



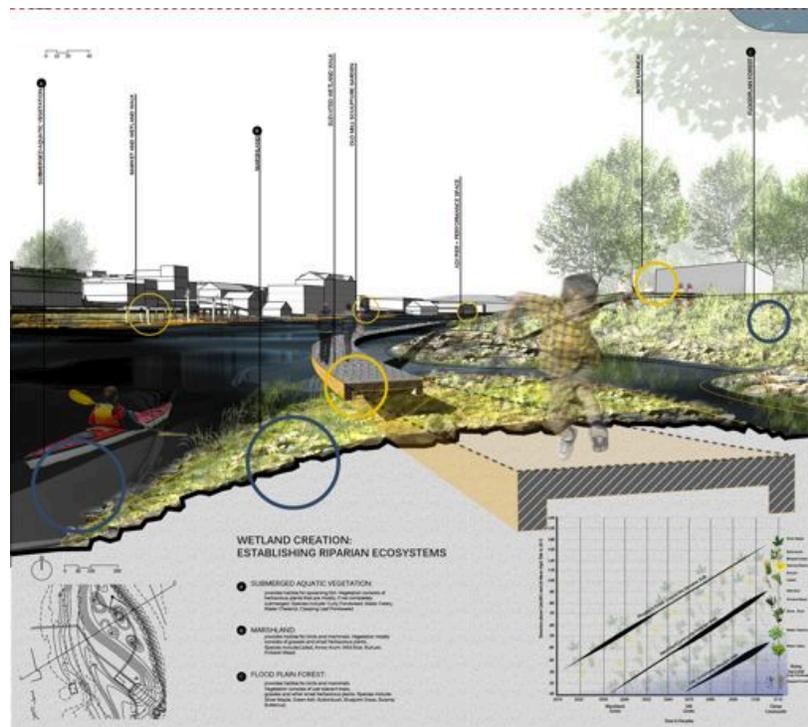
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Design for Climate-resilient Hudson River Communities

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Abstract

This pilot project investigated planning and design implications of emerging municipal climate adaptation interests by developing alternative design strategies for a downtown waterfront location in Village of Catskill, New York. The project was developed in a senior urban design studio at Cornell University Department of Landscape Architecture. The project accessed a climate-adaptive design framework to identify projected climate change hazards, risks, and potential climate adaptation opportunities for downtown Catskill's water systems, ecosystems, and built environment features. The project team reviewed planning and policy documentation, conducted contextual analysis and site reconnaissance and interviewed stakeholders prior to developing five alternative design concepts that addressed projected climate change risks in combination with the urban revitalization interests and needs of stakeholder interviewees. These concepts included provisions for green infrastructure, flood-adapted landscapes and structures, contributions to urban ecosystems, and other features. The alternative design concepts developed for Village of Catskill can serve as a case study for other Hudson Valley municipalities seeking to confront climate risks to their water systems, built environment, ecosystems and community as their municipality changes and grows.

Three Summary Points of Interest

- Many Hudson waterfront communities are subject to climate change associated risks, but few climate adaptation precedents are scaled to the size of these municipalities
- This project identified the Catskill, NY downtown waterfront as a pilot site for an academic design studio investigation exploring projected climate change impacts and potential climate adaptation options
- During this design process, five alternative design concepts were generated to address goals for climate adaptation and urban renewal consistent with the interests of Catskill and its stakeholder entities

Keywords: climate-adaptive design, urban resilience, community engagement, urban ecology

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Introduction

Climate change is coming to every city, and will have far-reaching effects on urban environments and land uses. Many cities are or will be subject to sea level rise, changing flood elevations, and/or extremes in temperature and precipitation, with diverse impacts on human and natural systems. For some cities, there is an emerging understanding that we need to be thinking of climate change as a comprehensive set of impacts that require a comprehensive set of adaptation responses, each folded within other important municipal objectives for urban growth and renewal.

This pilot project investigates the potential for incorporating climate adaptation options into urban renewal strategies for the Village of Catskill, New York. Much like many Hudson waterfront municipalities, Catskill is experiencing growing urban redevelopment interest. As downtown Catskill grows toward its waterfront, with time the waterfront will also grow toward downtown Catskill- in the form of sea level rise and increased frequency of flooding and precipitation (Village of Catskill, 2014). This investigation proposes a set of alternative planning and design strategies for Catskill as a means for exploring new futures for its waterfront, in the interests of catalyzing a more resilient approach as the municipality grows and changes.

The project piloted a methodology for engaging a waterfront community around a climate-adaptive urban planning and design process that incorporated aspects of action research (Deming and Swaffield, 2011). It accessed an academic-public partnership to create an expert-rich, studio-based process for delivering alternative design concepts that engaged the community, within a single, semester-long four month timeline.

Results & Discussion

Five alternative design concepts were developed for the downtown Catskill project area. Each generated options for climate adaptation including floodable park spaces and flood-adapted structures, while seeking to link interventions to the ongoing revitalization of Catskill's Main Street and its downtown waterfront. The five projects and select highlights are briefly described below:

1) Three major strategies guided the “Coalescing Catskill” design concept: restoration of urban form to energize streets and spaces, elevation of program areas, and creation of wetland habitat. Notable features include exploration of a conceptual grading plan for an elevated street on the west side of the creek for flood protection benefits (Village of Catskill, 2014) (see Figure 1), floodable park amenity on both sides of the creek, and a proposal for a new structure on upper elevations of Water Street to meet both parking and commercial space needs for Catskill as part of a “Water Street Market” revitalization concept.

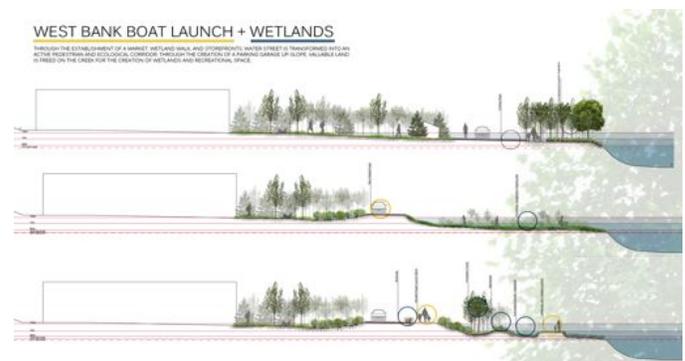


Figure 1. Sections cut through West Main Street, illustrating multiple benefits of the “Coalescing Catskill” alternative design concept including flood protection for a nearby school and businesses and floodable park amenities in between the road and the creek. Image by Garrett Craig-Lucas and Madison Gawith, Cornell Landscape Architecture 2015 LA4010 Urban Design Studio.

2) Inspired by Catskill's burgeoning arts culture, the “Catwalk” alternative design concept proposes use of stormwater art installations as a means for attracting visitors and residents to the Village's new waterfront trail planned for installation in 2016. It carries the Village's theme of park “slides” connecting residential areas to downtown down all the way to the waterfront through a new pedestrian-only walkway on Canal street composed of flow-through planters to capture and detain roof and street runoff as a demonstration of the environmental and amenity benefits of urban green infrastructure. See Figure 2.

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Figure 2. Illustrative plan and drawing of the Canal Street proposal in the “Catwalk” alternative design strategy linking downtown Main Street to the waterfront by combining a pedestrian-only walkway with green infrastructure features. Images by Julie Romualdez and Zhijun Guo, Cornell Landscape Architecture 2015 LA4010 Urban Design Studio.

3) “(Un)discovering Catskill” seeks to retain the uniqueness and charm of Catskill as it undergoes a period of renewal. A phased plan proposes spaces for discovery and mingling while replacing a parking lot with a floodable park space over time. See Figure 3. Creek-side features are connected by the forthcoming creek trail loop to link sustainable shoreline bioengineering techniques, proposed floodable park spaces, and a new Water Street corridor to turn the downtown back toward the waterfront within the constraints of projected flood elevations.



Figure 3. Section-perspective showing floodable park space in the foreground with downtown Catskill in the background. Image by Sabrina Miller, Kelly Mathiesen, Angela Moreno-Long, Cornell Landscape Architecture 2015 LA4010 Urban Design Studio.

4) “Let’s Meet with Water!” takes a phased approach that seeks to juxtapose redevelopment and open space creation in concert with sea level rise and changing flood elevations. See Figure 4. It proposes retrofitting a parking lot used only during weekday business hours to facilitate an artist open market on weekend days or evening hours when parking isn’t needed.

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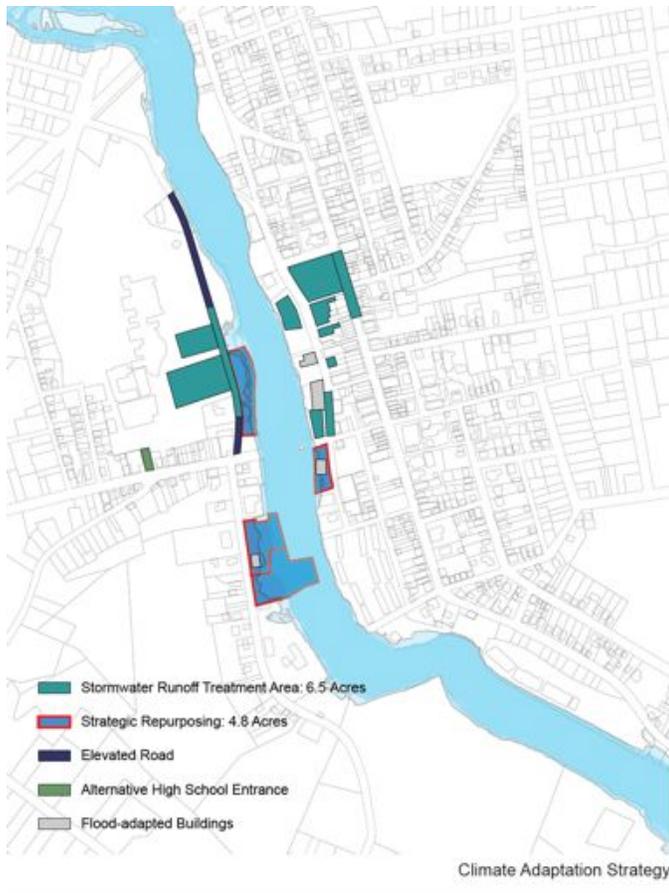


Figure 4. Diagram showing “Let’s Meet with Water’s” water-based planning interventions. Image by Xiaotang Tang and Zili Xiang, Cornell Landscape Architecture 2015 LA4010 Urban Design Studio.

5) “Connection (In)tension” seeks to tie the businesses and open spaces along each side of the creek together through a series of “anchor points.” See Figure 5. These locations can activate the waterfront by connecting sites, views, and people along Catskill Creek while addressing climate adaptation goals.

All of the final boards for the project were displayed in an open house held on 12/14/2015 in Catskill Mill, which was attended by about 50 invited stakeholders and interested parties. The design concepts for this pilot project demonstrated the potential for incorporating climate adaptation goals into project redevelopment plans, in ways that can be well-received by the interested public and useful for future visioning and planning. While the academic studio portion of the pilot

project is complete, participating DEC and Columbia-Greene CCE partners continue to follow up with municipal and organizational stakeholders in Catskill to offer technical support and provide information about future funding opportunities.

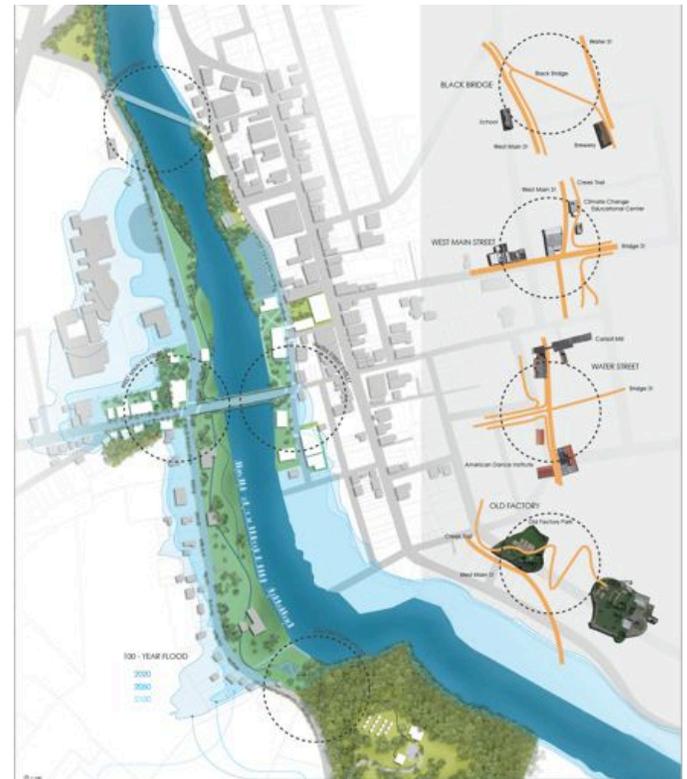


Figure 5. Plan diagram showing “Connection (In)tension’s” concept with its four “anchor points.” Image by Nicole Nakakura and Paviya Chiaravanont, Cornell Landscape Architecture LA4010 Urban Design Studio.

Policy Implications

Village of Catskill staff, planning board and partners are actively pursuing implementation of one or more of the design ideas developed in the alternative design concepts (The Daily Mail, 2016). A student design team member has also taken on part of the studio project location for his honors design research thesis. Following on from the studio investigation, the student designer continues to work with the American Dance Institute, which recently acquired a large Catskill waterfront parcel, to develop a design concept that meets their organizational program while taking into account rising

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sea levels and change flood elevations on private property.

The design studio concepts also helps the Village move forward with their Resilient Catskill Task Force report, Resilient Catskill: Report of the Catskill Waterfront Resilience Task Force documentation (Village of Catskill, 2014), completed in 2014 in response to significant damages from Hurricanes Irene and Sandy in 2011 and 2012. Furthermore, the adaptive design studio reflects the latest strategies supported and being explored by relevant state and federal funding and regulating agencies.

Methods

The project began with collaboration with NYSDEC Hudson River Estuary Program staff and Columbia-Greene County Cornell Cooperative Extension (CCE) staff to determine potential municipal locations for the project based on urban setting, policy, and projected future climate vulnerability. The project list was narrowed to three locations along the Hudson River waterfront. After a set of field visits a location in the Village of Catskill, New York was selected.

The selected project study area straddles both sides of Catskill Creek as it bisects the Village of Catskill. See Figure 6. Catskill is a historic town with a significant arts community undergoing a recent period of urban renewal in its downtown location. Recent land acquisitions along Catskill Creek on the west side of downtown indicate the potential for urban growth and waterfront revitalization along the creek. The Catskill Creek watershed originates in the Catskill Mountains and is a tidally influenced tributary to the Hudson River near its mouth.

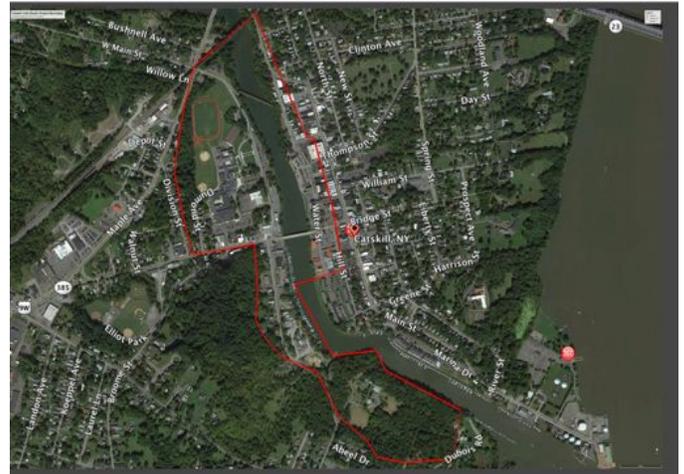


Figure 6. Catskill waterfront study area, outlined in red in the aerial photo. (Image adapted from aerial imagery by Google Earth)

The project team was composed of Cerra, Libby Zemaitis of the NYSDEC Estuary Program, Liz LoGiudice of Columbia-Greene CCE, 10 senior landscape architecture students and one urban and regional studies planning student. Village of Catskill Community Development Coordinator Nancy Richards was a key partner during the project. Targeted technical support was provided by multiple collaborators during the design process including members of the Cornell Soil and Water Lab, NYS Department of Environmental Conservation, Scenic Hudson, and others.

The project was developed in the Fall 2015 LA4010 Climate-adaptive Design (CAD) studio led by Cerra. Work began by accessing the *ClimAID Integrated Assessment for Effective Climate Change Adaptation* Technical and Synthesis reports (ClimAID Reports) (Rosenzweig et al. 2011a, Rosenzweig et al 2011b) and their updated 2014 update (Horton et al. 2014), to understand climate projections for the Region 2 Catskill Mountains and West Hudson River Valley area. Sea level rise projections, Mean High High Water (MHHW), and flood event elevations were adopted from the COAST report (Lockman, 2014) and Resilient Catskill: Report of the Catskill Waterfront Resilience Task Force documentation (Village of Catskill, 2014). Consistent with these reports and the FEMA Flood Insurance Study (FEMA, 2008) for the Catskill watershed, we assumed that the primary driver for the .1%, .02%, .01% and

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.002% flood event elevations was Catskill Creek Watershed hydrology versus Hudson River influences. Also, while the site would be subject to sea level rise and surge effects on the Hudson, due to the location of the downtown Catskill site upstream of the mouth of the Hudson River we assumed it would not be subject to Hudson wave run-up effects.

The project team used a comprehensive climate-adaptive design (CAD) framework (Cerra, 2016, in press), modified for coastal communities, to categorize projected climate change hazards, climate-associated risks to the site and potential adaptation options for addressing these risks. The CAD framework organized adaptation options based on three adaptation categories: water systems support (flood preparedness, low impact development (LID)), ecosystem support (landscape connectivity, resilient planting design) and built environment support (flood-adapted structures, urban heat island mitigation, multimodal mobility). The project team also used this framework to organize a set of climate adaptation precedent case studies gathered for reference during the project.

During the analysis and concept development phases, two visits to Catskill were conducted for field visits and interviews with project stakeholders including staff from the city, Scenic Hudson, Cultivate Catskill, NYSDEC, and several businesses located either downtown or along the Catskill waterfront. The project team broke into five design teams to develop alternative concepts. During the second visit several early design concepts were shared with stakeholders for feedback and suggestions for improvement. Interviews and desk critiques by technical experts and four formal studio reviews of the design concepts were conducted during the design development phase. Review critics included faculty in landscape architecture, practicing professionals, and NYSDEC and Columbia-Green CCE staff. Each design team reacted to critique to produce a set of final design boards for their design concept that included site plans, sections, design details, perspective drawings, plant lists and/or performance metrics illustrating project concepts. The final design boards were presented to stakeholders and interested personnel during an open house on December 14, 2015, which was attended by about 50 stakeholders and invited guests.

Outreach Comments

The project was developed in collaboration with multiple partners including key NYSDEC Estuary Program, Hudson Estuary Watershed Resiliency Project, Scenic Hudson, and Biological and Environmental Engineering Soil and Water Lab staff. Multiple individual and group meetings (in-person and via video conference) were held with project stakeholders during the course of the project. As described in the Methods section, staff from the Village of Catskill, Scenic Hudson, Cultivate Catskill, NYSDEC, practicing professionals, and several Catskill businesses were engaged during the project's field visits, interviews, desk critiques and formal reviews.

The results of this project were shared with the Village of Catskill and a set of stakeholders in the final open house event on December 14, 2015. Since, Estuary Program and Columbia-Greene CCE staff have maintained contact with Village of Catskill staff to assist moving the project forward.

The following government and community groups were engaged during the course of the project:

- Village of Catskill
- NYSDEC Hudson River Estuary Program
- Columbia-Greene Cornell Cooperative Extension
- Hudson River Estuary Resiliency Project
- Scenic Hudson
- Sustainable Shorelines
- Cultivate Catskill
- Catskill Creek Awareness Project
- American Dance Institute
- Catskill Mill
- Greene County
- Hudsonia

Student Training

11 undergraduate seniors were trained in developing climate-adaptive planning and design practices in consideration of community stakeholder interests. One graduate student served as a research assistant to develop GIS flood layers specific to the project area that were compatible with Scenic Hudson's modeling methodology

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(<http://www.scenichudson.org/slr/mapper>), and other technical tasks.

Additional final reports related to water resource infrastructure research are available at <http://wri.cals.cornell.edu/research-reports>

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