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Testimony on Climate Change Adaptation

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Thank you for the opportunity to testify before your Commission on climate change adaptation.

Professional Background

I am a law professor at Loyola University New Orleans, where I hold the Gauthier-St. Martin Chair in Environmental Law at Loyola University New Orleans. There I teach courses related to environmental law, as well as a seminar called, "Disaster Law and Policy." I also teach a graduate course called "Environmental Hazards Science" at Tulane University's Disaster Resilience Leadership Academy, in the School of Social Work. Finally, I am a research scholar at the Center for Progressive Reform, a non-profit research institution working to protect public health, safety, and the environment.

In 2009 and 2010, I served in the Obama administration as Deputy Associate Administrator for Policy at the U.S. Environmental Protection Agency. In that role I helped develop climate adaptation policy for the EPA and served on President Obama's Interagency Climate Change Adaptation Task Force. In the fall of 2012, I researched climate adaptation policies in India as a Visiting Scholar at the Centre for Policy Research in New Delhi, supported by a Fulbright-Nehru Environmental Leadership Award. I have a law degree from Harvard University and a bachelor's degree from Stanford University.

My research focuses on environmental regulation, climate change adaptation, and the developing field of disaster law. My work has appeared in many places, including the *California Law Review*, the *Southern California Law Review*, and the environmental law journals at Harvard, Stanford, and Berkeley. I am a co-author of the first American textbook on disaster law, *Disaster Law and Policy*¹ (WoltersKluwer/Aspen, 2d ed. 2009) (with Daniel A. Farber, Jim Chen, and Lisa Grow Sun), which is used in law schools and other graduate programs throughout the country. A more recent book of mine, *Facing Catastrophe: Environmental Action for a Post-Katrina World*,² was listed as a CHOICE Outstanding Academic Title by the American Library Association. I have testified before the U.S. Congress several times on issues of disaster response and environmental regulation.

The Impacts of Climate Change

For decades, global warming has silently been affecting our communities, our livelihoods, and our environment. The phenomenon, caused mainly by human activity,³ is increasing average temperatures, messing with precipitation patterns, raising the seas, and juicing up storm cycles. In short, global warming is shaping a future that promises to be a lot hotter, wetter, drier, and weirder. Societies and ecosystems have historically adjusted to the natural variability of climatic conditions. But the rate and intensity of anthropogenic climate change are occurring outside the range of past experience, propelling us toward what has been called a “no-analog” future that will demand new ways of coping with environmental disruption and new ways of building resilience.

The U.S. Global Change Research Program (USGCRP), reports that U.S. average temperatures have risen by 1.5 degrees Fahrenheit since 1895 and are projected to

¹ DANIEL A. FARBER, JIM CHEN, ROBERT R.M. VERCHICK, & LISA GROW SUN, *DISASTER LAW AND POLICY* (WoltersKluwer/Aspen, 2d ed. 2009).

² ROBERT R.M. VERCHICK, *FACING CATASTROPHE: ENVIRONMENTAL ACTION FOR A POST-KATRINA WORLD* (Harvard University Press 2010).

³ U.S. Environmental Protection Agency, *Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act; Final Rule*, 74 Fed. Reg. 66496, 66497 (Dec. 15, 2009) (relying on scientific assessments by the U.S. Global Change Research Program, the Intergovernmental Panel on Climate Change, and the National Research Council), available at <http://www.epa.gov/climatechange/endangerment>.

increase more in the future.⁴ It notes that the intensity of severe precipitation events has increased across the United States over the last 50 years and projects an increase in both frequency and intensity of the heaviest downpours in the future.

At the same time, the number of dry days is projected to increase, especially in the more arid areas.⁵ Heat waves are expected to become more frequent, more intense, and longer-lasting.⁶ The USGCRP also notes correlation between the increase in frequency and intensity of large wild fires and higher temperatures.⁷

Satellite data indicate that over the last fifteen years, sea level has been rising at a rate roughly double that observed over the 20th century.⁸ Global sea level is expected to rise at least one meter in this century, depending on the location and on future greenhouse gas emission levels. An increase of this magnitude, combined with the potential for stronger storms and storm surges, would pose an increasing threat to coastal cities, residential communities, infrastructure, beaches, wetlands, and other ecosystems. Many coastal areas would face an increasing risk of erosion and flooding. According to the National Oceanic and Atmospheric Administration (NOAA), approximately 153 million people (53 percent of the nation's population) lived in U.S. coastal counties in 2003.⁹

It is sometimes said that global warming will be a boon to North American farmers, but this seems overly optimistic. The USGRRP finds that while modest increases in temperature are theoretically conducive to increased crop production, it warns that such benefits could be undercut by the droughts, downpours, and pest infestations that are projected to accompany warmer temperatures.¹⁰ In addition to food production, sectors at particular risk include energy production (which often involves heavy water use for cooling), natural resource management, and public health and safety.

Adaptation

⁴ U.S. GLOBAL CHANGE RESEARCH PROGRAM, DRAFT 2013 NATIONAL CLIMATE ASSESSMENT 25, available at <http://ncadac.globalchange.gov>.

⁵ *Id.* at 26.

⁶ *Id.*

⁷ *Id.* at 39, 52.

⁸ *Id.* at 63.

⁹ U.S. Department of Commerce, *Population Trends Along the Coastal United States: 1980-2003* (2004), available at http://oceanservice.noaa.gov/programs/mb/pdfs/coastal_pop_trends_complete.pdf.

¹⁰ DRAFT 2013 NATIONAL CLIMATE ASSESSMENT, *supra* note 4, at 228.

People have been adapting to climatic changes for millennia. They resist. They adjust. Or they retreat. These concepts never change, but the technologies (both mechanical and legal) do. Resistance might refer to coastal engineering activities that reduce the risk of flooding, erosion, or inundation of land and structures. Approaches for maintaining shorelines in the face of sea level rise include both “soft” measures and “hard” measures. Each of these approaches or some combination of them may be appropriate depending on the characteristics of a particular location (for instance, shore protection costs, property values, the environmental importance of habitat, the feasibility of protecting shores without harming the habitat). “Soft” measures aim to develop living shorelines through beach nourishment, planting dune grasses, marsh creation, and planting submerged aquatic vegetation.¹¹ Seawalls are impermeable barriers designed to withstand the strongest storm waves and prevent overtopping during a storm.

Adjustment, as I use the term, refers to the myriad ways that communities have learned to live with excess water, heat, or other stressors. On the coast, it might involve elevating buildings in flood-prone areas. In the desert, it might require building codes that emphasize passive cooling technologies and the capture and reuse of rainwater. Adjustment also includes changes in settlement and land-use practices, modifications to financial mechanisms or incentives, and enhancements to public safety (effective warning and evacuation systems, fortified “safe houses,” and public education).¹²

Retreat involves the migration of people, property, businesses, and perhaps wildlife. Its goal is to minimize hazards and environmental impacts by removing development (or, in the case of wildlife, habitat) from the most vulnerable areas. In its most extreme form, retreat means abandoning development that cannot reasonably be protected or serviced in another way. But retreat can also mean imposing limits, such as restricting development in existing communities or prohibiting development in sensitive undeveloped landscapes. Although we often think of retreat in the context of coastal communities, the strategy might also be considered in forested areas prone to wild fire or desert communities experiencing continued water shortages.

¹¹ Environmental Protection Agency, *Management Goad: Maintain Shorelines Utilizing “Soft” Measures*, <http://www.epa.gov/climate/readyestuaries/shorelinessoft.html>.

¹² J.G. Titus, and M. Craghan, *Shore Protection and Retreat*, available at <http://papers.risingsea.net/coastal-sensitivity-to-sea-level-rise-6-shore-protection-retreat.html>.

Today there is not a lot of law specifically designed with climate adaptation in mind. Most of the “explicit” law on the subject concerns commissioned studies or planning efforts. In the courts, climate change litigation has almost exclusively involved mitigation rather than adaptation, though that will probably change. Of course, there are many existing bodies of law – in the areas of property, land use, tort, and contracts – that will shape public and private adaptation efforts. Conversely, climate change and the compelling need to adapt may also reshape the contours of those bodies of law.

The ultimate goal is to build *resilience* into a community or ecosystem by mixing standard risk-management strategies with a robust array of planning and economic initiatives. Adaptation planners seek transformation on a broad scale by doing what is reasonably affordable and by preferring options that offer multiple benefits and help protect against an array of challenges. In this way, planning for resilience is like eating a healthy diet. You don’t eat right *just* to avoid colon cancer or to run that half-marathon. You eat right because it makes your body stronger, more vital, and less vulnerable to risks of all kinds—including those you do not expect.

Disaster Law and Adaptation Strategies

Those interested in designing adaptation strategies can learn a lot from studying disaster risk management. Developments in that field of study, particularly those in the last few decades, emphasize the need for thinking holistically, addressing both physical and social vulnerabilities, and integrating risk management into all administrative sectors.

Since 2005, the year of Hurricane Katrina, I have devoted much of my teaching and research to developing the field of “disaster law.” While hazard mitigation policies of some sort have been around since the aftermath of the 1755 Lisbon earthquake, the study of disasters as a comprehensive field—integrating physics, engineering, economics, geography, history, and more—is only a few decades old. In adding law to the mix, my co-authors and I approach the subject in a functional way. We focus mainly on disasters triggered by natural forces like storms, floods, heat waves, or wildfires. Such calamities are often called “natural disasters”; but, that’s not quite true. Nearly all natural disasters feature some human contribution, whether it be poor construction standards, the human disruption of rivers or coasts, or urban sprawl. To this list we must also add human-

induced climate change, a subject I'll return to in a moment. Disaster *law* encompasses the set of legal strategies that address the progressive stages of disaster risk management, from mitigation planning, to emergency response, to victim compensation, to recovery and rebuilding—with the last step, ideally, feeding back into the first. Disaster law is an applied field; and the success of various legal tools can be judged by their results in minimizing disaster costs, as a whole, as well as minimizing disparate impacts on vulnerable communities.

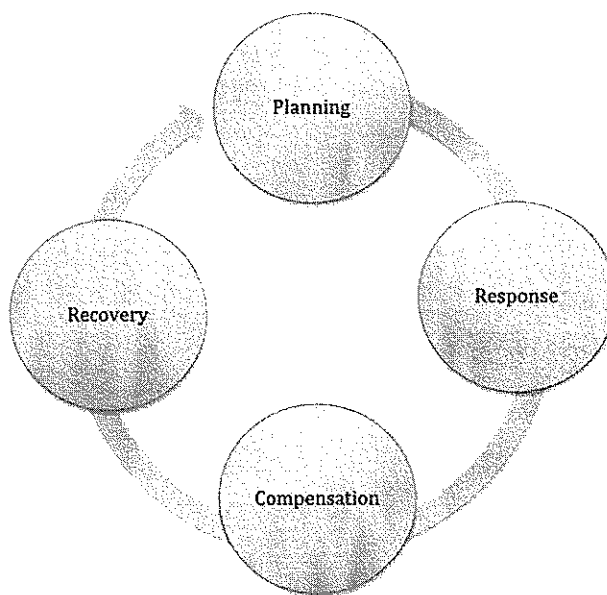


Fig. 1. Circle of Disaster Risk Management

It's important to get it right. Every year in the United States, natural disasters cause hundreds of deaths and cost billions of dollars in disaster aid, disruption of commerce, and the destruction of homes and critical infrastructure.¹³ Although the number of lives lost to natural hazards has generally declined, the economic cost of major disaster response and recovery continues to rise.¹⁴ Every ten years, property damage from natural hazards in the United States doubles or triples. Only Japan suffers more economic

¹³ VERCHICK, *FACING CATASTROPHE*, *supra* note 1.

¹⁴ *Id.*

damage from natural hazards.¹⁵ There are many reasons for this trend. Perhaps the most obvious is that the population is growing and expanding into areas that are more prone to natural hazards, like open coasts, forested areas, or scenic hillsides.

One of the most important insights of the last twenty years is the relationship between what we might call, “physical vulnerability” and “social vulnerability.” Physical vulnerability refers to a community’s physical exposure to a place-based risk—for example, a flood, an earthquake, or a wildfire. Social vulnerability refers to the susceptibility of a community’s population groups to the impacts of a hazard. This susceptibility is not only a function of characteristics like age, wealth, and gender, but also more complex constructs like access to health care and dependable public transportation. We can describe the relationship of hazard and vulnerabilities like this.

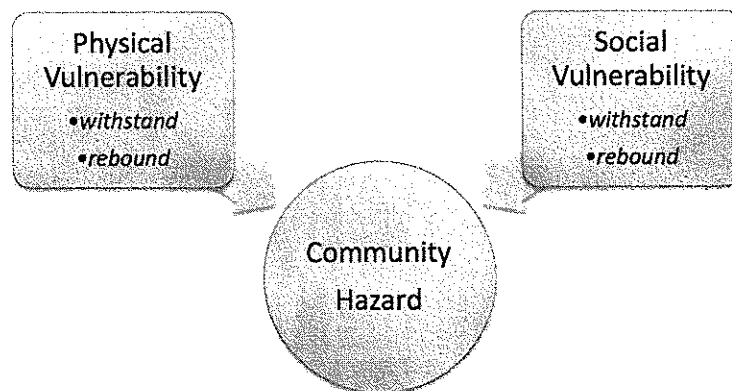


Fig. 3. Components of Community Hazard¹⁶

Note that my use of the term “vulnerability,” whether physical or social, suggests a present and future tense: it refers both to a community’s ability to *withstand* an immediate assault and its ability to *rebound* from it afterwards.¹⁷

Looking at disasters in terms of both physical and social drivers leads one to see

¹⁵ *Id.*

¹⁶ I derive this schematic, adding my own modifications, from a more comprehensive visual presented in Susan L. Cutter & Christopher T. Emrich, *Moral Hazard, Social Catastrophe: The Changing Face of Vulnerability Along the Hurricane Coasts*, ANNALS AM. ACAD. POL. & SOC. SCI. 102, 107 fig. 1 (2006), available at <http://ann.sagepub.com/content/604/1/102> 107 (showing a conceptual framework for place-based vulnerability).

¹⁷ The terms *vulnerability* and *resilience* are not always used consistently in the social science literature, even by the same authors. See Robert R.M. Verchick, *Disaster Justice: The Geography of Human Capability*, 24 DUKE ENVIRONMENTAL LAW & POLICY FORUM 23, 39 n.76 (2012) (noting inconsistent use of terms). But this gives you the basic idea.

that nearly every public or private decision, from land-use planning to health care to employment, can have some effect on risk management. It also reveals that uncertainties are everywhere—not just in the climate science, but in land development, storm-water flow, and population-growth. The trick is to build flexibility into the regulatory system so that policies can evolve as the climate and other factors evolve. And, yes, doing this while balancing the public’s interest in predictability and stability.

*Some Guiding Principles*¹⁸

In applying the lessons of disaster research to state adaptation policy two years ago, my colleagues and I proposed a short list of principles that we think should guide a smart adaptation strategy:

Acknowledge uncertainty. The strength of climate models is their ability to predict general trends in average surface temperature, sea level rise, or other global impacts. However, regional or local models are unable to predict the precise extent of these impacts at localized scales that are more useful for planning. Although the ability to downscale climate impacts is improving, uncertainty surrounding the precise impacts should be acknowledged and accommodated through scenario-based planning and other tools, rather than used as an excuse for inaction. The corollary of acknowledging uncertainty is to collect as much information and data as possible and to conduct vulnerability assessments and mapping.

Increase resilience of natural systems and human communities. For natural systems, increasing resilience means in part to remove to the extent possible existing stressors such as invasive species and air and water pollution. For human communities, increasing resilience may include improving public health or socio-economic conditions before a disturbance and ensuring access to re-building resources after a disturbance.

Rely on natural infrastructure as much as possible. Natural systems have evolved to adapt to changing climates, and this natural or green infrastructure should be incorporated into the overall climate change adaptation strategy. Green infrastructure prolongs the natural ecosystem, whereas gray and other manmade infrastructure often eliminate natural buffers. In many places, however, human development and encroachment have permanently eliminated this capacity or rendered the ecosystem much less resilient. Where possible, climate change adaptation strategies should use the natural buffering capacity of forests, shorelines, and wetlands to absorb the impacts of climate change, whether by designating protected areas, restoring natural features, or increasing resilience.

¹⁸ The following is derived from a previous work I contributed to: Robert L. Glicksman, et al., *Climate Change and the Puget Sound: Building the Legal Framework for Adaptation* (Center for Progressive Reform 2011), available at http://www.progressivereform.org/articles/Puget_Sound_Adaptation_1108.pdf.

Incorporate fairness and reduce personal and community vulnerability. Climate change impacts, like natural disasters, are likely to highlight social and economic fractures by disproportionately affecting vulnerable groups such as low-income populations or racial minorities. Adaptive reforms should protect public health, safety, and environment in ways that promote distributional fairness and that do not increase vulnerabilities. (More on this in a moment.)

Prefer proactive strategies. Proactive strategies are designed to reduce future harms before those harms occur or to maximize benefits. In contrast, reactive strategies are contemporaneous responses to observed climate change impacts, typically through emergency response. This wait-and-see approach is inefficient and unsuccessful in addressing irreversible damage, though it may be appropriate for some climate-related impacts that are highly uncertain and difficult to anticipate.

Select strategies that provide multiple benefits for other sectors and for greenhouse gas reduction (also known as “climate change mitigation”). Adaptation approaches are sometimes described as “low regrets,” “no regrets,” or “win-win.” “Low regrets” actions result from moderate additional investments to increase the ability to adapt to climate change impacts. “No regrets” actions provide benefits regardless of whether or not a projected climate change impact occurs. “Win-win” strategies reduce the magnitude of a particular impact and also provide additional environmental, social, or economic benefits. Restoring or preserving coastal wetlands would buffer inland areas from sea level rise while also generating environmental and economic benefits through recreation and tourism. Some adaptation strategies, such as reforestation, may also benefit mitigation efforts.

Consider longer-term temporal scales for adaptation planning. Because the impacts of climate change are likely to occur over several decades, if not centuries, adaptation planning must extend over a commensurate timeframe. The exact timeframe will vary from sector to sector but should generally encompass the lifespan of a proposed action.

Avoid maladaptive actions. “Maladaptation” increases vulnerability to the impacts of climate change. These actions tend to deliver short-term gains or economic benefits but lead to increased vulnerability in the medium- to long-term and may foreclose future adaptation options or have negative impacts on mitigation efforts. Sea walls may provide temporary protection for coastal development but they lead to complete erosion of the shoreline and thus foreclose the ability to restore the shoreline as a natural buffer. Policymakers should identify and avoid these maladaptive strategies.

Maximize the use of existing legislation and legal tools. We must recognize that the current and future political and economic situation may not be amenable to passing new legislation or financing new programs. Thus policy makers must often use existing legislation and legal tools to achieve adaptation goals where possible. Some existing laws simply need better, stronger, and more consistent enforcement, whereas others require some reinterpretation or emphasis on overlooked provisions. Where these laws do not adequately address adaptation, changes in state or local laws may help move the ball forward.

Two issues are worth expanding upon: the role of social vulnerability and the importance of a holistic administrative structure.

*Social Vulnerability*¹⁹

One of the most important insights into disaster policy in the last few decades centers on the role that racial, ethnic, and socioeconomic differences play in disaster response and recovery. Research shows that at nearly every point along the Circle of Disaster Risk Management, social vulnerability loads the dice. The literature tells us that low-income and minority populations are less likely to be prepared when disasters hit.²⁰ Some studies suggest that minority and low-income households are less likely to receive official disaster warnings or even believe them.²¹ Federal and local evacuation planning has long underestimated the needs of those without private transportation and has proven terribly inadequate for the elderly, the poor, and the disabled.²² And studies consistently show that in a disaster, poor people and people of color are more likely to suffer property damage, injury, and death.²³ The most significant factor, the literature suggests, is that low-income and minority populations are simply more likely to live in older, denser, disaster-prone neighborhoods, with shoddy housing and inadequate services.²⁴ Government assistance programs—often crucial in the wake of a large catastrophe—tend to favor middle-class homeowners over less affluent renters or the homeless.

Age is a factor too. Because the elderly tend to have more health problems, reduced mobility, and fixed incomes, they are often at higher risk of death or injury during disasters. Following the 2003 European heat wave, which killed an estimated 70,000 people, the World Health Organization reported that “in European cities, the elderly suffered the greatest effects of heat-waves,” adding that elderly women bore a

¹⁹ The following discussion draws from Robert R.M. Verchick, *Disaster Justice: The Geography of Human Capability*, 24 DUKE ENVIRONMENTAL LAW & POLICY FORUM 23 (2012).

²⁰ Sammy Zahran, Samuel D. Brody, Walter Gillis Peacock, Arnold Vedlitz & Himanshu Grover, *Social Vulnerability and the Natural and Built Environment: A Model of Flood Casualties in Texas*, 32 DISASTERS 537, 539-40 (2008)

²¹ *Id.* at 540.

²² For more on the inadequacy of evacuation planning, see ROBERT D. BULLARD & BEVERLY WRIGHT, THE WRONG COMPLEXION FOR PROTECTION: HOW THE GOVERNMENT RESPONSE TO DISASTER ENDANGERS AFRICAN AMERICAN COMMUNITIES 280-87 (2012).

²³ Verchick, *Disaster Justice*, *supra* note 19, 42-43 (presenting evidence).

²⁴ *Id.*

higher risk of dying than elderly men.²⁵ In New Orleans, the elderly made up 60 percent of Katrina's death toll.²⁶ In its investigation of fatalities from the 2011 Japan tsunami, the Japanese newspaper, *Yomiuri Shimbun*, estimated that more than 65 percent of those who died were over sixty years old. Children also tend to be more vulnerable in times of disaster and recovery.²⁷ Physically, their smaller bodies put them at higher risk for allergies, infections, malnutrition, and other problems.²⁸ Gender can also play a key role. Women, for instance, were hit particularly hard by Hurricane Katrina. Of the 180,000 Louisianans who lost their jobs after the storm, 103,000—or 57 percent—were female. Of the thousands of households that lost public housing services in New Orleans when they were summarily closed after the storm, 88 percent were headed by women.²⁹

Using computerized mapping techniques, analysts are now able to “aggregate” the hazard risk of a whole community by combining a series of variables related to physical and social vulnerability, from geography to climate, from income and education levels to race and age. If performed systematically, these analyses can then be compared across the country. Geographer Susan Cutter is a leader in the field of “vulnerability science.” Cutter's research shows that the social aspect of vulnerability is an important driver of hazard risk. While the concentration of social vulnerability (as measured by county) has declined in recent decades, significant clusters exist in the lower Mississippi Valley, south Texas, the upper Great Plains, and California's Central Valley.³⁰

What this research suggests is that any successful adaptation strategy must focus not only on reducing aggregate risk, but on reducing risk *across* the lines of geography, race, class, and other personal characteristics. It also suggests that care should be taken not improve one group's protection at the expense of a more marginalized group.

²⁵ *Heat Threatens Health: Key Figures for Europe*, WORLD HEALTH ORG. REG'L OFFICE FOR EUR., <http://www.euro.who.int/en/what-we-do/health-topics/environment-and-health/Climate-change/activities/prevention,-preparedness-and-response/heathealth-action-plans/heat-threatens-health-key-figures-for-europe>.

²⁶ VERCHICK, *FACING CATASTROPHE*, *supra* note 1, at 130.

²⁷ Noriko Murai, *But Is It Not in Fact Leaking a Little?*, in *TSUNAMI: JAPAN'S POST-FUKUSHIMA FUTURE* at Kindle Locations 1852–56 (Jeff Kingston ed., 2011) (ebook published by Foreign Policy), *available at* http://www.foreignpolicy.com/ebooks/tsunami_japans_post_fukushima_future.

²⁸ VERCHICK, *FACING CATASTROPHE*, *supra* note 1, at 140-41. (discussing children's health issues after hurricane Katrina).

²⁹ Sarah Vaill, Women's Funding Network & Ms. Foundation for Women, *The Calm in the Storm: Women Leaders in Gulf Coast Recovery* 3 (2006).

³⁰ Susan L. Cutter & Christina Finch, *Temporal and Spatial Changes in Social Vulnerability to Natural Hazards*, 105 *PROC. NAT'L ACAD. SCI.* 2301, 2302 (2008).

*Improving Holistic Strategies: Footholds and Ropelines*³¹

Policymakers dropped into the valley of adaptation might learn some lessons from mountain climbers. Technical climbers on snow or glaciers know the importance of footholds and rope lines. A foothold is a place from which a climber advances. When you jam your steel-toothed boot into a crevice, you need something secure, a hold capable of supporting your frame and positioned to afford leverage for the next step. Because you are roped to other climbers, these rifts and ridges have to be visible, even in predawn light, and strong enough to withstand the load of several climbers, each ascending with the same ice-crunching rhythm. But you need more than frozen footholds. Ultimately, the success and safety of your journey depend on your *partners*—those trustworthy souls you have invited to clip into your rope. You need companions who are reliable, who share common goals, and who are excellent communicators. Special skills (like medical training or search-and-rescue experience) also come in handy.

In terms of adaptation policy, the climber's footholds are the legal standards or government structures that provide positioning and leverage for the adaptation advocate to move forward. The rope line is the network of partners temporarily assembled to reach a chosen peak, knowing that other summits, some equally alluring, wait patiently for another day.

Footholds and rope lines help address the challenges of scope, scale, and uncertainty. Because these factors conspire to keep regulators and lawmakers from designing standards specific to the problem, decision makers must make do with less specific administrative tools. Because these factors demand an evolving strategy that transcends administrative and geographic boundaries, decision makers must rely on dependable and pliable networks.

When a policymaker is unsure how fast or how high the sea will rise over the next fifty or hundred years, there is a tendency to put off worrying about it. Even for those who do worry, it may not be apparent who bears the responsibility to act. Because many climate impacts will be experienced locally, some federal officials might expect the states

³¹ The following discussion draws from Robert R.M. Verchick & Abby Hall, *Adapting to Climate Change while Planning for Disaster: Footholds, Rope Lines, and the Iowa Floods*, 2011 B.Y.U. LAW REVIEW 2201 (2011).

to initiate the effort, as, in fact, some have. Because addressing climate impacts requires such major investments in science, engineering, and planning, some local officials might expect the federal government to set the foundation. The result has been too little policy development at either level.

The cross-sector nature of adaptation makes things even worse. With so many government sectors having some relationship to climate resilience, it is unlikely that any single sector-based agency will “own” the issue. And that is why only a few sector-based agencies in the federal government—Department of the Interior (DOI), NOAA, and Department of Defense (DOD), for example—think very much about adaptation at all: it is someone else’s problem. Thus few agencies have developed specialized regulations or guidelines to promote climate resilience. Nor has Congress broadly directed agencies to focus on adaptation or created specific authorities for them to do so. Political controversy over climate change has kept that from happening. But even without the controversy, the sheer scope of the problem makes it less likely that a sympathetic Congress would have the attention and resources to create special standards or structures for every agency that needed them. This analysis similarly applies at the state and local levels. When a mountain has no handrails, the policymaker looks instead for footholds—those more general authorities that, while not specific to climate change, allow officials to build resilience into their mission.

Footholds. To understand how footholds work in real life, let’s examine a few concrete examples. Consider first the federal commitment to environmental justice, which similarly calls for “mainstreaming” a special concern into broad swaths of federal policy. Environmental justice is stressed in a 1994 presidential executive order, endorsements from the Obama White House, and EPA’s own 2011–2015 strategic plan.³² Yet, as commentators have long complained, a specific charge to pursue environmental justice is all but nonexistent in the nation’s vast armada of federal environmental statutes. As a result, much of EPA’s progress in this area comes from its ability to use more general statutory authorities as a point of leverage. Thus, EPA roots its authority to

³² See Exec. Order No. 12898, 3 C.F.R. 859 (1995); Press Release, Council on Env’tl. Quality, Obama Administration Convenes Environmental Leaders at Historic White House Environmental Justice Forum Featuring Five Cabinet Secretaries (Dec. 15, 2010), available at http://www.whitehouse.gov/administration/eop/ceq/Press_Releases/December_15_2010; U.S. EVTL. PROT. AGENCY, FY 2011-15 STRATEGIC PLAN 30–31 (Sept. 30, 2010), available at <http://www.epa.gov/planandbudget/strategicplan.html>.

consider the effects of its ambient air pollution standards on low-income and minority populations in provisions of the Clean Air Act requiring it to protect public health with an adequate margin of safety, while taking into account the vulnerability of “sensitive populations.”³³ Similarly, EPA finds “broad discretion to consider impacts on minority, low-income, and indigenous populations” in developing hazardous waste regulations based on language in the Resource Conservation and Recovery Act directing it to set standards “as may be necessary to protect human health and the environment.”³⁴

Adaptation advocates are also chopping footholds in the ice. A look at Florida’s campaign against saltwater intrusion makes the point. In addition to the climate impacts discussed earlier, the GCRP finds that global warming has contributed or will contribute to shortages of freshwater in many states. What is more, hydraulic pressure caused by rising seas is pushing saltwater into freshwater aquifers on the coast, rendering some water unusable for drinking or irrigation. States have few, if any, laws requiring officials to fight climate impacts per se, but they do have more general laws aimed at protecting natural resources and public health, which can serve as footholds. For instance, the Southwest Florida Water Management District (SFWMD) and the Florida Department of Environmental Protection are fighting climate-induced saltwater intrusion into the aquifers of southwest Florida by invoking a variety of preexisting legal authorities. These include the SFWMD’s regulatory powers to limit water-use permits and encourage better land-use planning, its ability to promote municipal water conservation through financial assistance, and its authority under the Florida Water Resource Act to protect surface water and reduce groundwater demand. Law professor Robin Kundis Craig argues that the state common-law doctrine of public necessity might be expanded to allow states like Florida even more latitude in allocating water where supplies are affected by climate change.³⁵

Ropelines. In developing a strategy for climate resilience, the President Obama’s Adaptation Task Force was very aware of the challenges presented by cross- sector scope, political scale, and uncertainty. To address these factors, it emphasizes in its “guiding

³³ See U.S. ENVTL. PROT. AGENCY, INTERIM GUIDANCE ON CONSIDERING ENVIRONMENTAL JUSTICE DURING THE DEVELOPMENT OF AN ACTION 5 (July 2010), available at <http://tinyurl.com/3vp2qrd> 5 (box titled “Examples of Statutory Authority”).

³⁴ *Id.*

³⁵ Robin Kundis Craig, *Adapting Water Law to Public Necessity: Reframing Climate Change Adaptation as Emergency Response and Preparedness*, 11 VT. J. ENVTL. L. 709, 710 (2009).

principles” the need for strong partnerships and evolutionary adjustment. The partnerships should “require[] coordination across multiple sectors and scales and should build on the existing efforts and knowledge of a wide range of public and private stakeholders.”³⁶ That implies a shift away from the ritualized “Matching Principle” of traditional federalism theories, in favor of shared state and federal responsibility and jurisdictional redundancy. Note, also, the insistence on having private stakeholders at the table from the very beginning and the injunction to draw in individuals already working on some aspect of the problem, so as to benefit from their existing knowledge and experience.

The mechanism of evolutionary adjustment, embedded in the Task Force’s adaptation framework, requires a continuous process of action, evaluation, and adjustment. “Successful climate adaptation,” the Adaptation Task Force explains, “requires ongoing monitoring and evaluation of adaptation planning efforts to continually assess the effectiveness of actions and adjust as necessary. Because of the uncertainties inherent in projecting future climate conditions, impacts, and responses, adaptation cannot be simply a policy or action that requires a one-time change.” The relationship looks less like a “chain of command” and more like a “networking cloud,” where relationships are less hierarchical, more promiscuous, and infinitely self-adjusting.

Such networks or partnerships offer flexibility and encourage adaptability. For instance, if a city planning board needed more customized projections of changing rain patterns, a “partnership committee” or “regional consortium” could link local board members to federal researchers at DOI or NOAA to address the concern. By organizing a network around a challenge or problem, the structure encourages innovation and experimentation.

Adaptation in Practice

California has already made impressive strides toward increased climate resilience. The California’s climate change adaptation recommends that local governments incorporate climate change considerations in coastal planning. The

³⁶ THE WHITE HOUSE COUNCIL ON ENV’T L QUALITY, PROGRESS REPORT ON THE INTERAGENCY CLIMATE CHANGE ADAPTATION TASK FORCE 10 (2010) [hereinafter TASK FORCE REPORT], available at <http://www.whitehouse.gov/sites/default/files/microsites/ceq/Interagency-Climate-Change-Adaptation-Progress-Report.pdf>.

California Coastal Act requires that local coastal programs insure that new development minimizes and does not entail hard armoring.³⁷ Several coastal states, including California, have begun to design concrete “next steps” to implement specific risk-reducing policies with climate change in mind. An excellent source for information on these developments can be found at the Web-based “Adaptation Clearinghouse,” maintained by the Georgetown Climate Center.³⁸ In addition, the Center for Progressive Reform offers a variety of specific initiatives in a climate adaptation manual it prepared for the Puget Sound region in Washington.³⁹ To give you some idea of what such regulatory tools look like, here are few examples on the topic of coastal preservation and sea-level rise.⁴⁰

1. Overlay Zones. Using this tool, local governments superimpose additional regulatory requirements on an existing zone in order to take into account special characteristics of the land. Many municipalities already use overlay zones for beaches, wetlands, and barrier islands. But they could go further. Overlay zones could be used to identify areas to be considered for “accommodation,” regulating density or building codes, or “managed retreat,” forbidding the improvement or rebuilding of structures.⁴¹

2. Enhanced Flood Plain Regulation. The National Flood Insurance Program (NFIP) has inspired many municipalities to regulate development in floodplains. But these regulations could go further. Current FEMA flood maps do not reflect climate change and sea level rise projections. Further, the program requires only that municipalities regulate building *design*, not *use*. A better approach would regulate development with an eye toward *future* conditions. For instance, the Florida Action Team recommends amending its building code to “incorporate design criteria for buildings to resist future loads that may result from the impact of climate change-exacerbated hazards during a minimum service life of 50 years.”⁴² In certain cases, *use* could also be regulated. Chatham County, Massachusetts, for instance, revised its zoning ordinance to prohibit all residential development in the 100-year floodplain, while allowing for recreational and agricultural uses.⁴³

³⁷ See 20 Cal. Pub. Res. Code § 30253.

³⁸ Available at <http://georgetownclimate.org/adaptation/clearinghouse>.

³⁹ See Robert L. Glicksman, et al., *supra* note 18.

⁴⁰ More detailed treatment of these and other tools can be found in Jessica Grannis, *Adaptation Toolkit: Sea Level Rise and Coastal Land Use* (Georgetown Climate Center 2011), available at <http://www.georgetownclimate.org/resources/adaptation-tool-kit-sea-level-rise-and-coastal-land-use>.

⁴¹ See *id.* at 19.

⁴² Florida Action Plan, appendix F at 29.

⁴³ See Wes Shaw, *Mass. Stormsmart Coasts, Fact Sheet 3, Case Study – A Cape Cod Community Prevents New Residences in Floodplains* (Apr. 2008), available at http://www.mass.gov/czm/stormsmart/resources/stormsmart_chatham.pdf.

3. Rolling Coastal Management Statutes. Such statutes regulate coastal land use with reference to a baseline natural feature, such as the mean high tide line or the line of vegetation. The restrictions “roll” as the tideline or vegetation line move. (Artificial armoring is generally not permitted. States with such laws (among them, Texas, South Carolina, Rhode Island, and Maine), usually anchor the principle in the local public trust doctrine. For example, development of any kind might be prohibited on the sea side of the mean high tide. If the beach erodes and an owner’s boardwalk (or house!) becomes situated beyond the new tideline, she would be required to remove the structure. Rolling restrictions have become popular among adaptation advocates, but they come with political and legal risks. Unless properly conceived, they could lead to successful takings litigation.

Other promising tools might include changes in soft armoring permits, acquisition and buyout programs, conditional development permits, and use of impact fees and exactions. Information on all of these is available in the appendix of this testimony.⁴⁴

⁴⁴ See Jessica Grannis, *supra* note 40.

