# U.S. GREEN BUILDING COUNCIL

G325

## New York State Climate Hazards Profile

USGBCNYU_CHP

Nicholas B. Rajkovich

April 18, 2019

# Learning Objectives

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

1. Understand how climate hazard events including hurricanes, severe storms, and winter storms have caused significant damage to buildings, as well as occupants, users and any others, in New York State.
2. Explain how changing climate conditions, including increases in temperature and precipitation, could potentially increase the frequency and intensity of these climate hazard events in the future.
3. Anticipate how each of the covered hazards are expected to change and how those changes will impact our buildings, as well as occupants, users and any others.
4. Utilize provided links and references to dig deeper and access more specific information on each hazard, their impacts, and how to prepare for them during project planning and design.


NEW YORK
STATE OF
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NYSERDA


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NEW YORK
UPSTATE

Presentation prepared by:

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Research

Our Approach

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 Urban Planning

# Adapting Buildings for a Changing Climate


ap.buffalo.edu/adapting-buildings

# New York State Climate Hazards Profile

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

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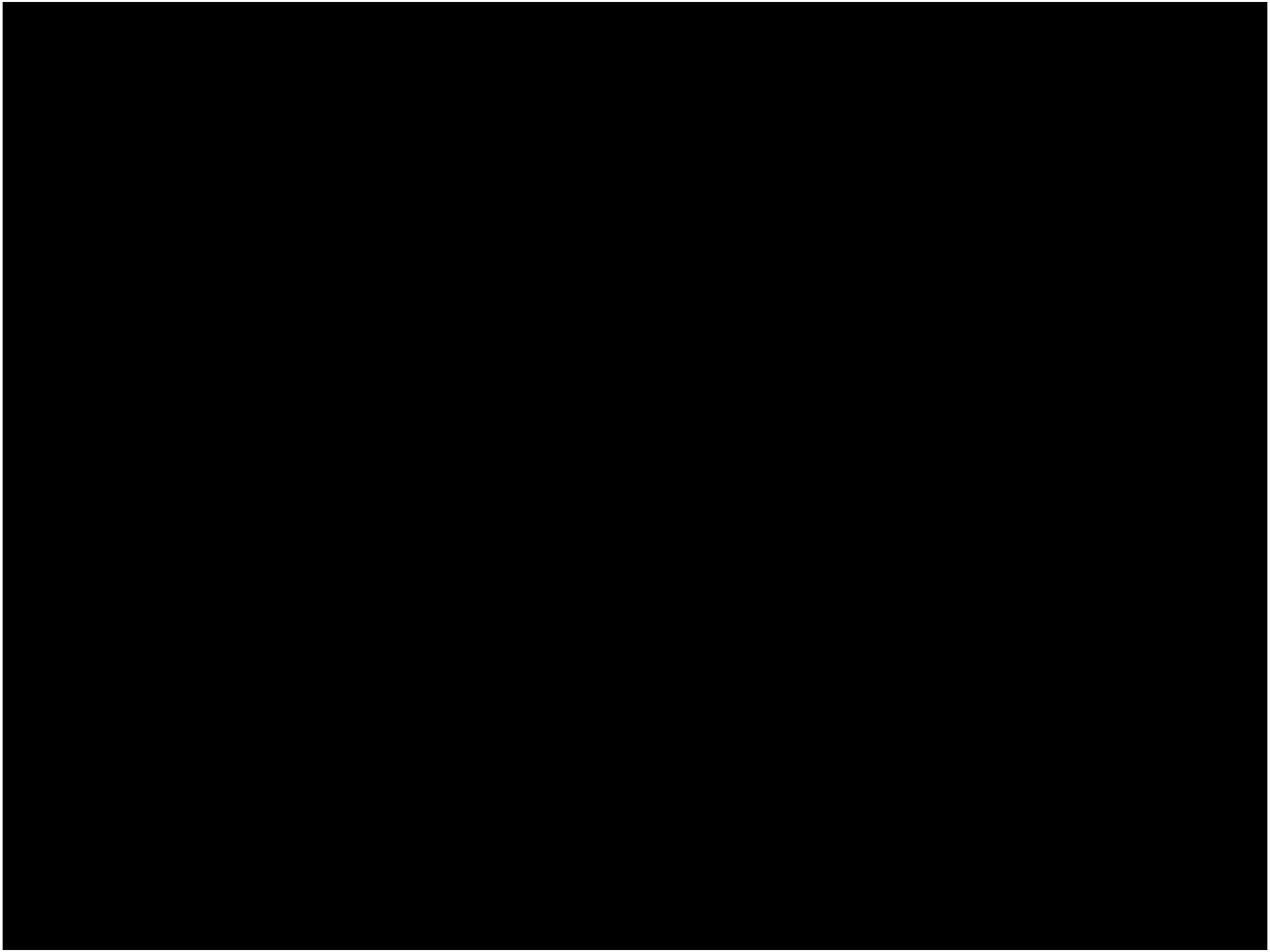


# Hurricanes / Tropical Storms

- HAZARD DESCRIPTION
- HAZARD HISTORY IN NEW YORK STATE
- IMPACT ON BUILDINGS
- ANTICIPATED CHANGES

Tuzzo, Michael E., Elizabeth Gilman, Nicholas B. Rajkovich, Bartholomew Roberts, Ellen Cousins, Sean Daigneault, and Stefan Cecelski. 2018. *New York State Climate Hazards Profile.* New York State Energy Research and Development Authority (NYSERDA), Albany, New York.

# Hurricanes / Tropical Storms

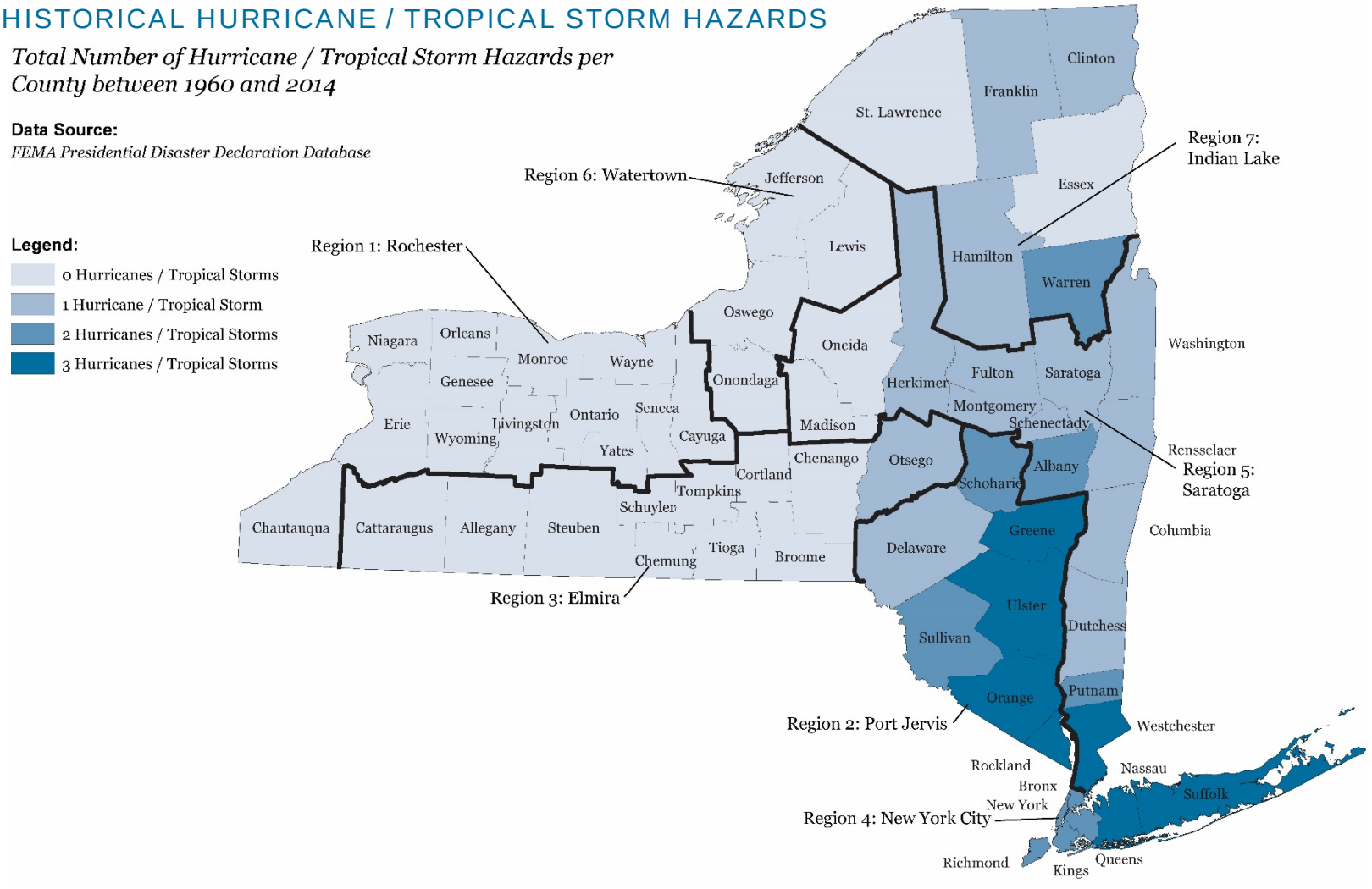
- Hurricanes and tropical storms produce severe winds, intense precipitation, and storm surge.
- Although there have been only 10 major hurricanes / tropical storm events in NYS over the past 50 years, the cost to communities has been nearly $11 billion.
- Extreme winds can remove roof and wall coverings, destroy homes, and tear up trees. Flooding can lift smaller structures from their foundations or cause significant damage to building systems located below the base flood elevation (BFE).
- The strength of hurricanes and tropical storms may increase due to a rise in oceanic and atmospheric temperatures.

Tuzzo, Michael E., Elizabeth Gilman, Nicholas B. Rajkovich, Bartholomew Roberts, Ellen Cousins, Sean Daigneault, and Stefan Cecelski. 2018. *New York State Climate Hazards Profile.* New York State Energy Research and Development Authority (NYSERDA), Albany, New York.

## HISTORICAL HURRICANE / TROPICAL STORM HAZARDS

*Total Number of Hurricane / Tropical Storm Hazards per County between 1960 and 2014*

**Data Source:**
*FEMA Presidential Disaster Declaration Database*

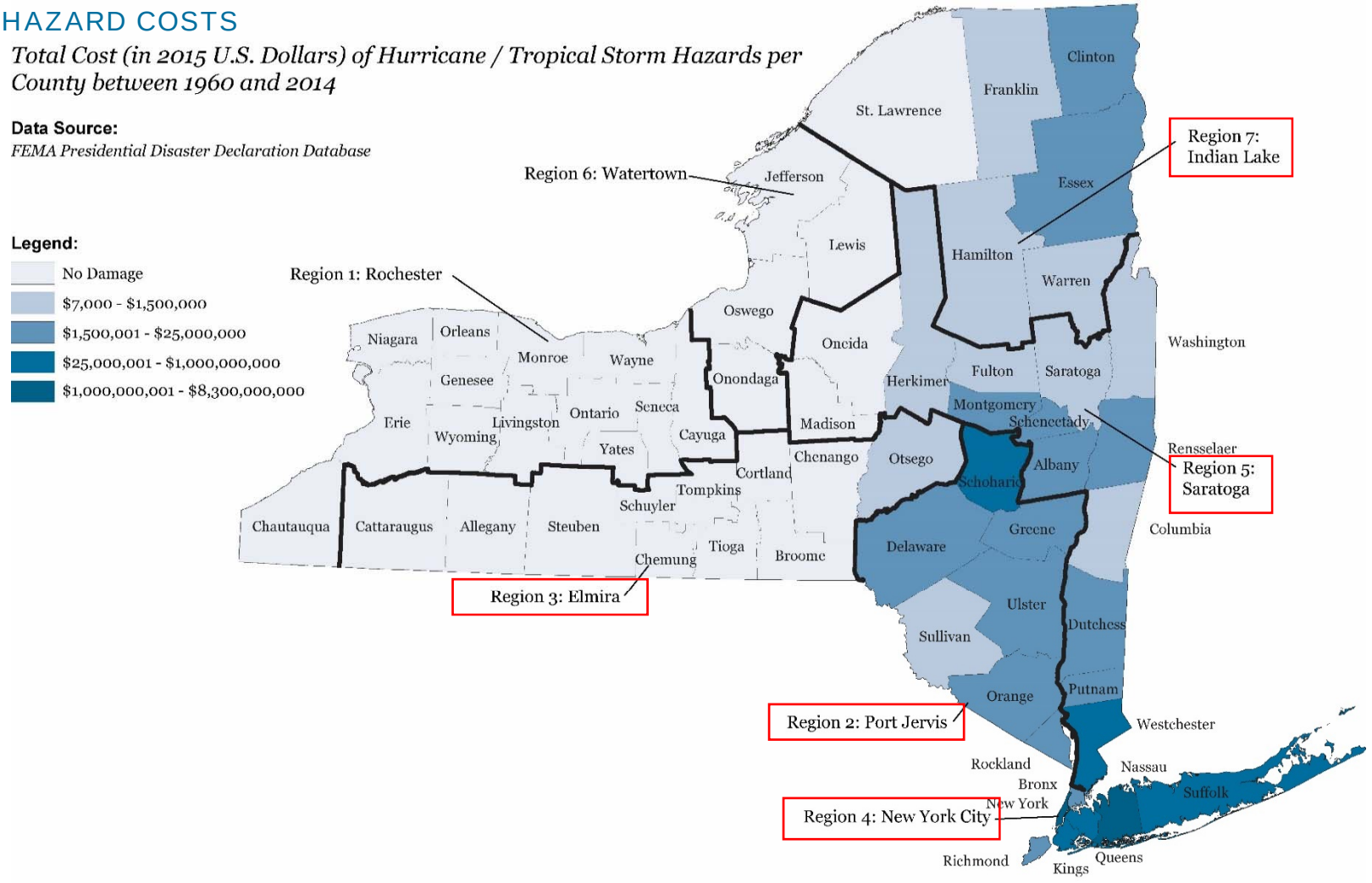



Data Source: *FEMA Presidential Disaster Declaration Database*

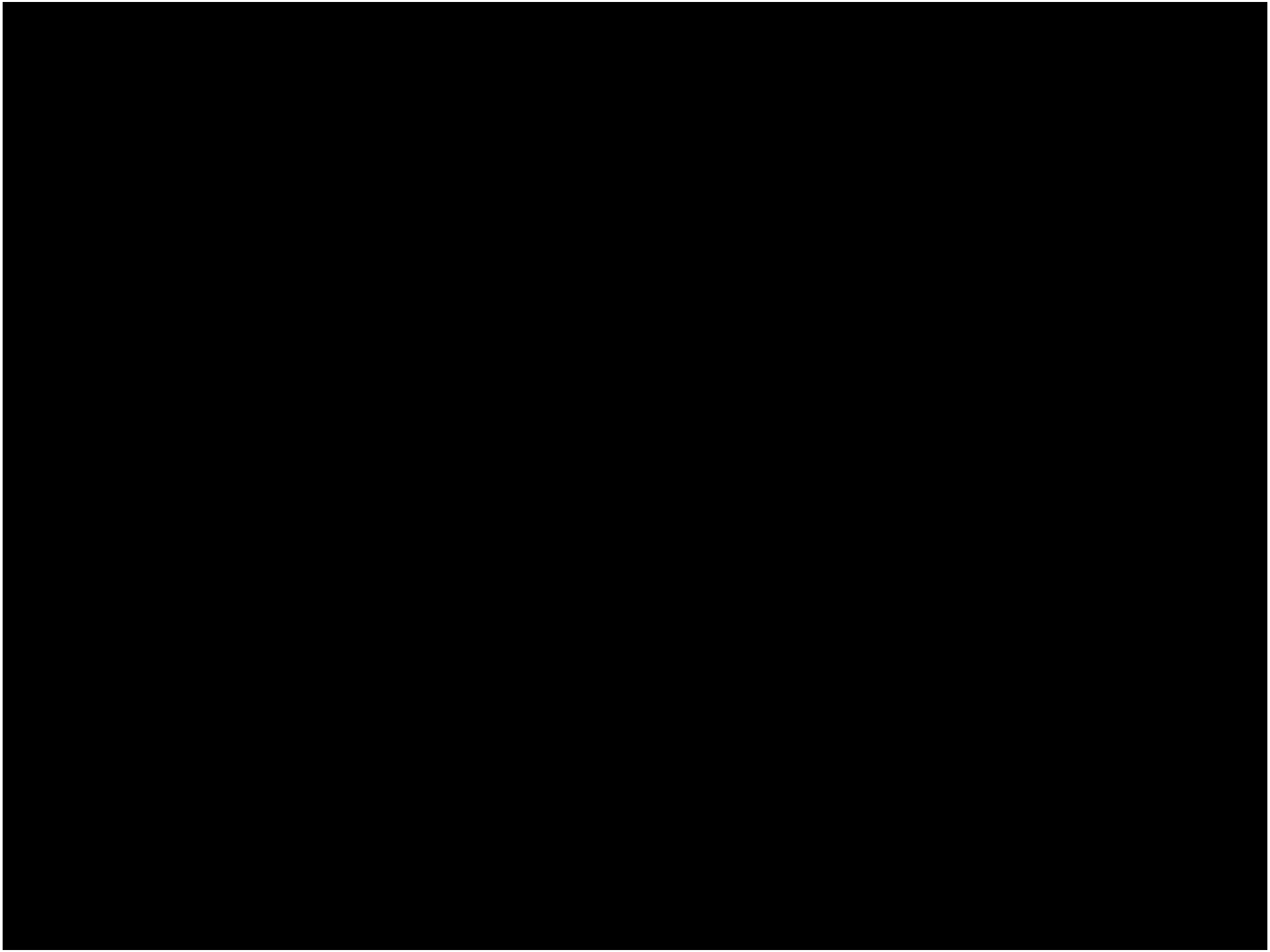
## HISTORICAL HURRICANE / TROPICAL STORM HAZARD COSTS

*Total Cost (in 2015 U.S. Dollars) of Hurricane / Tropical Storm Hazards per County between 1960 and 2014*

**Data Source:**
*FEMA Presidential Disaster Declaration Database*




Data Source: *FEMA Presidential Disaster Declaration Database*



# Flooding

- There are nine types of flooding that can cause damage to buildings: (1) riverine overbank flooding, (2) flash floods, (3) alluvial fan floods, (4) mudflows or debris floods, (5) dam- and levee-break floods, (6) local draining or high groundwater levels, (7) fluctuating lake levels, (8) ice jams, and (9) coastal flooding.

- Over the past 50 years, communities near large bodies of water, such as the Great Lakes and the Hudson River, have all experienced higher-than-average rates of flooding.

- Buildings can be damaged by floods through foundation scour, uplift from hydrostatic pressure, and debris carried by floodwaters.

- Strategies should aim to break the “damage-rebuild-damage” cycle.

Tuzzo, Michael E., Elizabeth Gilman, Nicholas B. Rajkovich, Bartholomew Roberts, Ellen Cousins, Sean Daigneault, and Stefan Cecelski. 2018. *New York State Climate Hazards Profile.* New York State Energy Research and Development Authority (NYSERDA), Albany, New York.

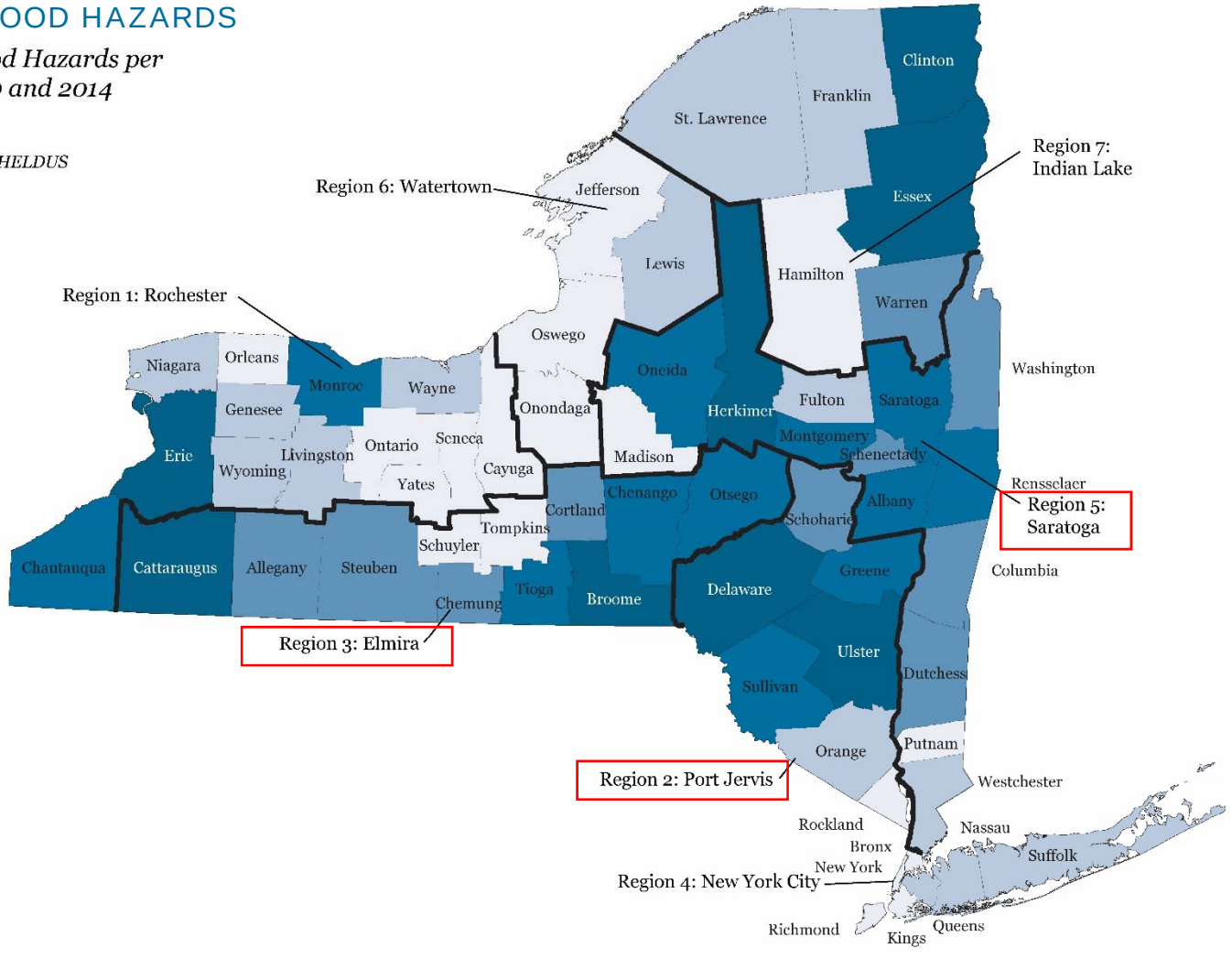
## HISTORICAL FLOOD HAZARDS

*Total Number of Flood Hazards per County between 1960 and 2014*

**Data Source:**
*University of South Carolina SHELDUS*

**Legend:**

- 24 - 33 Floods
- 34 - 42 Floods
- 43 - 50 Floods
- 51 - 63 Floods
- 64 - 83 Floods




Data Source: *University of South Carolina SHELDUS*

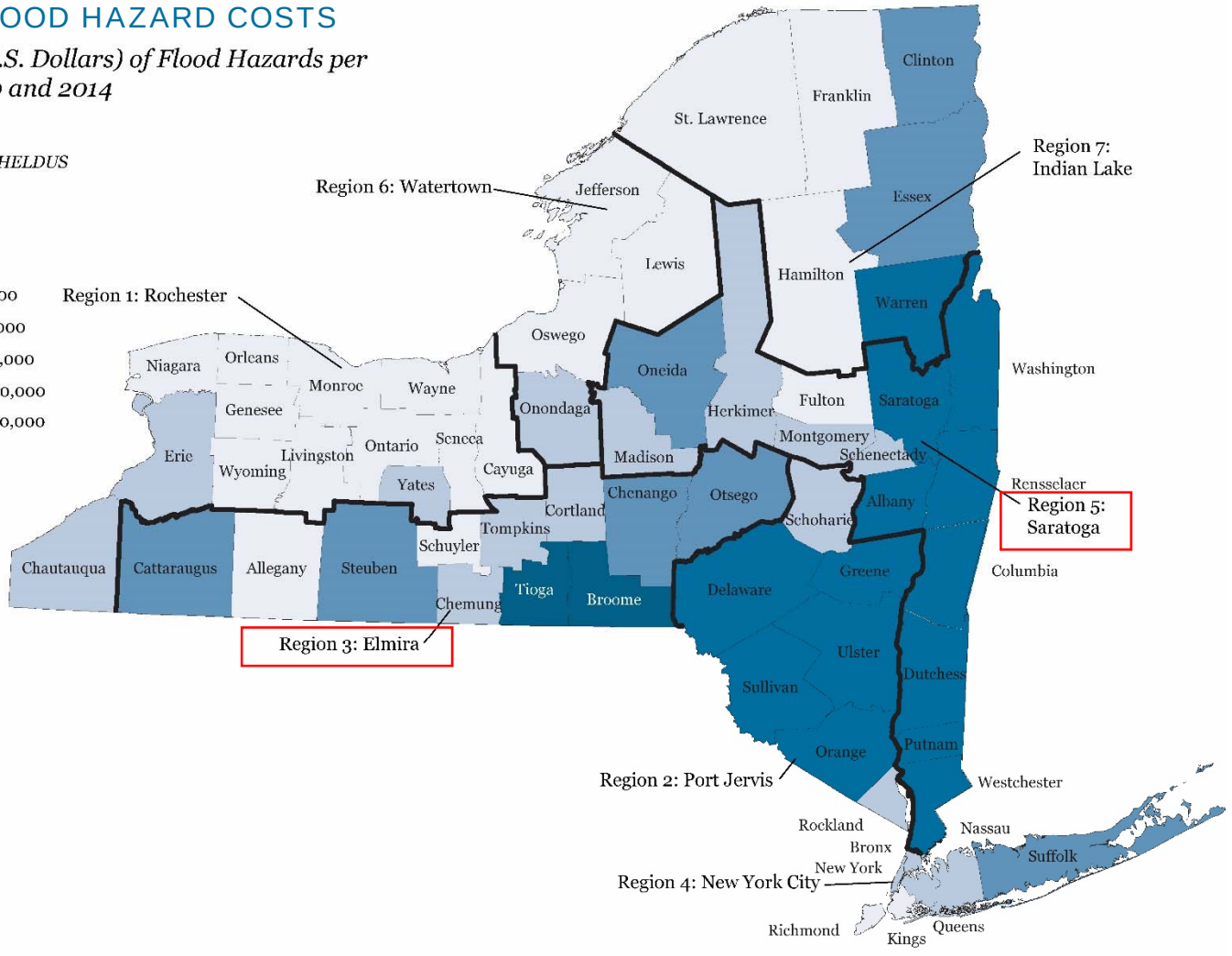
## HISTORICAL FLOOD HAZARD COSTS

*Total Cost (in 2015 U.S. Dollars) of Flood Hazards per County between 1960 and 2014*

**Data Source:**
*University of South Carolina SHELDUS*

**Legend:**

- $3,100,000 - $25,300,000
- $25,300,001 - $57,000,000
- $57,000,001 - $163,000,000
- $163,000,001 - $430,600,000
- $430,600,001 - $915,000,000




Data Source: *University of South Carolina SHELDUS*

## CURRENT DAYS OVER 1" OF RAINFALL

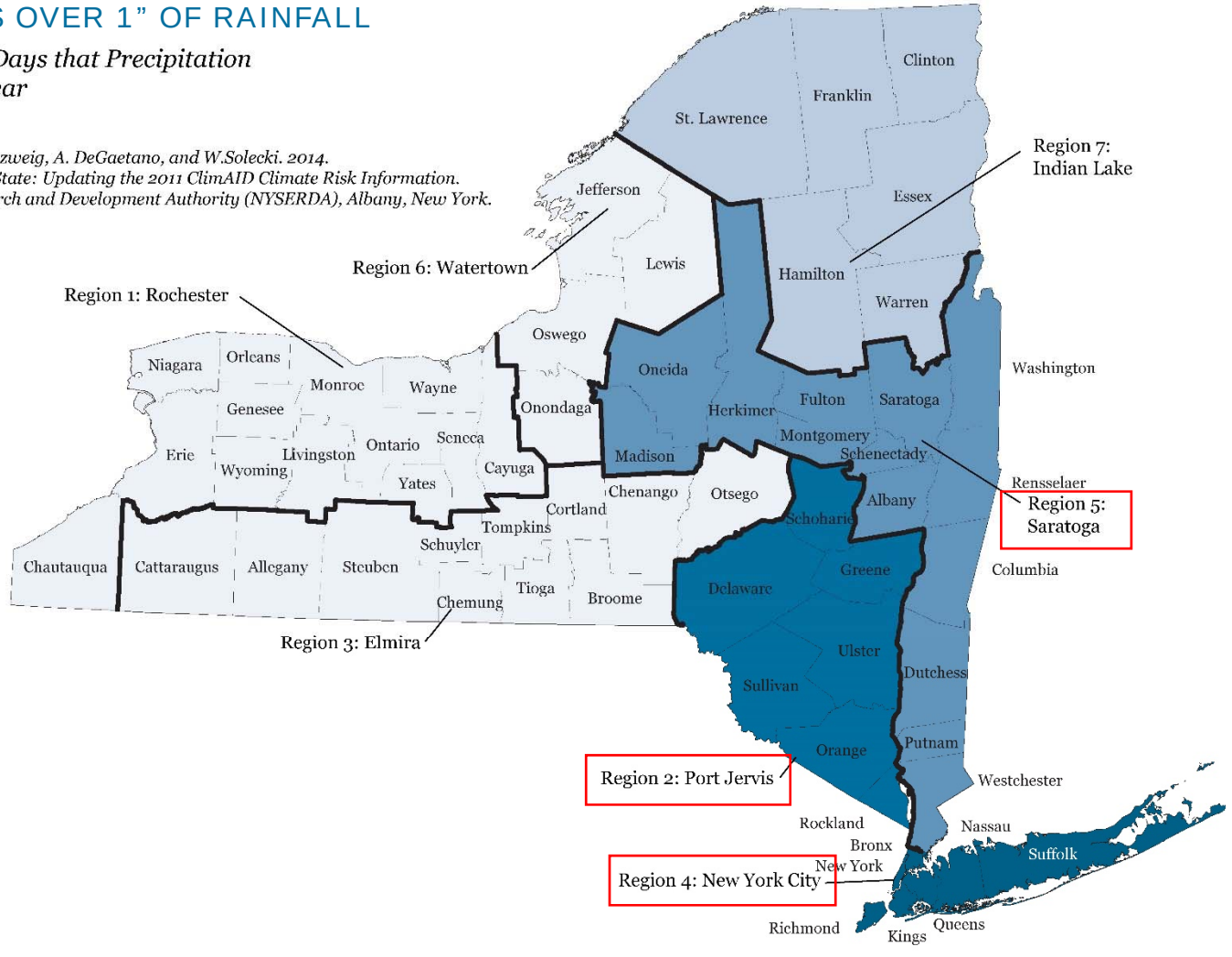
*Average Number of Days that Precipitation Will Exceed 1" in a Year*

**Data Derived From:**

*Horton, R., D. Bader, C. Rosenzweig, A. DeGaetano, and W.Solecki. 2014. Climate Change in New York State: Updating the 2011 ClimAID Climate Risk Information. New York State Energy Research and Development Authority (NYSERDA), Albany, New York.*

**Legend:**

- 5 - 6 days
- 7 - 8 days
- 9 - 10 days
- 11 - 12 days
- 13 - 14 days




Data Source: Horton, R., D. Bader, C. Rosenzweig, A. DeGaetano, and W.Solecki. 2014. *"Climate Change in New York State: Updating the 2011 ClimAID Climate Risk Information*." https://www.nyserda.ny.gov/climaid.

## FUTURE DAYS OVER 1" OF RAINFALL

| ClimAID Region: City (Current Baseline) | 2020s | | | 2050s | | | 2080s | | |
|---|---|---|---|---|---|---|---|---|---|
| | Low | Middle | High | Low | Middle | High | Low | Middle | High |
| Region 1: Rochester (Average of 5 days/year) | 4 | 5 to 5 | 6 | 4 | 5 to 5 | 6 | 4 | 5 to 6 | 7 |
| Region 2: Port Jervis (Average of 12 days/year) | 11 | 12 to 13 | 14 | 12 | 13 to 14 | 15 | 12 | 13 to 15 | 16 |
| Region 3: Elmira (Average of 6 days/year) | 6 | 6 to 7 | 7 | 6 | 6 to 7 | 8 | 6 | 7 to 8 | 8 |
| Region 4: New York City (Average of 13 days/year) | 13 | 14 to 15 | 16 | 13 | 14 to 16 | 17 | 14 | 15 to 17 | 18 |
| Region 5: Saratoga (Average of 10 days/year) | 10 | 10 to 11 | 12 | 10 | 11 to 12 | 13 | 10 | 11 to 13 | 14 |
| Region 6: Watertown (Average of 6 days/year) | 6 | 7 to 8 | 8 | 7 | 7 to 8 | 9 | 7 | 7 to 9 | 10 |
| Region 7: Indian Lake (Average of 7 days/year) | 7 | 7 to 8 | 9 | 7 | 8 to 9 | 10 | 8 | 8 to 10 | 11 |

Data Source: Horton, R., D. Bader, C. Rosenzweig, A. DeGaetano, and W.Solecki. 2014. *"Climate Change in New York State: Updating the 2011 ClimAID Climate Risk Information*." https://www.nyserda.ny.gov/climaid.

## CURRENT DAYS OVER 2" OF RAINFALL

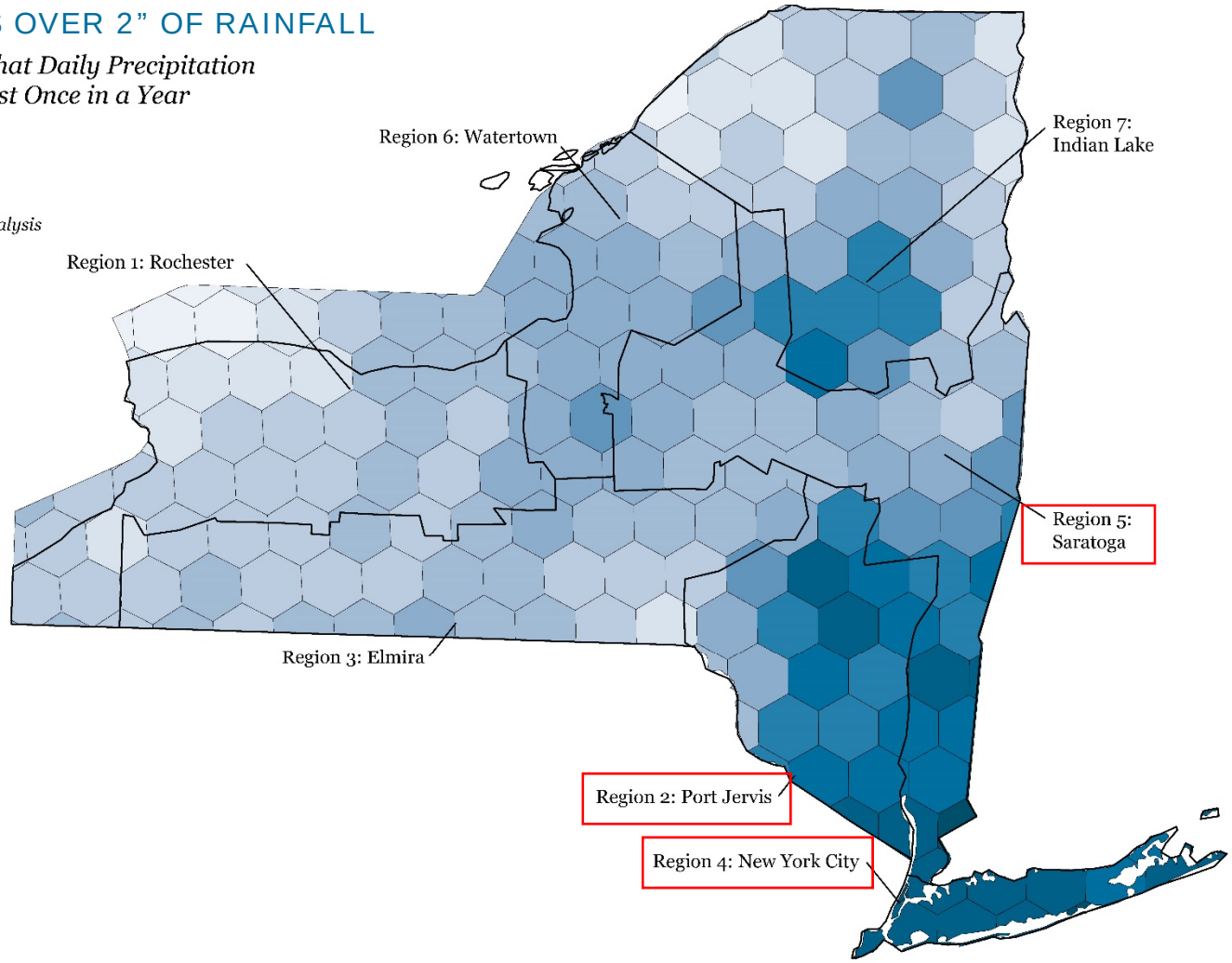
*Percent Probability that Daily Precipitation Will Exceed 2" at Least Once in a Year*

**Map Produced By:**
*Weather Analytics*

**Data Derived From:**
*Climate Forecast System Reanalysis*

**Legend:**

- 10.80 - 18.40%
- 18.41 - 25.90%
- 25.91 - 33.50%
- 33.51 - 41.10%
- 41.11 - 48.60%
- 48.61 - 56.20%
- 56.21 - 63.80%
- 63.81 - 71.40%
- 71.41 - 78.90%
- 78.91 - 86.50%

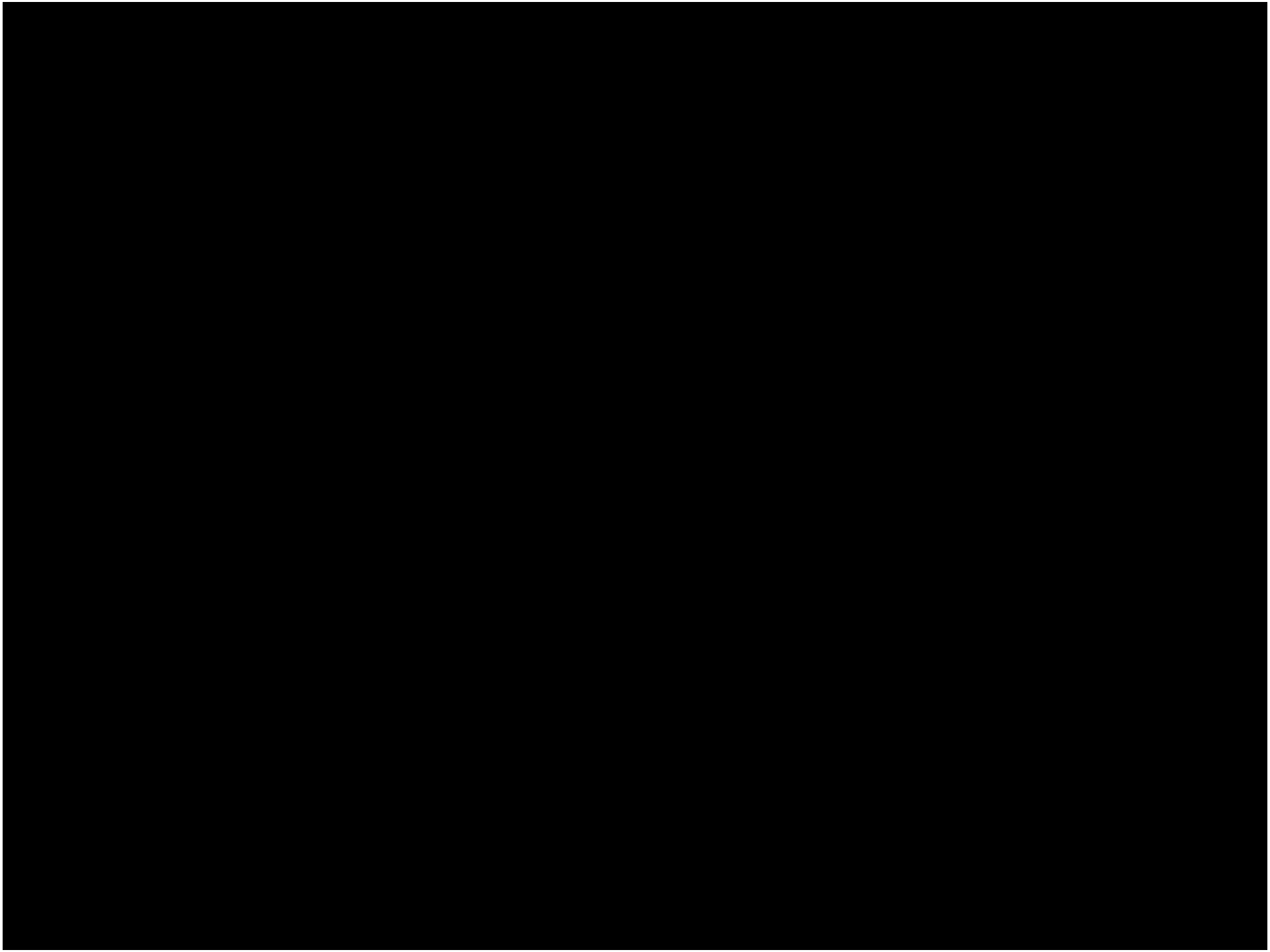



Data Source: *Climate Forecast System Reanalysis*

## FUTURE DAYS OVER 2" OF RAINFALL

| ClimAID Region: City (Current Baseline) | 2020s | | | 2050s | | | 2080s | | |
|---|---|---|---|---|---|---|---|---|---|
| | Low | Middle | High | Low | Middle | High | Low | Middle | High |
| Region 1: Rochester (Average of 0.6 days/year) | 0.6 | 0.6 to 0.7 | 0.8 | 0.5 | 0.6 to 0.8 | 0.9 | 0.5 | 0.6 to 0.9 | 1 |
| Region 2: Port Jervis (Average of 2 days/year) | 2 | 2 to 2 | 3 | 2 | 2 to 3 | 3 | 2 | 2 to 3 | 3 |
| Region 3: Elmira (Average of 0.6 days/year) | 0.6 | 0.7 to 0.9 | 1 | 0.7 | 0.8 to 1 | 1 | 0.7 | 0.8 to 1 | 1 |
| Region 4: New York City (Average of 3 days/year) | 3 | 3 to 4 | 5 | 3 | 4 to 4 | 5 | 3 | 4 to 5 | 5 |
| Region 5: Saratoga (Average of 1 day/year) | 1 | 1 to 2 | 2 | 1 | 1 to 2 | 2 | 1 | 1 to 2 | 2 |
| Region 6: Watertown (Average of 0.8 days/year) | 0.6 | 0.7 to 1 | 1 | 0.7 | 0.7 to 1 | 1 | 0.7 | 0.8 to 1 | 1 |
| Region 7: Indian Lake (Average of 0.8 days/year) | 0.7 | 0.8 to 1 | 1 | 0.8 | 0.9 to 1 | 1 | 0.8 | 0.9 to 1 | 1 |

Data Source: Horton, R., D. Bader, C. Rosenzweig, A. DeGaetano, and W.Solecki. 2014. *"Climate Change in New York State: Updating the 2011 ClimAID Climate Risk Information*." https://www.nyserda.ny.gov/climaid.



# Severe Storms

- Severe storms include intense precipitation events that occur over a short period of hours or even minutes (not including hurricanes or tropical storms).

- Over the past 50 years, severe storms have impacted most regions of New York State, with two-thirds of these hazard events occurring between May and August.

- Severe storms can cause wind damage, water damage, and power loss from downed electrical lines.

- With temperatures projected to warm across New York State, the frequency and intensity of severe storms may increase.

Tuzzo, Michael E., Elizabeth Gilman, Nicholas B. Rajkovich, Bartholomew Roberts, Ellen Cousins, Sean Daigneault, and Stefan Cecelski. 2018. *New York State Climate Hazards Profile.* New York State Energy Research and Development Authority (NYSERDA), Albany, New York.

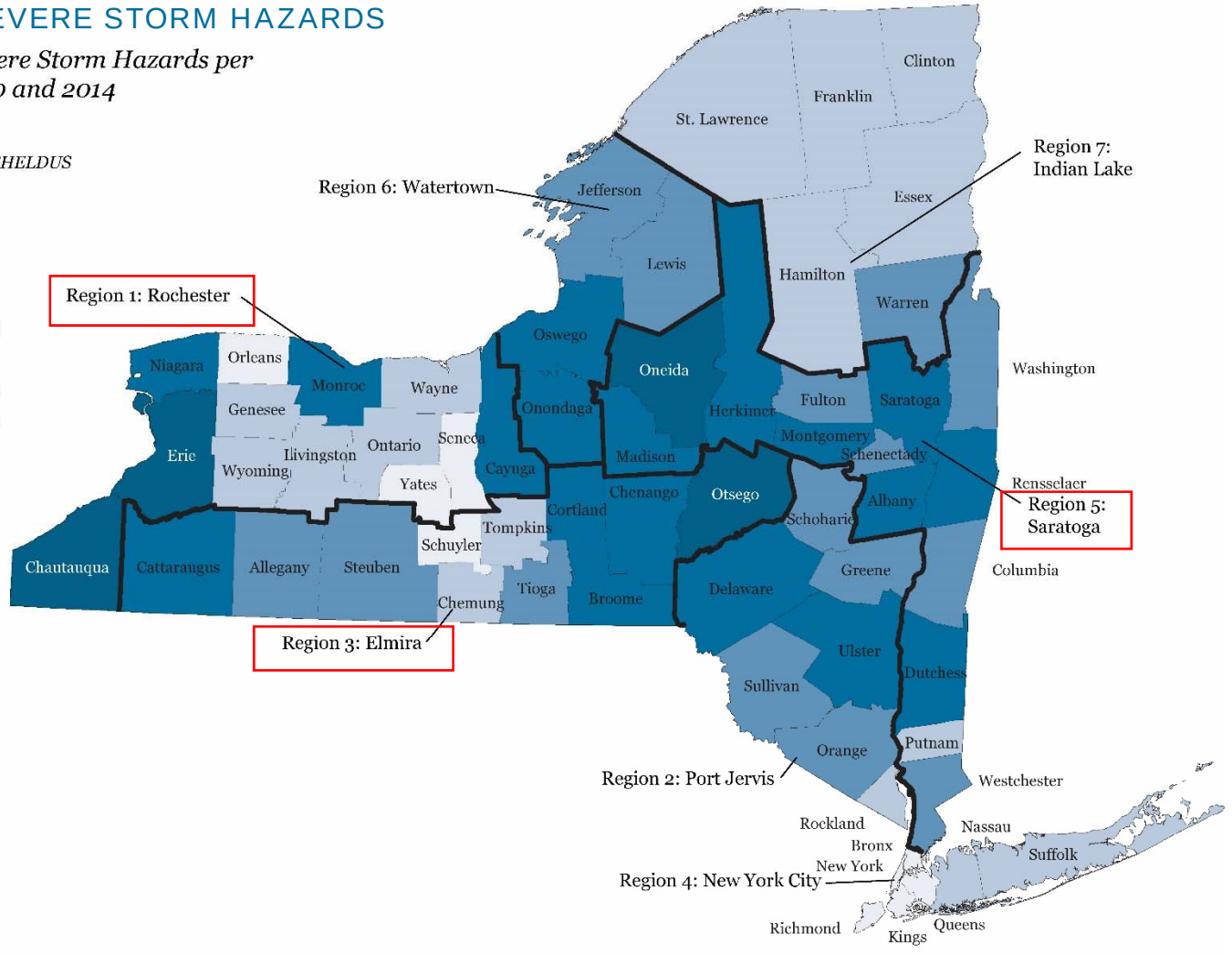
## HISTORICAL SEVERE STORM HAZARDS

*Total Number of Severe Storm Hazards per County between 1960 and 2014*

**Data Source:**
*University of South Carolina SHELDUS*

**Legend:**

- 90 - 102 Severe Storms
- 103 - 120 Severe Storms
- 121 - 139 Severe Storms
- 140 - 164 Severe Storms
- 165 - 194 Severe Storms




Data Source: *University of South Carolina SHELDUS*

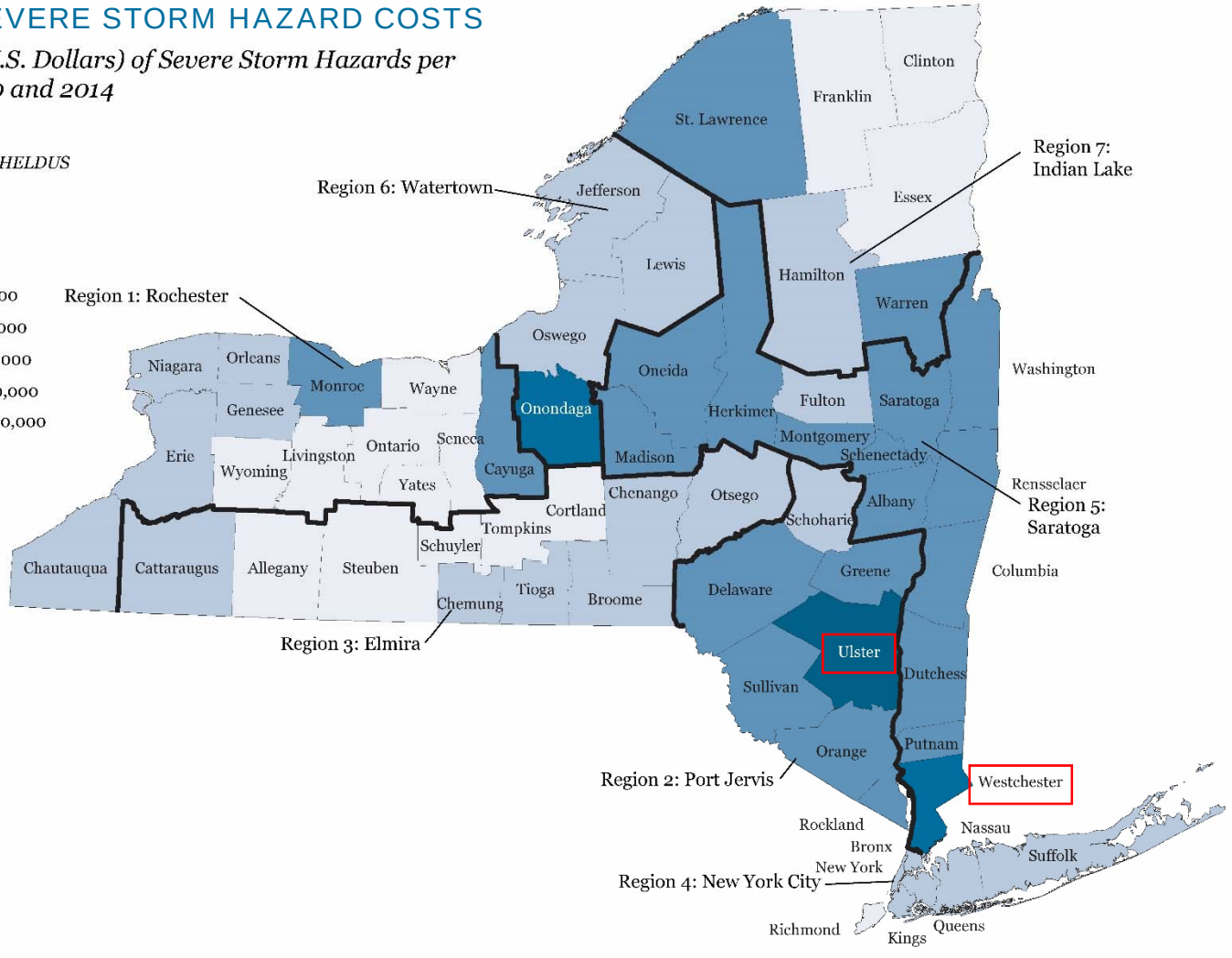
## HISTORICAL SEVERE STORM HAZARD COSTS

*Total Cost (in 2015 U.S. Dollars) of Severe Storm Hazards per County between 1960 and 2014*

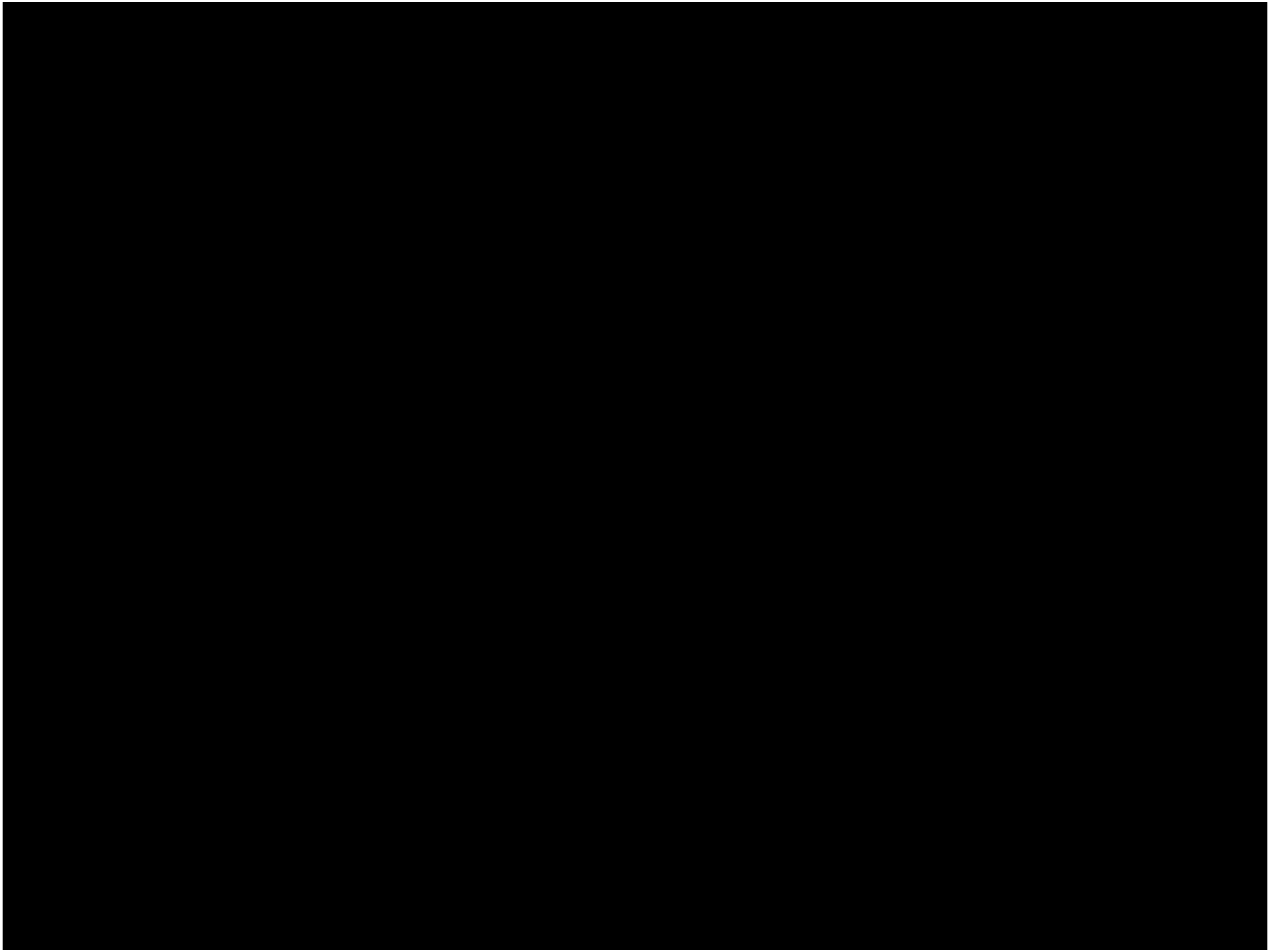
**Data Source:**
*University of South Carolina SHELDUS*

**Legend:**

- $4,350,000 - $16,700,000
- $16,700,001 - $38,000,000
- $38,000,001 - $82,000,000
- $82,000,001 - $136,000,000
- $136,000,001 - $667,800,000




Data Source: *University of South Carolina SHELDUS*



# Winter Storms

- Winter storms can include cold temperatures, snow, ice, high winds, blizzard conditions, and other localized phenomena, such as lake effect snowstorms.

- Areas along the eastern shores of Lake Ontario and Lake Erie, counties in the Adirondacks, and the Tug Hill Plateau are more susceptible to winter storms due to a greater exposure to the moisture from the Great Lakes.

- Winter weather hazards can cause roofs to collapse from excessive snow loads, power outages, and damage to overburdened heating systems.

- Models suggest that the decrease in ice cover on the Great Lakes may lead to increased lake effect snow in the coming decades.

Tuzzo, Michael E., Elizabeth Gilman, Nicholas B. Rajkovich, Bartholomew Roberts, Ellen Cousins, Sean Daigneault, and Stefan Cecelski. 2018. *New York State Climate Hazards Profile.* New York State Energy Research and Development Authority (NYSERDA), Albany, New York.

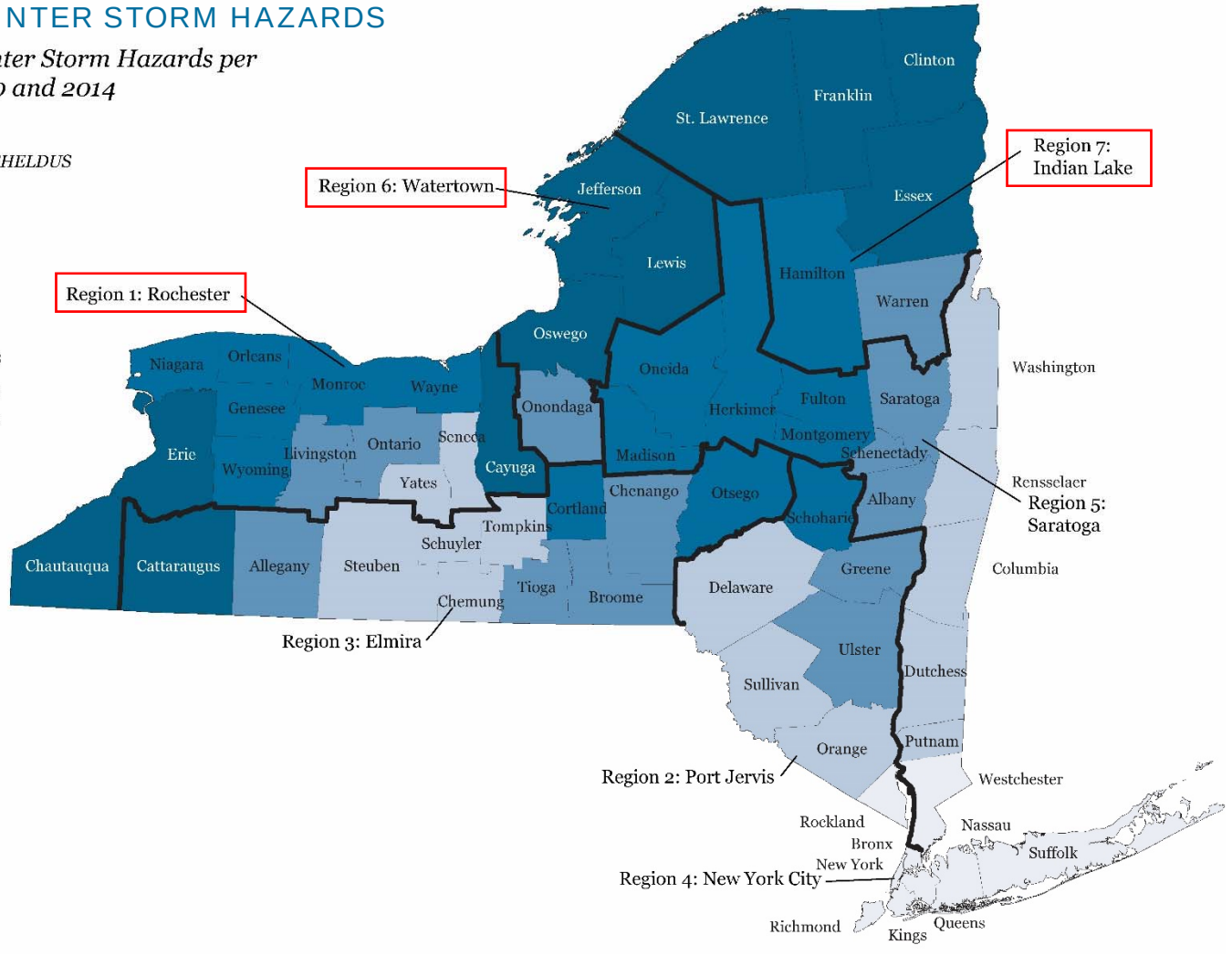
## HISTORICAL WINTER STORM HAZARDS

*Total Number of Winter Storm Hazards per County between 1960 and 2014*

**Data Source:**
*University of South Carolina SHELDUS*

**Legend:**

- 52 - 66 Winter Storms
- 67 - 106 Winter Storms
- 107 - 128 Winter Storms
- 129 - 155 Winter Storms
- 156 - 195 Winter Storms




Data Source: *University of South Carolina SHELDUS*

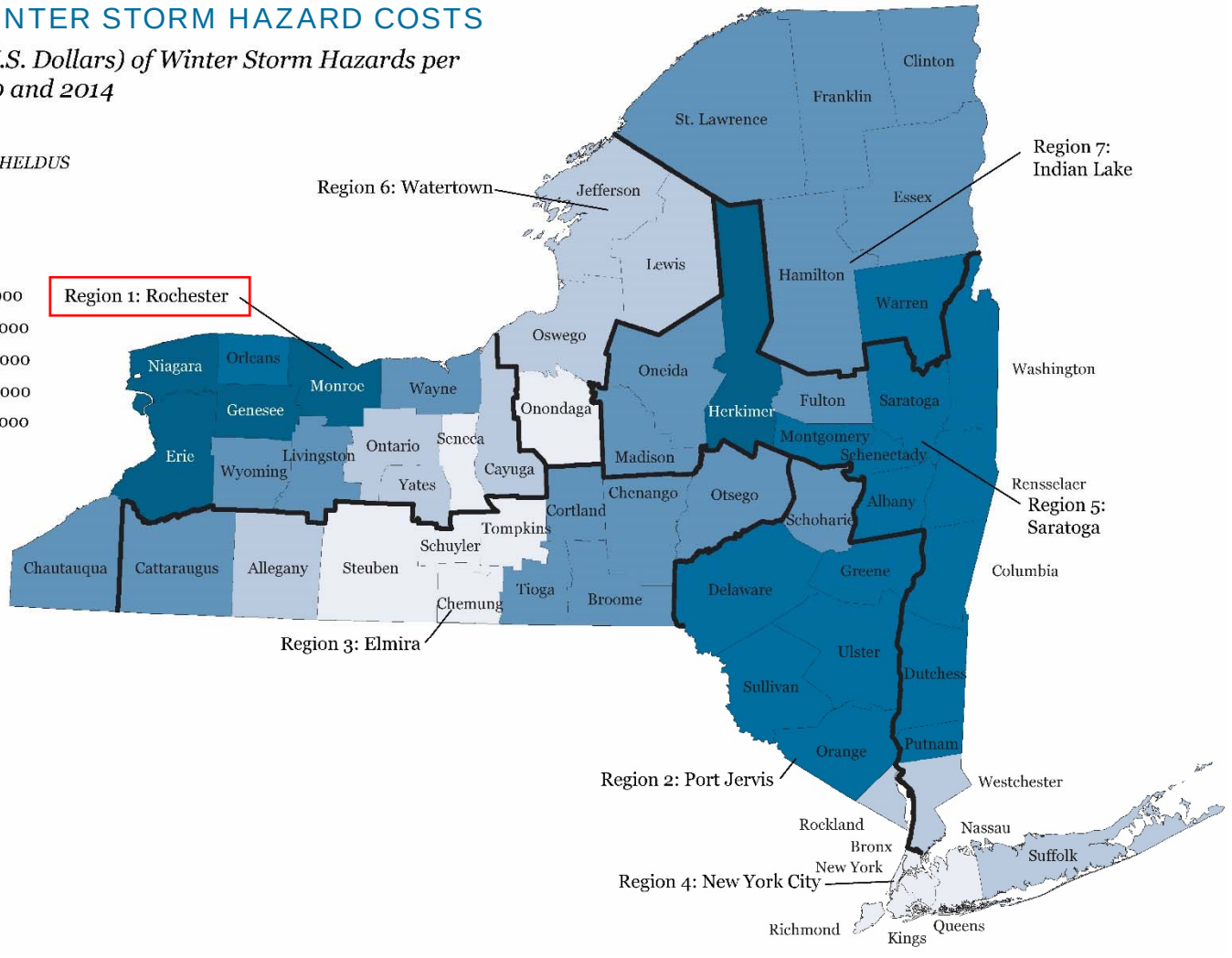
## HISTORICAL WINTER STORM HAZARD COSTS

*Total Cost (in 2015 U.S. Dollars) of Winter Storm Hazards per County between 1960 and 2014*

**Data Source:**
*University of South Carolina SHELDUS*

**Legend:**

- $5,600,000 - $23,000,000
- $23,000,001 - $42,500,000
- $42,500,001 - $60,000,000
- $60,000,001 - $82,500,000
- $82,500,001 - $98,500,000




Data Source: *University of South Carolina SHELDUS*

## CURRENT DAYS UNDER 32°F

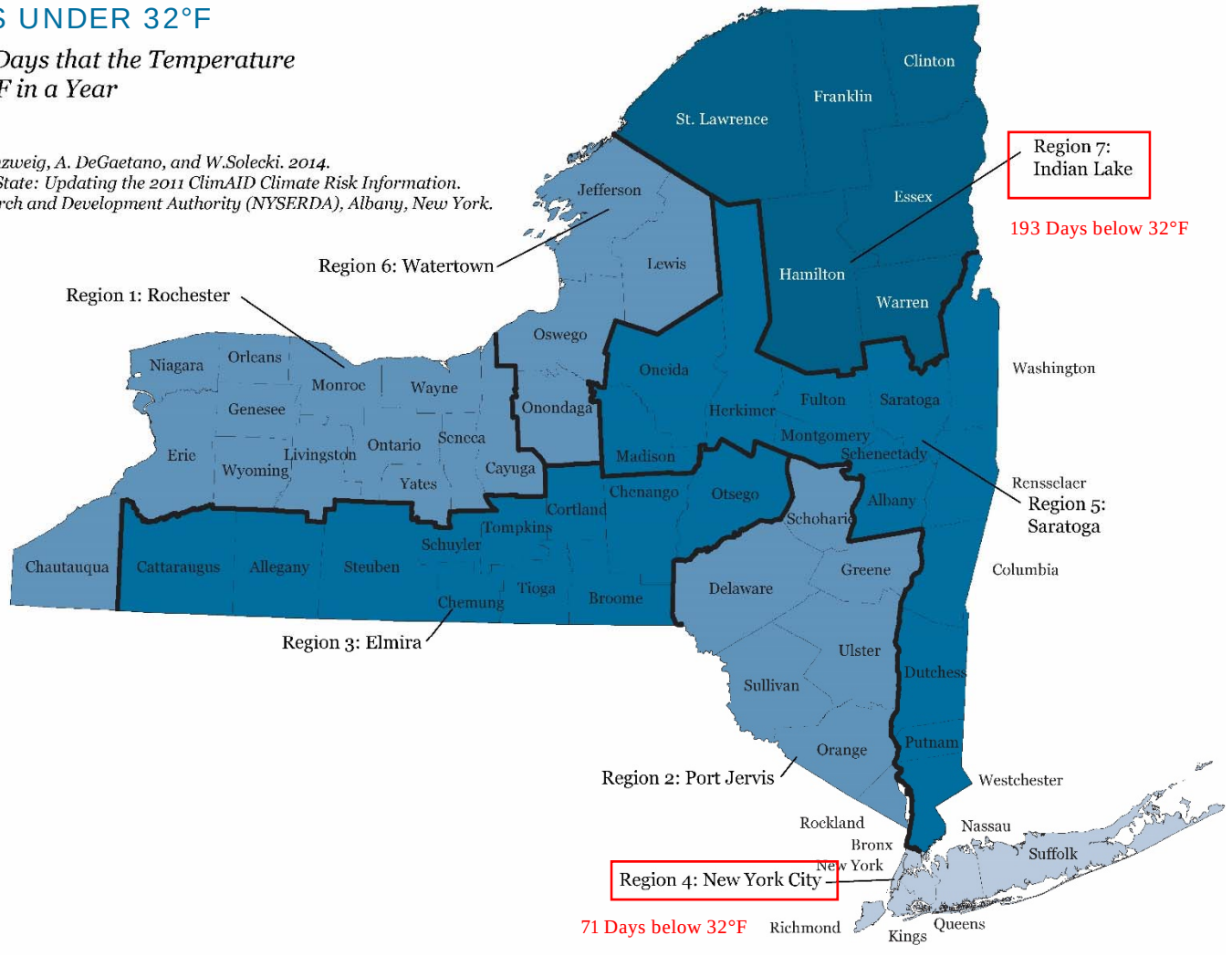
*Average Number of Days that the Temperature Will Drop Below 32°F in a Year*

**Data Derived From:**

*Horton, R., D. Bader, C. Rosenzweig, A. DeGaetano, and W.Solecki. 2014. Climate Change in New York State: Updating the 2011 ClimAID Climate Risk Information. New York State Energy Research and Development Authority (NYSERDA), Albany, New York.*

**Legend:**

- < 69 days
- 70 - 109 days
- 110 - 149 days
- 150 - 189 days
- > 190 days




Data Source: Horton, R., D. Bader, C. Rosenzweig, A. DeGaetano, and W.Solecki. 2014. *"Climate Change in New York State: Updating the 2011 ClimAID Climate Risk Information*." https://www.nyserda.ny.gov/climaid.

## FUTURE DAYS UNDER 32°F

| ClimAID Region: City (Current Baseline) | 2020s | | | 2050s | | | 2080s | | |
|---|---|---|---|---|---|---|---|---|---|
| | Low | Middle | High | Low | Middle | High | Low | Middle | High |
| Region 1: Rochester (Average of 133 days/year) | 99 | 103 to 111 | 116 | 78 | 84 to 96 | 102 | 59 | 68 to 88 | 97 |
| Region 2: Port Jervis (Average of 138 days/year) | 106 | 108 to 116 | 120 | 79 | 86 to 100 | 108 | 59 | 65 to 89 | 101 |
| Region 3: Elmira (Average of 152 days/year) | 119 | 122 to 130 | 134 | 94 | 100 to 114 | 120 | 72 | 79 to 103 | 116 |
| Region 4: New York City (Average of 71 days/year) | 50 | 52 to 58 | 60 | 37 | 42 to 48 | 52 | 25 | 30 to 42 | 49 |
| Region 5: Saratoga (Average of 155 days/year) | 123 | 127 to 136 | 139 | 98 | 104 to 119 | 125 | 77 | 84 to 109 | 120 |
| Region 6: Watertown (Average of 147 days/year) | 116 | 119 to 126 | 130 | 96 | 102 to 113 | 119 | 78 | 85 to 104 | 114 |
| Region 7: Indian Lake (Average of 193 days/year) | 159 | 162 to 172 | 177 | 131 | 138 to 154 | 161 | 107 | 118 to 143 | 156 |

Data Source: Horton, R., D. Bader, C. Rosenzweig, A. DeGaetano, and W.Solecki. 2014. *"Climate Change in New York State: Updating the 2011 ClimAID Climate Risk Information*." https://www.nyserda.ny.gov/climaid.

# Wildfire

- Wildfires are the unplanned and unwanted burning of vegetation. They occur not only in forested or undeveloped areas, but also along the wildland-urban interface.

- Over the past 25 years, rangers have suppressed 6,971 wildfires, which burned a total of 67,273 acres.

- Though wildfires can pose a serious threat to buildings and human safety, they tend to occur in areas with few structures and haven't caused the same level of damage to the built environment as other climate-related hazards.

- As extended droughts and heat waves are projected to increase in NYS, wildfire hazards are likely to increase.

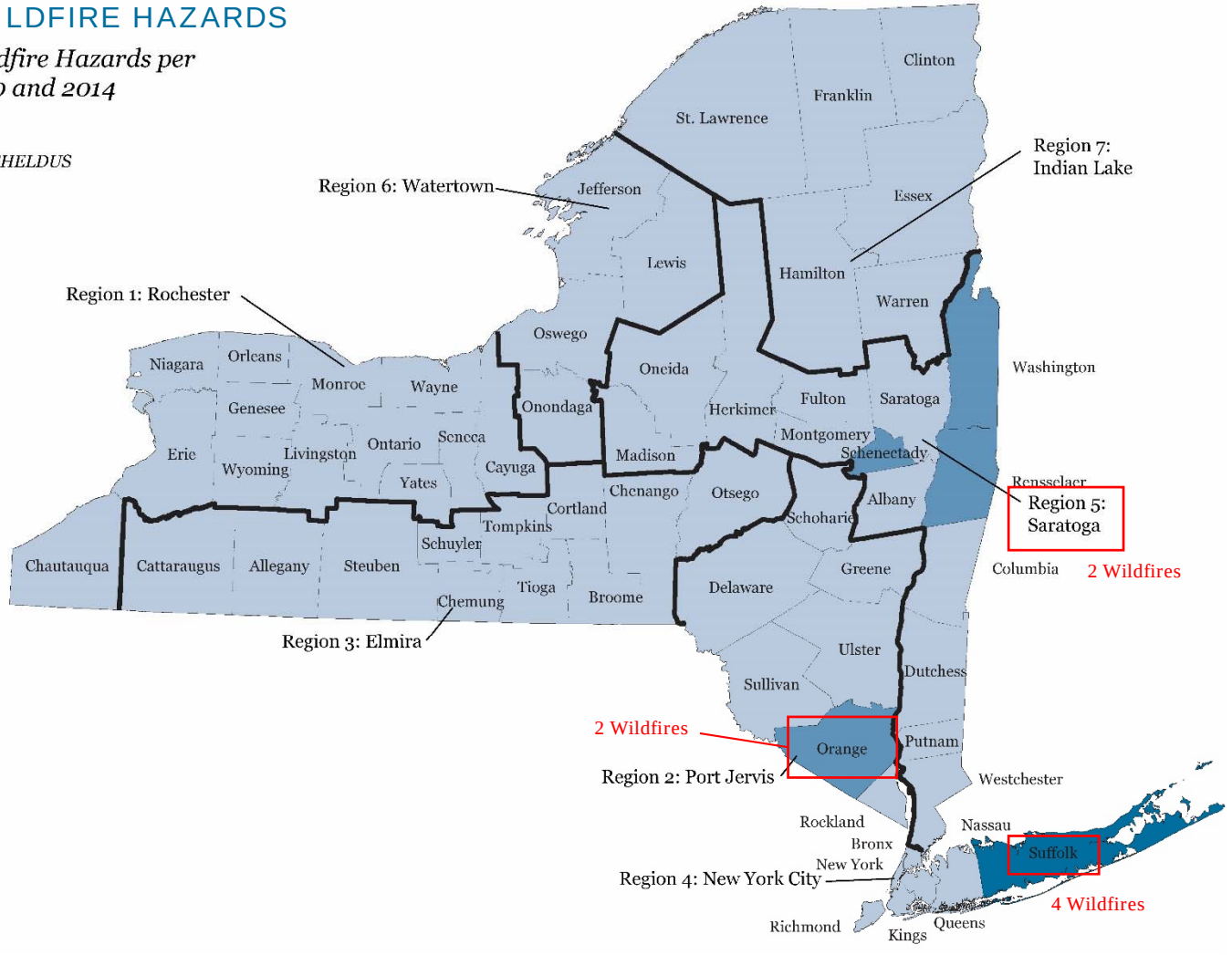
Tuzzo, Michael E., Elizabeth Gilman, Nicholas B. Rajkovich, Bartholomew Roberts, Ellen Cousins, Sean Daigneault, and Stefan Cecelski. 2018. *New York State Climate Hazards Profile.* New York State Energy Research and Development Authority (NYSERDA), Albany, New York.

## HISTORICAL WILDFIRE HAZARDS

*Total Number of Wildfire Hazards per County between 1960 and 2014*

**Data Source:**
*University of South Carolina SHELDUS*

**Legend:**
- 1 Wildfire
- 2 Wildfires
- 4 Wildfires




Data Source: *University of South Carolina SHELDUS*

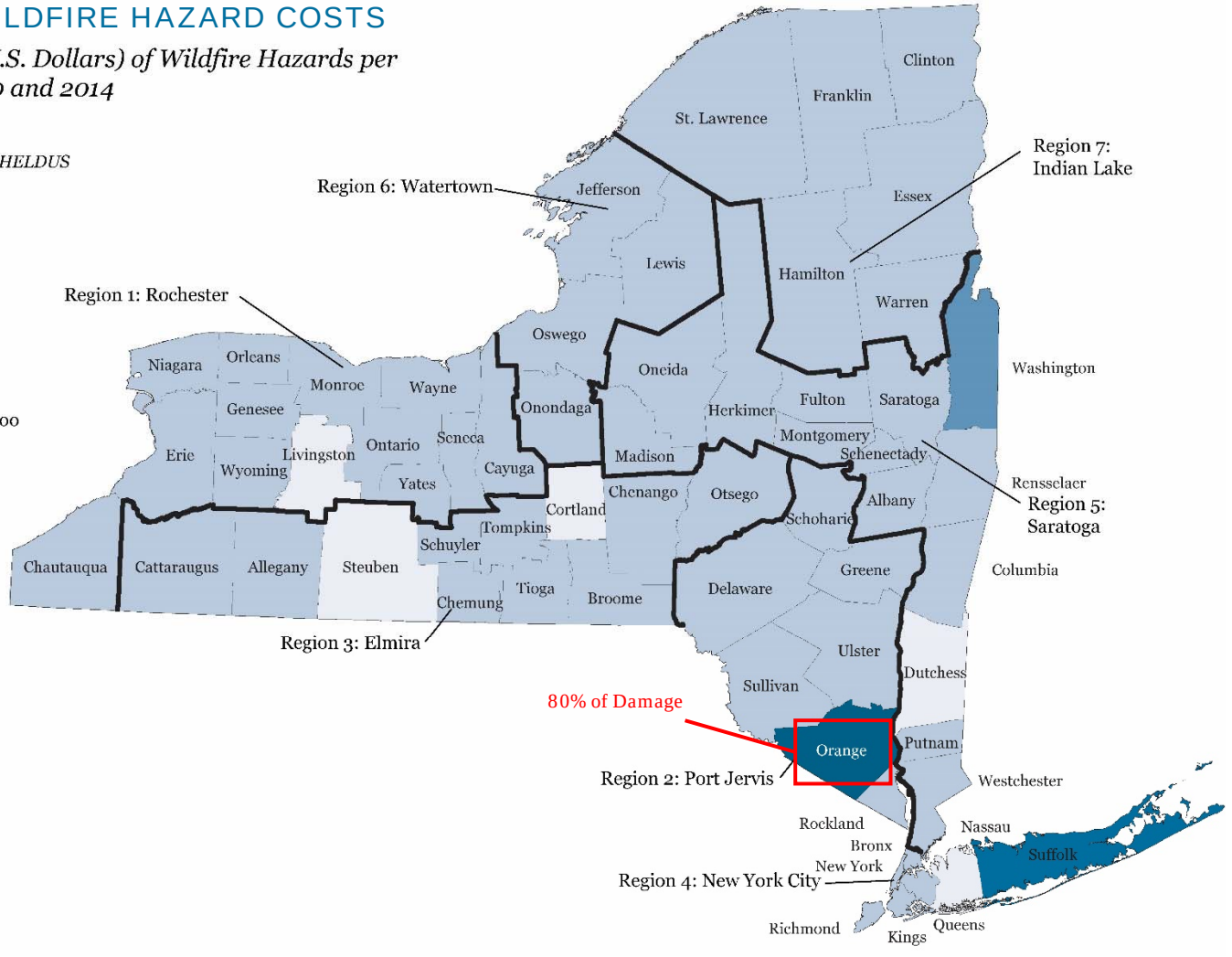
## HISTORICAL WILDFIRE HAZARD COSTS

*Total Cost (in 2015 U.S. Dollars) of Wildfire Hazards per County between 1960 and 2014*

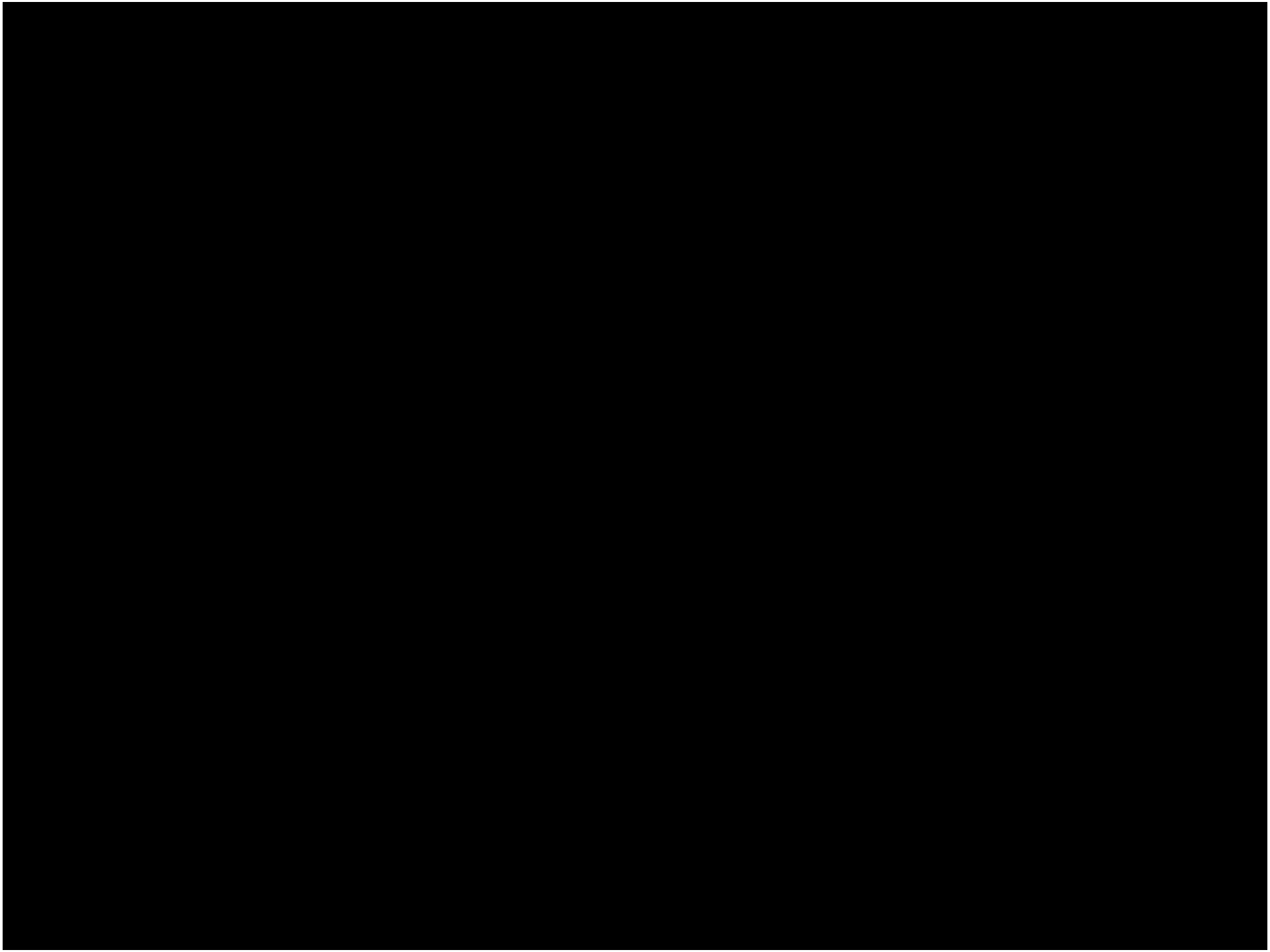
**Data Source:**
*University of South Carolina SHELDUS*

**Legend:**

- $0 - $32,000
- $32,001 - $70,000
- $70,001 - $190,000
- $190,001 - $4,600,00
- $4,600,001 - $30,700,000




Data Source: *University of South Carolina SHELDUS*



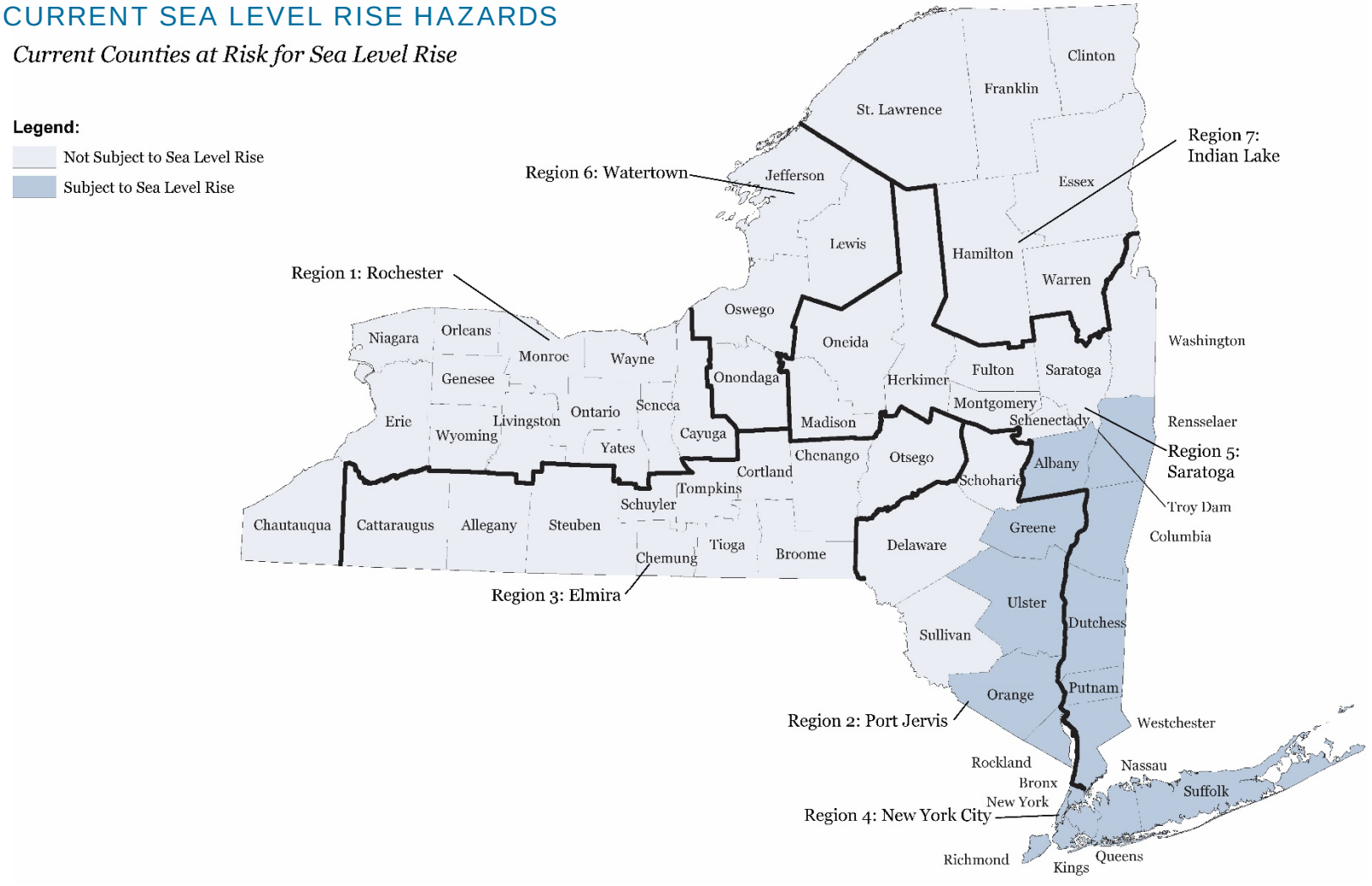
# Sea Level Rise

- Sea level rise can exacerbate risks from hurricanes and tropical storms.
- The current rates of sea level rise on coastlines in NYS range from 0.86 to 1.5 inches per decade.
- Most of the infrastructure that protects coastal areas, including levees and seawalls, has been designed for current sea levels and may be overtopped by rising water levels or undermined by increased erosion in the future.
- In the long term, rising sea levels may cause permanent inundation in areas currently occupied by buildings and exacerbate the effects of storm surges, increasing the risk associated with coastal flooding events.

Tuzzo, Michael E., Elizabeth Gilman, Nicholas B. Rajkovich, Bartholomew Roberts, Ellen Cousins, Sean Daigneault, and Stefan Cecelski. 2018. *New York State Climate Hazards Profile.* New York State Energy Research and Development Authority (NYSERDA), Albany, New York.

## CURRENT SEA LEVEL RISE HAZARDS

*Current Counties at Risk for Sea Level Rise*

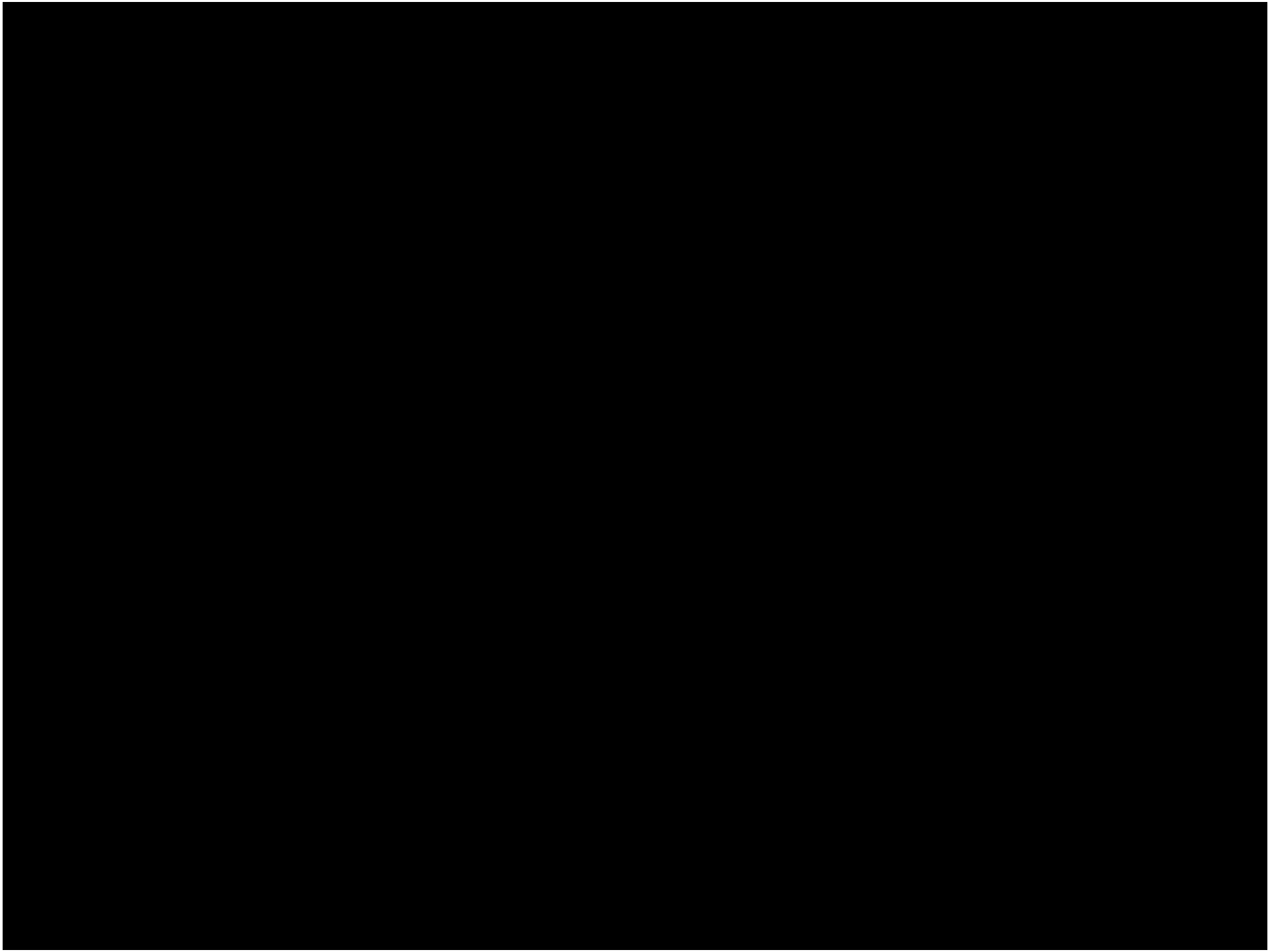



Data Source: New York State Energy Research and Development Authority. 2016. *"Coastal New York Future Floodplain Mapper."* https://www.nyclimatescience.org/catalog/doc?DocId=vitroIndividual:http://www.nyclimatescience.org/individual/n30129.

## FUTURE SEA LEVEL RISE HAZARDS (INCHES)

| ClimAID Region (Analyzed City) | 2020s | | | 2050s | | | 2080s | | |
|---|---|---|---|---|---|---|---|---|---|
| | Low | Middle | High | Low | Middle | High | Low | Middle | High |
| Region 4 (at New York City) | 2 | 4 to 8 | 10 | 8 | 11 to 21 | 30 | 13 | 18 to 39 | 58 |
| Regions 2 and 5 (at Troy Dam) | 1 | 3 to 7 | 9 | 5 | 9 to 19 | 27 | 10 | 14 to 36 | 54 |

Data Source: Horton, R., D. Bader, C. Rosenzweig, A. DeGaetano, and W.Solecki. 2014. *"Climate Change in New York State: Updating the 2011 ClimAID Climate Risk Information*." https://www.nyserda.ny.gov/climaid.



# Heat Waves

- Excessive heat can create stresses on human populations, including heat-related illness and death, and can pose new challenges to energy systems, air quality, infrastructure, and buildings.

- New York State's geography and atmospheric circulation conditions make all regions of the state susceptible to heat waves.

- Though heat waves do not generally cause physical damage to buildings, they can stress energy systems and reduce air quality.

- The average annual temperatures across NYS are projected to increase by as much as 10 degrees Fahrenheit by the 2080s.

Tuzzo, Michael E., Elizabeth Gilman, Nicholas B. Rajkovich, Bartholomew Roberts, Ellen Cousins, Sean Daigneault, and Stefan Cecelski. 2018. *New York State Climate Hazards Profile.* New York State Energy Research and Development Authority (NYSERDA), Albany, New York.

## CURRENT DAYS OVER 90°F

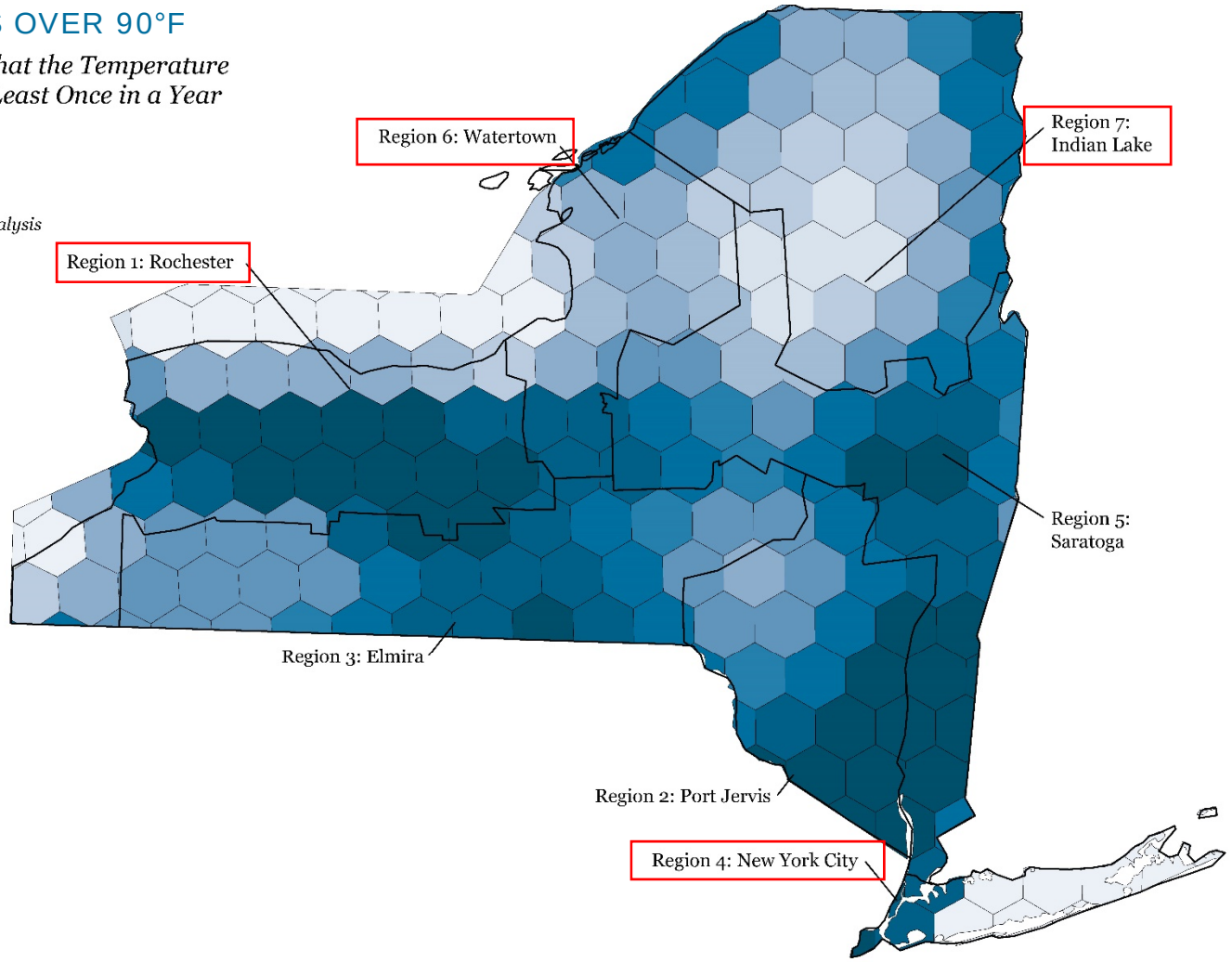
*Percent Probability that the Temperature Will Exceed 90°F at Least Once in a Year*

**Map Produced By:**
*Weather Analytics*

**Data Derived From:**
*Climate Forecast System Reanalysis*

**Legend:**

- 0.00 - 10.00%
- 10.01 - 20.00%
- 20.01 - 30.00%
- 30.01 - 40.00%
- 40.01 - 50.00%
- 50.01 - 60.00%
- 60.01 - 70.00%
- 70.01 - 80.00%
- 80.01 - 90.00%
- 90.01 - 100.00%




Data Source: *Climate Forecast System Reanalysis*

## FUTURE DAYS OVER 90°F

| ClimAID Region: City (Current Baseline) | 2020s | | | 2050s | | | 2080s | | |
|---|---|---|---|---|---|---|---|---|---|
| | Low | Middle | High | Low | Middle | High | Low | Middle | High |
| Region 1: Rochester (Average of 8 days/year) | 12 | 14 to 17 | 19 | 18 | 22 to 34 | 42 | 22 | 27 to 57 | 73 |
| Region 2: Port Jervis (Average of 12 days/year) | 16 | 19 to 25 | 27 | 24 | 31 to 47 | 56 | 31 | 38 to 77 | 85 |
| Region 3: Elmira (Average of 10 days/year) | 15 | 17 to 21 | 23 | 22 | 26 to 41 | 47 | 28 | 33 to 67 | 79 |
| Region 4: New York City (Average of 18 days/year) | 24 | 26 to 31 | 33 | 32 | 39 to 52 | 57 | 38 | 44 to 76 | 87 |
| Region 5: Saratoga (Average of 10 days/year) | 14 | 17 to 22 | 23 | 22 | 27 to 41 | 50 | 27 | 35 to 70 | 82 |
| Region 6: Watertown (Average of 3 days/year) | 5 | 6 to 8 | 10 | 9 | 12 to 21 | 26 | 12 | 17 to 44 | 57 |
| Region 7: Indian Lake (Average of 0.3 days/year) | 0.5 | 0.8 to 2 | 2 | 2 | 3 to 6 | 10 | 3 | 5 to 19 | 27 |

Data Source: Horton, R., D. Bader, C. Rosenzweig, A. DeGaetano, and W.Solecki. 2014. *"Climate Change in New York State: Updating the 2011 ClimAID Climate Risk Information*." https://www.nyserda.ny.gov/climaid.

## CURRENT HEAT WAVE PROBABILITY

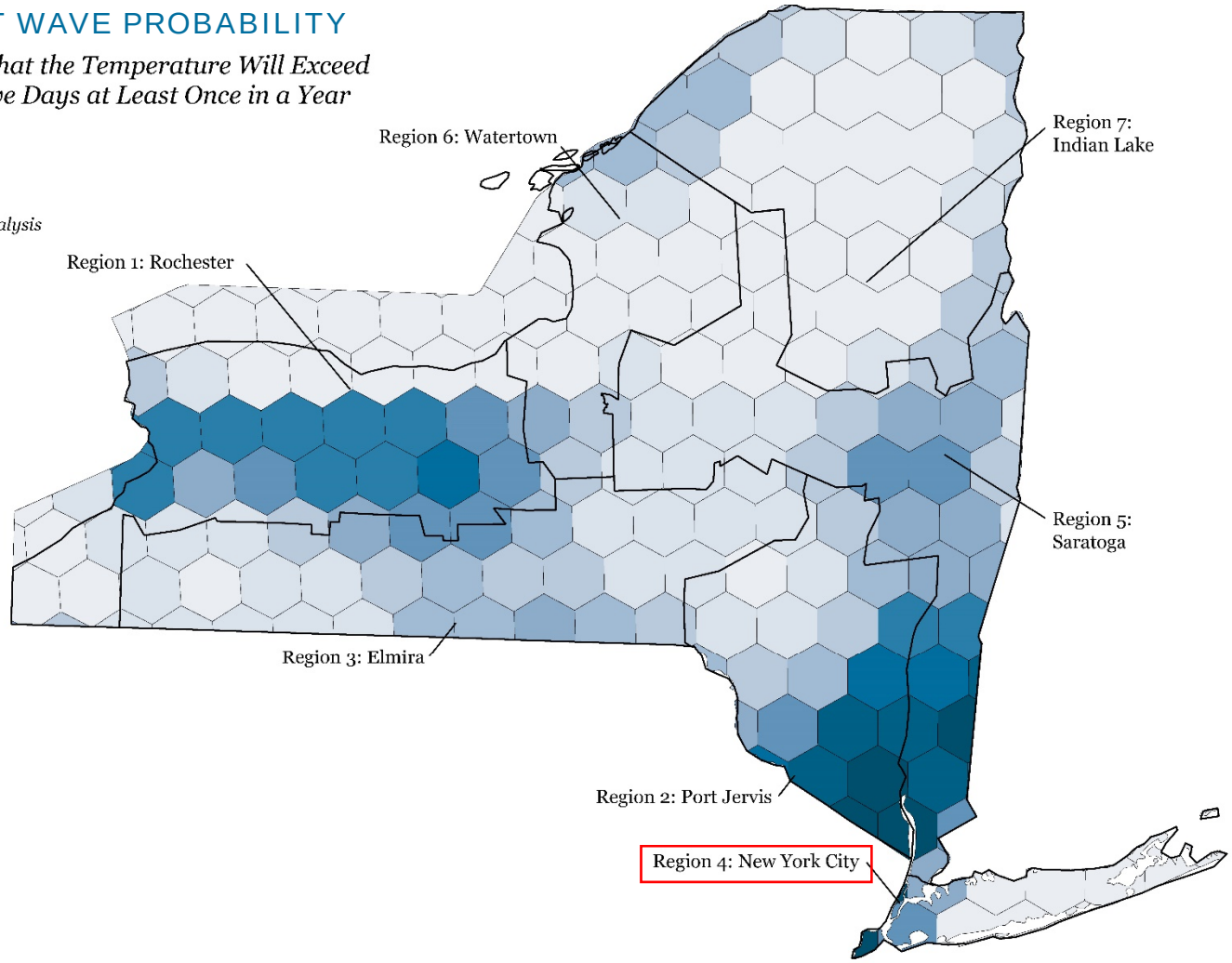
*Percent Probability that the Temperature Will Exceed 90°F for 3 Consecutive Days at Least Once in a Year*

**Map Produced By:**
*Weather Analytics*

**Data Derived From:**
*Climate Forecast System Reanalysis*

**Legend:**

- 0.00 - 7.60%
- 7.61 - 15.10%
- 15.11 - 22.70%
- 22.71 - 30.30%
- 30.31 - 37.80%
- 37.81 - 45.40%
- 45.41 - 53.00%
- 53.01 - 60.50%
- 60.51 - 68.10%
- 68.11 - 75.70%




Data Source: *Climate Forecast System Reanalysis*

## FUTURE NUMBER OF HEAT WAVES

| ClimAID Region: City (Current Baseline) | 2020s | | | 2050s | | | 2080s | | |
|---|---|---|---|---|---|---|---|---|---|
| | Low | Middle | High | Low | Middle | High | Low | Middle | High |
| Region 1: Rochester (Currently 0.7 per year) | 2 | 2 to 2 | 2 | 2 | 3 to 4 | 5 | 3 | 3 to 8 | 8 |
| Region 2: Port Jervis (Currently 1 per year) | 2 | 3 to 3 | 4 | 3 | 4 to 6 | 8 | 4 | 5 to 9 | 9 |
| Region 3: Elmira (Currently 1 per year) | 2 | 2 to 3 | 3 | 3 | 3 to 6 | 6 | 3 | 4 to 9 | 9 |
| Region 4: New York City (Currently 2 per year) | 3 | 3 to 4 | 4 | 4 | 5 to 7 | 7 | 5 | 6 to 9 | 9 |
| Region 5: Saratoga (Currently 1 per year) | 2 | 2 to 3 | 4 | 3 | 4 to 6 | 7 | 4 | 5 to 8 | 9 |
| Region 6: Watertown (Currently 0.2 per year) | 0.6 | 0.8 to 0.9 | 1 | 1 | 1 to 3 | 3 | 1 | 2 to 6 | 7 |
| Region 7: Indian Lake (Currently 0 per year) | 0 | 0.1 to 0.2 | 0.2 | 0.2 | 0.3 to 0.7 | 1 | 0.2 | 0.5 to 2 | 3 |

Data Source: Horton, R., D. Bader, C. Rosenzweig, A. DeGaetano, and W.Solecki. 2014. *"Climate Change in New York State: Updating the 2011 ClimAID Climate Risk Information*." https://www.nyserda.ny.gov/climaid.

## CURRENT DURATION OF HEAT WAVES

*Average Number of Consecutive Days that the Temperature Will Exceed 90°F in a Year*

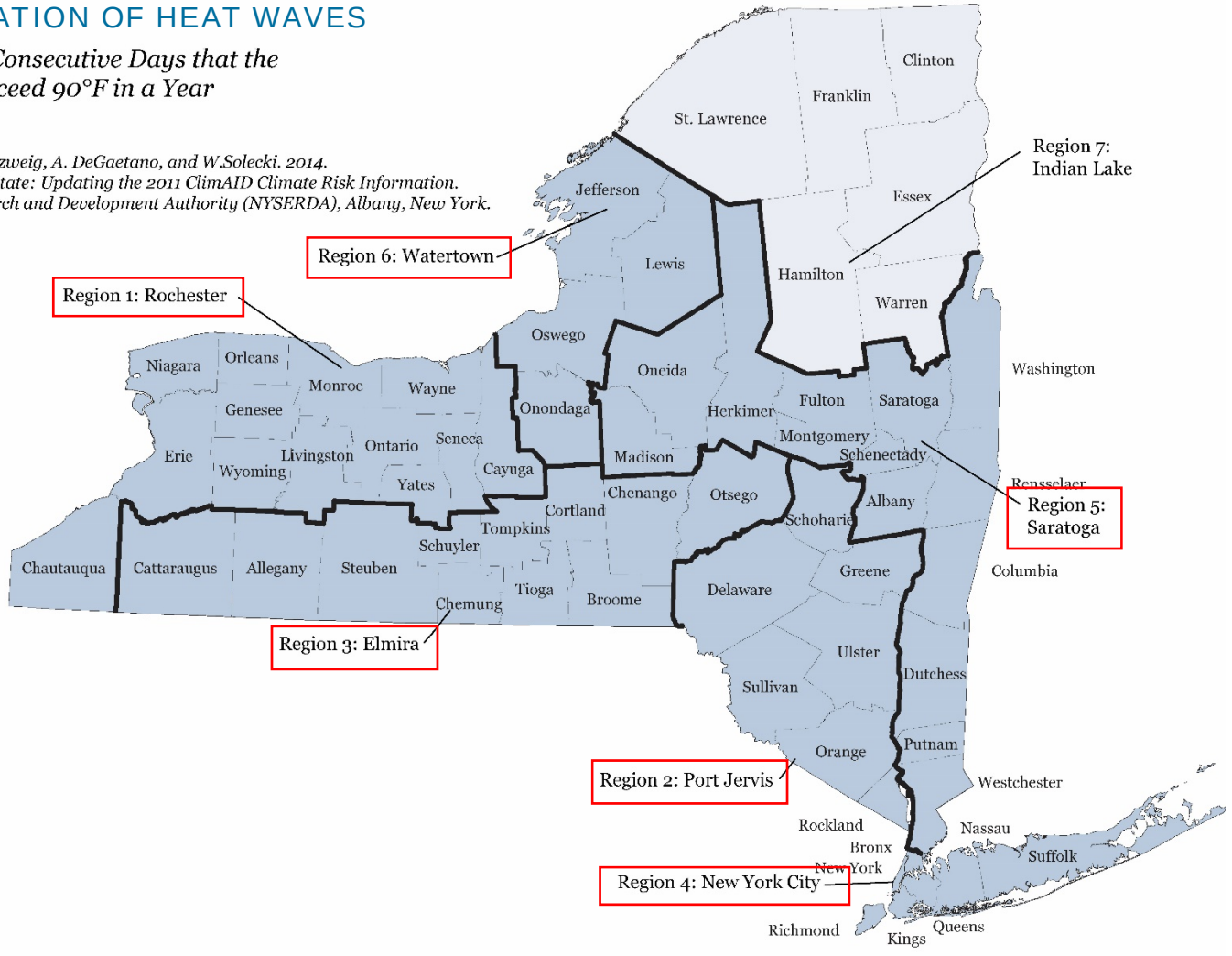
**Data Derived From:**

*Horton, R., D. Bader, C. Rosenzweig, A. DeGaetano, and W.Solecki. 2014. Climate Change in New York State: Updating the 2011 ClimAID Climate Risk Information. New York State Energy Research and Development Authority (NYSERDA), Albany, New York.*

**Legend:**

3 days

4 days

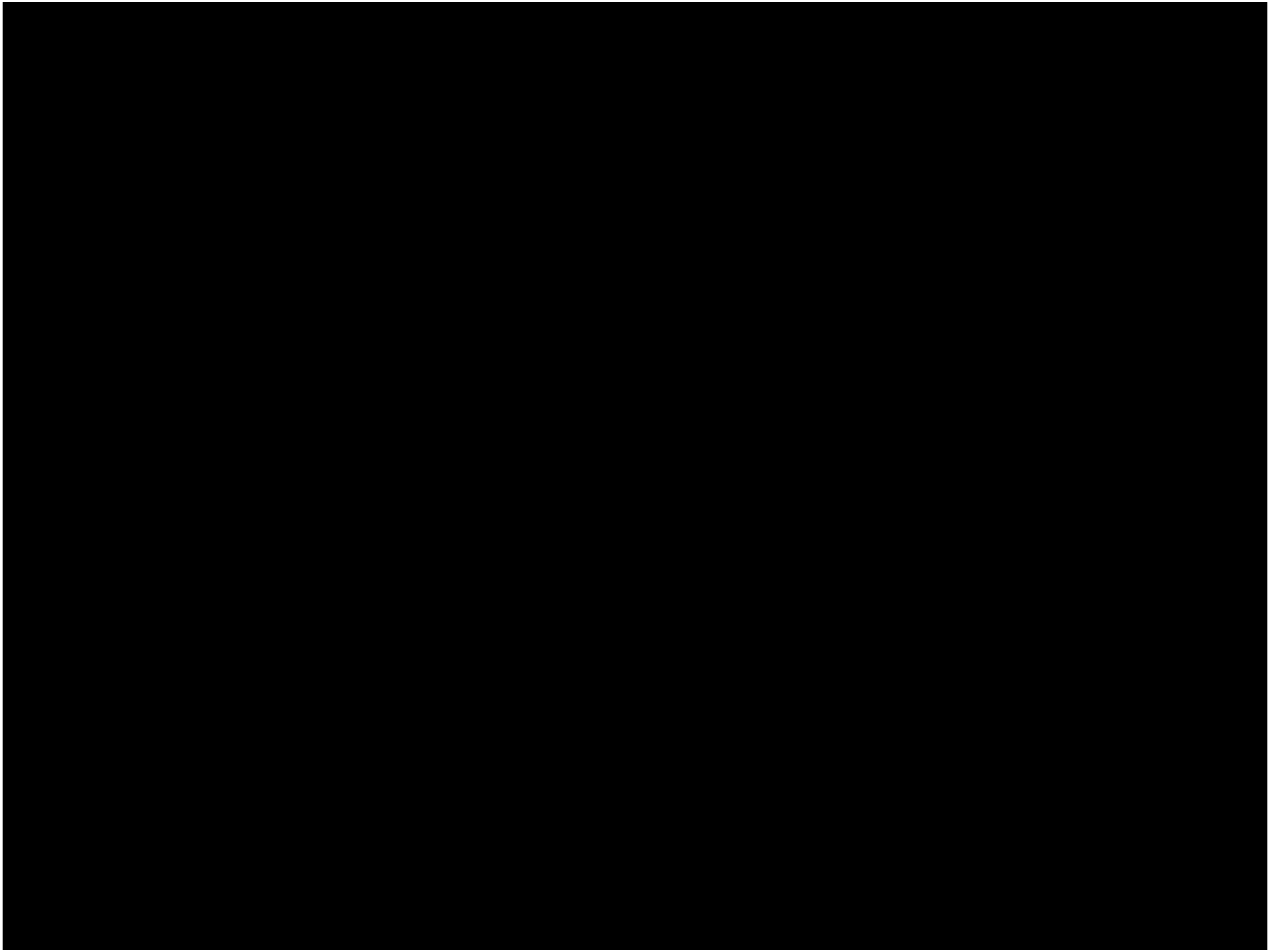



Data Source: Horton, R., D. Bader, C. Rosenzweig, A. DeGaetano, and W.Solecki. 2014. *"Climate Change in New York State: Updating the 2011 ClimAID Climate Risk Information*." https://www.nyserda.ny.gov/climaid.

## FUTURE DURATION OF HEAT WAVES

| ClimAID Region: City (Current Baseline) | 2020s | | | 2050s | | | 2080s | | |
|---|---|---|---|---|---|---|---|---|---|
| | Low | Middle | High | Low | Middle | High | Low | Middle | High |
| Region 1: Rochester (Average of 4 days) | 4 | 4 to 4 | 4 | 4 | 4 to 5 | 5 | 4 | 5 to 6 | 6 |
| Region 2: Port Jervis (Average of 4 days) | 4 | 5 to 5 | 5 | 5 | 5 to 6 | 6 | 5 | 5 to 7 | 8 |
| Region 3: Elmira (Average of 4 days) | 4 | 4 to 5 | 5 | 5 | 5 to 5 | 5 | 5 | 5 to 6 | 7 |
| Region 4: New York City (Average of 4 days) | 5 | 5 to 5 | 5 | 5 | 5 to 6 | 6 | 5 | 5 to 7 | 8 |
| Region 5: Saratoga (Average of 4 days) | 4 | 5 to 5 | 5 | 5 | 5 to 6 | 6 | 5 | 5 to 7 | 9 |
| Region 6: Watertown (Average of 4 days) | 3 | 4 to 4 | 4 | 4 | 4 to 4 | 5 | 4 | 4 to 6 | 6 |
| Region 7: Indian Lake (Average of 3 days) | 3 | 3 to 4 | 4 | 3 | 3 to 4 | 4 | 4 | 4 to 5 | 5 |

Data Source: Horton, R., D. Bader, C. Rosenzweig, A. DeGaetano, and W.Solecki. 2014. *"Climate Change in New York State: Updating the 2011 ClimAID Climate Risk Information*." https://www.nyserda.ny.gov/climaid.



# Pest Infestation

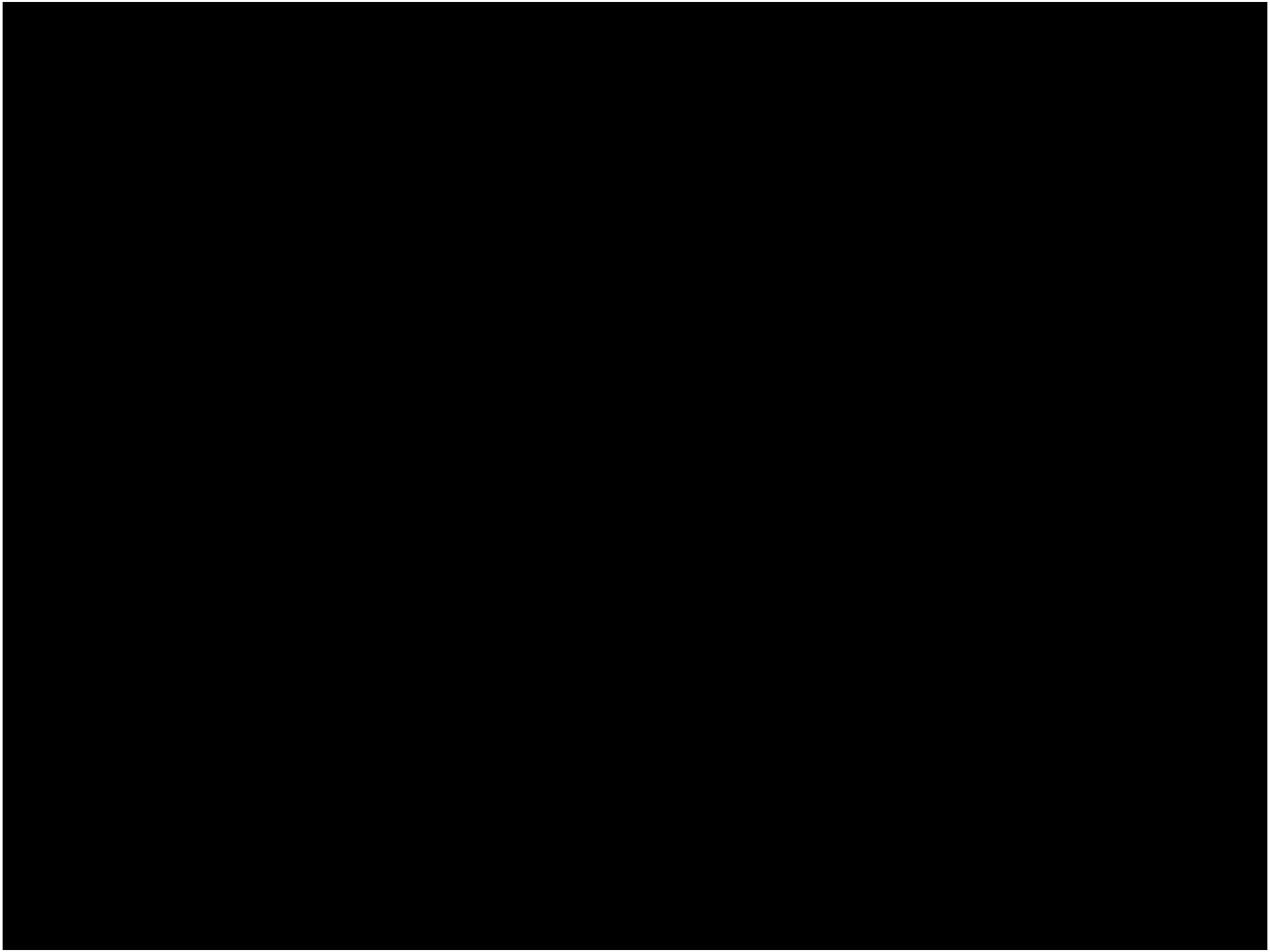
- Rising temperatures may contribute to an increase in pests and invasive species, which can cause disruptions to ecosystems and the agricultural sector.

- Climate change has caused a fluctuation in seasonal timings of migration and budding, and in the range of species in the Northern Hemisphere.

- Higher temperatures can lead to building damage as insects and other pests increasingly use wood and other common building materials as food and shelter.

- By 2100, New York State's climate may resemble that of the Southeastern U.S., allowing some invasive species to migrate northward.

Tuzzo, Michael E., Elizabeth Gilman, Nicholas B. Rajkovich, Bartholomew Roberts, Ellen Cousins, Sean Daigneault, and Stefan Cecelski. 2018. *New York State Climate Hazards Profile.* New York State Energy Research and Development Authority (NYSERDA), Albany, New York.

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Presentation prepared by:

Nicholas B. Rajkovich, Elizabeth K. Gilman, Hope Forgus, and Thomas J. Mulligan

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# Adapting Buildings for a Changing Climate


New York's climate is changing. Are your buildings prepared?

ap.buffalo.edu/adapting-buildings

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