

SECTION 3.2 CLIMATE AND PRECIPITATION

Ulster County Climate Data

A preliminary analysis of the Preserve's weather data shows that the average temperature has risen about two degrees over the past 114 years.

Composed of more than 40,000 days of weather observations, these records comprise the collection of the Preserve's Mohonk Lake Cooperative Weather Station, established in 1896 by the U.S. Weather Bureau (now the National Weather Service).

Weather readings at Mohonk began in the mid-1880s, taken by the Smiley family, founders of the neighboring Mohonk Mountain House, and are now continued by Preserve research staff. Beginning in the late 1970s, data collection expanded to include regular monitoring the pH of precipitation, lakes, and streams.

The Daniel Smiley's Research Center /weather station offers 100-plus years of invaluable information on changes in weather patterns, temperature shifts, seasons beginning sooner and ending later, and how it all affects the 180 species that live and thrive in this little corner of Ulster County.

This data is important to identifying the extent of global climate change; researchers need access to reliable data covering the longest period possible. The Preserve's weather data is dependable because the station has been in the same, comparatively stable location for over a century and the same protocol has been followed by the relatively few people involved in collecting the data

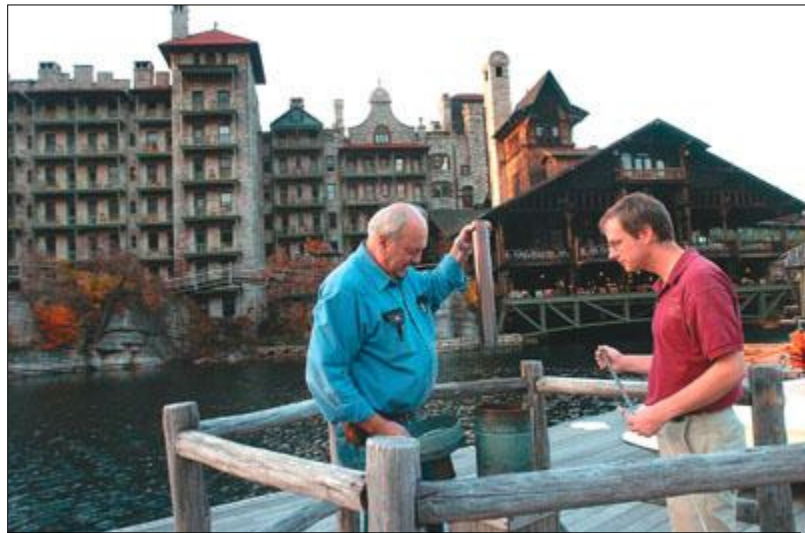


Photo 3.2.1 Paul Huth, left, director of research at Daniel Smiley Research Center of the Mohonk Preserve, and John Thompson, natural resource specialist, check the rain gauge near the Mohonk Mountain House. (Freeman photo by Tania Barricklo)

(<http://www.mohonkpreserve.org/index.php?weatherdata>). That information is carefully recorded, by hand, in a daily logbook, which is exactly what Smiley used in his observations, spanning more than 50 years. The weather observers provide the information each month on a digital database for the National Weather Service .

¹ www.nws.noaa.gov

The data documents a shift over time to warmer temperatures and there has been fewer a number of zero degree or fewer days and more 90-degree or more days at the Mohawk Preserve. It has also been recorded that the past seven years since 2003 have been the warmest on record here.

Changes on the ground have also been recorded: How many days in winter is the ground bare; how many days did rain fall instead of snow; noting that the bare ground will affect the food supply for the animal species in the Preserve come spring seasons.

In reference to Ulster County's dynamic biodiversity and ecological systems, the data has shown a trend over time verifying that the mountain laurel blooms five to seven days earlier now than in the past and the first birds arrive from the south about a week earlier than before. It's noted that the robin has been removed from the migratory list because winters have been warm enough for them to overwinter. Even though they prefer worms, they can change to seeds during the winter to sustain them.

Results of this precise procedure have illuminated climate researchers about the following: A warming trend driven largely by trends in maximum temperatures, especially during summer; increasing daily temperature range during summer and a reduction in the number of freeze-days per year with little change in the length of the freeze-free season. (Nov 15, 2010 – Daily Freeman)

Daniel Smiley's Research Center reports that the annual precipitation on the preserve is 44.57 inches and the average for Nov 2010 is 3.79 inches (calculated by adding up all the measures from each rain event and dividing by the number of months in a year; with an average deviation of +/- 51).

Municipal Climate Data

The average temperatures for Wawarsing, Rosendale, Marbletown and Rochester are all similar to each other and the US average. None of the towns have average temperatures above 80⁰F or below 10⁰F. Based on comparison of Figures 3.2.1 –3.2.4 from city-data.com, the precipitation within each town is greater than the US average, with no town receiving more than 5 inches of precipitation. Rosendale has the least variation in precipitation with Marbletown, Wawarsing and Rochester having periods of lows of 3 inches followed by highs of 4 to 5 inches (*Based on data reported by over 4,000 weather station and processed through city-data.com*)².

² <http://www.city-data.com>

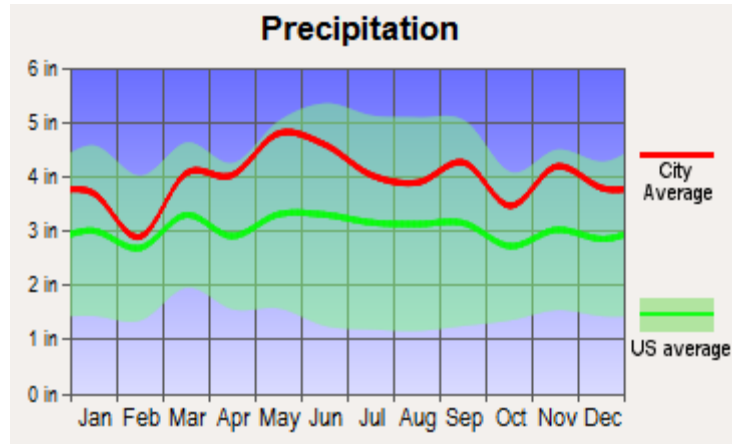
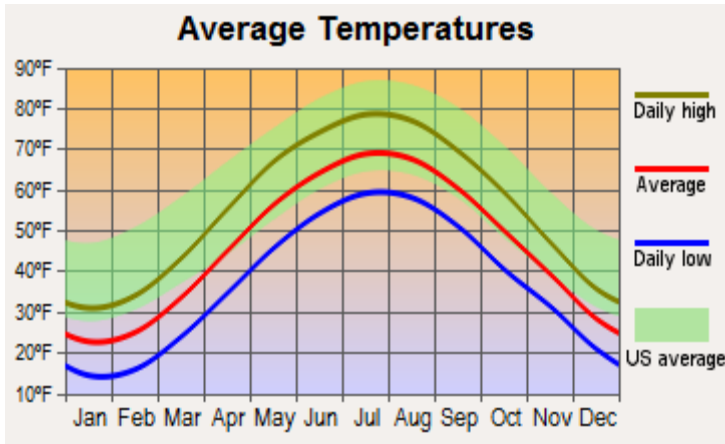


Figure 3.2.1: Average climate in Wawarsing, NY. Data for this graphs is based on reports from over 4,000 weather stations (www.city-data.com)

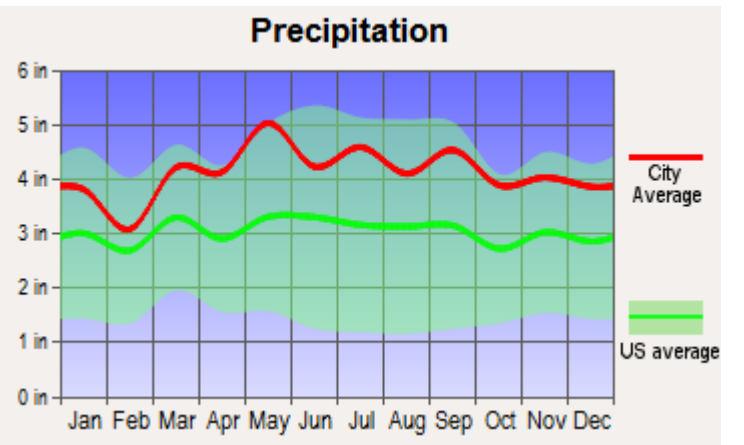
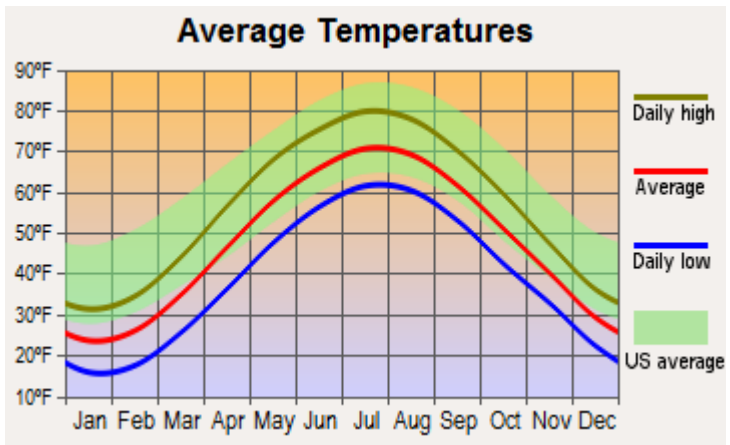


Figure. 3.2.2: Average climate in Accord NY – one of Rochester’s largest hamlets.

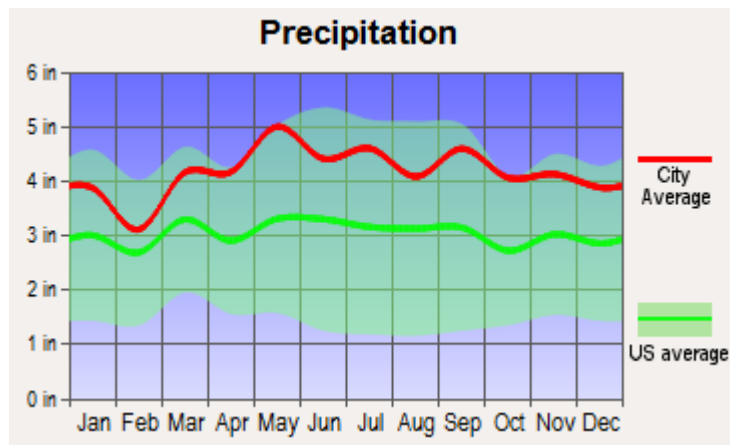
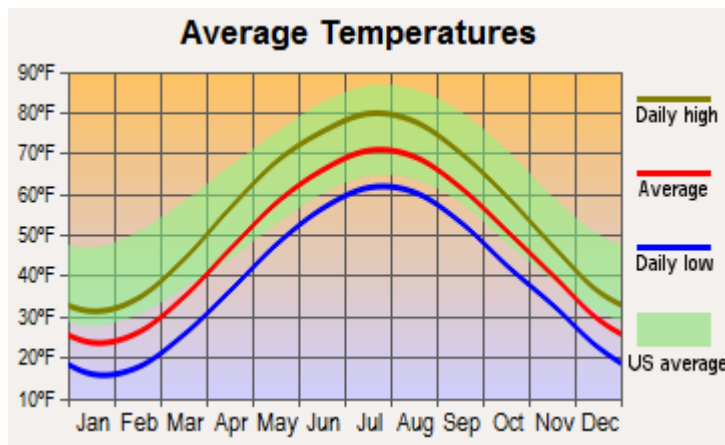


Figure. 3.2.3: Average climate in Marbletown, NY.

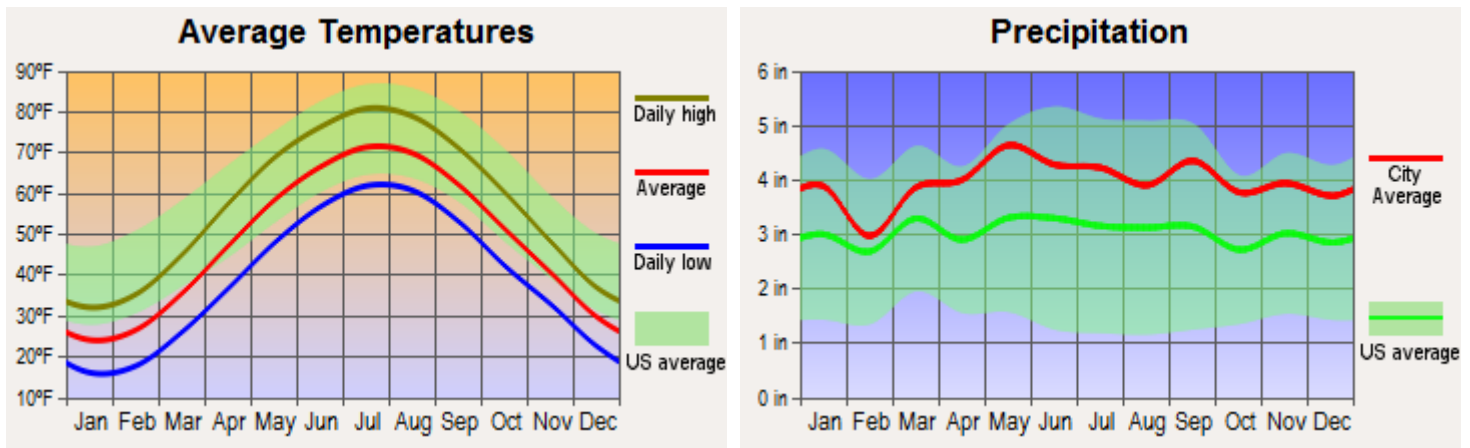


Figure. 3.2.4: Average climate in Rosendale, NY.

Climate Change and Sea Level Rise

Our climate is changing. Since 1970 the global annual average temperature has increased nearly 1 degree and annual average temperatures in the United States have increased by 1.8 degrees. More specifically, annual average temperatures in New York State and the Hudson Valley have increased 2 degrees and winters in New York State are almost 5 degrees warmer than they were in the 1970's³.

More recently, 2010 from January to August is tied with 1998 as the warmest year on record. Temperature records dates back to 1880. Furthermore the summer of 2010 was the hottest on record in New York City as well as 10 other states. In comparison to other decades, the 2000's were the hottest for the entire globe surpassing the previous record set in the 1990's.

On a local level, warmer winters, hotter summers and more extreme heat have been observed and these trends are predicted to continue. Scientists also project that the most intense rainfall events will become even more intense. With warmer air temperatures we are likely to see more winter precipitation come as rain rather than snow. The snow that does fall is likely to be wetter and heavier than average. Snow pack is also melting earlier in the year. When combined with changes in precipitation patterns this will lead to seasonally early and more intense high river flows.

The effects of global warming have been and will continue to contribute significantly to sea level rise. Sea level has risen fifteen inches over the last 150 years in New York Harbor and 4-6 inches since 1960⁴. Effects of sea level rise are compounded by potential increases in extreme precipitation and storms associated with climate change.

³ (<http://www.epa.gov/climatechange/science/recenttc.html>).

⁴ (<http://www.epa.gov/climatechange/science/recenttc.html>)

Shoreline communities along the Rondout are very likely to see an increase in the frequency of flooding and erosion events. For example, the City of Kingston is in the tidal portion of the Rondout Creek watershed and is vulnerable to a variety of impacts from sea level rise and storm surge. Shoreline communities with brownfields or contaminated sites in areas at high risk of flooding could see the regular resuspension of waterborne pollutants that may put public health at risk. Critical infrastructure and facilities may be inundated leading to a loss of services at great cost to the community. Degraded stormwater and sewage systems will be further stressed by more intense large rainfall events and the vulnerability of bridges, culverts and road failures will increase. Rising temperatures or flood events reducing water quality may affect drinking water. Short term drought may affect water quantity and quality both for drinking water and for aquatic life in the creek. Warmer air and water temperatures will affect recreational fish species of the region and may lead to an increase in pests and insect epidemics.

ClimAID⁵ is a state-funded integrated assessment program for effective climate change adaptation strategies in New York State with the goals of providing the state with cutting-edge information on its vulnerability to climate change and to facilitate the development of adaptation policies informed by both local experience and state-of-the-art scientific knowledge. Through this effort the state has developed sea level rise projections. See Figure 3.3.5.

Draft ClimAID Sea Level Rise Projections:

Lower Hudson Valley & Long Island	2020s	2050s	2080s
Sea Level Rise ¹	+ 2 to 5 in	+ 7 to 12 in	+ 12 to 23 in
Sea Level Rise ² Rapid Ice Melt	~ 5 to 10 in	~ 19 to 29 in	~ 41 to 55 in
Mid-Hudson Valley & Capitol Region	2020s	2050s	2080s
Sea Level Rise ¹	+ 1 to 4 in	+ 5 to 9 in	+ 8 to 18 in
Sea Level Rise ² Rapid Ice Melt	~4 to 9 in	~ 17 to 26 in	~ 37 to 50 in

Figure. 3.2.5: 1. Shown is the central range (middle 67%) of values from model-based probabilities (16 models x 3 scenarios) rounded to the nearest inch. 2. The rapid ice melt scenario is based on acceleration of recent rates of ice melt in the Greenland and West Antarctic Ice sheets and paleoclimate studies. Note: Baseline is average sea level from 1971-2000.

⁵http://www.nyscrda.org/programs/Environment/EMEP/conference_2009/presentations/Solecki_DeGaetano_Horton_Climat%20Change%20in%20New%20York%20State.pdf

Climate Change Recommendations:

The communities of the Lower Non-Tidal Rondout Creek watershed have to be prepared. The warming of the globe will continue even if all greenhouse gas emissions are halted. The following are recommendations to be considered by the communities that border the Rondout Creek.

1. Based on the ClimAID Sea Level Rise Projections, the municipalities of the lower non-tidal Rondout Creek watershed should revise land use and zoning ordinances to require a buffer between mean high water and any proposed structures.
2. All communities bordering the Rondout should adopt the Climate Smart Communities Pledge (Appendix H)
3. Join and be an active member of the Hudson Valley Climate Change Network of the DEC Hudson River Estuary Program
4. Get involved in the 10% Challenge. This can best be managed through the local CAC and advised through the Rondout Creek Watershed Council in partnership with Sustainable Hudson Valley (SHV). SHV is leading the way in the Hudson Valley for implementation of the 10% Challenge.
5. Pass a local law to insure that predevelopment runoff is equal to post development runoff for all proposed projects in your community.
6. Require that all proposed development designs include tree plantings to prevent the expansion of impervious surfaces.
7. Map vulnerable stream bank areas that need to be revegetated and collaborate with state partners to rehabilitate them over a set period of time.
8. Pass a local law to increase the protection of wetlands in your community.
9. Engage CACs in reviewing development proposals and providing guidance to the planning board on ways to reduce the impact of development on natural systems.
10. Limit development in the 100-year floodplain and/or require developers to show how they will be addressing the projections of sea level rise in their proposal.
11. Direct new development away from high risk areas and develop programs to fund elevation and/or relocation of structures or systems in high risk areas.
12. Work on seeking funding through joint projects or proposals with neighboring municipalities.
13. Make use of mapping tools to identify at risk areas. Define areas of both greatest current and future vulnerability to flooding with the intent of reducing vulnerability in high-risk areas and transition to long-term cost-effective measures that emphasize natural flood protection systems.

14. Adopt NYS Sea Level Rise (SLR) projections as guideline measures from which to base strategies for addressing climate change and the affects of flooding on land use. Incorporate climate change and increased vulnerability to flooding into local emergency management planning.