



LEGAL STUDIES RESEARCH PAPER SERIES
PAPER NUMBER 2012-05

Adapting to Climate Change while Planning for Disaster: Footholds, Rope Lines, and the Iowa Floods

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Published at 2011 B.Y.U. Law Review 2203 (2011)

This paper can be freely downloaded from the
Social Science Research Network at:

<http://ssrn.com/abstract=2017137>

Adapting to Climate Change While Planning for Disaster: Footholds, Rope Lines, and the Iowa Floods

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I. INTRODUCTION

If you have never seen a pig swim, you have never been in Iowa during a flood. When the rivers jump their banks in southeastern Iowa they flood thousands of acres of hog farms. With a little planning and enough trucks and skiffs, hog farmers have been able to evacuate these animals in surprising numbers.¹ But pigs that miss the boat must take their chances in the waves or on the corrugated roofs of buildings.² A few unlucky ones caught scrambling up the tops of levees will, out of concern for the structures' integrity, be shot.³ The state of Iowa has experienced catastrophic flooding three times in the past seventeen years—1993, 2008, and 2010.⁴ Those disasters

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1. *See The Lucky Ones . . . Iowa Flood Pigs*, KINSHIP CIRCLE (June 26, 2008), <http://www.kinshipcircle.org/disasters/relief/08-06-26.html>.

2. *Id.*

3. *Pigs' Journey through Floodwaters Ends on Levee*, MSNBC.COM (June 19, 2008, 9:27 AM), http://www.msnbc.msn.com/id/25258516/ns/us_news-midwest_flooding/t/pigs-journey-through-floodwaters-ends-levee/#.Tne6eus0qTk.

4. A WATERSHED YEAR: ANATOMY OF THE IOWA FLOODS OF 2008 xi–xii (Cornelia F.

threatened considerably more than livestock. The 2008 Midwest floods, sometimes called “Iowa’s Katrina,” inundated Iowa City, Cedar Rapids, and several other smaller communities, displacing families, flooding thousands of homes, and causing millions of dollars in property damage.⁵

So many calamitous floods over so short a period of time spurred a federal and state effort to rebuild Iowa’s devastated communities and to increase resilience through improved disaster planning and mitigation.⁶ At the same time, local experts concerned about climate change saw floods like these as consistent with prevailing climate models.⁷ Perhaps it was time for the state’s disaster planning mechanism to factor in the science of climate change. In 2010, the U.S. Environmental Protection Agency (EPA) convened a pilot project on behalf of the Interagency Climate Change Adaptation Task Force (“Adaptation Task Force”) to bring together stakeholders from all levels of government to understand how such a fusion might occur.⁸

The lessons learned through this experience have relevance to many climate change adaptation efforts around the country. In particular, the Iowa Pilot Project helped focus attention on three challenges often cited by experts in adaptation policy: coordinating efforts across government sectors, coordinating efforts among levels of government, and developing an action model that can successfully move forward in the context of great uncertainty. One promising way to address these concerns, we believe, is to pay close attention to what we metaphorically call “footholds” and “rope lines.” A foothold is a preexisting law or standard that, while not specifically intended to abet adaptive efforts, may be successfully used that way, thus allowing the integration of important climate concerns into an existing public or private mission. A rope line refers to the dynamic

Mutel ed., 2010); Press Release, FEMA, President Declares Major Disaster for Iowa (July 27, 2010), *available at* <http://www.fema.gov/news/newsrelease.fema?id=52234>.

5. See NAT’L OCEANIC & ATMOSPHERIC ADMIN., 2008 MIDWESTERN U.S. FLOODS, <http://www.ncdc.noaa.gov/special-reports/2008-floods.html> (last updated July 9, 2008).

6. *Smart Growth Technical Assistance in Iowa*, U.S. ENVTL. PROT. AGENCY, http://epa.gov/smartgrowth/iowa_techasst.htm (last visited Oct. 14, 2011).

7. Eugene S. Takle, *Was Climate Change Involved?*, in *A WATERSHED YEAR: ANATOMY OF THE IOWA FLOODS OF 2008*, *supra* note 4, at 111, 115.

8. U.S. ENVTL. PROT. AGENCY, *IOWA CLIMATE CHANGE ADAPTATION & RESILIENCE REPORT 2* (2011) [hereinafter *IOWA CLIMATE CHANGE REPORT*], *available at* http://epa.gov/smartgrowth/pdf/iowa_climate_adaptation_report.pdf.

network of public and private stakeholders—across many relevant sectors and levels of government—that can support the adaptive effort and guide it flexibly through a process of evolutionary learning in the face of uncertainty. The lessons we glean from the Iowa Pilot Project are necessarily tentative: its work, and the work of the Adaptation Task Force, has only begun. But trends are emerging, and we think they can shed light on future endeavors.

Part II of this Article will briefly describe how climate change is increasing the risk of catastrophic events and thus making climate trends relevant to traditional disaster mitigation policies. This Part also introduces the concept of climate change adaptation and notes the structural challenges of scope, scale, and uncertainty. Part III describes the federal government's recent efforts toward climate adaptation and introduces the work of the Adaptation Task Force, which supports the Iowa Pilot Project. Part IV introduces the ideas of footholds and rope lines, which we believe helps conceptualize the coordination problems inherent in adaptation policy; as a bonus, the reader is apt to learn a little about ice climbing too. Part V describes in detail the process and findings of the Iowa Pilot Project, emphasizing the issues presented by scope, scale, and uncertainty. Part VI concludes with a summary of lessons learned and our thoughts about next steps.

II. CLIMATE-BASED DISASTERS AND THE NEED TO ADAPT

A. Climate Impacts as Disaster Impacts

We know from scientific observation that Earth's climate is already warming and that, according to strong scientific consensus, human activity is the main cause.⁹ Moreover, global temperatures are projected to rise faster this century (2°F to 11.5°F) than they did in the last century (1.5°F).¹⁰ According to the Global Change Research Program (GCRP)—a consortium of federal agencies devoted to climate research—temperatures in the United States are “very likely to rise more than the global average over this century, with some variation from place to place.”¹¹ Compared to decades ago, observers

9. U.S. GLOBAL CHANGE RESEARCH PROGRAM, GLOBAL CLIMATE CHANGE IMPACTS IN THE UNITED STATES 9 (2009) [hereinafter GLOBAL CLIMATE CHANGE IMPACTS], *available at* <http://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf>.

10. *Id.*

11. *Id.*

in the United States have already recorded higher air and water temperatures, fewer frost days, more frequent and more intense downpours, reduced snow cover, longer growing seasons in some places, and rising seas.¹² These trends are expected to continue even as new trends emerge, including more intense hurricanes and storm surges, and drier conditions in the Southwest, affecting drought cycles and increasing wildfires.¹³

Among such ills, experts in the United States worry especially about rainstorms. The increased frequency and intensity of heavy downpours appears responsible for most or all of the average precipitation increases seen in the United States over the last fifty years.¹⁴ During that time, states in the Midwest and Northeast swallowed most of the surge, with Alaska and Hawaii also taking impressive shares.¹⁵ Climate models suggest that the trend will only get worse. Heavy downpours that now have a 5% chance of happening in a given year are expected to have anywhere from a 6.7% to 25% chance of occurring in a given year by the end of the century depending on location.¹⁶ Storm intensity is similarly expected to increase by 10% to 25%.¹⁷ In addition, cities near the coasts are vulnerable to the added threats of sea-level rise, increased storm surge, and the possibility of stronger or more frequent hurricanes.¹⁸ Cities like New Orleans, Miami, and New York “are particularly at risk, and would have difficulty coping with the sea-level rise projected by the end of the century under a higher emissions scenario.”¹⁹ For example, projections suggest that a 100-year flood event in the New York City areas might “occur at least

12. *Id.*

13. *Id.*; *Early Warning Signs of Global Warming: Droughts and Fires*, UNION OF CONCERNED SCIENTISTS, http://www.ucsusa.org/global_warming/science_and_impacts/impacts/early-warning-signs-of-global-4.html (last visited Oct. 14, 2011).

14. GLOBAL CLIMATE CHANGE IMPACTS, *supra* note 9, at 32.

15. *Id.*

16. *Id.* (describing current downpours as “1-in-20-year events” and future projected downpours as occurring every “4 to 15 years”).

17. *Id.*

18. *Id.* at 103. The effects of global warming on hurricane strength and intensity are not yet known. For instance, a 2008 long-view study conducted by researchers from the National Oceanic and Atmospheric Administration and the University of Miami suggest that warming trends, paradoxically, appear to weaken cyclonic movement because of corresponding increases in vertical wind shear. See Chunzai Wang & Sang-Ki Lee, *Global Warming and United States Landfalling Hurricanes*, 35 GEOPHYSICAL RES. LETTERS L02708 (2008).

19. GLOBAL CLIMATE CHANGE IMPACTS, *supra* note 9, at 103.

twice as often by mid-century, and 10 times as often . . . by late this century.”²⁰ As Vermonters and upstate New Yorkers learned after Hurricane Irene, even places hundreds of miles inland can be blasted by tropical storms whose weakening bands continue to swamp cities and churn the landscape.²¹

Stronger downpours, hurricanes, and floods all translate into greater property damage, increased demands on emergency management, and increased cleanup and rebuilding costs. Many cities, particularly in the Midwest and Northeast, where the traditional flood-safety standard is designed for a “1-in-100 year” event (with a 1% chance of occurring in a given year), will find themselves overwhelmed as “outlier” floods become more common. As a result, municipalities will be forced to increase emergency weather response, while maintenance costs for transportation systems and other infrastructure will also rise.²²

Other disasters include heat waves, droughts, crop failures, wildfires, and outbreaks of illness. Drought related to reduced precipitation, increased evaporation, shrinking snowpack, and increased water loss from plants will dominate climate challenges in the western United States.²³ Many of these factors may also lead to more frequent and more destructive wildfires, which each year claim 1.2 million acres of U.S. woodland.²⁴ Crop failure (another slow-moving disaster) in rural areas looms large on the horizon. Many crops respond well to slight boosts in carbon dioxide levels with low levels of warming, but higher levels of warming kill crop yields.²⁵ Increased pests, water stress, diseases, and weather extremes threaten not only plants, but also livestock production.²⁶ Moreover, traditional public health-related disasters are likely to increase with warming. In the United States, warming trends are associated with increased heat stress, harmful air quality (like longer ozone seasons),

20. *Id.* at 109–10.

21. See Abby Goodnough & Danny Hakim, *Storm’s Push North Leaves Punishing Inland Flooding*, N.Y. TIMES, Aug. 29, 2011, at A1 (describing inland floods that destroyed homes, displaced hundreds of residents, and caused several deaths).

22. GLOBAL CLIMATE CHANGE IMPACTS, *supra* note 9, at 102.

23. *Id.* at 12.

24. *Facts About Wind and Wildfires*, WEATHER CHANNEL, <http://www.weather.com/ready/fire/facts.html> (last visited Oct. 14, 2011).

25. GLOBAL CLIMATE CHANGE IMPACTS, *supra* note 9, at 71.

26. *Id.* at 121.

waterborne illness, and diseases transmitted by insects and rodents.²⁷ On the plus side, reduced cold stress in northern regions will bring benefits, reducing to some degree injuries and deaths attributable to colder weather as well as funds spent on road maintenance and other services.²⁸

As Dan Farber notes in this symposium issue, heat stress is a big killer, especially among the elderly.²⁹ According to the GCRP, the number of days with high temperatures above 90°F is projected to increase throughout the country.³⁰ In parts of the South, assuming higher emissions scenarios, the number of days per year exceeding 90°F would more than double, soaring from 60 to 150 by the end of the century.³¹ In regions not accustomed to hot weather (and where many homes lack air conditioning), the debilitating “scorcher” will come more often. “Recent studies using an ensemble of models,” according to the GCRP, “show that [extreme heat waves] that now occur once every twenty years are projected to occur about every other year in much of the country by the end of this century.”³² What’s more, these hot days are projected to be about 10°F warmer than they are today.³³ For these reasons, the city of Chicago predicts that without adaptation efforts, heat-related fatalities could rise to anywhere from 450 to 1200 by 2085.³⁴

It’s important to keep in mind that while the information we have on domestic climate impacts is useful—and we think “actionable”—there are important gaps in almost every area of study. For instance, “our knowledge of changes in tornadoes, hail, and ice storms is quite limited,” reports the GCRP, “making it difficult to know if and how such events have changed as climate has warmed, and how they might change in the future.”³⁵ And the effect of climate change on hurricanes in the United States remains a subject

27. *Id.* at 117–19.

28. *See id.* at 119.

29. Daniel A. Farber, *Disaster Law and the Environment*, 2011 B.Y.U. L. REV. (forthcoming Dec. 2011).

30. GLOBAL CLIMATE CHANGE IMPACTS, *supra* note 9, at 33–34.

31. *See id.* at 34.

32. *Id.*

33. *Id.*

34. *CCAP Frequently Asked Questions*, CHI. CLIMATE ACTION PLAN, http://www.chicagoclimateaction.org/pages/ccap_frequently_asked_questions/89.php (last visited Oct. 14, 2011).

35. GLOBAL CLIMATE CHANGE IMPACTS, *supra* note 9, at 11.

of some disagreement.³⁶ The theme of uncertainty and incomplete information is an important aspect of our analysis.

B. Adapting to Climate-Based Disasters

1. Defining adaptation

The U.N. Intergovernmental Panel on Climate Change (IPCC) defines climate change adaptation as “the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects.”³⁷ The concept recognizes that climate impacts have occurred and are continually occurring; it presumes that many of these trends will inevitably continue to some degree, independent of our efforts to reduce greenhouse gases (“mitigation”). Adaptation aims to lessen the magnitude of these impacts through proactive or previously planned reactive actions. As the IPCC said, “[M]itigation will always be required to avoid ‘dangerous’ and irreversible changes to the climate system. Irrespective of the scale of mitigation measures that are implemented in the next 10–20 years, adaptation measures will still be required due to inertia in the climate system.”³⁸ Or, as President Obama’s science advisor, James Holdren, explains, “We must avoid the climate impacts we can’t manage and manage the climate impacts we can’t avoid.”³⁹

We can divide adaptation strategies into three broad categories: resistance, adjustment, and retreat.⁴⁰ Resistance is most commonly associated with flood or storm surge—using manmade or natural

36. *See id.* at 25.

37. U.N. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: IMPACTS, ADAPTATION AND VULNERABILITY 27 (2007), *available at* http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_wg2_report_impacts_adaptation_and_vulnerability.htm (follow “Technical Summary” hyperlink).

38. U.N. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: MITIGATION OF CLIMATE CHANGE 101 (2007), *available at* http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_wg3_report_mitigation_of_climate_change.htm (follow “Chapter 1: Introduction” hyperlink).

39. James Holdren, Assistant to the President for Sci. and Technology and Dir. of the White House Office of Sci. and Technology Policy, Remarks at the National Climate Adaptation Summit, Washington, D.C. (May 25, 2011) (notes on file with the authors).

40. *See* Robert R.M. Verchick & Joel D. Scheraga, *Coastal Protection*, in *THE LAW OF ADAPTATION TO CLIMATE CHANGE* (Michael B. Gerard & Katrina Kuh eds., forthcoming 2011); *see also* J.B. Ruhl, *Climate Change Adaptation and the Structural Transformation of Environmental Law*, 40 ENVTL. L. 363, 385–87 (2010) (suggesting a taxonomy of resist, transform, and move).

buffer systems to block the punch of souped-up “natural hazards.” Adjustment refers to modifications to existing practices that increase resilience to hazards like floods, droughts, heat waves, or insect-borne illness. Adjustment strategies include innovations in engineering, settlement, and land-use practices; modifications to risk-pooling systems like insurance or tort law; and changes to public health and safety programs. Retreat involves the migration of people and property to less hazardous areas. In its most extreme form, retreat means abandoning development that cannot reasonably be protected in another way. But retreat can also mean imposing limits, such as restricting development in hazard-prone areas. What distinguishes climate change adaptation from other forms of environmental coping is that climate adaptation strategies are specifically intended to address hazards posed by or aggravated by global warming. As such, they typically take into consideration climate change trends and projections, as well as other climate-related scientific information.

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.

2. *Inherent structural challenges*

The pursuit of resilience is a project so vast and varied in form that it is bound to have structural complications. Students of disaster policy have long pointed to the administrative challenges of building physical and social resilience into agency missions.⁴¹ In particular, disaster scholars worry about problems of cross-sector scope and political scale.⁴² Broadening the *scope* of an administrative program to involve all relevant sectors is sometimes referred to as a problem of

41. See DANIEL A. FARBER ET AL., *DISASTER LAW AND POLICY* 75–76, 83–84 (2d ed. 2010).

42. See *id.* at 83–84 (referring to the need for “horizontal” and “vertical” coordination).

horizontal integration.⁴³ Engaging government actors at the appropriate levels of government (whether national, state, tribal, or local) is a challenge of *scale* and requires what is sometimes called *vertical* integration.⁴⁴ Because disaster planning often involves “expecting the unexpected,” the literature also stresses the role of uncertainty and even unknowability.⁴⁵ Climate adaptation policy, which also focuses on far-flung impacts and general resilience, similarly struggles with scope, scale, and uncertainty.⁴⁶

a. Scope. Government policymakers are forever trapped in silos. We have federal agencies assigned to transportation, housing, emergency response, environmental protection—you name it. The system is designed for specialization but is fashioned poorly for challenges of an interdisciplinary nature. Some agencies could be arranged differently and some priorities re-nested, but unless every public concern could fit in a single barrel, the conceptual problem remains.

Multidimensional problems often require cooperative approaches. For instance, in order to promote more sustainable growth in local communities, the Obama administration created the HUD-DOT-EPA Partnership for Sustainable Communities. Through that partnership, member agencies pursue their traditional goals related to housing, transportation, and environmental protection, while embracing a basket of shared “livability principles” concerned with enhancing transportation and housing choices, investing in existing neighborhoods, and growing job opportunities.⁴⁷ Improving public health is another cross-sector challenge. Thus, the recent Patient Protection and Affordable Care Act created a body called the National Prevention, Health Promotion, and Public Health Council.⁴⁸ Headed by the Surgeon

43. *See id.*

44. *See id.*

45. Stephen H. Schneider & Kristin Kuntz-Duriseti, *Uncertainty and Climate Change Policy*, in CLIMATE CHANGE POLICY: A SURVEY 53, 56, 66 (Stephen H. Schneider, S.H. et al. eds., 2002).

46. *See, e.g.*, WILLIAM D. WALKER ET AL., WISCONSIN INITIATIVE ON CLIMATE CHANGE IMPACTS, ADAPTING TO CLIMATE CHANGE: WHY ADAPTATION POLICY IS MORE DIFFICULT THAN WE THINK (2010).

47. *See* U.S. ENVTL. PROT. AGENCY, PARTNERSHIP FOR SUSTAINABLE COMMUNITIES: A YEAR OF PROGRESS FOR AMERICAN COMMUNITIES 4 (2010), available at http://www.epa.gov/smartgrowth/pdf/partnership_year1.pdf.

48. 42 U.S.C.A. § 300u-10 (2010).

General, with representatives from twenty federal agencies, the Council is promoting a cross-sector national strategy to improve public health, with recommendations related to everything from healthy eating to safer highways to environmental protection.⁴⁹

Climate adaptation is a cross-sectoral problem too, whose notion of resilience, in fact, shares many of the values of community sustainability as well as public health. As such, it too will require a sophisticated cooperative structure.

b. Scale. As with disaster law, there is a strong case for federal involvement in climate-adaptation efforts. A single earthquake or flood, for instance, can flatten an entire region, wreaking havoc across city, state, and even international boundaries.⁵⁰ The resources needed to predict, plan for, and respond to catastrophic events are often beyond the capabilities of many local and regional governments. Coastal cities in the mid-Atlantic, for instance, use federal flood-plain maps to inform development decisions and rely on experts from the National Oceanic and Atmospheric Administration to anticipate the need for hurricane evacuations. When severe disaster strikes, the Stafford Act⁵¹ is meant to see that federal response teams quickly swoop in when the capabilities of state and local governments have been knocked out or overwhelmed. Comprehensive cash-payment and rebuilding programs demand federal involvement too. These arguments, and more, apply to climate change adaptation.

The federal government also has an important stake in adaptation because climate change directly affects federal services, operations, and programs across the country. Virtually every aspect of the federal government will be impacted by climate change in some way, including national security, food security, transportation infrastructure, stewardship of federal lands, and immigration. In addition, the federal government controls or influences myriad policies that affect local climate vulnerability, including water-resources management (including dams and levees), grants and

49. See generally NAT'L PREVENTION, HEALTH PROMOTION AND PUB. HEALTH COUNCIL, NATIONAL PREVENTION STRATEGY: AMERICA'S PLAN FOR BETTER HEALTH AND WELLNESS (2011), available at <http://www.healthcare.gov/center/councils/nphpphc/strategy/report.pdf>.

50. FARBER ET AL., *supra* note 41, at 75 (describing argument for federal involvement in disaster policy).

51. 42 U.S.C. §§ 5121–5206 (2006 & Supp. 2009).

subsidies for infrastructure development, the National Flood Insurance Program, and agricultural policy.

The U.S. federal government creates and controls some of the most impressive climate science on the planet, certainly more than any U.S. city or state. The federal government also participates in the climate research of international bodies like the United Nations Intergovernmental Panel on Climate Change.⁵² Subnational governments and private businesses cannot collect or downscale this information on their own. Just as Los Angeles County relies on the United States Geological Survey to provide it the best information on seismic activity,⁵³ subnational governments and private entities will rely on the federal climate programs to provide them with the most reliable and accessible information on localized risks, impacts, and vulnerabilities arising from climate change.

Because climate impacts span geographic boundaries and can affect multiple sectors, federal involvement is key to organizing subnational governments, relevant agencies of all levels, business interests, and civil society.⁵⁴ But because climate impacts vary widely across the landscape (just as non-climate-related disasters do), adaptation policy simultaneously demands strong local participation and chains of command. As J.B. Ruhl explains:

Adaptation for Florida, where sea level rise is the primary threat, will not be what it is for Nevada, where even less water is the likely scenario. Even within many states, local impacts will be sufficiently varied as to demand specialized adaptation profiles. It seems unlikely that the federal government could effectively devise a national adaptation strategy that fulfills the needs of every state and local community.⁵⁵

52. See *Climate Change—U.S. Climate Policy: International Cooperation*, U.S. ENVIRONMENTAL PROTECTION AGENCY, <http://www.epa.gov/climatechange/policy/international-cooperation.html> (last updated Apr. 14, 2011).

53. *Southern California Earthquake Data Center*, CALIFORNIA INSTITUTE OF TECHNOLOGY, <http://www.data.scec.org/about/index.html> (last visited Oct. 20, 2011).

54. INTERAGENCY CLIMATE CHANGE ADAPTATION TASK FORCE, PROGRESS REPORT OF THE INTERAGENCY CLIMATE CHANGE ADAPTATION TASK FORCE 1 (2010), available at <http://www.whitehouse.gov/sites/default/files/microsites/ceq/20100315-interagency-adaptation-progress-report.pdf>.

55. Ruhl, *supra* note 40, at 423 (footnotes omitted); see also ROBERT L. GLICKSMAN ET AL., CLIMATE CHANGE AND THE PUGET SOUND: BUILDING THE LEGAL FRAMEWORK FOR ADAPTATION 16 (2011).

This raises the thorny issue of federalism, which we will tackle shortly, along with Professor Ruhl's sensible skepticism toward a "national" strategy.

c. Uncertainty. Preparing for catastrophe always involves handling uncertainty, if by catastrophe we mean a terrible thing that does not regularly occur. But the uncertainties in climate impacts are especially annoying. For instance, while climate models generally agree that global warming will affect precipitation patterns across the country, they are not very good at predicting particular local effects in particular months or even seasons.⁵⁶ Moreover, even if scientists could downscale rain effects with precision, uncertainties in hydrological models might still prevent us from predicting the occurrence or severity of floods or water shortages.

Climate change also undermines the reliability of historical data. When assessing the future risk of a hurricane or drought, we are used to looking *backward* over time for patterns that we can then project *forward* into the future. With a long enough record and precise enough information, the reasoning goes, our ability to assess risk increases. But with climate change, all bets are off. The one thing we know is that the future will not be like the past. The traditional planning and environmental laws allow agencies to address only environmental variations that fall in mostly predictable and limited ranges based on historical records. But climate change requires new analytical tools and new decision making structures. In addition, non-climatic factors such as demographic changes and population growth, invasive species, and habitat degradation may further affect climate impacts or create feedback loops and vice versa.⁵⁷

These uncertainties have some of the aspects of what J.B. Ruhl and James Salzman call "massive problems."⁵⁸ There are many "causal mechanisms" (heat, wind, precipitation, sea-level rise, acidic sea water, etc.) where scale, timing, and causal relationship are not fully understood.⁵⁹ The "cumulative effects" are "subject to nonlinear tipping points that punctuate changes in aggregation and disaggregation rates."⁶⁰ This makes it hard to design effective policy

56. GLOBAL CLIMATE CHANGE IMPACTS, *supra* note 9, at 41–52.

57. GLICKSMAN ET AL., *supra* note 55, at 16 (footnotes omitted).

58. J.B. Ruhl & James Salzman, *Climate Change, Dead Zones, and Massive Problems in the Administrative State: A Guide for Whittling Away*, 98 CAL. L. REV. 59, 73–75 (2010).

59. *Id.* at 75–78.

60. *Id.* at 78; *see also* Stephen H. Schneider, *Abrupt Non-linear Climate Change*,

measures. Nonlinear patterns make it harder to link policy measures with changes in cumulative effects within relevant political time frames. Challenges come when cumulative effects are hard to identify, hard to measure, have disproportionate spatial distribution, have disproportionate temporal distributions, and are not reversible.⁶¹

But it gets worse: in some scenarios, we cannot imagine what the worst case will be. For instance, there may be a plausible connection between global warming and earthquakes.⁶² We assume most scientists would today consider this connection unlikely, but the fact that we cannot rule it out forces us to confront the value of precaution. Students of disaster often emphasize the unusual difficulty in this field of *imagining* what the next risk or threat could even be.⁶³

III. CURRENT ADAPTATION EFFORTS AND THE INTERAGENCY CLIMATE CHANGE ADAPTATION TASK FORCE

A. Current Efforts

Climate change adaptation in the United States has largely been the work of cities and states. Some cities, like Chicago and New York, have already begun planning efforts to prepare for increased heat waves, storms, and other threats to public health and economic wellbeing.⁶⁴ According to the Georgetown Climate Center's database of state and local adaptation plans, fourteen U.S. cities and thirteen states have or are developing adaptation plans.⁶⁵ Most of this planning has so far advanced with little federal support.

Irreversibility and Surprise, 14 GLOBAL ENVTL. CHANGE 245 (2004).

61. Ruhl & Salzman, *supra* note 58, at 79.

62. Elizabeth Burlison, *Multilateral Climate Change Mitigation*, 41 U.S.F. L. REV. 373, 377 (2007) (noting that melting of glaciers caused by global warming can affect seismic activity and trigger earthquakes).

63. LEE CLARKE, *WORST CASES: TERROR AND CATASTROPHE IN THE POPULAR IMAGINATION* 144 (2006) (describing the importance of "imagination stretch"); ROBERT R.M. VERCHICK, *FACING CATASTROPHE: ENVIRONMENTAL ACTION FOR A POST-KATRINA WORLD* (2010).

64. See CHI. CLIMATE TASK FORCE, *CHICAGO CLIMATE ACTION PLAN* (Nicole Friedman ed. 2008), *available at* <http://www.chicagoclimateaction.org/filebin/pdf/finalreport/CCAPREPORTFINALv2.pdf>; *see also* N.Y.C. DEP'T. OF ENVTL. PROT., *CLIMATE CHANGE PROGRAM ASSESSMENT AND ACTION PLAN* (Kate Demong et al. eds., 2008), *available at* http://www.nyc.gov/html/dep/pdf/climate/climate_complete.pdf.

65. *State and Local Adaptation Plans*, GEORGETOWN CLIMATE CENTER,

Federal efforts to build adaptive capacity and increase climate resilience have been underway for some time, although they are not always well publicized. Some activities, like the GCRP's support for climate monitoring and data analysis, aim to improve our current understanding of climate science and climate impacts.⁶⁶ Other efforts, like those underway at the Department of Agriculture (USDA), the Department of Interior, and the Department of Transportation, seek to identify ways in which agency missions or practices are vulnerable to climate change and to develop effective responses.⁶⁷ Some initiatives lend support to regional efforts, as do EPA's Climate Ready Estuaries program and its Climate Ready Water Utilities Working Group. Others take an international view. The Navy, for instance, is examining how warming in the Arctic could open new channels of navigation and affect the department's objectives and plans.⁶⁸ The State Department contributes to international adaptation efforts through the U.N. Framework Convention on Climate Change, while the U.S. Agency for International Development is integrating adaptation planning into the Famine Early Warning Systems Network and other foreign assistance programs.⁶⁹

B. Interagency Climate Change Adaptation Task Force

1. The general charge

In October 2010, the Adaptation Task Force published a report with recommendations toward a "national strategy" that would better prepare the United States to respond to the impacts of climate change.⁷⁰ The goal was "to foster collective action toward a common adaptation agenda" by proposing "initial steps in what must be a

<http://www.georgetownclimate.org/adaptation/state-and-local-plans> (last visited Sept. 10, 2011).

66. THE WHITE HOUSE COUNCIL ON ENVTL. QUALITY, PROGRESS REPORT OF THE INTERAGENCY CLIMATE CHANGE ADAPTATION TASK FORCE (2010) [hereinafter TASK FORCE REPORT], *available at* <http://www.whitehouse.gov/sites/default/files/microsites/ceq/Interagency-Climate-Change-Adaptation-Progress-Report.pdf>.

67. *Id.* at 23–25.

68. *Id.* at 24.

69. *Id.*

70. *Id.* at 19.

long-term, iterative approach to building a resilient, healthy, and prosperous Nation in the face of a changing climate.”⁷¹

The report recommends that federal agencies implement actions to expand and strengthen the nation’s capacity to better understand, prepare for, and respond to climate change. That includes making adaptation a standard part of agency planning and ensuring that scientific information about the impacts of climate change is easily accessible.⁷²

The Adaptation Task Force, which is co-chaired by the Council on Environmental Quality (CEQ), the Office of Science and Technology Policy (OSTP), and the National Oceanic and Atmospheric Administration (NOAA), includes representatives from more than twenty federal agencies, including EPA.⁷³ When President Obama signed the Executive Order on Federal Leadership in Environmental, Energy, and Economic Performance (E.O. 13,514) in 2009, he had called on the Adaptation Task Force to develop federal recommendations within a year for a “national strategy” to adapt to climate change.⁷⁴

Focusing on the “federal” part of a national strategy in this report, the Adaptation Task Force recommends a series of actions to strengthen the country’s climate resilience. They are:

- Make adaptation a standard part of Agency planning to ensure that resources are invested wisely and services and operations remain effective in a changing climate.
- Ensure that scientific information about the impacts of climate change is easily accessible so public and private sector decision makers can build adaptive capacity into their plans and activities.
- Align Federal efforts to respond to climate impacts that cut across jurisdictions and missions, such as those that threaten water resources, public health, oceans and coasts, and communities.

71. *Id.* at 14.

72. *Id.* at 10.

73. Robert Verchick represented EPA on the Task Force in his role as EPA’s Deputy Associate Administrator for Policy.

74. Exec. Order No. 13,514, 74 Fed. Reg. 52,117 (Oct. 8, 2009).

- Develop a U.S. strategy to support international adaptation that leverages resources across the Federal Government to help developing countries reduce their vulnerability to climate change through programs that are consistent with the core principles and objectives of the President's new Global Development Policy.
- Build strong partnerships to support local, state, and tribal decision makers in improving management of places and infrastructure most likely to be affected by climate change.⁷⁵

The Adaptation Task Force report identifies a set of “guiding principles” for decision makers to consider in designing and implementing these policies:

- **Adopt Integrated Approaches:** Adaptation should be incorporated into core policies, planning, practices, and programs whenever possible.
- **Prioritize the Most Vulnerable:** Adaptation strategies should help people, places, and infrastructures that are most vulnerable to climate impacts and be designed and implemented with meaningful involvement from all parts of society.
- **Use Best-Available Science:** Adaptation should be grounded in the best-available scientific understanding of climate change risks, impacts, and vulnerabilities.
- **Apply Risk-Management Methods and Tools:** Adaptation planning should incorporate risk-management methods and tools to help identify, assess, and prioritize options to reduce vulnerability to potential environmental, social, and economic implications of climate change.
- **Apply Ecosystem-Based Approaches:** Adaptation should, where appropriate, take into account strategies to increase ecosystem resilience and protect critical ecosystem services on

75. TASK FORCE REPORT, *supra* note 66, at 11–12.

which humans depend to reduce vulnerability of human and natural systems to climate change.⁷⁶

The Office of the Federal Environmental Executive, with the advice of the Adaptation Task Force's Agency Adaptation Workgroup, also developed an implementation process. Through this process, agencies are supposed to develop and implement strategic plans that identify how and where adaptation should be incorporated into their programs, policies, and regulations. The task force promised to establish, by Spring 2011, a partnership committee composed of local, state, and tribal representatives to consult with the federal government as it begins to implement the recommended actions. The Adaptation Task Force will continue to meet over the next year as an interagency forum for discussing the federal government's adaptation approach and to support and monitor the implementation of recommended actions in the Progress Report. It plans to prepare another report in October 2011 that documents the government's progress and offers additional recommendations for the future.

To integrate, or "mainstream" climate considerations into current activities, the Report calls on agencies to create "climate adaptation action plans," using a framework that prompts officials to examine how projected climate trends could affect Agency goals and to develop an evolving system of responses based on continuous assessment and evaluation.⁷⁷ As applied, the framework would look something like this:⁷⁸

76. *Id.* at 10.

77. *Id.* at 26.

78. *Id.* at 28.



Figure 5. Six step approach to climate change adaptation planning

In order to evaluate this framework in action, the Adaptation Task Force supported a set of pilot tests, from Agency-wide to the individual project level. The Department of Homeland Security (DHS), the Department of Transportation's Federal Highway Administration, the Army Corps of Engineers, and EPA all took part.⁷⁹

Some members of Congress are skeptical of the Obama administration's efforts to make federal programs stronger and more resilient in the face of climate change. Representative Steve Scalise of Louisiana sponsored an amendment that would prevent the USDA from pursuing its plan to assess climate vulnerabilities in its programs.⁸⁰ Representative John Carter of Texas did the same for the DHS.⁸¹ In June 2011, the House of Representatives passed both initiatives with little fanfare.⁸² Neither proposal has moved past the

79. *Id.* at 29.

80. *Scalise Passes Amendment on House Floor Blocking Reckless Climate Change Regulations*, SCALISE.HOUSE.GOV (June 16, 2011), <http://scalise.house.gov/press-release/scalise-passes-amendment-house-floor-blocking-reckless-climate-change-regulations>.

81. *Carter Blocks DHS Funding on Climate Change*, HOUSE.CARTER.GOV (June 2, 2011), <http://tinyurl.com/3mw39ce>.

82. See *Bill Summary and Status: 112th Congress (2011-2012) H.AMDT.384*, LIBR. CONGRESS THOMAS, <http://thomas.loc.gov/cgi-bin/bdquery/z?d112:HZ00384>: (last visited Oct. 20, 2011); *Bill Summary and Status: 112th Congress (2011-2012) H.AMDT.378*,

Senate, but these efforts show how far some federal lawmakers are drifting from the geographic realities of even their own states (Louisiana being vulnerable to storms and sea-level rise and Texas being vulnerable to those, plus heat waves, droughts, and wildfires). And they suggest that with the approach of the 2012 elections, the ingenuous forces of climate adaptation may soon be dragged into the Greenhouse Holy War.

2. Adapting to climate-based disasters

The Report's third action item—"to respond to climate impacts that cut across jurisdictions and missions, such as those that threaten water resources, public health, oceans and coasts, and communities"—included a set of sub-directives emphasizing disaster mitigation. In its discussion of climate impacts that threaten communities, the Report notes:

Adaptation planning for communities and their underlying infrastructure is crucial. . . . Investments in community infrastructure are generally long-term, difficult to reverse, and resource-intensive, emphasizing the importance of "getting it right the first time." Climate change impacts that will most affect communities . . . include extreme heat, poor air quality, increased flooding, higher storm surges, and sea level rise. Reducing vulnerability and enhancing resilience of community infrastructure present challenges that require coordination among public and private interests, local to national jurisdictions, and within localities (e.g., zoning, building codes, and emergency management).⁸³

Specifically, the Report urges the federal government to take the lead by harmonizing existing policies and adaptation efforts that influence actions "at the local, state, [and] Tribal levels."⁸⁴ For instance, the Department of Transportation (DOT) might reassess transportation-design standards, which local governments rely on, in light of climate change trends.⁸⁵ EPA could integrate climate change impacts into design standards for water treatment plants to avoid flooding.⁸⁶ The Federal Emergency Management Agency (FEMA)

LIBR. CONGRESS THOMAS, <http://thomas.loc.gov/cgi-bin/bdquery/z?d112:HZ00378>: (last visited Oct. 20, 2011).

83. TASK FORCE REPORT, *supra* note 66, at 39.

84. *Id.* at 39.

85. *Id.* at 40.

86. *Id.*

could update its flood insurance maps to reflect climate change, and so on.⁸⁷

The Report also prompts agencies to integrate adaptation into their local-assistance programs, such as those concerned with municipal housing, transportation, and hazard mitigation.⁸⁸ On this point, coordination among agencies is key. The Report suggests a variety of collaborative strategies, from memoranda of understanding to joint grant-making programs, citing the HUD-DOT-EPA Partnership for Sustainable Communities as one promising example.⁸⁹ Significantly, the Report urges agencies with existing community-resilience programs to “work collaboratively in conducting pilot projects to deliver direct technical assistance to individual communities that can then serve as models for other areas.”⁹⁰

IV. Footholds AND ROPE LINES

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

87. *Id.*

88. *Id.* at G-1 to G-2.

89. *Id.* at 40.

90. *Id.* at 40–41.

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.

A. Footholds

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 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—Department of the Interior (DOI), NOAA, and Department of Defense (DOD), for example—think very much about adaptation at all⁹¹: 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

91. *Id.* at 23–25.

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.

The choice of footholds is often not obvious. In describing how agencies should fit adaptation into their plans, the Adaptation Task Force reports:

[A]gencies must consider a comprehensive set of potential climate adaptation measures – including infrastructural, technological, behavioral, and risk management measures. Criteria for selecting priority adaptation activities and projects will vary from agency to agency, and it is difficult to provide a comprehensive list that will be applicable and realistic for each Federal agency.⁹²

To understand how footholds work in real life, we 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. EPA defines environmental justice as “the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.”⁹³ The notion includes both an injunction against imposing or increasing disproportionate environmental effects on low-income and minority populations as well as a charge to identify existing inequalities and to remediate them.⁹⁴ Environmental justice is stressed in a 1994 presidential executive order, endorsements from the Obama White House, and EPA’s own 2011–2015 strategic plan.⁹⁵ Yet, as commentators have long complained, a specific charge to pursue

92. *Id.* at 28.

93. OFFICE OF ENVTL. JUSTICE, U.S. ENVTL. PROT. AGENCY, PLAN EJ 2014, at 3 (Sept. 2011) [hereinafter PLAN EJ 2014], *available at* <http://www.epa.gov/compliance/ej/resources/policy/plan-ej-2014/plan-ej-2011-09.pdf>.

94. *See* U.S. ENVTL. PROT. AGENCY, INTERIM GUIDANCE ON CONSIDERING ENVIRONMENTAL JUSTICE DURING THE DEVELOPMENT OF AN ACTION 6 (July 2010), *available at* <http://tinyurl.com/3vp2qrd>.

95. *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. ENVTL. PROT. AGENCY, FY 2011–2015 STRATEGIC PLAN 30–31 (Sept. 30, 2010) [hereinafter FY 2011–2015 PLAN], *available at* <http://www.epa.gov/planandbudget/strategicplan.html>.

environmental justice is all but nonexistent in the nation's vast armada of federal environmental statutes.⁹⁶ It's not that our environmental statutes *reject* environmental justice, or that they are necessarily inconsistent with it (although some have considered the point).⁹⁷ Rather, the laws were not developed with this priority in mind. 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 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."⁹⁸ 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."⁹⁹ Most recently, EPA has used footholds like these to require better monitoring of nitrogen dioxide emissions near highways (where low-income and minority populations are more likely to live)¹⁰⁰ and to write new hazardous-material recycling controls—ones based on a full demographic analysis and a specially tailored community engagement plan.¹⁰¹ The Agency suggests it will continue to use such authorities, along with other legal tools, to promote environmental justice even more in the future.¹⁰²

96. *See, e.g.*, CLIFFORD RECHTSHAFFEN ET AL., ENVIRONMENTAL JUSTICE: LAW, POLICY, AND REGULATION 215-16 (2d ed. 2009) (noting, in the context of setting standards, that "current federal environmental laws do not directly address environmental justice concerns").

97. *See, e.g.*, LUKE COLE & SHIELA FOSTER, FROM THE GROUND UP: ENVIRONMENTAL RACISM AND THE RISE OF THE ENVIRONMENTAL JUSTICE MOVEMENT 126 (2001).

98. *See* U.S. ENVTL. PROT. AGENCY, *supra* note 94, at 5 (box titled "Examples of Statutory Authority").

99. *Id.*

100. U.S. ENVTL. PROT. AGENCY, DOCKET ID NO. EPA-HQ-OAR-2006-0922 (2009).

101. 40 C.F.R. §§ 260, 261, 266; *see also* U.S. ENVTL. PROT. AGENCY, DOCKET ID NO. EPA-HQ-RCRA-2010-0742 (2011) ("Definition of Solid Waste").

102. *See* PLAN EJ 2014, *supra* note 93, at 23 (committing legal assistance from EPA's Office of General Counsel for EPA policymakers "to advance their environmental justice objectives").

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.¹⁰³ 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.¹⁰⁴ 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.¹⁰⁵ 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.¹⁰⁶ Another option would be to expand the common-law notion of the public trust so as to require protection of the people's drinking water resources.¹⁰⁷

Finally, some advocates believe that adaptation research and planning can be leveraged through the law that protects against species demise, the Endangered Species Act (ESA).¹⁰⁸ The ESA

103. GLOBAL CLIMATE CHANGE IMPACTS, *supra* note 9, at 115.

104. VERCHICK & SCHERAGA, *supra* note 40, at 25; *see also* *New York and Connecticut: Visualizing Coastal Impacts, Planning Wisely for the Future, and Advancing Adaptive Responses Today*, COASTAL RESILIENCE, <http://coastalresilience.org/geographies/long-island-sound/issue/groundwater> (last visited July 17, 2011).

105. *A Sustainable Water Supply*, SW. FLA. WATER MGMT. DISTRICT, www.swfwmd.state.fl.us/about/isspapers/watersupply.html (last visited July 17, 2011); COASTAL RESILIENCE, *supra* note 104.

106. 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).

107. Robin Kundis Craig, *Adapting to Climate Change: The Potential Role of State Common-Law Public Trust Doctrines*, 34 VT. L. REV. 781, 781 (2009).

108. 7 U.S.C. §136 (2006); 16 U.S.C. §§1531–44 (2006). The Endangered Species Act

provides for an array of activities designed to protect threatened and endangered species, conserve and restore habitat, and encourage interagency dialogue. J.B. Ruhl finds in the ESA an assortment of footholds that he believes may not only benefit some species threatened by changing climate, but also further important research into the ways global warming is affecting our local and regional ecosystems. He urges the Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS) to use its “listing” powers under Section 4 aggressively to identify species threatened by climate change.¹⁰⁹ Early identification of such species, along with the habitat necessary for their transition, would not only help threatened species, but also promote more general learning so as to help “defin[e] the extent of ecological reshuffling and guide human adaptation programs.”¹¹⁰ He sees the consultation requirements of Section 7 as a similar means to press federal agencies to investigate the effects of climate change on the local biology. Even if the elaborate investigative process does not ultimately prevent the proposed federal action (which is usually the case), Ruhl insists it is “by no means a waste of agency resources,” since the research improves scientific knowledge about climate impacts on the species.¹¹¹

Reviewing these examples together, we notice a few themes emerging. First, these examples show agencies focusing on a program or standard that promotes the relevant mission in broad and significant ways—that is to say, that delivers impressive “bang for the buck.” EPA’s focus on ambient air standards in pursuing environmental justice strikes at the heart of public health benefits, as no program claims to do more to save lives and prevent illness than the Agency’s air pollution program.¹¹² The SFWMD exercises broad control of water consumption, water quality protection, and even

might also provide a means to limit greenhouse gas emissions through its Section 7 and Section 9 regulatory programs, but we leave this issue to the side. See J.B. Ruhl, *Climate Change and the Endangered Species Act: Building Bridges to the No-Analog Future*, 88 B.U. L. REV. 1, 60 (2008) (arguing that for practical reasons the ESA should not be invoked to regulate greenhouse gas emissions).

109. Ruhl, *supra* note 108, at 29–31.

110. *Id.* at 60.

111. *Id.* at 49.

112. See ZYGMUNT J.B. PLATER, ET AL., ENVIRONMENTAL LAW AND POLICY: NATURE, LAW, AND SOCIETY 465 (4th ed. 2010) (describing the Clean Air Act as “arguably the most successful piece of environmental legislation ever drafted”).

land use, making it a powerful ally in the campaign for adaptation. Under the Endangered Species Act, the FWS and NMFS, also bring muscle to the adaptation mission with their powers to list and study climate-threatened species on land (public or private) and water.

Second, some of these footholds serve to reframe the policy issue (and thus the political conversation) in potentially useful ways. EPA, for instance, has effectively and appropriately framed the issue of environmental justice as one involving not just equity, but basic public health.¹¹³ The SFWMD was recently able to reframe the abstract issue of climate change adaptation as one involving a concrete threat to the public's drinking water supply.¹¹⁴ Robin Kundis Craig would take this a step further by framing the issue as one of emergency response and public necessity.¹¹⁵ We think this potential to reframe an issue in a more concrete and immediate way is very useful, and should be considered when choosing among possible footholds. Of course, a foothold should never be used to deliberately mischaracterize an issue or to push for change outside the legal bounds of a given authority.

Third, footholds can provide the opportunity to create conversations among interested parties who might not otherwise have a seat at the table. EPA's incorporation of demographic analysis in its recycling rule resulted in a series of meetings with policymakers, technical experts, and affected residents.¹¹⁶ Ruhl's proposal that the FWS and NMFS aggressively list climate-threatened species would lead to a series of consultations among the Services, federal climate research agencies, and federal and state agencies involved in permitting and construction projects. These collaborative efforts are the best way to approach the challenges of adaptation because the scope and scale of the problem are so broad.

Fourth, in all of the examples, the activities engaged in remain at the "core" of the agency's mission, with only a tweak here and there. EPA is an agency devoted to public health and environmental protection; paying attention to the effects of pollution on low-income and minority populations easily fits into that charge. The SFWMD is charged with protecting its residents' water supply, and it

113. See PLAN EJ 2014, *supra* note 93, at 1 (describing Agency effort "to improve the environmental conditions and public health in overburdened communities").

114. See *A Sustainable Water Supply*, *supra* note 105.

115. Craig, *supra* note 106, at 710.

116. PLAN EJ 2014, *supra* note 93, at 9.

cannot do that without factoring climate impacts into its future calculations. And the FWS, in taking actions to prompt further study of climate impacts on vulnerable species, remains safely within the bounds of its original mission of wildlife stewardship. Paying attention to an agency's core mission makes good sense: the strategy not only plays into the strength of an agency's expertise, but also makes integrative efforts less vulnerable to charges of "mission creep" by well-meaning officials or political opponents. Even while respecting this point, however, we believe agencies should seek out areas of policy overlap with sister agencies and build a coordinated response to multidimensional problems. This strategy broadens an initiative's "policy clout" both within the administration and in the public eye. It also furthers the goal of maximizing the "bang for the buck." Agencies should follow the same advice for areas of policy overlap with local, state, and tribal governments. Here, agencies should make efficient use of their regional offices for more direct involvement.

Fifth, as a group, the foothold examples illustrate how different laws offer different tools. The EPA's work on air and recycling standards, of course, takes advantage of the Agency's regulatory power. But the rulemaking processes also initiated detailed research projects on human susceptibility, exposure pathways, and demographics.¹¹⁷ Similarly, Ruhl suggests that a major benefit of using the ESA's listing and habitat designation programs would be the development of better science.¹¹⁸ We think agencies should experiment with all types of tools within their authorities, from regulations to research projects to assistance programs. A good general example concerning adaptation appears in EPA's "2011–2015 Strategic Plan," which promises to integrate climate adaptation into five rulemakings, five grant opportunities, and five research projects over five years.¹¹⁹

117. *See generally* OFFICE OF SOLID WASTE AND EMERGENCY RESPONSE, U.S. ENVTL. PROT. AGENCY, ENVIRONMENTAL JUSTICE ANALYSIS OF THE DEFINITION OF SOLID WASTE RULE (June 30, 2011) (providing an expanded analysis of the potential disproportionate impacts of the Revisions to the Definition of Solid Waste, 40 C.F.R. pts. 260, 261, and 270 (2008)).

118. *See* Ruhl, *supra* note 40, at 388.

119. FY 2011-2015 Plan, *supra* note 95.

To close the conversation on footholds, we believe the above examples suggest a set of guidelines that can help decision makers get started:

- Focus on programs or standards that have the potential to strengthen community resilience in broad and significant ways, delivering the most “bang for the buck.”
- Focus on programs or standards that might frame adaptation goals in concrete and immediate terms so as to build public support.
- Focus on opportunities to create conversations among interested parties who might not otherwise be brought to the table.
- Focus on activities that are near the core of an agency’s mission and that play to its strengths. But at the same time look for areas of policy overlap with other agencies at all levels of government to build a coordinated response to multidimensional problems.
- Experiment with all types of tools within agency authority, from regulations to research projects to assistance programs, and more.

Our discussion of the Iowa Project in Part VI further elaborates on the art of the foothold.

B. Rope Lines

In developing a strategy for climate resilience, the Adaptation Task Force was keenly aware of the challenges presented by cross-sector scope, political scale, and uncertainty. To address these factors, it emphasizes in its “guiding 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.”¹²⁰ That implies a shift away from the

120. TASK FORCE REPORT, *supra* note 66, at 10.

ritualized “Matching Principle” of traditional federalism theories,¹²¹ 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 Flexible Framework,¹²² 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.”¹²³ If efforts fail, then learn and modify. If they succeed, then replicate. Taken together, these prescriptions reach beyond the Etch-a-Sketch mentality of horizontal and vertical ties, suggesting, instead, the image of a “networking cloud,” where relationships are less hierarchical, more promiscuous, and infinitely self-adjusting.

The idea is innovative, but not completely new. In their thoughtful work on administrative structure and “massive” environmental problems, J.B. Ruhl and James Salzman believe that recent developments in political theory—in the form of Dynamic Federalism, New Governance, and Transgovernmental Network Theory—are already helping policymakers come to grips with scope, scale, uncertainty, and other hobgoblins.¹²⁴ Dynamic Federalism, for instance, rejects the view that policy problems should be optimally “matched” to a particular level of government authority, arguing that uneven multi-scalar effects, need for innovation, and democratic values demand a broader overlap among jurisdictional authorities.¹²⁵

121. For discussion of the Matching Principle, compare David E. Adelman & Kirsten H. Engel, *Adaptive Federalism: The Case Against Reallocating Environmental Regulatory Authority*, 92 MINN. L. REV. 1796 (2008), with Henry N. Butler & Jonathan R. Macey, *Externalities and the Matching Principle: The Case for Reallocating Environmental Regulatory Authority*, 14 YALE L. & POL'Y REV. 23 (1996).

122. See *supra* Part III.B.1, fig. 5.

123. TASK FORCE REPORT, *supra* note 66, at 28.

124. Ruhl & Salzman, *supra* note 58; see also Ruhl, *supra* note 40, at 428–31.

125. See *e.g.*, Adelman & Engel, *supra* note 121, at 1798 (stressing the complexity and multi-scalar nature of environmental problems as justification for greater jurisdictional overlap).

New Governance theory emphasizes the need for flexibility and adaptive learning when approaching complex cumulative problems. Adherents reject “the familiar model of command-style, fixed-rule regulation” in favor of “a new model of collaborative, multi-party, multi-level, adaptive, problem-solving.”¹²⁶ Transgovernmental Network Theory is a concept used to explain developments in international relations and focuses on the nonhierarchical networks formed among individual officials of national or international bodies, through which information is shared, standards are harmonized, and policies are enforced.¹²⁷ Ruhl and Salzman believe some administrative networks are moving toward this model at the national and state levels:

[These] interagency networks are not fixed, legally codified, or uniform. . . . While they may be memorialized through planning agreements, they depend as much or more on personal relationships and reputations as on formal institutional relationships and legalistic channels of communication. A scientist or policymaker in an agency might be a member of many such semiautonomous networks addressing different problems, one link in a set of “weak ties” that facilitate information flow across and between social networks. As many people in many agencies build these ties, the overlapping authorities structure becomes less a mangle and more an organism.¹²⁸

One administrative organism to watch, according to the authors, is the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force, a network of federal and state agencies committed to

and a stronger federal regulatory role); Robert A. Schapiro, *Toward a Theory of Interactive Federalism*, 91 IOWA L. REV. 243, 292–93 (2005) (stressing the need for fuller democratic dialogue, more inventive solutions, and stronger government accountability). For a fuller discussion of Dynamic Federalism, see Ruhl & Salzman, *supra* note 58, at 103–06.

126. Bradley C. Karkkainen, “New Governance” in *Legal Thought and in the World: Some Splitting as Antidote to Overzealous Lumping*, 89 MINN. L. REV. 471, 473 (2004). For a fuller discussion of New Governance theory, see generally THE TOOLS OF GOVERNMENT: A GUIDE TO THE NEW GOVERNANCE (Lester M. Salamon ed., 2001); Orly Lobel, *The Renew Deal: The Fall of Regulation and the Rise of Governance in Contemporary Legal Thought*, 89 MINN. L. REV. 342 (2004); Orly Lobel, *Setting the Agenda for New Governance Research*, 89 MINN. L. REV. 498 (2004); and Michael Waterstone, *A New Vision of Public Enforcement*, 92 MINN. L. REV. 434 (2007).

127. Ruhl & Salzman, *supra* note 58, at 107–09.

128. *Id.* at 108 (footnotes omitted).

shrinking the 8,000-square-mile hypoxic “Dead Zone” in the Gulf of Mexico.¹²⁹

Another might be the Adaptation Task Force and its expected progeny. The Adaptation Task Force proposes to rope together relevant national, subnational, and private actors through a “partnership committee” and “regional climate change adaptation consortia.”¹³⁰ The partnership committee, made up of “local, state, Tribal, and Federal Government representatives” would propose new ways for federal agencies and stakeholders to interact and set a foundation “for sustained and robust dialogue to better leverage, coordinate, and support U.S. adaptation efforts.”¹³¹ In addition to the committee, the Adaptation Task Force would continue to foster “local-to-global collaboration[s],” in particular, working with private-sector and community-based organizations in developing its plans.¹³² The regional consortia would comprise the regional offices of relevant federal agencies, many of which maintain impressive networks with local governments, businesses, and community organizations. The consortia would make sure that federal activities, like outreach, data collection, and information dissemination, meet regional needs.¹³³ It would pay special attention to factors that vary from region to region, such as social and geographic vulnerabilities, cultural practices, and administrative domains.¹³⁴ The consortia would help develop region-specific guidance for federal planning and support “the preparation, implementation, and evaluation” of state and local adaptation plans.¹³⁵ The Report urges performance metrics and an “iterative evaluation process” to allow federal adaptation efforts “to be revised as necessary if desired outcomes are not being achieved or if undesired consequences are occurring.”¹³⁶

129. For more on Gulf hypoxia and the Gulf Hypoxia Task Force, see *Mississippi River Gulf of Mexico Watershed Nutrient Task Force*, U.S. ENVTL. PROT. AGENCY, <http://www.epa.gov/msbasin/taskforce.htm> (last visited Nov. 12, 2011); U.S. ENVTL. PROT. AGENCY, 2001 ACTION PLAN FOR REDUCING, MITIGATING, AND CONTROLLING HYPOXIA IN THE NORTHERN GULF OF MEXICO (2001), available at http://water.epa.gov/type/watersheds/named/msbasin/upload/2001_4_4_msbasin_actionplan2001.pdf.

130. TASK FORCE REPORT, *supra* note 66, at 50.

131. *Id.*

132. *Id.*

133. *Id.*

134. *Id.* at 51.

135. *Id.*

136. *Id.*

These sorts of networks or partnerships offer flexibility and encourage adaptability.¹³⁷ 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,¹³⁸ as illustrated by the Adaptation Task Force’s own pilot projects. Networks allow for the pursuit of multiple policy goals but at the same time encourage a convergence of objectives.¹³⁹ Access to information, funding, technical resources, and legal authorities are all interdependent. This works toward a locus of power, in the current case, the federal government.

But there is a problematic side, too. Because of its emphasis on personal relationships, the weak-ties strategy sometimes creates an air of exclusivity or clubbiness that, in junior-high-school fashion, marks potential members as “in” or “out” without paying attention to the merits.¹⁴⁰ Informal networks are generally less transparent than formal ones, leading to questions about who is influencing important decisions and who is accountable for them.¹⁴¹ The heterogeneity of weak networks—in some ways an advantage—is also a source of instability where members do not share equal resources, timelines, or institutional commitments. Such imbalances could lead to situations where some members are unable to participate as regularly or energetically as needed, and where other members must pick up the slack. This relates to a final concern we might call “imperial policymaking.” Here the concern is that more powerful actors in the network (those with more money, staff, or expertise) will unduly influence decision making, sailing their goals and values through the ports of weaker entities.¹⁴²

137. Ruhl & Salzman, *supra* note 58, at 105–06; *see also* Kal Raustiala, *The Architecture of International Cooperation: Transgovernmental Networks and the Future of International Law*, 43 VA. J. INT’L L. 1, 10–17 (2002) (examining cooperative networks in international contexts).

138. Raustiala, *supra* note 137, at 7.

139. *Id.* at 56.

140. *Id.* at 25 (noting effects of exclusivity among personal relationships in international coordination).

141. *Id.* at 21–24.

142. *See id.*

The trick in developing a network with “weak-ties,” is to accentuate the positives and minimize the negatives, an issue now being studied as the Iowa pilot project moves into a new phase.

V. THE IOWA PILOT PROJECT

A. Background

As we noted in the introduction, Iowa has been swamped by violent floods three times in seventeen years (1993, 2008, and 2010).¹⁴³ The 2008 floods, alone, forced designations of federal disaster in eighty-five of Iowa’s ninety-nine counties.¹⁴⁴ This history has focused attention on Iowa’s changing climate and the associated risks posed to the state’s cities and scattered rural populations. In a state where politicians do not easily or openly discuss climate change, community leaders, county planners, hydrologists, engineers, and state officials began meeting and quietly developing strategies for making their state more resilient to the region’s already changing climate.¹⁴⁵

At about this time, members of the Adaptation Task Force were looking for examples of regional and local adaptation needs to understand how, and to what extent, federal involvement might be able to leverage change. On behalf of the task force, EPA convened a pilot project developed around local land-use and hazard mitigation planning.¹⁴⁶ The idea was to assemble a range of state officials, regional scientists, and community leaders for a set of serious discussions about climate change and regional disaster risk. EPA hoped that by facilitating these meetings and providing technical and policy guidance throughout, the Agency might create an environment in which regional stakeholders could identify opportunities for building climate resilience and locate legal and

143. CORNELIA F. MUTEL, *A WATERSHED YEAR: ANATOMY OF THE IOWA FLOODS OF 2008* (2010); *see also* Fed. Emergency Mgmt. Agency, U.S. Dep’t of Homeland Security, *Mississippi Floods*, <http://www.fema.gov/news/event.fema?id=1309> (last visited Oct. 20, 2011).

144. Fed. Emergency Mgmt. Agency, U.S. Dep’t of Homeland Sec., *Iowa Severe Storms, Tornadoes, and Flooding*, FEMA, <http://www.fema.gov/news/eventcounties.fema?id=9867> (last visited Oct. 20, 2011).

145. *See* IOWA CLIMATE CHANGE REPORT, *supra* note 8, at 2.

146. *See id.*

policy tools for pursuing an inclusive and flexible plan for moving forward.¹⁴⁷

EPA's interest in conducting this pilot in Iowa grew out of a successful partnership between the State, EPA, and FEMA regarding smart growth technical assistance in communities hard-hit by the floods of 2008. This partnership led to EPA and FEMA signing a Memorandum of Agreement (MOA) to continue working on ways to incorporate smart growth and sustainable community approaches into hazard mitigation planning and long-term community recovery.¹⁴⁸ The efforts put forward in this pilot project fit within the scope of the MOA, and the findings of this report have already begun to define follow-up collaborative projects. FEMA and EPA are currently working on a new set of pilots in coastal North Carolina that will explore the ways that communities can use best available data about sea-level rise, coastal storms, and increased precipitation to influence near-term infrastructure investments and planning projects.¹⁴⁹ The two agencies intend to continue working together and with states, tribes, and local communities to identify ways that federal policies, programs, and funding can better support climate change adaptation and disaster resilience.

During the Iowa adaptation pilot, EPA worked with stakeholders and governments in Iowa to

identify barriers to and incentives for considering regional effects of climate change in hazard mitigation planning and other community planning processes. . . . [Iowa communities] are experiencing floods that are growing more severe and frequent. Communities in Iowa engage in multiple planning activities, including hazard mitigation planning and comprehensive or community planning, that can help guide them as they try to become more resilient to the effects of climate change. . . . Climate change information will be important to both risk assessment and community recovery decisions.¹⁵⁰

147. *See id.*

148. Memorandum of Agreement between the Dep't of Homeland Sec. (DHS), Fed. Emergency Mgmt. Agency (FEMA) and the Env'tl. Prot. Agency (EPA) (May 12, 2010), *available at* http://epa.gov/smartgrowth/pdf/2011_0114_fema-epa-moa.pdf.

149. Press Release, Univ. of N.C. Ctr. for the Study of Natural Hazards and Disasters, EPA/FEMA Partnership to Build Resilient Coastal Communities (Aug. 23, 2011), *available at* <http://tinyurl.com/43zb88b>.

150. TASK FORCE REPORT, *supra* note 66, at G-2.

The pilot project identified some key challenges to and incentives for considering regional effects of climate change in hazard mitigation and other community planning processes, incorporating the following approaches:¹⁵¹

- Use predictive models and future climate scenarios for risk assessment, risk management, and scenario planning;
- Develop smart planning solutions that reduce risks and enhance community resilience;
- Incorporate broad changes into the current planning framework through smart planning solutions that reduce risks and enhance community resilience; and
- Integrate these smart planning solutions into existing planning frameworks.

B. Iowa Pilot Process

This pilot project first explored how climate science and scenario planning can inform hazard mitigation and community planning, as well as what challenges exist for incorporating climate science in hazard mitigation planning.¹⁵² Second, the pilot explored opportunities to encourage integrating hazard mitigation and local comprehensive planning processes to adapt communities' land-use decisions to the effects of climate change.¹⁵³ The findings were intended to inform the Adaptation Task Force, as well as other audiences with relevant programs and policies, about the role that federal and state programs play in local adaptation efforts. The Adaptation Task Force outlined eight Guiding Principles for Adaptation, as mentioned above.¹⁵⁴ These eight principles are in line with the recommendations that came out of the pilot, which will be discussed below, and emphasize the importance of integrating local plans with hazard mitigation plans.

151. IOWA CLIMATE CHANGE REPORT, *supra* note 8, at 6–7.

152. *Id.* at 7.

153. *Id.*

154. *Id.*

The project incorporated separate stages:

- *Stage 1*: Climate change science and risk assessments.
- *Stage 2*: The role of hazard mitigation and other community planning programs in responding to climate change.
- *Ongoing*: Evaluation of progress and building awareness and skills.¹⁵⁵

The first stage was intended to highlight the risks from climate change and explore how climate science can inform hazard mitigation and community planning. It was also intended to highlight challenges to incorporating climate science in these planning efforts. The Iowa Pilot Project was aided in large part by participation by climate scientists from Iowa State University's Climate Science Program.¹⁵⁶ This pilot project revealed the importance of using regionally based science and working with teams of trusted climate scientists to successfully engage stakeholders around the local impacts of climate change. At the onset of the pilot, some stakeholders suggested that EPA researchers could aid in the first stage of the pilot, but wiser participants recommended teaming up with state-based university climate experts who were well-known and could speak the language most relevant to Iowans, which in this case focused on the increasing likelihood of flood events caused by climate change.

After the 2008 floods in Iowa, the State of Iowa established and funded the Iowa Flood Center (IFC) at the University of Iowa.¹⁵⁷ Although there were some explicit links to climate change made following the 2008 flood events,¹⁵⁸ the state government and many citizens in Iowa were more comfortable focusing on the repetitive impacts of flooding, and much of the continuing work there uses

155. *Id.*

156. *Id.* at 64.

157. For more information on the Iowa Flood Center, see IOWA FLOOD CENTER, <http://www.iowafloodcenter.org/> (last visited Oct. 20, 2011).

158. The Iowa State Legislature established the Iowa Climate Change Impacts Committee in 2009, which produced a final report in early 2011 titled "Climate Change Impacts on Iowa" before being disbanded in July 2011. See IOWA DEP'T NAT. RES., IOWA CLIMATE CHANGE ADVISORY COUNCIL, <http://www.iowadnr.gov/Environment/ClimateChange/ClimateChangeAdvisoryCo> (last visited Oct. 20, 2011).

language more focused on resilience to floods than resilience to climate change. A valuable lesson from the Iowa pilot project is that the most effective means to protecting communities may require focusing more on the immediate climate threats to that community, state, or region, as opposed to highlighting the global problem of climate change. This may mean not only thoughtful messaging, but also thoughtful partners that recognize the political or social values of the place. In Iowa, the Iowa Flood Center continues to receive funding for its important scientific research and outreach related to floods.

C. Current and Future Climate Changes in Iowa

Comprehensive local climate projections do not currently exist for Iowa communities: state scientists are developing local projections that will one day help community planners to better mitigate climate impacts. But, some substantial information does exist on current and future climate changes in Iowa. Changes have already been observed in precipitation, stream and river flow, temperature, and wind patterns:

- *Precipitation in Iowa has increased since the 1940s:* Total annual precipitation has increased about 10% since the 1940s, with more rain falling during spring and early summer and more heavy downpours.¹⁵⁹
- *Changes in precipitation are impacting stream and river flow:* Stream and river flow have increased about 20 to 50% since the 1940s.¹⁶⁰ There are more days with high streamflow in central Iowa, and spring soil moisture is close to saturation more frequently.¹⁶¹

159. We define more heavy downpours as a greater number of days when rainfall exceeds 1.25 inches. See IOWA CLIMATE CHANGE IMPACTS COMM'N, CLIMATE CHANGE IMPACTS ON IOWA 2010, at 10–11 (2011), available at <http://www.water.iastate.edu/Documents/CompleteReport,%20final.pdf>.

160. *Id.*

161. *Id.*

- *Statewide winter temperatures have increased:* On average, there are about five more frost-free days than in 1950, and thaw-freeze cycles are more frequent.¹⁶²
- *Wind speeds have declined over the last 30 years,* worsening air quality.¹⁶³

Further changes are projected to occur in Iowa's climate in the future, specifically by 2065:

- *Springtime precipitation is expected to increase,* resulting in heavier downpours.¹⁶⁴
- *Stream and river flow may increase by 20% or more.*¹⁶⁵
- *Annual temperatures are expected to increase by 2.5 to 7.2°F.*¹⁶⁶

These known climate changes will have a direct impact on the types and severity of hazards in Iowa, including:

- *Flood Hazards:* Changes in precipitation and streamflow have already and will continue to lead to increased risk of riverine flooding, flash flooding, and damage due to expansive soils, especially during spring and early summer.¹⁶⁷
- *Heat Waves:* Higher average temperatures will lead to more heat waves, resulting in more heat-related illness.¹⁶⁸
- *Severe Weather Events:* Neither historical data nor future climate projections provide information on changes in the intensity or frequency of severe weather events, such as tornadoes or windstorms.

162. *Id.*

163. *Id.*

164. *Id.*

165. *Id.*

166. Eugene S. Takle, *Assessment of Potential Impacts of Climate Changes on Iowa Using Current Trends and Future Projections*, IOWA CLIMATE CHANGE ADVISORY COUNCIL, 1, 5–7 (Dec. 2009), <http://tinyurl.com/3v286ev>.

167. *Id.*

168. *Id.*

The Iowa pilot project identified three challenges to translating climate projections into estimates of future hazards in Iowa. First, changes in rainfall do not directly correspond to changes in flooding. Traditional measures of rainfall extremes relate to only about half of future flood events.¹⁶⁹ This means that it is difficult to determine future flood risks on the basis of projected increases in heavy rainfall. Second, rainfall projections vary greatly.¹⁷⁰ In many cases, small changes in weather patterns may significantly alter the intensity and location of rainfall. Finally, methods for mapping future riverine flooding are not well established, making it difficult to estimate property damages and other economic losses.¹⁷¹

Climate scientists should address these challenges and improve the information available to planners in two ways. First, climate scientists should compare local projections from multiple downscaling techniques to determine whether daily rainfall projections are sensitive to downscaling. Second, climate scientists should work with hydrologists to conduct improved hydrological modeling of the floodplain that uses different scenarios of future climate changes to provide a more accurate picture of future flooding.

Integrating consideration of climate impacts into hazard mitigation and community planning is a relatively new area and there are no established best practices for accomplishing this goal. The entry points for considering the impacts of current and future climate changes on hazard mitigation and land planning efforts will vary by community based on a number of factors. EPA and FEMA are continuing to work with communities to create more examples and ideally develop guidance and tools on the subject.

D. Findings from the Iowa Pilot Project

The overarching recommendation of the Iowa pilot is for FEMA and other federal agencies, the State of Iowa, and the local jurisdictions to work together to develop programs and incentives that encourage incorporating climate projections into the risk assessment process and consider ways to encourage innovative ways to integrate hazard mitigation and comprehensive planning. Such

169. IOWA CLIMATE CHANGE REPORT, *supra* note 8.

170. *Id.*

171. *Id.*

change will better equip communities to protect their citizens, their property, and the public and private investments that have been made over generations. For these improvements to happen, federal, state, and local governments and other stakeholders will have to rethink some existing programs and policies, and the Iowa pilot group has recommended both near- and long-term steps in this direction. Iowa has already moved forward in this area by adopting the Iowa Smart Planning Principles and local comprehensive planning guidance, which includes integration of hazard mitigation strategies.¹⁷² But, further steps are necessary.

The primary findings and lessons developed through this project are intended to provide feedback to key federal and state agencies that impact local land-use and hazard mitigation planning, to scientists and researchers that work to develop climate change information that might impact local decisions and investments, and to communities trying to better invest in sustainable, resilient solutions that meet multiple local goals. The pilot findings include the following:¹⁷³

1. Local governments are at the forefront of adapting to climate change.
2. Land use is a primary determinant of community and regional climate change adaptation capacity.
3. Climate change data must be formatted and distributed in a way that is accessible and usable by state and local planners.
4. State and local planners need to increase skill sets to effectively utilize climate change data.
5. Federal and state programs should create incentives that will improve the use of climate change data, including in the production of hazard mitigation plans.

172. *Id.* at 6.

173. For the full-length versions of these nine findings, see Aaron Todd, Rebuild Iowa Office, State/EPA Environmental Innovation Symposium, Iowa Climate Change Adaptation and Resilience Pilot Project (Nov. 2, 2010), *available at* http://environmental-symposium.org/2010/ppt/Nov-2/HallOfIdeas-GJ/Nov-2-1330-Todd-community_resilience_planning_for_and_responding_to_climate_challenges.pdf.

6. Communities need to integrate planning processes, specifically hazard mitigation and comprehensive land-use planning.
7. Federal and state programs and policies should give communities incentives to integrate planning processes, specifically hazard mitigation and comprehensive land-use planning, and to incorporate no regrets adaptation measures to produce symbiotic outcomes.
8. Federal funding should be aligned and leveraged, and the focus should shift to pre-disaster planning for community resilience and sustainability.
9. Investment decisions should take a regional perspective and be integrated across infrastructure types and sectors to realize co-benefits.

The American Planning Association came to many of these same conclusions in its *Policy Guide on Planning and Climate Change*, which was first released in 2008 and updated in 2011 to provide planners, engaged citizens, and elected officials with strategies to mitigate the further onset of climate change and to adapt to its impacts.¹⁷⁴ In addition, the legal literature referred to above supports many of these same findings. Different disciplines, including professional planning organizations, environmental policy experts, and legal scholars, are coming to the same conclusions about the need to address structural challenges that stand in the way of effective local adaptation efforts.

E. Footholds and Rope Lines in Iowa

The Iowa project provides examples of both vertical and horizontal integration to get at common adaptation goals. FEMA, EPA, U.S. Army Corps of Engineers, and even USDA worked horizontally at the federal level, while Iowa state agencies like Iowa Homeland Security and Emergency Management (HSEM) and the Rebuild Iowa Office (RIO) partnered horizontally at the state level.

174. AM. PLANNING ASS'N, POLICY GUIDE ON PLANNING AND CLIMATE CHANGE (Apr. 11, 2011), *available at* <http://www.planning.org/policy/guides/pdf/climatechange.pdf>.

In addition, these federal and state agencies worked vertically with county and local governments.

1. Footholds

The Iowa pilot revealed several existing footholds that towns and communities there can use to start adapting to the reality of more frequent and serious flood conditions in the state. These existing footholds include federal, state, and local policies and programs.

The Iowa pilot identified a few federal-level footholds that could support climate change adaptation, including FEMA's Hazard Mitigation Assistance program, which offers pre- and post-disaster planning and grant programs intended to reduce the risk of both property damage and loss of life due to disasters. The findings that came out of the Iowa pilot suggested that this federal program and others could create incentives and points of flexibility in the overall program. New flexibility in this existing program could support communities trying to innovate and push the program to work better for changing needs in a changing climate. For example, incentives within the Hazard Mitigation Assistance Program¹⁷⁵ could help planners incorporate climate change data into their hazard mitigation plans; this could significantly change the way planning for increased floods and even sea-level rise occurs. In addition, the Iowa pilot participants identified the potential for incentives to link different planning requirements, to reduce the burden on planners, and produce common outcomes for land use, hazard mitigation, and long-term climate resilience.¹⁷⁶ Local planners have difficulty addressing existing requirements for simply preparing and updating hazard mitigation plans, especially when paired with the typically separate requirements of local comprehensive land-use planning. "Consideration of climate change adaptation is currently viewed as a cumbersome and time-consuming addition to an already difficult set of planning requirements. There may be ways to align these planning needs to reduce the workload of local planners and redundancy of potentially overlapping planning needs."¹⁷⁷

FEMA's Hazard Mitigation Assistance program suggests many of the characteristics of a "firm foothold" reviewed in Part IV.

175. IOWA CLIMATE CHANGE REPORT, *supra* note 8, at 14.

176. *Id.* at 9–10, 12.

177. *Id.* at 13.

Especially impressive is the program's potential for leverage ("bang for the buck"). Tens of thousands of communities maintain hazard mitigation plans approved by FEMA.¹⁷⁸ Introducing strategies for climate adaptation into the program has the potential to produce change across the country.

Similarly, focusing on hazard mitigation successfully frames the issue of climate adaptation in a way that makes the risks more concrete. During the Iowa pilot project meetings, we often heard participants say that while politicians and residents were reluctant to talk about climate change in the context of pollution control, sometimes questioning the underlying science, these same people were often willing to learn about climate change and future scenarios within the context of hazard mitigation and disaster planning. While we are not experts in cognitive behavior, we believe these statements may reflect the contextual nature of risk in the public mind. It may be that Iowa residents have a tendency (rightly or wrongly) to frame pollution and energy issues in terms of a balance between short-term economic productivity and long-term public health and environmental protection. Where such a balance is central to the analysis, it may be easier for people who do not follow climate issues closely to dismiss the scientific findings. But when citizens are instead asked to think about disaster planning, we suspect their tendency is to frame policy issues in terms of insuring against low-probability, high-impact events. In such situations, the certainty of the science may seem less important than the mere plausibility of a bad event. There is much more to say about the role of framing in climate policy; we happily leave that to others. But our experience with the Iowa pilot project suggests that disaster planning and hazard mitigation may reveal an important psychological gateway into stronger climate initiatives.

Because the Hazard Mitigation Assistance program envisions an interactive effort between federal and local officials, the program serves the goal of pulling stakeholders together into informal networks and has the potential to create connections with federal and state climate scientists too.

178. AM. PLANNING ASS'N, HAZARD MITIGATION: INTEGRATING BEST PRACTICES INTO PLANNING 18 (James C. Schwab ed., 2010), *available at* <http://www.fema.gov/library/viewRecord.do?id=4267>.

The key state-level foothold identified in the pilot is the Iowa Smart Planning Act (SF 2389),¹⁷⁹ which was signed into law on April 26, 2010 and requires that communities and state agencies consider Smart Planning Principles when planning for future land use and development. This state law does not require any action, but provides guidance and encourages comprehensive plans that address catastrophic flooding with better pre-disaster planning and post-disaster recovery planning.¹⁸⁰ While the Act does not mandate smart planning principles, the mere mandate to consider ensures that planners throughout the state will be exposed to the principles. If climate projections are incorporated into the information provided on catastrophic flooding, planners throughout Iowa will be engaged in adaptation planning indirectly. Because planning necessarily involves community outreach and public participation, this foothold also serves the goal of broadening the conversation of climate impacts among a larger set of stakeholders.

At the local level, Iowa communities can use comprehensive land-use plans, zoning codes and ordinances, and council resolutions as footholds for adaptation. For example, a council member from the city of Cedar Falls made the point during the pilot that planning requirements and even land-use plans may not result in the kind of real, meaningful action that council resolutions and new laws can produce.¹⁸¹ After the 2008 floods destroyed many homes and buildings in Cedar Falls, the city council adopted a resolution requiring no new development in the 500-year floodplain, which goes above and beyond FEMA requirements and many other municipal standards for floodplain development.¹⁸² In essence, the Cedar Falls city council skipped over the existing planning tools and took action through separate, locally controlled means. This example highlights the potential for experimenting with lots of legal tools, from stricter controls on floodplains to, perhaps, better building codes, land-use regulations, and the like.

The pilot participants identified ways these footholds could be better coordinated and explicitly linked for community planners and

179. S.F. 2389, 83rd Gen. Assemb., First Reg. Sess. 3–13 (Ia. 2010), *available at* http://www.rio.iowa.gov/resources/legislation/2010_SF2389_smart_planning.pdf.

180. *Id.* at 5–7.

181. IOWA CLIMATE CHANGE REPORT, *supra* note 8, at 19, 34–35.

182. CEDAR FALLS, IOWA, RESOLUTION no. 16,741 (2009), *available at* <http://www.cedarfalls.com/DocumentView.aspx?DID=571>.

local officials who are held to these planning requirements or seek grant funding attached to these plans and programs.¹⁸³ Participants in the Iowa adaptation pilots, like elected officials and staff from communities in other places feeling the impacts of climate change, would like to see these footholds work better to meet existing purposes as well as be flexible enough to support innovations in adapting to and preparing for climate change.¹⁸⁴

2. *Rope lines*

Following the 2008 floods, the governor of Iowa established the RIO to coordinate the recovery and rebuilding efforts, which formalized a set of rope lines that came in handy as EPA and FEMA worked with several communities to provide technical assistance.¹⁸⁵ State-level staff from RIO was able to provide consistency and reliability in the process of establishing federal-to-local relationships that can be short-lived and, at worst, imperialistic on the part of agencies with the most funding and power in a disaster recovery situation.¹⁸⁶ RIO provided a trustworthy link for locals, while also ensuring that communities received the best assistance and most resources possible from a range of federal and state partners. However, institutional barriers and simple territoriality among different disciplines and organizations have prevented more effective rope lines from developing in Iowa. Political turnover and the eventual closing of the Rebuild Iowa Office may have altered the systems created following the 2008 floods,¹⁸⁷ but we can assume some of those same players are still working around Iowa and that new systems may develop to continue the work at the state level.

As mentioned above, two key findings from the Iowa pilot recognize that local governments are at the forefront of adapting to climate change, and land-use planning is an important process to start adapting.¹⁸⁸ Local governments are in a constant state of

183. IOWA CLIMATE CHANGE REPORT, *supra* note 8, at 15.

184. *Id.*

185. *Smart Growth Technical Assistance in Iowa*, U.S. ENVTL. PROT. AGENCY (July 13, 2011), http://epa.gov/smartgrowth/iowa_techasst.htm.

186. *See* IOWA CLIMATE CHANGE REPORT, *supra* note 8, at 6.

187. Lynn Campbell, *Outgoing Rebuild Iowa Officials Worry About Future Flood Recovery Efforts*, IOWAPOLITICS.COM (June 23, 2011), <http://www.iowapolitics.com/index.lml?Article=240347>.

188. IOWA CLIMATE CHANGE REPORT, *supra* note 8, at 9.

updating, repairing, and investing in the built environment. Development decisions about where to build and, more importantly for climate change, where not to build, are made every day and can have lasting effects for many decades to come. In the United States, where there is no federal land-use planning policy, much less a mandate to plan for climate change, local governments are the logical entities that can start to really take action on climate change. But this action requires that climate change data be formatted and distributed in a way that is accessible and usable by state and local planners. These local decision makers are often unable to use the data and link it into relevant processes like land-use planning, disaster recovery planning, or hazard mitigation planning. At the same time, local and state planners need to develop the skills to effectively utilize climate change data.

The Iowa pilot participants recognized a need to establish rope lines across jurisdictional boundaries to take regional action on climate adaptation.¹⁸⁹ Although many infrastructure investments and planning decisions are made locally, independent towns and cities can take a regional perspective in planning for adaptation-related land-use decisions and infrastructure investments. On top of interjurisdictional cooperation, different types of planning should be linked to realize the greatest number of near- and long-term benefits. For example, planning for water resources needs to include consideration of land uses as well as link plans for drinking water, stormwater, wastewater, and natural water systems. Experts can include civil engineers, economists, water managers, land-use planners, landscape architects, and more.

Finally, the Iowa pilot highlighted the need to identify trusted organizations and individuals to help establish these cross-community and crosscutting partnerships. Iowa has ninety-nine counties, many of them full of very small towns and rural communities.¹⁹⁰ The trusted organizations in more rural parts of Iowa are county-based councils of governments that take a lead in helping different towns plan together, while working with different disciplines to link various planning tools and expertise. In the Iowa pilot, these councils of governments were instrumental in providing

189. *Id.* at 21.

190. *County Officials, Contact Information, History, Map, and Websites*, IOWA ST. ASS'N COUNTIES, <http://tinyurl.com/3pfy982>.

feedback about the limitations, the possibilities, and more importantly, the key people, processes, and even timelines to most effectively start to link planning processes.

VI. CONCLUSION

Beyond Iowa and the lessons learned in the Iowa pilot project, other states, tribes, and local communities across the United States are beginning to offer examples for how to begin to incorporate climate change science into land-use decisions. Federal and state agencies have the potential to support climate change adaptation at the local level through a number of mechanisms, including:

- Funding and supporting pilot projects with communities at the forefront of integrating climate adaptation and land-use planning.
- Compiling case studies and best practices for how to effectively and legally incorporate climate change projections into local plans and for how to link land-use plans with hazard mitigation plans.
- Conducting research that follows up on this report to further identify opportunities and challenges for adapting to climate change through local plans and hazard mitigation plans.
- Offering incentives for communities that use climate change projections in local plans and hazard mitigation plans.
- Offering incentives for communities to integrate planning processes, specifically hazard mitigation and comprehensive land-use planning, and to incorporate no-regrets adaptation measures to produce symbiotic outcomes.

The Iowa pilot project underlines the fact that loose networks are important to developing locally appropriate and place-based solutions to the risks posed by climate change. A full range of local decisions are made every day that have lasting effects on the vulnerability or resilience of a community to climate change impacts. The federal government plays a real role, whether active or passive, in the ways and means by which these local decisions are made. The

Iowa pilot project was an attempt to identify some of the most important roles that federal agencies play in local land-use and disaster planning, and then ask questions about how well these federal agencies are supporting well-informed, thoughtful decisions that can help that community adapt to climate change. What the pilot project revealed is that there are some formal mechanisms that can be put into place, like the Memorandum of Agreement between EPA and FEMA, that simply establish loose networks and make it easier for communities to work with the federal government and easier for two federal agencies to work together on common projects and issues. As listed above, there is also a range of incentives, research efforts, and pilot projects that the federal government can use to both support smarter local decision making and create feedback loops for making internal changes to agency policy or regulations. Specifically, pilot projects and technical assistance programs set up informal, but valuable, relationships across geographic and sector-based boundaries. In all, the lesson is that a more reflective, nimble, and actively engaged federal government will be necessary to support local solutions to the challenge of climate change. There is no question that the difficulties involved at all levels are great; but we should be allowed our optimism. We know pigs don't fly. But some can swim.