

Learning Objectives

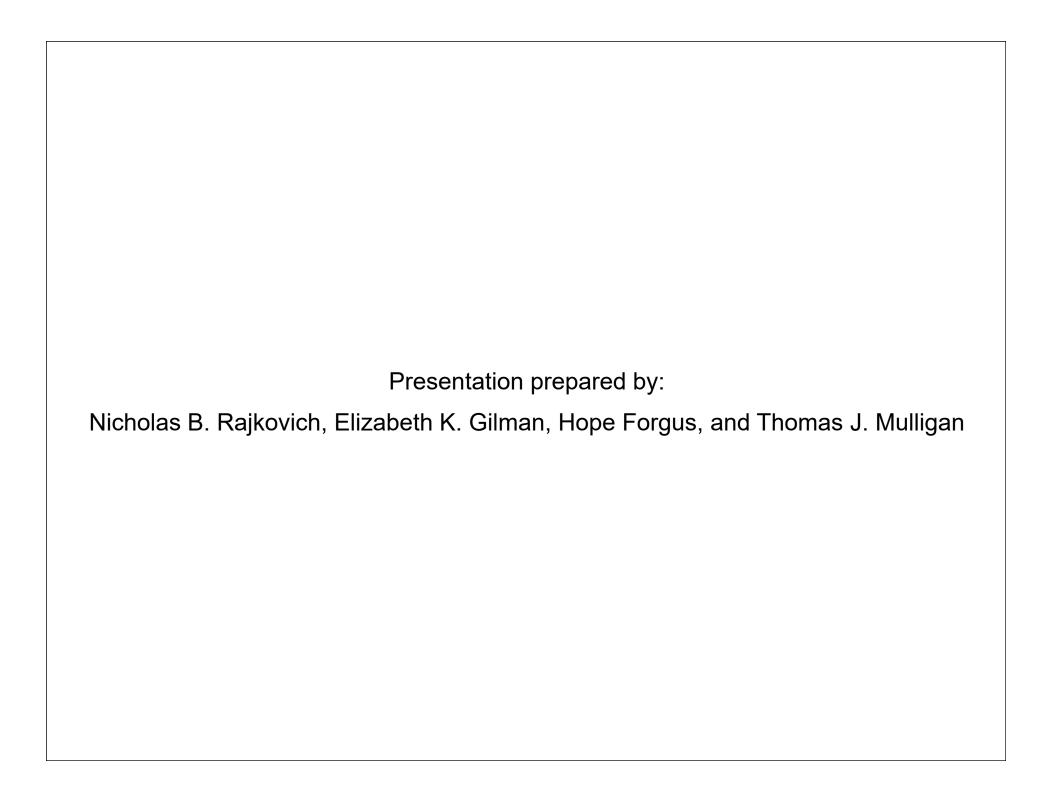
At the end of the this course, participants will be able to:

- 1. Describe what climate hazards may affect NYS's buildings and its occupants, user and any others in the future.
- 2. Assess inherent vulnerabilities of NYS's buildings through analysis of historical property damage by region due to climate hazard events.
- 3. Understand how the adaptive capacity of each region's building sector might affect its ability to prepare for, or recover from future hazard events to use during project planning and design.
- 4. Identify gaps in knowledge that must be bridged in order to more effectively prepare the state's building sector for climate change.









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Centers and Labs

Initiatives

The UB Affordable Housing Initiative

> Adapting Buildings for a Changing Climate

See It Through Buffalo

University Heights Initiative

Insights

Related Links

- > Graduate Research in Architecture
- Graduate Research in

Adapting Buildings for a Changing Climate



Regional Costs of Climate-Related Hazards for the New York State Building Sector

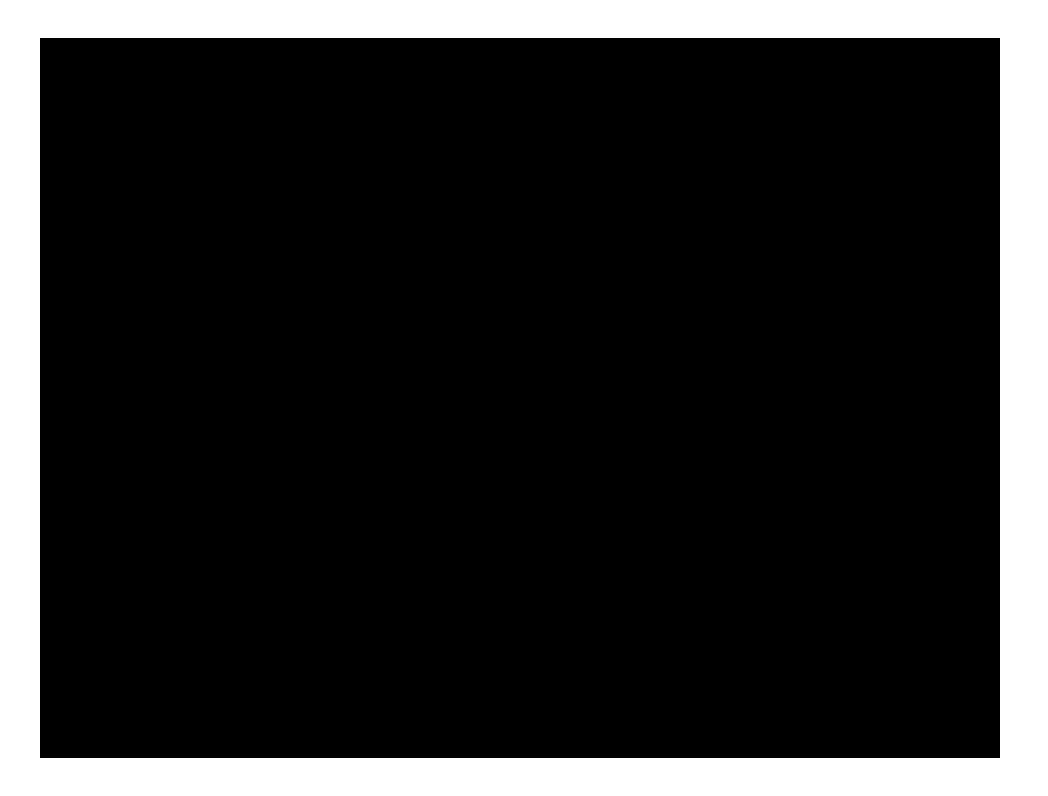


Final Report | Report Number 18-11b | June 2018



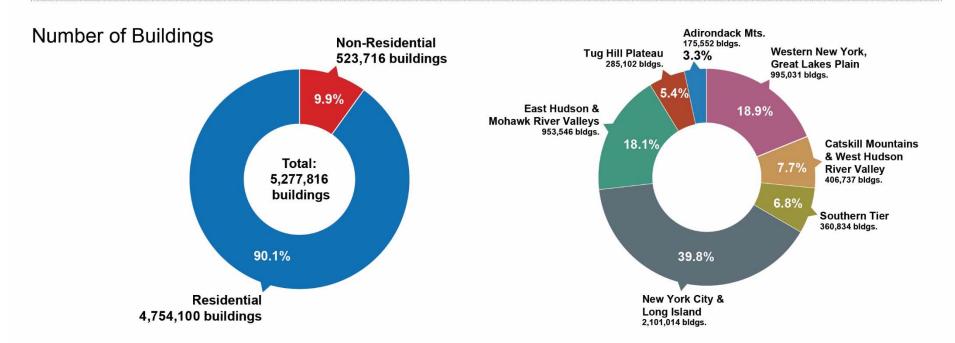


ap.buffalo.edu/adapting-buildings



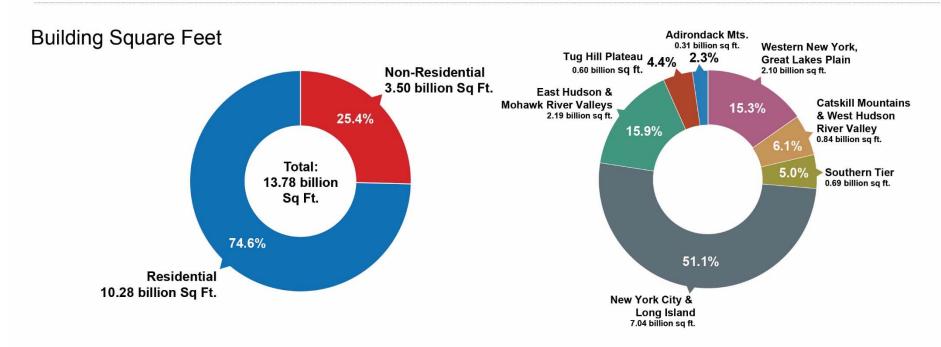
New York State's Building Stock by the Numbers

New York's Total Building Stock Regional Distribution of Building Stock



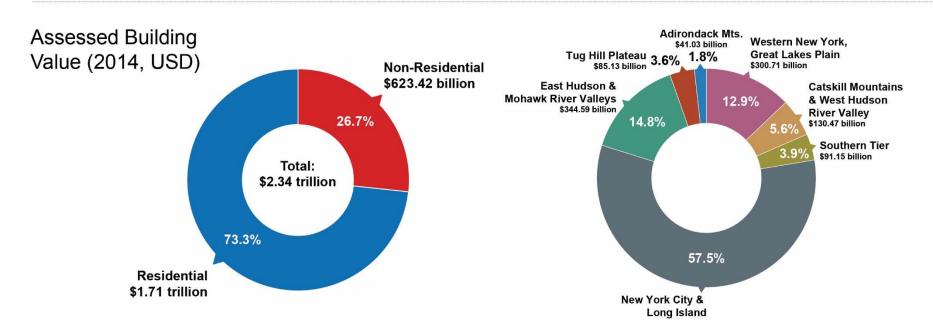
New York State's Building Stock by the Numbers

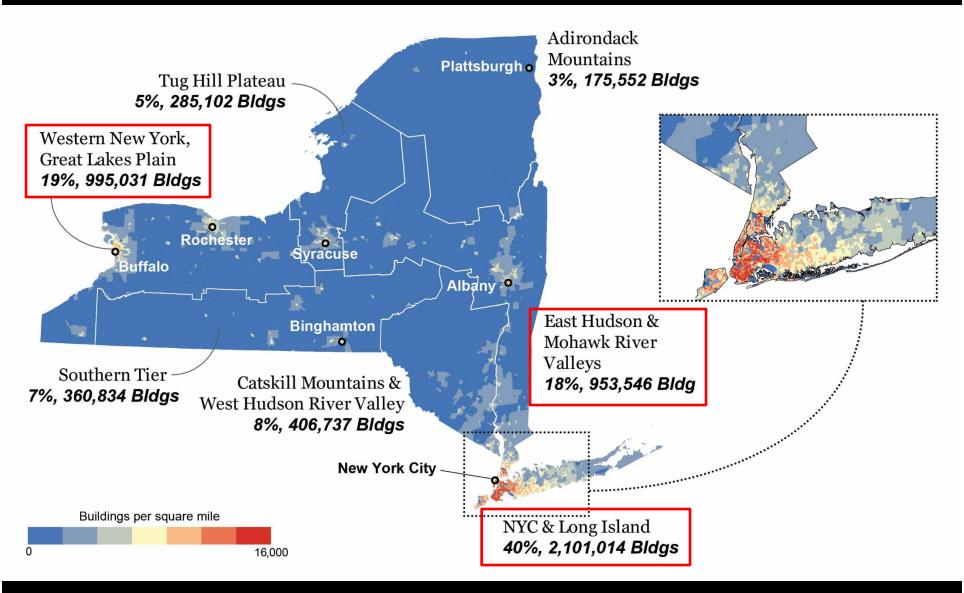
New York's Total Building Stock Regional Distribution of Building Stock

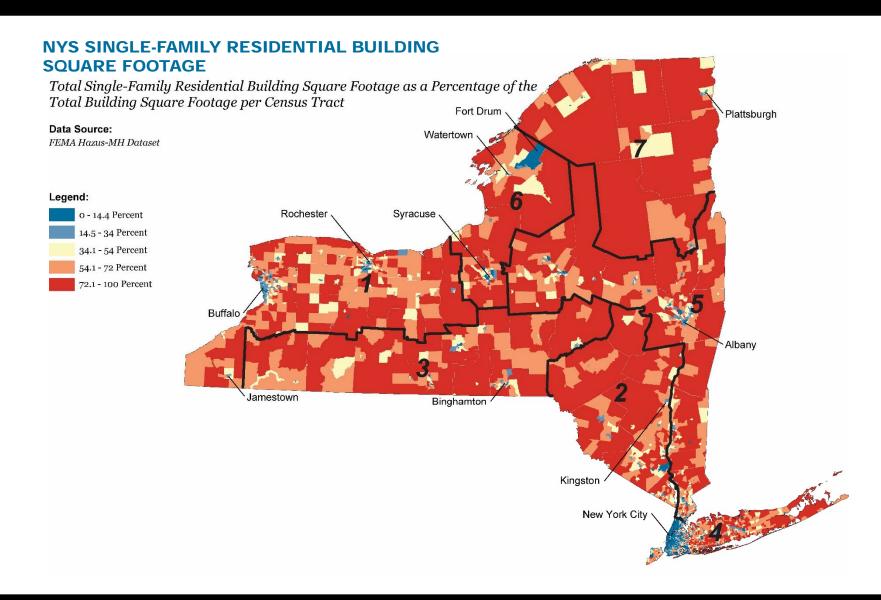


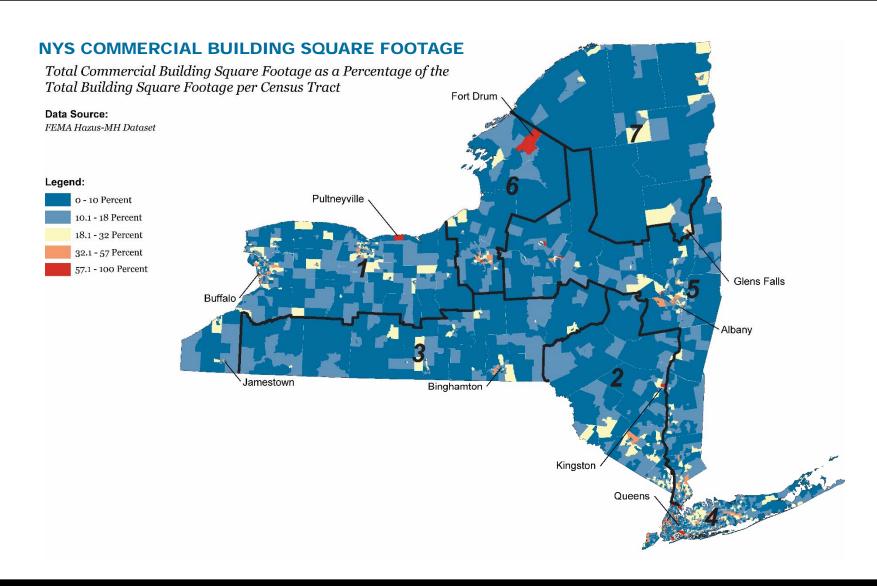
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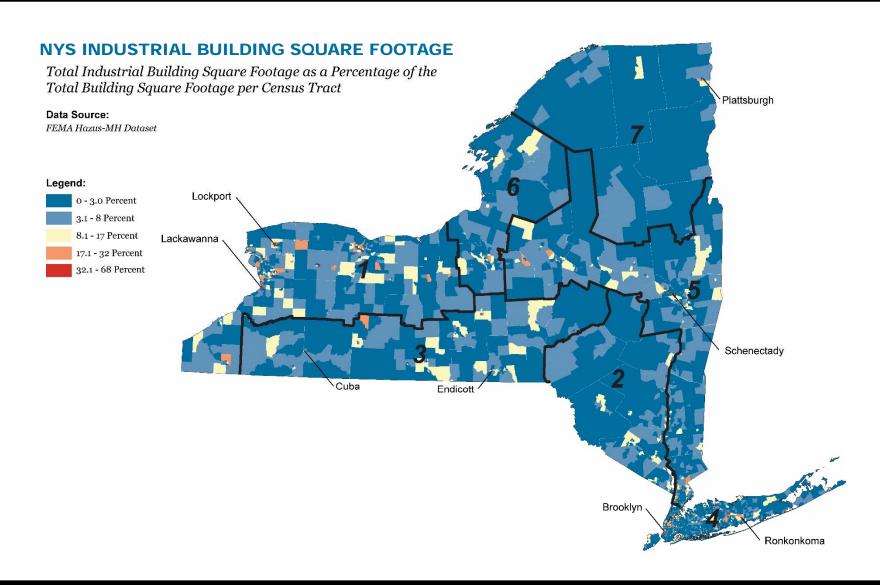
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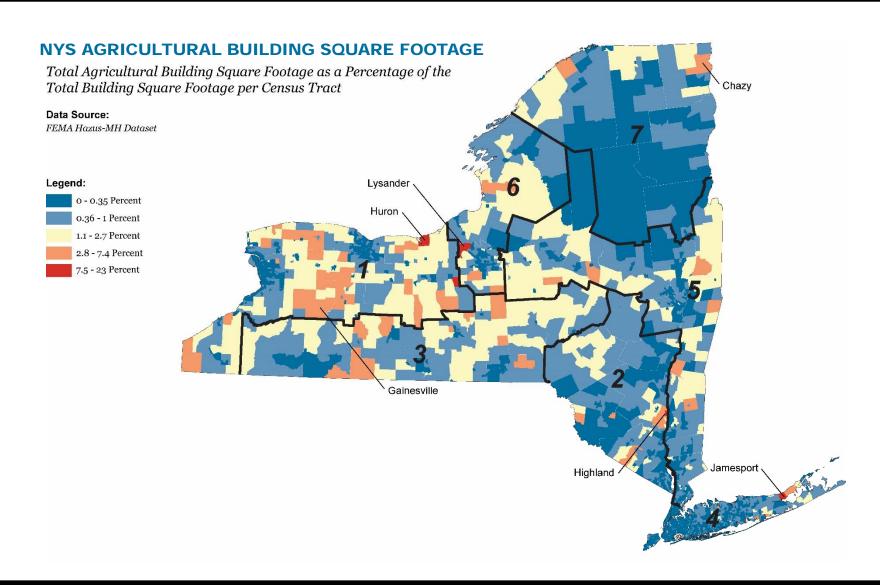


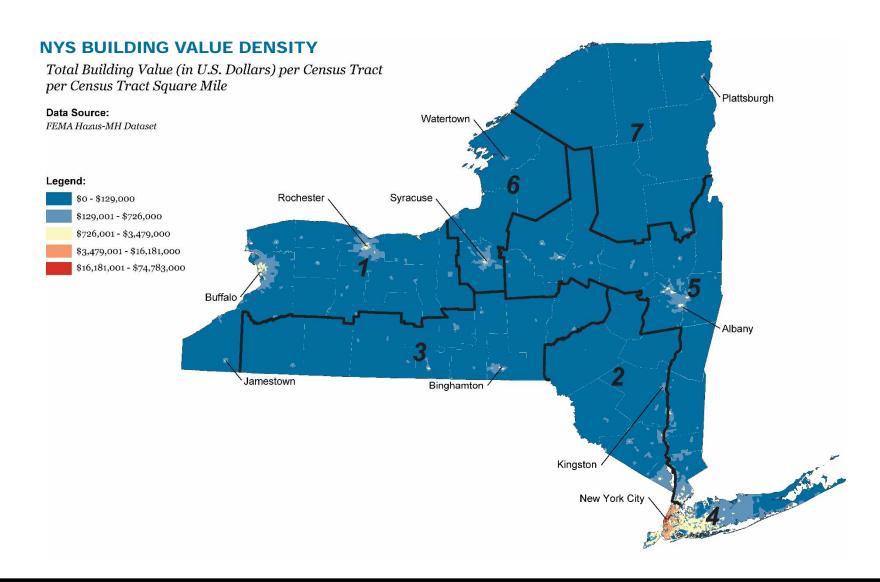


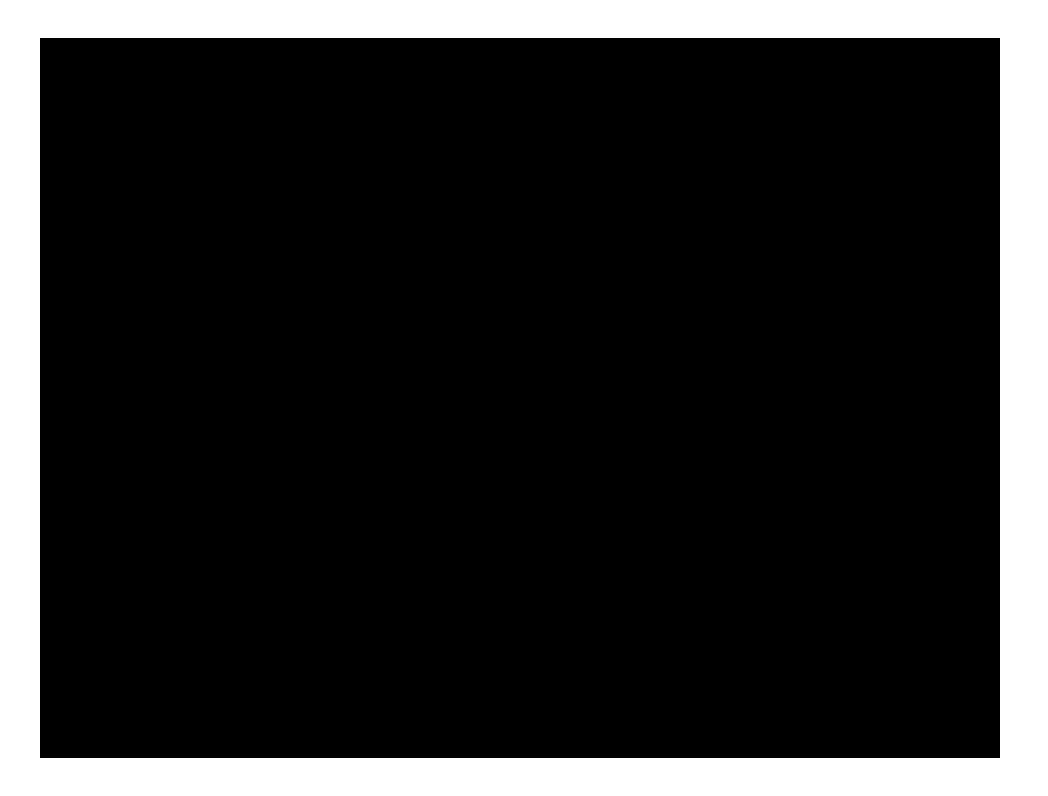










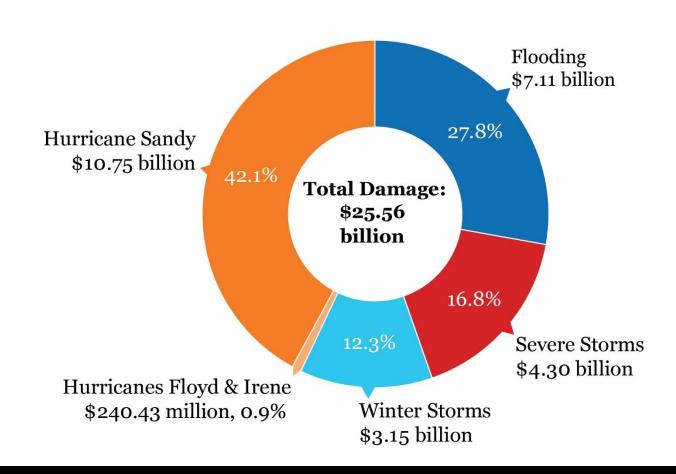


Climate Hazards

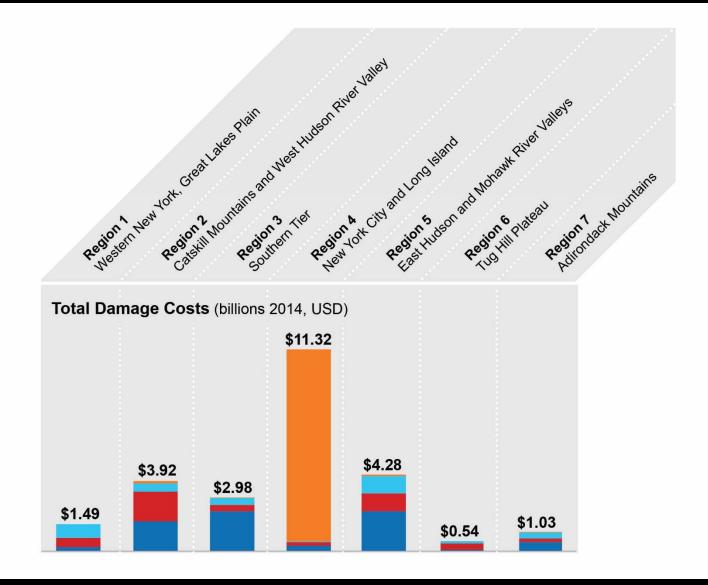


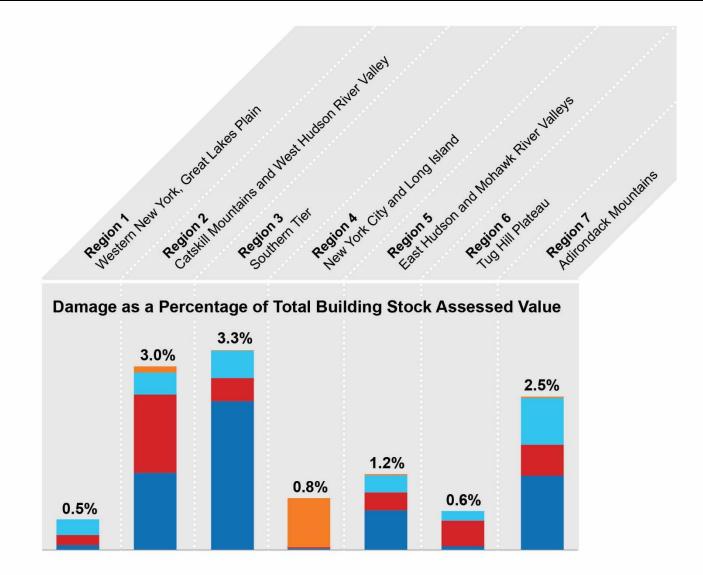
Ray, Paul, Nicholas B. Rajkovich, Michael E. Tuzzo, Martha Bohm, and Bart Roberts. 2018. Regional Costs of Climate-Related Hazards for the New York State Building Sector. NYSERDA, Albany, New York.

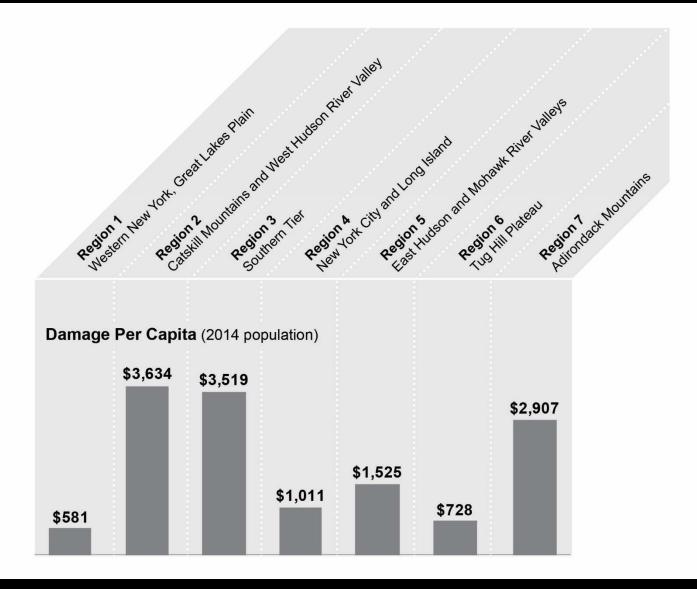
Total State-wide Estimated Building Damage (2014 USD)



Data Source: SHELDUS, FEMA

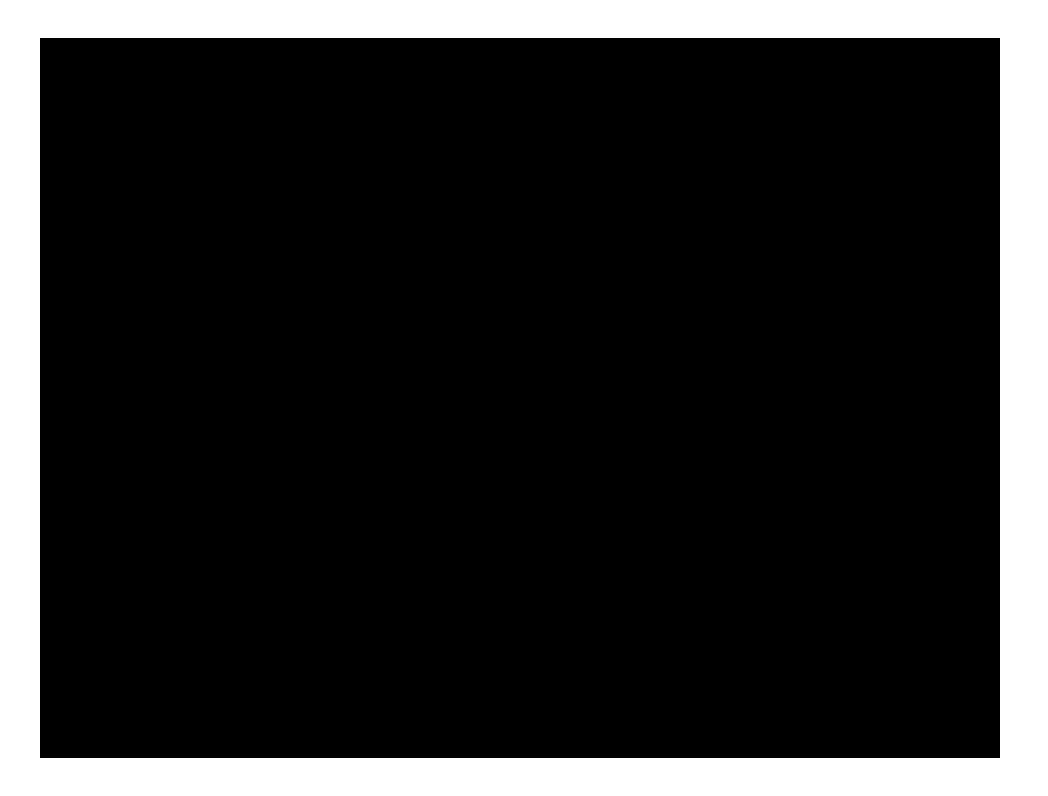






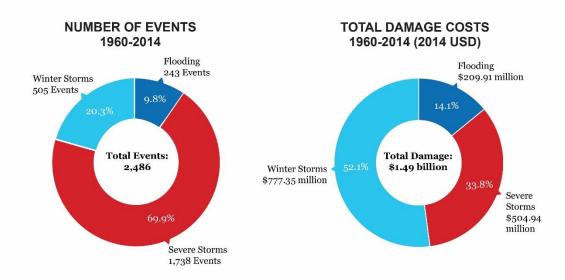
Key Findings from Historical Cost Data Analysis

- Hurricanes have been the most destructive.
- Hurricanes impact more than just New York City and Long Island.
- Flooding events are widespread, frequent, and costly in NYS.
- NYC and Long Island sustained the most building damage but did not sustain the most damage per total building value or per capita.
- Winter storms are not widespread, but they cause significant damage in the Western New York/Great Lakes Plain Region.
- Decentralized regions may be impacted more than other regions.
- The Tug Hill Plateau Region has had the lowest exposure to climate hazards.





Region One | Western New York/Great Lakes Plain

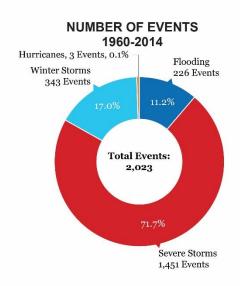


REGIONAL AVERAGE COST PER EVENT (2014 USD)

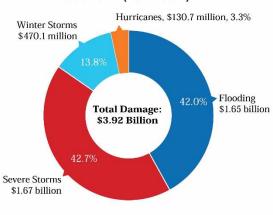
Climate Hazard	Cost per Capita (2014 Population)	Regional Average Cost Per Event	Average Cost per Event across All Regions
Hurricanes	Property damage was not recorded for this region		
Flooding	\$81.75	\$0.86 million	\$5.09 million
Severe Storms	\$196.64	\$0.29 million	\$0.43 million
Winter Storms	\$302.72	\$1.54 million	\$1.03 million



Region Two | Catskill Mountains & West Hudson River Valley



TOTAL DAMAGE COSTS 1960-2014 (2014 USD)

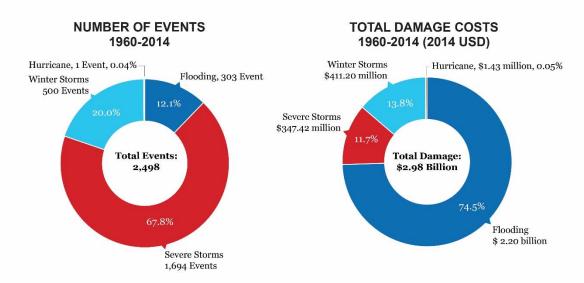


REGIONAL AVERAGE COST PER EVENT (2014 USD)

Climate Hazard	Cost per Capita (2014 Population)	Regional Average Cost Per Event	Average Cost per Event across All Regions
Hurricanes	\$121.12	\$43.57 million	\$916.31 million
Flooding	\$1,525.02	\$7.28 million	\$5.09 million
Severe Storms	\$1,552.08	\$1.15 million	\$0.43 million
Winter Storms	\$435.57	\$1.37 million	\$1.03 million



Region Three | Southern Tier



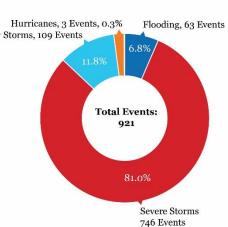
REGIONAL AVERAGE COST PER EVENT (2014 USD)

Climate Hazard	Cost per Capita (2014 Population)	Regional Average Cost Per Event	Average Cost per Event across All Regions
Hurricanes	\$1.68	\$1.43 million	\$916.31 million
Flooding	\$2,621.56	\$7.33 million	\$5.09 million
Severe Storms	\$410.48	\$0.21 million	\$0.43 million
Winter Storms	\$485.39	\$0.82 million	\$1.03 million

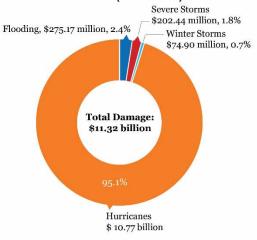


Region Four | New York City and Long Island





TOTAL DAMAGE COSTS 1960-2014 (2014 USD)

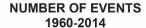


REGIONAL AVERAGE COST PER EVENT (2014 USD)

Climate Hazard	Cost per Capita (2014 Population)	Regional Average Cost Per Event	Average Cost per Event across All Regions
Hurricanes	\$961.32	\$3.59 million	\$916.31 million
Flooding	\$24.56	\$4.37 million	\$5.09 million
Severe Storms	\$18.07	\$0.27 million	\$0.43 million
Winter Storms	\$6.68	\$0.69 million	\$1.03 million



Region Five | East Hudson and Mohawk River Valleys

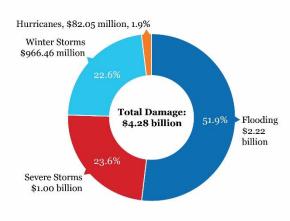


Hurricanes, 3 Events, 0.1% – Flooding 273 Events Winter Storms 451 Events 16.8% Total Events: 2,688

73.0%

Severe Storms 1,961 Events

TOTAL DAMAGE COSTS 1960-2014 (2014 USD)



REGIONAL AVERAGE COST PER EVENT (2014 USD)

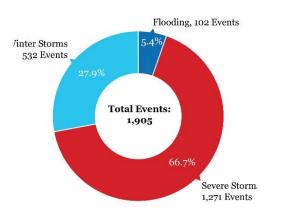
Climate Hazard	Cost per Capita (2014 Population)	Regional Average Cost Per Event	Average Cost per Event across All Regions
Hurricanes	\$29.26	\$27.35 million	\$916.31 million
Flooding	\$791.01	\$8.12 million	\$5.09 million
Severe Storms	\$359.80	\$0.51 million	\$0.43 million
Winter Storms	\$344.66	\$2.14 million	\$1.03 million

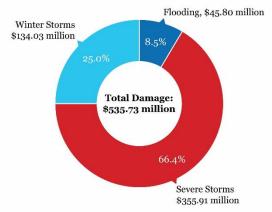


Region Six | Tug Hill Plateau

NUMBER OF EVENTS 1960-2014

TOTAL DAMAGE COSTS 1960-2014 (2014 USD)



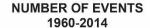


REGIONAL AVERAGE COST PER EVENT (2014 USD)

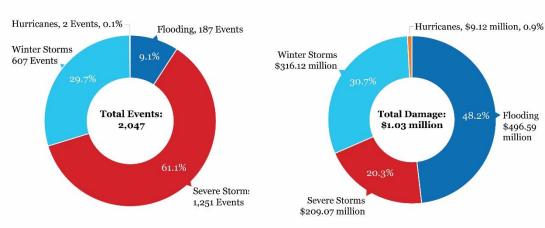
Climate Hazard	Cost per Capita (2014 Population)	Regional Average Cost Per Event	Average Cost per Event across All Regions
Hurricanes	Property damage was not recorded for this region		
Flooding	\$62.26	\$0.45 million	\$5.09 million
Severe Storms	\$483.86	\$0.28 million	\$0.43 million
Winter Storms	\$182.22	\$0.25 million	\$1.03 million



Region Seven | Adirondack Mountains

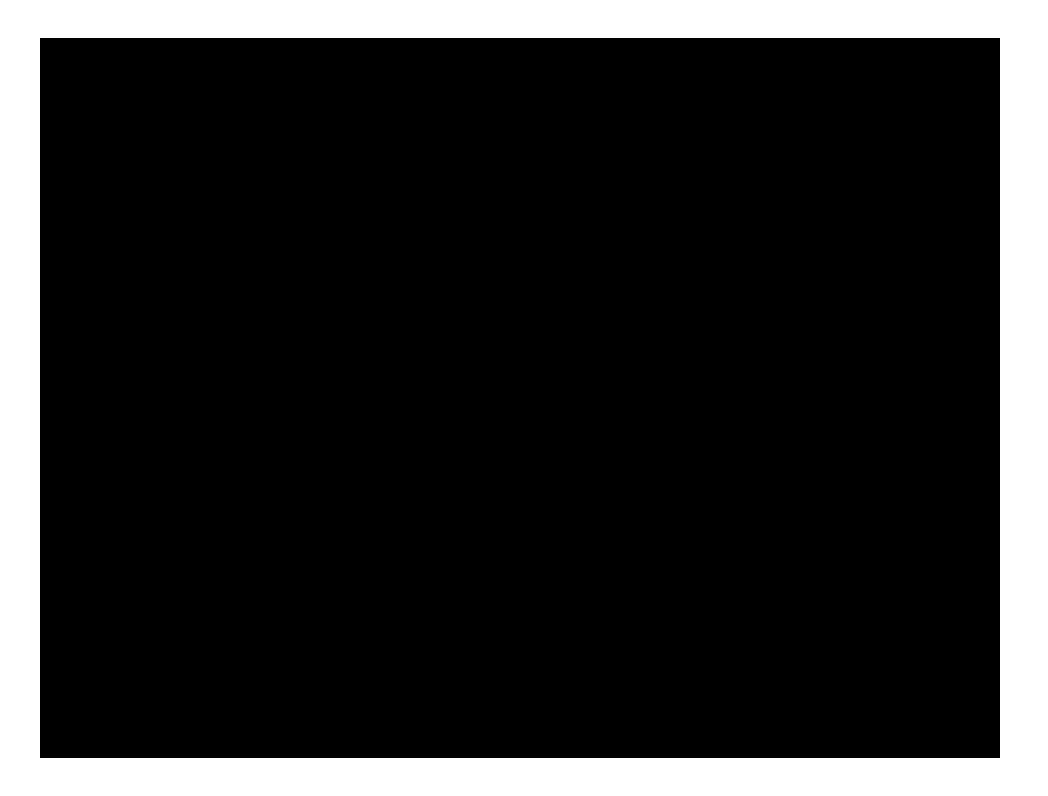


TOTAL DAMAGE COSTS 1960-2014 (2014 USD)



REGIONAL AVERAGE COST PER EVENT (2014 USD)

Climate Hazard	Cost per Capita (2014 Population)	Regional Average Cost Per Event	Average Cost per Event across All Regions
Hurricanes	\$25.72	\$4.56 million	\$916.31 million
Flooding	\$1,400.45	\$2.66 million	\$5.09 million
Severe Storms	\$589.59	\$0.17 million	\$0.43 million
Winter Storms	\$891.49	\$0.52 million	\$1.03 million



What is Adaptive Capacity?

Defined as "the ability of a system to adjust to actual or expected climate stresses, or to cope with the consequences."

Also the actions that build adaptive capacity aim to lessen the physical, social or economic impacts of climate change.

Building adaptive capacity may take advantage of new opportunities emerging from a changing climate.

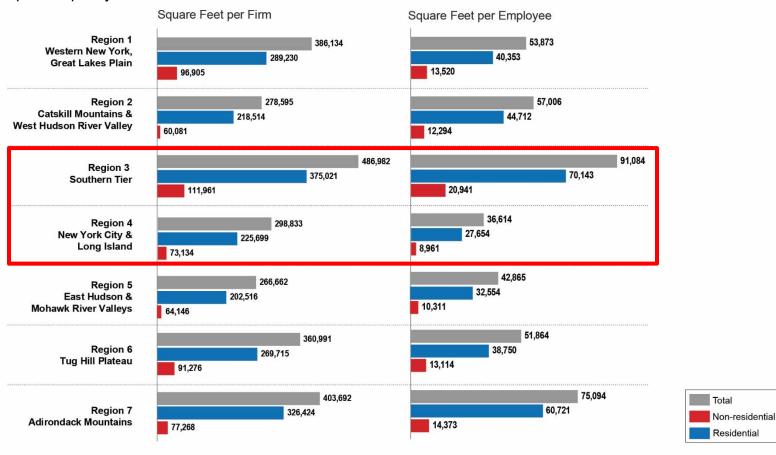
Total Construction Employment and Firms in Each ClimAid Region (2015)



Data Source: NYSDOL, FEMA

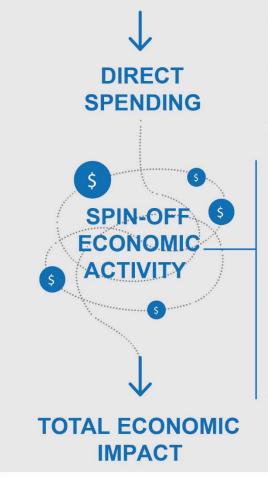
Square Feet per Construction Employee and Firm (2015)

The amount of building space that each firm/employee is responsible for, on average, in their region. The lower the figure, the higher the adaptive capacity.



Data Source: NYSDOL, FEMA

HOW DOES DIRECT SPENDING CREATE ADDITIONAL ECONOMIC ACTIVITY WITHIN REGIONAL ECONOMIES?



DIRECT EFFECT

An infusion of new money into the local economy to increase adaptive capacity. This might include payments to contractors and design professionals for building retrofits, new buildings, or post-disaster recovery activities.

INDIRECT EFFECT

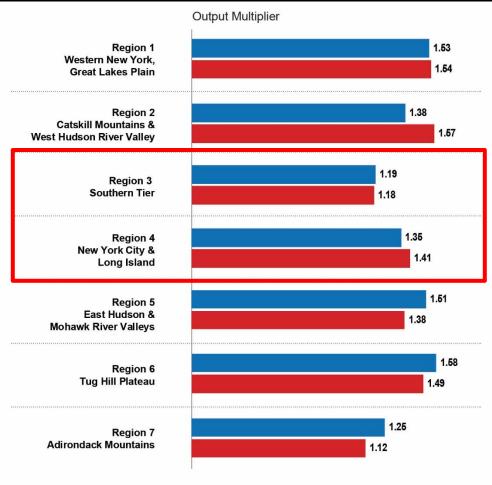
Additional activity caused by direct spending recipients as they perform their work. This might include spending on commodities and materials or additional services from subcontractors.

INDUCED EFFECT

Employees of the businesses supporting the direct spending recipients spend their wages within the local economy to create even more economic activity and employment.

Ray, Paul, Nicholas B. Rajkovich, Michael E. Tuzzo, Martha Bohm, and Bart Roberts. 2018. *Regional Costs of Climate-Related Hazards for the New York State Building Sector.* NYSERDA, Albany, New York.

Output Multipliers for Residential and Non-Residential Construction (2015)



Non-residential Residential

Data Source: MIG, Inc. Impact Analysis for Planning (IMPLAN)

Research Limitations:



Site-Level Data on Building Attributes



Historical Loss Data

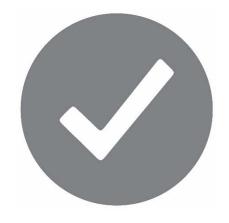


Weather Predictions

Ray, Paul, Nicholas B. Rajkovich, Michael E. Tuzzo, Martha Bohm, and Bart Roberts. 2018. *Regional Costs of Climate-Related Hazards for the New York State Building Sector.* NYSERDA, Albany, New York.

<u>Limitations on Loss Estimation Data Sources:</u>









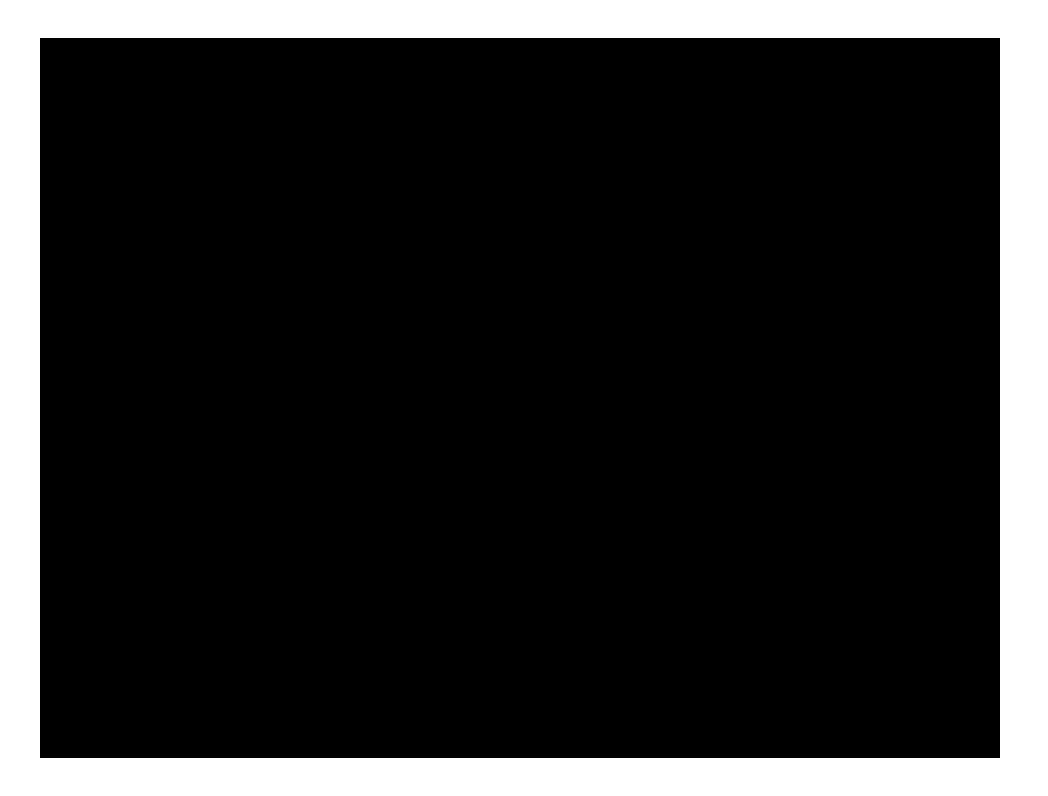
Accuracy (Internal Biases)

Availability (Open Source versus Proprietary)

Comparability

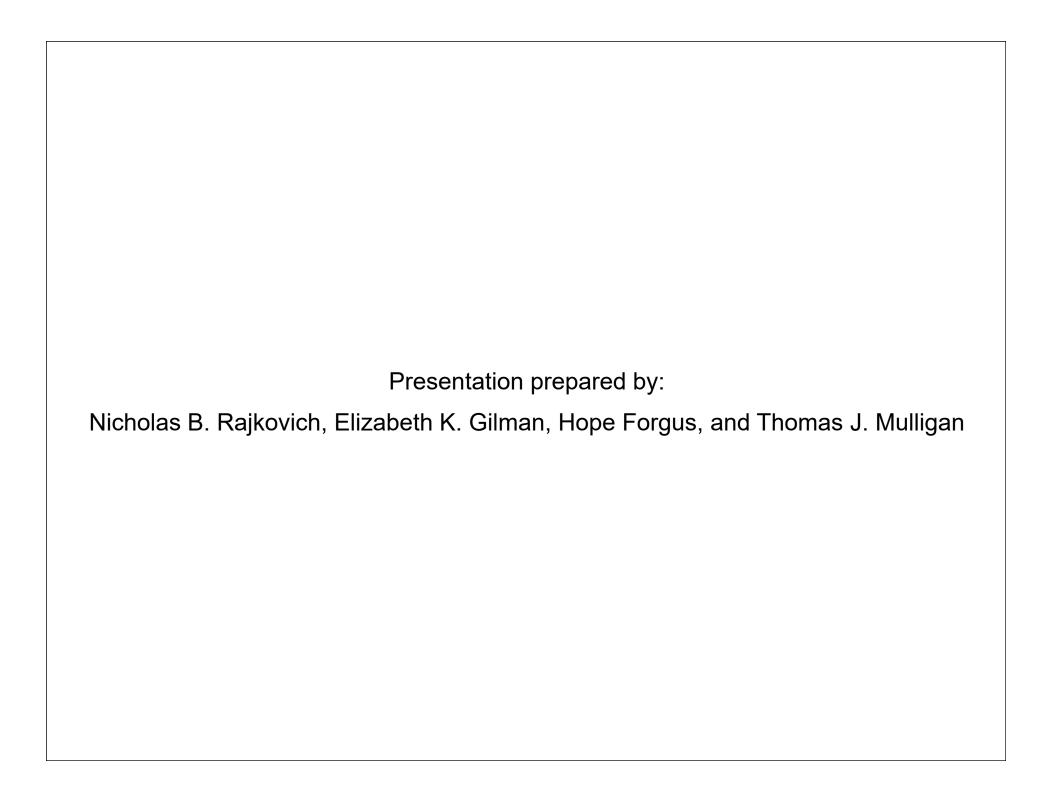
Lack of Locallevel Loss Estimations

Ray, Paul, Nicholas B. Rajkovich, Michael E. Tuzzo, Martha Bohm, and Bart Roberts. 2018. *Regional Costs of Climate-Related Hazards for the New York State Building Sector.* NYSERDA, Albany, New York.









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