Working Together to Build Climate Resilience in Hudson Riverfront Communities

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Abstract

Hudson riverfront communities are facing climate risks on a scale greater than their small populations and capacity-limited governments can easily address. Led by a partnership of state and municipal governments and nonprofit organizations, four of these communities (ranging in size from 2500 to 25,000 residents) embarked on year-long resilience planning processes beginning in 2012. Each community created a resilience plan, drawing on stakeholder education, participatory mapping, vulnerability assessment, and cost-benefit analyses. These plans included specific priority actions for adapting their waterfront to increasing flood risk. Since these reports were finalized in 2013 and 2014, the four communities have begun tackling actions, updating their plans, and leveraging public grant funding. More recently in 2016 and 2017, the partnership organized a Learning Group for these communities to collaborate and receive technical assistance on the following topics: planning, emergency management, water infrastructure, and community engagement. This paper introduces the context of climate adaptation in the Hudson Valley region; outlines the resilience planning and Learning Group processes; shares insights, including resilience recommendations communities had in common, and lessons learned; and proposes future work.

Keywords

Climate change · Adaptation · Resilience · Community resilience · Resilience plan · Hudson River

Introduction: Climate Change Risks to Hudson Riverfront Communities

The tidal Hudson River in New York state runs 153 miles from the federal dam in Troy to Manhattan, where it joins the Atlantic Ocean. The Hudson River Valley is a historic region that inspired the nineteenth-century American art movement of landscape artists known as the Hudson River School. More recently in the 1960s, the Hudson Valley inspired the modern environmental movement when the battle to protect Storm King Mountain set a new legal precedent for conservation. Today, the shorelines of the Hudson River are home to 78 communities, essential infrastructure including wastewater treatment plants, power-producing facilities and freight and commuter railroads, and a unique natural setting that includes 85% of the state's wildlife species and globally rare freshwater tidal wetlands.

Although the Earth's climate is always shifting, the global average temperature has been rising in unison with increasing inputs of greenhouse gases, which trap the sun's heat, driving changes to global, regional, and local climates. Warming atmospheric temperatures alter the water cycle, leading to more extreme precipitation, short-term drought, and severe storms. New York has experienced particularly rapid changes to the regional climate in the last century, and this trend is projected to continue through the twenty-first century.

Three significant climate hazards (trends) are expected to affect New York state residents during the twenty-first century: *increasing temperatures*, *rising sea level*, and *changing precipitation patterns*. These trends are leading to three primary climate risks (human impacts): *flooding*, *heat waves*, and *drought* (Rosenzweig 2011; NYS 2100 Commission 2013). Flooding has emerged as the most pressing climate risk faced by Hudson River communities. Since the Hudson River is an estuary, it experiences the coastal dynamics of daily tides and sea-level rise. Flood risk along Hudson River shorelines includes the risk from storm surge from more frequent and intense tropical and extratropical cyclones, increasing high tides, and river, tributary, and stormwater flooding from more extreme precipitation events, which have increased 71% from 1958 to 2012 (Melillo 2014). Many riverfront communities were highly impacted by extreme events like Hurricane Sandy in 2012 and tropical storms Irene and Lee in 2011 that caused millions of dollars each in damage. Today's federally regulated floodplain, the area inundated by the 1% or "100-year" flood, is projected to flood up to 610% more frequently by the 2080s, and the new 1% flood will bring flood heights that are 1.5 to 3.3 ft higher (Rosenzweig 2011).

While New York City is a leader in resilience planning, the majority of Hudson riverfront communities have populations under 50,000, and their governments do not have the resources to address these challenges on their own. Many have few or no staff, and, for the most part, their elected officials serve in a voluntary capacity.

This paper describes an effort by a coordinated group of partners to help Hudson River communities assess their vulnerabilities, plan and implement resilience strategies, and learn from one another's experience with the ultimate goal of helping them to thrive under changing climate conditions.

Efforts to Foster Community Resilience in NYS and the Hudson Valley

NYS is a national leader in addressing climate change mitigation and adaptation. In 2010 it created the NYS Sea Level Rise Task Force which developed recommendations to the legislature for how the state should respond to and plan for sea-level rise (www.dec.ny.gov/docs/administration_pdf/slrtffinalrep.pdf). In 2012, as a result of storm damages from Sandy, Irene, and Lee, Governor Cuomo appointed the NYS 2100 Commission to investigate how to make the state more resilient. The Commission was charged to review and make recommendations for, among other things, resilient infrastructure and natural systems, improved emergency services and updates to insurance, and risk management (NYS 2013). Several new initiatives, including community planning processes, infrastructure investments, and buyout programs, were organized by the new Governor's Office of Storm Recovery, which also came about as a result of the storms. In 2013, the state created the Climate Smart Communities Certification program (www.dec.ny.gov/energy/50845.html), which offers technical and funding assistance to communities to take action to reduce greenhouse gas emissions and adapt to climate change. To help provide state-level

Table 1 New York state sea-level rise projections in inches by time horizon (NYS DEC 2017)

Region	Long Island					NYC/Lower Hudson					Mid-Hudson				
Descriptor	L	L-M	M	H-M	H	L	L-M	M	H-M	H	L	L-M	M	H-M	H
2020s	2	4	6	8	10	2	4	6	8	10	1	3	5	7	9
2050s	8	11	16	21	30	8	11	16	21	30	5	9	14	19	27
2080s	13	18	29	39	58	13	18	29	39	58	10	14	25	36	54
2100	15	21	34	47	72	15	22	36	50	75	11	18	32	46	71

Values represent inches of rise over baseline level, which is defined as the average level of the surface of marine or tidal water over the years 2000 through 2004

guidance and support to New York municipalities, NYS passed the Community Risk and Resiliency Act (CRRA) in 2014. This law requires the state to adopt sea-level rise projections (see Table 1); create guidance for permitting and funding programs to consider the risk of sea-level rise, storm surge, and flooding; create guidance on the use of natural resilience measures; and develop model local laws to enhance community resilience (NYS DEC 2017). In 2018, the Governor announced the Resilient NY program with an aim to update building standards and improve mapping of natural features that can reduce flood risk, like freshwater wetlands (NYS 2018).

Focus on State and Regional Partnerships

In the Hudson Valley, the New York State Department of Environmental Conservation (NYS DEC) Hudson River Estuary Program (Estuary Program) coordinates regional efforts to foster community resilience (www.dec.ny.gov/lands/4920.html). The Estuary Program is a nonregulatory program of the NYS DEC that works with partners to engage, educate, and empower decision-makers to take a watershed approach to managing the unique natural resources of the Hudson River Valley. The Estuary Program's Climate Resilience Program works in collaboration with the NYS DEC Office of Climate Change and several strong partners to promote community-led planning for resilient natural and built environments, climate-adaptive design, and natural and nature-based approaches to managing the risk of flooding, heat, and drought. The DEC defines climate resilience as the ability to manage climate risks, respond productively as climate changes, and recover quickly from extreme events.

Other strong and committed organizations that are based in, or work in, the Hudson Valley share similar goals for promoting community resilience. Scenic Hudson (www.scenichudson.org) is a nonprofit environmental advocacy organization and land trust based in the Hudson Valley that offers planning support to waterfront communities. They developed the first sea-level rise mapper for the Hudson and have been a leader in crafting resilience planning processes with

municipalities. In 2017, they co-organized "Hudson River on the Rise," a planning conference for shoreline communities.

The Consensus Building Institute (CBI, www.cbi.org), a Cambridge-based nonprofit organization with decades of experience helping leaders collaborate to solve complex problems, works extensively in the Hudson Valley. CBI has developed a new initiative, climigration.org, a community of practitioners seeking to drive innovation into conversations, policies, and practices in places where sea-level rise and storm impacts are eroding the viability of living with increased flooding.

The NYS Department of State (DOS), the New York State Energy Research and Development Authority (NYSERDA), and other state agencies have funded planning and implementation of risk reduction projects and supported flood-risk mapping tools to foster community resilience. Cornell Cooperative Extension, a county-based agricultural outreach program associated with Cornell University, developed programming on watershed resilience.

New partnerships have expanded to include leading state academic institutions that employ new strategies to foster community resilience in the Hudson Valley. For example, the climate-adaptive design (CAD) studio uses design to inspire community climate adaptation. Each semester, CAD links Cornell University students in landscape architecture with flood-risk Hudson riverfront communities to explore design alternatives for more climate-resilient, beautiful, and connected waterfront areas (www.tinyurl.com/CornellCAD). Community stakeholders and state and regional partners are engaged throughout the studio to help inform the student design process and encourage results that are most suitable to the municipality that CAD is partnered with.

New York's changing climate presents brand-new challenges and opportunities for communities. It is vital for local decision-makers to understand their community's vulnerability, take steps to adapt to climate risks, and capitalize on opportunities to increase their climate resilience. Many Hudson Valley communities have an interest but lack the resources to develop an appropriate response. They are managing day-to-day operations with limited staff. The situation is similar across NYS. In this instance, several Hudson Valley partners stepped in to create community engagement and planning support programs like the Waterfront Resilience Task Force and the Sea Level Rise Implementation Learning Group.

Waterfront Resilience Task Forces: A Process for Community-Led Resilience Planning

The literature demonstrates that by undergoing long-term, cooperative planning processes to build physical resilience to climate risks, municipalities can simultaneously build community resilience (Nelson 2011). Several federal, state, and nonprofit efforts have focused on cooperative planning processes to foster community resilience including NOAA's Digital Coast Program (www.coast.noaa.gov/digitalcoast/training/climate-adaptation.html), similar state programs in Massachusetts (www.mass.gov/municipal-vulnerability-preparedness-program),

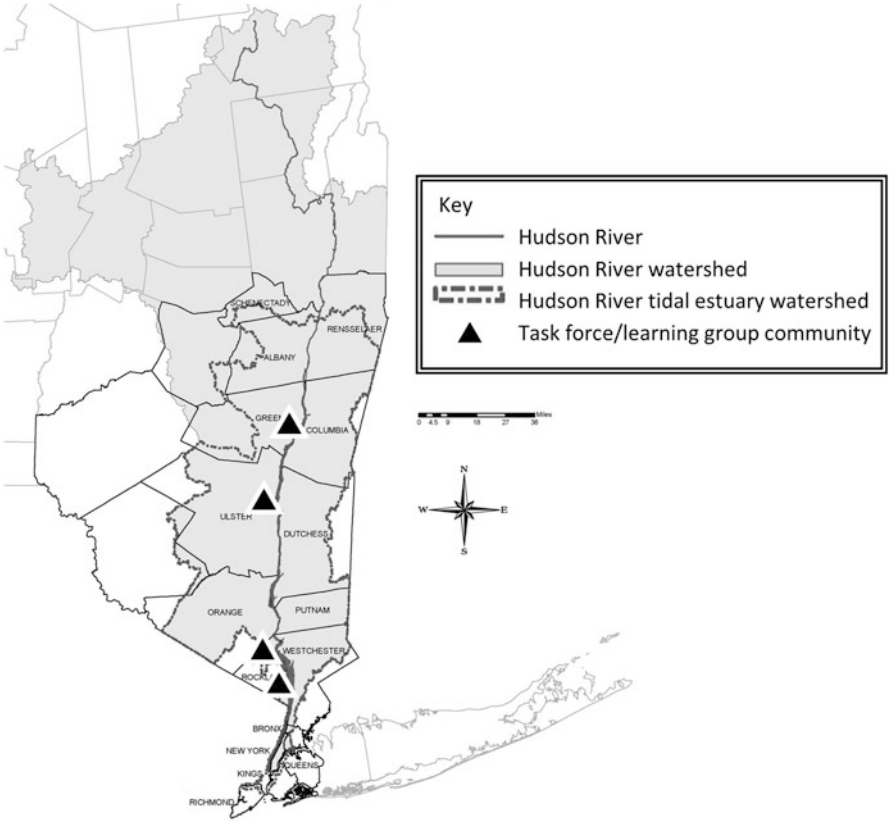

Fig. 1 Location of four Hudson riverfront communities (compiled by author)

and efforts developed and led by nonprofits, including The Nature Conservancy's community resilience building (www.communityresiliencebuilding.com) and flood-smart communities programs (www.nature.org/ourinitiatives/regions/northamerica/unitedstates/newyork/climate-energy/new-york-flood-smart-communities.xml). These processes engage the community, building trust and language skills necessary to productively plan for and adapt to climate change (Adger 2003; Harrison et al. 2016; Kerner and Thomas 2014).

Building on this learning, the Estuary Program, Scenic Hudson, and the Consensus Building Institute and their partners piloted a vulnerability assessment and resilience planning process in the city of Kingston in 2012. Kingston had recently experienced significant flooding and had staff willing to dedicate time to piloting the effort. Soon after, the program expanded to three more waterfront municipalities: village of Catskill, village of Piermont, and town of Stony Point (see Fig. 1). All four communities range in size from 2500 to 25,000 residents. The effort was funded through grants from the Estuary Program and leveraged funds raised by the Consensus Building Institute and Scenic Hudson. These Waterfront Resilience Task

Forces (Task Forces) consisted of local government-appointed stakeholders, including residents, business owners, municipal staff, and volunteers. Each Task Force went through a nearly year-long resilience planning process. The process kicked off with a public meeting that included participatory mapping where attendees shared their local knowledge of flooding and identified community assets that were important to protect. The public also contributed to a vision statement to help guide the Task Force in their work – highlighting the importance of issues like preserving history and a sense of place, keeping people safe, providing water access, and fostering economic revitalization.

Equipped with input and guidance from the public, each Task Force began the work of learning about its community's current and future climate risks and applying them to a vulnerability assessment of the entire waterfront. They mapped, described, and scored the vulnerability of each waterfront asset. Next, the Project Team presented the Task Forces with examples of how to adapt to their climate risks, drawing on models from New York City and around the globe. Drawing on their learning together, each Task Force formed three strategic adaptation pathways for making its waterfront resilient at both the neighborhood and municipal scale. A consultant then completed a cost-benefit analysis of each pathway to determine if avoided damages would justify the costs of proposed adaptive actions. The process culminated with each community creating its own resilience plan, with specific priority actions, based on the entire Task Force process and what they learned.

Common Resiliency Recommendations Across the Four Task Force Communities

Although each Task Force community has its own unique character, opportunities, and risks, there were many overlapping recommendations across their resilience plans.

Recommended resilience actions shared by all four Task Force communities:

- Create or update a comprehensive emergency management plan.
- Collaborate with other waterfront/watershed communities and county and state governments.

Recommended resilience actions shared by three of the four Task Force communities:

- Improve emergency communications and real-time response.
- Use green infrastructure and nature-based features to manage stormwater, upland flooding, combined sewer overflow, and erosion.
- Create or update a comprehensive municipal master plan.
- Ensure that new and existing plans address projected sea-level rise and are responsive to flood resilience issues.
- Provide public presentations on storm preparedness and flood mitigation.

- Consider applying to participate in a program that rewards adaptive action by reducing flood insurance premiums for the entire community (the National Flood Insurance Program's Community Rating System).
- Create a capital improvement plan that addresses adaptation to changing conditions.
- Train staff and elected officials on resilience issues and how to incorporate information into their work.

Recommended resilience actions shared by two of the four Task Force communities:

- Post key information on emergency response on the municipal website.
- Train staff and volunteers on tools for emergency response and planning.
- Review and update zoning and building codes.
- Ensure that new proposals in flood-risk areas take flood risk into account.
- Create or improve floodplain management plan, including training for the floodplain manager.
- Participate in and incorporate resiliency actions into funding and support program like the County Natural Hazard Mitigation Plan and Climate Smart Communities.
- Design and install high-water mark signs.
- Conduct annual outreach to floodplain residents, tenants, and prospective buyers.
- Establish a permanent resilience committee.
- Conserve and restore natural protective features like tidal wetlands and natural shorelines.
- Officially adopt the sea-level rise and flood projections for planning purposes.
- Create and implement a Climate Action Plan.

These areas of commonality created a foundation for the communities to work together on actions and share their hard work and lessons learned. Inspired by this insight, planning partners from the Task Force process launched a "Learning Group" for the four communities to come together to collaborate, learn from each other's experiences, and receive technical assistance to make progress toward implementing their recommendations.

Learning Group: Piloting a Participatory Process Where Communities Work Together to Make Progress on Implementing Resilience Actions

The Sea Level Rise Resilience Implementation Learning Group (Learning Group) project brought together leaders and members from the four Task Force communities (Catskill, Kingston, Piermont, and Stony Point) to (1) share their progress in implementing Task Force recommendations, (2) learn from one another and explore opportunities for additional actions that could increase their flood resilience, and (3) access resources that would enable them to make progress on resilience actions.

The project included a series of four workshops hosted over the course of a year. It was led by a Project Team comprising staff from Scenic Hudson, the Consensus Building Institute, the Estuary Program, and a Task Force municipality (the City of Kingston) under grant funding from the Estuary Program.

At the project's outset, the Project Team reviewed the progress to date of each community in implementing recommendations from their Task Force reports. Based on recommendations in each community's report, the Project Team proposed an array of candidate topics to focus Learning Group sessions under the following broad categories: (1) emergency services, (2) water infrastructure, (3) land use planning instruments, and (4) community engagement. Based on prioritizations by the four communities, the Project Team identified the following as more specific areas of overlapping interest among the communities:

- Producing a flood preparedness guide for residents and businesses
- Creating and/or digitizing maps of water infrastructure
- Completing an assessment and emergency planning for wastewater treatment facilities
- Identifying and mapping green infrastructure opportunities
- Advancing zoning and building code updates
- Learning about and implementing community engagement strategies, including social media

The Project Team worked with representatives from each of the four communities throughout the project to design meetings that emphasized areas of overlapping interest. The Project Team designed and facilitated the meetings, provided meeting summaries, and in some cases presented meeting content. Throughout the project, the team also consulted with designated representatives from each of the communities to ensure the focus areas and meeting agendas were relevant and of interest. The Project Team engaged topical experts to give presentations, guide exercises, lead discussions, and answer questions at the meetings.

A total of 19 community members from the four Task Force municipalities participated in the Learning Group process. Dialogues both within and across the four communities were encouraged, often through a format including (1) a plenary presentation on a topic, (2) breakout into community groups for local discussion/application, and (3) full group discussion and report out from each community. Wherever possible, the project drew on the expertise within each community to foster peer-to-peer learning.

In some instances there were "homework" assignments, either prior to or after a Learning Group meeting, which primarily involved gathering information on local data, policies, or community interest in specific initiatives. Project Team members regularly engaged with community participants to assist with these assignments in between the Learning Group meetings.

Resilience Building Accomplishments of the Learning Group

Together in the Learning Group process, the four communities were able to make progress toward several priority actions in their resilience plans:

- **Flood preparedness guide for residents and businesses**. The village of Catskill worked with Cornell Cooperative Extension who served as a partner to provide technical assistance to create a small, informative guide that mapped roads likely to flood and safe evacuation routes and identified safe parking locations and key emergency contacts. They printed and distributed it widely to residents and business owners in the floodplain. Village of Catskill representatives presented their guide at the first Learning Group meeting, and the Project Team followed up with each community to gauge their interest and help interested communities move forward in creating their own versions of the guide. Cornell Cooperative Extension staff were assigned to work with interested municipalities to produce the guides and answer the participants' questions about information needs and the drafting process.
- **Web content**. Web content highlighting each community's efforts to address flood resilience was identified as a potentially effective community engagement strategy for all four communities. A planning partner was assigned to organize presentations and lead discussions on opportunities to use social media and websites, as well as provide examples of effective websites addressing resilience. Between meetings, the planning partner worked with each community individually to customize the web components for municipal websites. Since some content overlapped across communities, the planning partner was able to take advantage of efficiencies and worked with communities individually to customize each website plan and content. Each community was then responsible for uploading the content and design onto their municipal websites.
- **Wastewater infrastructure mapping**. As a result of very high levels of interest in the topic during the Learning Group meetings, the Project Team researched the possibility of helping each community develop an inventory and map of its wastewater infrastructure, including treatment and pumping facilities and underground piping. The community representatives first identified the current state and availability of data and maps for their wastewater infrastructure, which several of them had not previously done. This exercise only reinforced interest as communities realized much of the information was difficult to find, was only available in paper map form rather than in digital form, or was never mapped at all. This in itself represented an important baseline information-gathering accomplishment. The Estuary Program pursued a pilot project partnering with The New School (Manhattan) to have undergraduate students in geographic information systems (GIS) develop basic maps of manhole covers for one community, Stony Point, and their vulnerability to flooding from sea-level rise. The project will continue into Spring 2018 with the help from a graduate student from Columbia University. The Project Team will seek additional opportunities and funding to

work with GIS students to advance mapping of wastewater infrastructure in other Hudson River waterfront communities.

- **Siting green infrastructure**. The Learning Group also explored the potential for the use of stormwater green infrastructure – techniques that mimic, accommodate, or enhance the natural capture and infiltration of rainwater into the ground – to manage stormwater flooding in each community. Following introductory presentations on green infrastructure (including definitions, how it works, examples, and siting considerations), each municipality was guided by experts in an exercise to map potential green infrastructure projects that could alleviate flooding problems. The Project Team provided maps depicting factors that are important for green infrastructure siting, and each community's participants made sketches of potential locations and green infrastructure solutions. They discussed which locations were highest priority and began to evaluate opportunities for next steps.

Network Building and Learning Accomplishments of the Learning Group

A primary goal of the Learning Group workshops was to provide an opportunity for the communities to continue their learning and to deepen their connections to one another and to other resources to support future efforts. The communities achieved the following network building and learning outcomes as a result of the Learning Group process:

- **Building ties to outside experts**. Over the course of the four meetings, the Project Team enlisted the involvement of a number of professionals to make presentations and, in some cases, lead exercises with the group. These presentations covered areas of financing, water infrastructure, zoning codes, engineering, outreach, and designing public spaces. These presentations created links to programs and people capable of serving as resources for communities moving forward.
- **Deepening ties to Project Team**. In addition to spearheading and organizing the Learning Groups, the Project Team members served as important sources of expertise on a range of topics. These Project Team members will remain important resources moving forward, and several have continued their work with the communities beyond the formal end of the Learning Group project.
- **Deepening linkages across communities**. Prior to the Learning Group, the four communities worked independently in their Task Forces to better understand their municipality's unique risks and to begin outlining near- and longer-term adaptation strategies. The Learning Group built on those individual efforts by creating an opportunity for these four communities to learn from one another and make connections likely to continue beyond the Learning Group process. Some of these linkages are easily demonstrated. Piermont, Stony Point, and Kingston, for example, began working on flood preparedness guides after learning of Catskill's success and the collaboration with other planning partners. Piermont explored the

viability of partnering with another interested community to hire a shared consultant to coordinate resilience planning efforts. Each community highlighted the importance of the Learning Group in fostering cross-community connections, and there is strong interest in maintaining and even expanding these ties. The Learning Group also allowed the group to explore and highlight the common opportunities and challenges across communities – cross-community learning that is likely to foster dialogue and, where appropriate, future collaboration.

- **Deepening Project Team and state government understanding of climate adaptation interests, barriers, and opportunities.** The Learning Group process provided tremendous insight into which adaptation topics are highest priority for communities on the Hudson and where gaps exist in current state and partner funding and technical assistance programs to meet these needs. Over the course of the project, the Project Team regularly evaluated emerging needs expressed by the communities, reached out to technical experts, and developed new content. New content was refined and tailored to community needs and interests, through a very dynamic communication and facilitation process. The insights and new content developed for each topic area have been incorporated into programming for other shoreline communities in the Hudson Valley and can serve as models for other areas of the state.
- **Maintaining focus and momentum**. All four communities recognize the imperative to tackle long-term resilience planning, but as small communities with limited resources, it is difficult to maintain focus and momentum. Learning Group members credit the process with helping their communities maintain or sharpen their focus on adaptation. "Homework" assignments, for example, forced the members from each community to interact between meetings and "take on" topics that might otherwise have slipped out of view. There is a shared sense that the Learning Group (and the mutual accountability tied to each meeting) has served as an important catalyst for dialogue within each community, helping to maintain and/or reinvigorate waterfront initiatives and collaborations. Additionally, an initial inventory of progress to date and the regular sharing among the communities of successful actions served as positive motivational tools.

Progress Made Since the Task Force and Learning Group Processes

The Task Force and Learning Group processes created working relationships and local champions that will likely foster future projects. Since the Task Forces were completed in 2013 and 2014, the four communities have begun tackling priority actions in their resilience plans, like updating their plans and leveraging public grant funding. Of the 91 priority actions recommended across the 4 community resilience plans, 11 have been completed, 25 are in process, and 11 are in process and ongoing by nature. The communities have also received over 20 grants totaling over $5 million to work on these actions and related projects. Different paths of progress on priority actions have been formed in each community:

- **The Village of Catskill** and its nearly 4000 residents sit on the mouth of the Catskill Creek, 115 miles north of New York City on the Hudson River. The village relies on the perseverance of a few key municipal representatives and local champions and struggled to engage the larger community during the Task Force process. Despite the challenge of the community's reluctance to change, the village has made several advancements in building resilience. The village became the first to participate in the climate-adaptive design (CAD) studio, which successfully engaged business owners and municipal representatives around envisioning a resilient future for their waterfront. The village planning board created a strategy to implement CADs for a green alleyway that would connect people and views from Main Street to the waterfront and use green infrastructure to convey stormwater during rain events. Catskill also created and widely distributed a flood guide to residents and businesses in the floodplain. The village received grants for a consultant to complete both a zoning code analysis for flood resiliency and a risk and engineering review of the wastewater treatment system. They also incorporated aspects of their resilience plan into their Brownfield Opportunity Area (BOA) Implementation Plan, (or BOA Program) a DOS program that provides funding and technical assistance to municipalities looking to revitalize areas affected by brownfields. The village is collaborating with their neighboring communities to address flooding in the steep, flashy Catskill Creek watershed. Most recently, the village received a grant from the DOS Local Waterfront Revitalization Program (LWRP) to create a community waterfront plan that will make them eligible for a significant funding stream to implement projects in the future.
- **The City of Kingston** sits on the western shore of the Hudson River at the mouth of the Rondout Creek, 90 miles north of New York City. With 23,000 residents, it is the largest Task Force community and has more municipal staff capacity to implement resilience actions. Immediately following the Task Force process, the city officially adopted the high sea-level rise projections for consideration in planning and proposals. Since then, Kingston has been highly successful at applying for and receiving state grant funding for projects relating to resilience – eight grants and nearly $3.5 million in total to date. These grants have funded projects focused on waterfront access, shoreline improvements, engineering studies, greenhouse gas emission inventory, complete streets, and more. The city has also been adapting and securing their wastewater treatment plant and completed a planning and visioning process to redevelop the waterfront as part of their BOA program. Three design studios led by landscape architect students have engaged Kingston stakeholders to envision a future resilient waterfront through the CAD program, and additional funding through the National League of Cities was secured to further engage the waterfront community and to help advance the students' designs beyond the conceptual phase.
- **The Village of Piermont** is a small waterfront community in the lower Hudson Valley just 30 miles north of New York City. The village is home to just over 2500 residents, many of whom are weekenders or summer residents or commute daily to Manhattan. Many of the village's professional residents apply their expertise in

their active involvement in the local government and community. Directly following the resilience planning process, the village formed the Piermont Waterfront Resilience Commission to continue the work of the Task Force. They also received a grant to update and incorporate resilience into their LWRP plan. The Consensus Building Institute completed a community engagement process, facilitating "living room" meetings in four neighborhoods to provide a safe, intimate space for residents to openly discuss the sensitive issue of adapting to climate change. This process improved stakeholder participation in the village's CAD studio. More recently, the village completed a flood guide for residents and business owners and hired a half-time coordinator to advance progress on resilience goals.

- **The Town of Stony Point** is located 45 miles north of New York City with a population of just over 15,000 people. The town's Task Force was led by a different planning group and occurred immediately following NY Rising, a state program led by the Governor's Office of Storm Recovery, to help waterfront communities with the recovery and reconstruction following Hurricane Sandy in 2012. Thus, Stony Point experienced a different Task Force planning process than the three other communities. Following the process, the town created a waterfront zoning district that requires consideration of current and future flooding. They also received a grant to update and include resilience in their local waterfront plan but were unable to provide the local match and accept the funding. Most recently, the town benefitted from the wastewater infrastructure mapping pilot program through the Learning Group, as described above.

Lessons Learned: Strengths of the Learning Group Process

Several important observations were made about the strengths of this collaborative process. These lessons are drawn from a post-Learning Group survey distributed to all participants, as well as reflections from the Project Team:

- Most participants valued the group format as both a motivational and learning opportunity and expressed a strong interest in continued meetings and collaboration. Participants were highly engaged, open to learning, and generous with sharing their knowledge.
- Progress on priority actions was possible thanks to sustained effort by the Project Team working with the communities between Learning Group meetings. Making progress on projects with participants was more effective when a draft product was compiled or created by the Project Team as a starting point or for editing. This is particularly important for communities without dedicated staff to address resiliency planning.
- An engaged core of participants and a point person, or champion, for each community ensured a higher level of that community's engagement, learning, progress on projects, and the interest in continuing to work with the Learning Group in the future.

- Participants readily engaged in map exercises (such as green infrastructure siting and public realm visioning) and high-level plenary discussions about topics such as community engagement, where they could share both successes and ongoing challenges.
- The participation of a municipal leader on the Project Team, as well as regularly including a representative from each community in the planning of the Learning Group, ensured that the meetings were valuable to the participants.
- The participation of a public agency helped the Project Team incorporate the latest information on state funding, regulations, and guidance, helping waterfront communities plan more efficiently and get "ahead of the curve."

Lessons Learned: Challenges of the Learning Group Process

While the Learning Group process was deemed a success by most measures, the following challenges were identified:

- Consistent attendance is valuable for progress (and for avoiding communication breakdowns) but can be difficult to achieve when participants are largely working on a voluntary basis. It was difficult to find meeting times and locations that worked for all of the community representatives, because many have day jobs. Some participants cited travel and the timing of the meetings as obstacles for participation. The approach of enlisting a slightly larger group of participants than were expected to be able to attend any one meeting ensured a generally good level of participation (i.e., there were representatives from each community at each meeting, with some of the same participants attending three or all four of the meetings).
- From a project planning perspective, it can be challenging to find overlapping priorities between four communities of differing size, geography, and flood risk. However, most participants felt there was sufficient overlap in community interests and priorities (and the meeting focus areas) to support their progress.
- Funding for implementing priority actions was identified as important to all four communities before the Learning Group began meeting; as a result, funding opportunities were announced and explained in the meetings on multiple occasions. However, a meaningful increase in participants' familiarity and comfort with securing funding often requires the experience of working on applying for an actual funding opportunity, which several communities have now done.
- The Project Team attempted to strike a balance between including enough topics so there would be interest for each community and advancing work on specific projects. This was a challenge to accomplish in the limited time (four meetings lasting just 3 hours each), as it did not provide sufficient time to tackle and work completely through any one topic (e.g., the Project Team struggled to fit all the desired topics into the agendas with sufficient time for each). However, this format was effective in allowing the Project Team to assess interest in follow-up efforts. Other formats should be considered in the future depending on the

desired outcome (education and exposure to topics as opposed to deeper engagement on a topic or project).
- Planning for the meetings significantly exceeded the projected level of effort. While there will likely be efficiencies gained from this effort for future projects, additional time should be allotted for planning similar projects in the future.

Future Work: Addressing Barriers and Sharing Learnings with More Communities

After working closely for several years with the four waterfront communities through the Task Force and Learning group processes, members of the Project Team recognized several barriers and opportunities for future work.

Adapting to climate change and building resilience is a complex and ongoing task. It is vital to engage the full spectrum of community stakeholders who will be impacted by this work: residents, community organizations, business owners, municipal staff, volunteers, and others. It was a challenge to recruit and retain residents and community organizations in the Task Force process, which later evolved into the Learning Group. Of these stakeholders, low-income and minority populations are often the most challenging to reach yet also stand to be affected the most by climate change, often due to housing affordability and discriminatory infrastructure development (Schrock et al. 2015). Ultimately the community as a whole benefits from diverse stakeholders participating and imbuing local knowledge in the resilience planning process. Using effective engagement strategies can build community resilience – trust, unity, and understanding – and produce more effective actions and plans to address physical resilience (Shi et al. 2016).

In the future, the Estuary Program and its partners would like to successfully include more diverse community stakeholders in resilience planning processes. The literature suggests several strategies to overcome physical and social barriers to engaging these populations. Prior to launching a climate adaptation planning process, the municipality and its partners should identify all types of stakeholders in their community to reach out to. Decision-makers should understand historic tensions, issues, and previous communication efforts (Frerichs et al. 2016). Some stakeholders may need help addressing or just being heard on more basic issues before they are able to effectively participate in climate planning. A variety of in-person, digital, and print communications can explain and invite them into the planning process. Once engaged in the process, it is vital to use clear, relatable language and visuals to help express complex climate concepts (Stults and Woodruff 2016). Translated materials and interpreters may be required (Andrulis et al. 2011). It may be necessary to change meeting times and offer assistance like transportation, food, and child care to prevent barriers to and encourage stakeholder attendance.

Facilitation consultants from the Consensus Building Institute (CBI) piloted a new stakeholder engagement strategy using some of the tactics suggested above. Intimate, living room meetings allowed neighbors to speak candidly with each other about past tensions and their concerns for the future. This process appeared to

improve the attendance of residents in subsequent resilience programming. In the future, CBI is expanding on these pilot neighborhood meetings by training local residents to become the facilitators to make participation in resilience work in their community more inclusive and ongoing.

Another barrier to resilience building, which requires continual evaluation, development, and action, is the limited municipal capacity. New York is a home rule state where municipalities and their representatives are self-governing and have the decision-making power to pass laws. Home rule can present a challenge when most waterfront communities along the Hudson River are small towns and villages with few municipal staff. Thus, resilience building is often left to volunteers and elected officials with a high turnover rate. Even communities highly engaged in this work, like the four in the Learning Group, experience planning fatigue and difficulty balancing longer-term resilience goals with pressing day-to-day priorities that keep their municipality running.

Limited staff capacity was a lesser obstacle in the City of Kingston, which, as a relatively larger community, has a dedicated staff person focused on advancing sustainability and resilience goals. Thus, members of the Project Team recognized the importance of dedicated staff and developed the concept of resilience coordinators in each community, or even shared by two or more neighboring communities with similar climate risks. These coordinators ideally would be paid municipal staff who are responsible for achieving progress on priority resilience actions. New York communities are required to have certain designated positions like floodplain and emergency managers, so why not require the same for something as important as climate resilience? The resilience coordinators could become self-sustaining by tapping into the significant amount of annual state funding focused on resilience – over $300 million in 2017 alone.

The village of Piermont has received budget approval to hire a half-time resilience coordinator beginning in 2018. The Project Team hopes that this position will become sustainable and act as a cost-effective and successful model for other communities to replicate and for perhaps the state to require and support in the future. Sharing resilience staff across communities could be a cost-effective model with the potential to multiply the resilience benefits by emphasizing collaboration, sharing learnings, and avoiding duplicating work.

Finally, the Project Team and the four communities that underwent the Task Force and Learning Group processes have become regional leaders and would like to continue working together on building resilience. Though not yet realized, there is an interest and, for some, even a sense of responsibility, to share their learnings with other communities that were not involved in the process. Repeatedly throughout the process, Learning Group members voiced interest in networking with other communities that are just now stepping into the first stages of resilience planning. At the final Learning Group session, participants expressed interest in participating in periodic workshops or conferences that would bring together a wider array of communities as a way to share lessons and expand networking opportunities. The Project Team will continue to explore opportunities for a forum for continued

engagement with the four communities as well as for fostering collaboration and information exchange across the Hudson Valley and perhaps beyond.

Conclusion

The Hudson River and its valley is a unique and historic landscape where some manifestations of climate change are being experienced at rates faster than national and global averages. This presents distinctive challenges and opportunities for the many small Hudson riverfront communities trying to adapt to flooding and other climate risks. Over the past 5 years, state government and nonprofit partners have worked closely with four leading waterfront communities through the Task Force and Learning Group processes to help them create resilience plans and complete priority actions. Since these processes began in 2012, each community has made impressive progress and successfully accessed public funding for resilience projects. Perhaps of equal or greater value, they are increasing their adaptive capacity by building internal community expertise and resilience and forming ties and linkages across levels of government and with each other and external experts. Future work will focus on continuing these relationships, addressing barriers to engaging diverse stakeholders and increasing municipal capacity, and finding venues to share the lessons they learn with other communities in the region and beyond.

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