# Introduction to *Legal Solutions to Coastal Climate Change Adaptation in Connecticut* Symposium Special Issue

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*Abstract: The* Legal Solutions to Coastal Climate Change Adaptation in Connecticut *conference was held at the University of Connecticut School of Law on February 10, 2012. The conference presentations and discussions aim to enhance understanding and promote discussion of cutting-edge policy and legal approaches to climate change adaptation in coastal areas, with potential application to Connecticut. The conference was funded through the generous support of the National Sea Grant Law Center, Connecticut Sea Grant, the Connecticut Chapter of The Nature Conservancy, and the University of Connecticut School of Law Center for Energy and Environmental Law.*



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## I. Introduction

The papers compiled in this Special Issue of the *Sea Grant Law and Policy Journal* were generated and presented at a conference convened by Connecticut Sea Grant (CTSG) in partnership with the University of Connecticut School of Law and The Nature Conservancy. This initiative, focusing on climate change adaptation, recognizes that the climate is already changing significantly in Connecticut and these changes and associated ramifications will increasingly demand the attention of Connecticut's coastal communities and stakeholders.

### *A. Climate Change Impacts and Responses in Connecticut*

Since its formation in 1988 by the World Meteorological Organization and the United Nations Environment Program, the Intergovernmental Panel on Climate Change (IPCC) has issued and routinely updated a series of reports on the status and potential trajectories of climate change. The last assessment completed in 2007 states that evidence of climate change is now unequivocal.[6] Connecticut's climate is changing as well. Average air and water temperatures are increasing and sea levels along the coast of Long Island Sound are rising and all are projected to continue trending in the same direction, although the rate and trajectories of these changes are not yet entirely clear. Models have forecast increases in New England's air temperature ranging from 4°F to 9°F by 2100[7] and corresponding increases in sea surface and bottom water temperatures ranging from 4°F to 8°F.[8] Rising emissions of carbon dioxide have also been implicated in the acidification of marine waters.

Precipitation, especially in coastal areas of the Northeast, has been shown to already be increasing, at about 1.9 cm per decade, and is forecast to continue to increase.[9] More problematically, the frequency of extreme precipitation events is also increasing, especially in the spring and fall and expected to continue to do so.[10] There is also projected to be an increase in intense tropical hurricane activity in the North Atlantic, including Connecticut. Researchers have projected that by 2100 the frequency of the 100-year storm surge event in the New London/Groton area will increase, as compared to 2005, recurring every 3 to 50 years depending upon the emission scenario used in the model.[11]

Associated with these predictions of air temperature changes are increases in sea level; however, currently no consensus on rates of increase exists among the scientific community, sea level rise forecasts in Connecticut are complicated by subsidence associated with its recent geological history as well as the phenomenon of isostatic rebound. Currently sea level in Connecticut is increasing on the order of 2 to 3 mm per year, but this rate has increased over the last decade trending toward 4 mm per

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[6] IPCC, CLIMATE CHANGE 2007: SYNTHESIS REPORT 30 (2007), *available at* http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_synthesis_report.htm.

[7] ENVTL. DEFENSE, BRACING FOR CLIMATE CHANGE IN THE CONSTITUTION STATE: WHAT CONNECTICUT COULD FACE 9 (2004), *available at* http://pubs.giss.nasa.gov/docs/2004/2004_Gornitz_etal.pdf.

[8] NORTHEAST CLIMATE IMPACTS ASSESSMENT SYNTHESIS TEAM, CONFRONTING CLIMATE CHANGE IN THE US NORTHEAST: SCIENCE, IMPACTS AND SOLUTIONS 36 (2007), *available at* http://www.climatechoices.org/assets/documents/climatechoices/confronting-climate-change-in-the-u-s-northeast.pdf [hereinafter NORTHEAST CLIMATE IMPACTS ASSESSMENT].

[9] *See generally*, SUSAN G. SPIERRE & CAMERON WAKE, TRENDS IN EXTREME PRECIPITATION FOR THE NORTHEAST UNITED STATES 1948-2007 (2010), *available at* http://carbonsolutionsne.org/resources/ne_climate_reports/pdf/2010_NortheastExtremePrecip.pdf.

[10] *Id. See also* NORTHEAST CLIMATE IMPACTS ASSESSMENT, *supra* note 8.

[11] *See* Paul Kirshen et al., *Coastal Flooding in the Northeastern United States due to Climate Change*, 13 MITIGATION AND ADAPTATION STRATEGIES FOR GLOBAL CHANGE 437–51 (2008).

year.[12] Rising sea levels coupled with more frequent and intense storm events will put more people and structures in high risk flood areas.

The IPCC has published a series of estimates of the rates and extents of sea level rise based on different emission scenarios.[13] Often considered conservative, these estimates reflect only the thermal expansion of water into account and do not consider the melting of continental ice sheets (e.g., Antarctica and Greenland). Great uncertainties over the rate of melting of the Antarctic and Greenland ice sheets, in addition to other variables, limit the accuracy of these estimates. The IPCC projects a sea level rise ranging from 18 to 59 cm by the end of the 21st century under their modeled scenarios, and notes that that these estimates do not indicate the maximum extent as they exclude potential future rapid changes in ice flows. Local projections of sea level rise in Connecticut have forecast increases on the high end of IPCC projections, in the order of 28 to 89 cm by 2080.[14] Other studies have attempted to take the melting of ice sheets into account and have accordingly forecast even higher rates of sea level rise, up to 1 to 2 meters in the next century.[15]

These climatic changes are likely to create a suite of impacts for Connecticut's coastal communities, including the inundation of coastal areas, eroding shorelines, loss of wetlands, more severe damage associated with the increasing magnitude of storm surge causing destruction of coastal property and infrastructure and corresponding impacts to local economies and human health and well-being. In addition, there are probable impacts to coastal and marine species, both aquatic and terrestrial, caused by greater volumes of stormwater runoff, acidification of coastal waters, more frequent and severe hypoxic events, harmful algal blooms, invasive species, and new or more problematic pests and pathogens.

The economic consequences of climate change in Connecticut are substantial, especially those associated with sea level rise and increased storm intensity. Estimates of property damage and business interruptions associated with storm events reach the billions of dollars. The cost of damages generated by a 100-year flood scenario, using a FEMA HAZUS (risk assessment methodology) analysis, are estimated to be on the order of $18,683,770,000.[16]

Clearly, Connecticut and its coastal communities need to understand these impacts and develop strategies to decrease their vulnerabilities. State and municipal governments can facilitate this process by creating laws and policies that provide legal and economic incentives for individuals and communities to either mitigate or adapt to climate change. The mitigation route involves the reduction of greenhouse gases emissions, while the adaptation aims to enhance resilience to climate change impacts.

Indeed, responding to escalating concerns regarding these projections and future trends, the state of Connecticut developed a Climate Change Action Plan that laid out steps which the state should take to reduce greenhouse gas emissions and thereby mitigate potential climate change impacts.[17] The

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[12] Interview with Dr. Frank Bohlen, University of Connecticut Department of Marine Science (Feb. 2011).

[13] IPCC 2007, *supra* note 6.

[14] ENVTL. DEFENSE, *supra* note 7, at 24.

[15] *See* Stefan Rahmstorf, *A Semi-Empirical Approach to Projecting Future Sea-Level Rise*, 315 SCI. 368–370 (2007). Another reference along these lines is IAN ALLISON ET AL., THE UNIVERSITY OF NEW SOUTH WALES CLIMATE CHANGE RESEARCH CENTER, THE COPENHAGEN DIAGNOSIS: 2009: UPDATING THE WORLD ON THE LATEST CLIMATE SCIENCE (2009).

[16] ADAPTATION SUBCOMMITTEE TO GOVERNOR'S STEERING COMMITTEE ON CLIMATE CHANGE, THE IMPACTS OF CLIMATE CHANGE ON CONNECTICUT AGRICULTURE, INFRASTRUCTURE, NATURAL RESOURCES, AND PUBLIC HEALTH 18 (2010), *available at* http://ctclimatechange.com/index.php/the-impacts-of-climate-change-on-connecticut-agriculture-infrastructure-natural-resources-and-public-health-2010/ [hereinafter ADAPTATION SUBCOMMITTEE REPORT].

[17] GOVERNOR'S STEERING COMMITTEE ON CLIMATE CHANGE, CONNECTICUT CLIMATE CHANGE ACTION PLAN 2005 (2005), *available at* http://ctclimatechange.com/StateActionPlan.html.

same year, seven New England and Mid-Atlantic states, including Connecticut, signed an agreement to create the Regional Greenhouse Gas Initiative, a market-based emissions trading program aimed at reducing $CO_2$ emissions from power plants. The program, currently in operation, now includes ten states and aims to cut $CO_2$ emissions by 10% by 2018. The funds generated by this program are earmarked for energy conservation efforts and in the case of Connecticut for adaptation efforts.

This was followed in 2008 by Connecticut Public Act No. 08-98 (An Act Concerning Global Warming Solutions) which laid out specific greenhouse gas reduction goals along with a timeframe for achieving them and directed the Governor's Steering Committee on Climate Change to establish an Adaptation Subcommittee. The Adaptation Subcommittee set up four working groups focused on infrastructure, agriculture, natural resources, and public health to develop adaptation plans. These working groups completed assessment reports on the likely impacts of climate change and in 2011 completed a preliminary report identifying specific adaptation strategies which is currently open for public comments. [18]

At the same time, in an attempt to fill the lack of top-down policy direction, municipalities have begun to address climate change on their own. Some have established committees focused on energy and climate change and are launching mitigation and adaptation planning efforts along with developing informational baselines through energy audits and carbon footprint models. Several Connecticut municipalities are members of ICLEI (an international association of local governments committed to sustainable development).

These nascent efforts were brought into sharp relief when, in the summer of 2011, Tropical Storm Irene approached the coast of Connecticut. Although downgraded from a hurricane, with much of her force eroded by the time she hit Connecticut, Irene was still able to generate a great deal of damage. According to Munich Re, the storm caused economic losses in the Caribbean and U.S. totaling $15 billion, of which $7 billion was insured.[19] In Connecticut, the insurance companies paid out more than $230 million to property owners for insurable losses due to Irene, according to the Connecticut Insurance Department.[20] The federal government through the Federal Emergency Management Agency (FEMA) provided nearly $9 million to assist individuals who had expenses and losses not covered by insurance.[21] Connecticut's Congressional delegation sent a letter to the President stating,

> As with other neighboring states, Hurricane Irene devastated parts of Connecticut and left many of our residents displaced, under water and without power. The Connecticut, Housatonic, Farmington, Pomperaug and Pequabuck Rivers have experienced major flooding. Additionally, Hurricane Irene's forceful winds pushed water into the western Long Island Sound resulting in coastal flooding, wave damage and erosion which damaged or destroyed numerous homes, public beaches and other public and private facilities. At one time over 900,000 customers were without electricity, a new historic outage level. Downed trees closed over 1,000 local roads and 65 state roads. During the disaster, shelters housed over 2,000 residents. Preliminary surveys

[18] *See* ADAPTATION SUBCOMMITTEE REPORT, *supra* note 16.

[19] Press Release, Munich Re, Review of Natural Catastrophes in 2011: Earthquakes Result in Record Loss Year (Jan. 4, 2012), http://www.munichre.com/en/media_relations/press_releases/2012/2012_01_04_press_release.aspx (last visited June 28, 2012).

[20] Gerard O'Sullivan & George Bradner, Connecticut Insurance Department, Storm Irene: Response and Recovery, Remarks at the Meeting of the Connecticut Shoreline Preservation Task Force (May 23, 2012), *available at* http://www.housedems.ct.gov/Shore/pubs/MAY23CIDpresentation3.pdf.

[21] *Id.*

by local officials in those areas that are reachable have discovered over 7,300 homes with some degree of damage.[22]

This was followed at the end of October by a record-setting snowstorm which again paralyzed the state for weeks, left approximately three million residents across the Northeast without electricity, of which almost one-third (~875,000) were from Connecticut. Insurance companies paid about $247 million in claims for that storm, state insurance regulators said.[23]

The State Legislature responded to Irene with notable alacrity by passing Connecticut Public Act 12-101 (An Act Concerning the Coastal Management Act and Shoreline Flood and Erosion Control Structures), which amended Connecticut's Coastal Management Act.[24] It is the first legislation to specifically define and identify sea level rise as a consideration for planning decisions and requires that any future revisions to the State's Plan of Conservation and Development take into consideration risks associated with a rise in sea level. It also seeks to minimize the use of shoreline armoring to protect coastal properties and encourages the use of "feasible, less environmentally damaging alternative[s]," which include realignment ("the relocation of an inhabited structure to a landward location"), elevating structures, restoring or creating dunes, salt marshes and vegetated coastal buffers, among other options.[25] In addition a Shoreline Preservation Task Force has been created by the Legislature and is holding hearings as this journal issue goes to press.[26] It appears that in Connecticut climate change is now recognized as part of the policy agenda and has begun to move through the various phases of the policy process.

### *B. Legal Solutions Conference and Papers*

At this policy juncture, it makes sense for the state and its coastal communities to have a better understanding of the feasible options available to address a climate that may already be changing and to begin to develop strategies to decrease their vulnerabilities. Government can facilitate this process of adaptation by making or modifying laws, regulations, and policies that either require or create incentives to adapt to climate change. However, no analysis of Connecticut's existing legal framework or assessment of innovative policy options available for climate change adaptation has been completed. The conference *Legal Solutions to Coastal Climate Change Adaptation in Connecticut* was conceived of as a means to begin to fill that gap.

In many respects, Connecticut represents the perfect policy model in which to discuss local climate change adaptation. A "home rule" state, Connecticut's state constitution places matters such as land

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[22] Letter from Joseph Lieberman, U.S. Senate, to President Barack Obama (Sept. 1, 2011), *available at* http://lieberman.senate.gov/index.cfm/news-events/news/2011/9/delegation-asks-president-to-view-ct-irene-damage.

[23] O'Sullivan & Bradner, *supra* note 20.

[24] CONN. GEN. STAT. §§ 22a-90 – 22a-111.

[25] The bill was signed by the Governor on June 8, 2012. Most of the provisions take effect on October 1, 2012. *See* An Act Concerning the Coastal Management and Shoreline Flood and Erosion Control Structures, 2012 Conn. Legis. Serv. P.A. 12-101 (June 8, 2012).

[26] House Democrats of Connecticut, Preserve the CT Shore, http://www.housedems.ct.gov/Shore/index.asp (last visited June 28, 2012). *See also* Jan Ellen Spiegel, *New Shoreline Task Force to Explore Post-Irene Issues,* THE CT MIRROR, Feb. 2, 2012, http://www.ctmirror.org/node/15328 (last visited July 10, 2012).

use in the hands of the 169 municipalities.[27] This localized approach has been reinforced by the elimination of the county government system. As a result, the statewide effects of climate change must be addressed, at least in part, by each municipality. The solutions presented at the conference addressed not only policies to be potentially enacted, but the municipal-state strategies to enact and implement them as well.

A call for papers was drafted and disseminated that identified policy-relevant topics for climate adaptation in Connecticut. These included examinations of (1) the opportunities and roadblocks to adaptation in existing laws and policies, (2) the interplay between public resource protection and private property rights, (3) use of the Coastal Management Act for climate change adaptation, (4) rolling easements, (5) ecosystem-based adaptation incentives, (g) land use planning and growth strategies for adaptation at the municipal and state levels, (7) climate justice: who bears the burden? who reaps the benefits?, (8) legal approaches to emergency planning and changing hazards, (9) adaptation economics: the costs of adapting or not, who pays and when?, (10) reactive versus proactive approaches to adaptation, and (11) strategies for financing adaptation.

From the abstracts received, seven manuscripts were produced and presented at the conference, in addition to two keynote addresses from invited speakers. Conference organizers made efforts to provide ample opportunities for the audience, comprised of state and municipal elected officials and agency staff, scientists, planners, lawyers, practitioners, students and others involved in or merely intrigued by the topic of climate change adaptation in Connecticut, to share their legal and policy adaptation strategies and priorities. These are presented in the next two sections of this paper, and are followed by a discussion of the legal solutions recommended by the authors. The conference was videotaped and the conference website (http://seagrant.uconn.edu/climatelaw/) provides a link to this video as well as presentation slides and other supporting information.

## II. Climate Change Adaptation Approaches

The articles in this Special Issue all seek in one way or other to develop or translate legal and policy approaches to climate change adaptation for application in Connecticut or to identify and assess existing approaches. The articles fall into one of three thematic clusters. One theme, building on the state-town sharing of governance authority, focuses on assessing and elaborating on existing municipal governance structures in Connecticut and includes Mark Boyer's examination of the scope of existing municipal adaptation planning and action and Carl Zimmerman and Katherine Owen's proposed creation of municipal Climate Adaptation Boards based on the existing Inland Wetlands Agency model. A second cluster comprised of three articles examines adaptation approaches used in other states and regions of the United States and translates these approaches to Connecticut. These articles include Jessica Grannis, Julia Wyman, Meagan Singer, Jena Shoaf, and Colin Lynch's examination of local adaptation approaches developed in Maryland and state-level approaches adopted in Rhode Island. Nicole Rinke and Sarah Fort base their legal analysis of adaptation strategies on work conducted in South Boston, while David Lewis examines the acquisition of flood-prone coastal areas used by Louisiana and Mississippi as a means of adapting to climate change impacts. The third group, comprised of two papers, analyzes the legal implications associated with various coastal retreat

[27] *See* Conn. Const. Art. X. Specifically, "After July 1, 1969, the general assembly shall enact no special legislation relative to the powers, organization, terms of elective offices or form of government of any single town, city or borough, except as to (a) borrowing power, (b) validating acts, and (c) formation, consolidation or dissolution of any town, city or borough, unless in the delegation of legislative authority by general law the general assembly shall have failed to prescribe the powers necessary to effect the purpose of such special legislation." *Id.* Art. X, § 1.

strategies and the constitutional ramifications of the Fifth and Tenth Amendments of the U.S. Constitution in adopting these approaches.

Although not included as an article in this Special Issue, the conference was kicked off by a morning presentation by Tony MacDonald, Director of the Urban Coast Institute at Monmouth University, who has been a participant in the current National Climate Assessment effort. MacDonald's presentation was critical in setting a foundation for the following presentations of legal and policy approaches. MacDonald highlighted the problematic nature of adaptation planning, noting it is difficult because it is contingency planning for high impact, low probability outcomes, which are often compounded by other anthropogenic impacts such as invasive species, habitat fragmentation, pollution, and overfishing, as well as natural hazards. In addition, locating funding mechanisms for this scale of policy effort is often difficult. Adaptation outputs need to carefully match the scale of the problem to the solution, have a larger landscape focus, be adaptable in and of themselves, and explicitly focus on ecosystems which include humans as a component of the environment. From an organizational point of view, adaptation has to be somebody's job, not just another task on a to-do list. It is important to engage the appropriate actors within the private sector, which include the insurance and real estate industries, and focus on creating the right incentives for adaptation to occur. Several states already have developed adaptation plans such as California's 2009 Climate Adaptation Strategy which used a hybrid public-private committee to set adaptation priorities; Maine, where the state has embedded the concept of No Regrets Actions into adaptation planning; and Southeast Florida.

Mark Boyer, a political scientist from the University of Connecticut, who has focused much of his research on issues related to international relations, has recently moved his gaze down several levels of organization to Connecticut's municipalities which have begun efforts to adapt to climate change. He has surveyed all 169 municipalities in the state to track their responses and the results are being used by Connecticut's Department of Energy and Environmental Protection to populate an online map of adaptation efforts within the state. His analysis of his research included in his article, *Adapting to Climate Change: Mapping Connecticut's Coastal Responses to a Global Problem*, focuses only on the efforts of 24 coastal towns and cities and the impetus behind these efforts. His research finds that these municipalities are already highly engaged in the process of adaptation, having integrated climate change into their Plans of Conservation and Development[28] and that policy entrepreneurs are clearly a critical factor driving this high response rate.

Carl Zimmerman of the University of Connecticut and Katherine Owens of the University of Hartford outline a novel approach to climate change planning in their article, *A Local Solution for Climate Change: The Climate Adaptation Board*. Using municipal Inland Wetlands Agencies as a model for a Climate Adaptation Board, they outline a municipal governance structure for adaptation decision-making. They believe that local level adaptation has the nuanced ability to reflect local values and knowledge as well as the local scale of development needs and is the best fit for a "home-rule" state like Connecticut.

Nicole Rinke, and Sarah Fort from the Harvard Emmett Environmental Law and Policy Clinic translate their experience assisting the municipality of South Boston with the development of a suite of legal options for adaptation to the state of Connecticut. Building on the legal research and analyses conducted by Wendy B. Jacobs, Leah R. Cohen, and Jennifer McGrory, Rinke and Fort's paper, *Legal Options for Municipal Climate Adaptation in South Boston: An Example for Connecticut Coastal Jurisdictions*, examines the efficacy of using five policy tools for adaptation. Regulating land use

[28] *See* CONN. GEN. STAT. § 8-3(a)(1). ("At least once every ten years, the commission shall prepare or amend and shall adopt a plan of conservation and development for the municipality… The commission may adopt such geographical, functional or other amendments to the plan or parts of the plan, in accordance with the provisions of this section, as it deems necessary…")

through zoning relies on the broad powers that municipalities possess over local land use decision-making. However, although Connecticut municipalities have broad powers, there exists little legal structure which coordinates or encourages cooperative solutions for common problems, such as climate change threats. Addressing this concern, specific policy approaches advanced in the paper include the use of overlay zones to protect particular resources or to promote various adaptation outcomes. The use of freeboard regulations to increase building elevations is a tool available to state managers, but problematic for Massachusetts municipalities since it is regulated under the state building code rather than through local ordinance. Mandating a process of development site review and/or design review is another tool available to ensure that potentially adverse impacts are mitigated through design techniques and that adaptation considerations are incorporated into new developments. Procurement strategies can be modified by communities to integrate adaptation goals such as climate resilient building criteria and a consideration of life cycle costs into municipal projects and activities. Wetland regulations can be modified to extend the designated coastal wetland zone and thereby increase protections on wetlands which are important in buffering adjacent developed uplands. Finally, they suggest that the state's environmental review process for projects funded or authorized by the state can be amended to consider project impacts at the design stage and incorporate features that provide resilience to climate change impacts.

Adapting to climatic impacts along Connecticut's coast will require a balance of competing demands of economic development and environmental conservation assert Jessica Grannis of Georgetown Law and Julia Wyman of the Rhode Island Sea Grant Law Program, along with students Meagan Singer, Jena Shoaf, and Colin Lynch, in their article, *Coastal Management in the Face of Rising Seas: Legal Strategies for Connecticut*. The authors suggest that the governance challenges and tradeoffs of this balance hinge on three primary strategies to adapt to sea level rise: protection, accommodation, and retreat. The authors evaluate the legal approaches for each strategy against current land use law resulting in an assessment of legal feasibility, opportunities for implementation under existing authorities, the identification of any legal and policy changes needed at municipal and state levels, and most appropriate governance level to implement these strategies in Connecticut. Specific legal approaches discussed include a model sea level rise ordinance for Connecticut municipalities that augments existing land use regulations and provides flexibility to tailor adaptation measures by dividing coastal areas into three districts for each of the primary strategies (protection, accommodation, conservation districts). At the state level, the authors explore the application of a "rolling" coastal management statute designed to regulate coastal activities including development through reference to a "dynamic" and moving coastal feature. Ultimately, the authors provide regulatory recommendations Connecticut that are actionable either today or that require additional legal authority and a longer time horizon. These legal tools and changes reduce climate risk through retreat.

In his article, *Adapting to Climate Change through the Acquisition of Flood-Prone Coastal Properties: Lessons from the Gulf Coast and Application in Connecticut*, David Lewis suggests that Connecticut policy-makers and property owners "break the cycle" that subsidizes and protects development in flood-prone areas through proactive relocation strategies such as acquisition and redevelopment elsewhere. In this well-constructed argument, the reader is guided through a construct beginning with "benefits and barriers" to acquisition programs along with a policy framework. This is followed by an examination of two distinctly different approaches following Hurricanes Katrina and Rita: Louisiana's Road Home Program and Mississippi's Coastal Improvement Plan. Benefits identified by Lewis include proven success in numerous federal, state and local contexts; cost effectiveness over the long-term versus continued fortification (i.e., seawalls and levees) and elevation of structures; improved environmental conditions; and economic benefit when combined with redevelopment outside of flood-prone areas. Barriers to implementing an acquisition program are centered primarily on political and

cultural barriers that are driven by proclivity to build and protect private property rights, emotional connections to "coastal living," value of real estate, and the corresponding dependence on this tax base. Other barriers discussed here involve the current uncertainty of the magnitude of future hazards and the engineering challenges presented by relocation in highly urbanized coastlines. A few of the key recommendations as presented by Lewis involve establishing a comprehensive acquisition plan prior to a catastrophic event, engagement with the public and the federal/state agencies in high-hazard locations, reducing subsidies and other incentives that favor rebuilding versus relocation after events, and coupling redevelopment in low-hazard areas with relocation efforts. To enable the development of a broad acquisition plan in Connecticut, Lewis suggests a spatial inventory of hazards and vulnerable development and the phased establishment of "high-priority acquisition areas" and redevelopment sites in low-risk areas. Lewis provides recommendations based on the successes and failures of these case studies for a potential acquisition strategy in Connecticut and other northeastern states and ultimately finds that acquisition represents an often overlooked opportunity to comprehensively reduce risk posed to coastal development from hazards.

Chad McGuire and Jason Hill of the University of Massachusetts, Dartmouth examine the role of the U.S. constitutional protections against taking private property for public purpose[29] in coastal adaptation, conducting a takings analysis of certain strategies in their article, *Climate Adaptation and the Fifth Amendment of the United States Constitution: A Regulatory Takings Analysis of Adaptation Strategies in Coastal Development with Application to Connecticut's Coastal Management Regime*. Two primary responses to sea level rise exist in coastal areas: stay and armor or retreat and allow sea level rise to occur. Rolling easements provide a means of staying, at least temporarily, and allowing sea level rise. They urge a shifting of risks from government to landowners.

Hyo (Charlene) Kim and Caroline Karp of Brown University also examine the legal foundation of coastal adaptation focusing their analysis on the Fifth Amendment to the U.S. Constitution, as well as the Public Trust Doctrine. The critical question they ask in their article, *When Retreat is the Better Part of Valor: A Takings Analysis of Strategies to Incentivize Retreat from the Shore*, is whether state and local governments can regulate or prohibit development of property in high risk areas (e.g., FIRM A, V, high erosion zones) if that regulation results in loss of all economic beneficial uses. They note that mitigation will be cheaper and easier to accomplish than adaptation. They list a series of coastal adaptation strategies coupled with an analysis of the legal and policy implications of their implementation. These strategies include enhancing real estate disclosure forms, assessing risk-based special assessments to reflect the actual costs to municipalities in responding to climate change-related coastal hazards (e.g., flooding), requiring special insurance for high risk property owners, conditioning ownership on performance bonds to be used if/when there is catastrophic loss, state laws to prohibit rebuilding after catastrophic losses, requiring/acquiring setbacks and buffers for coastal features, prohibiting development in high risk areas, requiring the disclosure of flood, storm damage and FIRM designation at the sale of coastal properties, establishing rolling easements and erosion control easements and developing coastal growth boundaries.

## III. Summary of Discussion and Audience Ideas

A novel aspect of this conference was the invitation extended to the audience to become active players in the conference's policy recommendations. Pads of paper and links to the conference email address were given to all attendees along with the request that they share their top three adaptation ideas. Over 60 ideas were generated, collected and entered into a database. Some ideas were process-

[29] The Fifth Amendment to the U.S. Constitution provides, in part, that "…nor shall private property be taken for public use, without just compensation."

oriented, other involved structural approaches like engineering, and others involved legal and policy changes. Ample time was also allowed for audience questions and panel discussions. Audience feedback and points of discussion are categorized and summarized below in several general themes. A majority of the discussions and feedback focused on regulatory approaches to increase coastal resiliency.

Home Rule and the Scale of Governance

Climate change is a wicked, messy policy problem[30] for a number of reasons, notably including the cross-scale challenges generated by the institutional mismatches among the scale of the problem's causes and effective and feasible policy responses. Reflecting this, there was uncertainty on whether local regulations should precede state regulations, and how the respective roles of local and state governments would be defined. As noted above, Connecticut is a "home rule" state, with the decision-making process regarding land use weighted heavily toward the municipal government level. There is a need to use local governance structures to implement adaptation, but significant differences in size, affluence and opinions exist between the 169 municipalities within the state. Some suggestions highlight the need for a menu of adaptation options which may be selected by coastal communities based on their appropriateness or political viability. However, adaptation will require broader regional and statewide approaches as well. Thus it was recognized that guidance and leadership from the state will be useful to guide and facilitate local actions. Some audience members suggested building upon the existing Coastal Management Act, which has a tiered, geographic and regulatory approach already in place.

Regulatory Changes

According to one conference participant, government needs to "provide tools and remove obstructions" while recognizing the importance of protecting the public trust, by encouraging "less damaging alternatives" to development. Those in government need to have the enabling statutes amended to implement such advice. Thinking "outside the box", this audience member suggested that Sections 8-2 and 8-2b of the Connecticut General Statutes could be amended to include:

- "Such regulations may also encourage climate adaptation patterns of development to minimize uncertain costs of reconstruction, emergency response, and clean-up after severe weather events of high impact and low probability."

- "Such regulations may also provide incentives for developers who include accommodations for sea level rise and uncertain, anticipated relocations of high tide lines including transferable development rights, designated shoreline and inland wetland conservation

[30] For a discussion of wicked, messy policy problems, *see* Robert T. Lackey, *Axioms of Ecological Policy*, 31 FISHERIES 286-90 (2006). "Wicked, messy ecological policy problems share several qualities: (1) complexity — innumerable options and trade-offs; (2) polarization — clashes between competing values; (3) winners and losers — for each policy choice, some will clearly benefit, some will be harmed, and the consequences for others is uncertain; (4) delayed consequences — no immediate "fix" and the benefits, if any, of painful concessions will often not be evident for decades; (5) decision distortion — advocates often appeal to strongly held values and distort or hide the real policy choices and their consequences; (6) national vs. regional conflict — national (or international) priorities often differ substantially from those at the local or regional level; and (7) ambiguous role for science — science is often not pivotal in evaluating policy options, but science often ends up serving inappropriately as a surrogate for debates over values and preferences." *Id.* at 286.

> areas which reduce local tax assessments, designed-in portability and modular construction which allows for future relocation and/or raising of structures as less damaging design alternatives to protect expanding public trust areas, and voluntary abandonment of the right to maintain the use of structures in vulnerable areas based on a schedule for such abandonment to be filed on the land records of such municipality."

Several participants proposed that innovations, improvements or mandated changes in building codes, and the design of shoreline structures would enhance coastal resilience. Some were concerned that these changes would increase building costs.

Amending Connecticut's Coastal Management Act (CMA) to increase its focus and support for adaptation was a common discussion topic and suggestion, however divergent preferences existed among participants regarding shore armoring or living shorelines approaches.[31] Some suggested the need to add flexibility to the CMA to accommodate the need for engineered adaptation solutions, given that under the current regulatory scheme those efforts are often either non-starters or too complex to implement. Others suggested that hard armoring is not the solution and proposed that flood-proofing by raising elevations would be more effective. It was agreed that land use policies are a critical component, and will require significant public education and outreach efforts. Some participants further proposed that the Connecticut Tidal Wetlands Act could be amended to include a mandatory setback, which towns could implement under the Inland Wetlands and Watercourses Act.

There were discussions on the Army Corps of Engineers' current efforts that would allow the filling of wetlands for a fee to be used for mitigation and or wetland creation elsewhere. Some suggested the elimination or restructuring of the federal flood insurance program, its implicit subsidies, and facilitation of new construction and significant reconstruction in flood-prone areas.

Enforcement

Some participants noted that these changes in building codes or other public policies would not be effective without compliance, suggesting the need for sustained and strong monitoring and enforcement programs.

Novel Approaches/Practices

There were suggestions to include sea level rise as a factor in local and state planning – plans of conservation and development and other plans – and to allow towns to consider sea level rise when considering permit applications for development or construction activities in coastal zones. It was suggested to require property sellers to verify, on real estate disclosure forms, that all structures on a given piece of property have all the necessary permits and to further explicitly note that property ownership does not include the right to construct structures below the high tide line. It was suggested to protect and, when possible, acquire marshland, dunes and coastal wetland as barriers against storm

[31] The passage into law earlier this year of Senate Bill 376, now known as Conn. Public Act 12-101, is highly relevant to this debate which exists in the larger public sphere as well as among participants of the conference. The act, which amended Connecticut's Coastal Management Act, states "A coastal site plan for a shoreline flood and erosion structure shall be approved if the record demonstrates and the commission makes specific written findings that such structure is necessary and unavoidable for the protection of infrastructural facilities, cemetery or burial grounds, water-dependent uses fundamental to habitability or primary use of such property or inhabited structures or structure additions constructed as of January 1, 1995, that there is no feasible, less environmentally-damaging alternative and that all reasonable mitigation measures and techniques are implemented to minimize adverse environmental impacts."

surges and buffers against sea level rise and coastal flooding, and to take steps to reduce storm water runoff. It was urged that towns have up-to-date Hazard Mitigation Plans in place and noted that federal grant funds (distributed by FEMA) are usually contingent upon having such a plan. Planning also forces communities to identify if they are prepared and how they can improve their preparedness and ultimately their resilience.

Economic Incentives

How do we balance the economic needs of towns, the state, businesses, and homeowners with the urgency of adaptation? Innovative funding mechanisms will be necessary to support implementation of local/regional action. Monetary incentives/disincentives such as flood insurance taxes or the incorporation of risks into property value may be powerful means to promote adaptation. Participants proposed to take advantage of brownfields in Bridgeport and New Haven as opportunities to develop natural areas/buffers. Such measures would raise property values and help coastal communities build resilience.

The Role of Insurance Companies

The potential role of insurance companies was a major discussion point. Some participants suggested that these companies should leverage their power to incentivize the incorporation of adaptive building technologies and strategies. Refusal to provide insurance might prevent rebuilding in vulnerable or previously affected areas. Insurance policies that require adaptive structural changes or other strategies with adaptation benefits could be tied to reductions in premiums. Other participants suggested that the insurance industry could potentially be a new source of funding to implement actions that reduce vulnerabilities and are thus likely to result in lower damage claims.

Public Awareness and Education

The public needs to recognize that a changing climate is going to create a new suite of problems and exacerbate existing ones. Connecticut's coastal residents and communities are for the most part affluent, and getting homeowners to recognize that they are assuming a risk when they choose to live on the shore will not be an easy task. Engineering solutions cannot solve all the problems associated with a changing climate, and coastal communities will need ultimately to view climate adaptation, not merely as a series of costly mandates, but as beneficial policies that will enhance the resilience and livability of these communities. A review of recent behavioral science research and other relevant publications associated with public perceptions of climate change should be conducted to target strategies that maximize the effectiveness of communication approaches.

In Connecticut, municipal land use commissions and boards are comprised of public volunteers who make decisions on local issues related to climate change adaptation, and need to be better educated to understand the full implications of permitting more development in flood zones, in waterfront areas, and near critical natural resources as sea level continues to rise. Efforts need to be made to encourage more working professionals, scientists, and engineers to become involved with local government and advocate policy change. It was suggested that with greater public education and awareness, people and infrastructure could be relocated and plans for the management and/or adaptive reuse of vulnerable areas could be generated before large-scale disasters occur, leaving abandonment as the only recourse at that point. It was pointed out that some individuals perceive a significant disconnect between themselves and their environment, and perceiving no consequences from their activities. Changing this mindset will go a long way towards addressing climate change problems.

Inclusive Approaches

The issue of inclusivity and need for more holistic approaches was identified. Rather than treat climate adaptation as an end unto itself, it would be desirable to connect or incorporate adaptation planning into existing environmental management and conservation planning activities. Strategies such as coastal habitat restoration can be integrated into on-going processes focused on systemic waterfront/community improvement, green infrastructure, and providing public access, recreational, and tourism opportunities.

Municipal policies need to consider the reuse of groundwater and treated effluent for applications such as landscaping, lawn watering, and water features like public fountains rather than drawing on potable water sources and Connecticut's rivers and aquifers. Future withdrawals from watercourses will further lower water levels, causing increased warming and higher rates of evaporation. It is important to consider the impact of potentially increasing storm frequency and intensity on inland development and infrastructure and the implications of this shift on stormwater generation. This highlights the need to manage better or reduce stormwater runoff in these areas. Finally, in coastal areas saltwater intrusion into freshwater resources will become a more frequent occurrence that will need to be mitigated or resolved. The Association of State Floodplain Managers and the local Chambers of Commerce may be important actors in addressing the resulting issues that arise.

Environmental Justice

Several conference participants noted the importance of keeping in mind the environmental justice implications of sea level rise and climate change adaptation. Although Connecticut as a whole and the coastline communities in particular are among the most affluent in the United States, pockets of extreme poverty exist in both the small towns and major cities. It is these impoverished populations that disproportionately include racial and ethnic minorities, the elderly, and the disabled, which are likely to be overwhelmingly impacted by climate change and unable to easily adapt. We have only to look at the tragedy which unfolded in New Orleans during and after Hurricane Katrina in 2005 to appreciate the extreme vulnerability of these populations within our stratified society and to understand the socio-economic landscape of death and destruction. Although few direct suggestions emerged from this conference to directly address the environmental justice themes embedded in climate change adaptation efforts, this is surely a topic that deserves additional examination and targeted work.

## IV. Lessons Learned

The attendance at this conference testifies to the considerable interest in the *legal solutions to coastal climate change adaptation in Connecticut,* and this interest was not merely held by individuals living or working within the state of Connecticut. Attendees hailed from Connecticut as well as several other Northeast and mid-Atlantic states, filling the meeting room to capacity. Registration closed several days early because it was feared that despite moving the venue to a larger room there would be insufficient space. A post-conference survey clearly indicated that while academically oriented presentations were interesting and useful to a point, there is an unmet demand and need for follow-up conversations to occur between seasoned (and not-so-seasoned) practitioners who are in the business of planning for and implementing climate change adaptation. There is no clear venue for such conversations to transpire among municipalities, regional entities, the state, or even federal managers. Nor are there clear forums to share stories regarding the successes and failures of climate adaptation

strategies. The session on state and municipal strategies for climate adaptation and the opportunities for networking were the most valued aspects of the conference. Respondents expressed desire for more discussions on the range of legal and policy approaches to climate change adaptation, reinforcing the need and urgency for such exchanges.

## V. Concluding Thoughts on Legal and Policy Solutions for Adaptation in Connecticut

The *Legal Solutions* conference drew considerable attention, maybe because of the paucity of forums to discuss climate change adaptation between local leaders and practitioners, state agencies, and academics. It is clear that the "home rule" doctrine has significant influence on the ways in which Connecticut can prepare and adapt to a changing climate. Local governments appeared to have a strong desire to see the state in a leadership role, providing guidance and facilitating municipal adaptation activities, through changes in the regulatory context and to some extent through state enforcement efforts.

Climate adaptation for coastal states, like Connecticut, represents one of the most complex challenges that will be faced in this century. All levels of government will be required to work together to develop feasible and effective approaches. Participants expressed interest in a range of novel approaches and practices that may be feasible at the local level in the present regulatory environment. One size will not fit all, however. Connecticut municipalities have different environmental, social and political environments and different adaptation abilities and needs as well. Assembling a suite of adaptation options would be a useful first step to address the broad range of municipal adaptation needs and desires. Economics will play a large role in adaptation efforts and monetary incentives and disincentives at the individual and community levels will no doubt be powerful tools to promote adaptation activities and the adoption of new and more resilient technologies. Insurance companies will likely play an important role in this regard. Public outreach efforts will be critical to engage and educate the public, encouraging them to play an active role in climate change adaptation planning and implementation and, at the same time, address some of the pernicious environmental justice issues which our society faces and will be exacerbated by climate change.

Ultimately, we will most likely never be able to stop adapting to climate change impacts. Efforts to adapt and enhance the resilience of the state and each of its communities will have to become an ongoing process – a process that will involve anticipating and being prepared for change, whatever those changes may be, and decreasing the vulnerabilities of people and communities in a fair and equitable manner. Resilience is not about stability and recovery to a previous state of being, but rather about flexibility and adaptation, continuous reinvention in order to persist. By forging broad and inclusive approaches that integrate ongoing planning efforts with existing and new environmental strategies, we will be taking a step in the right direction, but it is clear that this step will need to be followed by many more.