with resistance, and even when evacuations are successful and reduce mortality, they still leave properties demolished and communities devastated.

In sum, this special issue demonstrates that adaptation failure stems from governance failure. Moral hazards, regulatory capture, and regulatory failure impede the ability of coastal and riverine communities to make themselves resilient to threats posed by climate change. Adaptation failure is not a consequence of information deficit about climate change and its current and future impacts. Rather, it reflects political and institutional problems that perpetuate moral hazard and regulatory capture. The special issue thus raises important research and policy questions on the relationship between governance failure and adaptation failure and how to overcome both.

Acknowledgments The authors gratefully acknowledge the University of Notre Dame’s Institute for Scholarship in the Liberal Arts, Keough School of Global Affairs, Notre Dame Global Adaptation Initiative (ND-GAIN) with the Environmental Change Initiative, Department of Political Science, Global Commons Initiative, Minor in Sustainability, ND Energy, and the Notre Dame Law School, as well as the University of Washington’s Center for Environmental Politics, for funding the workshop on “Adapting to Climate Change: Actions, Implementations, and Outcomes,” from which this special issue emerged.

Publisher’s Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

References

- Biesbroek GR, Swart RJ, Carter TR, Cowan C, Heinrichs T et al (2010) Europe adapts to climate change: comparing national adaptation strategies. *Glob Environ Change* 20:440–450
- Dolšak N, Prakash A (2018) The politics of climate change adaptation. *Annu Rev Environ Resour* 43(2)
- Javeline D (2014) The most important topic political scientists are not studying: adapting to climate change. *Perspectives on Politics* 12(2):420–434
- Panic M, Ford JD (2013) A review of national-level adaptation planning with regards to the risks posed by climate change on infectious diseases in 14 OECD nations. *Int J Environ Res Public Health* 10:7083–7109