A Local Solution for Climate Change: The Climate Adaptation Board

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Abstract: Climate change will impact coastal water resources like wetlands and watercourses, and tidally influenced areas in Connecticut because of sea level rise and potential weather pattern changes. The impacts will occur across a variety of temporal and spatial scales. Climate change adaptation is a multi-faceted political, legal, and land use issue that will potentially change the character of many communities. It is also a thorny governance problem because of conflicting jurisdictions, limited natural resources, and changing land uses. Existing governance entities that conduct natural resource governance have jurisdictional overlap, do not match the scale of the necessary climate adaptation, or are not organized to handle rapid or variable rates of climate change onset. Potential governance solutions should incorporate the "home rule" tradition in Connecticut and New England. The authors propose a new governance entity called the Climate Adaptation Board that emphasizes the advantages of municipal level governance for climate change adaptation. It is modeled after the unique Municipal Inland Wetland Agencies which are volunteer governance entities that regulate inland wetlands and watercourses within the towns of Connecticut.

I. Introduction

Climate change is the anthropogenic modification of the earth's atmosphere through the addition of carbon dioxide and other gases that alter the earth's heat budget and cause resulting changes in the climate and biosphere. A variety of dynamic and emergent health, societal, economic, ecological, and environmental impacts will potentially occur from climate change processes in Connecticut. Planning is

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already beginning in the state for direct impacts such as sea level rise, flood events and coastal erosion in and around local water resources, coastlines, wetlands and watercourses, and adjacent lands. [2]

Because water and natural resource areas act as commons area with competition between a variety of economic interests, political actors, and environmental services, land use governance systems already exist in Connecticut to manage these areas but they were not designed for dynamic environmental and land use change. Multiple governance systems in Connecticut have jurisdiction around these vulnerable water resources, coastal areas, and adjacent areas linked to these resources.[3] Potential jurisdictional and citizen conflicts over land use and divergent policy implementation approaches could occur during periods of rapid climate change. Further emergent impacts may occur at multiple temporal and spatial scales.

Connecticut has an unusual home rule political culture in water and natural resource management, and strong municipal governments. While climate change impacts will occur at multiple scales and have jurisdictional overlap, many of the direct land use impacts such as land and building inundation and infrastructure impacts will affect citizens at the site or local level. The authors propose that the current multi-jurisdictional governance approach of water resources and adjacent land in Connecticut will not be effective for handling climate change adaptation in coastal areas because jurisdictional areas are organized around activities, and not dynamic risk assessment and responses to climate change processes and impacts.[4] Rapid and flexible responses, which reflect community values to enhance legitimacy, are necessary for managing impacts at the site and local levels.

To help coastal Connecticut manage climate change and the future variability of dynamic environmental conditions, this article proposes an alternative municipal governance system called the Climate Adaptation Board (CAB) which could increase the municipal capacity to manage dynamic and chaotic climate change impacts and land use adaptation to areas in and around wetlands and watercourses. Ideally, this approach should be legitimate, equitable, and effective.[5] The CAB's gains legitimacy because it is complimentary to Connecticut's home rule and direct democracy traditions, it is equitable because it matches the scale of impacts with the scale of governance, and it is potentially effective because it is modeled on Connecticut's system of wetlands governance.

This system is modeled after the Municipal Inland Wetland Agencies (MIWA) through which each of the 169 towns manages their own wetlands and watercourses with an unpaid executive board with enforcement powers that determines allowable activities and development around local natural resources.[6] A bottom-up governance approach for natural and water resource areas impacted by climate change could be a useful model for other communities and regions as well.

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[2] *See generally*, CONN. DEP'T OF ENVTL. PROTECTION, FACING OUR FUTURE: ADAPTING TO CONNECTICUT'S CHANGING CLIMATE (2009), *available at* http://www.ct.gov/dep/lib/dep/air/climatechange/adaptation/09032ofacingourfuture.pdf .

[3] Under Connecticut's Inland Wetlands and Watercourses Act, municipal wetland agencies have authority over activities within wetlands and watercourses, as well as activities in surrounding upland areas likely to affect wetlands and watercourse. CONN. DEP'T OF ENVTL. PROTECTION, GUIDELINES FOR UPLAND REVIEW AREA REGULATIONS UNDER CONNECTICUT'S INLAND WETLANDS AND WATERCOURSES ACT 1 (1997), *available at* www.ct.gov/dep/lib/dep/water_inland/wetlands/upland_review_document_june1997.pdf.
Upland areas designated as within the jurisdiction of the Municipal Inland Wetlands Agency are referred to as "Upland Review Areas." [hereinafter UPLAND REVIEW AREA GUIDELINES].

[4] *See* CONN. GEN. STAT. § 22a-38(13) (defining "regulated activity" not wetland areas).

[5] *See* W. Neil Adger, Nigel W. Arnell, & Emma L. Tompkins, *Successful Adaptation to Climate Change Across Scales*, 15 GLOBAL ENVTL. CHANGE 77-86 (2005).

[6] CONN. GEN. STAT. § 22a-42.

II. Connecticut Geography

Connecticut is a small urban state with approximately 600 miles of coastline, and it was originally settled in the 17th century. Population centers are on the coastal regions and along the large tidally influenced rivers. Just over a million people live in the 24 towns on the Connecticut shore of the Long Island Sound[7] and many of these coastal communities are wealthy: some are among the richest communities in the country.[8] The shoreline communities have variable population densities, land use, and zoning. Despite the presence of urban centers like Greenwich, Stamford, Bridgeport, the New Haven area, and Hartford, no town in Connecticut has a population greater than 140,000.[9] Extensive residential developments exist in coastal Connecticut, especially in wealthy Fairfield County. The potential financial impacts of sea level rise are enormous: as of 2007, about $400 billion in insured assets are present along coastal Connecticut.[10]

Connecticut sits on a passive coastal margin like much of the Atlantic coast of North America and consists of wide coastal plains and relatively flat continental shelves offshore.[11] The coastal areas of Connecticut and the surrounding regions are not virginal tracts; rather they have been subject to land use modifications and alteration for centuries. For instance, approximately 33% of the New England and Mid-Atlantic coast exhibits some type of coastal structures or development, according to data derived from an overflight and aerial surveillance in 2009.[12] When sea levels increase vertically, flat areas get inundated faster than areas with greater slopes. Glacial processes from repeated Ice Ages heavily influence the landscape with a variety of glacial features including moraines and outwash areas that are rich in sediments overlaying bedrock areas. Many of the shore regions are adjacent to higher ground, called uplands, which are typically composed of bedrock.

The shoreline areas of coastal Connecticut can be classified into four types: (A) rocky coasts; (B) bluffs with narrow fronting beaches; (C) mainland beaches connected to the mainland with fronting bluffs, dunes, or extensive wetlands; and (D) barrier island beaches. Shore types A and B are less vulnerable to sea level rise because of their resistant erosion (Type A) and their vertical elevation difference (Type B). Shore type D is sensitive to sea level rise because of the dynamic nature of barrier islands but Connecticut has only a small number of these features.[13] Much of the Connecticut shore is type C which is relatively flat, consists of sediments that erode quickly compared to bedrock; and is vulnerable to sea level rise.

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[7] While 24 towns border Long Island Sound, 33 towns have coastal access sites. Long Island Sound Resource Center, Coastal Access Guide, Town Search, http://www.lisrc.uconn.edu/coastalaccess/searchtown.asp (last visited June 14, 2012).

[8] *See* Conn. Dep't of Econ. and Community Dev., Connecticut Income Data, http://www.ct.gov/ecd/cwp/view.asp?a=1106&q=250652 (last visited June 14, 2012).

[9] CONN. DEP'T OF PUBLIC HEALTH, ESTIMATED POPULATIONS IN CONNECTICUT AS OF JULY 1, 2010, *available at* http://www.ct.gov/dph/lib/dph/hisr/hcqsar/population/pdf/pop_towns2010.pdf.

[10] CONN. DEP'T OF ENVTL. PROTECTION, NATURAL HAZARD MITIGATION PLAN FOR 2007-2010 iv (Dec. 2007) *available at* www.ct.gov/dep/lib/dep/water_inland/hazard_mitigation/plan/hazardmitigationplan.pdf.

[11] "Passive" in this context refers to the lack of interaction between plates which reduces the risks of earthquakes and subsidence events offshore.

[12] U.S. GEOLOGICAL SURVEY, NATIONAL ASSESSMENT OF SHORELINE CHANGE: HISTORICAL SHORELINE CHANGE ALONG THE NEW ENGLAND AND MID-ATLANTIC COASTS 26 (2010), *available at* http://pubs.usgs.gov/of/2010/1118/pdf/ofr2010-1118_report_508_rev042312.pdf.

[13] The adjacent state of Rhode Island has extensive barrier island features.

III. Environmental Impacts of Climate Change

Long-term sea rise (i.e., vertical changes in the surface of the ocean) is part of an ongoing historical environmental trend. Worldwide sea levels are rising around 1.7 mm/year.[14] Along the Connecticut coast at New London, sea levels increased 2.13 mm (+/-0.15 mm) per year between 1939 and 1999.[15] Utilizing different models and scenarios, average sea levels have been projected to increase between 20 cm and 120 cm. The adjacent state of Rhode Island utilizes sea level rise estimates of between three and five feet (i.e., between 1 and 1.66 meters) for planning purposes which, if accurate, will cause changes in the near shore areas such as land and habitat inundation, infrastructure damage, and property losses.[16] For New England, the historical coastline is eroding at a median rate of 0.4 m per year in the landward direction. About 70% of the sampled transects in this study are eroding in both the short-term (decadal) and long-term (geologic time). Only 3% of sampled sites are eroding more rapidly than 3 m/yr in the landward direction.[17]

The expected impacts of climate changes to coastal Connecticut include higher sea levels, more variable and severe weather conditions, and rainfall changes. The climate of the northeastern United States in the coming century is expected to become warmer with winter and summer temperatures rising from 6°F to 14°F above historic averages.[18] Winter precipitation may increase an average of 20 to 30%, with a much greater proportion of winter precipitation expected to fall as rain rather than as snow.[19] The flashiness of precipitation will increase and more storm events are likely to occur. For instance, the extreme coastal flooding that now occurs only once a century could strike New York City on average once every decade and every year or two in Boston and Atlantic City.[20] Connecticut has seen several historic flood events in the past decade though the precise link with climate change is unknown and difficult to quantify.

IV. Land Use Impacts and Adaptation

In referring to adaptation, this article emphasizes environmental issues such as sea level rise and extreme weather events. It does not address climate change adaptation in its entirety, including health or infrastructure adaptations. The environmental, economic, and political impacts of climate change will occur over spatial scales and may unfold in chaotic, unpredictable, and variable time frames. The unpredictable impacts will enhance disputes over property damage, the utilization of natural systems, and water access as citizens and different levels of government struggle with resource losses and funding adaptation responses. Many direct and critical impacts of climate change (coastal inundation of houses, damage to infrastructure, changes in runoff patterns) will be primarily experienced at the site, local, and intra-municipal levels by the citizens of Connecticut and others in coastal areas.

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[14] U.S. ENVTL. PROTECTION AGENCY, U.S. CLIMATE CHANGE SCIENCE PROGRAM, COASTAL SENSITIVITY TO SEA LEVEL RISE: A FOCUS ON THE MID-ATLANTIC REGION 2 (2009), *available at* http://www.epa.gov/climatechange/effects/coastal/pdfs/SAP_4-1_SynthesisandAssessmentProduct.pdf.

[15] *Id.* at 19.

[16] NOAA COASTAL SERVICES CENTER, LOCAL STRATEGIES FOR ADDRESSING CLIMATE CHANGE 12 (Feb. 2009), *available at* https://www.csc.noaa.gov/magazine/climatechangestrategies.pdf.

[17] USGS, *supra* note 12, at 27.

[18] PETER C. FRUMHOFF ET AL., CONFRONTING CLIMATE CHANGE IN THE U.S. NORTHEAST: SCIENCE, IMPACTS, AND SOLUTIONS x (2007), *available at* http://www.northeastclimateimpacts.org/pdf/confronting-climate-change-in-the-u-s-northeast.pdf.

[19] *Id.* at 8.

[20] *Id.* at 15.

A. Stormwater and Runoff Changes

If as expected the typical design[21] storms increase and rainfall becomes more "flashy" than expected, stormwater systems away from coastlines may become more vulnerable to flooding, erosion, and infrastructure damage. Rapid expenditures of money for infrastructure repair may become common. New urban development and the associated construction of impervious surfaces, like rooftops, roads, and parking lots, make flood risk potentially even more severe because the addition of impervious cover alone in a watershed can increase runoff exponentially.[22] Climate change will impact stormwater infrastructure both in single storm events and over greater durations as stream and receiving water change to meet altered precipitation, runoff, and evapo-transpiration patterns. The U.S. Army Corp of Engineers believes that, "**climate change could affect all sectors of water resources management**, since it may require changed design and operational assumptions…" and long-term assumptions of continual environmental change.[23]

B. Coastal Impacts and Adaptations

Coastal impacts will occur because of sea level rise, a very slow process, and the increasing frequency of large storms, which are sudden and unpredictable. The process of sea level rise will take decades.[24] In addition, emergent environmental and social impacts may occur that are unpredictable and require an avenue for adaptive management. For instance, conflicts may occur over the zoning enforcement of adaptive management methods, and the reaction to the variable property impacts (i.e., abandonment versus adaptation versus accommodation) which depend on the financial resources and political connections of local citizens. Intra-community conflicts over perceived fairness of the municipal governance system may become more common.

As with other land use problems, the adaptation issues, problems, and conflicts related to climate changes are multivariate and multi-dimensional. Unexpected emergent processes and impacts must be accounted for with climate change and sea level rise adaptation. Therefore, adaptation solutions for climate change in Connecticut include different components of land use management, engineering, conservation, and governance with different time horizons and spatial scales. Solutions can be grouped into the following categories: (1) shoreline armoring and elevation change, (2) accommodation, and (3) retreat.[25] Already in Connecticut, conflicts exist between state environmental professionals who favor "soft" and non-structural planning-oriented solutions, and local officials and property rights advocates who want the flexibility to control their own property and limit takings.[26] A recently passed law in Connecticut attempts to balance these two sides by incorporating sea level rise planning into state policy for the first time while discouraging structural protection schemes.[27] This is a policy that is far

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[21] A design storm is the volume, rate, or depth of precipitation that an engineered water resources system is designed to handle.

[22] *See* Chester Arnold & James Gibbons, *Impervious Surface Coverage,* 62 J. OF THE AM. PLAN. ASS'N 243-58, (1996).

[23] U.S. ARMY CORPS OF ENGINEERS, USACE CLIMATE CHANGE ADAPTATION PLAN AND REPORT 2011 4 (Sept. 2011), *available at* http://www.corpsclimate.us/docs/usaceadaptnplanreport2011v02.pdf (emphasis in original).

[24] *Id.* at 33.

[25] JAMES TITUS, U.S. ENVTL. PROTECTION AGENCY, ROLLING EASEMENTS 1 (2011), *available at* www.epa.gov/cre/downloads/rollingeasementsprimer.pdf.

[26] Jan Spiegel, *Coastal Management Legislation Balances Environmental Concerns with Property Rights*, THE CT MIRROR, May 9, 2012, *available at* http://www.ctmirror.org/story/16289/coastal-management-legislation-balances-environmental-concerns-property-rights (last visited June 15, 2012).

[27] An Act Concerning the Coastal Management and Shoreline Flood and Erosion Control Structures, 2012 Conn. Legis. Serv. P.A. 12-101 (S.B. 376) (June 8, 2012).

harder to implement in urban areas than rural areas. Nevertheless, the Connecticut Department of Energy and Environmental Protection (DEEP) has jurisdiction on coastlines where impacts will be felt first by citizens within local towns. The law of erosion or law of accretion is a common law concept (both marine and riverine) where the property boundary moves with the natural boundary line and it appears to apply here.[28] No matter how far the coastline migrates into the Connecticut municipalities, DEEP will have jurisdiction at the coastal interface between land and water.

V. Issues in Governance and Natural Resource Management

A. Bottom-up vs. Top-down Governance

Water and natural resources areas, such as coastal wetlands and watercourses, are complex natural resource systems that are difficult to manage and govern because of overlapping jurisdictions, multiple ownership, and the functioning of their resource and land use areas as a commons.[29] These areas have a limited capacity to provide environmental services and products. Conflicts over natural and water resource commons may become more dynamic and unpredictable with additional problems interlinking between scales of governance. These changes can be difficult to manage due to variability in process scales and spatial distribution of resources.[30] Top-down governance structures have many strengths when it comes to managing natural resource commons including the application of significant financial and human resources to problems such as climate change, the consistency in the application of laws over different regions, and the ability to control local governance. But large institutions, such as state governments, can also be slow to adapt to dynamic changes and blunt in their governance approach with smaller governmental entities: a critical consideration in a home rule state such as Connecticut. A potential problem with centralized resource governance is the inability to recognize that individual ecological regions are composed of a unique mix of biophysical and social attributes: another critical consideration in a state like Connecticut with remarkable geographic, social, and economic diversity.[31]

Local governance has many benefits that are particularly useful for water and natural resource areas potentially impacted by climate change. When detailing the benefits of local decision-making, researchers focus on closeness to the issues, local knowledge, and participation. Community resource management puts management in the hands of local populations, who have more interest in sustainable use than higher-level managers or corporations.[32] For instance, "local communities are more cognizant of the intricacies of local ecological processes and practices; and they are more able to

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[28] JOHN JACOB & STEPHANIE SHOWALTER, THE RESILIENT COAST: POLICY FRAMEWORKS FOR ADAPTING THE WETLANDS TO CLIMATE CHANGE AND GROWING COASTAL AREAS OF THE U.S. GULF OF MEXICO 23 (2007), *available at* http://www.urban-nature.org/publications/documents/ResilentCoastWetlands-sm.pdf.

[29] *See* Elinor Ostrom & Harini Nagendra, *Insights on Linking Forests, Trees, and People from the Air, On the Ground, and in the Laboratory*, 103 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE U.S.A. 19,224-19,231 (2006).

[30] *See* Krister Andersson & Elinor Ostrom, *Analyzing Decentralized Resource Regimes from a Polycentric Perspective*, 41 POL'Y SCI. 71-93 (2008).

[31] *See* Harini Nagendra & Elinor Ostrom (Lead Author); Peter Saundry (Topic Editor), *Governing the Commons in the New Millennium: A Diversity of Institutions for Natural Resource Management*, *in* ENCYCLOPEDIA OF EARTH (Cutler J. Cleveland, ed. First published in the Encyclopedia of Earth Aug. 12, 2008; Last revised Date August 12, 2008), http://www.eoearth.org/article/Governing_the_commons_in_the_new_millennium:_A_diversity_of_institutions_for_natural_resource_management (last visited June 15, 2012).

[32] *See* Anna Lowenhaupt Tsing, J. Peter Brosius & Charles Zerner, *Assessing Community-based Natural-resource Management*, 28 AMBIO 197–99 (1999).

effectively manage those resources through local or 'traditional' forms of access."[33] There are also advantages to decentralized systems and local knowledge.[34] Several scholars contend that localized decision-making is the key to achieving social justice and ecological sustainability and that incorporating indigenous knowledge is critical.[35]

That being said, local governance is challenging. Some researchers posit that local governance is no better than any other kind of governance. Researchers argue against what they call the "local trap" of "development researchers and practitioners falsely assum[ing] that localized decision-making is inherently more socially just or ecologically sustainable." It can be argued that there is nothing inherent about scale, whether positive or negative.[36] Others cite evidence that so-called participation can devolve into a scenario where locals are "co-opted simply to slot into [pre-determined] externally defined objectives."[37] To answer these problems, scholars promote a "sophisticated governance system [which] recognizes the multi-scale aspects of natural resource governance as well as the presence of countervailing incentives, and seeks to correct them."[38] In Connecticut, the local MIWAs, if aggregated geographically, have avoided the "local trap" by independently governing and policing their own municipalities. They successfully permit, enforce, and work with other levels of government and balance land use impacts and natural resource protection in and around wetlands and watercourses.[39]

B. Matching Scale of Governance to Process Impacts

The environmental (inundation, flooding, weather pattern changes, flash flooding) and social (loss of housing, recreational resources, community buildings, infrastructure damage) impacts of climate change may occur across many scales. For the communities of Connecticut, many of the impacts are experienced within municipalities or even at the site level. "Bridging organizations" or boundary-spanning strategies can provide governance links across scales and at multiple levels.[40] Elinor Ostrom, a Nobel Prize winner, describing research on climate change and adaptation, encourages polycentric governance approaches that "facilitate achieving benefits at multiple scales as well as experimentation and learning from experience with diverse policies."[41] She proposes that climate change in particular should be addressed through "small- to medium-scale units that are linked together through diverse information networks."[42] Andersson and Ostrom posit that a "sophisticated governance system

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[33] *Id.* at 197.
[34] *See* Andersson & Ostrom, *supra* note 30.
[35] *Id. See also*, Nancy Peluso, *Traditions of Forest Control in Java: Implications for Social Forestry and Sustainability*. 32 NAT. RESOURCES J. 883–918 (1992) and Tsing, *supra* note 32.
[36] *See* Mark Purcell & Christopher Brown, *Against the Local Trap: Scale and the Study of Environment and Development Progress*, 5 DEV. STUD. 279–97 (2005).
[37] Peris Jones, *Urban Regeneration's Poisoned Chalice: Is There an Impasse in Community Participation-Based Policy?* 40 URBAN STUD. 581, 599 (2003).
[38] Andersson & Ostrom, *supra* note 30, at 88.
[39] *See* CONN. DEP'T OF ENVTL. PROTECTION, STATEWIDE INLAND WETLANDS AND WATERCOURSES ACTIVITY REPORTING PROGRAM, STATUS AND TRENDS FOR THE YEAR 2007 (2010), *available at* http://www.ct.gov/dep/lib/dep/water_inland/wetlands/stat_trends__2007_full_doc.pdf [hereinafter STATUS AND TRENDS REPORT].
[40] *See generally*, Nitaya Kijtewachakul, Ganesh P. Shivakoti, & Edward L. Webb, *Forest Health, Collective Behaviors, and Management,* 33 ENVTL. MGMT. 620-36, (2004). *See also*, Carl Folke et al., *Adaptive Governance Of Social-Ecological Systems,* 30 ANN. REV. ENVTL. RESOURCES 441-73 (2005).
[41] Elinor Ostrom, *Polycentric Systems for Coping with Collective Action and Global Environmental Change*, 20 GLOBAL ENVTL. CHANGE 550, 550 (2010).
[42] *Id.* at 556.

recognizes the multi-scale aspects of natural resource governance as well as the presence of countervailing incentives, and seeks to correct them."[43]

There may be inherent challenges of the governance of natural resource systems include matching scales of biogeophysical systems with scales of management systems, avoiding scale discordance; and accounting for cross-scale dynamics.[44] To address such challenges, scholars recommend using boundary spanning between scientists, decision-makers, and political actors at different scales, as well as using "scale-dependent comparative advantages – coordinating the allocation of resources, technical expertise, and decision-making authority to best capitalize on scale-specific capabilities," and "employ[ing] adaptive assessment and management strategies constructing long-term, iterative, experiment-based processes of integrated assessment and management."[45] To achieve the goals of climate change adaptation policies, "multi-stakeholder processes must formally feed into decision-making forums or they risk being viewed as irrelevant by policy-makers and stakeholders."[46]

VI. Governance of Natural Resources In Connecticut

Some of the critical properties of governance necessary for management of the non-linear and dynamic impacts of climate change are (1) the ability of an organization to learn, (2) matching the scale of biophysical systems with management scale, and (3) the deployment of resources at the appropriate scale. As a New England state, Connecticut shares in the regional tradition of direct democracy and local governance.[47] Connecticut has a strong tradition of "home rule" governance. It is a philosophy of sufficient importance that a website called the Connecticut's Heritage Gateway has its own section on Home Rule.[48] As part of the home rule philosophy, Connecticut disbanded much of the power of county governments in the 1960s. Furthermore, larger metropolitan-style governments are not popular with the citizens of Connecticut. The citizens of Connecticut identify with their local government despite the inherent inefficiencies of this approach for managing regional land use problems and political issues.[49] As such, governance in and around natural and water resources within Connecticut is controlled primarily by the 169 towns and the state government.

The coastal areas of Connecticut are on the front lines of climate change impacts and most of the potential impacts such as inundation, flooding, and infrastructure damage are experienced at fine scales within municipal boundaries such as the local or site scale. Natural and water resources, along with adjacent areas potentially impacted by climate change, are concurrently managed within a complicated system of overlapping local and state jurisdictions.

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[43] Andersson & Ostrom, *supra* note 30, at 88.

[44] *See* David Cash & Susanne Moser, *Linking Global and Local Scales: Designing Dynamic Assessment and Management Processes*, 10 GLOBAL ENVTL. CHANGE 109-20 (2000).

[45] *Id.* at 118.

[46] Evan Fraser et al., *Bottom Up and Top Down: Analysis of Participatory Processes for Sustainability Indicator Identification as a Pathway to Community Empowerment and Sustainable Environmental Management*, 78 J. OF ENVTL. MGMT. 114, 114 (2006).

[47] *See* JOSEPH ZIMMERMAN, THE NEW ENGLAND TOWN MEETING: DEMOCRACY IN ACTION (Praeger Pub.: Westport, CT 1999).

[48] Connecticut's Heritage Gateway, *City, Town, Burough, County*, http://www.ctheritage.org/biography/topical_govsince1818/city.htm (last visited Jan. 15, 2012). At the time of publication, this webpage is no longer available. The Connecticut Humanities Council has launched a new website at http://connecticuthistory.org/.

[49] *See* Neil O. Littlefield, *Municipal Home Rule – Connecticut's Mature Approach*, 37 CONN. BAR J. 390 (1963).

A. Jurisdictions within Coastal Areas

In the state of Connecticut, wetlands and watercourses are regulated simultaneously by the state (a top-down governance system) and from within the municipalities (local or bottom-up control) in an overlapping and complicated governance structure. The Connecticut Department of Energy and Environmental Protection (DEEP), Office of the Long Island Sound (OLISP) has jurisdiction over tidal wetlands[50] and navigable waters of the state through the Structures, Dredging and Fill Act[51] and the Tidal Wetlands Act.[52] OLISP issues permits for activities to citizens from across the coastal areas of Connecticut and may also review the impact of activities in surrounding uplands.

In addition, the Connecticut Coastal Management Act[53] (CMA) lays out the legislative findings of general goals and policies for coastal areas and Long Island Sound which include maintaining the "natural relationship between eroding and depositional coastal land forms … and … minimiz[ing] the adverse impacts of erosion and sedimentation on coastal land uses through the promotion of nonstructural mitigation measures."[54] The CMA identifies those land use activities that require review by municipalities and which are exempt. Shoreline flood and erosion control structures which are likely important in inundation controls have a particularly severe threshold for approval under the CMA as an applicant needs to meet seven criteria designated by DEEP. For example, a control structure is not consistent with the CMA unless, among other thing, there has been a "*clear* and *compelling* demonstration that nonstructural alternatives such as vegetative stabilization … are not possible" and that "… there is clear evidence of *significant* erosion or flooding."[55] DEEP has direct jurisdiction over activities occurring in *tidal wetlands* and/or waterward of the coastal jurisdiction line, while a municipality regulates upland activities under local planning and zoning authority landward of the coastal jurisdiction line.[56] (See Figure 1).

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[50] CONN. GEN. STAT. § 22a-29(2). (Wetland is defined as "areas which border on or lie beneath tidal waters, such as, but not limited to banks, bogs, salt marsh, swamps, meadows, flats, or other low lands subject to tidal action, including those areas now or formerly connected to tidal waters, and whose surface is at or below an elevation of one foot above local extreme high water; and upon which may grow or be capable of growing some, but not necessarily all, of the following: Salt meadow grass …")

[51] *Id.* §§ 22a-359–22a-363(f). This act authorizes DEEP to regulate dredging, erection of structures, and fill and give regard to fish and wildlife and the prevention of shore erosion and coastal flooding for the tidal, coastal, or navigable waters of the state on the water side of high tide. *See* National Oceanic and Atmospheric Administration, Digital Coast, Legislative Atlas, *Structures Dredging And Filling Act*, http://www.csc.noaa.gov/legislativeatlas/lawDetails.jsp?lawID=197 (last visited June 15, 2012).

[52] CONN. GEN. STAT. §§ 22a-28–22a-35a.

[53] *Id.* §§ 22a-90–22a-111.

[54] *Id.* § 22a-92(2)(J).

[55] Office of Long Island Sound Programs, *Shoreline Flood and Erosion Control Structures Consistency Checklist*, *in* CONNECTICUT DEP'T OF ENVTL. PROTECTION, CONNECTICUT COASTAL MANAGEMENT MANUAL (2000), *available at* http://www.ct.gov/dep/lib/dep/long_island_sound/coastal_management_manual/manual_08.pdf.

[56] Office of Long Island Sound Programs, *Fact Sheet for State and Municipal Regulatory Jurisdictions*, *in* COASTAL MANAGEMENT MANUAL, *supra* note 55.

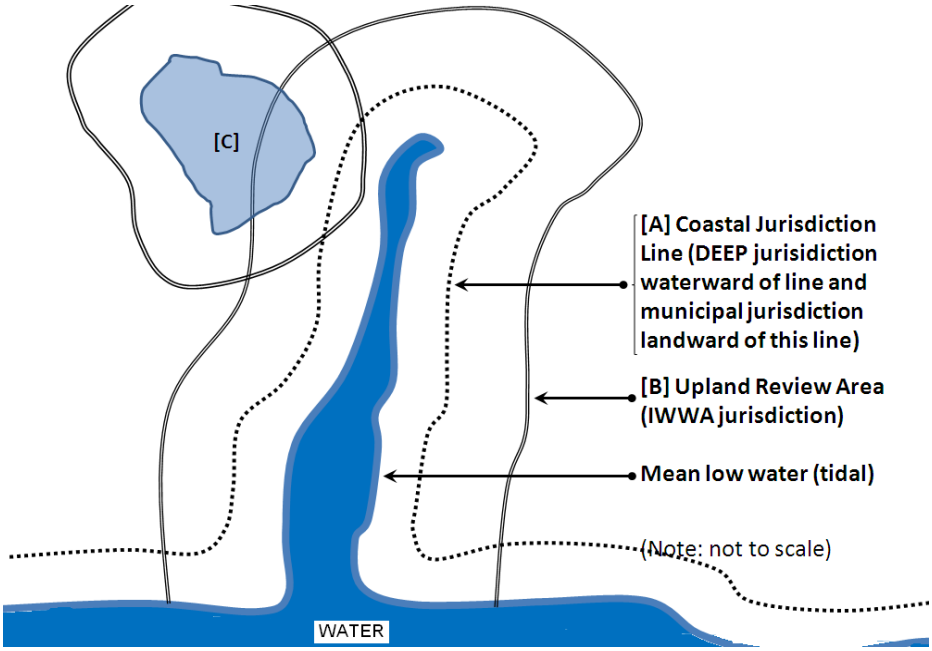

Fig. 1: Coastal jurisdiction relationship between the state of Connecticut and municipalities.

B. Municipal Authority

Municipalities are strong in Connecticut. The rights of the municipalities include powers for taking and acquiring property; providing public services, management of drainage, responsibility for keeping streets open, and providing for the protection of the environment.[57] In addition, Connecticut law provides protection for municipalities in the case of losses: "When it becomes necessary and feasible for a municipality to safeguard itself from losses, to acquire, purchase, foreclose on, manage or operate, hold or dispose of development property ... incidental to the protection of its interests under any law, mortgage contract or agreement."[58] The Connecticut Legislature has given far-reaching powers to the municipality.

Municipalities in the state of Connecticut have created several commissions that can have jurisdictional influence in natural resource and water resource commons areas influenced by climate change including the Municipal Inland Wetlands Agencies (MIWAs), Planning and Zoning Commissions (PZ), and the less common Conservation Commissions (CC). The governance of non-tidal, inland wetlands and watercourses[59] is guided by the Inland Wetlands and Watercourses Act (IWWA)[60] which allocates jurisdiction of land use activities in and around wetlands and watercourses to town-level permitting entities (i.e., MIWAs).

Connecticut has 170 MIWAs representing the 169 towns of Connecticut. Each utilizes a bottom-up approach, is run by volunteers or unpaid appointees, and is independent of the federal[61] and state

[57] *Id.* § 7-148(c).
[58] *Id.* § 7-483(g).
[59] Watercourses are defined in Conn. Gen. Stat. § 22a-38(16) using general terms such as "... rivers, streams, brooks, waterways, lakes, ponds, marshes, swamps, bogs, and all other bodies of water, natural or artificial..."
[60] CONN. GEN. STAT. §§ 22a-36–22a-45
[61] The U.S. Army Corps of Engineers is the lead federal permitting agency for activities in wetlands and navigable waters of the United States.

wetland and water resource management systems.[62] Each also has potential influence on the management of coastal areas. The MIWAs may review activities outside their primary inland wetlands[63] and watercourses jurisdiction within an administrative review area or buffer[64] called the Upland Review Areas (URA).[65] Activities in the URA and areas beyond may be evaluated by the MIWA for potential physical impact to local water resources including wetlands and watercourses.

Because the watercourse definition is broad and does not include a scientific classification system like that available for wetlands, most "bodies of water" fall under the regulatory authority of municipalities. This is true even if the body of water is immediately adjacent to coastal areas, which can extend municipal jurisdiction into areas generally under the management of DEEP. Case law has not resolved this jurisdictional issue, but a joint guidance letter from DEEP's Inland Water Resources Division and OLISP noted, "Fortunately, this legal uncertainty has rarely been of more than theoretical importance, as most municipalities have not regularly asserted jurisdiction over tidal, coastal or navigable waters."[66]

Planning and Zoning Commissions are typically combined in the towns of Connecticut. The Planning Commission has powers and duties related to long-term management of the towns. Responsibilities include development of a Plan of Conservation and Development on a 10-year cycle. This plan identifies the most attractive land uses and can designate areas for conservation and preservation. In addition, the Planning commission has responsibilities for infrastructure planning, making recommendations for important and sensitive land uses like street and bridge locations, and regulating the subdivision of land.[67] The Zoning Commission has specific powers and duties related to the density, height, size, location, and placement of buildings, including water dependent uses. In addition, the Zoning Commission can create districts that have specific criteria (e.g., village districts) and can create special exemptions for density limits.[68] The Conservation Commissions have relatively limited power and are intended to help with planning and management, research, and inventory of local natural and cultural resources.[69]

Since the 1940s the state of Connecticut has recognized the need to address regional issues for development and efficiency purposes. The core of this process remains "comprehensive planning."[70] This is defined as simultaneous planning of distinct elements such as housing, economic development, transportation, land use, and water and sewer services.[71] The primary governance entity bridging the scale gap between municipalities and the state in Connecticut are the regional planning organizations

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[62] The DEEP Wetlands Management Section provides training and technical support for the MIWAs but does not evaluate permits.

[63] Wetlands in Connecticut are defined by soil drainage class and floodplain soils. *See* Conn. Gen. Stat. § 22a-38(15).

[64] In Connecticut, buffers are typically 100 feet.

[65] *See* UPLAND REVIEW AREA GUIDELINES, *supra* note 3.

[66] Letter from Charles Berger, Director, Inland Water Resources Division, and Charles Evans, Director, Long Island Sound Programs, to Richard Holloway, Chairperson, Town of Chester Inland Wetland and Watercourse Agency re: Municipal Inland Wetlands And Watercourses Jurisdiction Over Tidal, Coastal, And Navigable Waters (July 2, 2001) (on file with authors).

[67] Michael Zizka, *What's Legally Required: A Guide to the Legal Rules for Making Local Land use Decisions in the State Of Connecticut*, CT DEP BULLETIN 39 (7th ed., 2004).

[68] *Id.*

[69] CONN. GEN. STAT. § 7-131a.

[70] CONN. ASS'N OF REGIONAL PLANNING ORG., THE GEOGRAPHIC SCOPE OF CONNECTICUT'S REGIONAL PLANNING 8 (2010), *available at* http://www.hvceo.org/GEOGRAPHIC_SCOPE_OF_CT_REGIONAL_PLANNING.pdf.

[71] *Id.*

(RPO) that are charged with providing assistance to municipalities. Three types of RPO are allowed under Connecticut law: Regional Council of Elected Officials, Regional Council of Governments, and Regional Planning Agencies.[72] The RPOs must include representatives from the local communities within the organization.[73] RPO boundaries are determined by the Connecticut Office of Planning and Management. RPOs are organized around metropolitan areas so no RPOs are organized around coastal areas in particular – potentially problematic when handling impacts caused by climate change. In fact, there are five different RPOs that border the coastal areas of Long Island Sound.

Table 1: Primary duties of governance entities

Governance Entity	Role	Level
Municipal Inland Wetlands Commission (MIWA)	Permits activities for inland wetlands and watercourses.	Municipality/Town
Planning and Zoning Commission (PZ)	Creates conservation and development plans; districts; infrastructure plans; zoning for building placement and density.	Municipality/Town
Conservation Commission (CC)	Inventories natural resources, plays advisory role.	Municipality/Town
Regional Planning Organization (RPO)	Community planning for group of municipalities.	Regional
Connecticut Department of Energy and Environmental Protection (DEEP)	Permits activities in tidal wetlands and provide coastal management planning guidance.	State
United States Army Corps of Engineers (USACE)	Permits fill in navigable waterways.	Federal

Table 2: A comparison of adaptation type, time and spatial scale, solutions and governance entities.[74]

Adaptation Type	Time scale	Spatial Scale	Type of Solution	Governance
Shoreline armoring (rip rap)	Short, periodic	Site	Engineering	DEEP, USACE, PZ
Elevation change (fill, berming, embankments)	Short, periodic	Site	Engineering, Zoning	DEEP, MIWA, PZ
Accommodations (setbacks, rolling easements, cluster development)	Medium	Neighborhood	Planning and Zoning	PZ, CC
Retreat (abandonment, infrastructure changes, property compensation)	Long, periodic	Town	Planning	PZ, CC, Coastal Management, DEEP, USACE

VII. Municipal Inland Wetlands Agency

A. Overview of Governance Structure

The Connecticut MIWAs are a potential local model for climate adaptation governance that adheres to the tradition of home rule in New England. The MIWAs represent a unique natural resource governance system within the United States as each municipality in Connecticut governs and enforces activities in their own inland wetlands and watercourses. While the Connecticut DEEP provides a set of "model regulations" as guidance for each town, the towns create their own statutes. The MIWAs are

[72] State of Connecticut, Office of Policy and Management, *Regional Planning Organizations (RPOs) In Connecticut*, http://www.ct.gov/opm/cwp/view.asp?a=2986&q=383046 (last visited June 15, 2012).
[73] *See* CONN. GEN. STAT. §§ 4-124j, 4-124k.
[74] Adapted from TITUS, *supra* note 25.

staffed by volunteers and unpaid appointees and are independent of both the DEEP and USACE.[75] The Connecticut DEEP only provides educational and technical assistance. Rulings from a MIWA in Connecticut are not appealed to the state DEEP but directly to Connecticut Superior Court.

A justifiable managerial concern is that this sort of local governance entity lacks the sophistication to handle complicated technical and legal issues under the IWWA. Despite the possible chaos and inefficiencies of having 170 different governing entities for wetlands and watercourses within Connecticut, the MIWAs have shown the ability to improve and adapt over time (Figure 2) both in terms of progressing towards becoming a No- Net Loss state[76] and reducing the average size of impacts per application. Under the management of the MIWAs, the rate of wetland loss has decreased over time in the state of Connecticut (Figure 2) and citizen member have shown the capacity to engage in a "sophisticated governance system" as envisioned by Andersson and Ostrom.

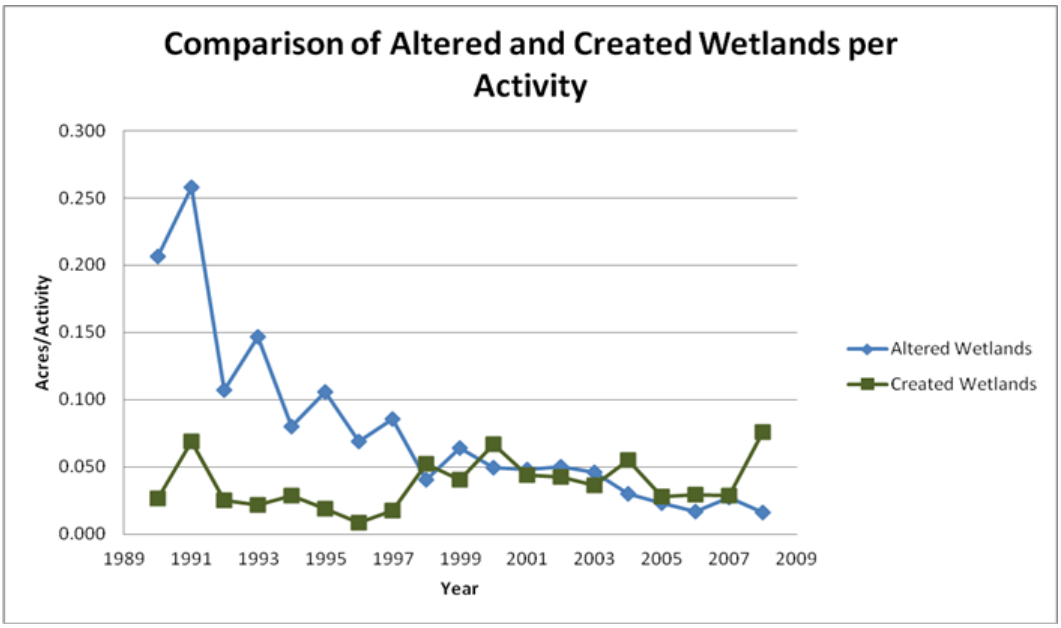

Fig. 2: The changing relationship between wetlands created and altered in Connecticut per averaged reported activity over the past twenty years

Volunteer commissioners and citizen applicants have also demonstrated that they can handle legal and scientific subtleties that balance land-use and resource protection. In the evaluation process, called the "factors for consideration,"[77] they need to balance the short- and long-term environmental impacts of activities; the potential for safety and health issues; and the potential for impact on the reasonable usage of a property. At the same time, they need to determine whether "feasible and prudent" alternatives for activities exist. To do so, they must evaluate engineering, construction, and environmental information.

The IWWA statutes include a section on agricultural exemptions. Many, but not all, land use activities associated with farming are allowed in and around wetlands "as of right."[78] Farmers, however, must first obtain a "jurisdictional ruling" from a MIWA regarding whether their agricultural activity falls

[75] The Commissioner of DEEP does review permits for state activities.
[76] STATUS AND TRENDS REPORT, *supra* note 39, at 1.
[77] *See* CONN. GEN. STAT. § 22a—41.
[78] *Id.* § 22a-40(1).

within an exemption. If the activity is exempt, farmers have no further interaction with the agency. For non-exempt activities, farmers must go through the regular application procedures.

Despite the potential for abuse of this exemption process and the complexity faced by volunteer commissions seeking to determine exemptions, impacts to wetlands and watercourses from agricultural activities have been extremely small in the past several reporting years.[79] In addition, MIWAs have enforcement powers that they utilize such as the ability to write tickets and conduct cease and correct orders against persons impacting wetlands and watercourses without a permit. This provides some evidence that local actors can be trusted to manage natural resources in an environmentally sustainable manner.

Agricultural activities share characteristics with climate change. They are ephemeral, driven by dynamic events, and somewhat random on a site basis. The experience of the MIWAs shows that volunteer commissions often incorporate a great deal of expertise and capacity, and have consistently protected natural resources over time. Many municipalities have also implemented a new statute that allows *de minimis* activities to be handled outside the normal regulatory structure and thus reduce regulatory headaches of ordinary citizens for a simple fence post of only a few square feet.[80] While this may not prove that local actors will manage climate adaptation accordingly, it demonstrates the capacity for sustainable decision-making among local actors.

Other characteristics identified in the literature as important in climate adaptation in and around natural and water resources areas include collaboration, equity, accountability and transparency, legitimacy, and water/land planning integration are found in MIWAs (Table 3). The MIWAs utilize agency members that are local appointees which enhances equity and accountability. Meetings are easily attended by citizens and neighborhood groups because of municipal scale. Local jurisdiction enhances legitimacy because the appointees are from the same town.

B. Problems with the Current Governance Structure

A governance system managing, planning, and permitting for climate change adaptation around water and natural resource areas needs to be adaptive, flexible, and scaled properly. As demonstrated earlier, the current jurisdictional structure in Connecticut has potentially significant regulatory overlap for coastal wetlands and watercourses areas. This overlap between the MIWAs, DEEP and Municipal Planning and Zoning Commissions creates a system where no single policy or governance structure is available to handle climate change oriented processes. This yields a slow and inflexible regulatory and governance framework during times of rapid environmental and land use changes.

Governance of the coastline in Connecticut is managed by the DEEP but problems exist with this approach. Civil servants manage the permitting of activities directly; therefore, decision-making is not at the local level. The DEEP's jurisdiction is limited to a thin coastal strip and may overlap with municipal authority. Finally, the DEEP's focus is not on protecting site-level impacts but coastal planning and limiting structural solutions. The RPOs have some municipal level decision-making input, but are problematic as governance vehicles because they are strictly planning-oriented and lack authority to permit impacts in and around natural resource areas. Furthermore, as currently structured, their geographic layout is not oriented around climate change and coastal impacts. The municipal scale of governance appears to be best suited for climate change adaptation in Connecticut because decision-making is by local officials on local issues and hence is closest to the home rule philosophy. In addition, different political actors join the executive boards of MIWAs ensuring a diversity of interests. Finally, these groups have local knowledge and expertise about natural resource processes and

[79] STATUS AND TRENDS REPORT, *supra* note 39, at 1.
[80] *See* CONN. GEN. STAT. § 22a-42a(c)(2).

communities. While the state of Connecticut is pursuing a "soft" non-structural approach to shoreline protection, accommodating impacts and conflicts over natural resource commons will be left to the municipalities. An alternative entity is needed to manage the potentially shifting jurisdiction of the coastline between the state and municipalities and the impacts of climate change at the local scale, and to maintain legitimacy during periods of high conflict and potentially rapid change.

VIII. Climate Adaptation Board

To emphasize a local governance approach in Connecticut, the structure of the municipally controlled MIWAs could be repurposed for climate change adaptation regulation and planning through the creation of a local, municipal level, volunteer board of governance called the Climate Adaptation Board (CAB). The board would serve as a bridging entity that incorporates knowledgeable volunteers in a local governance structure that complements the multiple levels of governance currently in place related to water and natural resources. It should retain the transparency, legitimacy, and equitability associated with the MIWA system which is part of the home rule governance tradition in Connecticut, and allow for a governance system that is aligned with local values for natural resource management and land use decision-making while being adaptable in a municipal context. A state governance entity may be less able to handle the differences in local values and physical layout associated with different community types across the urban and rural development gradient.

The CAB should occupy a hybrid governance position and should consist of local volunteers and one member each from the municipal level PZ, MIWA, CC, and emergency management office, as well as the local floodplain administrator. The CAB, of course, would have the opportunity to enlist experts as needed for planning assistance. The proposed CAB would have jurisdiction within coastal municipalities for specified rapid deployment, high-value activities determined by statute (i.e., structural improvements or potentially controversial "retreat" techniques like abandonment) and would provide recommendations and guidance for longer-term climate change adaption planning where risk assessment issues and adaptive management methods are critical. In addition, the CAB could provide recommendations to PZ and Public Works Departments for longer-term adaptation strategies that may need to change quickly from planning to implementation phases because of climate change uncertainties, particularly in rate and magnitude.

The CAB should have authority over jurisdictional inland and tidal water resource areas for those activities related to rapid, climate change adaptation. A more aggressive law could limit the state jurisdiction to the present coastal jurisdiction line so that the state jurisdiction line does not advance into municipal areas. A less aggressive law would allow for the state jurisdiction line to move with sea level rise and erosion. Similar to the agriculture exemption model of the IWWA, these activities (e.g., berming around houses) related to climate change adaptation would be reviewable by the CAB. The CAB would have the authority to bring applicants in for jurisdictional ruling as is done by the MIWA. If not part of the specific adaptation activity list, the applicant would be channeled back into the regular local and state permitting processes. The components of proposed land use activities beyond the scope of climate adaptation would also be moved into the normal municipal permitting process where speed and flexibility are not as important. If the CAB has jurisdiction over an activity, then a more severe test would exist for an expedited regulatory process.

Following the model of the URA from the MWIAs, the area of jurisdiction or administrative review could be limited to a fixed vertical distance above high tide and a fixed horizontal distance away from coastal tidal wetlands, watercourses, and upland review areas. If "rolling" jurisdictional areas impacted by horizontal changes in the shoreline and vertical changes in the water levels were part of the structure of the CAB then jurisdiction lines could be changed periodically via a GIS mapping system to accommodate the spatial changes in local jurisdictional water resources and adjacent uplands. Updated

maps could be published periodically allowing the public to understand the spatial changes in their environment and the jurisdiction of the CAB. Regional infrastructure planning such as the rerouting of state highways or utility right of ways would fall to RPOs or state-level governance entities, but finer scale activities such as local road changes would be left to the CAB. Input and cross-communication between the different levels of government would be encouraged and facilitated to the greatest degree possible which is already occurring.

IX. Evaluating the CAB

Evaluating the chances of success or failure of a Climate Adaption Board is difficult because the unfolding of spatial, meteorological, and temporal processes related to climate change is fraught with variability and uncertainties. Policy implementation, in addition, is laden with its own complexity as decades of scholarship have shown, even under ideal circumstances,[81] and important social or governance criteria may not lend themselves directly to quantitative measures. Nevertheless, researchers have developed criteria for adaptability in climate change and effectiveness in water policy. In this section, the results of several studies on climate change and water policy are discussed and compared with the system proposed above, a Climate Adaptation Board mirroring the structure of the Connecticut MIWA system. The research used in this assessment either relates to climate change adaptability exclusively, or focuses on interrelated policy areas, such as natural resource management of water quantity or achieving sustainability in general.

In evaluating climate change adaptability, criteria for evaluating success include "effectiveness, efficiency, equity, and legitimacy."[82] Judging adaptations at different scales "will involve new and challenging institutional processes."[83] In addressing local management of water shortages in Ontario, scholars found several key factors influence management effectiveness, including clarification of agency roles and responsibilities, integration of management and land use planning, recognition of both urban and rural stakeholders. Also noted was the importance of the local communities in fostering local partnerships and local transparency which is critical in translating knowledge into action in local communities.[84]

International research has shown leaders can prepare a system for change by exploring alternative system configurations and developing strategies for choosing from among possible futures.[85] Leadership functions include the ability to span scales of governance, orchestrate networks, integrate and communicate understanding, and reconcile different problem domains.[86] Scholars have created an

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[81] *See* Katharine Owens, *Understanding How Actors Influence Policy Implementation: A Comparative Study of Wetland Restorations in New Jersey, Oregon, the Netherlands, and Finland* (unpublished thesis 2008); HANS BRESSERS & KRIS LULOFS, GOVERNANCE AND COMPLEXITY IN WATER MANAGEMENT: CREATING COOPERATION THROUGH BOUNDARY SPANNING STRATEGIES (2010); MICHAEL HILL & PETER HUPE, IMPLEMENTING PUBLIC POLICY (2002); DENNIS PALUMBO & DONALD CALISTA, OPENING UP THE BLACK BOX: IMPLEMENTATION AND THE POLICY PROCESS (1990); and JEFFERY PRESSMAN & ARON WILDAVSKY, IMPLEMENTATION: HOW GREAT EXPECTATIONS ARE DASHED IN OAKLAND; OR, WHY IT'S AMAZING THAT FEDERAL PROGRAMS WORK AT ALL, THIS BEING A SAGA OF THE ECONOMIC DEVELOPMENT ADMINISTRATION AS TOLD BY TWO SYMPATHETIC OBSERVERS WHO SEEK TO BUILD MORALS ON A FOUNDATION OF RUINED HOPES (1973).

[82] Adger, *supra* note 5, at 77.

[83] *Id.*

[84] *See* Janet Ivey et al., *Community Capacity for Adaptation to Climate-Induced Water Shortages: Linking Institutional Complexity and Local Actors*, 33 ENVTL. MGMT. 36-47 (2004).

[85] *See* Per Olsson et al., *Shooting the Rapids: Navigating Transitions to Adaptive Governance of Social-Ecological Systems*, ECOLOGY AND SOC'Y 11(1): 18 (2006), *available at* http://www.ecologyandsociety.org/vol11/iss1/art18/.

[86] *Id.*

extensive list of policy options to reduce the potential risks of global climate change: incorporate climate change in long-term planning, inventory existing practices, promote awareness, and integrate ecosystem planning and management. [87]

These studies provide an extensive list of systems characteristics for climate adaptability, sustainability, and water management. While it may seem daunting, many of these characteristics exist in the MIWA model. Table 3 highlights characteristics important to adaptation, effective water governance, and sustainability as well as research supporting the importance of these characteristics. The column on the far right denotes if this characteristic is already encompassed in the MIWA model, is not applicable, or if it has the potential for inclusion in a CAB.

As illustrated by Table 3, a CAB modeled on Connecticut MIWAs has the potential to fulfill many key characteristics of success. The CAB could be structured to include other areas of importance, such as identifying alternative pathways for response, involvement in planning and design, and inventorying existing practices. Whether a CAV can effectively deal with climate change may only be determined after the fact. That being said, the CAB model represents an adaptive governance structure based on characteristics researchers have shown to be important in similar processes and capable of rapid response in times of crisis.

Table 3: Research describing characteristics important to adaptation compared to the Wetland Agency Model, with some characteristics broadened.

	Ivey et al. [88]	**Cuthill and Fein** [89]	**Adger et al.** [90]	**Olsson et al.** [91]	**MIWA Model**
Characteristic					
Collaborative process with leaders, stakeholders (urban and rural), local users, and citizens linking to government	X	X			X
Clear roles and responsibilities	X				X
Multi-level and government-spanning	X		X	X	(Municipal only)
Equitable policy and processes		X	X		X
Accountable and transparent process	X	X			X
Efficient			X		X
Legitimate			X		X
Collecting and disseminating information, including local knowledge	X	X			X
Identifying alternative pathways for response/create windows of opportunity	X			X	(potentially)
Integrate ecosystem planning, design, and management, including water/land planning integration	X				X

[87] Joel Smith & Stephanie Lenhart, *Climate Change Adaptation Policy Options*, 6 CLIMATE RES. 193, 195 (1996).
[88] Ivey, *supra* note 83.
[89] Michael Cuthill & John Fien, *Capacity Building: Facilitating Citizen Participation in Local Governance,* 64 AUSTRALIAN J. OF PUB. ADMIN. 63-80 (2005).
[90] Adger, *supra* note 5.
[91] Olsson et al., *supra* note 84.

X. Conclusions

A local governance structure, modeled after Connecticut's MIWA, could provide Connecticut with the capacity to adapt to climate change. The advantages of this system are that the CAB exemptions would follow local policy, economics, and land use philosophy rather than top-down policy goals. This authority would provide faster adaptation for the dynamic and emergent climate change problems which are primarily experienced at the site or local scale, and eliminate the need for multi-governmental hierarchical agreement on some specific adaptation land use activities. The CABs would provide spatially adaptable jurisdictions when environmental change is occurring at rapid or variable rates. It would also involve citizens in authentic participatory local governance. Finally, the CAB could act as conduits for state and federal funding such as from FEMA to local- or site-specific problems and provide a single local entity for risk assessment planning. In this way, the CAB system should overcome problems with the governance structure in place, providing governance that can span the boundaries of current local and state wetlands policies in the state. Namely, by providing a risk assessment component, allowing timely reactions to negative externalities of climate change, overriding jurisdictional conflicts in the case of climate adaptation, and allowing communities to react to changes in a way that incorporates their local values. Ultimately, the ability of the volunteer governance board to learn and improve, like the MIWAs, will guide their success. Training and support of these citizens will likely improve outcomes within the municipalities of Connecticut that utilize governance structures like the proposed CAB.