Village of Montour Falls
2021 Climate Vulnerability Assessment

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Introduction

Climate change has impacted and will continue to impact every region of the world. The northeast region of the United States is one of the fastest warming regions in the northern hemisphere (Milman, 2021). This region has already heated up by 2°C over the past century due to increases in temperatures, especially of the Atlantic Ocean (Milman, 2021).

To help prepare for potential effects of climate change, the Village of Montour Falls prepared this climate vulnerability assessment. This report will help to understand how the Village could be affected most by climate change and what actions could be taken to potentially mitigate any negative effects. This project is supported by NYSDEC grant number x.

The Village of Montour Falls resides in Schuyler County and has a population of approximately 1,638 individuals (U.S. Census Bureau, 2019). The Village is located in the Finger Lakes Region of New York State and is committed to becoming a resilient and sustainable community. In 2019, Montour Falls became a certified Bronze Climate Smart Community.

Climate Vulnerability Assessment Background

The Climate Smart Communities (CSC) Program is a statewide program in New York State that helps local governments to take action to reduce greenhouse gas emissions and adapt to a changing climate. This program is jointly sponsored by several state agencies: New York State Department of Environmental Conservation (NYSDEC), New York State Energy Research and Development Authority (NYSERDA), Department of Public Service (DPS), Department of State (DOS), New York State Department of Transportation (NYSDOT), New York State Department of Health (NYSDOH), and the New York Power Authority (NYPA). With a list of eligible actions that are part of the CSC Certification Program, communities can be recognized for their accomplishments through a rating system leading to three levels of award: bronze, silver, and gold (NYS, n.d.).

There are 12 categories that CSC actions can fall under. The Climate Vulnerability Assessment action satisfies section PE7.1, which is under PE7: Enhance community resilience to climate change. This action identifies community assets, systems, and populations that may be susceptible to impacts of climate change and can help determine what elements may need adaptive measures. Climate resilience begins with understanding hazards posed by a changing climate and identifying community vulnerabilities, and this action aims to be one of the first and most foundational steps in developing an effective strategy for adapting to climate change at the local level (NYS, n.d.).

Developing a Climate Vulnerability Assessment involves the following steps:

1. Research relevant studies of climate change projections to identify hazards that apply to your community;
2. Assess potential impacts to assets and systems in your community based in identified climate hazards from Step 1;

3. Identify and assess the vulnerabilities of each asset or system using the three criteria: exposure, sensitivity, and adaptive capacity;
4. Identify vulnerable populations and assess how they will be affected by current or future climate hazards;
5. Share a summary of climate hazards, community assets, systems and vulnerabilities with community residents and other stakeholders via public meetings, surveys, and/or other means;
6. Prioritize assets and systems based on the following factors:
    - Their exposure and sensitivity to the effects of climate hazards and their adaptive capacity;
    - How critical they are in respect to the functioning and prosperity of the community;
    - Their ability to reduce vulnerabilities and risks in the community, and to vulnerable populations in particular;
7. Develop a report of vulnerability assessment findings;
8. Establish a timeline for re-assessing vulnerabilities (updates should occur at least every 10 years or when a new understanding of hazards occurs or when updated climate projects become available)

Assessment Process and Alignment with Statewide Resources

The changing climate can cause changes in magnitude and intensity of storms, precipitation levels, temperature changes, and lake water levels. There are many climate and weather scenarios that could potentially occur in the years to come. With this uncertainty, this climate vulnerability assessment aims to prepare for a range of possibilities and will use general trends and estimates found to analyze potential hazards. This assessment identifies community vulnerabilities and analyzes potential hazards with information included from the following sources:

- The 2014 New York State Climate Impacts Assessment, referred to as ClimAID
- Northeast Regional Climate Center data

ClimAID was a NYSERDA-led, comprehensive assessment of observed and projected impacts of climate change on New York State. This effort assessed how climate change will affect New York's communities, ecosystems, and economy, and inform climate choices at all levels of decision-making in the State. As of 2021, ClimAID is in the process being updated. In partnership with leading academic institutions, science organizations, community leaders, and others, New York State is undertaking a comprehensive research effort to better understand and document how climate change is affecting our state, what future impacts may be, and how we can prepare for them. The Village should continue to track this effort as interim resources are released that can inform updates to Village plans, policies, and climate adaptation activities. This climate vulnerability assessment provides interim guidance to inform activities that can be undertaken in 2022 to 2023. The Village should track the outcomes of the New York State Climate Impacts Assessment and prepare for significant updates to its own climate vulnerability assessment in 2023 to 2024.

The New York State Climate Impacts Assessment development effort was launched in June 2021 and is scheduled to be completed by early 2023 (NYS, nd). This effort will incorporate and reflect the latest data, models, and scientific understanding of climate change. It will also incorporate input from more stakeholders and decisionmakers so that its information is relevant, topical, and accessible to the full

range of New York's diverse communities and interests. In addition to these sector topics, the assessment will address several cross-cutting perspectives of significant interest: equity and underserved communities, municipal government concerns, marine coastal zones, and the Great Lakes.

Specifically, the assessment will include:

- Up-to-date projections of future climate conditions in New York State
- Sector-based literature reviews
- In-depth economic impact assessments
- A peer-reviewed technical report that conveys scientific findings
- Summaries and syntheses for a wider audience
- Adaptation strategies and case studies
- Links and references to primary sources for full transparency

The assessment will focus on climate change impacts across eight sectors and investigate a range of research topics:

- Agriculture: Growing seasons/winter chill; crop yields; soil health; food security—distribution and use; gardening and urban agriculture
- Buildings: Building envelope and systems; building materials and resilient design; housing, schools, other specific building types of concern; flooding impacts (inland, coastal); property loss/insurance costs
- Ecosystems: Species distribution, biodiversity, and invasives; forest health/management, productivity, and disturbances (wildfire, insects, disease); iconic ecosystems and products (e.g., maple syrup); Great Lakes and other fresh surface waters (e.g., temperature, lake levels, water and habitat quality); marine/estuarine waters (e.g., temperature, acidification, other physical parameters; water and habitat quality)
- Energy: Energy generation (e.g., electricity, natural gas, oil, and renewables); energy delivery (e.g., infrastructure, power outages); energy demand, peaks; telecommunications systems
- Human Health and Safety: Heat-related concerns (e.g., heat-related illnesses, urban heat islands); waterborne, foodborne, and vector-born disease; air quality (e.g., pollutants, aeroallergens); mental health; public and private health systems; impacts on crime, violence, and civil unrest
- Society and Economy: Finance and investment; employment; labor productivity; impacts on specific industries (e.g., winter recreation, coastal tourism); emergency preparedness, disaster relief aid; trade and supply chain disruptions; migration and social change (e.g., crime, climigration); just transition
- Transportation: Transportation infrastructure; various climate impacts (e.g., flooding, storms, heat); inter-and intra-city transportation; mass transit; boat transportation (e.g., shipping, canals); ports and airports; mobility
- Water Resources: Water supply; water demand; water quality; water supply and wastewater infrastructure (including septic systems)

Climate Projections and Identified Hazards

A Climate Vulnerability Assessment involves research on climate projections to be able to identify potential hazards applicable to the location of interest. ClimAID Chapter 1 (Climate Risks) identifies changes in temperature and precipitation, sea level rise, snowfall, extreme events, and a historical analysis. Sea level rise will be excluded in this assessment because the Village of Montour Falls does not lie on the coast, but it does lie to the south of Seneca Lake, and that factor is analyzed. Although the Village does not lie on the coast, coastal storms still have influence on New York State and are considered in this assessment. New York State was divided into seven regions for the ClimAID's assessment, and the Village of Montour Falls falls into Region 3, as seen in Figure 1. The closest meteorological station to the Village of Montour Falls that is used in this analysis is in Elmira, NY, which lies approximately 20 miles south of the Village.

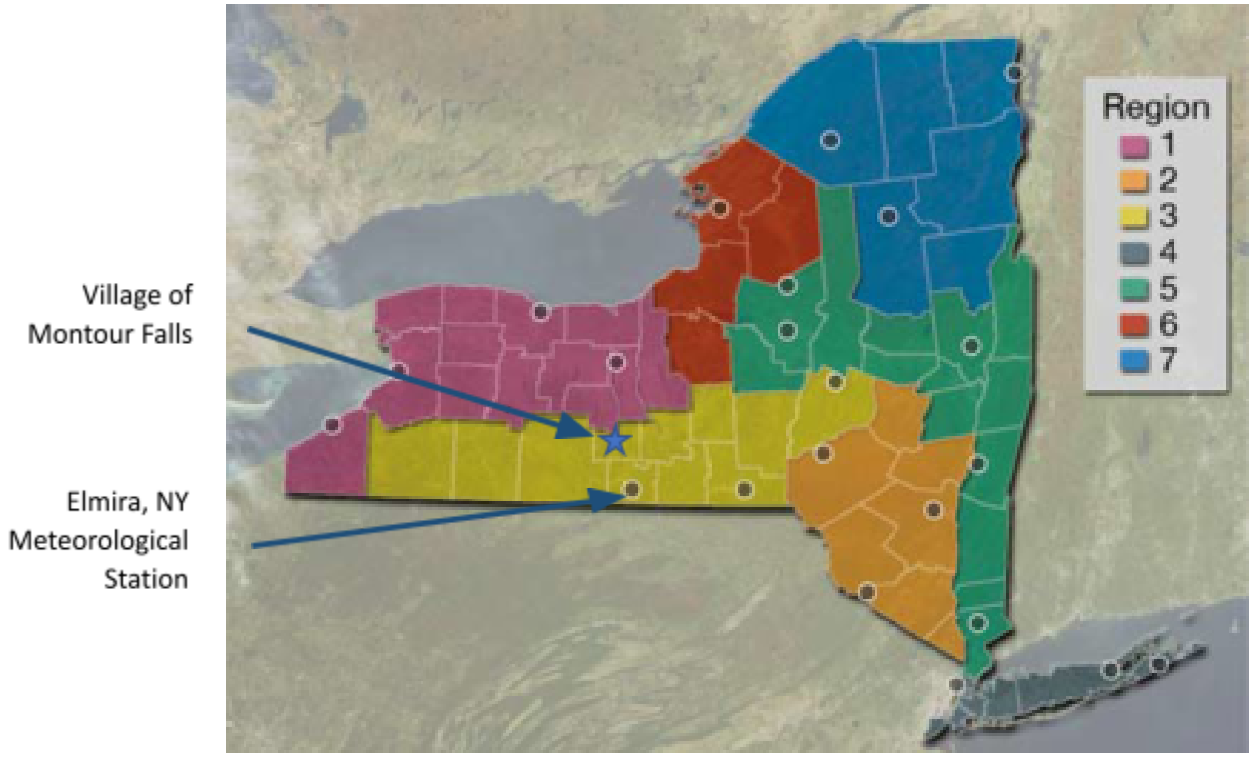


Figure 1: ClimAID Climate Regions (ClimAID 2014)

Representative Concentration Pathways (RCP) describe several potential future pathways. Each scenario defines a pathway in terms of the concentration of carbon in the atmosphere at any date. The RCP 8.5 pathway describes business as usual in terms of emissions with an increase in global average temperature of about 4.3 °C by the year 2100. The RCP 4.5 pathway describes a scenario with a roughly 2.45 °C increase in global average temperatures by 2100. For this report, unless specifically noted, predictions (typically ranges or means) include a combination these two scenarios. In summary, these two scenarios are used as reference points because they describe best case and worst case scenarios for the amount of warming based on the expected pace at which global carbon reduction activities occur.

Temperature

New York State's climate can be described as humid continental, and the temperature in Schuyler County is on average 46-48 °F (Horton, Bader, Tryhorn, DeGaetano, & Rosenzweig). This is based on a baseline from the year 1971 to 2000 (Horton, Bader, Tryhorn, DeGaetano, & Rosenzweig). Historically from 1990 to 2010, there have been on average 2.5 days with temperatures above 90 °F , 0.15 days per year with temperatures above 95 °F, and 0 days above °F (NYCCSC, n.d.). During that same time period, there were on average about 147 days per year with temperatures below 32 °F (NYCCSC, n.d.). Figure 2 below depicts baseline temperatures in New York State (Horton, Bader, Tryhorn, DeGaetano, & Rosenzweig).

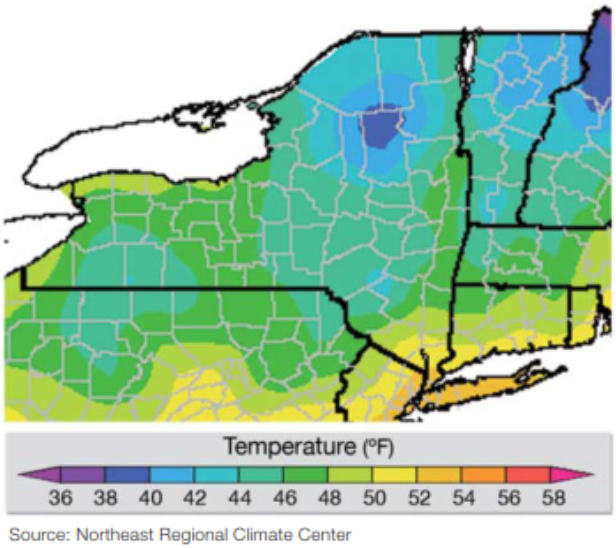
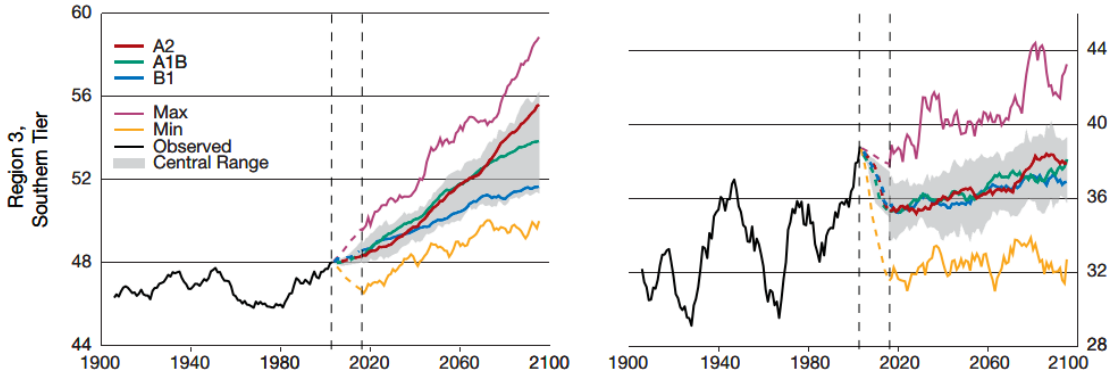


Figure 2: Baseline Temperatures in New York State

From the baseline temperatures, there is predicted to be an approximately 2.0 to 3.0 °F increase in average temperature in the 2020s, 3.5 to 5.5 °F increase by the 2050s, and 4.5 to 8.5 °F increase by the 2080s. The table below summarizes predicted increases in temperatures. The left portion of the figure below the table shows a visual representation of predicted increases in temperatures.

Projected Temperature (Region 3)				
Factor of Consideration	Baseline (1971-2000)	Projected 2020s	Projected 2050s	Projected 2080s
Average Temperature	46°F	+2.0 to 3.0 °F	+3.5 to 5.5 °F	+4.5 to 8.5 °F
Number of Days with Temperature Exceeding 90°F	10 days	11 to 25 days	15 to 45 days	19 to 70 days
Number of Days with Temperature Exceeding 95°F	1 day	2 to 7 days	2 to 18 days	4 to 38 days
Number of Heat Waves per Year	4	4 to 5	4 to 5	4 to 7
Number of Days per Year with Min. Temp. At or Below 32°F	152	116 to 145	86 to 168	68 to 124

Table 1: Projected Temperatures in Region 3



Observed (black line) and projected temperature (left) and precipitation (right). Projected model changes through time are applied to the observed historical data. The green, red, and blue lines show the average for each emissions scenario across the 16 global climate models. The shaded area indicates the central range. The bottom shows the minimum projection across the suite of simulations, and the top line shows the maximum projections. A 10-year filter has been applied to the observed data and model output. The dotted area between 2004 and 2015 represents the period that is not covered as a result of 10-year filter. Note different scales for temperature and precipitation.
Source: Columbia University Center for Climate Systems Research. Data are from USHCN, WCRP and PCMDI

Figure 3: Temperature Predictions (left) for ClimAID Region 3

From the baseline years, there have been approximately 10 days per year with a maximum temperature exceeding 90 °F, and 1 day per year exceeding 95 °F. Typically, there has been 1 heat wave per year lasting for about 4 days. There have been approximately 152 days per year with a minimum temperature at or below 32 °F.

In the 2020s, the number of days with maximum temperature exceeding 90 °F is expected to rise to between 11 and 25 days, and days with maximum temperature above 95 °F between 2 to 7 days. Heat waves could increase up to 3 times per year averaging to 4 to 5 days in duration. The number of days below 32 °F are predicted to decrease to between 116 and 145 days per year.

Potential Impacts to the Village

Higher temperatures can worsen many types of disasters, including storms, heat waves, floods, and droughts. A warmer climate creates an atmosphere that can collect, retain, and drop more water, changing weather patterns in such a way that wet areas become wetter and dry areas drier.

Higher temperatures can also pose a threat to human and animal health. Higher temperatures mean that heat waves are likely to happen more often and last longer, too. Heat waves can be dangerous, causing illnesses such as heat stroke, or even death.

Higher temperatures can also damage public infrastructure and cause faster degradation of many different types of materials, driving up costs of developing public infrastructure projects and maintaining or upgrading current public infrastructure. This can affect transportation infrastructure such as roads and sidewalks, electrical infrastructure, and water and sewer infrastructure. The New York State Department of Health (DOH) has developed a Heat Vulnerability Index (HVI) to identify areas in New York State (excluding New York City, which has its own HVI) with high proportions of heat-vulnerable populations. The HVI helps to quickly identify heat-vulnerable populations in NYS using the four vulnerability categories to describe underlying causes of heat vulnerability. This can help inform interventions to target specific vulnerable populations. For example, the Village can:

1) set up more cooling centers in vulnerable areas where homes are less likely to have air conditioning;

2) provide transportation to and from cooling centers when public transportation is unavailable;

3) include risk communication and alerts in multiple languages for populations with low English proficiency; and
4) conduct additional outreach efforts to check on vulnerable populations (those with disabilities, elderly living alone, etc.).

Appendix A – Schuyler County Heat Vulnerability Index Report describes and summarizes the methodology used to determine the Village's overall heat vulnerability based on four criteria:

Language Vulnerability: Among populations with limited understanding of English, language is commonly a barrier to accessing resources and understanding alert messages issued in English during heat events. Heat awareness messages should be announced in commonly spoken languages of the specific area to best communicate the risks of heat.

Socio-economic Vulnerability: Economic status of an individual and their community can affect how one copes with extreme heat. While recommendations to use air conditioners during hot days are commonly a part of cool-down messaging, this may not be an affordable option for low-income households.

Community resources like cooling centers can help provide the public with a few hours of relief from hot weather. Public transportation to these facilities make them accessible to families and individuals who may not have their own vehicle.

Environmental Vulnerability: Built environment and urban heat island effect contribute to heat vulnerability in urban areas. Unlike surfaces covered in vegetation, areas covered by sealed surfaces, such as asphalt and concrete (buildings and pavements) tend to retain heat. Developing parks, increasing green space, constructing green roofs, and using materials that cool rooftops and pavements can help with regional cooling.

Elderly Isolation/Elderly Vulnerability: Elderly people are often the first population to be affected by extreme heat. Elderly in rural areas are also vulnerable if they are socially isolated from family and the community and face additional challenges including fewer options for healthcare and timely assistance. For these reasons, efforts to reduce the health effects of heat should also target elderly in these areas.

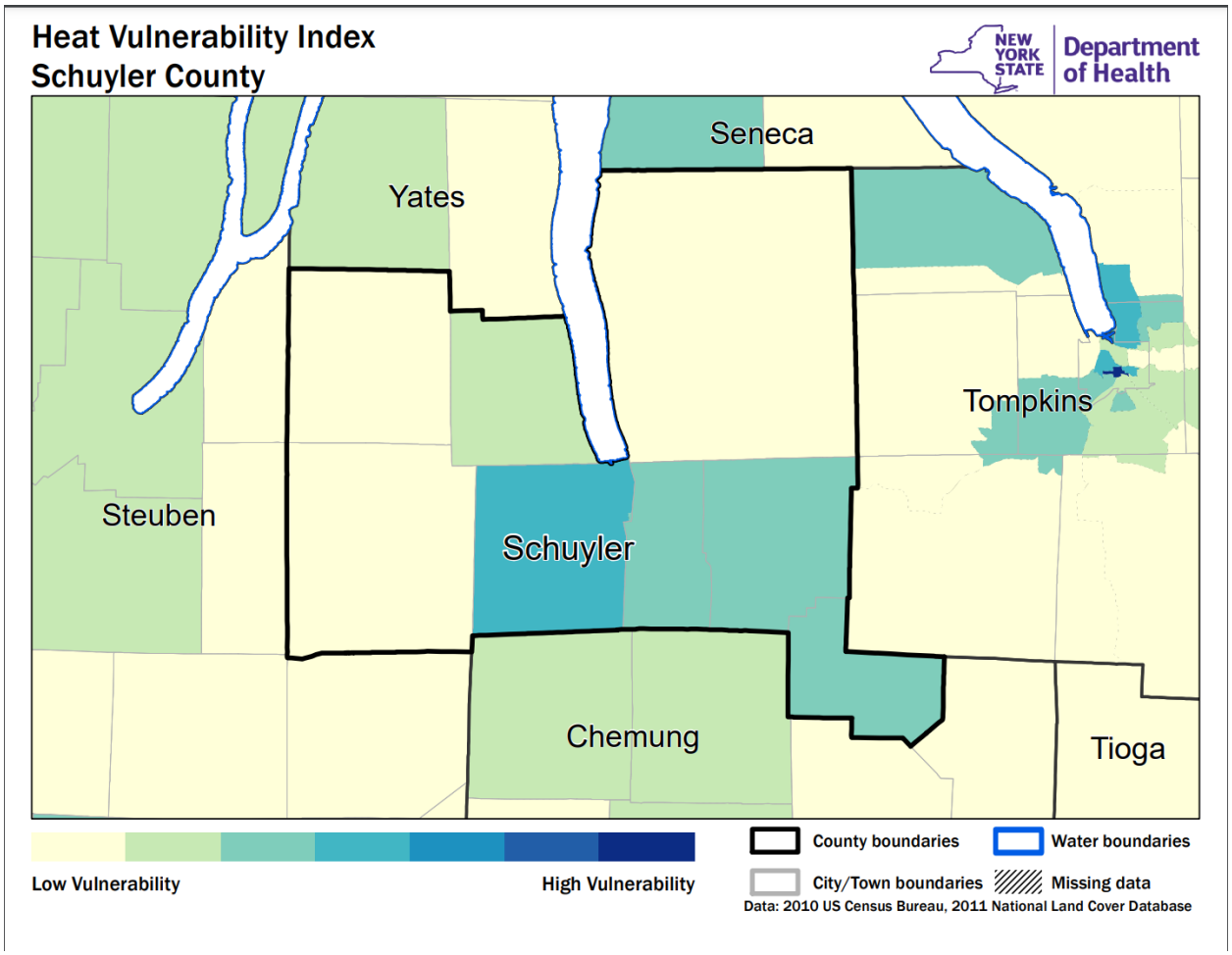


Figure X1

Figure X1 shows the overall heat vulnerability of the Town of Montour. The Town has a moderate level of heat vulnerability. This is primarily due to two factors: socio-economic vulnerability and elderly vulnerability, as seen In Figure X2 below.

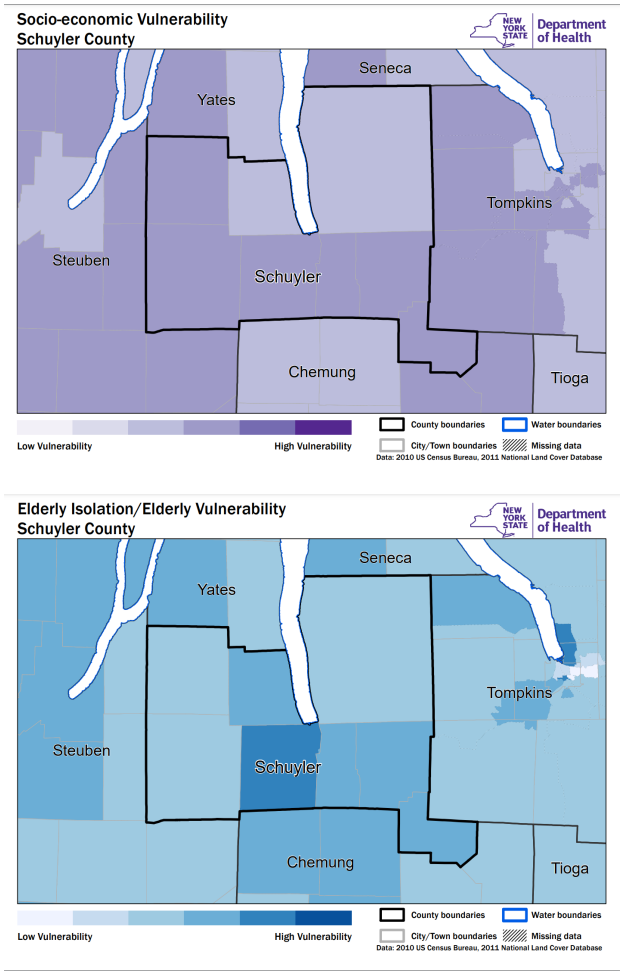


Figure X2: Socioeconomic and Elderly Heat Vulnerability

Higher temperatures, along with changing precipitation patterns, can also pose a threat to natural water systems. Higher temperatures affect the amount of water in lakes, rivers, and streams, as well as the amount of water that soaks into the ground to replenish ground water.

With increases in temperatures, water temperatures will also increase, thus increasing evaporation and thus precipitation and storm intensities. Precipitation is analyzed in the next section.

Precipitation

Precipitation in Schuyler County, on average, has been about 33-38 inches per year (of rain). This was observed from baseline years 1971 to 2000 (Horton, Bader, Tryhorn, DeGaetano, & Rosenzweig). Historically, from 1990 to 2010, there has been an average of about 2.21 days with precipitation greater than 1" (NYCCSC, n.d.). However, there was an increase each decade during that time period (NYCCSC, n.d.). In that same period of time, there was an average of about 0.092 days per year with extreme precipitation above 2". The figure below depicts average precipitation in New York State (Horton, Bader, Tryhorn, DeGaetano, & Rosenzweig).

From the baseline precipitation, there is predicted to be an increase of 0-5% more precipitation in the 2020s, 0-10% in the 2050s, and 5-10% in the 2080s. By the end of the century, precipitation could increase by almost 4 inches per year. Table 2 and Figure 4 show these predictions.

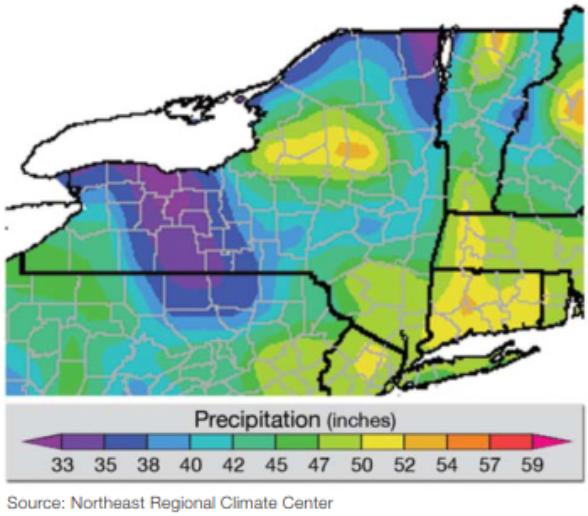


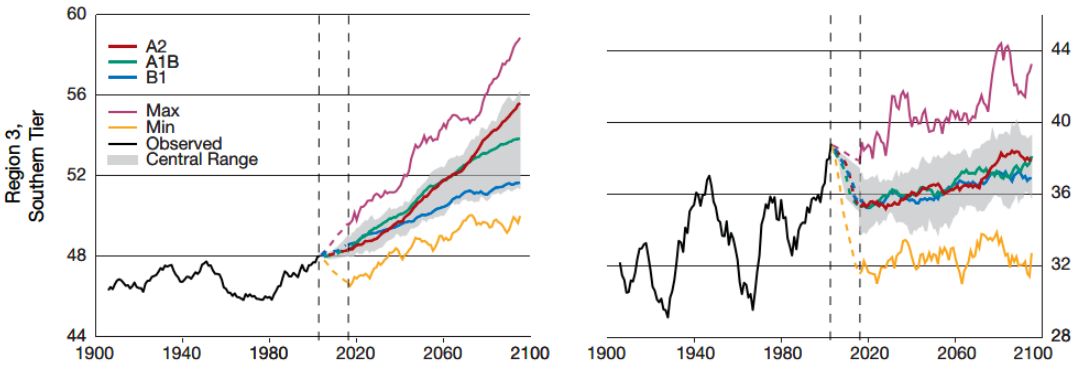
Figure 5: Baseline Precipitation in New York State

From the baseline years, there have typically been about 6 days per year with rainfall exceeding 1 inch, and 0.6 days per year with rainfall exceeding 2 inches. In the 2020s, this is predicted to increase to between 5 to 8 days with precipitation above 1 inch, and 0.5 to 1 days above 2 inches of rainfall. The 2050s are estimated to have similar precipitation levels to the 2020s, and in the 2080s, days with rainfall greater than 1 inch could occur up to approximately 10 days per year, and above 2 inches about 2 days per year.

Projected Precipitation (Region 3)				
Factor of Consideration	Baseline Precipitation (1971-2000)	Projected Precipitation 2020s	Projected Precipitation 2050s	Projected Precipitation 2080s
Total Rain Depth	38 in	+0 to 5%	+0 to 10%	+5 to 10%
# of Days Rainfall Exceeding 1 inch	6	5 to 8	5 to 8	5 to 10
# of Days Rainfall Exceeding 2 inches	0.6	0.5 to 1	0.5 to 1	0.4 to 2

Table 2: Projected Precipitation in ClimAID Region 3

New York State does experience extreme events, with some being caused by tropical storms, hurricanes, and nor-easters. Not only will precipitation increase, but the intensity of storms will also increase. It is predicted that intensities for storms of all durations will increase, as seen in Figure 5.



Observed (black line) and projected temperature (left) and precipitation (right). Projected model changes through time are applied to the observed historical data. The green, red, and blue lines show the average for each emissions scenario across the 16 global climate models. The shaded area indicates the central range. The bottom shows the minimum projection across the suite of simulations, and the top line shows the maximum projections. A 10-year filter has been applied to the observed data and model output. The dotted area between 2004 and 2015 represents the period that is not covered as a result of 10-year filter. Note different scales for temperature and precipitation.
Source: Columbia University Center for Climate Systems Research. Data are from USHCN, WCRP and PCMDI

Figure 5: Precipitation Predictions (right) for ClimAID Region 3

Storm intensities are expected to increase in the coming decades. It is predicted that intensities will increase around 12% in 2040-2069 compared to observed intensities in 1970-1999. This can be seen in Figures 6 and 7 below. The probability of exceeding 4.00 inches of precipitation in 24 hours during a 30-year period is expected to increase over time, as well. This is shown in Figure 8.

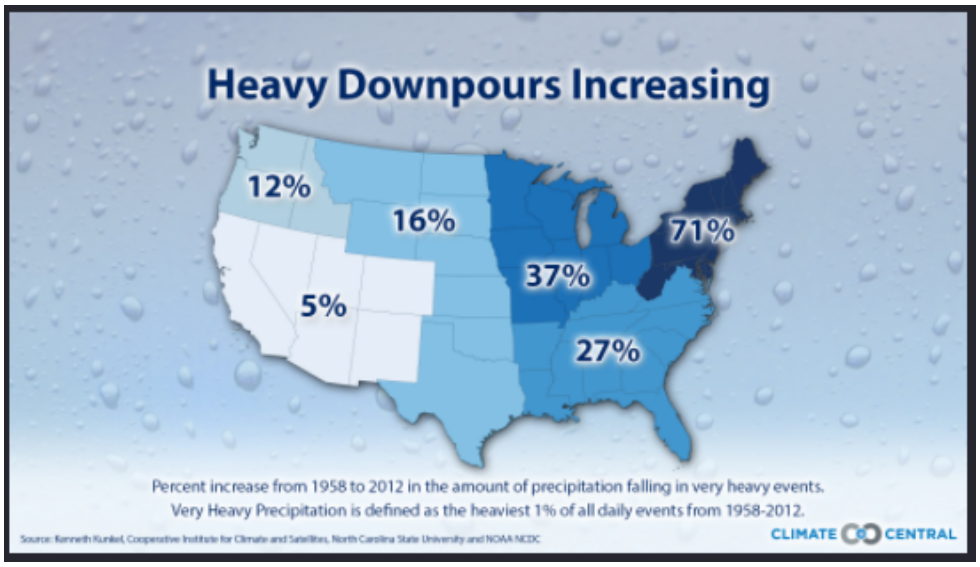


Figure 6: Increasing Storm Intensities

Duration (hrs)	Projected 2040-2069 Intensity Ensemble Member			Observed 1970-1999 Intensity with Confidence Interval (CI) Bounds		
	10th	Mean	90th	Low CI	Mean	High CI
1	2.27	2.56	2.95	1.96	2.27	2.36
2	1.41	1.59	1.83	1.21	1.41	1.46
3	1.06	1.20	1.38	0.92	1.06	1.11
6	0.66	0.74	0.85	0.57	0.66	0.69
12	0.41	0.46	0.53	0.35	0.41	0.43
18	0.31	0.35	0.40	0.27	0.31	0.32
24	0.25	0.28	0.33	0.22	0.25	0.26

Figure 7: Increasing Storm Intensities – Elmira (Source: Northeast Regional Climate Center)

Based on projected changes in storm occurrences provided by the Northeast Regional Climate Center, for the RCP 4.5 scenario, it is predicted that a 50-year storm will become a 45-year storm and a 100-year will become a 90-year storm in 2040-2069 compared to 1970-1999. For the RCP 8.5 scenario, it is predicted that a 50-year storm will become a 42-year storm and a 100-year storm will become an 85-year storm in the same time periods. These predictions are shown in the figure below, with the top two images representing the RCP 4.5 scenario and the bottom two images representing the RCP 8.5 scenario.

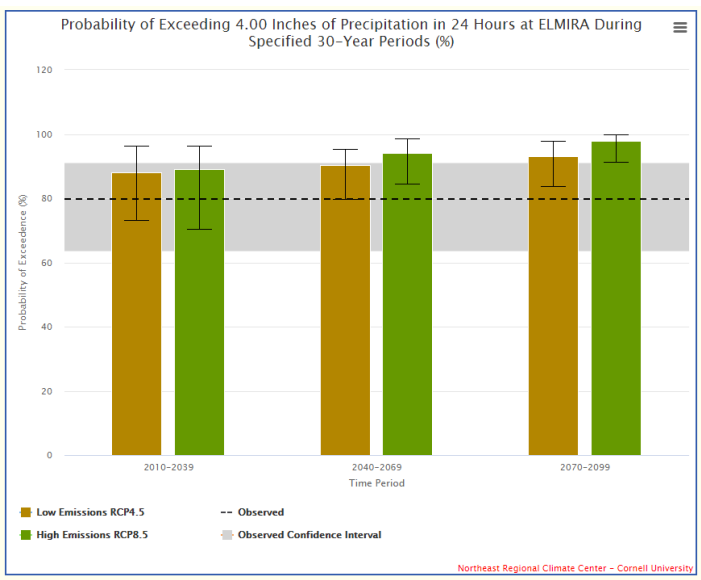


Figure 8: Probability of Occurrence – Elmira (Source: Northeast Regional Climate Center)

Snowfall

Snowfall in Schuyler County, on average, is approximately 40-70 inches per year. This is based on a baseline from the year 1971 to 2000. The Finger Lakes region can experience some effects from lake-enhanced snow events. With increasing temperatures, there will be a reduction of the duration of ice cover of the lakes (Great Lakes and Finger Lakes), and the seasonal increase in moisture that can be drawn will likely increase snowfall in addition to other forms of precipitation.

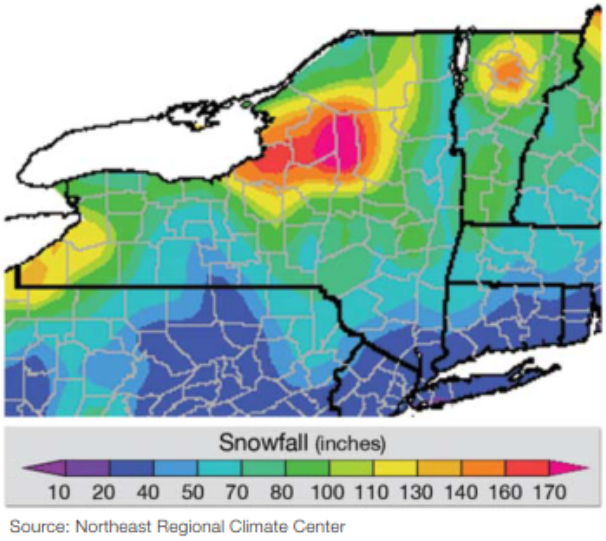
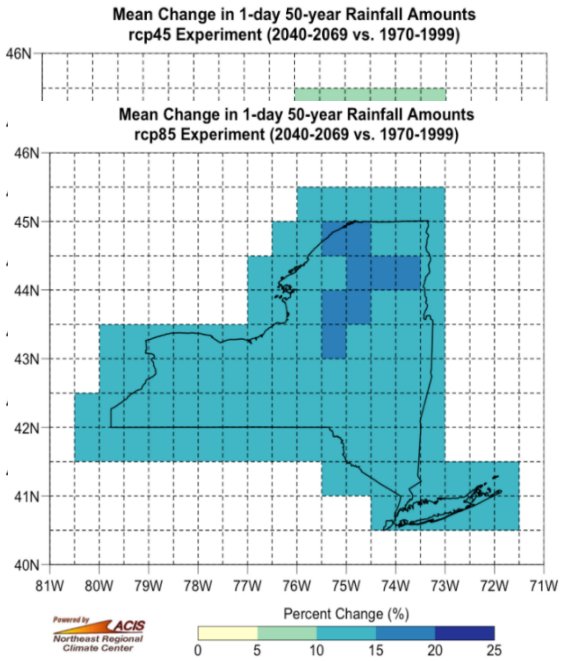


Figure 11: Baseline Snowfall in New York State



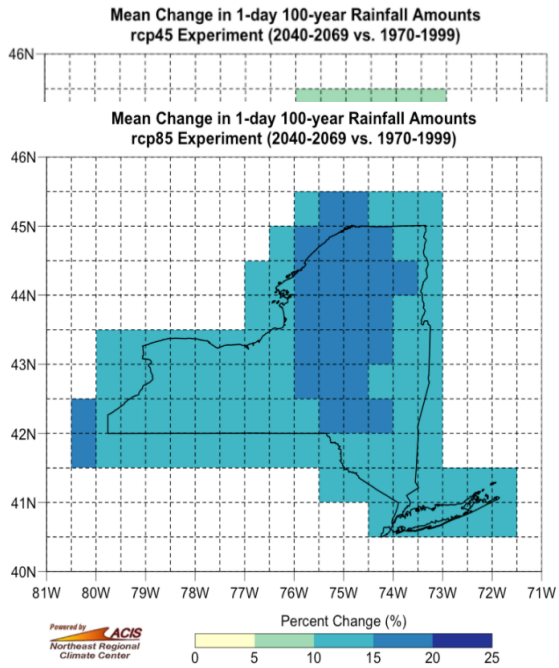


Figure 9: Changes in Storm Occurrences (Northeast Regional Climate Center)

Potential Impacts to the Village

Flooding: Short Term Impacts

Flooding can overwhelm streams, ditches and infrastructure that is not built to handle such high quantities of runoff. With increasing precipitation and storm intensities, flooding is predicted to increase in frequency and intensity.

In August of 2018, heavy rain and flash flooding impacted the Village of Montour Falls and surrounding areas. The waterfalls in Montour Falls had intense amounts of water flowing. Route 14 was closed for a period of time, power outages were reported, and a major water main broke in Schuyler County. Events like these will become more prevalent in years to come with increasing precipitation and intensities of storms.

Figure 10: August 2018 Flooding Event (Source: WFLA 8 Staff)

The flooding in 2018 was approved by FEMA for a major disaster declaration. Up to nine inches of rain fell in some areas in the span of only a few hours. Creeks and waterways overflowed which swept trees, property, and debris. FEMA provided disaster assistance funding to counties including Schuyler County to mitigate the negative economic impacts (FEMA Approves Major Disaster Declaration for Seneca, Schuyler Counties, 2018). The total public assistance cost estimate was $36,530,321 with a countywide per capita impact in Schuyler County of $105.36. Schuyler County had among the highest damages per capita (FEMA, 2019).

Flooding: Long Term Impacts

Riverbanks with inadequate natural barriers and areas experiencing new water table depth patterns are susceptible to impacts from flooding. Adequate natural barriers can help mitigate effects of flooding.

Erosion

A long-term impact of flooding would be erosion. The canal off Seneca Lake may be prone to damage from erosion. Recurrent flooding can erode banks with inadequate natural barriers, which in turn can cause infrastructure damage and property loss.

Potential Impacts Summary

Climate change is extremely likely to bring higher temperatures to New York State along with more frequent, intense, and longer duration heat waves. Total precipitation annually is more than likely to increase with storm intensities increasing, as well. Dry periods and droughts are also expected to increase in frequency and duration.

More precipitation and heavier rainfall can lead to more frequent and severe flooding in all seasons. Impervious pavements also increase impacts to sewer systems during precipitation events by increasing runoff, which could lead to sewer overflows. With the greater precipitation and more intense storms, flooding and sewer overflows could become more frequent and worse in severity. Destructive winds, lightning strikes, and hail are all common during severe thunderstorms, which are predicted to become more frequent.

Natural Resources Systems

Climate change can have major impacts on the Village's natural resources systems, including marina impacts.

Public Infrastructure Systems

Marina Infrastructure

Climate change could have significant impacts on the marina environment in the Village of Montour Falls. This environment would already be under stress due to human influence such as infrastructure developments and human population growth (Cowan Jr., Kleypas, Twilley, Hare, & Kennedy, 2002). Temperature changes from climate change can influence ecosystems in that it can alter ecological processes such as productivity and species interactions (Cowan Jr., Kleypas, Twilley, Hare, & Kennedy, 2002). Changes in precipitation and any changes in the level of the water body also have consequences on marine environments. Increases in runoff from increases in precipitation and storm intensities can increase the probability of flooding in communities along waterfronts (Cowan Jr., Kleypas, Twilley, Hare, & Kennedy, 2002). Precipitation and storm intensity changes can also cause erosion or other damages to marine communities. In addition to all this, circulation of bodies of water can change which could have a variety of impacts such as erosion, change in currents, or other consequences that impact ecological systems.

Levee Infrastructure

Summary of 2021 Levee Infrastructure Study

The Catharine Creek Levee System located in the Village of Montour Falls is comprised of the earthen levees of the Northern Left Bank, Southern Left Bank, and Right Bank Ring Dike. The Northern Left Bank is approximately 0.9 miles long, while the southern section is just under 0.4 miles, and the right bank measures about 0.2 miles in length. There are six (6) numbered culverts closures along the Catharine Creek Right and Left Bank levee systems starting at the northern limit of the left bank north reach. The Shequaga Creek flood protection system consists of an upstream concrete stilling basin at the base of the falls, a twin-cell concrete box culvert, downstream stilling basin, and an earthen levee. The Shequaga Creek levee is approximately 0.2 miles in length and contains five (5) culverts and an abandoned railroad

crossing (currently a pedestrian bridge). The crossing is located approximately 770 feet downstream from the end of the culvert floodwall.

In August Schnabel-Lachel Engineering, P.C. produced a key report – the Certification Evaluation and Scoping Study Report for the Montour Falls Flood Damage Reduction Project (MFFDRP). This report includes the findings and discussion of the engineering evaluation of the Catharine Creek Left and Right Bank, the Shequaga Creek levee systems. The Phase 1 study provides information regarding how FEMA maps levee systems, a checklist of the types of data and documentation that must be submitted for levee systems to be accredited on flood insurance rate maps (FIRMs), and a preliminary assessment of what geotechnical investigations, hydrologic and hydraulic modeling and structural evaluations are needed for accreditation of the Catharine Creek an Shequaga Creek levee systems. Schnabel's assessment concluded that the MFFDRP is certifiable with the completion of updated hydrologic and hydraulic modeling and with the completion of a supplemental geotechnical exploration program. The engineer's opinion of probable accreditation costs (EOPAC) which includes thirteen (13) engineering, geotechnical investigation and hydrologic & hydraulic modeling tasks is $280,000. Schnabel also prepared a preliminary estimate for the relining of eleven (11) culvert closures within the Catharine Creek and Shequaga Creek levee systems assuming relining the culvert in necessary. This additional design and construction cost is estimated to range from $330,000 to $460,000 for the design methods detailed in Schabel's report.

Economic System

Climate change can negatively affect the Village's economy, including agriculture as well as recreation and tourism.

Agriculture

Agriculture is a rich industry for New York State's economy, Schuyler County, and the Village of Montour Falls. Agriculture and farming are currently an important part of community life and economy in the Village (Village of Montour Falls Comprehensive Plan, 2007). In Schuyler County, the net market value of farms is $14 million. Land use for cropland has decreased in Schuyler County in the past 5 decades, but land use for animal pastures has increased (Goddard, et al., n.d.).

Climate change can negatively impact the agriculture presence in the Village due to impacts such as flooding, drought, heat stress, rising temperatures, more frequent heavy rainfalls, insect population changes, weed population changes, and a vulnerable livestock industry. These impacts can affect production sites and surrounding ecosystems (Goddard, et al., n.d.).

Many crops are heat sensitive and a 1°F change can pose significant threats. Between 2013-2016, 11% of crops in the northeast that were lost were due to increases in temperature. Heat stress from rising temperatures will cause decreases in productivity yields. Also, increasing temperatures will create higher demands for water resources (Goddard, et al., n.d.).

Increases in temperatures will also negatively impact livestock. Temperature rise can create unhealthy living conditions, decrease the quality of milk produced, and will require greater investments in air conditioning units to create better environments for livestock (Goddard, et al., n.d.).

Higher temperatures also increase weed growth and cause certain species of insects to migrate north and reproduce at faster rates. These impacts will negatively affect crop production. It is predicted that certain pesticides will also lose effectiveness with climate change (Goddard, et al., n.d.).

Droughts also pose a threat to agriculture. Preparing for droughts can require extensive investments. Irrigation can help mitigate the effects of drought, but in increases demand on water supplies. It is currently predicted that the northeast of the United States will have an additional demand of 2,500 hectares of irrigated land by 2090 (Goddard, et al., n.d.).

Increased precipitation and storm intensities also can have negative consequences. It is predicted that these events of heavy storms will take place in winter and spring which will cause snow to melt sooner. This causes soil to be drier in the summer and fall. Between 2013-2016, about 33% of crops in the northeast United States were lost due to excess moisture. Due to spring flooding from the predicted winter and spring storms, planting will be delayed. Flooding can also have cascading negative impacts to farmland. Schuyler County is especially vulnerable due to the soil composition. Flooding can cause a loss of beneficial fungi in the soil, erosion, and increase in sand and debris in prime agriculture soils. These impacts can create financial stress and decrease crop yields. Using heavy machinery over wet soils can cause soil compaction, more erosion, and water contamination. More frequent extreme precipitation events can cause water contamination from fertilizer and manure transport and runoff. Also, increases in heavy rainfalls can cause certain leaf and root pathogens to occur more frequently (Goddard, et al., n.d.).

Recreation and Tourism

The Village of Montour Falls is known for its natural glens with beautiful waterfalls. Climate change effects including increases in precipitation and storm intensities can create challenges for the Village's recreation and tourism activities since the natural glens and waterfalls can be vulnerable to flooding and intense storm damages.

Significant natural sites of attraction in the Village include the Catharine Valley Trail, She-Qua-Ga Falls, Havana Glen Park, Aunt Sarah's Falls, Queen Catharine Marsh, Rock Cabin Road, and Montour Falls itself.

Social System

Analysis of the Village's socioeconomic profile demonstrates that there are vulnerabilities to climate change, particularly for low-to-moderate income persons, elderly persons, persons requiring life-saving medications or medical equipment, homeless persons, and companion animals. While *Appendix E: 2020 Village of Montour Falls Heat Emergency Plan* provides public education tools and designates a heat plan coordinator, the government's readiness to train and carry out responsibilities during heat emergencies should be assessed.

Social Economic Vulnerability

According to the United States Census Bureau, approximately 22% of the population are children and 33% of the population are over the age of 60. The per capita income is about $22,549 and the median household income is approximately $35,000 (Bureau, 2019). Approximately 23.7% of individuals that reside in the Village are below the poverty line. This poverty rate is about 1.5 times more than the rate in both Schuyler County and New York State as a whole. It is also about 10.3% higher than the national

average. About 39% of children under 18 falls under the poverty line and about 16% of those over the age of 65 fall into poverty (Bureau, 2019). Low-income families and communities often don't have resources to evacuate or seek shelter during times of climate emergencies.

Vulnerability Re-Assessment Timeline

Recertification requirements state that local governments should revisit their vulnerability assessment at least every 10 years or when other relevant circumstances change. The Village intends to revisit and update as necessary every 5 years or sooner for Climate Smart Communities recertification.

Assessment Findings and Prioritization

The Village of Montour Falls has potential risks associated with climate change. The most significant impacts include, but are not limited to, intense storms, flooding, and erosion. Prior intense storms have demonstrated how climate events can have destructive outcomes. For example, the flooding event in August of 2018 had detrimental impacts to infrastructure. Storms are expected to increase in strength into the future, so preparing for these storms is necessary. Possible mitigation strategies could include a water retention system, microgrid with backup energy supply to allow for grid stability, and levee management.

Recommendations and Next Steps

Community Outreach

To obtain more detailed information, it is recommended that the Village engage in community outreach. These can include community surveys, meetings, workshops, and other involvement. These would help to assess vulnerable populations and other risk factors. In order to avoid survey fatigue, existing data from community health and transportation surveys implemented from 2019 to 2021 could be mined to assess existing vulnerabilities that could be exacerbated by climate change impacts.

Municipal Planning

The Village should revisit their vulnerability assessment at least every 10 years or when other relevant circumstances change. It is recommended that the Village re-assess climate vulnerabilities in 2024 in order to align with up-to-date climate change projections and statewide guidance.

Interim Disadvantaged Communities Criteria

New York State announced in March 2022 the release of draft criteria developed by the Climate Justice Working Group (CJWG) for identifying disadvantaged communities. The draft criteria will guide the equitable implementation of New York's ambitious Climate Leadership and Community Protection Act (Climate Act - CLCPA). Pursuant to the Climate Act's disadvantaged community provisions, the draft includes an interactive map and a list of communities the criteria would cover for directing programs and projects to reduce air pollution and climate-altering greenhouse gas emissions, provide economic development opportunities, and target clean energy and energy efficiency investments.

The Climate Act requires New York State to invest or direct resources to ensure that disadvantaged communities receive at least 35 percent, with the goal of 40 percent, of overall benefits of spending on clean energy and energy efficiency programs. In addition to the geographic component, the draft criteria

include low-income households located anywhere in New York State for the purpose of investing or directing clean energy and energy efficiency programs, projects, and investments. These individual households report annual total income at or below 60 percent of the State median income, or households otherwise eligible for low-income programs. The

2022 Jurisdiction Coordination Opportunities

Although hazard mitigation planning occurs at every scale, coordination with Schuyler County officials as well as municipal officials in neighboring jurisdictions will assist the Village with identifying and prioritizing actions it can take to reduce or eliminate risks to people and property from natural and human-caused hazards that are exacerbated by climate change. The previous Schuyler County Hazard Mitigation plan approved by FEMA in 2016 expired in 2021.

2022 is an excellent year for Schuyler County to coordinate with the Village on integrating climate vulnerabilities into hazard mitigation planning activities. A new FEMA program introduced in 2021 Building Resilient Infrastructure and Communities (BRIC) supports states, local communities, tribes and territories as they undertake hazard mitigation projects, reducing the risks they face from disasters and natural hazards. The BRIC program guiding principles are supporting communities through capability- and capacity-building; encouraging and enabling innovation; promoting partnerships; enabling large projects; maintaining flexibility; and providing consistency. The Village is classified as a potential subapplicant. Subapplicants should touch base with their respective State Hazard Mitigation Officer (State Division of Homeland Security and Emergency Services) and Schuyler County Emergency Management representatives to ask about project priorities and additional application requirements or deadlines for submitting information. The next application period will open in approximately September 2022 and close in January 2023.

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Appendix A - Schuyler County Heat Vulnerability Index Report

Appendix B Terms and Definitions

Asset: A resource that a town/village has access to that will aid in the protection from the effects climate change.

FEMA: Federal Emergency Management Agency

Hazard: A physical process or event that can harm human health, livelihoods, or natural resources

Risk: A situation or event that causes an exposure to danger

Vulnerability: Refers to the degree to which people or the things they value are susceptible to, or are unable to cope with, the adverse impacts of climate change.

Appendix C Recent Community Surveys

- Transportation Complete Streets
    - Flooding
- DOH Community Health survey (2018-2019)

Appendix D Natural Resources Inventory

Published version to be added by Village Clerk.

Appendix E: 2020 Village of Montour Falls Heat Emergency Plan

Published version to be added by Village Clerk.