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CLIMATE CHANGE ADAPTATION AND LAND USE: EXPLORING THE FEDERAL ROLE*

ALICE KASWAN**

I. INTRODUCTION

Scientists agree that climate change impacts are already occurring and will only get worse.¹ Measures to reduce, or “mitigate,” greenhouse gas (GHG) emissions are, of course, of central importance. However, even if the international community adopted robust measures to mitigate GHG emissions, accumulated GHGs would nonetheless continue to warm the planet and change its climate.² And the truth is that worldwide GHG emissions are increasing, not decreasing, with little sign of an imminent turnaround.³ Consequently, policymakers must focus not only on

* This essay is adapted from a longer article: Alice Kaswan, *Climate Adaptation and Land Use Governance: The Vertical Axis*, 39 COLUM. J. ENVTL. L. ___ (forthcoming 2014). That article highlights the features of a multilevel governance approach to land use-related adaptation. The longer piece provides a more in-depth justification, grounded in federalism theory, for a greater federal role within a multilevel governance structure.

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1. See generally *Global Climate Change Impacts in the United States*, U.S. GLOBAL CHANGE RESEARCH PROGRAM 9 (Susan J. Hassol et al eds., 2009), available at <http://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf> [hereinafter USGCRP REPORT] (describing climate change impacts within the U.S.). In 2014, the U.S. Global Change Research Program will complete the Third National Climate Assessment; a draft of the report is available at <http://www.globalchange.gov/what-we-do/assessment/draft-report-information>. See also *Intergovernmental Panel on Climate Change, Climate Change 2013: The Physical Science Basis: Working Group I Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, SUMMARY FOR POLICYMAKERS, available at <http://www.climatechange2013.org/spm> (describing the international impacts of climate change).

2. *Adapting to the Impacts of Climate Change*, THE NATIONAL ACADEMIES PRESS 31 (2010), available at <http://www.climateneeds.umd.edu/reports/NRC-Adapting%20to%20the%20Impacts%20of%20Climate%20Change.pdf>.

3. See *Global Carbon Budget 2013*, GLOBAL CARBON PROJECT (Nov. 2013), available at http://www.globalcarbonproject.org/carbonbudget/13/files/GCP_budget_2013.pdf / (showing that both total CO₂ emissions and the CO₂ atmospheric concentration growth rates are still increasing).

mitigating emissions, but also on adapting to climate change.

In the United States, adapting to a wide range of climate impacts will implicate many legal domains, including disaster law, water law, environmental law, natural resources law, agricultural law, immigration law, housing law, and land use law.⁴ This essay focuses on land use governance. Because land use law plays a critical role in determining where and how we live, our land use response to – and preparation for – climate change will strongly determine our capacity to adapt. It is time to rethink land use federalism because the existing reliance on local control, overlaid as it may be with state and federal influences, is unlikely to result in a sufficient response to the climate change challenge. Effective, democratic, and fair governance requires a more integrated and comprehensive federal, state, and local response.

This Essay identifies key functions essential to improving land use law's capacity to serve adaptation and suggests a better balance of federal and local power to accomplish those functions. Although new federal adaptation legislation may ultimately be necessary, the principles described in the essay could guide the exercise of existing federal authority, inspire legislative or administrative revisions to existing federal programs, and ultimately influence new and comprehensive federal adaptation initiatives.

Part I introduces a range of climate impacts and describes the important role of land use law in adaptation. Part II provides a snapshot of the current state of land use related adaptation measures at the federal, state, and local levels, concluding that the status quo is not sufficient. Part III describes the value of a multigovernance approach to land use related adaptation. It begins by emphasizing the essential role of state and local governments. It next explains why the federal government should nonetheless require land use related climate impact assessments and adaptation planning and, to a limited extent, why the federal government should define certain minimum parameters to guide state and local adaptation planning and programs. Part IV identifies three practical functions the federal government could offer, including providing information resources, providing financial resources, and providing interagency and multijurisdictional coordination. Part V offers a few words about the proposal's political feasibility.

4. See J.B. Ruhl, *Climate Change Adaptation and the Structural Transformation of Environmental Law*, 40 ENVTL. L. 363, 411 (2010) (describing the many areas of law implicated by adaptation). The fact that climate change impacts will involve so many different areas of the law is one of the unique challenges facing "adaptation law." See generally J.B. Ruhl & James Salzman, *Climate Change Meets the Law of the Horse*, 62 DUKE L.J. 975 (2013) (discussing whether adaptation law represents its own legal field or is, instead, simply a piecemeal combination of legal issues).

II. CLIMATE IMPACTS, ADAPTATION, AND THE ROLE OF LAND USE MEASURES

A. Climate Change Impacts and Adaptation

Although climate change is a global issue, this Essay focuses on U.S. climate impacts and the domestic response to those impacts.⁵ Scientists predict that by 2100, thermal expansion from warming oceans and an influx of melted polar ice will raise sea levels by one to four feet.⁶ The greatest harm from rising sea levels will be caused by higher storm surges that wreak extensive damage on heavily populated coastal areas.⁷ Many of these areas already suffer from aging infrastructure that is ill-prepared to withstand current conditions, much less worsening future conditions.⁸ Precipitation will change as some areas, including the Midwest and Northeast, experience higher levels of rainfall,⁹ often in more intense form with higher flood risks.¹⁰ Other areas,

5. This Essay's focus on domestic impacts is not intended to slight the severity of anticipated climate impacts elsewhere on the globe. Nonetheless, global adaptation presents a completely different set of legal questions from domestic adaptation. Moreover, the severity of impacts elsewhere does not lessen the importance of developing a more robust domestic institutional response in the United States.

6. *Third National Climate Assessment (Draft)* U.S. GLOBAL CHANGE RESEARCH PROGRAM, 63-65 (2013), available at <http://ncadac.globalchange.gov/download/NCAJan11-2013-publicreviewdraft-fulldraft.pdf> [hereinafter *Draft Third Assessment*]. Local sea level rise will vary due to shifts in land levels and changing ocean currents. See Asbury H. Sallenger, Jr., et al., *Hotspot of accelerated sea-level rise on the Atlantic coast of North America*, NATURE CLIMATE CHANGE 884 (2012), available at <http://www.nature.com/nclimate/journal/vaop/ncurrent/full/nclimate1597.html> (observing higher levels of sea level rise in the mid-Atlantic due to changing ocean currents); see also *Impacts of Climate Change and Variability on Transportation Systems and Infrastructure: Gulf Coast Study, Phase I*, U.S. CLIMATE CHANGE SCIENCE PROGRAM, 3-18-3-23 (Virginia R. Burkett, et al. eds., 2008), available at <http://downloads.globalchange.gov/sap/sap4-7/sap4-7-final-all.pdf> (observing higher levels of sea level rise along the Gulf Coast due to subsiding land levels); *Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future*, THE NATIONAL ACADEMIES PRESS, 5-7 (2012), available at <http://www.nap.edu/openbook.php?recordid=13389&page=1> (observing lower levels of sea level rise in the Pacific Northwest due to rising land levels).

7. See *Draft Third Assessment*, *supra* note 6, at 876 (noting that higher sea levels and storm surges pose risks to water supplies, energy infrastructure and evacuation routes on the coast). While no individual storm can be attributed to climate change, Hurricane Sandy, which devastated coastal areas in New Jersey, New York, and other northeastern states, demonstrated the power of higher seas and increasingly intense storms. Eric S. Blake et al., *Tropical Cyclone Report: Hurricane Sandy*, NATIONAL HURRICANE CENTER (Feb. 12, 2013), available at http://www.nhc.noaa.gov/data/tcr/AL182012_Sandy.pdf.

8. *Draft Third Assessment*, *supra* note 6, at 420.

9. *Id.* at 42-46, 108.

10. *Id.* at 47-51, 108-09. Although the number of severe Atlantic

including the West and Southwest, are experiencing intensifying droughts, jeopardizing water supplies.¹¹ Drought, combined with higher temperatures, also increases the risk of wildfires.¹² Additionally, a range of public health consequences are likely, including higher average temperatures,¹³ more harmful heat waves,¹⁴ and higher levels of air pollution triggered by higher temperatures.¹⁵ Warmer water, increased precipitation, and compromised sewage treatment capacity¹⁶ will also cause new water contamination challenges. The enhanced range of disease vectors, like ticks and mosquitoes, will increase the spread of disease and further impact public health.¹⁷ A changing climate also has profound impacts on species besides our own, creating unprecedented threats to biodiversity as the climate changes faster than endangered species can adapt or migrate.¹⁸

hurricanes has increased in the last few decades, the climate dynamics associated with hurricane and tornado intensity and frequency are more uncertain than predictions of increasing precipitation and heavy rains. *Id.* at 59-62.

11. The Southwestern and Western states in the United States are projected to receive less precipitation. *Id.* at 43-45. That, combined with higher temperatures, is expected to lead to drought. *Id.* at 56-58, 113, 690. Summer water shortages will be further intensified by a shift from snow to rain, which impacts the degree to which the snowpack serves a water storage function, providing snowmelt during the region's arid summers. *Id.* at 690-92. The U.S. Global Change Research Program predicts that, by 2050, 32 percent of counties will be at risk of water shortages. *Id.* at 295.

12. *Id.* at 694-95.

13. *See id.* at 35 (noting the average temperature increase of 1.5 degree Fahrenheit since 1895 and the acceleration of this warming trend). By 2100, scientists predict a 3-5 degrees Fahrenheit increase in average U.S. temperatures under low emissions scenarios and a 5-10 degrees Fahrenheit increase under high emissions scenarios. *Id.* at 35-36.

14. *See id.* at 51-55, 342-43 (describing evidence of a recent increase in the incidence of heat waves, projections for increased heat wave events, and the health impacts of increasing heat waves).

15. A reaction between nitrogen oxides and volatile organic compounds causes ground-level ozone pollution. Because warmer weather enhances that reaction, a given level of emissions will lead to higher ozone levels at higher temperatures. Climate change will exacerbate the health threat to 108 million people already living in areas of the country that fail to meet public health standards for ozone. *See Our Nation's Air: Status and Trends through 2010*, U.S. ENVTL. PROTECTION AGENCY, 1 (2012), available at <http://www.epa.gov/airtrends/2011/report/fullreport.pdf> (showing the number of Americans living in countries with unhealthy air quality concentrations of ozone). *See also Draft Third Assessment*, *supra* note 6, at 334-35 (describing increased risk from climate-related increases in ozone levels). Increasing wildfires also have significant impacts on air quality, with consequent public health effects. *Id.* at 340-41.

16. *See id.* at 117, 129, 292-94, 346-48 (discussing: indirect water pollution risks from climate change impacts, the risk of increased sewage treatment plant overflows, contamination from flood waters, and the risk of harmful algae blooms from warmer water temperatures).

17. *Id.* at 343-45.

18. *Id.* at 296-97.

Adaptation measures strive to increase resilience, and pursue resilience by reducing exposure to harm, reducing underlying sensitivity to impacts, and increasing the capacity to cope with impacts when they occur.¹⁹ Factors influencing exposure include natural geographic attributes (high or low ground), the presence of buffers (levees or natural buffers like wetlands), and development patterns (like floodplain development or dense urban settings generating a heat island effect). Sensitivity is determined by the degree of preparation (e.g., appropriate weather proofing and preparedness plans), as well as by factors determined by underlying socioeconomic conditions (e.g., the quality of the housing stock and demographic factors such as age, income, race, and underlying health risk factors).²⁰ The capacity to cope focuses on what happens once impacts occur, including the ability to respond to and recover from an extreme weather event (with effective disaster response plans, cooling centers, and sufficient personal, governmental, or insurance resources) or, as conditions deteriorate, the ability to migrate and find housing.

B. The Role of Land Use Planning in Adapting to Climate Change

Land use planning is one of many public and private strategies critical to adapting to future climate change impacts.²¹ This section explores the role of land use in the context of several climate change impacts. Land use law is critical to effective disaster management, which will be of key importance as rising sea levels and intensifying storms increase the frequency and severity of disasters. More broadly (whether a consequence of increasing disaster risk or other conditions, like heat or insufficient water supplies), neighborhoods, regions, and other parts of the world are likely to become less habitable, generating internal and international migration and creating new areas of housing demand. Moreover, land use law and urban design also play key roles in addressing urban heat, water use, and endangered species survival.

1. Land Use Law and Disasters

Because many climate change impacts will increase the risk and severity of disasters, disaster law is highly relevant to climate change adaptation. Land use patterns play a critical role in determining vulnerability to direct harm, including exposure to climate risks like flooding, erosion, and wildfire. Three central adaptation strategies are available: protect, accommodate, and

19. *Id.* at 421.

20. *See id.* at 349-52, 425 (discussing socioeconomic variables' role in determining the health impacts of climate change).

21. *See generally*, Ruhl, *supra* note 4, at 381 (describing the likely role for both private and public actors).

retreat.²²

Protection can take a variety of “hard” and “soft” forms. Levees, a type of hard protection, impact land use and shape what areas are suitable for development by controlling river flooding and blocking sea level rise. Another hard protection measure is seashore armoring through sea walls that protect against erosion. “Soft” forms of protection include beach renourishment, which impacts coastal property owners’ rights in the shore land, and preservation and development of natural buffers, such as coastal and riparian wetlands, to slow floodwaters and control erosion. Land use measures like conservation easements and development moratoria can preserve existing wetland buffers.²³ In populated areas, the creation of wetland buffers may require not only land use conservation measures, but also planned retreat, discussed below.

Accommodation to climate change can occur through a variety of zoning and building code provisions.²⁴ For example, set-back requirements create buffers between streams or areas at risk from storm surge and development. Green infrastructure requirements improve storm water drainage to avoid flooding and sewage treatment plant overflows. Land use ordinances control vegetation to reduce fire risks. Building codes that require stilts in flood-prone areas, limit uses on ground-floor levels, or require weatherproofing reduce storm damage.

Retreat is the most controversial response to climate impacts. Residents and local governments are loathe to relinquish settled

22. Robert R.M. Verchick & Joel D. Scheraga, *Protecting the Coast*, in THE LAW OF ADAPTATION TO CLIMATE CHANGE: U.S. AND INTERNATIONAL ASPECTS 235, 239 (Michael B. Gerrard & Katrina Fischer Kuh, eds., 2012); Megan M. Herzog & Sean Hecht, *Combating Sea-Level Rise in Southern California: How Local Governments Can Seize Adaptation Opportunities While Minimizing Legal Risk*, 19 HASTINGS W. NW. J. ENVTL. L. & POL’Y 463, 472-77 (2013).

23. See generally Jessica Grannis, *Adaptation Tool Kit: Sea-Level Rise and Coastal Land Use*, GEORGETOWN CLIMATE CENTER 2-3 (2011), available at http://www.georgetownclimate.org/sites/default/files/Adaptation_Tool_Kit_SLR.pdf (listing mechanisms for controlling development to enhance shoreline buffers); see also Anne Siders, *Managed Coastal Retreat: A Legal Handbook on Shifting Development Away from Vulnerable Areas*, COLUMBIA LAW SCHOOL CENTER FOR CLIMATE CHANGE 5-7 (2013), available at https://web.law.columbia.edu/sites/default/files/microsites/climate-change/files/Publications/ManagedCoastalRetreat_FINAL_Oct%2030.pdf (providing a list of tools for coastal management); Verchick & Scheraga, *Protecting the Coast*, in THE LAW OF ADAPTATION TO CLIMATE CHANGE, *supra* note 22, at 239 (discussing potential “soft” and “hard” measures for maintaining shorelines).

24. See generally Grannis, *supra* note 23, at 5-15 (introducing a variety of tools available to policymakers and providing a framework for analyzing their respective strengths and weaknesses); see also J. Cullen Howe, *Buildings*, in THE LAW OF ADAPTATION TO CLIMATE CHANGE, *supra* note 22, at 209 (describing building code provisions for the design, construction, and operation of buildings to address the impacts of climate change).

neighborhoods. Nonetheless, increasing risk exposure and the cost and fallibility of protection and accommodation measures suggest that, ultimately, for some areas, retreat is the only feasible and financially affordable option.²⁵

Some retreat may occur without government intervention. As disasters recur, people move away on their own, as occurred to some degree in the New Orleans area after Hurricane Katrina.²⁶ Combined public and private measures also influence retreat: risk-based premium rates for flood insurance through the National Flood Insurance Program could indirectly engender some retreat from at-risk areas.²⁷ In addition to these private market and public/private mechanisms, however, direct land use measures that encourage retreat will be necessary to protect vulnerable populations.²⁸ The most controversial land use approach to disasters is organized retreat from disaster-prone areas like floodplains. Numerous land use measures could facilitate such retreat, including public purchase through eminent domain, limits on post-disaster re-building, or the imposition of rolling conservation easements that ultimately preclude habitation.²⁹

25. See Siders, *supra* note 23, at 2 (asserting policy makers will eventually be forced to use managed retreat to avoid disasters); Lisa Grow Sun, *Smart Growth in Dumb Places: Sustainability, Disaster, and the Future of the American City*, 2011 B.Y.U. L. REV. 2157, 2160 (2011).

26. Campbell Robertson, *Smaller New Orleans after Katrina, Census Shows*, N.Y. TIMES (Feb. 3, 2011), available at http://www.nytimes.com/2011/02/04/us/04census.html?pagewanted=all&_r=0.

27. High insurance premiums could have a significant impact on housing because those who cannot afford (or choose not to pay for) the insurance will have difficulty obtaining a mortgage, because properties in flood zones must have flood insurance to obtain federally-guaranteed mortgages. Siders, *supra* note 23, at 9-10. Risk-based premiums are not yet a reality; 2012 legislation to increase NFIP premiums to better reflect actual risk were rolled back in 2014. Deborah Barfield Berry & Ledyard King, *House passes flood insurance bill*, USA TODAY (Mar. 4, 2014), available at <http://www.usatoday.com/story/news/nation/2014/03/04/house-passes-flood-insurance-bill/6037775/>.

28. Exclusive reliance on rising flood insurance rates to control at-risk development will be insufficient. The NFIP requires flood insurance to obtain a mortgage, but has no impact on long-standing homeowners without mortgages. Moreover, some states may attempt to bypass the federal flood insurance program, providing alternative sources of insurance that undercut the retreat incentives created by the federal program. See Siders, *supra* note 23, at 12 (noting that increasing federal premiums will create pressure for subnational flood insurance subsidies). In general, as disaster risks lower the price of housing in at-risk areas, and to the extent flood insurance premiums do not keep them out, poor and minority populations may be more likely to move to at-risk areas due to their need for affordable housing, notwithstanding the greater risk. Alice Kaswan, *Domestic Climate Change Adaptation and Equity*, 42 ENVTL. L. REPORTER 11125, 11139 (2012). Thus, government programs to achieve retreat may be necessary.

29. See Grannis, *supra* note 23 (describing different land use tools that can be used to encourage retreat from at-risk coastal areas); Siders, *supra* note 23; J. Peter Byrne & J. Grannis, *Coastal Retreat Measures*, in THE LAW OF

Land use law also plays a critical role in avoiding indirect disaster harms. When landfills, hazardous waste sites, sewage treatment plants, and industry are flooded or subject to wildfires, they create significant risks of indirect harm.³⁰ Examples abound. Hurricane Katrina's floodwaters contained high levels of bacterial contamination, and numerous hazardous waste sites and industries were in the flood path.³¹ In fall 2013, Colorado floods similarly led to high levels of bacterial contamination.³² A 2011 wildfire threatened the Los Alamos National Laboratory, a national center for nuclear weapons research. Land use laws control the siting of hazardous land uses and the flood or fire protections such facilities must adopt.

2. Land Use Law and Future Migration Shifts

When land use rules or the operation of the free market result in "retreat" from at-risk or increasingly inhospitable neighborhoods or regions, the challenge is not only how to depopulate, but also how to accommodate those who have been displaced. Internal migration will occur as people leave at-risk seashores, floodplains, heat-stressed areas, and agricultural areas rendered unproductive because of drought or other climate impacts.³³ In other words, climate change could create significant housing demand in areas that are relatively unscathed by climate change. Land use laws will play a critical role in responding to that demand. Although the private market will likely generate sufficient supply of high-end housing, chronic shortages of affordable housing are likely to become more severe.³⁴

ADAPTATION TO CLIMATE CHANGE, *supra* note 22, at 267.

30. *Draft Third Assessment*, *supra* note 6, at 346-47; ROBERT R. M. VERCHICK, *FACING CATASTROPHE: ENVIRONMENTAL ACTION FOR A POST-KATRINA WORLD* 59 (2010).

31. Leslie Fields, et al., *Katrina's Wake: Arsenic-Laced Schools and Playgrounds Put New Orleans Children at Risk*, NATURAL RESOURCES DEFENSE COUNCIL 19 (2007), available at <http://www.nrdc.org/health/effects/wake/contents.asp>; Dina Capiello, *Report finds "sobering" impacts on environment*, HOUS. CHRON. (Sept. 15, 2005), available at <http://www.chron.com/news/hurricanes/article/Report-finds-sobering-impact-on-environment-1668834.php>. In 2009, southeastern floods compromised a sewage treatment plant in Atlanta, Georgia, leading to discharges of raw sewage. *Draft Third Assessment*, *supra*, note 6, at 123.

32. *E. coli found in Colorado flood zones, but no oil, gas contamination*, THE DENVER POST (Oct. 8, 2013), available at http://www.denverpost.com/breakingnews/ci_24264793/e-coli-found-colorado-flood-zones-but-no. About 40,000 gallons of oil spilled from the state's many oil and gas operations, but oil contamination was not detected in state sampling. *Id.*

33. Robin Kundis Craig, "Stationarity is Dead" – Long Live Transformation: Five Principles for Climate Change Adaptation Law, 34 HARV. ENVTL L. REV. 9, 55 (2010).

34. See Peter W. Salsich, Jr., *Toward a Policy of Heterogeneity: Overcoming A Long History of Socioeconomic Segregation in Housing*, 42 WAKE FOREST L.

International immigration is also possible in light of predicted severe international climate impacts, including flooding of small island states, coastal flooding in Asia and Africa, and African drought.³⁵ Experts estimate there could be 200 million climate migrants by 2050.³⁶ Although international law does not recognize most climate migrants as refugees entitled to international assistance,³⁷ international treaties obliging countries to absorb climate-related migration are a future possibility.

3. Land Use Law and Heat, Water, and Endangered Species

Land use law plays a role not only in mitigating disasters and addressing migration-induced housing pressures, but in many other contexts as well. Urban design elements and building codes significantly influence the “urban heat island” effect.³⁸ Appropriate design and building standards provide low-emission mechanisms for adapting to higher temperatures.³⁹ As water scarcity increases throughout much of the west, land use regulation could enhance water conservation through landscaping measures. Land use law could also facilitate endangered species preservation and migration through conservation easements or the creation of migration corridors through inhabited areas.⁴⁰

REV. 459, 497-98 (2007) (describing existing affordable housing deficit).

35. *Impacts, Adaptation and Vulnerability*, IPCC 935 (2007), available at <http://www.ipcc.ch/ipccreports/tar/wg2/index.htm> (describing risks to small island states); see *id.* at 330-34 (describing Asian and African flood risks); see also *id.* at Executive Summary (describing drought risk in Africa).

36. *Adapting to the Impacts of Climate Change*, *supra* note 2, at 31. Though conceding great uncertainty, the International Organization for Migration (IOM) notes that estimates of environmentally-induced global migration (both within and between countries) vary from 25 million to 1 billion, “with 200 million being the most widely cited estimate.” *Migration, Climate Change and the Environment*, IOM (Aug. 10, 2013), available at <http://www.iom.int/cms/en/sites/iom/home/what-we-do/migration-and-climate-change/a-complex-nexus.html#estimates>.

37. *Forced Displacement in the Context of Climate Change: Challenges for States under International Law*, OFFICE OF THE U.N. HIGH COMMISSIONER FOR REFUGEES, 10 (2009), available at <http://www.unhcr.org/4a1e4d8c2.html>.

38. Urban environments are often several degrees warmer than less densely populated areas. See BRIAN STONE JR., *THE CITY AND THE COMING CLIMATE: CLIMATE CHANGE IN THE PLACES WE LIVE* 75-76 (2012) (explaining how urban areas’ decreased vegetation, dark surfaces that absorb heat, reflected heat from tall buildings, and localized heat from combustion sources contribute to the urban heat island effect).

39. Careful design can reduce the heat island effect. *Adapting to the Impacts of Climate Change*, *supra* note 2, at 70; Blake Hudson, *Reconstituting Land-Use Federalism to Address Transitory and Perpetual Disasters: The BiModal Federalism Framework*, 2011 BYU L. REV. 1991, 2007-08 (2011).

40. See generally J.B. Ruhl, *Climate Change and the Endangered Species Act: Building Bridges to the No-Analog Future*, 88 B.U. L. REV. 1 (2008) (describing climate change impacts on endangered species).

III. THE STATE OF THE ART

Federal, state, and local governments have not stood still in the face of climate threats. On-going federal disaster, housing, and infrastructure programs regularly impact land uses in ways relevant to adaptation. State and local governments have addressed disaster risks and begun exploring, if not implementing, adaptation-related land use measures. While a full survey of all federal, state, and local programs is beyond the scope of this essay, a brief survey, and assessment of their sufficiency in meeting the nation's land use-related adaptation needs, is provided.

A. Federal Initiatives

Congress has not passed comprehensive climate change legislation addressing either mitigation or adaptation. Nonetheless, federal agencies are pursuing adaptation-related initiatives under existing legal authorities, efforts that were initially coordinated by an interagency Adaptation Task Force.⁴¹ These federal initiatives were endorsed by President Obama in his June 2013 Climate Action Plan,⁴² and were further refined and restructured through a November 2013 Executive Order on adaptation.⁴³ Within the limitations of existing laws and mandates, these initiatives provide overarching principles,

41. See *Progress Report of the Interagency Climate Change Adaptation Task Force: Recommended Actions in Support of a National Climate Change Adaptation Strategy*, THE WHITE HOUSE COUNCIL ON ENVIRONMENTAL QUALITY (Oct. 5, 2010), available at <http://www.whitehouse.gov/sites/default/files/microsites/ceq/Interagency-Climate-Change-Adaptation-Progress-Report.pdf> (describing federal initiatives); see also *Progress Report of the Interagency Climate Change Adaptation Task Force*, FEDERAL ACTIONS FOR A CLIMATE RESILIENT NATION (Oct. 28, 2011), available at http://www.whitehouse.gov/sites/default/files/microsites/ceq/2011_adaptation_progress_report.pdf (describing federal initiatives). See generally Robert R.M. Verchick & Abby Hall, *Adapting to Climate Change while Planning for Disaster: Footholds, Rope Lines, and the Iowa Floods*, 2011 B.Y.U. L. REV. 2203, 2216-22 (2011) (discussing federal initiatives coordinated by the Interagency Climate Change Adaptation Task Force).

42. *The President's Climate Action Plan*, EXECUTIVE OFFICE OF THE PRESIDENT, (June 2013), <http://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf>.

43. *Executive Order—Preparing the United States for the Impacts of Climate Change*, THE WHITE HOUSE OFFICE OF THE PRESS SECRETARY (Nov. 1, 2013), available at <http://www.whitehouse.gov/the-press-office/2013/11/01/executive-order-preparing-united-states-impacts-climate-change>. The Executive Order replaces the interagency Adaptation Task Force with a new Council on Climate Preparedness and Resilience. It also created a State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience to provide a forum for subnational input into how the federal government can help support adaptation.

encourage inter-agency coordination, encourage the provision of information and resources to a wide range of governmental and private stakeholders (at all levels of government), and provide ongoing institutional structures for exchanging information about climate impacts and potential adaptation responses. As important as these coordinating efforts are, however, they primarily support federal agency action. Although they explicitly demonstrate the federal government's commitment to supporting state and local efforts, they do not create a federal mandate for subnational action.

In addition to these explicit and overarching adaptation initiatives, individual federal programs indirectly implicate land use and adaptation. The Coastal Zone Management Act (CZMA) already creates incentives for coastal land use planning and coastal management programs.⁴⁴ NOAA, the agency that administers the CZMA, provides states with adaptation planning resources.⁴⁵ Although the CZMA recognizes the risk of rising sea levels and encourages states to engage in adaptation planning, the CZMA does not require state and local governments in vulnerable coastal areas to plan for sea-level rise, establish clear and precise goals for state adaptation planning, nor directly require coastal states to engage in adaptation planning.⁴⁶ NOAA and the Coastal States Organization have advocated, without success, for CZMA reauthorizations that would provide more explicit climate change planning directives.⁴⁷

The federal government affects disaster-related components of land use through several programs, including the National

44. 16 U.S.C. §§ 1451 *et seq.* Federal incentives for local coastal land use planning include federal funding and a "consistency" requirement that federal projects be consistent with local coastal plans. See TIMOTHY BEATLEY, DAVID J. BROWER, & ANNA K. SCHWAB, AN INTRODUCTION TO COASTAL ZONE MANAGEMENT, 102-06 (2d ed. 2002) (discussing federal incentives for coastal planning).

45. *Coastal Climate Adaptation: Resources*, NOAA, available at <http://collaborate.csc.noaa.gov/climateadaptation/default.aspx> (last visited Dec. 26, 2013).

46. See Byrne & Grannis, *Coastal Retreat Measures*, in THE LAW OF ADAPTATION TO CLIMATE CHANGE, *supra* note 22, at 289-90 (stating that the CZMA contains broad objectives for both preserving and developing the coast, a mix of objectives that do not provide coastal states with a clear directive to engage in adaptation planning).

47. *The Role of Coastal Zone Management Programs in Adaptation to Climate Change: Second Annual Report of the Coastal States Organization's Climate Change Work Group*, COASTAL STATES ORGANIZATION (Sept. 2007), available at <http://www.coastalstates.org/wp-content/uploads/2010/07/CSO-2008-Climate-Change-Report2.pdf>. Efforts to reauthorize the CZMA to more explicitly require and direct planning for climate change have, to date, stalled in legislative committees. Coastal State Climate Change Planning Act, H.R. Rep. No. 1905, 111th Cong. (1st Sess.); Coastal State Climate Change Planning Act, H.R. Rep. No. 4314, 112th Cong. (2d Sess.); Coastal State Climate Change Planning Act, H.R. Rep. No. 764, 113th Cong. (1st Sess.).

Flood Insurance Program (NFIP) as well as through disaster preparedness and planning programs. By providing subsidized flood insurance only within communities that adopt local floodplain management plans and building construction requirements, the NFIP provides some incentive for local governments with land in designated floodplains to adopt land use measures.⁴⁸ Although an attractive tool in theory, some argue that the program's subsidized insurance rates and outdated floodplain maps have fostered development in at-risk areas that would not have been developed absent the federal insurance program.⁴⁹ Additionally, analysts argue that, even where adopted, local governments' floodplain management requirements have not offered sufficient protections against the unavoidable and increasing risks posed by floodplain development.⁵⁰ 2012 amendments to the NFIP to address some of these weaknesses were weakened in 2014,⁵¹ and the NFIP will not provide a sufficient federal mechanism for promoting local land use adaptation.

Federal disaster laws, including the Stafford Act and the Disaster Mitigation Act, provide federal funding for local and state government disaster mitigation planning.⁵² In addition to funding, incentives to engage in planning include conditioning non-emergency disaster relief on the completion of disaster

48. Siders, *supra* note 23, at 9. Without flood insurance, many buyers could not obtain a mortgage because the federal government will not back mortgages in flood-prone areas without flood insurance. Byrne & Grannis, *Coastal Retreat Measures*, in *THE LAW OF ADAPTATION TO CLIMATE CHANGE*, *supra* note 22, at 291.

49. *Id.* at 291-92; see also Sean B. Hecht, *Insurance*, in *THE LAW OF ADAPTATION TO CLIMATE CHANGE*, *supra* note 22, at 511, 518 (observing that offering subsidized insurance, even if conditioned on weather-proofing, could foster rather than inhibit development in risk-prone areas); see also *id.* at 528-31 (describing numerous NFIP weaknesses).

50. See Siders, *supra* note 23, at 9 (observing that local planning did not prevent damage and that many homes were not built to NFIP standards).

51. Siders, *supra* note 23, at 10; see also Hecht, *Insurance*, in *THE LAW OF ADAPTATION TO CLIMATE CHANGE*, *supra* note 22, at 529 (describing the 2012 amendments); see additionally Berry & King, *supra* note 27 (discussing legislation repealing portions of the 2012 amendments).

52. Victor B. Flatt, *Domestic Disaster Preparedness and Response*, in *THE LAW OF ADAPTATION TO CLIMATE CHANGE*, *supra* note 22, at 481; see generally John R. Nolan, *Disaster Mitigation Through Land Use Strategies*, 23 *PACE ENVTL. L. REV.* 959 (2006) (describing how land use planning can reduce disaster risks); Patricia E. Salkin, *Sustainability at the Edge: The Opportunity and Responsibility of Local Governments to Most Effectively Plan for Natural Disaster Mitigation*, 38 *ENVTL. L. REPORTER* 10158, 10159 (2008). The Federal Emergency Management Agency (FEMA) provides grants to state, local, and tribal governments for disaster mitigation, including post-disaster, pre-disaster, and to reduce long-term flood risks. *Hazard Mitigation Assistance*, FEMA, <http://www.fema.gov/hazard-mitigation-assistance> (last visited Dec. 26, 2013).

mitigation plans⁵³ as well as conditioning some funding for disaster mitigation measures on plan completion.⁵⁴ However, although FEMA, the overseeing agency, has expressed its intent to incorporate climate change adaptation into all of its programs,⁵⁵ to date, FEMA regulations do not require states to address climate change in their hazard mitigation plans,⁵⁶ and FEMA does not yet mention climate change in the rules guiding its review of state hazard mitigation plans.⁵⁷ A recent study reveals that only eleven states fully integrate climate change impacts into their disaster assessments and mitigation strategies.⁵⁸ Additionally, eighteen states have little or very poor discussion of climate change or, where they mention climate change, they do so in an unclear manner.⁵⁹ Finally, eleven states include only minimal discussion of the full range of risks, including several facing substantial risks, like Arizona, Louisiana, South Carolina, Texas, and Virginia.⁶⁰ Moreover, commentators have observed that mitigation planning is often not integrated into comprehensive local land use planning,⁶¹ and is therefore less likely to influence difficult local land use choices.

Other agencies have addressed climate change in particular programs, though none create a systematic, federal requirement for localized land use related adaptation planning or programs. For example, the Department of Housing and Urban Development has addressed future climate change in its authority over federal funding for post-Hurricane Sandy rebuilding.⁶² More broadly, the

53. *Multi-Hazard Mitigation Planning*, FEMA, <http://www.fema.gov/multi-hazard-mitigation-planning> (last visited Dec. 26, 2013).

54. The Disaster Mitigation Act of 2000 encourages local and state disaster planning by conditioning funding for hazard mitigation grants on the development of state and local disaster mitigation plans. See Flatt, *Domestic Disaster Preparedness and Response*, in *THE LAW OF ADAPTATION TO CLIMATE CHANGE*, *supra* note 22, at 486 (discussing incentives created by the Disaster Mitigation Act of 2000); Nolan, *supra* note 52, at 965.

55. See *FEMA Climate Change Policy Statement*, FEMA (2012), available at http://www.fema.gov/media-library-data/20130726-1919-25045-6267/signed_climate_change_policy_statement.pdf.

56. Matthew Babcock, *State Hazard Mitigation Plans and Climate Change: Rating the States*, COLUMBIA LAW SCHOOL CENTER FOR CLIMATE CHANGE LAW (Nov. 2013), http://web.law.columbia.edu/sites/default/files/microsites/climate-change/files/Publications/Students/SHMP%20Survey_Final.pdf.

57. *Id.* at 3.

58. *Id.* at 10-11.

59. *Id.* at 8. Some of these states, like Alabama, Georgia, and Delaware, face substantial climate risks.

60. *Id.* at 8-9. Ten states include accurate discussion that remains too limited. *Id.* at 9-10.

61. Salkin, *supra* note 52, at 109159.

62. A Hurricane Sandy Rebuilding Task Force developed guidelines for federal disaster relief that explicitly noted the importance of rebuilding to enhance resilience. *Fact Sheet: Key Recommendations to Guide the Continued Federal Investment in the Region*, HURRICANE SANDY REBUILDING TASK

Department of Transportation and the Environmental Protection Agency have indirectly impacted local land use through infrastructure planning and funding decisions.⁶³ A more comprehensive effort to link environmental, housing, and infrastructure planning has been initiated through the Sustainable Communities Initiative jointly administered by HUD, EPA, and DOT.⁶⁴ Although a valuable program, its grants are project-specific and are not designed to require or achieve comprehensive adaptation planning and implementation. Lastly, the Army Corps of Engineers' dam, levee, and wetland decisions all have significant impacts on local land use conditions. However, there is no explicit mechanism for ensuring that these decisions take climate change into account⁶⁵ and, even if they did, they are not coordinated with state or local land use planning.

Therefore, although many federal programs implicate land use and could implicate adaptation, most do not explicitly require attention to climate change. Federal programs provide support and grant funding, but they do not mandate action. There is no systematic mechanism for ensuring that local and state

FORCE, *available at* <https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&cad=rja&ved=0CCsQFjAB&url=http%3A%2F%2Fportal.hud.gov%2Fhudportal%2Fdocuments%2Fhuddoc%3Fid%3Dhsrebuildingstrategy.pdf&ei=C2npUpKAHMmfrAHU7ICwCA&usq=AFQjCNEzqaftuxpRZ-EMdQqlrdpCc—s1A&sig2=rNSdjMVOEXAYhKpyywwK0g>. As a condition for distributing infrastructure funding in November 2013, HUD required grant applicants to assess how climate change could impact the proposed project, and HUD may extend this approach in other funding contexts. Ethan I. Strell, *Second Round of Sandy Relief Money Conditioned on Future Sea Level Rise Risk Analysis*, CLIMATE LAW BLOG (Nov. 25, 2013), <http://blogs.law.columbia.edu/climatechange/2013/11/25/second-round-of-sandy-relief-money-conditioned-on-future-sea-level-rise-risk-analysis/>.

63. *Transportation and Climate Change Clearinghouse, Climate Change Impacts & Adaptation*, U.S. DEPARTMENT OF TRANSPORTATION, <http://climate.dot.gov/impacts-adaptations/index.html> (last visited Feb. 27, 2014). Sewage treatment facilities face significant threats of increased overflows where storm and sanitary sewers are combined. EPA is exploring the value of land use mechanisms, including permeable landscaping, to reduce stormwater flow and reduce the risk of sewage overflows. *Why Green Infrastructure?* EPA, http://water.epa.gov/infrastructure/greeninfrastructure/gi_why.cfm#WaterQuality (last visited Dec. 26, 2013); John Nolan, *Katrina's Lament: Reconstructing Federalism*, 23 PACE ENV'L L. REV. 987, 1007 (2006).

64. See *Sustainable Communities Initiative*, U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, *available at* <http://portal.hud.gov/hudportal/HUD?src=/hudprograms/sci> (last visited July 31, 2013) (providing information on the Sustainable Communities Initiative); see also Ashira Pelman Ostrow, *Land Law Federalism*, 61 EMORY L.J. 1397, 1428 (2012) (describing the interagency partnership and its goals).

65. See generally Victor Beyers Flatt and Jeremy M. Tarr, *Adaptation, Legal Resilience, and the U.S. Army Corps of Engineers: Managing Water Supply in a Climate-Altered World*, 89 N.C. L. REV. 1499, 1545-48 (discussing need for Army Corps of Engineers to address climate change).

governments engage in comprehensive adaptation related-land use planning.⁶⁶

B. State and Local Government Initiatives

Where systemic adaptation planning has occurred, state and local governments have been the primary drivers.⁶⁷ As of December 2013, twelve states have completed adaptation plans and three states have plans in progress.⁶⁸ Many, but not all, are coastal states facing the most evident risks of sea level rise and increased storm intensity.⁶⁹

Many local governments are national leaders in developing climate adaptation plans.⁷⁰ Chicago had one of the first adaptation plans in a major U.S. city, a plan including land use elements that reduce urban heat, pollution, and flooding.⁷¹ In 2013, New York City released a \$20 billion dollar plan to protect the city from the kind of devastation wreaked by Hurricane Sandy in fall 2012.⁷²

Overall, however, planning and implementation are not comprehensive. Many state and local governments have not engaged in systematic adaptation planning,⁷³ and where plans

66. Cf. Craig Anthony (Tony) Arnold, *The Structure of the Land Use Regulatory System in the United States*, 22 J. LAND USE & ENVTL. L. 441, 487, 490-91 (2007) (describing how federal and state influence over local land use operates as a fragmented overlay on local control and is not coherent or comprehensive).

67. Arroyo & Cruz, *State and Local Adaptation*, in THE LAW OF ADAPTATION TO CLIMATE CHANGE, *supra* note 22, at 569-87; see also *State and Local Adaptation Plans*, GEORGETOWN CLIMATE CENTER, available at <http://www.georgetownclimate.org/adaptation/state-and-local-plans> (last visited Dec. 31, 2013); see also *Local Governments, Extreme Weather, and Climate Change 2012*, ICLEI-LOCAL GOVERNMENTS FOR SUSTAINABILITY USA, available at <http://www.icleiusa.org/action-center/learn-from-others/local-governments-extreme-weather-and-climate-change-2012> (last visited Feb. 22, 2014) (detailing actions taken by 20 U.S. cities).

68. Arroyo & Cruz, *State and Local Adaptation*, in THE LAW OF ADAPTATION TO CLIMATE CHANGE, *supra* note 22, at 569-87.

69. *Id.*

70. *Id.*

71. See *Chicago Climate Action Plan: Adaptation* (Feb. 15, 2013), <http://www.chicagoclimatereaction.org/pages/adaptation/11.php> (summarizing Chicago's adaptation strategies).

72. *Climate Change Adaptation in New York City: Building a Risk Management Response*, NEW YORK CITY PANEL ON CLIMATE CHANGE (May 2010), available at <http://www.nyas.org/publications/annals/Detail.aspx?cid=ab9d0f9f-1cb1-4f21-b0c8-7607daa5dfcc>; *Plan NYC: A Stronger More Resilient New York*, THE CITY OF NEW YORK (June 11, 2013), available at <http://www.nyc.gov/html/sirr/html/report/report.shtml>.

73. Arroyo & Cruz, *State and Local Adaptation*, in THE LAW OF ADAPTATION TO CLIMATE CHANGE, *supra* note 22, at 593. The fate of North Carolina's efforts to address sea level rise provides a cautionary tale about full

have been adopted, they often lack specific implementation measures.⁷⁴ Instead of recognizing climate risks, many local governments are encouraging rather than discouraging development in vulnerable floodplains.⁷⁵ In general, they face a lack of data, a lack of money, and a lack of political commitment by local government and business leaders.⁷⁶ Unless a direct and certain threat is imminent, it is difficult for state and local policymakers to commit the financial and political capital necessary to initiate controversial changes to the land use status quo.⁷⁷ Moreover, local governments are reluctant to forego or curtail the short-term tax revenue and civic benefits that development offers.⁷⁸

Ultimately, existing land use provisions to adapt to climate change are not sufficient. As noted above, there is no comprehensive approach to land use at the federal level, and existing federal initiatives are fragmented and are not adequately integrated with each other or with state and local land use

reliance on state authority. Based on an extensive 2010 report, a state science panel had established a statewide sea level rise prediction that would have been useful to local government land use planning. However, in 2012, the legislature reacted by preventing the agency from providing a statewide prediction until 2016, depriving local governments of the state's expertise on predicted sea level rise. See Siders, *supra* note 23, at 32-33 (describing North Carolina experience).

74. See Joann Carmin et al., *Progress and Challenges in Urban Climate Adaptation Planning: Results of a Global Survey*, MIT (2012), available at <http://web.mit.edu/jcarmin/www/urbanadapt/Urban%20Adaptation%20Report%20FINAL.pdf> (describing factors that have impeded local government adaptation efforts); Arroyo & Cruz, *State and Local Adaption, in THE LAW OF ADAPTATION TO CLIMATE CHANGE*, *supra* note 22, at 593. Compared globally, U.S. cities had the lowest level of adaptation assessment and planning (59%). Carmin, et al., *supra* at 74. Even in areas likely to experience significant impacts, like southern California, most local governments have done little to plan for likely increases in sea level. See Herzog & Hecht, *supra* note 22, at 471 (describing lack of attention to sea level rise in many southern California communities).

75. See Hudson, *supra* note 39, at 2002 (describing local governments' encouragement of floodplain development).

76. See Carmin et al., *supra* note 74, at 23-24 (stating that in a recent survey, less than 25% of U.S. cities indicated that their local government officials strongly supported adaptation planning). See also Siders, *supra* note 23, at 27 (observing that many local governments lack the commitment, resources, and technical knowledge to develop coastal adaptation plans).

77. See Hudson, *supra* note 39, at 2027 n.178 (arguing that disaster risks often appear remote and speculative). Cf. Daniel C. Esty, *Revitalizing Environmental Federalism*, 95 MICH. L. REV. 570, 598-99, 631-33, and 637 (Dec. 1996) (observing that politicians often respond more to immediate concerns and are less responsive to as-yet intangible and distant harm).

78. See Hecht, *Insurance, in THE LAW OF ADAPTATION TO CLIMATE CHANGE*, *supra* note 22, at 518 (observing that "[l]ocal governments typically promote property development and do not want to make choices that jeopardize the value of property.").

planning initiatives.⁷⁹ While some state and local governments have taken great strides, many have not, leaving significant populations exposed to potentially devastating harm.

Reliance on piecemeal federal, state, and local efforts will be insufficient to achieve an adequate, collective response to climate change. Federal leadership is necessary. A key governance challenge is identifying how the federal government can help direct a cohesive – or at least more cohesive – multilevel governance approach that integrates appropriate roles for federal, state, regional, and local control over land use-related adaptation measures.

IV. FEDERAL FUNCTIONS WITHIN A MULTI-LEVEL GOVERNANCE STRUCTURE

Multilevel governance structures seek to take advantage of the strengths of differing jurisdictional levels, avoid their weaknesses, and reap the benefits of dynamic and overlapping authority.⁸⁰ This essay identifies key land use governance functions and suggests ways in which the federal government could play a more vital and supportive role to state and local governments.

The first section focuses on the fundamental building blocks: climate impact assessments and adaptation planning. It reviews the arguments for retaining a strong local role and explores the limits of exclusive reliance on local initiative. It then suggests a multilevel structure that includes a clear, federal requirement for assessment and planning. Substantively, the essay suggests that, while substantial discretionary authority must remain with local governments, federal planning requirements should also dictate certain minimum planning and program parameters. The second section addresses several practical functions the federal government could perform to support state and local action. These functions include the provision of financial and informational resources, as well as coordination of the multiplicity of federal, state, regional, and local efforts among multiple agencies.

This essay does not advance a specific one-stop proposal. Instead, it seeks to further the debate by identifying the specific kinds of functions that the federal government could play in

79. See *Adapting to the Impacts of Climate Change*, *supra* note 2, at 11 (finding that existing adaptation efforts “are not well coordinated” and could lead to unintended consequences and inefficient responses); see also Verchick & Hall, *supra* note 41, at 2223 (describing lack of coordination between local and federal agencies and lack of focused federal attention to adaptation).

80. See Nestor M. Davidson, *Cooperative Localism: Federal-Local Collaboration in an Era of State Sovereignty*, 93 VA. L. REV. 959, 1014 (2007) (observing that cooperative regimes that share power among multiple levels of government temper the drawbacks to decentralized power while still allowing the benefits of decentralization).

enhancing the nation's response to climate change. Comprehensive federal adaptation legislation may be necessary to realize the ideal degree of land use related adaptation planning. However, recognizing the challenge of adopting such legislation, this articulation of appropriate functions could occur through existing programs, like disaster planning or coastal planning programs, or be realized through modest legislative or administrative revisions to existing authority.

A. Federal Requirement for Subnational Adaptation Risk Assessments and Land Use Planning

As a threshold matter, climate risk assessments and land use planning to respond to identified risks will be essential to effective adaptation. Although climate risk assessments are subject to inevitable uncertainty,⁸¹ there is little doubt that climate change is occurring. Therefore, some assessment of potential impacts, however uncertain, is more accurate than assuming that the status quo will prevail.

Climate risk assessments will be of little value if they do not translate into planning effective and thoughtful responses. Given the importance of land use to adaptation, climate risk information needs to be translated into land-use plans, land-use measures, and building code measures that are integrated with local, regional, and state government land-use planning measures.

What, then, is the federal role in ensuring that such risk assessments and planning occur? As elaborated below, actual assessments and planning need to occur at a subnational level, likely with elements that are statewide, regional, and local. However, because many local, regional, and state governments are not engaging in such planning, the federal government could play a key role by establishing risk assessment and planning requirements as well as by creating a framework that facilitates and ensures adequate subnational efforts.⁸²

1. The Importance of Subnational Assessment and Planning

National risk assessments, like those done by the U.S. Global Change Research Program, are useful in identifying broad national and regional climate impact trends. However, they cannot identify the on-the-ground local impacts faced by particular communities and metropolitan areas.⁸³ Because local or regional

81. See *Adapting to the Impacts of Climate Change*, *supra* note 2, at 54-55 (stating that assessments are inevitably uncertain); Alejandro E. Camacho, *Adapting Governance to Climate Change: Managing Uncertainty through a Learning Infrastructure*, 59 EMORY L.J. 1, 14-15 (2009).

82. See Siders, *supra* note 23, at ii (observing that adaptation planning is needed at all levels of government).

83. See *Adapting to the Impacts of Climate Change*, *supra* note 2, at 55 (observing the local nature of many climate change impacts and response

governments have localized knowledge, they can design tailored responses to localized impacts.⁸⁴ Moreover, in the land use-planning context, local or regional communities ultimately must consider and choose among adaptation measures. Local and regional governments can often best perceive the tradeoffs posed by adaptation measures, and best weigh the benefits of reducing risk, the economic implications of changes to local land use patterns, and the tradeoffs among alternative mechanisms.

More specifically, in the disaster preparation context, local governments can weigh the various mechanisms and attributes of protection, accommodation, and retreat. They are in the best position to make collective choices about urban design that influence both environmental sustainability and quality of life more generally. The fundamental community features affected by land use decisions are of great import to local citizens.⁸⁵ Additionally, as a practical matter, the federal government does not have the resources to develop location-specific land use plans around the country.⁸⁶

Decentralized subnational planning also provides another classic benefit of local control: the proverbial laboratories of innovation. Although different areas of the country will encounter different circumstances, requiring differing approaches, there will be commonalities. Consequently, one area's experiment could provide important lessons for other areas experiencing similar circumstances. Lastly, the consequences of a failed local initiative would be less widespread than the failure of a monolithic federal approach.⁸⁷

In addition, small-scale decision-making offers participatory advantages.⁸⁸ Citizens can easily access hearings and other

measures); *See also* Daniel Farber, *Climate Adaptation and Federalism: Mapping the Issues*, 1 SAN DIEGO J. CLIMATE & ENERGY L. 259, 260 (2009) (noting that “[s]tate and local governments are in some ways the natural ‘first responders’ to climate change.”).

84. *See generally* William W. Buzbee, *Urban Sprawl, Federalism, and the Problem of Institutional Complexity*, 68 FORDHAM L. REV. 57, 94 (Oct. 1999) (describing local governments' superior understanding of local conditions).

85. *See* Sara C. Bronin, *The Quiet Revolution Revived: Sustainable Design, Land Use Regulation, and the States*, 93 MINN. L. REV. 231, 239 (Nov. 2008) (describing how land use rules affecting property fundamentally impact personal autonomy interests).

86. *Cf.* Katherine A. Trisolini, *All Hands on Deck: Local Governments and the Potential for Bidirectional Climate Change Regulation*, 62 STAN. L. REV. 669, 736 (Mar. 2010) (observing that the federal government could not manage designing and implementing local climate mitigation measures around the country).

87. *See* Erin Ryan, *Federalism and the Tug of War Within: Seeking Checks and Balance in the Interjurisdictional Gray Area*, 66 MD L. REV. 503, 617 (2007) (describing how local control limits the risk associated with innovative measures).

88. *See, e.g.,* Bronin, *supra* note 85, at 239 (describing participatory benefits of small-scale decision-making); *see* Ostrow, *supra* note 64, at 1442-

decision-making settings, and local voices are less likely to be diluted by large constituencies.⁸⁹ Moreover, given their closer proximity to the electorate and the risk that dissatisfied citizens will “exit” a jurisdiction that fails to meet their preferences,⁹⁰ local planners and government officials could be more accountable for their planning decisions.⁹¹

2. *The Limits of Subnational Control and Benefits of a Federal Role*

Whatever the virtues of maintaining a vital local or subnational role in conducting risk assessments and land use planning, the federal government could serve a vital function by ensuring that such assessments and planning in fact occur.⁹² A laissez-faire approach treating local or state inaction as “their problem” that “they have to live with”⁹³ will not suffice. Given the scale of risks ahead, a federal judgment that all citizens deserve the benefits of adaptation planning represents a legitimate democratic decision, even if certain local governments would prefer not to act.⁹⁴

Federal risk assessment and adaptation planning requirements are also justified by the pervasive extra-jurisdictional consequences that could arise from local governments’ actions and inactions in the adaptation context. In the federalism literature, extra-jurisdictional impacts frequently justify federal minimum standards.⁹⁵

In a few instances, certain local adaptation land use-related measures, like municipal or private sea walls, could cause extra-

43; ERIN RYAN, FEDERALISM AND THE TUG OF WAR WITHIN 44 (2011).

89. *Id.* at 51-53.

90. *Id.* at 53-54.

91. See DAVID L. SHAPIRO, FEDERALISM: A DIALOGUE 91-92 (1995) (stating that local government officials are more immediately accountable).

92. Cf. Hudson, *supra* note 39, at 2050 (proposing a federal law requiring state and local disaster mitigation planning).

93. See generally Henry N. Butler & Jonathan R. Macey, *Externalities and the Matching Principle: The Case for Reallocating Environmental Regulatory Authority*, 14 YALE L. & POLY REV. 23, 36-37 (1996) (stating “that local governments ought to be allowed to make judgments about their own interests, even if those judgments turn out to be misguided.”).

94. See Robert L. Glicksman, *Climate Change Adaptation: A Collective Action Perspective on Federalism Considerations*, 40 ENVTL. L. 1159, 1193 (2010) (suggesting that the federal government should provide minimal protections in case state and local governments are reluctant to act); see also Edward L. Rubin & Malcolm Feeley, *Federalism: Some Notes on a National Neurosis*, 41 U.C.L.A. L. REV. 903, 948-49 (Apr. 1994) (describing democratic legitimacy of national-level decision-making).

95. SHAPIRO, *supra* note 91, at 40-42; Esty, *supra* note 77, at 587. Professor Ostrow observes that extra jurisdictional impacts have been one of the most critical factors explaining the extension of federal control in a multiplicity of contexts. Ostrow, *supra* note 64, at 1408-20; 1421, 1438.

jurisdictional impacts, like beach erosion, in neighboring areas.⁹⁶ More importantly, a local, regional, or state government's inaction, like the failure to assess and plan for climate change impacts, could have significant consequences on neighboring jurisdictions and taxpayers more broadly, particularly in the disaster context.⁹⁷ When local land use measures fail to address disaster risks and extensive damage ensues, the federal government ends up providing billions of dollars in disaster relief.⁹⁸ Between 2011 and 2013, Congress authorized \$136 billion in disaster relief,⁹⁹ \$50 billion of which responded to Hurricane Sandy's widespread damage to the mid-Atlantic.¹⁰⁰

Subnational governments' failure to assess and plan for disasters can also lead to the loss of key infrastructure services, severely impacting surrounding areas. Damage to ports can interfere with national trade. Damage to transmission lines can have widespread impacts on energy systems, and damage to communication towers can have broadly felt impacts on national communication networks.¹⁰¹ Hurricanes Katrina and Rita, in 2005, temporarily shut down oil and natural gas production in the Gulf of Mexico, the source of over 20 percent of U.S. supplies, and significantly interfered with U.S. oil refining.¹⁰²

Additionally, local decisions about floodplain development have significant downstream impacts. Development that removes wetlands and increases impervious surfaces can exacerbate flooding risks. Local government decisions allowing development in floodplains not only places those in the floodplains at risk, but also has cumulative impacts on the riparian system, substantially increasing the risk and severity of downstream flooding.¹⁰³ Requiring local governments to assess flooding risks and develop

96. See Verchick & Scheraga, *Protecting the Coast*, in THE LAW OF ADAPTATION TO CLIMATE CHANGE, *supra* note 22, at 241 (discussing extra-jurisdictional impacts of coastal armoring).

97. For example, Hurricane Katrina caused extensive external impacts with large-scale ripple effects on surrounding jurisdictions. Ryan, *supra* note 87, at 591-93. Even Butler & Macey, who argue that the federal government should not interfere with local decision-making even if it is misguided, state deference to local decision-making is appropriate only "as long as the costs of these [local] decisions are fully internalized by the particular communities served by the local government." Butler & Macey, *supra* note 93, at 36-37.

98. Hudson, *supra* note 39, at 1996-98.

99. Siders, *supra* note 23, at 2.

100. See John Rudolph, *Sandy Bill Passes Senate, Measure Heads to White House for Obama Signature*, HUFFINGTON POST (Jan. 28, 2013), available at http://www.huffingtonpost.com/2013/01/28/sandy-bill_n_2569312.html (reporting that Senate passed a \$51 billion aid package for Hurricane Sandy victims).

101. See *Draft Third Assessment*, *supra* note 6, at 422.

102. Lawrence Kumins and Robert Bamberger, *Oil and Gas Disruption from Hurricanes Katrina and Rita*, CRS REPORT FOR CONGRESS 1 (Oct. 21, 2005), available at <http://fpc.state.gov/documents/organization/55824.pdf>.

103. Farber, *supra* note 83, at 266; Glicksman, *supra* note 94, at 1184.

land use measures to address them would help avoid indirect harms to downstream communities.

Moreover, local disasters have widespread housing impacts, both in the short and long-term. In the short-term, hurricane Katrina forced 800,000 Louisiana residents to disperse throughout the southeastern states and beyond.¹⁰⁴ In the long-term, disaster evacuees may not choose to return to disaster prone areas, particularly if they are renters without vested property interests.¹⁰⁵ To the degree local governments engage in appropriate climate assessments and planning, they could potentially reduce local vulnerability and the degree to which local residents end up as disaster refugees. While less dramatic, local governments' assessment and planning to address slower-moving risks, like increasing heat or water scarcity, could help certain areas maintain their sustainability and reduce migration to other areas.

Moreover, subnational governments will be unable to handle certain adaptation challenges because they occur on a larger scale. In these instances, it is not simply that local governments trigger extra-jurisdictional impacts. Instead, the problems transcend local boundaries and cannot be adequately addressed by local governments or by state governments acting alone.¹⁰⁶ For example, as parts of the country become uninhabitable due to sea-level rise, insufficient drinking water, or high temperatures, internal migration will create housing pressure in less vulnerable areas. The challenge is not just that local jurisdictions' failure to address housing vulnerability causes extrajurisdictional impacts, as noted above, but that climate change will generate housing shifts that require larger-scale planning than local governments can achieve. As another example, reducing the urban heat island effect requires collective action on a metropolitan scale, action that

104. *Draft Third Assessment, supra* note 6, at 352.

105. *See generally* Farber, *supra* note 83, at 267 (describing risk of climate refugees following large-scale related disasters).

106. *See Draft Third Assessment, supra* note 6, at 430 (describing inability of local governments to address climate change impacts on their own). Many climate impacts will occur at multiple scales simultaneously. *See generally* David E. Adelman & Kirsten H. Engel, *Adaptive Federalism: The Case Against Reallocating Environmental Regulatory Authority*, 92 MINN. L. REV. 1796, 1814-15 (describing the multiple geographic and temporal scales of many environmental problems). Professor Ryan observes that many modern policy challenges, including environmental protection, national security, and telecommunications, fall into an "interjurisdictional gray area" that cannot be characterized as exclusively local, state, or federal. RYAN, *supra* note 88, at 145-80. *See also* William W. Buzbee, *Recognizing the Regulatory Commons: A Theory of Regulatory Gaps*, 89 IOWA L. REV. 1, 13 (Oct. 2003) (observing that "[g]lobal warming . . . confronts no matching or commensurate political or legal regime that, due to the regime's geographical turf, subject responsibilities, or political constituency, is logically situated to take the lead and address global warming's causes and anticipated harm.").

is difficult to mobilize and coordinate where metropolitan areas are fragmented into multiple municipal jurisdictions. Similarly, infrastructure security requires coordinated action that extends beyond municipal boundaries.

Nor do local governments necessarily ensure ideal participatory opportunities; the ideal participatory structure depends on the scale of the problem and the presence or absence of extra-jurisdictional impacts. Local decision-making offers more opportunities for direct citizen influence, but does not provide participatory opportunities for all affected citizens. Citizens impacted by extra-jurisdictional consequences have no voice in the local decisions causing the impacts.¹⁰⁷ Larger-scale decision-making often better reflects the views of the full range of affected citizens. Moreover, although localized decision-making may provide a voice to locally-unique perspectives, it can also marginalize the voice of small groups within local settings. Some interests, like minority or low-income residents, could find their voices overwhelmed at a local level, but could wield more influence when combined with others at larger jurisdictional levels.¹⁰⁸

Another classic justification for a federal role is that it would help mitigate the “race to the bottom” that can arise when state and local governments compete for development. The race to the bottom could emerge if state or local governments fear that important development restrictions or requirements, like restrictions on floodplain development or strong building codes, will jeopardize growth and economic development.¹⁰⁹ These fears could lead local governments to forego restrictions or requirements they would otherwise have adopted. Requiring all jurisdictions to adopt minimum restrictions could mitigate the race to the bottom.¹¹⁰

107. JONATHAN LEVINE, ZONED OUT: REGULATION, MARKETS, AND CHOICES IN TRANSPORTATION AND METROPOLITAN LAND-USE 42 (2006); see also Davidson, *supra* note 80, at 1025 (observing that “majority preferences” are defined as such only “by virtue of the line drawn around the locus of decision-making”).

108. Rubin & Feeley, *supra* note 94, at 944-45.

109. See Edward L. Glaeser & Matthew Kahn, *The Greenness of Cities*, HARVARD UNIVERSITY, JOHN F. KENNEDY, SCHOOL OF GOVERNMENT 11 (Mar. 2008), available at http://www.hks.harvard.edu/var/ezp_site/storage/fckeditor/file/pdfs/centers-programs/centers/taubman/policybriefs/greencities_final.pdf (noting that environmental land use measures could shift development to less-regulated jurisdictions); Farber, *supra* note 83, at 267; Glicksman, *supra* note 94, at 1186; see e.g., Hudson, *supra* note 39, at 2002 (providing examples of local jurisdictions’ allowing (and facilitating) floodplain development due to fears that they would otherwise lose economic development).

110. Cf. Hudson, *supra* note 39, at 2059 (stating that overarching land development standards would help dampen the race-to-the bottom). These minimum restrictions will counter the downward pressure on standards created by competition. *Id.* They are nonetheless likely to be highly

A federal role in establishing standards could also counter the risk of interest group capture. While local governments' participatory and accountability advantages provide an argument in favor of local control, the flip side of local access is the risk that certain interest groups, like construction or real estate developers, could wield substantial power that is difficult for local officials to resist.¹¹¹ A federal role in setting minimum standards reduces the risk that these groups would use their local influence to fight adaptation-related land use controls. Of course, interest group capture risks are present at all levels of government. Nonetheless, one of the advantages of having federal minimum standards and retaining the option for stricter local standards is that multiple standard-setting opportunities reduce the risk of capture at any one governance level.¹¹²

A federal role could also promote equitable adaptation, both procedurally and substantively. In the land use context, adaptation planning requires difficult decisions about areas to protect, mechanisms to accommodate risk, and decisions about areas from which to retreat. The factors used to make such determinations have deep socioeconomic consequences. For example, relying on land value as the primary metric to determine what areas to protect versus abandon could systematically lead to the protection of wealthier areas and the abandonment of poorer areas.¹¹³ Even without a metric like land value, these decisions will be politically charged, and create the risk that politically powerful constituencies will fare better than more marginalized populations. Civil rights concerns have pervaded post-disaster rebuilding debates in New Orleans and Texas.¹¹⁴ Throughout the

controversial because they will not eliminate much of the underlying concern that drives down protective requirements: that economic development will go to places facing less risk and therefore facing fewer requirements. *Id.* Nonetheless, this shift is one that is necessary to direct new development into safer areas and to ensure that development in less safe areas does not occur without appropriate protections.

111. See Buzbee, *supra* note 84, at 80-84 (describing the powerful role of transportation and real estate interests relative to citizens); see also Hudson, *supra* note 39, at 2046 (quoting disaster scholar's observation that property and building interests are likely to reduce the reliability of local government-led disaster mitigation measures).

112. See Alejandro E. Camacho & Robert L. Glicksman, *Functional Government in 3-D: A Framework for Evaluating Allocations of Government Authority*, 51 HARV. J. ON LEGIS. 19, 52 (2014); Kirsten H. Engel, *Harnessing the Benefits of Dynamic Federalism in Environmental Law*, 56 EMORY L.J. 159, 178-79, 181 (2006).

113. See *the Impacts of Sea-Level Rise on the California Coast*, CALIFORNIA ENERGY COMMISSION 51 (2009), available at <http://www.energy.ca.gov/publications/displayOneReport.php?pubNum=CEC-500-2009-024-F> (observing that "what we choose to protect and how we pay for it may have a disproportionate impact on low-income neighborhoods and communities of color.").

114. See Mafruzha Khan, RACE, PLACE, AND ENVIRONMENTAL JUSTICE AFTER

nation's civil rights history, the federal government has created federal parameters to guide state and local action to respond to the risk that state and local governments will slight the interests of racially and economically marginalized populations.¹¹⁵

3. *The Federal Role*

The discussion above suggests the need for a multigovernance approach that combines a federal assessment and planning requirement with subnational implementation.¹¹⁶ The federal government could establish both an adaptation planning process and certain minimum substantive standards. Although this essay focuses on adaptation-related land use, such federal planning requirements and standards could be equally appropriate in other contexts impacted by climate change.

a. Federal Procedural Requirements

The central procedural requirement would be for the federal government to require subnational climate impact assessments and planning, including land use related planning. A critical and unanswered question is the precise scale for such assessment and planning. As a practical matter, at a minimum, state agencies could serve as intermediaries responsible for overseeing integrated state, regional, and local assessments and planning. Assessment and planning at multiple scales is likely to be necessary, and the states may be best positioned to determine the appropriate allocation of responsibility and authority.¹¹⁷ Ultimately, however,

HURRICANE KATRINA: STRUGGLES TO RECLAIM, REBUILD, AND REVITALIZE NEW ORLEANS AND THE GULF COAST 205, 214 (Robert D. Bullard & Beverly Wright eds., 2009) (describing how, post-Katrina, the local government initially decided to retreat from low-lying areas historically occupied by African American neighborhoods); *see also* Robbie Whelan, *A Texas-Sized Housing Fight*, WALL ST. J., (Aug. 3, 2012) available at <http://online.wsj.com/news/articles/SB10000872396390443545504577563271568716862> (describing racially charged resistance to re-building public housing in Galveston, Texas damaged by a 2008 hurricane).

115. *See* SHAPIRO, *supra* note 91, at 52-55 (discussing states' disregard of racial minorities' rights); *see also* Ryan, *supra* note 87, at 605 (noting the federal government's role in defending civil rights denied by states).

116. *See* Ostrow, *supra* note 64, at 1436-37 (discussing the benefits of shared federal-local power over land use that allows federal goals to be met but utilizes local governments' capacity to tailor such policies to "local geographic and economic conditions and community preferences"); *see generally* RYAN, *supra* note 88, at 94-96 (describing arguments in favor of cooperative federalism).

117. Several federal statutes, including the CZMA and the Disaster Mitigation Act, incorporate state and local planning. *See* BEATLEY, *supra* note 44, at 102-106 (describing CZMA requirements for local planning); Flatt, *Domestic Disaster Preparedness, and Response, in THE LAW OF ADAPTATION TO CLIMATE CHANGE*, *supra* note 22, at 481 (describing Disaster Mitigation Act planning requirements). Assessments of the strengths and weaknesses of these existing federal planning requirements could provide useful guidance to

any adaptation planning at state or regional levels must be integrated with and incorporated into local land use decision-making.

Effective implementation will require oversight. Federal review of local assessments and plans, or of state compilations of local efforts, will be a necessary component.¹¹⁸ Federal review of state and local initiatives is a common feature of multigovernance approaches. Such review does entail some overlap and potential inefficiency: federal oversight requires the expenditure of federal resources on matters that have already been addressed at state and local levels.¹¹⁹ Nonetheless, one of the advantages of a “dynamic federalism” structure that includes overlapping federal and state roles is the additional accountability flowing from federal oversight of state and local action,¹²⁰ as well as the policy dynamism resulting from the interaction among jurisdictional levels.¹²¹

Additionally, the federal government could establish minimum requirements to enhance meaningful participation by historically marginalized groups in climate assessment and land use planning processes.¹²² Local and state entities engaging in planning could be required to assess the best mechanisms for reaching all populations, including appropriate translation, utilizing non-governmental organizations with the knowledge and connections to reach all populations, and holding meetings at times and in places that facilitate access. While participation does not equal control, the federal government’s minimum participation standards could facilitate access and create greater accountability.

b. Substantive Federal Parameters

In addition to establishing a procedural requirement for subnational assessment and planning, the federal government should, to a limited extent, impose selective substantive standards or parameters on state and local planning and land use related

the development of a structure for adaptation-related land use planning.

118. Such review need not be at the level of specificity and detail as accompanies federal review of state implementation plans. See Clean Air Act § 110(k) (describing federal review of state implementation plans). Nonetheless, federal review of state and local adaptation planning will need to be robust enough to ensure that the assessments and planning initiatives are not empty exercises.

119. Camacho & Glicksman, *supra* note 112, at 48.

120. *Id.* at 52.

121. See Engel, *supra* note 112, at 171-73 (describing the benefits of dynamic federalism).

122. See Alice Kaswan, *Domestic Climate Change Adaptation and Equity*, 42 ENVTL. L. REP. 11125, 11141-42 (2012) (describing importance of participatory processes to equitable adaptation); see generally Siders, *supra* note 23, at 30 (describing the importance of community participation in adaptation planning generally and in enhancing fairness and including disadvantaged communities).

adaptation measures. This essay provides broad contours for the substantive standards that would be appropriate in light of the federalism principles described above, and lays the groundwork for policymakers to develop more detailed and context-specific proposals.

First, federal rules could establish clear adaptation-related goals that state and local plans must achieve, like limiting development in areas that currently, or will in the future, face high risks of property and environmental loss.¹²³ Such clearly stated goals would reduce extra-jurisdictional impacts, help local governments overcome the race-to-the-bottom, resist pressures from development interests, and help them resist their own short-term incentives for increasing development. Additionally, the federal government could eliminate support for development in these high-risk areas.¹²⁴

Second, federal assessment and planning requirements could require local governments to acknowledge the external impacts of local action and inaction. For example, in assessing disaster risk from flooding, local governments could be required to assess their capacity to absorb their own evacuees and, if their internal capacity is limited, they could be required to assess the impact of evacuees on surrounding communities. To the extent infrastructure, like ports, energy transmission, highways, and communications systems are at risk, local governments could be required to assess and address the external impacts of local vulnerability.

Third, where federal or state assessments and planning identify larger-scale needs and plans, federal law should provide a mechanism for these larger-scale interests to be incorporated into local planning and initiatives. For example, to the degree climate change will prompt internal migration, national assessments of projected shifts are necessary, and a national mechanism for accommodating such migrations, if not a national housing plan, will be needed. As such national planning proceeds, mechanisms for translating that national planning into state and local land use planning, particularly to assure adequate affordable housing in areas likely to experience in-migration, will be needed.¹²⁵

123. Cf. Siders, *supra* note 23, at 29 (stating, in the context of state-issued planning mandates, how clear state-set goals are important to and enhance the quality of local planning). Pragmatic actors, like the Association of State Floodplain Managers, have called for national leadership in floodplain and coastal areas management, urging the adoption of federal policies to be implemented by states and other subnational institutions. Hudson, *supra* note 39, at 2046-47.

124. The federal government has taken this approach for high-risk coastal barrier islands, which are not eligible for federal flood insurance and other federal funding. Siders, *supra* note 23, at 22.

125. See Glicksman, *supra* note 94, at 1190 (noting that states could try and block climate-sparked immigration).

Last, but not least, federal parameters could help protect potentially marginalized populations in the difficult land use decision-making that lies ahead. Federally required climate assessments could require local governments to identify the demographic characteristics of impacted areas. While local control over key land use decision-making remains essential, certain suspect approaches, like pure reliance on land value in decision-making, could be precluded. In land use adaptation plans, local governments could be required to explain how they are addressing the needs of marginalized communities and others at particular risk from climate change.¹²⁶

B. Federal Resources to Facilitate Subnational Adaptation Land Use Measures

The federal government could also facilitate state and local efforts through several practical measures. These include providing information, providing financial resources, and enhancing coordination among the multiplicity of federal, regional, state, and local entities that all have an interest in land use related adaptation measures.

1. Federal Information Resources

A first key function – and one that is already being served to some extent – is for the federal government to provide climate information to state and local governments to assist them in developing both climate risk assessments and appropriate land use responses.¹²⁷ Local governments have certain informational advantages: they know about local conditions, needs, and preferences. However, because many local governments lack the capacity to evaluate the latest climate science and assess its implications on local jurisdictions,¹²⁸ they could struggle to identify and assess the range of potential adaptation measures.

A number of federal programs are providing valuable informational resources to subnational entities. For example, the U.S. Global Change Research Program has performed periodic nationwide and regional climate impact assessments, with the latest due to be released in 2014.¹²⁹ NOAA provides adaptation information and resources for coastal area planning and

126. See VERCHICK, *supra* note 30, at 3 (articulating “Be Fair” as a guiding disaster law principle).

127. See Glicksman, *supra* note 94, at 1181-82 (describing value of federal role in providing information).

128. *Draft Third Assessment*, *supra* note 6, at 428; *Adapting to the Impacts of Climate Change*, *supra* note 2, at 75.

129. *Assess the U.S. Climate*, U.S. GLOBAL CHANGE RESEARCH PROGRAM, <http://www.globalchange.gov/what-we-do/assessment> (last visited Mar. 2, 2014).

programs,¹³⁰ and the U.S. Geological Survey engages in scientific research to better understand the physical impacts of climate change.¹³¹ EPA provides a broad range of information on climate impacts and links to programs offering more specific data and information,¹³² as well as having developed specific programs to support particular adaptation challenges.¹³³

The federal government can provide essential information not only about climate impacts, but also about measures to address them. Notwithstanding substantial differences among jurisdictions, many face common challenges in assessing both the practical and legal implications of a variety of potential adaptation measures. The federal government should continue to provide a clearinghouse for state and local efforts.¹³⁴ Additionally, the federal government could assess state and local efforts, helping to ensure that other jurisdictions learn from the strengths and weaknesses of state and local approaches.

2. Federal Financial Resources

Adaptation will be expensive.¹³⁵ Climate assessments and land use planning to address impacts are costly in and of themselves. Implementing measures to adapt could cost even more. While some measures, like requiring permeable pavements or set-backs or fire buffers, would fall largely on private entities,

130. See, e.g., *Coastal Climate Adaptation: Resources*, NOAA <http://collaborate.csc.noaa.gov/climateadaptation/default.aspx> (last visited Feb. 18, 2013).

131. *Climate and Land Use Change*, U.S.G.S. http://www.usgs.gov/climate_landuse/ (last visited Dec. 27, 2013).

132. See *Climate Change Impacts and Adapting to Change*, U.S. E.P.A. <http://www.epa.gov/climatechange/impacts-adaptation/> (last visited, Dec. 27, 2013).

133. EPA's Climate-Ready Estuaries and Climate-Ready Water Utilities programs provide federal information and assistance to local and regional entities. See *Federal and EPA Adaptation Programs*, U.S. E.P.A., <http://www.epa.gov/climatechange/impacts-adaptation/fed-programs.html> (last visited Dec. 27, 2013). Additionally, all of EPA's program and regional offices are developing adaptation plans that include support for state, regional, and local efforts. See *EPA Adaptation Implementation Plans*, U.S. E.P.A., <http://www.epa.gov/climatechange/impacts-adaptation/fed-programs/EPA-impl-plans.html> (last visited Dec. 27, 2013).

134. See *Climate Change Impacts and Adapting to Climate Change*, U.S. ENVIRONMENTAL PROTECTION AGENCY, <http://www.epa.gov/climatechange/impacts-adaptation/>, (last visited Mar. 2, 2014) (providing links to webpages for each region, webpages that include numerous examples of state and local adaptation initiatives).

135. Although subject to considerable uncertainty, the cost of U.S. adaptation measures is estimated to be in the billions of dollars. See generally Fran Sussman, et al., *Climate change adaptation cost in the US: what do we know?* 14 CLIMATE Policy 242 (2013), available at <http://www.tandfonline.com/doi/abs/10.1080/14693062.2013.777604#preview> (explaining that these estimates do not focus solely on urban land use related measures, but they do provide a sense of the scale of the challenge).

local governments could confront significant local expenditures. As noted above, implementation measures could include relocating infrastructure, exercising eminent domain, or purchasing conservation easements to control development in at-risk areas. While expensive, adaptation is a wise investment because funding adaptation measures now will cost less than incurring the damages anticipated from harm.¹³⁶

Certain large municipalities, like Chicago and New York, have the financial resources to engage in sophisticated climate assessments and planning. However, many cities and states are unable to adequately assess risks, plan, or implement adaptation measures because they lack sufficient financial resources.¹³⁷ These efforts are unlikely to be realized without federal funding.¹³⁸ Federal funding would also even out income disparities among municipalities, so that poorer cities have the same opportunities to prepare for climate change as wealthier areas.¹³⁹

Some might argue that state and local governments should not receive federal funding for planning and implementation measures that primarily provide local benefits.¹⁴⁰ However, at this point, areas vulnerable to climate change are not responsible for

136. See *Climate change: the cost of inaction and the cost of adaptation*, EUROPEAN ENVIRONMENT AGENCY 7 (2007) available at <http://www.tandfonline.com/doi/abs/10.1080/14693062.2013.777604#preview> (describing initial assessment that, in Europe, the costs of adaptation would be lower than the costs of inaction).

137. Carmin et al, *supra* note 74, at 20-22; see also Glicksman, *supra* note 94, at 1182 (noting that even if states have the incentive to act, they lack necessary resources).

138. Such federal funding for state and local land use planning is not uncommon in federal environmental laws; the CZMA and the Clean Water Act's nonpoint source control programs provide state and local planning funds. See *Funding*, U.S. DEPARTMENT OF COMMERCE, NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION, OCEAN & COASTAL RESOURCE MANAGEMENT, <http://coastalmanagement.noaa.gov/funding/welcome.html> (last visited Mar. 2, 2014) (describing NOAA's financing of coastal management programs); *Non-Point Source-Related Funding Opportunities*, EPA, <http://water.epa.gov/polwaste/nps/funding.cfm#content> (last visited Mar. 2, 2014) (describing EPA funding for state nonpoint source control programs). Notably, federal planning requirements that have not received full funding have lagged in implementation. ROBERT V. PERCIVAL, ET AL., ENVIRONMENTAL REGULATION: LAW, SCIENCE, AND POLICY 794-96 (7th ed. 2013). Current funding levels are, however, insufficient to fund large-scale coastal adaptation programs. See *Adapting to the Impacts of Climate Change*, *supra* note 2, at 75.

139. See Farber, *supra* note 83, at 271 (observing that poorer areas of the country may not be able to finance adaptation measures); see generally Davidson, *supra* note 80, at 1012 (suggesting that federal financing can be targeted to poorer communities to remedy existing inequities in available funds).

140. See generally Farber, *supra* note 83, at 269-72 (discussing whether the federal government should finance adaptation measures).

the impacts they will experience.¹⁴¹ Additionally, as noted above, if financial support reduces the federal government's future disaster-related expenditures, the benefits of providing financial support will extend well beyond the local level.

At this point in time, however, federal funding for comprehensive state and local adaptation planning and measures is not available. New federal funding mechanisms are necessary to actuate these proposals. The most plausible source of federal financing would be federal climate legislation that puts a price on carbon and then devotes some portion of the revenue to fund adaptation measures, effectively internalizing the cost of climate harms.

As a practical matter, this essay does not resolve the question of what subnational entity should receive funding. Arguably, the federal government could use states as intermediaries by allocating funds to states and having them, in turn, allocate assessment, planning, and implementation money.¹⁴²

3. Federally-facilitated Coordination

A federal role would be useful not only in requiring assessments and planning, providing information, and financing state and local efforts, but also in creating frameworks that coordinate and rationalize the network of federal, state, regional, and local programs that currently implicate adaptation and land use.¹⁴³ The challenge is in coordinating both vertically – among federal, state, regional, and local programs – and horizontally, among multiple agencies and entities that have some interest in or authority over adaptation and land use. Such coordination is independent of any substantive or procedural federal requirements. Instead, federal coordination would facilitate the work of other entities by enhancing communication and creating opportunities for synergistic efficiencies.

141. See *id.* at 272 (noting that public financing for adaptation is premised on “the idea that climate change is a national problem” and “that society as a whole should protect individuals.”).

142. Where federal programs are intended to influence local action, states often serve an intermediary role. At the same time, some analysts suggest that a more direct federal to local connection, with little role for the states as intermediaries, is preferable. Davidson, *supra* note 80; see also Ostrow, *supra* note 64, at 1437-38 (suggesting that direct federal influence over local land use could be preferable to having states as an intermediary). This essay focuses on the importance of a federal role, and does not resolve the role of the states.

143. See *Draft Third Assessment*, *supra* note 6, at 430 (discussing need for coordination that transcends municipal boundaries); see also Siders, *supra* note 23, at 34 (discussing importance of coordinated state and local adaptation planning for sea level rise); Glicksman, *supra* note 94, at 1183 (suggesting federal role in coordinating state and local adaptation policy); Hudson, *supra* note 39, (observing how fragmented and uncoordinated land use planning throughout the Mississippi River hinders land-use related disaster mitigation measures).

Federal initiatives could facilitate horizontal coordination among the many different federal agencies whose work involves land use and adaptation, including disaster, housing, wetlands, storm water, transportation, and other programs. This process, already initiated by the President's Interagency Adaption Task Force, is continuing through the newly constituted Council on Climate Preparedness and Resilience.¹⁴⁴ At the subnational level, many state and local agencies are already developing networks to enhance horizontal and vertical communication and adaptation planning.¹⁴⁵ The federal government could supplement and expand these initiatives, working to facilitate coordination where state and local entities have lacked either the resources or the will to develop their own networks.

V. POLITICAL FEASIBILITY

To succeed, new federal planning requirements and substantive parameters for state and local governments will require a range of incentives and disincentives. Federal funding is needed, not only because state and local governments lack the necessary resources, but to overcome political resistance to federal requirements.¹⁴⁶ Additional benefits, like the federal consistency requirement under the CZMA,¹⁴⁷ could provide similar assistance. Similarly, effective implementation requires "sticks" as well as carrots.¹⁴⁸ For example, as occurs under the Clean Air Act, state and local governments failing to engage in required planning could face the threat of federal planning.¹⁴⁹ Alternatively, as occurs to

144. *Interagency climate Change Adaptation Task Force*, *supra* note 41; *Executive Order*, *supra* note 43.

145. There have been various intrastate collaborations among local governments. *Climate Change Collaboration in the Pacific Northwest (C3)*, <http://www.c3.gov/>; *Gulf of Mexico Alliance*, <http://www.gulfofmexicoalliance.org/index.php>; *Western Governors' Association*, <http://www.westgov.org/> (interstate collaborations); *Colorado Climate Network*, <http://www.coclimatenetwork.org/index.html>; *Green Cities California*, <http://greencitiescalifornia.org/>; *Oregon Coastal Management Program*, <http://www.oregon.gov/LCD/OCMP/Pages/index.aspx>; *Southeast Florida Regional Climate Change Compact*, <http://www.broward.org/NaturalResources/ClimateChange/Pages/SoutheastFloridaRegionalClimateCompact.aspx>; *Wisconsin Initiative on Climate Change Impacts*, <http://www.wicci.wisc.edu/index.php>.

146. *Cf. Hudson*, *supra* note 39, at 2049 (discussing need for financial "carrots" to induce local government disaster planning).

147. Under the CZMA, federal actions must conform to statewide land use plans developed under the CZMA. *See Siders*, *supra* note 23, at 23. The legislative history reveals Congress' belief that the requirement that federal actions conform to state plans is "the single greatest incentive for State participation in the coastal zone management program." *Id.* (citing legislative history).

148. *Cf. Hudson*, *supra* note 39, at 2054-57 (discussing federal "sticks" to induce state and local participation in disaster mitigation planning).

149. One of the sanctions for states that fail to complete adequate state

some degree under FEMA, the availability of disaster mitigation or disaster relief funds could be linked to participation in required planning.¹⁵⁰

New adaptation land use legislation will pose a particularly significant political challenge. Proposals to expand federal control over land use are controversial and have not fared well historically. In the 1970s, federal legislation proposing a federal framework for local planning failed notwithstanding widespread recognition of the national interest in local land use measures.¹⁵¹ Provisions in the original Clean Air Act that encouraged land use measures were later stripped out.¹⁵²

Nonetheless, times change. Climate change presents local governments with huge risks, risks that many municipalities are unprepared to manage alone. The federal government could provide needed resources, including information, enhanced coordination, financial and technical assistance, and some alleviation of responsibility. If the benefits provided by federal engagement in adaptation-related land use measures are appealing enough, then it is possible that the political winds could shift in favor of a more productive and comprehensive integration of federal, state, and local roles, an integration necessary to face the critical land use challenges that lie ahead.

implementation plans is a federal implementation plan. Clean Air Act § 110(c)(1).

150. Hudson, *supra* note 39, at 2055.

151. In the 1970s, the proposed but unsuccessful National Land Use Policy Act would have provided funding and a national data system for state land use planning. See generally Fred Bosselman, *The Twilight of National Land Use Policy*, 45 J. MARSHALL L. REV. 237 (Winter 2012) (describing the history of the proposed National Land Use Policy Act); Ostrow, *supra* note 64, at 1406-07.

152. The original Clean Air Act required states failing to achieve air quality standards to develop land use control measures that would reduce driving and its associated pollution emissions. Facing intense resistance, Congress ultimately removed the requirement, see Ostrow, *supra* note 64, at 1407, and added language reaffirming that the Clean Air Act does not infringe upon local land use control. Clean Air Act, 42 U.S.C. § 7431.

