Environmental Finance Center
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Municipal Awareness and Perceptions of Resiliency in New York State

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Attitudes, Awareness, and Perceptions of Resiliency in New York State

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Abstract

The factors that influence local awareness of and engagement with resiliency concepts, programs, and actions are not fully understood. The objective of this report is to understand attitudes, awareness levels, preparedness levels, and the perceived ability to recover from climate threats (flooding) among decision-makers serving New York State communities. Identifying the relationships between these factors with respect to geographic location, community size, education level, and past experiences will inform future adaptation studies and guide technical assistance. This report also identifies the major barriers for local decision-makers working on resiliency projects.

A random sample of 1908 community leaders was selected from New York State contact lists managed by Syracuse University Environmental Finance Center, primarily town supervisors, planning board members, and town clerks. An online survey platform was used to distribute the survey. Survey response rate was 13.7% (n = 261). Survey questions addressed community preparedness, understanding leaders' attitudes towards locally relevant resilience planning, awareness of resiliency concepts and programs, and respondents' perceptions of their community's resilience. Statistical analysis was performed to derive results.

In New York State, community size does not influence likelihood of taking resiliency actions, such as using green infrastructure or conducting watershed assessments. Participation in one state or federal resiliency program, such as NOAA Storm Ready, can increase likelihood of completing resiliency planning actions. Some regions of the state are significantly less prepared than other regions. Positive attitudes towards topics like climate adaptation, green infrastructure, and renewable energy are influenced by education level and community size, but not by region or by gender. Climate policy and green infrastructure were viewed less positively than topics like renewable energy and recycling. Budget constraints and lack of local data were identified as major barriers to resiliency planning. Respondents most frequently identified funding guides as a useful resource for addressing barriers, followed by municipal planning tools and mapping tools.

Overall community preparedness levels across the state were moderate to low, with especially low levels of completion for green infrastructure projects, naturalized shoreline projects, and heat emergency plans; this indicates a need for increased technical assistance for these adaptation methods. There is an additional need for more research to systematically identify barriers to action at the community level, with a focus on qualitative data. Participatory models for identifying and addressing barriers, especially with respect to flooding, are needed to lower and remove barriers to action.

Background

The concept of community resilience has been described as the "existence, development and engagement of community resources by community members to thrive in an environment characterized by change, uncertainty, unpredictability and surprise", as well as "the ability to prepare and plan for, absorb, recover from or more successfully adapt to actual or potential adverse events."[1][2]

While many studies have investigated resilience, the factors that influence local awareness of and engagement with resiliency concepts, programs, and actions are not fully understood. Knowledge of local risks and needs is a necessary prerequisite for attaining community resiliency[3]. This kind of information may also be necessary for understanding the vulnerability of communities to natural disasters and other types of distress, and trends in decision-making currently taking place Knowledge of local needs may be especially important when it pertains to decision-making populations, such as local elected officials and planning board members.

This work targets local decision-makers such as elected officials, clerks, and planning board members in New York State. While many studies have investigated human perceptions of climate-related risks, few specifically target local decision-makers. Decision-makers' views and understandings may be critical for adaptation planning, as they are positioned to make decisions that reduce risk and vulnerability for their constituents. Given this target population,

[1] Magis, K. (2010). Community resilience: An indicator of social sustainability. *Society and Natural Resources*, *23*(5), 401-416.

[2] National Academy of Sciences. Web. Accessed March 2018 http://www.nationalacademies.org/topics/resilience/

[3] Cutter, S. L., Burton, C. G., & Emrich, C. T. (2010). Disaster resilience indicators for benchmarking baseline conditions. Journal of Homeland Security and Emergency Management, 7(1).

our conceptualization of awareness, preparedness, and perceived resilience takes into account contextual policies and programs.

Results of this report may be used to improve existing decision-support systems, such training programs for local government officials, planning tools, and federal and state agency guidance.

Major Findings

- In NYS, the community size does not matter when it comes to a community's likelihood of taking resiliency actions, such as using green infrastructure, passing a floodplain ordinance, or conducting watershed assessments.
- Participation in even one (1) state or federal program focused on resiliency, such as NOAA Storm Ready, can increase likelihood of completing resiliency planning actions.
- Some regions of the state are significantly less prepared than other regions.
- Positive attitudes towards topics like climate adaptation, green infrastructure, and renewable energy are influenced by education level and community size, but not by which region you live in or by gender.
- Climate policy and green infrastructure were viewed less positively than topics like renewable energy and recycling.
- Budget constraints and lack of local data were identified as major barriers to resiliency planning.

Survey Methods Summary

A random sample of 1908 community leaders was selected from New York State community contact lists managed by Syracuse University Environmental Finance Center. The sampling frame consisted of publicly listed email addresses for New York State community leaders representing 702 communities across the state. The community leaders targeted for the survey were primarily town supervisors, planning board members, and town clerks, although some of the contacts were not in elected roles. An online survey platform, Qualtrics, was used to distribute the survey. 13.7% (N = 261) of leaders responded to the survey. Please see Appendix C, part 2 for a complete description of survey methods. A copy of the survey instrument is included in Appendix A.

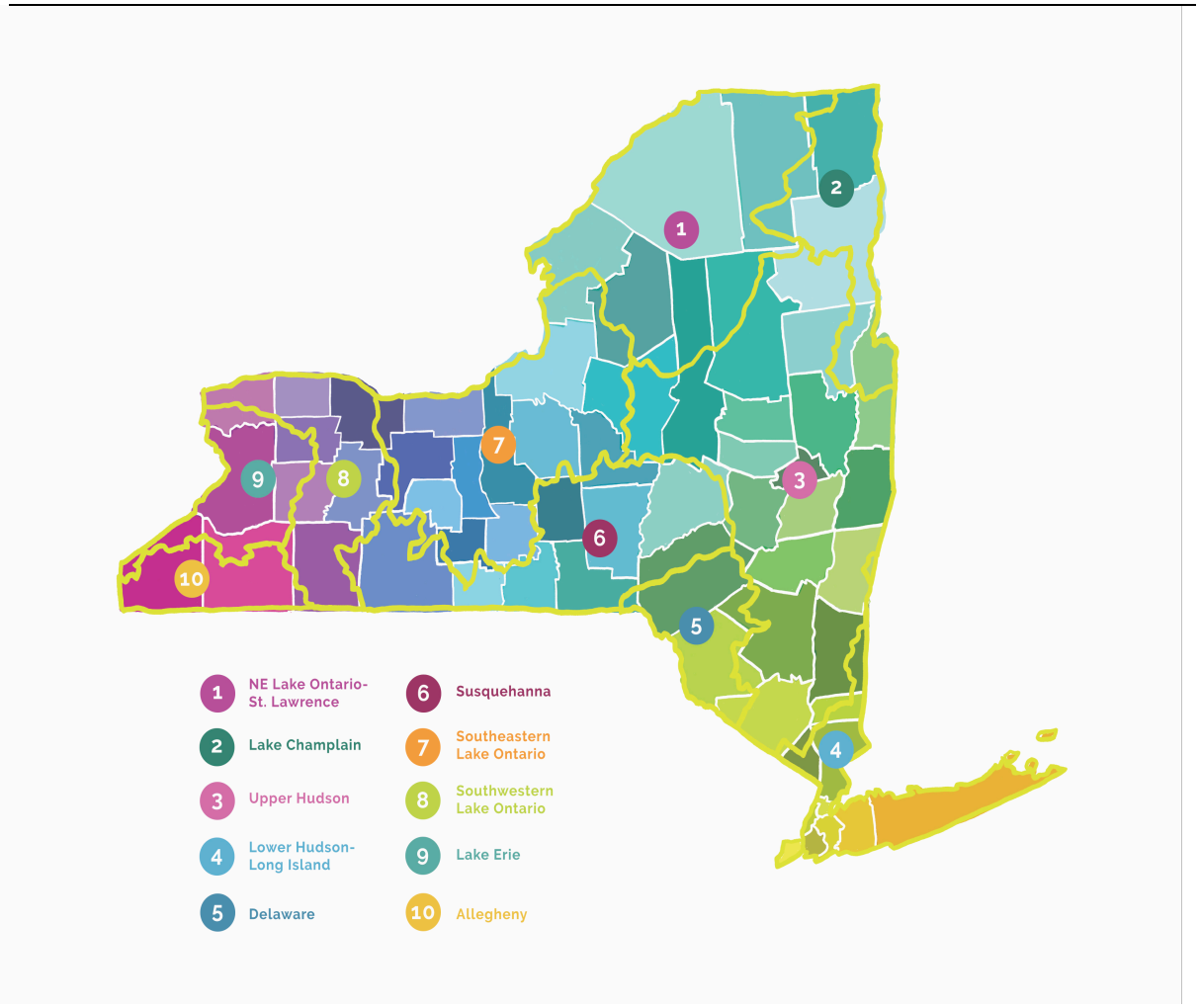
Demographics Overview

Drainage Basins

Awareness of climate-related threats, particularly flooding, is often linked to geographic factors and may be pertinent to leaders' attitudes, perceived level of resilience, and even the community's level of preparedness. Flooding, in particular, is a threat to many communities in New York State. In light of this, this report includes an analysis of attitudes, preparedness, perceived resilience that takes the respondent's drainage basin into account. Specifically, ten major New York drainage basins were used (depicted in the map below). These drainage basins may also serve as an indicator for regional and demographic differences. Table 1.1 contains details about the response rate per each drainage basin.

Table 1: Response Rates in New York State Drainage Basins

Drainage Basin	*Response %*	*N*
Allegheny	3.32%	7
Delaware	5.69%	12
Lake Champlain	6.16%	13
Lake Erie	4.74%	10
Lower Hudson- Long Island	4.27%	9
NE Lake Ontario- St Lawrence	14.22%	30
Southeastern Lake Ontario	23.22%	49
Southwestern Lake Ontario	7.58%	16
Susquehanna	14.69%	31
Upper Hudson	16.11%	34
Total	100%	211



Decision-Maker Profiles

Our respondents are elected officials or other institutional agents. Over 70% of the respondents were men. Please see Appendix B for additional demographic details about the survey population.

Table 2. Community Leader Job Roles

Job Role	*Response %*	*N*
Elected Official	54.75%	98
Planning Board Member	1.68%	3
Administration/Support	1.12%	2
Engineer	1.68%	3
Superintendent	2.79%	5
Town Board	3.35%	6
Town Clerk	14.53%	26
Environmental Specialist	1.68%	3
Natural Resource Manager	0.56%	1
Code Enforcement/ Zoning	3.35%	6
Other	14.53%	26
Total	100%	179

Community Size

Respondents were asked to identify the size of their community based on number of residents. As New York State has approximately 1600 local governments, there are major differences in community size and capacity[4]. Current demographic trends in New York State include declining rural populations and increasing metropolitan populations, which have led to reduced capacity and growth for smaller communities in the state. As a result, there are few large metropolitan areas (notably New York City) when compared to the many dispersed rural towns and villages. The majority of respondents represented communities of less than 10,000 residents.

Table 3: Respondent's Community Sizes

Population Size	*Response Rate*	*Count*
0-750	8.33%	18
751-1500	18.98%	41
1501-3000	25.46%	55
3001-4500	12.04%	26
4501-6000	9.26%	20
6001-8500	6.94%	15
8501-10000	1.39%	3
10001-15000	5.56%	12
Over 15000	12.04%	26
Total	100%	216

Community Preparedness

In addition to attitudes and awareness, this report aims to provide insight on community preparedness and factors that may contribute to better-prepared communities. To do this, respondents assessed the degree to which they had completed nine actions. A 4-point scale was used, based a climate adaptation survey by Carmin, Nadkarni, and Rhie (2012)[5], that was scaled as follows: (1) Action is completed; (2) presently conducting action, (3) planning to conduct action, 4) not conducted and no plans to conduct action. The following actions were selected from resiliency

[4] NY Department of State, Division Local Government Services: https://www.dos.ny.gov/lg/localgovs.html

[5] Carmin, JoAnn, Nikhil Nadkarni, and Christopher Rhie. 2012. Progress and Challenges in Urban Climate Adaptation Planning: Results of a Global Survey. Cambridge, MA: MIT.

checklists and indices including the NYS Climate Smart Communities program[6] and Cutter et. al's (2010) disaster resilience indicators[7], as well as input from planning and technical assistance experts:

- Create a watershed assessment to identify flooding and water quality priorities.
- Adopt a floodplain management and protection ordinance
- Right-size bridges and culverts and remove unnecessary and hazardous dams
- Conserve wetlands, floodplains, and other natural areas
- Use green infrastructure to manage stormwater in developed areas
- Develop early warning systems and community evacuation plans
- Implement a source water protection program
- Develop a heat emergency plan
- Use nature-based shoreline protection

It is important to note that these actions may not apply to every community, and that some communities may not explicitly conduct these actions but work with other agencies that do. All questions were voluntary, allowing for questions to be skipped. Additionally, due to the nature of this survey, many respondents did not know with certainty the degree to which actions had been taken—for this reason, an "I don't know" option was available. As a result, data is missing from the survey.

[6] NYS Climate Smart Communities Program. https://climatesmart.ny.gov/actions-certification/certification-overview/certification-framework/

[7] Cutter, S. L., Burton, C. G., & Emrich, C. T. (2010). Disaster resilience indicators for benchmarking baseline conditions. Journal of Homeland Security and Emergency Management, 7(1).

Table 4. Preparedness Actions Descriptive Results												
Action	Completed *(percent and count)*		Presently Conducting *(percent and count)*		Planning to Conduct *(percent and count)*		Not Conducted and No Plans to Conduct *(percent and count)*		Unsure *(percent and count)*		*Mean*	*N*
Create a watershed assessment to identify flooding and water quality priorities.	26.27%	62	14.83%	35	7.63%	18	30.08%	71	21.19%	50	236	236
Adopt a floodplain management and protection ordinance.	40.59%	97	5.44%	13	8.79%	21	27.20%	65	17.99%	43	239	239
Right-size bridges and culverts and remove unnecessary and hazardous dams.	23.53%	56	27.31%	65	10.92%	26	21.01%	50	17.23%	41	238	238
Conserve wetlands, floodplains, and other natural areas.	28.27%	67	22.78%	54	8.86%	21	19.83%	47	20.25%	48	237	237
Use green infrastructure to manage stormwater in developed areas.	13.19%	31	16.60%	39	15.32%	36	30.21%	71	24.68%	58	235	235
Develop early warning systems and community evacuation plans.	20.43%	48	13.19%	31	10.64%	25	35.74%	84	20.00%	47	235	235
Implement a source water protection program	20.09%	47	10.26%	24	8.12%	19	36.75%	86	24.79%	58	234	234
Develop a heat emergency plan	8.47%	20	4.24%	10	6.36%	15	53.39%	126	27.54%	65	236	236
Use nature-based shoreline protection	9.70%	23	8.02%	19	4.64%	11	52.32%	124	25.32%	60	237	237

More than 40% of respondents—more than any other action—reported that the process of implementing a floodplain ordinance was complete. When local governments pass and enforce floodplain management ordinances, residents may be allowed to enroll in federal flood insurance. This may partially explain the comparatively high levels of completion for this action[8]. 28% of respondents also reported that they had completed efforts to conserve wetlands and floodplains in their community.

According to the NYS Department of Health, over a third of the State's population live in heat vulnerable areas, typically with urban or metropolitan designations, yet heat emergency plans have the lowest reported completion rate on our survey (approximately 8% reporting completed plans)[9]. Additionally, the use of nature-based shorelines and the use of green infrastructure were reported as complete by only 9% and 13% of respondents respectively, a similarly low result.

Climate Preparedness Index Values

An index score for community climate preparedness was developed based on averaging each case response to the 9 actions in Table 1, using the same 4-point scale discussed above (1 = high preparedness, 4 = low preparedness). It is important to note that these nine actions may not comprehensive or "tell the whole story" of preparedness. However, together they can act as an internally consistent latent construct (Cronbach's alpha = .81), and can provide good insight into broader trends pertaining to the use of these actions. On average, community leaders had a mean score of 2.65, indicating a low to moderate level of preparedness across the state (N = 231). Responses that were marked as "unsure" were treated as missing data for the purpose of this analysis.

Preparedness Across Drainage Basins

Table 5. Central Tendencies in Preparedness across Drainage Basins

Basin	Mean 1= High, 4= Low	N	Std. Deviation	Maximum	Minimum
Delaware River Basin	2.565	10	.62680	3.63	1.67
Allegheny Basin	2.690	7	1.11012	4.00	1.00
Susquehanna Basin	2.601	30	.86089	4.00	1.00
Lower Hudson Basin/Long Island	2.244	9	.51900	3.14	1.50
Lake Erie Basin	2.765	10	1.09431	4.00	1.22
Upper Hudson	2.558	34	.77152	4.00	1.00
Lake Champlain	2.786	13	.80303	4.00	1.67
NE Lake Ontario- St Lawrence	3.148	28	.88667	4.00	1.20
Southeastern Lake Ontario	2.509	48	.91419	4.00	1.00
Southwestern Lake Ontario	3.042	16	.81171	4.00	1.22

The Lower Hudson drainage basin had the lowest score, indicating a high level of preparedness (basin mean = 2.244). The Northeast Lake Ontario/ St. Lawrence basin showed the lowest level of preparedness (basin mean = 3.148).

[8] NYSDEC, "Floodplain Management". Web. http://www.dec.ny.gov/lands/24267.html

[9] NYS Department of Health https://www.health.ny.gov/environmental/weather/vulnerability_index/nys_maps.htm

Influential Factors for Community Preparedness

This report examines how participation in specific state and federal programs, community size, and a community's location in a particular drainage basin influence their level of preparedness, as discussed above (completion of nine items). While these are by no means the only factors that influence communities' preparedness, the role of program participation and differences in community size and drainage basin location are especially important for focusing future technical assistance actions. Multiple linear regression modeling was used to examine the marginal influence of these factors on the level of preparedness. The model explained approximately 21% of the variation (R^2= .213).

Level of preparedness, based on the composite index, was not significantly influenced by the size of the community. It is important to note that community sizes reported were predominantly under 10,000 people. While further analysis of the community size may be needed, this indicates that the level of preparedness is not dependent on how many residents reside in the community or the capacity of a community that it retains due to size. At the very least, there are no distinct differences in preparedness between very small communities (under 500 people), and communities at least 3 times larger. This relationship may not hold true for much larger cities, such as New York City. A significant and positive relationship exists between program participation (participating in one of the 5 earlier discussed programs), suggesting that participation in even one state or federal program increases the likelihood that communities have undertaken preparedness actions. Finally, communities in the Northeast Lake Ontario/St. Lawrence River Basin (see Map in Sect. 1) were significantly less likely to have completed preparedness actions than communities in the Upper Hudson Basin. Please see the technical summary (appendix C) for presentation of regression coefficients.

Attitudes towards Resiliency Planning

In order to better understand community leaders' attitudes towards locally relevant resilience planning, community leaders assessed the degree to which they agreed or disagreed with statements focused on actions they could take in their communities. These statements focused the ability of certain actions to improve the resilience or state of communities, and the respondent's level of agreement is interpreted as the degree to which they favor those actions as resiliency-building. For example, respondents were asked to agree or disagree with the following statement: "Green infrastructure projects (such as bioswales and riparian buffers) would make my municipality more resilient to natural hazards". In addition to green infrastructure, we also examined attitudes towards the following planning actions:

- Renewable energy
- Compost and Sustainable Materials Management
- Climate Adaptation Policy
- Public Outreach and Education

Please see Appendix A- Survey Instrument, Q11 for details about each statement.

Community Leader Attitudes: Descriptive Results

For all topics examined, there was at least weak agreement that the actions increased the community's resiliency, indicating overall positive attitudes. Green Infrastructure and Climate Policies were viewed less positively, on average, than renewable energy, composting, and public education in making communities more resilient.

Table 6. Community Leader Attitudes towards Resiliency Actions

Statement	Strongly Disagree		Disagree		Somewhat Disagree		Neither Agree nor Disagree		Somewhat Agree		Agree		Strongly Agree		Total
Green infrastructure projects (such as bioswales and riparian buffers) would make my municipality more resilient to natural hazards	3.21%	7	3.67%	8	1.83%	4	41.28%	90	20.64%	45	19.72%	43	9.63%	21	218
Adopting policies for climate change adaptation would benefit my municipality.	5.48%	12	7.76%	17	3.65%	8	34.70%	76	18.72%	41	17.81%	39	11.87%	26	219
Renewable energy projects, such as solar or wind technology, would make my municipality more resilient.	4.52%	10	4.07%	9	2.26%	5	17.19%	38	28.96%	64	26.70%	59	16.29%	36	221
Public outreach and education about the risks of natural hazards and related social stressors would help my municipality become more resilient.	2.27%	5	3.64%	8	4.09%	9	20.45%	45	28.64%	63	28.18%	62	12.73%	28	220
Expanding composting and recycling programs would help my municipality become more resilient.	3.17%	7	5.43%	12	2.26%	5	21.72%	48	22.17%	49	30.77%	68	14.48%	32	221

Table 7. Central Tendencies in Community Attitudes

Statement Topic	*Mean*	*Std Deviation*	*Variance*	*Count*
Green infrastructure projects	4.7	1.35	1.82	218
Adopting policies for climate change adaptation	4.54	1.59	2.51	219
Renewable energy projects	5.07	1.51	2.27	221
Public outreach and education about the risks of natural hazards	5.05	1.36	1.85	220
Expanding composting and recycling programs	5.05	1.48	2.19	221

Factors Influencing Community Leader Attitudes

Ordinal logistic regression was utilized to assess if a respondent's age, community size, gender, education, and location (denoted by the drainage in which their community is located) influences their attitudes towards resilience actions. Neither the gender of the respondent nor the age of the respondent is significant in predicting their attitude towards the topics examined. There are **not** significant differences in attitudes between residents of different basins; indicating that attitudes are not influenced in the region in which your community is located. Across all topics examined (green infrastructure, climate policy, natural hazard education, compost/recycling, and renewable energy), there was a significant positive relationship between favorable attitudes and larger community sizes. Additionally, respondents with higher levels of education were more likely to express favorable attitudes towards the actions.

A further question explored in this study was whether social or natural events, as reported by the respondent, influenced attitudes towards resiliency actions. These include prior natural disasters, population decline, and economic turmoil in the form of a major employer closing. There was not a significantly relationship between these past events and attitudes, indicating past experience does not have an impact on decision-maker's attitudes towards resiliency-building actions.

These items all address aspects of direct experience, and the role it may play in perceiving and understanding risk, shaping attitudes, and ultimately shaping decisions. Experiences can trigger emotional responses of worry or concern, shape understanding of risk, and ultimately influence attitudes and decisions; however, this can often compete with factors related to the individual's values, cultural background and political beliefs in confounding ways[10]. Previous studies suggest that willingness to support adaptation measures is linked to heightened perceptions of risk, and also that climate-related risks are dependent on location and concepts of place[11]. While this relationship does not appear to exist in the decision-making population surveyed for this report, it may be important to explore why this is or otherwise verify this result. However, better data, such as population trends over time, economic indicators, or an indicator variable for climate impacts may be needed in future analyses. The survey questions/examples of population decline, past natural disaster, etc. may also have not adequately conveyed concepts of risk or direct experience.

Ordinal regression results is included in the technical summary (Appendix C).

Awareness of Resiliency Concepts and Relevant Programs

Concept Awareness

Community leaders, especially those in a planning or decision-making role, grapple with complex concepts, frameworks, and sometimes "buzz words" that underpin different approaches to community development and planning. This investigation aims to arrive at a basic understanding of this landscape, and determine levels of awareness for concepts and approaches often used in resiliency planning. While this instrument doesn't examine the ways community leaders make sense of these terms, we hope it acts as a general litmus test for the degree to which leaders are exposed to messages and approaches involving resiliency.

Respondents were asked to review a list of terms and check the terms that they came across frequently in their leadership role. This list included:

- Smart Growth
- Green Infrastructure

[10] Vogel, C., Moser, S.C., Kasperson, R.E., Dabelko, G.D., 2007. Global Environmental Change 17, 349-364.
[11] Hess, J.J., Malilay, J.N., Parkinson, A.J., 2008. American Journal of Preventive Medicine 35, 468-478.

- Climate Adaptation
- Resiliency
- Vulnerability Assessment
- Low Impact Development

Respondents most frequently encounter the term "smart growth" (68%) and "green infrastructure" (67%) in fulfilling their leadership role. Only 33% reported that they frequently encounter the term "climate adaptation". "Resiliency", "vulnerability assessment", and "low impact development" were familiar terms to approximately 50% of community leaders. Table 8 below summarizes these results. As each term was evaluated discretely (coded 0/1), averages presented reflect the percent of respondents that checked that term. The total number of items checked off was also analyzed. On average, respondents checked approximately 3 of the 5 terms investigated.

Table 8. Concept Awareness Central Tendencies

	Total number of concepts checked	Smart Growth	Green Infrastructure	Climate Adaptation	Resiliency	Vulnerability Assessment	Low Impact Development
Mean	3.1198	.68	.67	.33	.45	.46	.52
Median	3.0000	1.00	1.00	.00	.00	.00	1.00
Mode	2.00	1	1	0	0	0	1
N	217	220	220	220	220	218	217

Program and Resource Awareness

In order to better connect local communities with funding or assistance, this study examined awareness of the relevant resources and sources of funding available to New York State communities. The visibility of these programs may have direct relationships to the level of preparedness in a community. The following programs were financial and technical resources to New York State Communities:

- New York State Climate Smart Communities Program
- National Flood Insurance Community Rating System
- NYSERDA Clean Energy Communities Program
- NOAA Storm Ready Program
- NRCS Environmental Quality Incentive Program

These programs are all available to local governments in New York State. Additionally, these programs were selected based on the input of several technical assistance providers and regional planning groups with expertise on the range of existing programs. A 5-point scale for awareness (1 = low, 5 = high) was used to assess program awareness.

On average, respondents were most familiar with NYSERDA's Clean Energy Community Program and the National Flood Insurance Community Rating System (which impacts flood insurance rates). Community leaders exhibited lower levels of awareness for NRCS's EQIP program and the NOAA storm ready program—these are both federal programs. On average, community leaders had a moderate level of awareness for Climate Smart Communities. **Table 10** includes complete descriptive results.

Participation in Programs

Participation across programs in noted here. There are 120 total respondents that indicate participating in *any* of the five programs. As stated earlier, participation in these programs significantly increased likelihood of completing

preparedness actions. While participation is important, the degree to which elected officials that do not participate in the program know of and understand the purpose and mission of the program can help refocus assistance efforts.

Table 9. Program Participation Frequency		
Program	Number of Respondents indicating that their community participates	*N (Excludes Respondents that did not know if community participates)*
NYS Climate Smart Communities	74	120
NYSDERDA Clean Energy Communities	94	120
NOAA Storm Ready	19	120
NRCS Environmental Quality Incentives Program	11	120
National Flood Insurance Community Rating System*	60	120

The New York State Climate Smart Communities Program is a joint program between multiple New York state agencies, including the DEC and NYSERDA. The program is a voluntary, step-by-step certification process for municipalities. The first step is taking the "climate smart communities pledge." Communities that participate in the program have been eligible for matching funds on climate mitigation and adaptation projects that meet climate smart communities program goals.

NYSERDA Clean Energy Communities is available to local governments in New York to implement clean energy actions, save energy costs, create jobs, and improve the environment. Communities that implement 4 out of 10 specific actions and submit documentation to NYSERDA are eligible for additional funding for clean energy projects.

National Flood Insurance Community Rating System is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. The program is administered by FEMA. Participation can result in discounts on flood insurance rates for residents of participating municipalities. It is important to note that responses here likely do not represent participation in the rating system, just federal flood insurance*. Previous research has shown that this program is under-utilized in New York State, and that communities may not understand how to navigate the program beyond ensuring eligibility for flood insurance[12].

NOAA Storm Ready Program is a national program administered by the National Weather Service that provides guidelines on weather emergency preparedness and nationally recognizes communities that meet preparedness goals. There is no funding mechanism.

NRCS Environmental Quality Incentive Program provides cost-share to agricultural entities and others instating best management practices for maintaining environmental system integrity.

[12] Flood Smart Communities Action Plan, Genesee-Finger Lakes Regional Planning Council and UB Institute (2016) http://www.gflrpc.org/uploads/5/0/4/0/50406319/meetingschedule3situationanalysisrelationshipsdiagram.pdf

Table 10. Awareness of State and Federal Programs											
Program	I am not aware of this program		I have heard of this program but do not know anything about it		I have heard of this program and know a little about it		I have heard of this program and am somewhat familiar with its mission and objectives		I have heard of this program and I am very familiar with its mission and objectives		Total
New York State Climate Smart Communities Program	36.52%	84	10.87%	25	17.39%	40	17.83%	41	17.39%	40	230
National Flood Insurance Community Rating System	18.61%	43	20.78%	48	19.91%	46	19.91%	46	20.78%	48	231
NYSERDA Clean Energy Communities Program	11.69%	27	11.69%	27	16.02%	37	29.44%	68	31.17%	72	231
NOAA Storm Ready Program	38.53%	89	17.32%	40	21.21%	49	14.72%	34	8.23%	19	231
NRCS Environmental Quality Improvement Program	44.59%	103	21.65%	50	18.61%	43	10.82%	25	4.33%	10	231

Perceived Resilience

A core line of inquiry for this project is to probe how municipal audiences understand and think about resilience in their community. Previously in this report, a measure of preparedness was presented based on the respondent's assessment of his or her community, with respect to the nine actions discussed in Section 5. While this measure can illuminate preparedness at the community level, it does not provide insight on how respondents perceive their community's ability to cope with future events. By analyzing both perceived resilience as well as the status of community resiliency planning across the state, this report aims to paint a more complete picture of community resiliency.

Perceived or subjective resilience may be in important for understanding past and future decision-making, and offer ways for technical assistance providers to intervene. Jones (2016) offers concrete guidance on measuring individual's subjective understandings of resilience, and recommends open-ended questions/structured interviews as well as guidance on standardized questions. This project used previously developed frameworks (Cutter, 2008) suggested by Jones (2016) to construct a 4-item indicator for perceived resilience[13][14].

Community leaders assessed their level of agreement with multiple statements relating their community's ability to financially, socially, and physically recover from flooding scenario (chosen based on its relevance to most NYS communities). See survey instrument (appendix 1).

The results are summarized in Tables 11 and 12.

[13] Cutter, S. L., Barnes, L., Berry, M., Burton, C., Evans, E., Tate, E., & Webb, J. (2008). A place-based model for understanding community resilience to natural disasters. *Global environmental change*, *18*(4), 598-606.

[14] Jones, L., & Tanner, T. (2017). 'Subjective resilience': using perceptions to quantify household resilience to climate extremes and disasters. *Regional Environmental Change*, *17*(1), 229-243.

Table 11: Perceived Abilities to Recover from Floods: Descriptive Results

Question	Strongly Disagree		Disagree		Somewhat Disagree		Neither agree nor Disagree		Somewhat Agree		Agree		Strongly Agree		N
My municipality has access to sufficient financial resources to ensure that we fully recover from the threats posed by the flood.	15.83%	41	25.10%	65	14.29%	37	9.65%	25	16.22%	42	16.60%	43	2.32%	6	259
Members of my municipality would be able to draw on the support of family and friends to ensure that we fully recover from the threats posed by the flood.	5.77%	15	14.23%	37	10.38%	27	16.92%	44	26.15%	68	20.00%	52	6.54%	17	260
My municipality would be positioned to address, mitigate, and restore damage to habitats, water quality, and other natural resources caused by the flood.	12.06%	31	22.18%	57	18.68%	48	12.45%	32	18.68%	48	12.06%	31	3.89%	10	257
My municipality has the infrastructure, tools, and equipment to recover from the threats posed by the flood.	9.34%	24	21.79%	56	19.46%	50	12.06%	31	22.57%	58	12.45%	32	2.33%	6	257
Members of my municipality have the knowledge, expertise, and experience to ensure that we are able to recover from the threats posed by the flood.	7.78%	20	13.62%	35	15.18%	39	13.62%	35	23.35%	60	22.18%	57	4.28%	11	257

Table 12: Central Tendencies in perceived flood recovery ability

Statement	Minimum (Low agreement)	Maximum (High Agreement)	Mean	Std Deviation	N
My municipality has access to sufficient financial resources to ensure that we fully recover from the threats posed by the flood.	1	7	3.44	1.82	259
Members of my municipality would be able to draw on the support of family and friends to ensure that we fully recover from the threats posed by the flood.	1	7	4.3	1.66	260
My municipality would be positioned to address, mitigate, and restore damage to habitats, water quality, and other natural resources caused by the flood.	1	7	3.55	1.73	257
My municipality has the infrastructure, tools, and equipment to recover from the threats posed by the flood.	1	7	3.63	1.65	257
Members of my municipality have the knowledge, expertise, and experience to ensure that we are able to recover from the threats posed by the flood.	1	7	4.15	1.7	257

Overall, the elected officials and community leaders responding to this survey weakly disagreed (mean = 3.44) that their community had the financial resources to recover from a future flood. Respondents also weakly disagreed that their community would be able to address damage to vital natural resources and habitats (mean = 3.55); and weakly disagreed that their communities had the infrastructure and equipment necessary for quick flood recovery (mean = 3.66). However, there were overall positive levels of agreement in other aspects of flood resiliency— local decision makers had more confidence in their communities' ability to rely on support from family and friends (mean = 4.4) and the ability of local expertise and knowledge to assist recovery.

As a measure of subjective resilience, these results indicate that local decision makers across the state are not exceptionally confident about their community's ability to cope with flooding, especially financially. At face value, this is consistent with the community preparedness results listed in Sec. 5, (a low to moderate level of preparedness across the state, mean preparedness index score of 2.65). These metrics provide two separate ways to view and understand resiliency, but are also not independent concepts—in particular, it may be the case that a respondent who is aware of their community's level of preparedness (in terms of the projects they have conducted, like green infrastructure), may perceive his or her community's ability to recover differently. Our results indicate that respondents who checked off more preparedness actions were more likely to agree that their community had the ability to recover from a future flood event. Please see Appendix C, table C4 for statistical results.

Taken together, these results provide a reasonable baseline to track improvements in preparedness and resilience. These results also provide a reasonable justification for targeting programmatic strategies that both provide funding and structure for completing preparedness activities, such as those discussed in Sect. 5.

Community Challenges and Barriers to Resiliency Planning

Increasingly, New York state communities face challenges such as increased flooding and shoreline erosion, which impact ecological integrity and also have long-term impacts on livelihoods and local economies. Consequently, communities are tasked with adapting to these challenges in various ways, including in how they develop local plans and manage the natural and built environment.

Studies from the field of climate adaptation have established the importance of understanding the barriers and constraints to this process, as different constraints have vastly different policy solutions, especially at the local municipal level[15]. Identification of specific barriers is a perquisite for determining appropriate and tailored planning strategies[16]. In other words, a lack of information on barriers to climate adaptation contributes to the lack of progress towards climate adaption. This section describes the major barriers in New York State communities, as well as the tools survey respondents believe would be most useful for ameliorating challenges.

Respondents were asked to assess whether a given barrier was a major hurdle, a minor hurdle, or not a hurdle. The barriers were provided as multi-item indicator, with the option to write in their own description of barriers. The barriers included in this survey were based on barriers studied by Archie (2015)[17].

[15] Measham, T. G., Preston, B. L., Smith, T. F., Brooke, C., Gorddard, R., Withycombe, G., & Morrison, C. (2011). Adapting to climate change through local municipal planning: barriers and challenges. *Mitigation and adaptation strategies for global change*, *16*(8), 889-909.

[16] Moser, Susanne C., and Julia A. Ekstrom. "A framework to diagnose barriers to climate change adaptation." Proceedings of the national academy of sciences (2010): 201007887.

[17] Archie, 2014:
http://sciencepolicy.colorado.edu/admin/publication_files/2014.56.pdf

Budget constraints were most frequently assessed as a major hurdle to planning, followed by the lack of local data on impacts. Lack of leadership was the least commonly experienced barrier; however this is likely biased as the a vast majority of respondents to this survey hold leadership roles. An analysis of qualitative input on this topic is forthcoming.

Table 12. Barriers to Resiliency Planning in New York State

Barrier	Major Hurdle		Minor Hurdle		Not a Hurdle		Total
Budget Constraints	85.12%	183	13.02%	28	1.86%	4	215
Political Will	25.71%	54	53.33%	112	20.95%	44	210
Lack Of Local Data on Impacts	27.01%	57	58.77%	124	14.22%	30	211
Lack of Leadership	18.48%	39	35.55%	75	45.97%	97	211
Not A High Priority In My Community	22.07%	47	51.64%	110	26.29%	56	213
Lack of Perceived Solutions	27.96%	59	51.18%	108	20.85%	44	211
Conflicts with Stakeholders	24.06%	51	42.92%	91	33.02%	70	212
Personnel Constraints	32.06%	67	36.36%	76	31.58%	66	209
Other:	22.22%	2	22.22%	2	55.56%	5	9

Table 13. Central Tendencies and Trends in Responses to Barriers

Barrier	Mean (1 = Major concern, 3= Minor concern)	Std Deviation	Variance	Count
Budget Constraints	1.17	0.42	0.18	215
Political Will	1.95	0.68	0.46	210
Lack Of Local Data on Impacts	1.87	0.63	0.4	211
Lack of Leadership	2.27	0.75	0.57	211
Not A High Priority In My Community	2.04	0.69	0.48	213
Lack of Perceived Solutions	1.93	0.7	0.48	211
Conflicts with Stakeholders	2.09	0.75	0.56	212
Personnel Constraints	2	0.8	0.64	209
Other:	2.33	0.82	0.67	9

Respondents were asked to identify tools and resources that would be most useful for addressing the barriers they faced. A list of tools and resources was provided for respondents with the option to check all that apply. The results are summarized in table 14. Funding guides were identified as useful most frequently, followed by municipal planning tools and mapping tools.

Table 14. Tools and Resources Needed for Resilience and Adaptation Planning		
Tool or Resource Type	%	Count
Other	0.89%	8
Stakeholder engagement and communication resources	9.10%	82
Vulnerability assessments	12.10%	109
Policy guidance	13.87%	125
Model ordinances	13.87%	125
Mapping tools	14.21%	128
Tools for developing municipal plans	15.65%	141
Funding guides	20.31%	183

Research Needs and Implications

The objective of this report is to understand attitudes, awareness levels, preparedness levels, and the perceived ability to recover from climate threats (flooding) among decision-makers serving New York State communities. Identifying the relationships between these factors with respect to geographic location, community size, education level, and community past experiences can not only establish baselines for future adaptation studies, but also practically guide decision support systems. This report also provides an overview of the major barriers identified by local decision-makers for working on resiliency projects.

Community Preparedness and Perceived Resiliency

- Overall community preparedness levels across the state were moderate to low, with especially low levels of completion for green infrastructure projects, naturalized shoreline projects, and heat emergency plans; this indicates a need for increased attention to these issues in existing adaptation support systems.
- Community preparedness levels were not dependent on community size. In this study, results indicate communities of less than 500 people were just as likely to have completed adaptation actions as communities of 15,000.
- Participating in even 1 program increased the likelihood of a community completing adaption actions, such as installing green infrastructure or passing a floodplain ordinance. This underscores the need to engage non-adopter communities in existing programs. While this report does *not* evaluate program success for any specific program mentioned, this analysis does indicate that participation can lead to implementation of preparedness actions.
- Communities in the NE Lake Ontario/St Lawrence River water basin is significantly less likely conduct preparedness actions discussed in this report. This region is vulnerable to flooding, and home to many shoreline communities. This area may be a high priority for engagement in existing programs, such as those discussed in this report, as well as increased education, outreach, and technical assistance.
- Further research that focuses on the role of program participation and financial investment is needed, with a goal of determining which programs or combinations of programs influence preparedness, and, if possible, the marginal impacts of financial assistance supplied by those programs.
- Overall, decision-makers disagreed that their community had the financial resources, infrastructure and equipment, and ability to address environmental damage necessary for flood recovery.
- Taken together, these results on both perceived ability for recovery as well as preparedness level provide a baseline to track improvements in preparedness and resilience. These results also provide a reasonable justification for targeting programmatic strategies that both provide funding and structure for completing preparedness activities, such as those discussed in this report.

Attitudes and Awareness

- Across the state, there was weak but positive agreement that resiliency actions including green infrastructure, renewable energy projects, composting and recycling programs, natural hazard education, and climate change adaptation policy would increase resiliency in the respondent's community. However, green infrastructure projects and climate change adaptation policy were viewed the least favorably. At the same time, only 33% reported that they frequently encounter the term "climate adaptation" in their job role.
- New York State's decision maker attitudes were not influenced by location, gender or age in any topic area. However, across all topics examined (green infrastructure, climate policy, natural hazard education, compost/recycling, and renewable energy). However, there was a significant positive relationship between favorable attitudes and larger community sizes. Additionally, respondents with higher levels of education were more likely to express favorable attitudes towards the actions.
- Programs that decision-makers were most of aware of included NYSDERDA's Clean Energy Communities Program and FEMA's National Flood Insurance Community Rating System.
- Past experience with a natural disaster did not impact decision-maker's attitudes towards resiliency-building actions, suggesting other factors not examined in this study such as cultural background, political affiliation, or other social norms may have a role. Research on risk perception and concern in decision-making populations is needed to understand decision-maker's attitudes, and ultimately what shapes their choices on climate adaptation.

Barriers to Resilience

- While budget restraints were reported most frequently as posing a major hurdle (85% of respondents), a lack of local data and a lack of perceived solutions also poses barriers to planning. Additionally, it is important to note that financial constraints, while prevalent, can also be misidentified or interact with other types of barriers, and sometimes can obscure critical issues[18] These results underscore the need for information, training, and financial inputs to assist decision-making processes.
- Decision-makers identified funding guides, mapping tools, and municipal planning resources as useful for addressing resiliency in their communities.
- There is an additional need for more research to systematically identify barriers to action at the community level, with a focus on qualitative data. Participatory models for identifying and addressing barriers, especially with respect to flooding, are needed to lower and remove barriers to action.

[18]Moser, Susanne C., and Julia A. Ekstrom. "A framework to diagnose barriers to climate change adaptation." Proceedings of the national academy of sciences (2010): 201007887.