

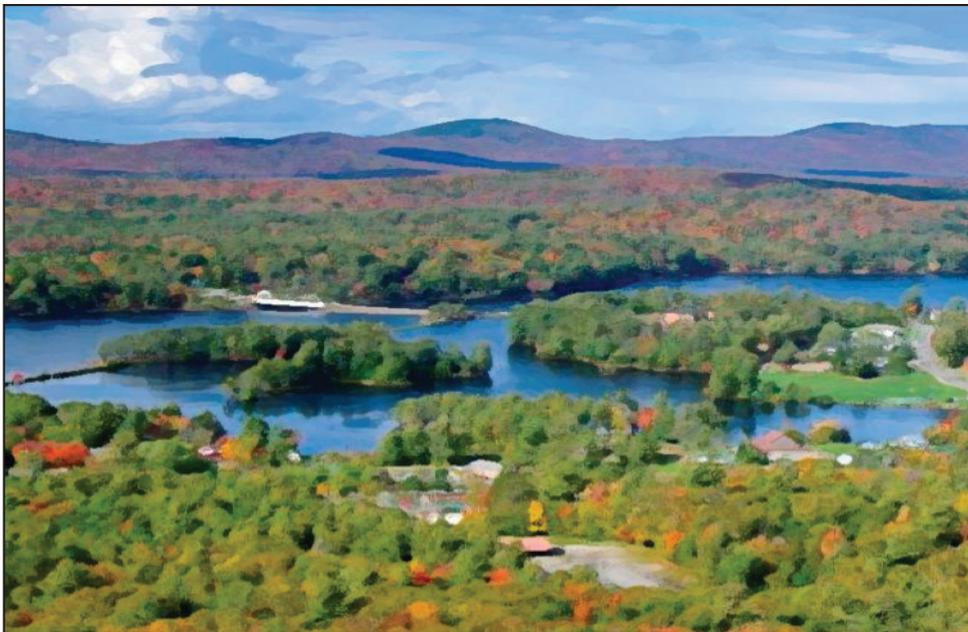
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# CaRDI Reports

ISSUE NUMBER 16/DECEMBER 2014

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## Building Local Capacity to Respond to Environmental Change: Lessons and Case Studies from New York State



Adapted image from photo by Johnathan Esper. Photo taken in Hamilton County, NY.

By Lincoln R. Larson, T. Bruce Lauber, David L. Kay



Cornell University  
Human Dimensions Research Unit



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## Building Local Capacity to Respond to Environmental Change: Lessons and Case Studies from New York State



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Photo taken in Lycoming County, PA.

### Building Local Capacity to Address Natural Gas Development: Lessons from New York's Southern Tier



© Nick Zungoli. Photo taken in Putnam County, NY.

### Building Local Capacity to Address Open Space Development: Lessons from Hudson Valley Towns



© Alan Wechsler. Photo taken in Franklin County, NY.

### Building Local Capacity to Respond to Climate Change: Lessons from Adirondack Towns

By **Lincoln R. Larson<sup>1</sup>, T. Bruce Lauber<sup>2</sup>, David L. Kay<sup>3</sup>**

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## Preface

Local governments face an array of challenges when it comes to environmental resource management. To improve municipal capacity to plan for and respond to different types of challenges, it is critical to understand the complex factors that influence local environmental governance. During 2012 and 2013, our research team at Cornell University teamed up with a variety of governmental and non-governmental partners across New York State to examine towns' responses to a range of environmental issues that vary by type of impact, their geographical scale of influence, and how quickly they lead to change. The focal issues and regions included climate change in the Adirondacks, natural gas development in the Southern Tier, and loss of open space due to residential/commercial development in the Hudson Valley. Study data were collected via interviews and surveys with supervisors and other high-ranking officials in towns across all three regions. A separate Research & Policy Brief describes key themes and lessons that emerged from a comparative analysis across all three issues/regions (see the December 2014 Issue #63, under "Publications" at [www.cardi.cornell.edu](http://www.cardi.cornell.edu)). This series of reports highlights the issue-specific findings and associated policy and management implications for each region of the state.

## Acknowledgements

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# Building Local Capacity to Address Natural Gas Development: Lessons from New York's Southern Tier



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**Lincoln R. Larson • T. Bruce Lauber • David L. Kay**



**Cornell University**  
**Human Dimensions Research Unit**



## What is the Issue?

The potential for natural gas development via high-volume hydraulic fracturing (HVHF) has created a number of challenges and opportunities for towns in New York State. The controversial economic, social, and environmental tradeoffs associated with wide-scale natural gas extraction are magnified in counties along New York's Southern Tier, where Marcellus Shale gas reserves are particularly abundant. Natural gas development holds great promise for economic revitalization through revenue generation and job creation. However, successful local revitalization is not guaranteed, and successful development of high value, depletable, and economically volatile resources like natural gas is challenging. This development also comes with significant risks to local environments and public health (e.g., water and air pollution, road congestion and damage, degradation of community character). Just as best case economic outcomes are not inevitable, neither are worst case environmental and health outcomes. Each depends, to no small extent, on the capacity of the public sector to maximize public benefits and minimize risks. Municipalities in regions like the Southern Tier are beginning to weigh these benefits and costs by considering the implications of "fracking" and engaging in policy development and implementation that reflects community priorities. Local officials attempting to respond to this complex issue would benefit from a better understanding of the array of factors that influence local governments' capacity to address natural gas development.

## Research Methods

Using seven Southern Tier counties in the Marcellus Shale region as a case study, we examined these factors through two phases of data collection (interviews and web surveys). In the interview phase (fall 2012), we asked 19 key contacts from the region (municipal officials, consultants, etc.) about knowledge of, concern about, and response to natural gas development at the local level. We also asked interview participants to discuss local

efforts to address natural gas development and key barriers to action. In the survey phase (fall 2013), we contacted 106 towns across the seven focal counties and asked at least one elected official in each town (typically the town supervisor) to respond to a web survey. When multiple responses were received from a town, we used the information from only one source: the highest authority or the most-experienced official. We obtained completed surveys from respondents in a total of 62 different towns (59% response rate). A telephone-based follow-up with 30 of the remaining towns did not reveal significant non-response bias. The survey allowed us to quantify municipal officials' beliefs and perceptions regarding HVHF and identify factors that might affect towns' capacity to address natural gas development and associated impacts.

## Municipal Officials' Beliefs about Natural Gas Development

Local officials were perceived to be relatively well-informed with respect to natural gas development; a majority of respondents (71%) agreed that "most officials" in their town knew a lot about the issue and its potential impacts (Table 1). In fact, 59% of respondents claimed their towns had spent a moderate or great deal of time debating or discussing natural gas development, more than any other specific municipal concern except transportation-related issues. For example, some interviewees reported spending 2-3 hours engaged in "fracking"-related discussions at monthly board meetings.

Across the region, respondents were divided when asked if natural gas development would create environmental problems in their town (29% agreed, 29% disagreed). Perceived effects of natural gas development on specific town attributes were also highly polarized, though most respondents anticipated benefits that enhanced gas extraction might bring to the local economy (Table 2). Despite environmental concerns, 50% of respondents claimed that the benefits of gas development

would outweigh the costs, compared to 13% who believed the costs outweighed the benefits. One town supervisor noted:

*“The pros outweigh the cons significantly. I mean, it’s 10 to 1 in my opinion. It’s not even close. The negative impacts are extremely short term and almost all of them are immediately reparable.”*  
– Town Supervisor

However, a supervisor in the neighboring county offered an opposing perspective:

*“I don’t think we have a real immediate environmental threat at the moment. It’s all pretty long range... But, I mean, the damage to*

*the community, setting aside the environmental threats. That’s another entire discussion. The roads, the housing infrastructure, the labor market, and the fact that there likely isn’t enough gas in the Marcellus anyway - not a lot of cash coming in from taxes or royalties to families... I think we’re likely to lose more than we will gain.”* – Town Supervisor

Overall, 32% of respondents came from towns that supported natural gas development, 16% opposed it, and 36% reported mixed or neutral perspectives (an additional 16% responded “don’t know”).

A majority of respondents (63%) indicated that “most officials” in their town thought it was their responsibility to do something to address natural

	Disagree (%)	Neutral (%)	Agree (%)	Don’t Know (%)
Most officials in my town...				
Know a lot about natural gas development and its potential impacts	10	10	71	10
Believe responding to natural gas development requires action by town government	3	21	63	13
Agree on the actions that should be taken to address natural gas development at the local level	7	24	60	10

Characteristic of Town	Perceived Impact (% of Towns)		
	Negative	No effect	Positive
Traffic	72	19	9
Natural environment (including forests, wetlands and waterways)	46	40	14
Safety and emergency response capacity	41	24	35
Farmland	40	36	24
Roads and physical infrastructure	39	19	43
Drinking water	34	56	10
Overall community character	31	40	29
Cost of living	30	22	48
Quality of public services (schools, health care, etc.)	23	42	36
Tourism	22	68	10
Recreation opportunities	18	71	12
Local economy (jobs, tax base, etc.)	6	7	87

gas development, and a similar number (60%) thought there was general agreement at the town level about actions that could be taken to address the issue (Table 1). Although substantial polarization was evident on a regional scale, consensus was much more commonly reported among local officials within municipal units.

## Municipal Actions Taken to Address Natural Gas Development

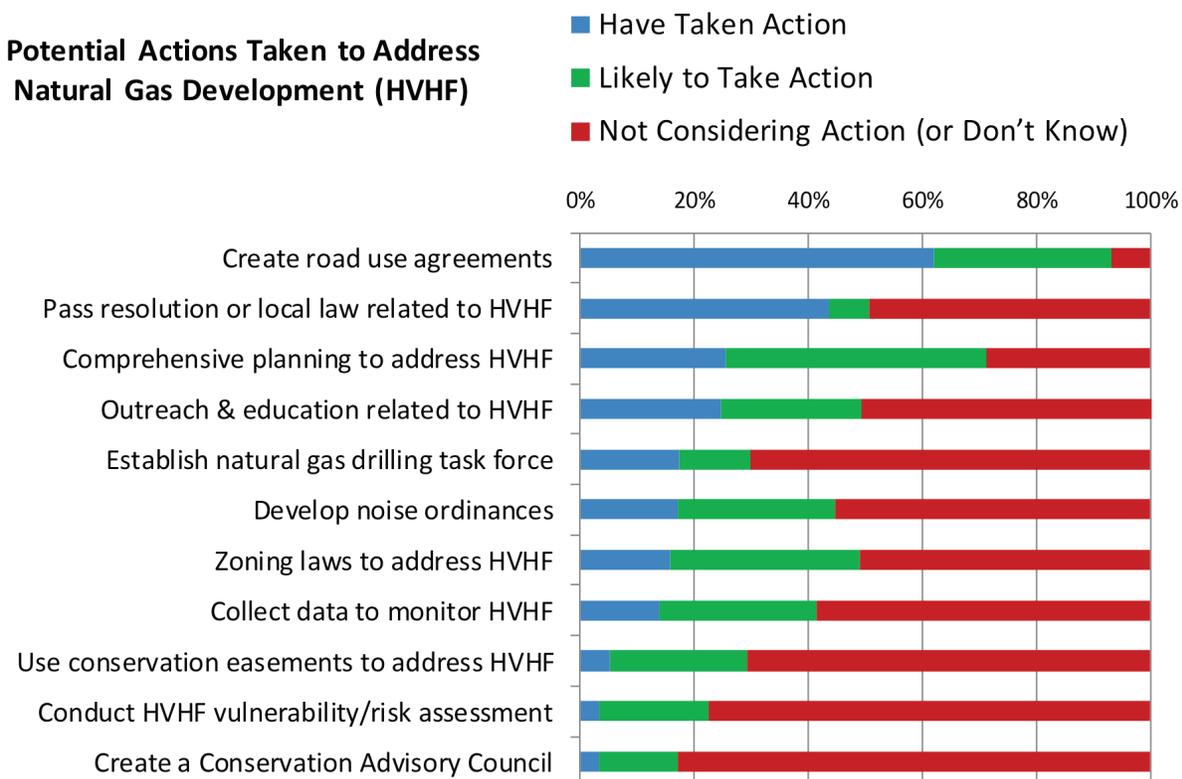
According to survey respondents, over 74% of Southern Tier towns had taken some action to specifically address natural gas development. The two most common actions taken were the creation of road use agreements and resolutions or local laws designed to facilitate (or obstruct) natural gas development. Some towns had already started to integrate HVHF-related issues into comprehensive planning, and many others were considering

these actions. Few towns (<20%) had established a natural gas drilling task force, and even fewer were actively collecting data to monitor natural gas development impacts and evaluate potential risks.

## Factors Affecting Municipal Response to Natural Gas Development

Towns' perceived capacity to address natural gas development varied considerably: 7% of towns said they had a low or very low ability, 61% reported a moderate ability, and 32% of town reported a high ability to respond to HVHF-related issues. Response capacity was affected by a variety of factors. Most (69%) of the towns believed they had the legal authority to address natural gas development in their respective municipalities, and 56% thought they had the resources required to do so in an effective manner.<sup>1</sup> Although local legal authority was generally assumed to exist, interview

**Figure 1:** Actions taken or considered by Southern Tier towns in response to natural gas development



<sup>1</sup> New York's highest court ruled with finality on one aspect of the authority issue in June 2014, well after the responses summarized here were gathered. The court ruled that local government authority over land use controls was not a regulatory authority that had been superseded by state law. See <http://www.nycourts.gov/ctapps/Decisions/2014/Jun14/130-131opn14-Decision.pdf>

participants (especially but not only those who wished drilling to proceed) described how desire for immediate municipal action was stymied by the state moratorium on drilling during the HVHF review process<sup>2</sup>:

*“The State definitely has responsibility for the actual regulation of the industry. They can help with the regulations and they have ability to move forward with an industry that can create jobs, create income... I think once the moratorium is lifted, and the gas drilling starts, it’s going to be very interesting. It’s going to require an awful lot of expertise in a lot of different ways. And let’s just hope that, between the State and the local governments, we can handle it in a positive way.” – Town Supervisor*

Certain resource deficits were also evident. For example, a majority of towns reported inadequate levels of support from higher levels of government (e.g., county, state, federal) with respect to HVHF (Table 3). Financial resources were also inadequate for nearly half of the towns surveyed. Although adequate levels of education and training, access to information, and support from non-governmental entities appeared to be present in many towns (Table 3), interview participants emphasized persistent deficiencies in multiple areas, highlighting the advantages of cooperation and collaboration with entities outside of municipal boundaries:

*“I honestly believe that no local government has the resources, the wherewithal to stand alone on this. Those communities that decided to stand on an island, I don’t believe are doing justice to themselves or to their constituents. They don’t have the wherewithal to do this alone. We don’t, and our town is not poor by any stretch of the imagination. We don’t have the technical expertise. We don’t have the scientific data and research that’s required.” – Town Supervisor*

Despite the recognized value of external support, many towns appeared reluctant to adopt this collaborative approach. Several interview

participants lamented local government officials’ reluctance to proactively seek help to plan for and respond to natural gas development before issues arise, and one supervisor effectively highlighted the importance of long-term thinking regarding HVHF:

*“I think we have what it takes [to address HVHF]. It takes energy and it takes time and it takes commitment. So if you’re a town that just sat back and said ‘We’re going to wait to see what the state regs say,’ then I can tell you that you missed the boat... Our job is to just be thinking out 20 years, out at least one generation if not 2 or 3... If you’re not thinking about those things, how can you ever be doing your job as a local official?” – Town Supervisor*

**Table 3:** Resource needs identified by Southern Tier towns with respect to natural gas development response capacity

Capacity Factor	Percent of Towns Rating Inadequate or Very Inadequate
Support from higher levels of government (county, state, or federal)	62
Financial resources at local level	48
Availability of local officials’ time	38
Education & training opportunities for local officials	34
Support from & collaboration with neighboring municipalities	29
Knowledge, understanding & expertise among local officials	27
Access to information & data to guide planning	24
Support from & collaboration with non-governmental entities (planners, consultants, university researchers, etc.)	23

If towns hoping to effectively respond to natural gas development require additional support from trusted, knowledgeable sources, what might those sources be? Respondents identified a number of

<sup>2</sup> For an update on this process, see the Revised Draft of the SGEIS: <http://www.dec.ny.gov/energy/47554.html>

**Table 4:** Southern Tier towns' helpfulness ratings of interactions with various actors (individuals, groups, and organizations) supporting local efforts to plan for and respond to natural gas development

Actors & Collaborators	Percent of Towns Rating Helpful or Very Helpful
Neighboring municipal governments	81
Other elected or appointed officials in town	79
Citizens in town	68
Consultants and planners	56
State government agencies	56
Industry or business experts	55
University researchers and extension agents	47
Conservation advisory councils	40
NGOs and advocacy groups	37

actors and collaborators that were particularly helpful contributors to efforts to address natural gas development (Table 4).

Support provided by neighboring towns, other elected officials, and town residents was rated as the most helpful. Some interview participants emphasized the added benefit of productively interacting with and soliciting input from these individuals in low-stakes, informal settings outside the political arena:

*"I'm free to talk to people. I interact with people all the time... I see people on the street. I see people at the local convenience store. I see them shopping, at social events. My board members are doing the same thing. We all can get to people, but we don't need to entertain [talk about HVHF], we won't entertain it, in the formal setting of the board."*  
– Town Supervisor

However, others highlighted the potential pitfalls of solely considering the input of an outspoken minority:

*"I've been to a lot of board meetings where you get emotions up about this type thing. You get five people in the room that are adamantly, vocally opposed to something and it stirs up a lot of emotion. And, you think, 'Oh my God, people are clamoring for this. We gotta do something. They're making our lives a living hell.' Well, five people can sound like a lot when there's no one coming saying 'Yes, I'm in favor of it.' Most people who are in favor of things never show up to say so. The only people who ever speak are those opposed to it."* – Town Supervisor

Although support originating within towns and adjacent municipalities was important to both survey respondents and interview participants, results also suggest that local input alone was insufficient to guide natural gas-related planning and policies. The next tier of useful collaborators (recognized as "helpful" by about 50% of towns) included consultants and planners, state government agencies, industry experts, and university researchers. When support from these entities was available, respondents generally believed this assistance was constructive. Fewer respondents (37%) indicated that current interactions with potential collaborators such as NGOs and advocacy groups were helpful, underscoring the desire for more unbiased and trusted perspectives to objectively inform discussions about HVHF. One interviewee effectively highlighted the value of objective, non-partisan input:

*"I think you've got to get it to a neutral thing... you know, and that's not what we have. We have the people that can benefit monetarily and that's all that drives them. And we have people that aren't going to benefit monetarily and that drives them to not support it.... I think you've got to leave it to science. You cannot leave it to hearsay. You cannot leave it to people's opinions."* – County Legislator

## Summary & Recommendations

Natural gas development is a key issue in most Southern Tier towns, and many elected officials have devoted substantial time and effort to build their knowledge and understanding of “fracking,” its impacts, and potential policy responses. As a result, officials in most towns believe they possess a moderate to high capacity to address natural gas development, and many towns have taken specific actions with respect to HVHF. Despite these positive indicators, certain barriers to action persist:

- **Intense disagreement regarding HVHF impacts.** Results of this study confirm substantial variation and polarization among Southern Tier towns when it comes to support for (or opposition to) natural gas development. Concerns of both supporters and opponents often center on environmental impacts and social consequences (e.g., traffic, safety and emergency response capacity). About one half of local officials surveyed believed economic benefits associated with HVHF outweigh the potential costs, highlighting the split perspective. Though many town boards reportedly agreed amongst themselves on actions that should be taken, respondents also suggested that policy development and implementation can be curtailed by conflicting emotional arguments and political maneuvering from vocal stakeholders.
- **Inadequate support from and collaboration with higher levels of government.** Results of this study demonstrate that although many Southern Tier towns possess the motivation to act, they generally feel they lack the financial, technical, and human resources – and, in some cases, the political legitimacy – needed to effectively address natural gas development. Most of the responding elected officials look to higher levels of government (particularly New York State) to provide this type of guidance and expertise. As the environmental review of HVHF continues, municipalities are anxiously waiting to see if and how state regulations will

interact with “fracking” policies at the local level. In the meantime, some towns are attempting to develop proactive municipal measures (e.g., road use agreements, zoning laws) that will minimize negative impacts of HVHF before drilling begins.

- **Over-reliance on subjective and biased information sources.** While many officials found communication and collaboration with each other and neighboring municipalities to be helpful, these interactions are unlikely to build sufficient capacity to respond. Enhanced support from a variety of external, non-governmental entities (e.g., planners and consultants, university researchers) could provide critical access to a broader array of resources and information that would inform long-term decision-making. Most importantly, the more balanced perspectives that are sometimes available via third-party support can be helpful in constructing policies that transcend the pitfalls of typical subjective HVHF discourse.

To effectively address natural gas development, municipal officials in the Southern Tier need more reliable information on the potential risks and benefits of HVHF and on the influence they and other policy makers can have on these risks and benefits. Although the will and motivation to govern natural gas development exists throughout the region, towns cannot address these challenges on their own. Support must come from multiple sources, including the federal and New York State government and a variety of non-governmental entities. A collective effort involving a combination of internal relationship-building and collaboration with external governmental and non-governmental actors is needed to provide municipalities with access to the resources, expertise, and support for implementation needed to inform decision making and build capacity to address natural gas development at the local level.

## References

- Christopherson, S. (2011). The economic consequences of Marcellus Shale gas extraction: Key issues. *CaRDI Report, Issue No. 14*. Ithaca, NY: Community & Regional Development Institute, Cornell University. Available from: [http://www.greenchoices.cornell.edu/downloads/development/shale/Economic\\_Consequences.pdf](http://www.greenchoices.cornell.edu/downloads/development/shale/Economic_Consequences.pdf)
- Christopherson, S., Frickey, C., & Reightor, N. (2013). A vote of "no confidence:" Why local governments take action in response to shale gas development *CaRDI Research & Policy Brief Series* (Vol. 54). Ithaca, NY: Community & Regional Development Institute, Cornell University. Available from: <http://cardi.cornell.edu/cals/devsoc/outreach/cardipublications/loader.cfm?csModule=security/getfile&PageID=1103677>
- Evensen, D. T., Jacquet, J. B., Clarke, C. E., & Stedman, R. C. (2014). What's the "fracking" problem? One word can't say it all. *The Extractive Industries and Society*. doi: 10.1016/j.exis.2014.06.004
- Goldstein, B. D., Kriesky, J., & Pavliakova, B. (2012). Missing from the table: Role of the environmental public health community in governmental advisory commissions related to Marcellus Shale drilling. *Environmental Health Perspectives*, 120(4), 483-486.
- Howarth, R. W., Ingraffea, A., & Engelder, T. (2011). Natural gas: should fracking stop? *Nature*, 477, 271-275. doi: 10.1038/477271a
- Jacquet, J. (2009). Energy boomtowns & natural gas: implications for Marcellus Shale local governments & rural communities (NERCRD Rural Development Paper No. 43) (pp. 63). University Park, PA: The Northeast Regional Center for Rural Development, The Pennsylvania State University.
- McGraw, S. (2011). *The end of country*. New York: Random House.
- Nolon, J. R., & Gavin, S. E. (2013). Hydrofracking: State preemption, local power, and cooperative governance. *Case Western Reserve Law Review*, 63(4), 1-44.
- Spence, D. B. (2013). Responsible shale gas production: moral outrage vs. cool analysis. *Social Science Research Network*. doi: 10.2139/ssrn.2228398. Available from: <http://ssrn.com/abstract=2228398>

# Building Local Capacity to Address Open Space Development: Lessons from Hudson Valley Towns



© Nick Zungoli. Photo taken in Putnam County, NY.

**Lincoln R. Larson • T. Bruce Lauber • David L. Kay**



**Cornell University**  
**Human Dimensions Research Unit**



## What is the Issue?

Population growth and associated residential and commercial development have created a number of challenges and opportunities for the Hudson Valley of New York State (NYS), a region long renowned for its stunning landscape and natural amenities. While municipal leaders may embrace the prospect of economic growth, the environmental and social consequences that accompany loss of open space (farmlands, forests, and other natural areas) remain major concerns. Initiatives such as the Hudson Valley Smart Growth Alliance<sup>1</sup> and the NYS Department of Environmental Conservation's Hudson River Estuary Habitat and Biodiversity Program<sup>2</sup> are helping local officials balance these tradeoffs and strategically plan for open space conservation. However, more information is needed to better understand the array of factors that influence local governments' capacity to address loss of open space due to residential and/or commercial development, which have implications for open space conservation policies in Hudson Valley towns.

## Research Methods

Using counties in the mid-Hudson Valley as a case study, we examined these factors through two phases of data collection (phone interviews and web surveys). In the interview phase (fall 2012), we asked 20 key contacts from the region (municipal officials, consultants, etc.) about knowledge of, concern about, and response to open space development at the local level. We also asked interview participants to discuss efforts to engage in open space planning and identify key barriers to action. In the survey phase (fall 2013), we contacted 98 towns across the six focal counties and asked at least one elected official in each town (typically the town supervisor) to respond to a web survey. When multiple responses were received from a town, we used the information from only one source: the highest authority or the most-experienced official.

We obtained completed surveys from respondents in a total of 50 different towns (51% response rate). A telephone-based follow-up with 23 of the remaining towns did not reveal significant non-response bias. The survey allowed us to quantify municipal officials' beliefs and perceptions with respect to open space development and identify factors affecting towns' capacity to address loss of open and associated impacts.

## Municipal Officials' Beliefs about Open Space Development

Local officials had mixed perceptions about the rate of open space development in the mid-Hudson Valley region over the last 5 years, with 54% reporting no change, 20% observing a decrease in the amount of open space, and 26% noting an increase. However, a majority of respondents (60%) indicated that they had noticed an increase with respect to public interest in preserving and protecting open space during that same time period. One respondent summarized his town's commitment to open space preservation:

*"We have a very rural community. People move here because they like the character of the area, and we want to keep the same character that people move here for. So our planning board is very persistent on design guidelines that keep this character and protect the environment." – Town Supervisor*

Local officials in the region were perceived by our respondents to be relatively well-informed regarding issues pertaining to open space development, and a majority of respondents (74%) agreed that "most officials" in their town knew a lot about the loss of open space and its potential impacts (Table 1). In fact, over 50% of respondents claimed their towns had spent a moderate or great deal of time debating or discussing open space development, nearly equivalent to other high-priority municipal concerns such as emergency services, transportation-related issues, and water quality protection.

Across the region, respondents were divided when asked if (a) loss of open space due to

<sup>1</sup> For more information, see: <http://www.scenichudson.org/ourwork/riverfrontcommunities/smartgrowthprinciples> & <https://www.facebook.com/hvsga/info>

<sup>2</sup> For more information, see: <http://www.dec.ny.gov/lands/5094.html>

residential/commercial development would create environmental problems for their town (34% agreed, 40% disagreed), and (b) benefits associated with open space development would outweigh the costs (44% agreed, 30% disagreed). Perceived impacts of the loss of open space on specific town attributes were highly polarized (Table 2). While a narrow majority of respondents anticipated negative effects on town attributes such as biodiversity, farmland, the natural environment, and overall community character, an approximately equal number of respondents anticipated no change or positive effects in their town. Slightly less than 50% of towns believed loss of open space due to

development would improve the local economy and cost of living. In fact, about 30% of town officials actually anticipated a negative effect of open space development on these economic indicators (Table 2).

A majority of respondents (76%) indicated that “most officials” in their town thought it was their responsibility to do something to address open space development, and a similar number (62%) thought there was general agreement at the town level about actions that could be taken to address the issue (Table 1). In other words, though substantial polarization regarding open space policies was evident on a regional scale, consensus was much more commonly reported among local officials within municipal units.

**Table 1:** Hudson Valley town officials’ perceptions of other officials’ beliefs about natural gas development and appropriate actions

	Disagree (%)	Neutral (%)	Agree (%)	Don’t Know (%)
Most officials in my town...				
Know a lot about open space development and its potential impacts	10	14	74	2
Believe responding to open space development requires action by town government	10	10	76	4
Agree on the actions that should be taken to address open space development at the local level	18	16	62	2

**Table 2:** Perceived impacts of open space development on Hudson Valley towns

Characteristic of Town	Perceived Impact (% of Towns)		
	Negative	No effect	Positive
Biodiversity and wildlife habitat	57	35	8
Overall community character	54	20	26
Farmland	54	40	6
Natural environment (including forests, wetlands and waterways)	53	35	12
Traffic	49	38	18
Tourism	46	31	23
Drinking water	45	40	15
Roads and physical infrastructure	35	37	28
Safety and emergency response capacity	33	46	22
Local economy (jobs, tax base, etc.)	33	22	46
Recreation opportunities	26	42	32
Cost of living	30	22	48
Quality of public services (schools, health care, etc.)	21	55	23

## Municipal Actions Taken to Address Open Space Development

According to survey respondents, over 61% of Hudson Valley towns had taken some action to specifically address loss of open space due to residential/commercial development, and it appeared that many other towns had engaged in other activities that indirectly affected open space development (Figure 1). The most common actions taken to address loss of open space, adjustments to comprehensive plans and zoning laws, were either being employed or considered by about 90% of towns. About 50% of towns had utilized more specific policy tools such as conservation easements, local environmental laws, and updated site plan review processes. Formal open space plans and active data collection and monitoring efforts were less common, practiced by 25-30% of towns (Figure 1).

## Factors Affecting Municipal Response to Open Space Development

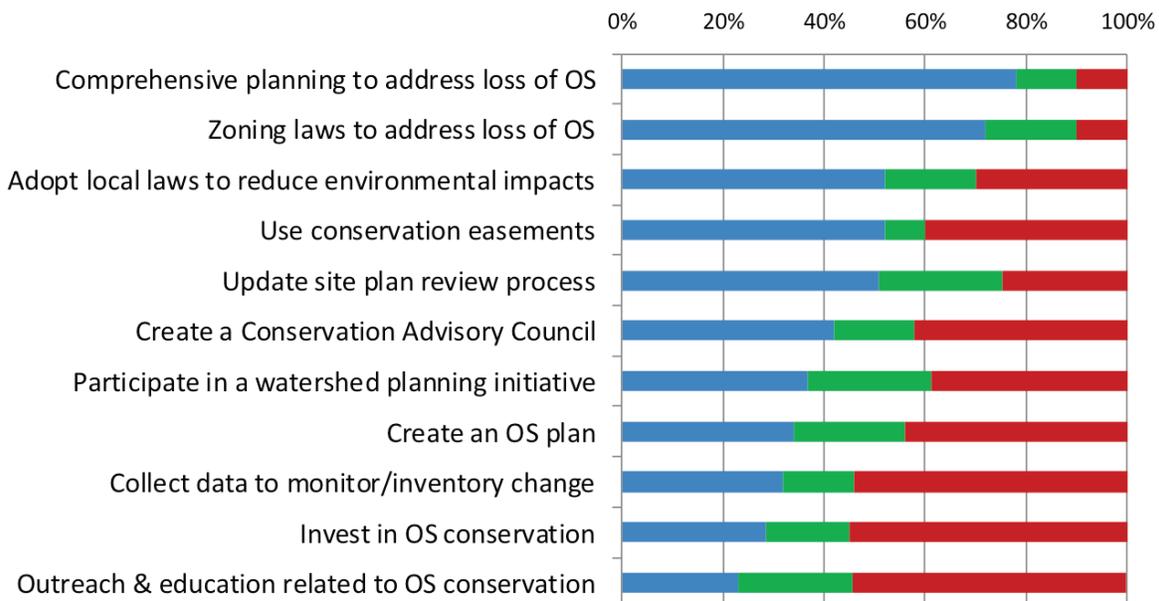
Towns' perceived capacity to plan for and respond to loss of open space due to development varied considerably: 10% of towns said they had a low or very low ability, 41% reported a moderate ability, and 49% of towns reported a high ability to address open space development. Response capacity was affected by a variety of factors. Most (73%) of the towns believed they had the legal authority to address issues associated with open space development in their respective municipalities, and 57% thought they had the resources required to do so in an effective manner.

Levels of knowledge and access to information to guide planning efforts were rated as adequate by a majority of respondents. Several interviewees noted the benefits of proactive education and training for local officials focused on open space conservation:

**Figure 1:** Actions taken or considered by Hudson Valley towns in response to loss of open space due to residential/commercial development.

### Potential Actions Taken to Address Loss of Open Space (OS) due to Residential/Commercial Development

- Have Taken Action
- Likely to Take Action
- Not Considering Action (or Don't Know)



*“We have programs like the Estuary Program which are different. They are not regulatory, but more about education, outreach and community programs. They are probably one of the better ways the DEC has of developing relationships with the community. They’re not regulatory and more proactive.” – Consultant*

Support from non-governmental entities (e.g., planners, consultants, and university researchers) was also rated as adequate or very adequate in almost 75% of Hudson Valley towns (Table 3). The critical role of another less tangible factor, leadership, also emerged in interview conversations. Experienced leaders capable of navigating the sometimes prickly political process were better equipped to conserve open space while simultaneously promoting economic development and addressing the needs of diverse constituents:

*“Interpersonal skills, political savvy. It’s definitely understanding the process and social science. The process is always 85% of it. That’s what I tell people. It can be the best thing in the world to do but if you don’t do it in a way that the community is going to accept it, it’s worthless. Sometimes that means having to compromise in some place, some form, in order to work through a process where it’s not going to be perfect.” – Consultant*

Although several positive indicators emerged, concerns about certain resource deficits were also evident. For example, more than 50% of towns reported inadequate levels of financial resources and support from higher levels of government (e.g., county, state, federal) (Table 3).

*“If the state made a concerted effort to educate communities like ours and provide support for them, maybe communities would listen more. They’d be hearing it both from the grassroots and they’d be hearing it from, let’s say, the Department of State... Our county could create a county GIS system, too... If there was a pot of money, that would help! That kind of capacity building would make a huge difference. Most supervisors are sophisticated enough to know this is important for them, but they really can’t see how to find the money.” – Planner*

**Table 3:** Resource needs identified by Hudson Valley towns with respect to open space development response capacity

Capacity Factor	Percent of Towns Rating Inadequate or Very Inadequate
Financial resources at local level	59
Support from higher levels of government (county, state, or federal)	52
Support from & collaboration with neighboring municipalities	36
Availability of local officials’ time	35
Support from & collaboration with non-governmental entities (planners, consultants, university researchers, etc.)	27
Education & training opportunities for local officials	19
Knowledge, understanding & expertise among local officials	18
Access to information & data to guide planning	13

Respondents identified a number of actors and collaborators that were particularly helpful contributors to efforts to address open space development (Table 4). Support provided by other elected officials was rated as the most helpful. Interview participants talked about the need for consistency and commitment on town boards, particularly when dealing with large-scale issues such as open space conservation that transcend geographical boundaries and election cycles:

*“Some of the bigger biodiversity habitat connection issues are hard. You have to have the planning documents, whether it’s the habitat biodiversity planning or the space plans for the town that the towns are willing to implement and, you know, stick with. That’s difficult because you have such turnover that you need that continuity of someone knowing about it, and knowing it’s important.” – Consultant*

Assistance provided by third party consultants and professional planners appeared to be indispensable for many towns, and support from town residents was also critical. Multiple interview participants underscored the important role of town citizens in the policy process:

*“Public pressure has to come from the residents of the municipality. It has to be well organized and well informed, credible and well networked. That works. I’ve seen it work, but it takes a special kind of a municipality with the right people in place to have the abilities to make that happen.” – Planner*

The next tier of useful collaborators (recognized as “helpful” by 60-70% of towns) included neighboring municipalities and local Conservation Advisory Councils (CACs). Several interview participants explained the benefits of CACs or other environmental advisory groups designed to specifically address loss of open space and associated degradation of environmental health and community character:

*“I have found that in communities that are progressive, you do have community involvement. You have government that listens. You have governments that will embrace the concerns and respond to the concerns. Some of the surrounding communities are great models.... They have a CAC and they are working very diligently on conservation measures to develop an inventory of various commercial enterprises. The important vehicle in a community is a CAC.” – Planning Board Member*

About 50% of respondents indicated that state government agencies, NGOs, and/or university researchers were currently helping their towns address open space development, highlighting opportunities for improved levels of interaction with these actors.

**Table 4:** Hudson Valley towns’ helpfulness ratings of interactions with various actors (individuals, groups, and organizations) supporting local efforts to plan for and respond to loss of open space due to residential/commercial development

Actors & Collaborators	Percent of Towns Rating Helpful or Very Helpful
Other elected or appointed officials in town	83
Consultants and planners	80
Citizens in town	77
Neighboring municipal governments	69
Conservation advisory councils	63
University researchers and extension agents	55
Land trusts	54
State government agencies	51
NGOs and advocacy groups	48
Industry or business experts	45

## Summary & Recommendations

Loss of open space due to residential and commercial development is a long-standing issue affecting many Hudson Valley towns. As a result, municipal governments and non-governmental collaborators continue to devote substantial time and effort to understanding the implications of open space development and potential policy responses, and about 90% of towns believe they currently have a moderate or high ability to address the issue. For example, many town officials are now equipped with (or are easily able to access) adequate information and expertise needed to engage in open space planning and conservation, and a majority of towns in the region have taken some actions to address loss of open space and associated impacts. Despite these positive indicators, certain barriers to effective action persist. These include:

- **Inadequate support from and collaboration with higher levels of government.** Results of this study demonstrate that although many Hudson Valley towns are motivated to protect open space for a

variety of reasons, they often feel they lack the financial resources needed to effectively address the issue. Many local officials perceive that their ability to plan for and address open space loss is hindered by inadequate levels of financial and technical support from state and federal governments. Expectations are more frequently met with respect to the adequacy of resources represented by non-governmental assistance providers such as planners, consultants, universities. Increased commitment from higher levels of government would augment existing efforts and enhance local capacity to address open space development.

- **Insufficient levels of inter-municipal collaboration.** Interview participants and survey respondents consistently indicated that interactions with other town officials, local citizens, and adjacent towns were among the most helpful in efforts to address open space development. However, over one third of survey respondents indicated that current levels of support from and collaboration with neighboring municipalities was inadequate, and towns across the region reported very different perspectives regarding the costs and benefits associated with loss of open space. These numbers, coupled with limited amount of time that local officials have to address complex challenges such as open space development, highlight the need for cohesive regional approaches that foster inter-municipal collaboration and a sense of collective purpose. incomplete
- **Piecemeal implementation of policies that specifically address open space development.** Though Hudson Valley towns are explicitly responding to concerns about open space development during revisions of their comprehensive plans and zoning laws, far fewer have taken the next step and adopted targeted policies to address open space planning and conservation. These actions include local environmental laws, conservation easements, and formal open space plans. Because a majority of towns continue to report negative impacts of open space development on attributes such as the natural environment, farmland, and

community character, these more focused policy responses may be worth considering. Additional resources and collaborations could help Hudson Valley towns achieve the level and type of open space conservation they desire.

Municipal officials in the Hudson Valley have already taken many steps to address the increasingly important issue of loss of open space due to residential/commercial development. While the economic growth that typically accompanies open space development is recognized and appreciated by municipal leaders, so are the potential threats to natural amenities that have come to define the region's character. To respond to these challenges and generate additional support for effective policy responses, some municipalities have already recognized the importance of collaborative efforts involving external actors and organizations. Such efforts must continue and expand for towns to continue to access the data, resources, expertise, and implementation support needed to guide decision making and build capacity to address open space development at the local level.

## References

- Connelly, N. A., & Knuth, B. A. (2002). Using the coorientation model to compare community leaders' and local residents' views about Hudson River Ecosystem restoration. *Society and Natural Resources*, 15(10), 933-948. doi: 10.1080/08941920290107666
- de Groot, R. S., Alkemade, R., Braat, L., Hein, L., & Willemsen, L. (2010). Challenges in integrating the concept of ecosystem services and values in landscape planning, management and decision making. *Ecological Complexity*, 7, 260-272. doi: 10.1016/j.ecocom.2009.10.006
- Guerrero, A. M., McAllister, R. R. J., Corcoran, J., & Wilson, K. A. (2013). Scale mismatches, conservation planning, and the value of social-network analyses. *Conservation Biology*, 27(1), 35-44. doi: 10.1111/j.1523-1739.2012.01964.x
- Loh, C. G. (2012). Four potential disconnects in the community planning process. *Journal of Planning Education and Research*, 32(1), 33-47. doi: 10.1177/0739456X11424161
- Scenic Hudson. (2014). Smart growth principles. Poughkeepsie, NY: Hudson Valley Smart Growth Alliance. Available from: <http://www.scenichudson.org/ourwork/riverfrontcommunities/smartgrowthprinciples>
- Steelman, T. A., & Hess, G. R. (2009). Effective protection of open space: Does planning matter? *Environmental Management*, 44, 93-104. doi: 10.1007/s00267-009-9272-1

# Building Local Capacity to Respond to Climate Change: Lessons from Adirondack Towns



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## What is the Issue?

Changing weather patterns are leading to unpredictable seasons and an increase in major storms and precipitation events, creating a number of challenges for towns across New York State. In northern regions such as the Adirondacks with greater ecological vulnerability and climate variability, these challenges are often magnified. Changing weather patterns could significantly impact many sectors that municipalities are charged with managing, including infrastructure and transportation, energy, water, agriculture, and public health. Climate shifts could also affect sensitive forest ecosystems and recreation opportunities that are fundamental to the cultural and economic backbone of many Adirondack communities. To address these challenges, New York State has made a concerted effort to identify statewide climate risks and highlight potential climate change adaptation and mitigation strategies<sup>1</sup>. However, it is not yet clear if or how this and other relevant information is being used to inform local policy development and implementation in communities. In places like the Adirondacks, more information is needed to better understand the array of factors that influence local governments' capacity to respond to this daunting and unprecedented challenge.

## Research Methods

Using the Adirondack region as a case study, we examined these factors through two phases of data collection (interviews and web surveys) in towns from the six counties that comprise most of the Adirondack Park. In the interview phase (fall 2012), we asked 15 key contacts from the region (municipal officials, consultants, etc.) about knowledge of, concern about, and response to climate change at the local level. We also asked interview participants to discuss the perceived efficacy of actions taken and major obstacles and barriers. In the survey phase (fall 2013), we contacted 108 towns across the six focal counties and asked at least one elected official in each town (typically the town supervisor) to respond to a web survey. When multiple responses were received from a town, we used the information

from only one source: the highest authority or the most-experienced official. We obtained completed surveys from respondents in a total of 63 different towns (56% response rate). A telephone-based follow-up with 31 of the remaining towns did not reveal significant non-response bias. The survey allowed us to quantify climate change beliefs and perceptions, local actions taken, and factors that might affect towns' capacity to address climate change and associated impacts.

## Municipal Officials' Beliefs about Climate Change

Most municipal officials surveyed (66%) indicated that they personally believed "climate change was contributing to unstable weather patterns in New York." However, when asked if "most officials" in their town believed climate change was occurring, only 40% of the respondents agreed and 24% were unsure (Table 1). Very few respondents agreed with the statement that "most officials" in their town knew a lot about climate change and its potential impacts. General attitudes toward climate change in Adirondack towns were succinctly summarized by one interview participant:

*"You just don't hear much about climate. Maybe it's something that is too broad for people to grasp or too far away. Is it really going to affect us? People are just like, this climate change, what is it really going to do to me? It is really a small percentage of the overall scale of the environment, and people don't think about that really." – Town Supervisor*

Despite uncertainty about other officials' knowledge, municipal officials reported some awareness of changing weather patterns. Most respondents (71%) observed an increase in extreme weather events over the past 5 years, and slightly more than half noted increases in annual precipitation and temperature over that same time period. More than half of the respondents (55%) believed climate change would cause environmental problems for the region, and comparatively few (23%) thought the local benefits of climate change would outweigh the costs. Perceived effects of climate change on towns varied, but many officials

<sup>1</sup> For example, the ClimAid Assessment (2011), the Climate Action Plan (2010), and the Climate Smart Communities initiative: <http://www.dec.ny.gov/energy/50845.html>.

**Table 1:** Adirondack town officials' perceptions of other officials' beliefs about climate change and appropriate climate change-related actions

	Disagree (%)	Neutral (%)	Agree (%)	Don't Know (%)
Most officials in my town...				
Believe climate change is occurring	11	25	40	24
Know a lot about climate change and its potential impacts	30	33	11	25
Believe responding to climate change requires action by town government	37	30	10	24
Agree on the actions that should be taken to address climate change at the local level	25	33	11	30

**Table 2:** Perceived impacts of climate change on Adirondack towns

Characteristic of Town	Perceived Impact (% of Towns)		
	Negative	No effect	Positive
Invasive species prevention/control	61	35	4
Roads and physical infrastructure	58	26	16
Natural environment (including forests, wetlands and waterways)	55	36	9
Winter tourism	51	37	12
Farmland	48	40	12
Safety and emergency response capacity	46	42	12
Shoreline resources	45	47	8
Recreation opportunities	39	44	17
Overall community character	38	55	7
Local economy (jobs, tax base, etc.)	33	56	11
Drinking water	27	67	6

anticipated negative impacts (Table 2). One interview participant believed local concerns about climate change had increased recently, attributing the shift to a growing emphasis on economic implications:

*“Now that invasive species are affecting people’s wallets, flooding is affecting people’s wallets, the decline of snowmobiling, the number of days of skiing... last winter was bad. I think people are starting to see that it [climate change] is a trend that’s happening.” – Planning Board Member*

Although many respondents recognized negative impacts associated with climate change, few

believed that “most officials” in the town thought it was the town’s responsibility to do anything about it (Table 1). Respondents also reported little consensus among “most officials” in their town about actions that could be taken to address climate change at the local level (Table 1). These attitudes were aptly expressed by interview participants:

*“Climate change is one of those global issues that people don’t want to think of as local. They don’t want to think of themselves as responsible. And they don’t, they don’t think they’re going to have an impact on it one way or another.” – Consultant*

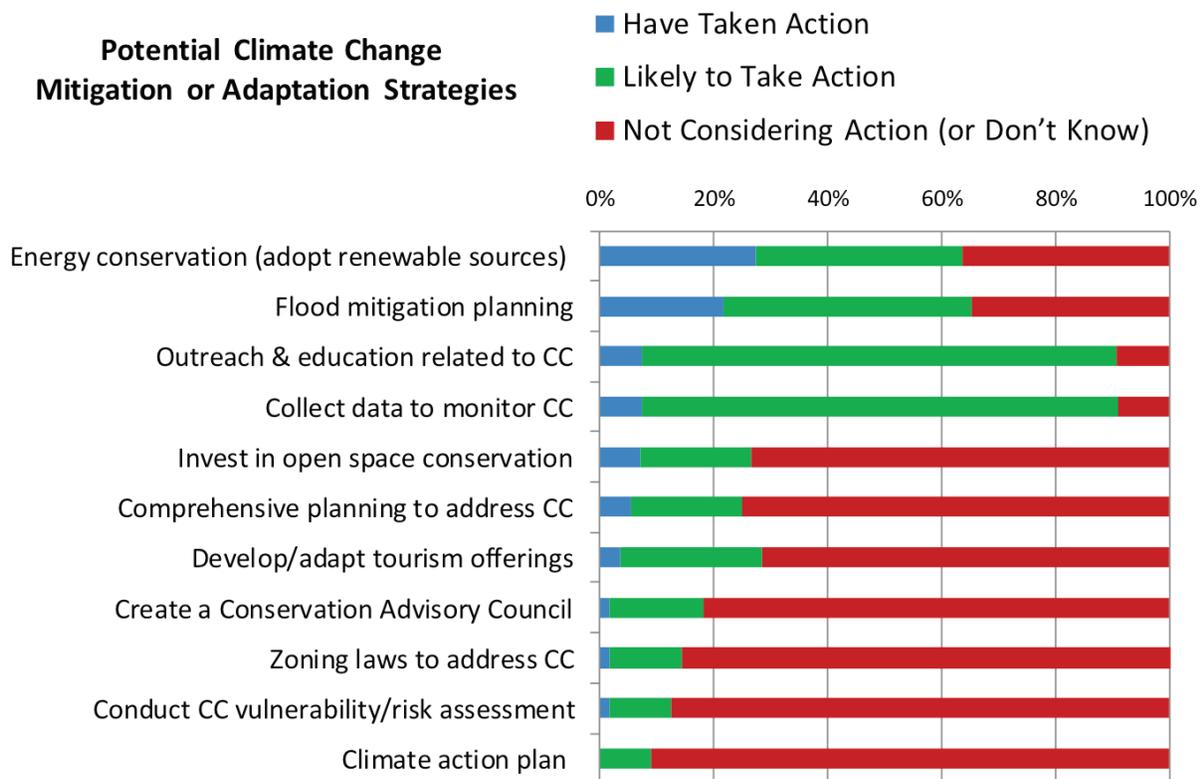
## Municipal Actions Taken to Address Climate Change

According to survey respondents, only 7% of Adirondack towns had taken some action to specifically address climate change. However, a larger portion of towns had engaged in activities that could indirectly function as climate change mitigation or adaptation strategies - even if local officials did not pursue these actions as a direct response to climate change itself (Figure 1). The two most common actions taken were energy conservation (or adoption of renewable energy sources) and flood mitigation planning, both of which had occurred in about 20% of towns. Although a large number of respondents indicated their towns were considering actions such as collecting data to monitor climate change or increasing opportunities for climate-related education and outreach, few had initiated these efforts yet. Climate action plans, risk assessments, and zoning laws to address potential climate change impacts had received very little consideration in a vast majority of towns.

## Factors Affecting Municipal Response to Climate Change

Considering the limited actions that have been taken by Adirondack towns to date, it is not surprising that towns believed their capacity to respond to climate change at the local level was relatively low: 57% of towns said they had a low or very low ability and only 8% of towns said they had a high or very high ability to respond. Response capacity was affected by a variety of factors. Slightly less than half (46%) of the towns believed they had the legal authority to address climate change in their respective municipalities, and only 19% thought they had the resources required to do so in an effective manner. When asked about specific resource deficits, municipal officials identified a lack of financial resources as the primary barrier to climate change response (Table 3). Lack of knowledge and expertise among local officials was also viewed as a major problem by respondents, exacerbated by inadequate

**Figure 1:** Actions taken or considered by Adirondack towns in response to climate change



support from higher levels of government, non-governmental entities, and an overall shortage of climate change-related education and training opportunities (Table 3). Lack of time was another constraint; most respondents indicated that their towns spent a substantial portion of their time addressing the immediate impacts of more salient local issues (e.g., transportation, emergency services, economic development strategies), and 97% of towns reported spending little or no time discussing or dealing with the long-term challenge of climate change. Interview participants effectively summarized these concerns:

*“It’s time, it’s money, and it’s expertise. Local towns may not have the expertise or the money to do something or have someone come in and help with the plan. That’s pretty expensive. And then there’s also the time to actually manage it. Agendas can be quite full every month, or however frequently these communities are meeting. It’s not that they don’t care. There are just these other factors.” – Planner*

<b>Table 3:</b> Resource needs identified by Adirondack towns with respect to climate change response capacity	
<b>Capacity Factor</b>	<b>Percent of Towns Rating Inadequate or Very Inadequate</b>
Financial resources at local level	82
Knowledge, understanding & expertise among local officials	69
Support from & collaboration with non-governmental entities (planners, consultants, university researchers, etc.)	66
Availability of local officials’ time	65
Support from higher levels of government (county, state, or federal)	64
Education & training opportunities for local officials	59
Access to information & data to guide planning	55
Support from & collaboration with neighboring municipalities	36

If towns concerned about climate change require external resources, support, and leadership to respond, how might these needs be addressed? Respondents identified a number of actors and collaborators that were particularly helpful contributors to climate change response efforts (Table 4). Support provided by neighboring towns and other elected officials was rated as the most helpful. Interview participants illustrated the benefits of open communication and collaboration among trusted networks of municipal officials, particularly those from towns that already dealing with impacts related to climate change:

*“For communities that have suffered [climate change impacts such as flooding], what works is to stand up and say, ‘This is what happened in my community. This is what we thought we were prepared for, this is what happened, and this is what we’re now preparing for.’ And those real life stories, I think that is what convinces people, eventually, that they need to be prepared as well... For the state to come in and start mandating that we’re going to do certain things, I think is going to be very difficult.” – Town Supervisor*

As noted above, however, even towns forced into action rarely had sufficient knowledge, skills, resources, and time to build climate change response capacity on their own. When support from the state was available (not the case in most towns), respondents generally believed this assistance was constructive (Table 4). While state assistance was generally welcomed, interview responses also suggested that state mandates were typically viewed unfavorably by local officials. According to respondents, current interactions with other potential collaborators such as university personnel, business and industry representatives, and NGOs were rated as inadequate (Table 3) and unhelpful (Table 4), suggesting opportunities for improvement in the way climate change initiatives are conceived, marketed, and implemented by

these different actors. An interview participant highlighted the value of objective, non-partisan intervention:

*“I think it’s key to have nonprofit organizations who are willing to be nonpartisan and non-confrontational on political issues, who are just there to help get information out, about climate change.”*  
– Planning Board Member

Another described effective capacity-building strategies that have been developed by certain NGOs, emphasizing the type of professional development approaches that could be useful in many towns:

*“I think what we needed was to learn how to do this, how to apply for grants, how to bring the community together, to create a vision that the community wanted... You need the grassroots efforts bringing this together to make it work. They [Wildlife Conservation Society] brought a professional background on how to do some of that stuff, guiding us through that process to put the foundation under us so that we could take off and continue some of that on our own.”* – Town Supervisor

**Table 4:** Adirondack towns’ helpfulness ratings for interactions with various actors (individuals, groups, and organizations) supporting local efforts to plan for and respond to climate change

Actors & Collaborators	Percent of Towns Rating Helpful or Very Helpful
Neighboring municipal governments	73
State government agencies	63
Other elected or appointed officials in town	61
Consultants and planners	53
Conservation advisory councils	52
Citizens in town	52
University researchers and extension agents	49
Industry or business experts	34
NGOs and advocacy groups	34

## Summary & Recommendations

Many municipal officials in the Adirondacks recognize changing weather patterns and the negative impacts generated by these changes. However, towns’ overall capacity to respond to climate change remains very limited. Very few towns have taken any action to address climate change, and many towns do not appear to be considering adaptation and mitigation strategies. Persistent barriers to action include:

- **Inadequate support from and collaboration with higher levels of government and non-governmental entities.** Results of this study demonstrate that Adirondack town officials generally believe they lack the financial, technical, and human resources needed to address climate change. While many officials found communication with neighboring municipalities to be helpful, these interactions are unlikely to build sufficient capacity to respond. External support from and collaboration with higher levels of government (particularly state and federal) and a variety of non-governmental entities (e.g., planners and consultants, university researchers and extensions agents, NGOs) can provide critical access to resources and information that otherwise might not be available. This third party help can be invaluable, supplying essential expertise to guide objective policy decisions.
- **Lack of knowledge about climate change and potential responses.** Though many municipal officials in the Adirondacks are beginning to anticipate negative effects of changing climate on their local communities, few believe that local officials have the expertise to characterize the potential severity of these impacts or identify strategies for preventing and/or adapting to change. There appears to be a lack of common understanding among municipal officials about what can be done to address climate change at the local level. As information about climate change

and possible adaptation strategies becomes more readily available, improved mechanisms of dissemination and training could address these knowledge gaps and facilitate action.

- **Other more pressing concerns and priorities.** Due to its variable impacts across geographical and temporal scales, many officials seem to believe that climate change is not a “local” issue. Therefore, they often feel that is either beyond their capability and/or not their responsibility to respond. Uncertainty also abounds regarding the appropriate course of action to address climate change and its potential impacts. Consequently, town boards are often focused on more immediate concerns and priorities that directly affect the social and economic well-being of their communities. Some of these actions might be considered indirect climate change mitigation or adaptation strategies, but it appears that few towns are directly addressing climate change itself. Unless local officials and their constituents perceive a more explicit link between climate change and municipal sectors that affect community vitality and dominate political agendas, effective responses remain unlikely.

To respond to climate change, municipal officials in the Adirondacks need more information about regional impacts and context-specific courses of action. Even in cases where political will and motivation exists, towns cannot address these challenges on their own. Support must come from elsewhere. A collective effort involving a variety of external actors and collaborators is needed to provide local municipalities with access to the resources, support for implementation, and expertise needed to inform decision making and build capacity to address climate change at the local level.

## References

- Jenkins, J. (2010). *Climate change in the Adirondacks: The path to sustainability*. Ithaca, NY: Cornell University Press.
- Mullen, M., Allred, S., & Chatrchyan, A. (2012). Climate change challenges and opportunities in New York municipalities: Assessing the perceptions of and actions to local climate change. *Outreach Series Publication 12-1* (pp. 4). Ithaca, NY: Human Dimensions Research Unit, Cornell University.
- Rosenzweig, C., Solecki, W., DeGaetano, A., O’Grady, M., Hassol, S., & Grabhorn, P. (2011). *Responding to climate change in New York State: The ClimAID integrated assessment for effective climate change adaptation (Synthesis Report)*. Albany, NY: New York State Energy Research and Development Authority (NYSERDA).
- Stager, J. C., & Thill, M. (2010). *Climate change in the Champlain Basin: What natural resource managers can expect and do*. Keene Valley, NY: The Nature Conservancy.

