



Delaware Water Gap National Recreation Area and Upper Delaware Scenic and Recreational River

Weather of 2008

Natural Resource Data Series NPS/ERMN/NRDS—2010/079



ON THE COVER

Photo description. Sunset over West Branch of the Delaware River near Shehawken Creek.

Photograph by: Caleb Tzilkowski.

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Natural Resource Data Series NPS/ERMN/NRDS—2010/079

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The National Park Service, Natural Resource Program Center publishes a range of reports that address natural resource topics of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Data Series is intended for timely release of basic data sets and data summaries. Care has been taken to assure accuracy of raw data values, but a thorough analysis and interpretation of the data has not been completed. Consequently, the initial analyses of data in this report are provisional and subject to change.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner. This report received informal peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data. Data in this report were collected and analyzed using methods based on established, peer-reviewed protocols and were analyzed and interpreted within the guidelines of the protocols.

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List of Key Acronyms

COOP	National Weather Service Cooperative Observer Program
CWOP	Citizen Weather Observer Program
DEWA	Delaware Water Gap National Recreational Area
FAA	Federal Aviation Administration
IFLOWS	Integrated Flood Observing and Warning System
NADP	National Atmospheric Deposition Program
NARR	North American Regional Reanalysis
NCDC	National Climatic Data Center
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
NRA	National Recreation Area
PDSI	Palmer Drought Severity Index
PRISM	Parameter-elevation Regressions on Independent Slopes Model
RAWS	Remote Automated Weather Stations
SRR	Scenic and Recreational River
UPDE	Upper Delaware Scenic and Recreational River
USDM	United States Drought Monitor
USGS	United States Geological Survey

2008 Climate Summary

The winter of calendar year 2008 was seasonably mild, averaging more than 2°F (1.2°C) above normal. The spring also had above-normal temperatures. The summer of 2008 was a bit warmer than average, but the autumn turned cooler than the long-term mean. A wet winter was followed by a dry spring, a moist summer, and a wet autumn. In fact, it was the wettest winter in both Pennsylvania Climate Division 1 and New York Climate Division 2 since records began in 1895. The wettest periods were during the first week of March and the second week of December. The snowiest month was February, though an unseasonably early snowstorm occurred on October 28, damaging some trees still in leaf. The most active thunderstorms occurred in mid-June, late July, and mid-August. The region felt the effects of Tropical Storm Hanna on September 6–7 with heavy rain and the indirect effects of Hurricane Kyle with more rain on September 28.

Long-term Trends

The calendar year averaged slightly above the long-term mean for temperature, though it was not as warm as earlier years in this decade. There were an average number of hot days (maximum temperatures above 90°F/32°C) during the summer (Table 1). The lengthening of the growing season noted a reversal in 2008 as a late freeze occurred in May and an early freeze was noted in the first week of October. The trend toward milder winter nights also had a setback in 2008 as an early January and late February cold snap produced several near 0°F (-17.8°C) mornings. Cold days (maximums below 32°F/0°C) also increased from previous years. The significant increase in autumn rainfall was evident with a very wet December. The fall season has shown the most significant rise in precipitation during the last century. While rainfall was above average for the year, the number of excessively wet days was also above normal. Dry spell occurrences were peppered around the winter and the late summer.

Table 1. Summary of 2008 climate indicators for Delaware Water Gap National Recreation Area and Upper Delaware Scenic and Recreational River. Summary statistics for 2008 from Matamoras (MATP1) and Hawley (HAWP1), PA compared to the 30 year normal from Wilkes-Barre (KAVP), PA.

Indicator	2008 Statistics	Comments on Trends
Average Annual Maximum Temperature	57.9–60.0°F 14.4–15.6°C	Near the 30-year mean of 59.3°F 15.2°C
Average Annual Minimum Temperature	35.2–37.1°F 1.8–2.8°C	Below the 30-year mean of 40.4°F 4.7°C
Hot Days (days with Tmax≥90°F/32°C)	6–7	Near the 30-year mean of 7.4 days
Cold Days (days with Tmax≤32°F/0°C)	29–39	Near the 30-year mean of 39.1 days
Winter Minimum (lowest temperature)	-2.0°F -18.9°C	Above the 30-year mean of -21.0°F -29.4°C
Sub-freezing Nights (days with Tmin≤32°F/0°C)	162–172	Above the long-term average of 123.9 days
Cold Winter Nights (days with Tmin≤0°F/-17.8°C)	0–2	Below the long term average of 3.5 days
Growing Season Length (days between last spring 32°F/0°C and first fall 32°F/0°C)	137–150 days	Below the 30-year mean of 166 days
Annual Precipitation	49.1–50.6 in 1247–1285 mm	Above the 30-year mean of 37.6 in 193 mm
Moderate Rain (days with ≥1.0 in (25 mm) rain)	12–14	Above the 30-year mean of 6.9 days
Annual Snowfall	24–35 in 61–89 cm	Below the 30-year mean of 47 in 119 cm

Introduction

Weather and climate are widely recognized as key drivers of terrestrial and aquatic ecosystems, affecting biotic as well as abiotic ecosystem characteristics and processes. Global and regional scale climatic patterns, trends, and variations are critical to the cycling of elements, nutrients, and minerals through the ecosystems and can deliver pollutants from regional and even global sources (National Assessment Synthesis Team 2001). These variations and trends influence the fundamental properties of ecologic systems such as soil-water relationships and plant-soil processes and their disturbance rates and intensity. Information obtained from meteorological monitoring will be useful to interpreting and understanding changes in species composition, community structure, water and soil chemistry, and related landscape processes (Marshall and Piekielek 2007).

The purpose of this report is to provide a concise weather and climate summary for the period from January 1 through December 31, 2008 and to place current patterns and trends in an appropriate historical and regional context (Knight et al., in preparation). It is our intention that this report will satisfy an inherent interest in meteorological phenomena and meet the Eastern Rivers and Mountains Network (ERMN) Weather and Climate Monitoring objectives:

- Document long-term trends in weather and climate through seasonal and annual summaries of selected parameters (e.g., multiple forms of precipitation, temperature).
- Identify and document extremes and averages of climatic conditions for common parameters (e.g., precipitation, air temperature) and other parameters where sufficient data are available (e.g., wind speed and direction, solar radiation).
- Provide information on near real-time weather parameters, historical climate patterns, and climate station metadata from a single, easy-to-use Internet portal.

To accomplish these objectives, a variety of atmospheric data streams were evaluated for their quality, longevity, and applicability to the ERMN parks. Since no single weather observing network contains all the pertinent measures of atmospheric phenomena to assess ecosystem health, an objective analysis of the data networks was developed and outlined in the Weather and Climate Monitoring Protocol for the Eastern Rivers and Mountains Network and Mid-Atlantic Network of the National Park Service (Knight et al., in preparation). Through this analysis, a select number of weather/climate observing stations were chosen as representative of each park, and these are the primary data sources used to profile climate summary and trends.

In addition to a suite of summary tables, graphs, and narratives, we specifically identify a series of key climatological indicators to report status and trends on an annual basis and periodically in separate and more thorough reports. These key indicators are further described in the protocol (Knight et al., in preparation) and summarized in the body of this report.

Climate of the Pocono Mountains and Eastern Plateau

Delaware Water Gap National Recreation Area lies in Pennsylvania Climate Division 1 “Pocono Mountains” and New Jersey Climate Division 1 “Northern NJ,” while Upper Delaware Scenic and Recreational River lies within the Pennsylvania Climate Division 1 and New York Climate Division 2 “Eastern Plateau.” A climate division is a region that is reasonably homogenous with respect to climatic and hydrologic characteristics and is frequently used for compiling climate statistics (<http://www.esrl.noaa.gov/psd/data/usclimate/map.html>). Pennsylvania and New York are each divided into 10 climate divisions; New Jersey has three divisions.

The three climate divisions encompassing Delaware Water Gap NRA and Upper Delaware SRR are generally considered to have a humid, continental type of climate, but the varied physiographic features have a marked effect on the weather and climate of the various parts of the Delaware River valley. The prevailing westerly winds carry most of the weather disturbances that affect the region from the interior of the continent, so that the Atlantic Ocean has limited influence on the climate of the area (Davey et al. 2006). Coastal storms do, at times, affect the day-to-day weather, especially in the winter. Also, storms of tropical origin can have the greatest effect within this portion of the Pennsylvania–New Jersey–New York region, causing severe floods in some instances.

Temperatures are moderately continental, with the tempering effects of the Great Lakes contributing to cloud production in the winter and onshore winds reducing the heat at times during the summer. The lowest readings in the winter occur with polar air masses of Canadian origin settling over the Northeast after a fresh snowfall. The highest readings of the summer happen when the sub-tropical fair weather system, the Bermuda high, pushes westward into the Carolinas. Its clockwise circulation will direct hot, humid air from the Gulf region into the Delaware River valley. The southwest winds gain additional warmth when descending the crest of the Appalachians.

Precipitation is fairly evenly distributed throughout the year. Annual amounts generally range between 34–52 in (864–1320 mm), while the majority of places receive 38–46 in (965–1168 mm). Greatest amounts usually occur in the late-spring and summer months, while February is the driest month, having about 2.0 in (51 mm) less than the wettest months. Precipitation tends to be somewhat greater in the mountains, due primarily to coastal storms which occasionally frequent the area. During the warm season these storms can bring heavy rain, while in winter heavy snow or a mixture of rain, ice, and snow may be produced.

Surface winds blow from the west and northwest in the cold season and from the southwest during the warm half of the year. Thunderstorms follow a frequency that matches the solar cycle, occurring between the equinoxes and reaching a peak near the summer solstice. Hail is relatively infrequent, but flash floods and damaging thunderstorm winds affect parts of the river valley each summer. On average, tornadoes pass through the area about once every three years. The direct effects of an Atlantic hurricane are uncommon, though remnant rains from hurricanes and tropical storms have contributed to the region’s worst floods. Ice storms, which can cause significant disruption, occur at irregular intervals and are primarily confined to the months between December and March (Kocin and Uccellini 2004).

Observing Stations

A total of 24 weather observing stations comprised of six observing networks were selected around Delaware Water Gap NRA and Upper Delaware SRR (Figure 1). Representative stations within a 100-km range of each park were chosen based on several criteria which include proximity to the park, the representativeness of the station to the park elevation profile, the type and frequency of observations, the period of record of the data, and data availability (Knight et al., in preparation). A subset of these observing networks (IFLOWS, GOES, NADP, and CWOP; 11 total weather stations) are not yet utilized for these reports due to limited data availability and/or lack of data quality assurance (Bureau of Land Management 1997). Moreover, the percentage of time a station reports particular parameters (e.g., temperature) can influence its data inclusion. Four stations were excluded in 2008 due to this criterion. Therefore, a total of nine stations were used for this report (Table 2).

In addition to the summary information available in this report, a near real-time data stream has been made available to the ERMN through a Web interface for the selected stations along with monthly, seasonal, and annual summaries. The Web interface is accessible through the following link: http://climate.met.psu.edu/gmaps/NPS_DEVELOPMENT/interface.php.

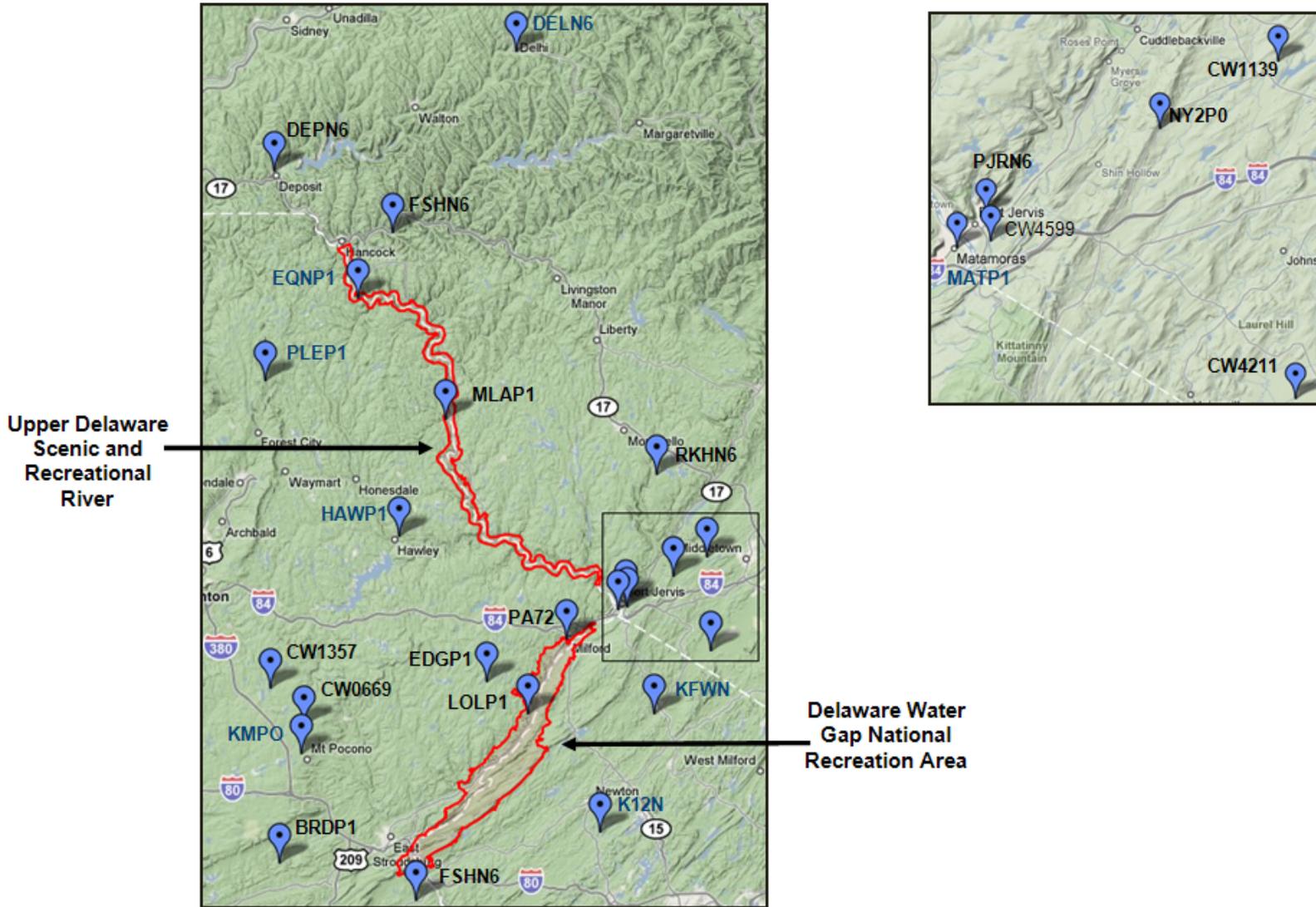


Figure 1. Location of weather observing stations around Delaware Water Gap National Recreation Area and Upper Delaware Scenic and Recreational River.

Table 2. List of weather observing stations around Delaware Water Gap Recreation Area and Upper Delaware Scenic and Recreational River. Those in bold have been selected as best representative of the parks in 2008.

Station	Observing Network	Station Name	Period of Record (POR)		Percentage of Time Reporting Temperature for 2008	Percentage of Time Reporting Precipitation for 2008	Percentage of Time Reporting Temperature for entire POR	Percentage of Time Reporting Precipitation for entire POR
MATP1	COOP	Matamoras	10/01/1904	Present	100.0	100.0	39.4	93.7
DELN6	COOP	Delhi 2 SE	01/01/2006	Present	100.0	99.2	99.5	98.8
DEPN6	COOP	Deposit	01/01/2006	Present	82.7	91.5	80.9	86.3
EQNP1	COOP	Equinunk 2	03/01/1957	Present	-	100.0	-	97.6
HAWP1	COOP	Hawley 1 E	11/01/1897	Present	100.0	99.2	73.3	79.3
MLAP1	COOP	Milanville	08/01/1945	Present	8.2	8.2	19.9	39.6
PJRN6	COOP	Port Jervis	01/01/2006	Present	56.0	56.0	76.1	75.5
PLEP1	COOP	Pleasant Mount 1 W	10/01/1924	Present	99.7	99.7	66.2	97.1
RKHN6	COOP	Rock Hill 3 SW	11/14/2006	Present	8.5	82.5	27.1	91.9
K12N	FAA	Andover	01/01/2000	Present	98.1	98.1	72.0	72.1
KMPO	FAA	Mount Pocono	01/01/1999	Present	96.2	96.2	91.4	91.6
KFWN	FAA	Sussex Airport	01/01/2000	Present	99.5	99.5	89.2	89.2
LOLP1	RAWS	Loch Lomond	01/01/2005	Present	98.9	98.9	88.4	88.4

Temperature Summary

Calendar year 2008 averaged above the long-term mean temperature (Table 3), though it was not as warm as earlier years in this decade. The first four months of 2008 were milder than usual, with January and April exhibiting the largest departures (Tables 4 and 5; Figures 2 and 3). The maps in Figures 2 and 3 were created using estimates from the Parameter-elevation Regressions on Independent Slopes Model (PRISM). PRISM uses an interpolation scheme for temperature between actual observations and corrects these estimates for changes in topography across the region (Daly et al. 2002). More information can be found at <http://www.prism.oregonstate.edu/>.

Pleasant Mount, PA, which is near Upper Delaware SRR, had an average monthly temperature of 24.5 degrees Fahrenheit (°F) (4.1 degrees Celsius [°C]) for January. This was 5.7°F (3.1°C) above the average (Tables 4 and 5). Several cold episodes brought morning readings to near and below 0°F (-17.8°C) during January and February and, oddly, the lowest values in many sections were measured on Leap Day (February 29, 2008). The number of sub-freezing nights was well above the mean (Table 3).

The spring had alternating warmth and chill with the period April–May–June averaging above the long-term mean. For example, the Pennsylvania Climate Division 1 “Pocono Mountains,” which encompasses most of Delaware Water Gap NRA and Upper Delaware SRR, ranked as the 35th warmest (57 is the average; Table 6). However, Delaware Water Gap NRA also resides in New Jersey Climate Division 1 “Northern NJ,” which ranked as the 8th warmest spring since 1895 (Table 7). Several outbreaks of unseasonably cold weather during May brought most sections a late freeze and frost (between May 19–22 and again May 28). Temperatures during May had the largest negative departures with readings between 0.6 and 5.7°F (0.3 and 3.2°C) below normal (Table 5). The highest readings of the year came early when temperatures rose well into the 80s to near 90°F (32°C) between June 7 and June 10. This warm period ended with heavy thunderstorms, some producing hail.

The summer period was warmer than average due to higher-than-normal minimum readings (Figure 3). No record maximums were recorded during July, August, and September. A warm spell occurred from July 16–21 and again from September 2–5 preceding Tropical Storm Hannah. Regular rainfall led to only a few dry spells, though the latter part of August turned quite dry.

Autumn temperatures were near to below average (Tables 4 and 5; Figures 2 and 3). Frosts and freezes occurred earlier than in recent years, with most sections noticing sub-freezing readings (<0°C) between October 3–8. Maximum temperatures during November were closer to normal and December brought milder weather with alternating cold and warm spells. A cold snap late in the month did bring some minimums near 0°F (-17.8°C).

Overall, the annual temperature for 2008 averaged above normal. Soil temperatures for the year also fit into a similar trend. These values have been on the rise during the past 30 years, which is consistent with the warming trend noted in the lower atmosphere during the past three decades (Figure 4). The total growing season length (days between last spring freeze and first fall freeze) ranged from 150–137 days in 2008.

Delaware Water Gap National Recreation Area and
Upper Delaware Scenic and Recreational River
Departure from Average Monthly Maximum Temperature
2008 vs. 1971–2000

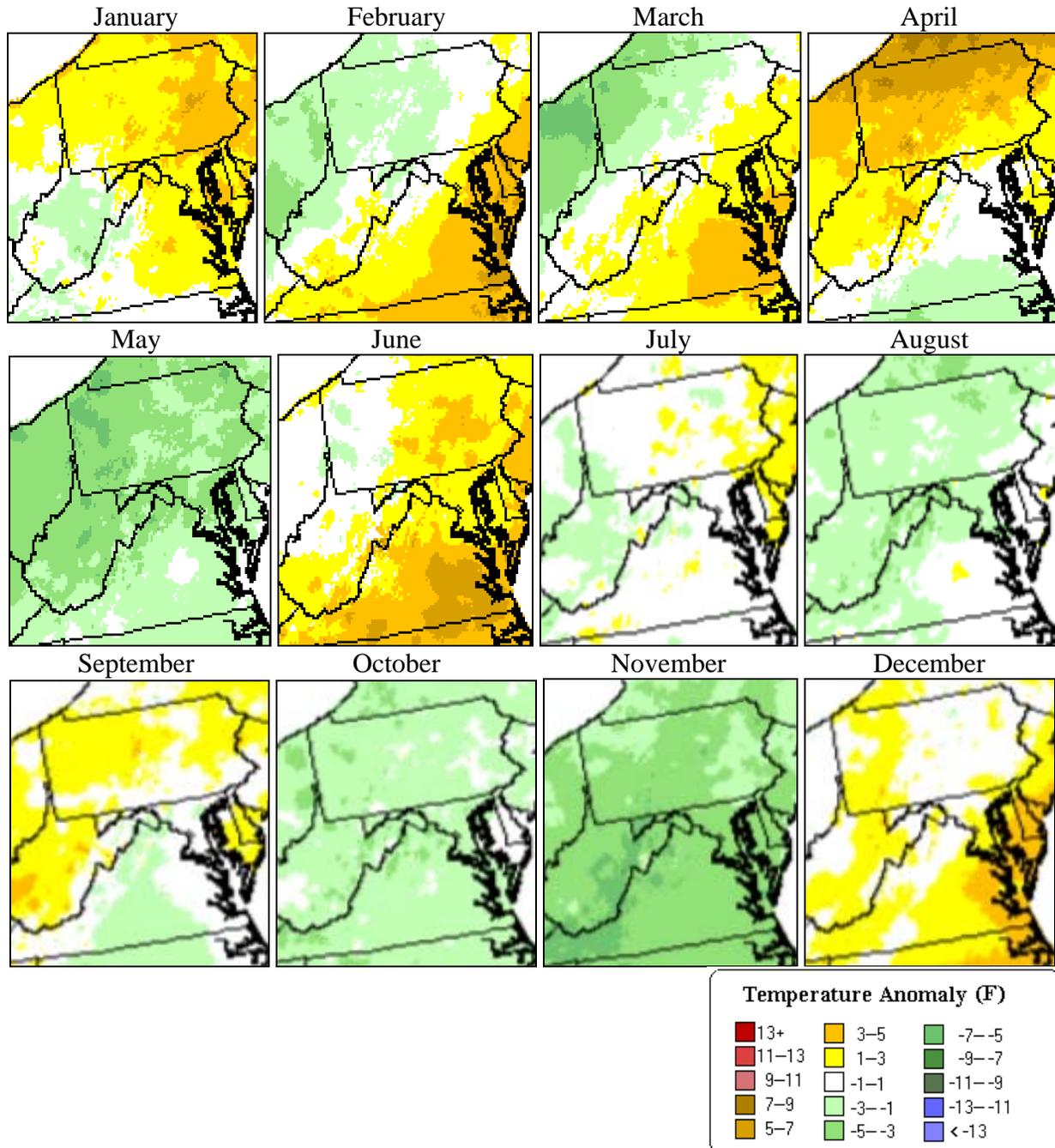


Figure 2. Maps showing departure from average monthly maximum temperature (°F) compared to the 30-year normal (1971–2000).

Delaware Water Gap National Recreation Area and
Upper Delaware Scenic and Recreational River
Departure from Average Monthly Minimum Temperature
2008 vs. 1971–2000

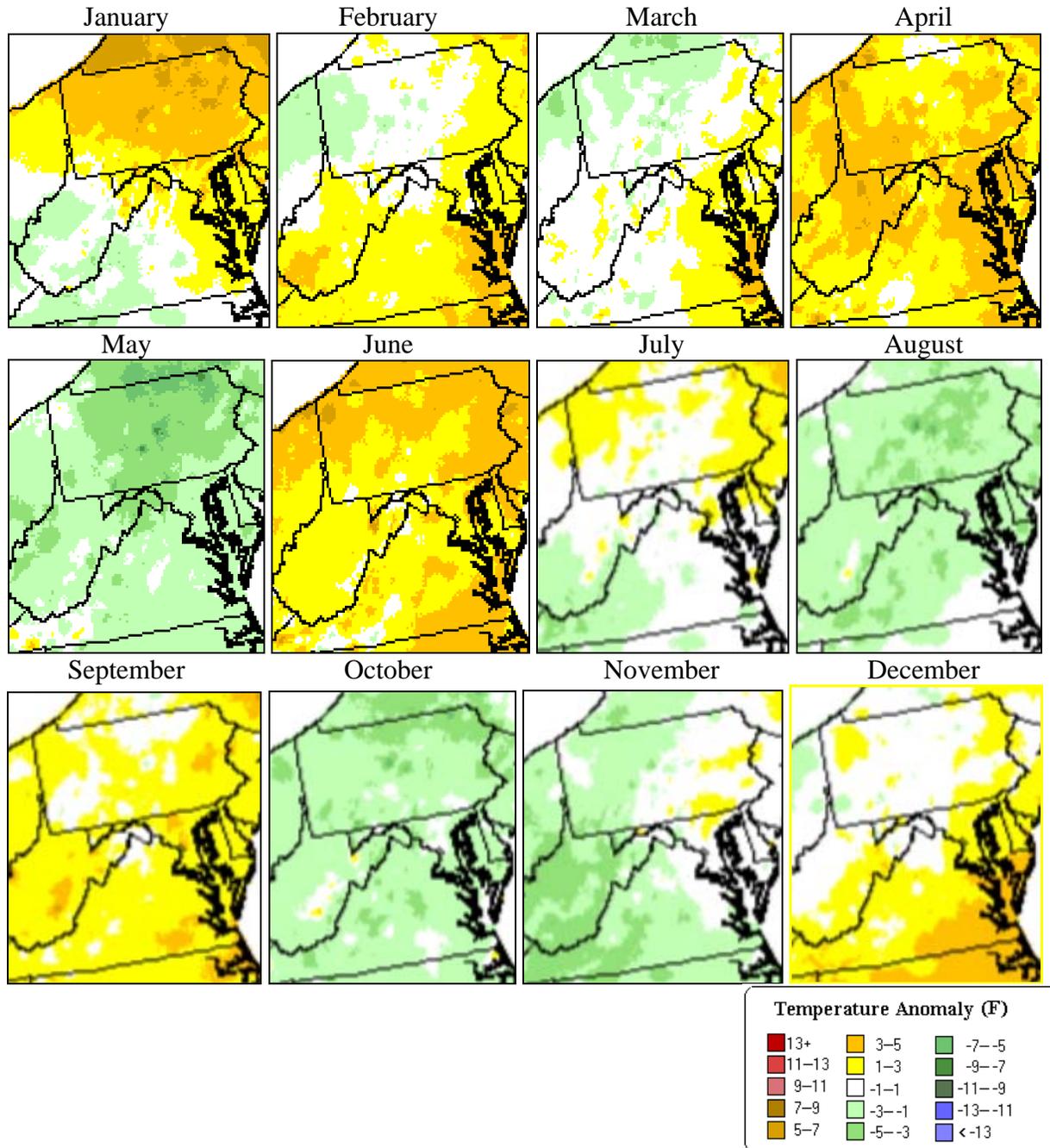


Figure 3. Maps showing departure from average monthly minimum temperature (°F) compared to the 30-year normal (1971–2000).

Table 3. Status of 2008 temperature indicators using the Matamoras and Hawley, PA stations compared the 30-year normal at Wilkes-Barre, PA.

Indicator	Matamoras, PA MATP1 2008	Hawley, PA HAWP1 2008	Wilkes-Barre, PA KAVP 1971–2000
Average Annual Maximum Temperature	60.0°F 15.6°C	57.9°F 14.4°C	59.3°F 15.2°C
Average Annual Minimum Temperature	37.1°F 2.8°C	35.2°F 1.8°C	40.4°F 4.7°C
Cold Days (days with Tmax≤32°F/0°F)	29	39	39.1
Sub-freezing Nights (days with Tmin≤32°F/0°C)	162	172	123.9
Winter Minimum (lowest temperature)	2.0°F -16.7°C	-2.0°F -18.9°C	-21.0°F -29.4°C
Summer Maximum (highest temperature)	94.0°F 34.4°C	91.0°F 32.8°C	Not Available
Cold Winter Nights (days with Tmin≤0°F/-17.8°C)	0	2	3.5
Hot Days (days with Tmax≥90°F/32°C)	7	6	7.4
Growing Season Length (days between last spring 32°F/0°C and first fall 32°F/0°C)	150	137	166

Table 4. Summary of monthly average temperatures for 2008 for the selected stations.

Station Location	ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Delhi, NY	DELN6	-4.6°C	-4.8°C	-1.4°C	8.0°C	9.6°C	18.1°C	20.2°C	17.6°C	16.1°C	6.5°C	2.1°C	-2.1°C	7.1°C
		23.7°F	23.4°F	29.5°F	46.4°F	49.2°F	64.5°F	68.4°F	63.8°F	61.0°F	43.7°F	35.8°F	28.2°F	44.8°F
Hawley, PA	HAWP1	-3.2°C	-3.79°C	0.7°C	8.9°C	10.5°C	19.3°C	21.0°C	18.1°C	16.3°C	7.9°C	2.7°C	-1.8°C	8.1°C
		26.2°F	25.2°F	33.2°F	48.1°F	50.8°F	66.7°F	69.9°F	64.6°F	61.4°F	46.3°F	36.8°F	28.8°F	46.5°F
Pleasant Mount, PA	PLEP1	-4.1°C	-5.3°C	-1.6°C	7.9°C	9.6°C	18.5°C	19.9°C	17.1°C	15.3°C	6.7°C	1.5°C	-3.4 ^a °C	6.9°C
		24.5°F	22.5°F	29.1°F	46.2°F	49.4°F	65.2°F	67.8°F	62.8°F	59.6°F	44.1°F	34.8°F	25.9 ^a °F	44.3°F
Andover, NJ	K12N	0.6°C	0.5°C	5.1 ^b °C	12.7°C	14.3°C	22.3°C	24.0 ^d °C	20.5°C	18.7°C	10.2°C	6.0°C	1.7°C	11.4°C
		33.1°F	32.8°F	41.1 ^b °F	54.9°F	57.8°F	72.1°F	75.1°F	68.9°F	65.7°F	50.3°F	42.7°F	35.0°F	52.5°F
Mount Pocono, PA	KMPO	-3.0°C	-3.8°C	0.2°C	8.7°C	11.0°C	18.8°C	20.3 ^b °C	17.4°C	16.0°C	7.5°C	-0.7 ^d °C	-2.5°C	7.5°C
		26.6°F	25.1°F	32.4°F	47.7°F	51.7°F	65.9°F	68.6 ^b °F	63.3°F	60.8°F	45.5°F	30.7 ^d °F	27.6°F	45.5°F
Sussex, NJ	KFWN	-0.7°C	-1.6°C	3.0°C	11.0°C	13.2°C	21.0°C	22.9°C	19.6°C	17.6°C	9.2°C	4.63°C	-0.1°C	10.0°C
		30.8°F	29.2°F	37.4°F	51.8°F	55.7°F	69.7°F	73.1°F	67.2°F	63.7°F	48.5°F	40.3°F	31.8°F	49.9°F

^a1 day missing; ^b2 days missing; ^c3 days missing; ^d4 days missing
 Monthly statistics not reported if more than 4 days are missing.

Table 5. Summary of 2008 departure from normal temperature based on 30-year normal (1971–2000) for the selected stations.

Station Location	ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Delhi, NY	DELN6	1.5°C	0.2°C	-1.7°C	1.6°C	-3.2°C	0.8°C	0.7°C	-1.1°C	1.7°C	-1.8°C	-0.8°C	1.0°C
		2.8°F	0.3°F	-3.1°F	2.9°F	-5.7°F	1.4°F	1.3°F	-1.9°F	3.1°F	-3.2°F	-1.4°F	1.8°F
Hawley, PA	HAWP1	1.7°C	0.02°C	-0.8°C	1.6°C	-2.9°C	1.5°C	0.8°C	-1.2°C	1.3°C	-1.1°C	-1.0°C	0.2°C
		3.0°F	0.03°F	-1.4°F	2.8°F	-5.2°F	2.7°F	1.4°F	-2.2°F	2.3°F	-2.0°F	-1.8°F	0.4°F
Pleasant Mount, PA	PLEP1	3.1°C	0.9°C	-0.4°C	2.6°C	-1.9°C	2.3°C	1.3°C	-0.4°C	2.3°C	-0.3°C	0.1°C	1.0°C
		5.7°F	1.6°F	-0.7°F	4.7°F	-3.5°F	4.1°F	2.4°F	-0.7°F	4.2°F	-0.5°F	0.1°F	1.9°F
Andover, NJ	K12N	4.5°C	3.04°C	0.1°C	3.9°C	-0.3°C	2.9°C	2.1°C	-0.1°C	2.6°C	-0.5°C	0.04°C	2.7°C
		8.2°F	5.5°F	0.1°F	7.1°F	-0.6°F	5.3°F	3.8°F	-0.2°F	4.6°F	-0.9°F	0.1°F	4.8°F
Mount Pocono, PA	KMPO	2.9°C	1.2°C	0.1°C	2.4°C	-1.3°C	2.0°C	1.0°C	-0.9°C	2.1°C	-0.6°C	-3.2°C	0.6°C
		5.2°F	2.1°F	0.2°F	4.4°F	-2.3°F	3.7°F	1.8°F	-1.7°F	3.7°F	-1.1°F	-5.8°F	0.98°F
Sussex, NJ	KFWN	3.6°C	1.2°C	0.4°C	2.4°C	-1.3°C	1.9°C	1.0°C	-1.1°C	1.5°C	-0.7°C	0.2°C	1.0°C
		6.4°F	2.1°F	0.6°F	4.3°F	-2.3°F	3.4°F	1.9°F	-2.0°F	2.6°F	-1.2°F	0.4°F	1.9°F

Table 6. Seasonal temperature and precipitation rankings over 114 years for Pennsylvania Climate Division 1.

PA Climate Division 1 Rankings "Pocono Mountains"	Jan–Feb–Mar WINTER	Apr–May–Jun SPRING	Jul–Aug–Sep SUMMER	Oct–Nov–Dec AUTUMN
Temperature-2008	22	35	33	60
Precipitation-2008	1	72	45	23

1 = Warmest or Wettest 114 = Coldest or Driest

Table 7. Seasonal temperature and precipitation rankings over 114 years for New Jersey Climate Division 1.

NJ Climate Division 1 Rankings "Eastern"	Jan–Feb–Mar WINTER	Apr–May–Jun SPRING	Jul–Aug–Sep SUMMER	Oct–Nov–Dec AUTUMN
Temperature-2008	10	8	10	42
Precipitation-2008	14	70	47	25

1 = Warmest or Wettest 114 = Coldest or Driest

Table 8. Seasonal temperature and precipitation rankings over 114 years for New York Climate Division 2.

NY Climate Division 2 Rankings "Eastern Plateau"	Jan–Feb–Mar WINTER	Apr–May–Jun SPRING	Jul–Aug–Sep SUMMER	Oct–Nov–Dec AUTUMN
Temperature-2008	29	25	69	65
Precipitation-2008	1	74	14	19

1 = Warmest or Wettest 114 = Coldest or Driest

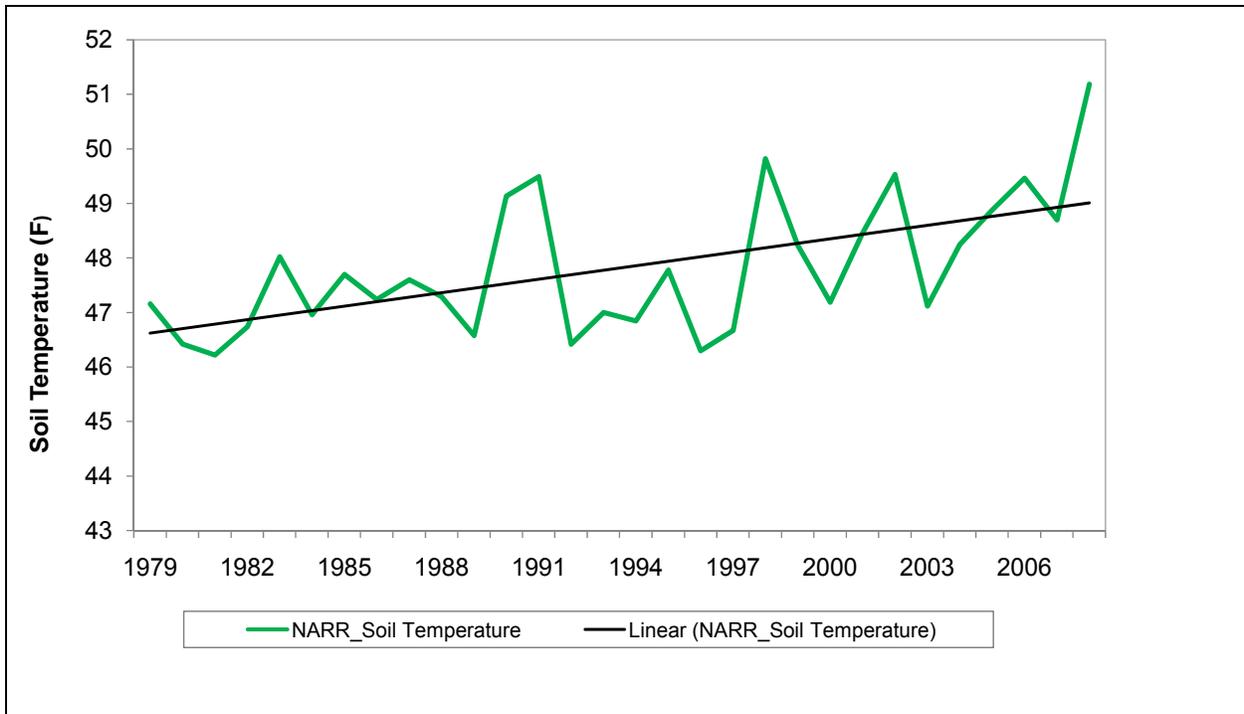


Figure 4. Annual soil temperature trends for Delaware Water Gap National Recreation Area and Upper Delaware Scenic and Recreational River. The black line is the soil temperature trend for a 32-km square box centered within Delaware Water Gap National Recreation Area as derived from the North American Regional Reanalysis (NARR). The steady rise is consistent with the warming trend noted in the atmospheric temperatures during the past 30 years.

Growing Degree Days

The derived quantity, growing degree days – base 55°F (12.8°C), is shown for its accumulation and long-term trend during several important intervals of the annual growing season. The accumulation of growing degree days is directly related to the phenological cycle of the flora and fauna and its related pests and diseases. Trends in the growing degree days can signal changes in the exposure of the region’s fauna to native and invasive pests. For the Delaware Water Gap National Recreation Area and the Upper Delaware Scenic and Recreational River, a slight decrease is noted for the ‘spring’ period (Figures 5 and 6) perhaps related to a little cooling during these months in recent decades. However, a warming trend during the summers has more than compensated for the decline earlier in the growing season (Figure 7). Data in Figures 5–7 are from the Pleasant Mount 1 W (PLEP1) COOP station.

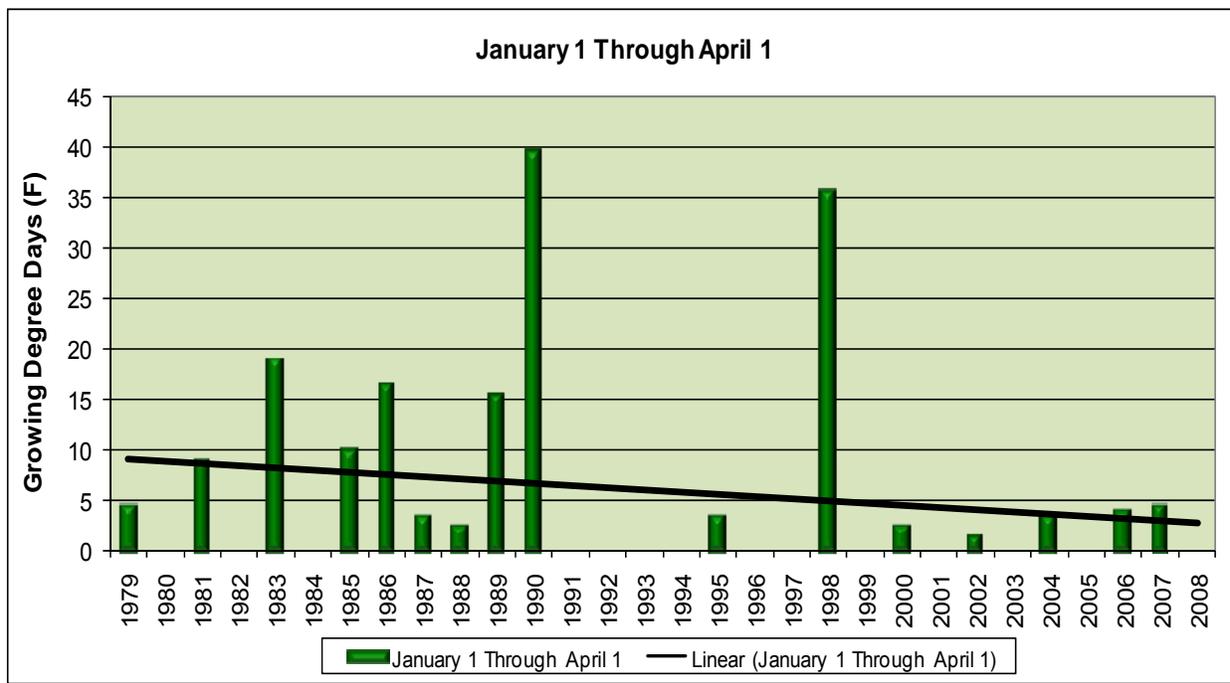


Figure 5. Trend in growing degree day accumulation (90 days) for Delaware Water Gap National Recreation Area and Upper Delaware Scenic and Recreational River, 1979–2008. There is no clear indication of a progressively earlier start to the growing season.

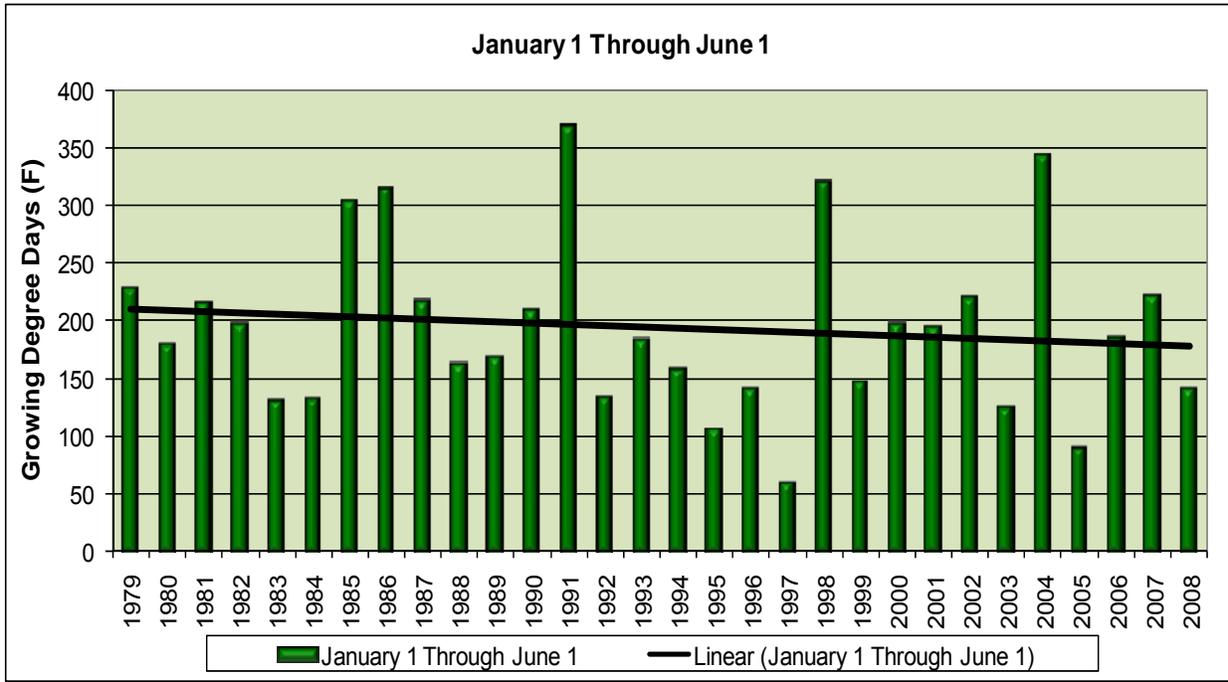


Figure 6. Trend in growing degree day accumulation (150 days) for Delaware Water Gap National Recreation Area and Upper Delaware Scenic and Recreational River, 1979–2008. There is slight downward trend during the last 30 years with a decrease of approximately 10%.

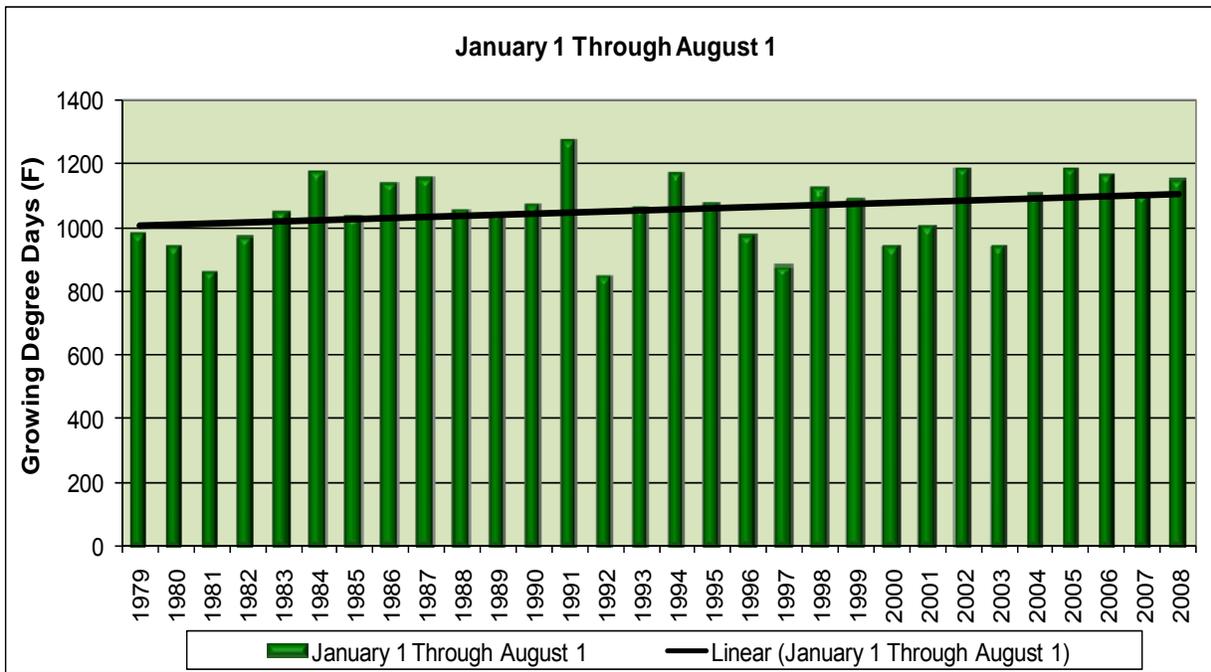


Figure 7. Trend in growing degree day accumulation (215 days) for Upper Delaware Scenic and Recreational River and Delaware Water Gap National Recreation Area 1979–2008. There is a small increase, approximately 10%, during the last 30 years which more than offsets the spring decrease seen in Figures 5 and 6.

Precipitation Summary

For the eighth consecutive year, annual precipitation for calendar year 2008 in the region averaged above the long-term mean (Table 9). In keeping with the trend of recent years, the majority of the wettest days occurred during the colder half of the year (Table 10). The months of February, March, September, October, and December averaged above-normal precipitation throughout the region (Table 11). Oddly, the highest accumulated liquid occurred in February and December. For example, Equinunk, PA, which is located near Upper Delaware SRR, accumulated 6.0 in (151 mm) during February and 4.9 in (125 mm) in December (Table 12). Dry spells were noted in August and September, which is typical, but also in January and April. Snowfall was well below normal due to a persistent wintertime storm track into the Great Lakes, which frequently brought mild, moist air into the region. The number of days with excessive rainfall (>1.0 in [25 mm]) were nearly double the long-term average for northeastern Pennsylvania (Table 9).

The winter was quite moist, though January only averaged approximately 70% of normal precipitation (Figure 8). February and March produced between 142–285% of the usual rain/snow fall (Table 10). The wettest period occurred during the first week of March (4–8) when many sections tallied more than 4.0 in (100 mm) of liquid equivalent which raised the monthly tally to near or above 6 in (150 mm) for most sections (Table 12).

Spring 2008 (April–May–June) was drier than normal with none of the months tallying above average rainfall (Figure 8). A 12-day dry spell was noted during the second half of April (Table 10). The most organized severe storms took place on June 10 as hail and high winds affected parts of the upper Delaware River valley.

The summer brought above-average rainfall with two contributions from tropical storms in September. Hannah brought heavy rain (between 1.0–2.0 in [25–50 mm]) on September 6 and the indirect effects of Hurricane Kyle deposited more rain (between 2.0–4.0 in [50–100 mm]) September 26–28. Despite these rainstorms, an 11-day dry spell occurred between these bouts of tropical moisture (Table 12).

The autumn was wetter than normal due to a moist October and December (Tables 6, 7, and 8). November was quite dry with most sections averaging less than 60% of the normal rainfall (Table 11). An unusually early heavy, wet snow fell on the higher elevations on October 28. A series of storms brought a wintry mixture to the region from December 10–24. Freezing rain glazed many sections just before Christmas. The above-average precipitation sustained the soil moisture, which remained slightly elevated compared with 30 years ago (Figure 9).

Upper Delaware Scenic and Recreational River and
 Delaware Water Gap National Recreation Area
 Percent of Average Monthly Precipitation
 2008 vs. 1971–2000

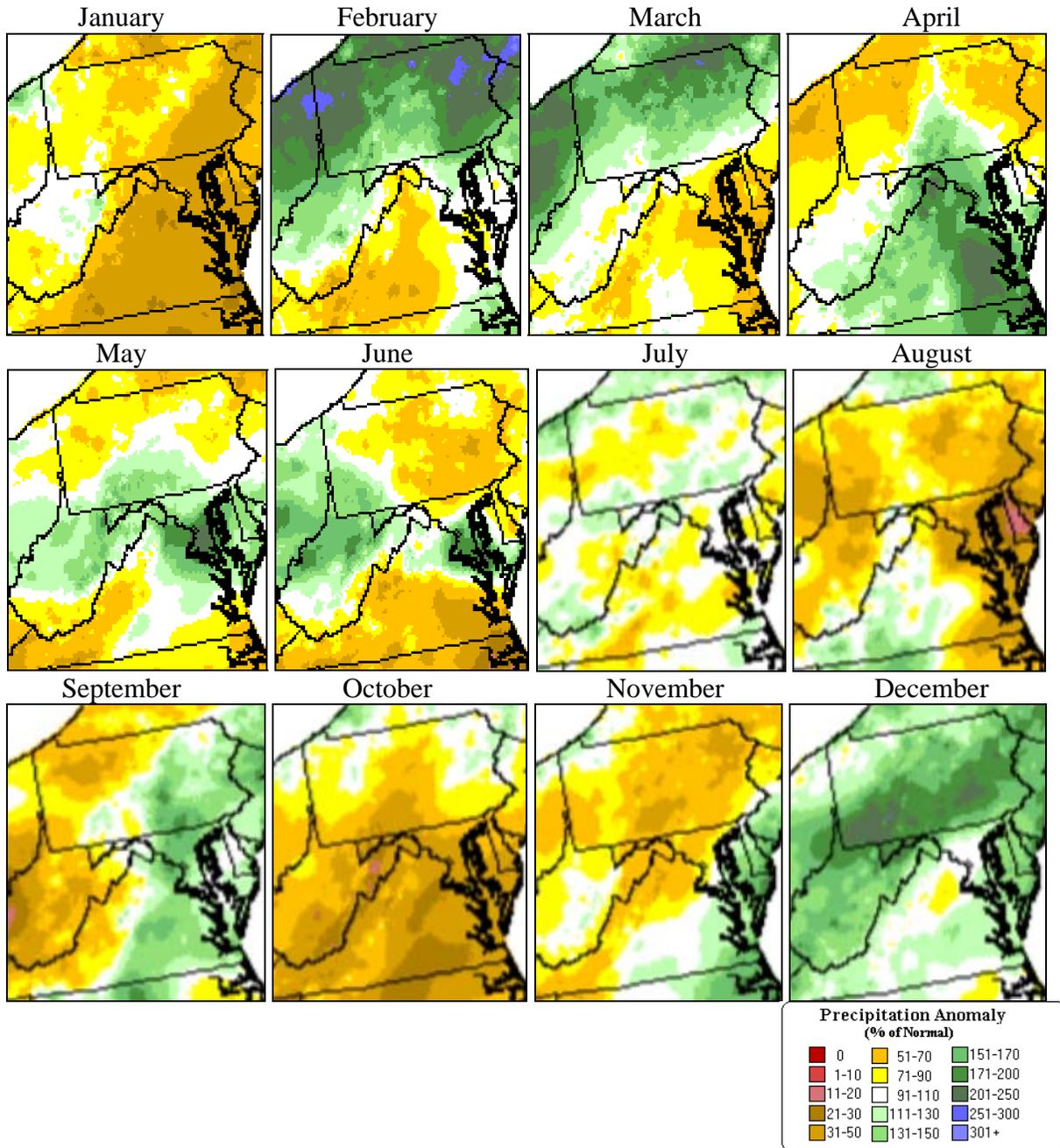


Figure 8. Maps showing percent of average monthly precipitation compared to the 30-year normal (1971–2000).

Table 9. Status of 2008 precipitation indicators using the Matamoras and Hawley, PA stations compared the 30-year normal at Wilkes-Barre, PA.

Precipitation Indicators	Matamoras, PA MATP1 2008	Hawley, PA HAWP1 2008	Wilkes-Barre, PA KAVP 1971–2000
Annual Precipitation	50.6 in 1285 mm	49.1 in 1247 mm	37.6 in 193 mm
Autumn (Oct, Nov, Dec) Precipitation	14.1 in 358 mm	12.1 in 307 mm	-
Annual Snowfall	35 in 89 mm	24 in 61 mm	47 in 119 mm
Micro-drought (strings of 7+ days without rain)	5	5	-
Moderate Rain (days with ≥ 1.0 in (25 mm) rain)	14	12	6.9
Heavy Rain (days with ≥ 2.0 in (51 mm) rain)	3	1	-
Snow (days with ≥ 0.1 in (0.3 cm) snow)	32	26	-

Table 10. Top four wettest days and top four dry spells (consecutive days with a trace or less of rainfall) during 2008.

Wettest Days in 2008	Dry Spells in 2008
Dec. 12: 2.7 in (69 mm)	Apr. 15–26
Jul. 14: 2.6 in (67 mm)	Jan. 19–29
Oct. 26: 2.2 in (56 mm)	Sept. 15–25
Mar. 5: 2.1 in (53 mm)	Aug 17–24

Table 11. Summary of 2008 percent of normal rainfall based on 30-year normal (1971–2000) for selected stations.

Station Location	ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Matamoras, PA	MATP1	42	270	166	81	71	65	114	43	126	148	61	208	116
Delhi, NY	DELN6	94	285	239	62	78	63	231	86	105	126	56	186	134
Hawley, PA	HAWP1	48	245	186	77	82	80	81	135	153	125	43	221	123
Pleasant Mount, PA	PLEP1	87	196	187	74	81	75	144	54	101	103	46	178	111
Equinunk, PA	EQNP1	81	215	185	70	75	104	154	73	111	122	50	142	115
Andover, NJ	K12N	35	241	155	57	92	57	76	41	146	114	67	170	99
Mount Pocono, PA	KMPO	40	147	142	49	68	75	73	60	143	111	34	134	89
Sussex, NJ	KFWN	21	224	147	55	66	46	72	94	122	95	53	124	90

Table 12. Summary of 2008 monthly total rainfall for selected stations.

Station Location	ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Matamoras, PA	MATP1	1.5 in	7.9 in	5.9 in	3.4 in	3.0 in	2.9 in	4.7 in	1.6 in	5.7 in	5.01 in	2.3 in	6.8 in	50.6 in
		37 mm	201 mm	150 mm	85 mm	76 mm	73 mm	120 mm	40 mm	145 mm	127 mm	57 mm	173 mm	1285 mm
Delhi, NY	DELN6	2.8 in	7.0 ^a in	8.2 in	2.4 in	3.4 in	2.8 in	8.9 in	2.9 in	4.2 in	4.7 in	2.2 in	5.7 ^a in	54.9 in
		70 mm	177 ^a mm	208 mm	61 mm	85 mm	71 mm	225 mm	72 mm	106 mm	119 mm	55 mm	145 ^a mm	1395 mm
Hawley, PA	HAWP1	1.5 in	6.6 in	5.8 in	2.9 in	3.3 in	3.4 in	2.9 in	4.7 in	5.8 in	3.9 in	1.6 in	6.6 in	49.1 in
		38 mm	169 mm	147 mm	74 mm	84 mm	86 mm	74 mm	120 mm	147 mm	99 mm	40 mm	167 mm	1246 mm
Pleasant Mount, PA	PLEP1	3.0 in	5.8 in	6.5 in	3.1 in	4.01 in	3.7 in	6.3 in	2.2 in	4.6 in	4.3 in	2.0 ^a in	6.3 in	51.7 in
		76 mm	147 mm	165 mm	79 mm	102 mm	93 mm	160 mm	57 mm	116 mm	109 mm	51 ^a mm	159 mm	1312 mm
Equinunk, PA	EQNP1	2.8 in	6.0 in	6.7 in	2.6 in	3.0 in	4.2 in	5.9 in	2.7 in	4.4 in	4.2 in	2.0 in	4.9 in	49.4 in
		70 mm	151 mm	171 mm	65 mm	77 mm	106 mm	149 mm	69 mm	112 mm	107 mm	52 mm	125 mm	1256 mm
Andover, NJ	K12N	1.2 in	6.8 in	5.8 ^b in	2.3 in	4.1 in	2.6 in	3.4 ^d in	1.8 in	6.5 in	4.1 in	2.5 in	5.7 in	44.8 in
		32 mm	172 mm	147 ^b mm	59 mm	103 mm	66 mm	85 ^d mm	47 mm	166 mm	104 mm	64 mm	144 mm	1138 mm
Mount Pocono, PA	KMPO	1.6 in	5.0 in	5.7 in	2.1 in	3.2 in	3.4 in	3.0 ^b in	2.4 in	7.1 in	4.2 in	1.4 ^d in	4.6 in	43.8 in
		41 mm	127 mm	146 mm	54 mm	82 mm	87 mm	76 ^b mm	61 mm	180 mm	105 mm	37 ^d mm	118 mm	1112 mm
Sussex, NJ	KFWN	0.8 in	6.9 in	5.6 in	2.4 in	3.0 in	2.1 in	3.0 ^b in	4.0 in	5.4 in	3.5 in	2.0 in	4.4 in	43.1 in
		21 mm	175 mm	143 mm	62 mm	75 mm	54 mm	77 ^b mm	102 mm	137 mm	90 mm	50 mm	111 mm	1095 mm

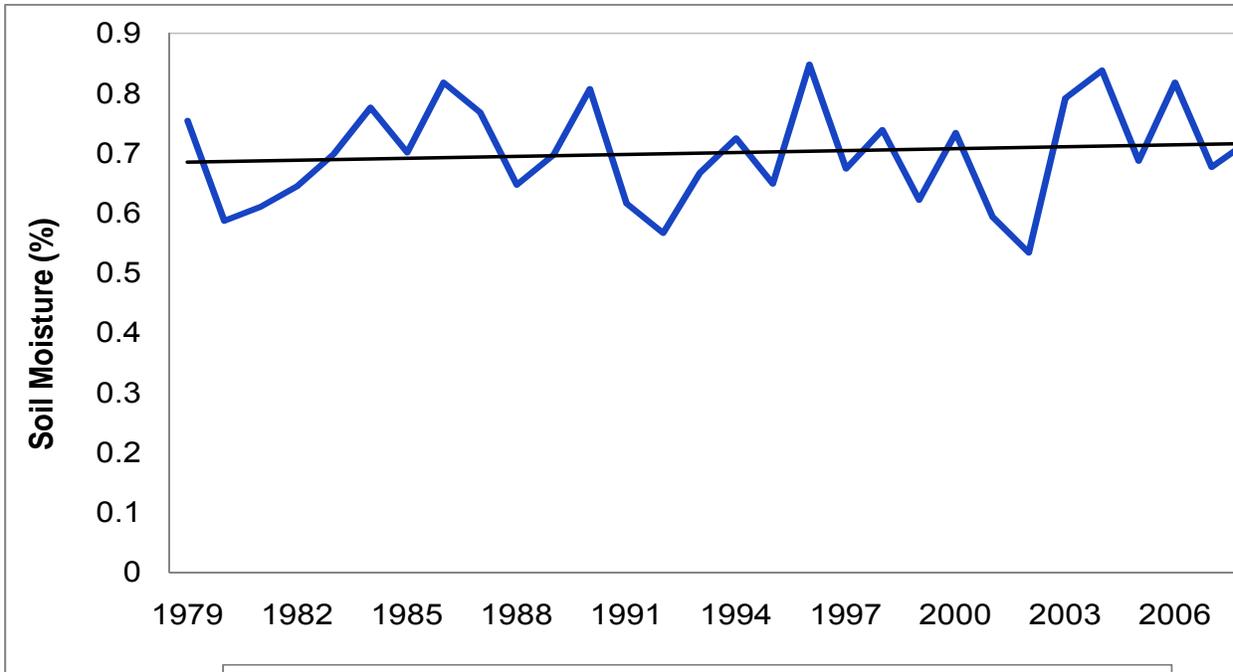


Figure 9. Annual soil moisture trends for Delaware Water Gap National Recreation Area and Upper Delaware Scenic and Recreational River. The black line is the soil moisture trend for a 32-km square box centered within Delaware Water Gap National Recreation Area as derived from the North American Regional Reanalysis (NARR). There has been only a slight upward trend in the soil moisture content during the last 30 years.

Drought Status

The U.S. Drought Monitor (USDM; <http://www.drought.unl.edu/dm/monitor.html>) tracks drought conditions across the nation on a weekly basis, and it incorporates data and expert input from a wide variety of state and federal agencies. The USDM is designed to represent a “broad brush,” regional perspective (e.g., summarized by climate division, state, or region) on drought, and therefore provides an ideal tool for tracking generalized drought conditions across the Delaware River valley parks and surrounding areas. One index used to track drought conditions, the Palmer Drought Severity Index (PDSI), uses temperature and rainfall information to determine dryness (the long-term average is “zero”). Since the PDSI responds to long-term effects, including evaporation, there is usually a lag between both long, dry spells and episodes of heavy rain and changes in the index value.

According to the USDM, there was no time during calendar year 2008 when it was drier than normal (Figures 10–12). In fact, despite some dry periods in April, August, and November, most of the time the region was abnormally moist ($> +2$). When compared with the past few years, 2008 was noticeably moister than 2007 and very similar to 2006.

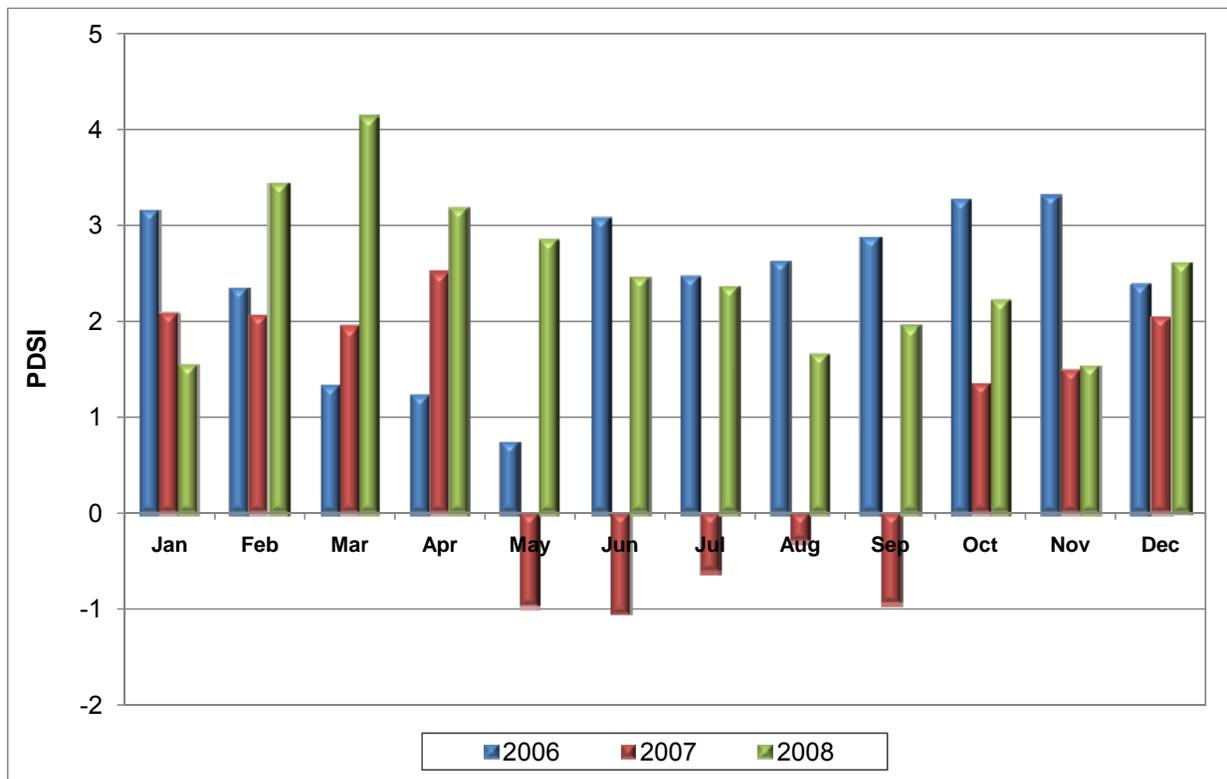


Figure 10. Palmer Drought Severity Index (PDSI) for Pennsylvania Climate Division 1, 2006–2008.

Drought Severity in Pennsylvania during 2008

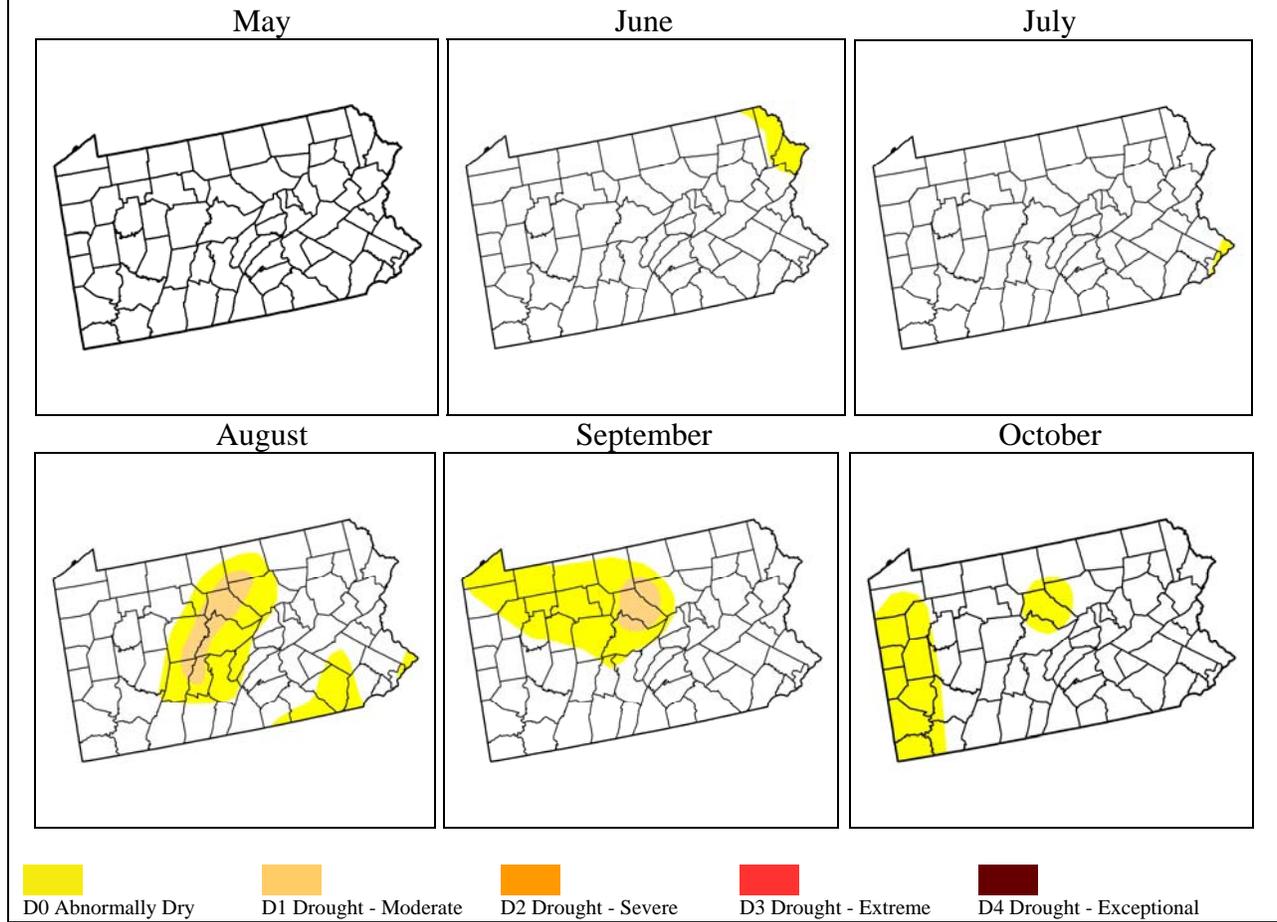


Figure 11. Mid-month values of the Palmer Drought Severity Index (PDSI) for Pennsylvania in 2008.

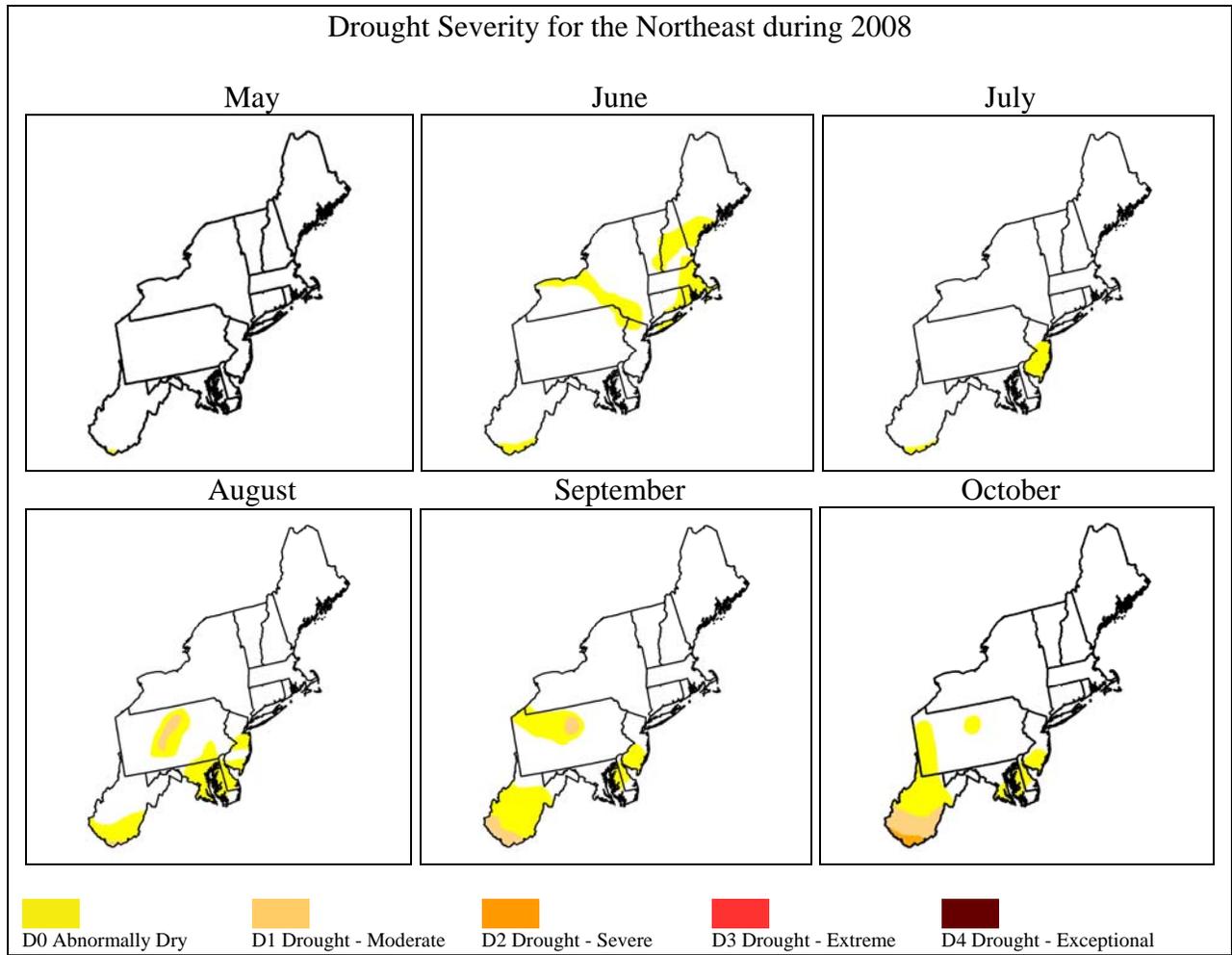


Figure 12. Mid-month values of the Palmer Drought Severity Index (PDSI) for the Northeast in 2008.

References

- Bureau of Land Management. 1997. Remote Automatic Weather Station (RAWS) and Remote Environmental Monitoring Systems (REMS) standards. RAWS/REMS Support Facility, Boise, Idaho.
- Daly, C., W. P. Gibson, G.H. Taylor, G. L. Johnson, and P. Pasteris. 2002. A knowledge-based approach to the statistical mapping of climate. *Climate Research* 22:99–113.
- Davey, C. A., K. T. Redmond, and D. B. Simeral. 2006. Weather and Climate Inventory. National Park Service. National Park Service, Eastern Rivers and Mountains Network. Natural Resource Technical Report NPS/ERMN/NRTR—2006/006. National Park Service, Fort Collins, CO.
- Knight, P., T. Wisniewski, C. Bahrmann, and S. Miller. In preparation. Weather and Climate Monitoring Protocol for the Eastern Rivers and Mountains and Mid-Atlantic Networks. Natural Resource Technical Report Series NPS/ERMN/NRR—2010/XXX. National Park Service, Fort Collins, Colorado.
- Kocin, P. J., and L. W. Uccellini. 2004. Northeast Snowstorms Volume 1: Overview. Meteorological Monographs. Vol 32. No 54. American Meteorological Society. Boston, MA.
- Marshall, M. R., and N. B. Piekielek. 2007. Eastern Rivers and Mountains Network Ecological Monitoring Plan. Natural Resource Report NPS/ERMN/NRR—2007/017. National Park Service. Fort Collins, CO.
- National Assessment Synthesis Team. 2001. Climate Change Impacts on United States: The Potential Consequences of Climate Variability and Change, Report for the U.S. Global Change Research Program. Cambridge University Press, Cambridge, UK.
- National Oceanic and Atmospheric Administration (NOAA). 2008. National Climatic Data Center. Climate of 2008 – Annual Review, Global and U.S. Summary. <http://lwf.ncdc.noaa.gov/oa/climate/research/2008/ann/us-summary.html>.

Appendix. Summary of Severe Weather

The following tables summarize reports of severe weather during 2008 in the counties that encompass Delaware Water Gap NRA and Upper Delaware SRR. These storm events were provided by the National Climatic Data Center (NCDC). NCDC receives this storm data from the National Weather Service, who acquires their information from a variety of sources. These sources include, but are not limited to county, state, and federal emergency management officials, local law enforcement officials, skywarn spotters, NWS damage surveys, newspaper clipping services, the insurance industry, and the general public. This Storm Data is an official publication of the National Oceanic and Atmospheric Administration (NOAA 2008) which documents the occurrence of storms and other significant weather phenomena having sufficient intensity to cause loss of life, injuries, significant property damage, and/or disruption to commerce. Each table contains the location, date, time, description of the severe event, its magnitude, and number of deaths, injuries, and property/crop damage associated with the event. The property and crop damage should be considered as a broad estimate.

Pike County

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
PAZ048 - 072	2008-02-22	01:00 AM	Winter Storm	N/A	0	0	0K	0K
Milford	2008-04-01	19:45 PM	Hail	0.75 in.	0	0	0K	0K
Dingmans Ferry	2008-04-01	19:46 PM	Hail	0.75 in.	0	0	0K	0K
Bushkill	2008-04-01	19:50 PM	Thunderstorm Wind	50 kts.	0	0	1K	0K
Millrift	2008-04-01	19:55 PM	Hail	0.75 in.	0	0	0K	0K
Milford	2008-06-07	17:00 PM	Thunderstorm Wind	50 kts.	0	0	0K	0K
Paupack	2008-06-08	18:35 PM	Hail	1.00 in.	0	0	0K	0K
Bushkill	2008-06-10	18:49 PM	Hail	1.25 in.	0	0	0K	0K
Greentown	2008-07-27	14:46 PM	Hail	1.00 in.	0	0	0K	0K
PAZ038>040 - 043>044 - 047>048 - 072	2008-12-19	09:00 AM	Heavy Snow	N/A	0	0	0K	0K
Totals:					0	0	1K	0K

Mag: Magnitude; Dth: Deaths; Inj: Injuries; PrD: Property Damage; CrD: Crop Damage

Monroe County

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
PAZ054 - 055	2008-01-01	05:00 AM	Winter Weather	N/A	0	0	0K	0K
PAZ054 - 055	2008-01-09	09:00 AM	Strong Wind	41 kts.	0	0	1K	0K
PAZ054 - 055	2008-01-11	12:00 AM	Winter Weather	N/A	0	0	0K	0K
PAZ054 - 055	2008-01-13	18:00 PM	Winter Weather	N/A	0	0	0K	0K
PAZ054 - 055	2008-01-29	20:00 PM	Winter Weather	N/A	0	0	0K	0K
PAZ054 - 055	2008-02-01	07:00 AM	Winter Storm	N/A	0	0	0K	0K
PAZ054 - 055	2008-02-04	12:00 PM	Winter Weather	N/A	0	0	0K	0K
PAZ054 - 055	2008-02-05	12:00 AM	Dense Fog	N/A	0	0	0K	0K
PAZ054 - 055	2008-02-09	08:00 AM	Winter Weather	N/A	0	0	0K	0K
PAZ054 - 055	2008-02-10	07:00 AM	Winter Weather	N/A	0	0	0K	0K
PAZ054 - 055	2008-02-10	14:00 PM	Winter Weather	N/A	0	0	0K	0K
PAZ054 - 055	2008-02-11	03:00 AM	Cold/wind Chill	N/A	0	0	0K	0K
PAZ055	2008-02-17	18:00 PM	Winter Weather	N/A	0	0	0K	0K
PAZ054 - 055	2008-02-26	08:00 AM	Winter Weather	N/A	0	0	0K	0K
PAZ054 - 055	2008-02-29	16:00 PM	Winter Weather	N/A	0	0	0K	0K
Blakeslee	2008-03-05	12:00 AM	Heavy Rain	N/A	0	0	0K	0K
PAZ054 - 055	2008-03-18	18:00 PM	Winter Weather	N/A	0	0	0K	0K
PAZ054 - 055	2008-03-31	07:00 AM	Winter Weather	N/A	0	0	0K	0K
Mountainhome	2008-04-01	19:25 PM	Thunderstorm Wind	52 kts.	0	0	0K	0K

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD	
PAZ054 - 055	2008-04-03	22:00 PM	Winter Weather	N/A	0	0	0K	0K	
PAZ055 - 060	2008-04-23	17:00 PM	Wildfire	N/A	0	0	0K	0K	
Swiftwater	2008-05-31	17:15 PM	Thunderstorm Wind	52 kts.	0	0	0K	0K	
Skytop	2008-06-04	15:35 PM	Thunderstorm Wind	50 kts.	0	0	0K	0K	
Tobyhanna	2008-06-10	17:05 PM	Thunderstorm Wind	52 kts.	0	0	0K	0K	
Saylorsburg	2008-06-10	18:10 PM	Thunderstorm Wind	52 kts.	0	0	25K	0K	
East Stroudsburg	2008-06-10	18:17 PM	Hail	1.25 in.	0	0	0K	0K	
Cresco	2008-06-14	14:30 PM	Flash Flood	N/A	0	0	0K	0K	
Tobyhanna	2008-06-14	16:55 PM	Lightning	N/A	1	3	0K	0K	
Swiftwater	2008-06-14	17:15 PM	Lightning	N/A	0	0	1K	0K	
Robin Hood Lakes	2008-06-14	18:30 PM	Flash Flood	N/A	0	0	0K	0K	
Scot Run	2008-06-16	16:35 PM	Hail	0.75 in.	0	0	0K	0K	
Stroudsburg	2008-06-16	16:45 PM	Thunderstorm Wind	52 kts.	0	0	25K	0K	
Bossardsville	2008-08-02	17:10 PM	Hail	0.75 in.	0	0	0K	0K	
Pocono Pines	2008-08-10	13:35 PM	Hail	1.00 in.	0	0	0K	0K	
Bossardsville	2008-08-15	14:15 PM	Flash Flood	N/A	0	0	0K	0K	
Paradise Vly	2008-09-09	07:50 AM	Thunderstorm Wind	52 kts.	0	0	0K	0K	
Skytop	2008-10-25	13:00 PM	Heavy Rain	N/A	0	0	0K	0K	
PAZ055	2008-10-27	21:00 PM	Heavy Snow	N/A	0	0	0K	0K	
PAZ054 - 055	2008-11-24	17:00 PM	Winter Weather	N/A	0	0	0K	0K	
PAZ054 - 055	2008-11-30	07:00 AM	Winter Weather	N/A	0	0	0K	0K	
PAZ054 - 055	2008-12-01	12:00 AM	Winter Weather	N/A	0	0	0K	0K	
PAZ054 - 055	2008-12-10	23:00 PM	Winter Storm	N/A	0	0	0K	0K	
Long Pond	2008-12-11	14:00 PM	Heavy Rain	N/A	0	0	0K	0K	
PAZ054 - 055	2008-12-16	19:00 PM	Winter Weather	N/A	0	0	0K	0K	
PAZ054 - 055	2008-12-19	08:30 AM	Winter Storm	N/A	0	0	0K	0K	
PAZ054 - 055	2008-12-22	12:00 AM	Cold/wind Chill	N/A	0	0	0K	0K	
PAZ054 - 055	2008-12-24	21:00 PM	Strong Wind	43 kts.	0	0	1K	0K	
PAZ054 - 055	2008-12-26	16:00 PM	Winter Weather	N/A	0	0	0K	0K	
PAZ054 - 055	2008-12-30	02:00 AM	Strong Wind	40 kts.	0	0	0K	0K	
PAZ054 - 055	2008-12-31	08:00 AM	Winter Weather	N/A	0	0	0K	0K	
					Totals:	1	3	52K	0K

Mag: Magnitude; Dth: Deaths; Inj: Injuries; PrD: Property Damage; CrD: Crop Damage

Sussex County

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
NJZ001 - 007>010 - 012 - 015 - 019	2008-01-09	10:00 AM	Strong Wind	40 kts.	0	0	1K	0K
NJZ001	2008-01-13	20:00 PM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 008	2008-01-17	16:00 PM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007	2008-01-29	10:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001	2008-01-29	22:00 PM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007>010 - 012	2008-01-30	09:00 AM	Strong Wind	40 kts.	0	0	2K	0K
NJZ001 - 007	2008-02-01	07:00 AM	Winter Storm	N/A	0	0	0K	0K
NJZ001 - 007	2008-02-01	07:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007 - 009	2008-02-05	03:00 AM	Dense Fog	N/A	0	0	0K	0K
NJZ001	2008-02-09	09:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007>010 - 012	2008-02-10	12:00 PM	High Wind	52 kts.	0	0	25K	0K
NJZ001 - 007>010 - 012	2008-02-10	12:00 PM	Strong Wind	40 kts.	0	0	2K	0K
NJZ001	2008-02-11	03:00 AM	Cold/wind Chill	N/A	0	0	0K	0K
NJZ001	2008-02-12	10:00 AM	Winter Storm	N/A	0	0	150K	0K
Montague	2008-02-13	07:45 AM	Flood	N/A	0	0	0K	0K
NJZ001 - 007>009 - 013	2008-02-22	01:00 AM	Winter Storm	N/A	0	0	0K	0K
NJZ001 - 007>009 - 013	2008-02-22	01:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001	2008-02-26	10:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007>010 - 012	2008-02-29	20:00 PM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007>010 - 012	2008-03-01	12:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007	2008-03-05	08:00 AM	Strong Wind	48 kts.	0	0	10K	0K
Flatbrookville	2008-03-05	12:08 PM	Flood	N/A	0	0	0K	0K
Huntsville	2008-03-08	18:35 PM	Thunderstorm Wind	52 kts.	0	0	0K	0K
NJZ001	2008-03-08	19:30 PM	Strong Wind	43 kts.	0	0	5K	0K
NJZ001 - 007>010 - 012	2008-03-20	04:00 AM	Strong Wind	40 kts.	0	0	1K	0K
NJZ001	2008-03-31	08:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001	2008-04-03	23:00 PM	Winter Weather	N/A	0	0	0K	0K
Newton	2008-05-27	15:40 PM	Hail	0.75 in.	0	0	0K	0K
NJZ001 - 007>010 - 012>023 - 026	2008-06-07	09:00 AM	Excessive Heat	N/A	0	10	0K	0K
Vernon	2008-06-07	16:45 PM	Thunderstorm Wind	50 kts.	0	0	0K	0K
Baleville	2008-06-08	19:26 PM	Thunderstorm Wind	52 kts.	0	0	0K	0K
Flatbrookville	2008-06-10	18:45 PM	Thunderstorm Wind	52 kts.	0	0	0K	0K
Mc Coys Corners	2008-06-16	17:00 PM	Thunderstorm Wind	52 kts.	0	0	0K	0K
Hainesville	2008-07-08	12:50 PM	Flash Flood	N/A	0	0	0K	0K

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
NJZ001 - 007>010 - 012>013 - 015>023 - 027	2008-07-16	09:00 AM	Excessive Heat	N/A	0	0	0K	0K
Montague	2008-09-06	15:00 PM	Heavy Rain	N/A	0	0	0K	0K
Montague	2008-10-25	14:00 PM	Heavy Rain	N/A	0	0	0K	0K
NJZ001 - 007	2008-10-28	05:00 AM	Heavy Snow	N/A	0	0	0K	0K
NJZ001 - 007	2008-10-28	05:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007>010 - 012>020 - 022 - 025	2008-10-28	11:00 AM	Strong Wind	40 kts.	0	0	5K	0K
NJZ001	2008-11-30	08:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001	2008-12-01	12:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007>010 - 012	2008-12-07	11:00 AM	Strong Wind	48 kts.	0	0	1K	0K
NJZ001	2008-12-10	23:00 PM	Ice Storm	N/A	0	0	1.0M	0K
Culvers Lake	2008-12-11	17:00 PM	Heavy Rain	N/A	0	0	0K	0K
NJZ001	2008-12-16	19:00 PM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007 - 008	2008-12-19	10:00 AM	Winter Storm	N/A	0	0	0K	0K
NJZ001	2008-12-21	12:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007 - 013>014 - 020 - 022	2008-12-21	22:00 PM	Strong Wind	47 kts.	0	0	1K	0K
NJZ001 - 007 - 008	2008-12-24	03:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001	2008-12-26	23:00 PM	Winter Weather	N/A	0	0	0K	0K
NJZ001	2008-12-27	21:00 PM	Dense Fog	N/A	0	0	0K	0K
NJZ001	2008-12-30	04:00 AM	Strong Wind	47 kts.	0	0	1K	0K
NJZ001	2008-12-31	06:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001	2008-12-31	18:00 PM	High Wind	56 kts.	0	0	5K	0K
Totals:					0	10	1.2M	0K

Mag: Magnitude; Dth: Deaths; Inj: Injuries; PrD: Property Damage; CrD: Crop Damage

Wayne County

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
Honesdale	2008-03-08	17:30 PM	Flash Flood	N/A	0	0	0K	0K
Hawley	2008-04-01	18:55 PM	Hail	0.88 in.	0	0	0K	0K
Bethany	2008-06-07	15:20 PM	Thunderstorm Wind	50 kts.	0	0	2K	0K
Niarara	2008-06-08	15:00 PM	Thunderstorm Wind	50 kts.	0	0	1K	0K
South Canaan	2008-06-08	18:15 PM	Hail	0.88 in.	0	0	0K	0K
Lake Ariel	2008-06-10	16:05 PM	Hail	1.25 in.	0	0	0K	0K
Honesdale	2008-06-10	16:21 PM	Hail	0.88 in.	0	0	0K	0K
Equinunk	2008-06-10	19:03 PM	Thunderstorm Wind	50 kts.	0	0	2K	0K
Waymart	2008-06-10	19:10 PM	Thunderstorm Wind	50 kts.	0	0	2K	0K
Honesdale	2008-06-10	19:15 PM	Hail	1.75 in.	0	0	0K	0K
Angels	2008-06-16	15:30 PM	Hail	0.88 in.	0	0	0K	0K
Honesdale	2008-06-16	15:45 PM	Hail	1.75 in.	0	0	0K	0K
Angels	2008-07-27	14:38 PM	Hail	1.00 in.	0	0	0K	0K
Hawley	2008-08-14	12:19 PM	Hail	1.00 in.	0	0	0K	0K
PAZ038>040 - 043>044 - 047>048 - 072	2008-12-19	09:00 AM	Heavy Snow	N/A	0	0	0K	0K
Totals:					0	0	5K	0K

Mag: Magnitude; Dth: Deaths; Inj: Injuries; PrD: Property Damage; CrD: Crop Damage

Sullivan County

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
PAZ004>006 - 010>012 - 017>019 - 024>028 - 033>035 - 037 - 041>042 - 045>046 - 049>053 - 058	2008-02-01	03:00 AM	Winter Storm	N/A	0	0	0K	0K
Sonestown	2008-02-06	18:56 PM	Hail	1.00 in.	0	0	0K	0K
Shunk	2008-03-05	03:00 AM	Flood	N/A	0	0	0K	0K
Forksville	2008-07-26	17:22 PM	Thunderstorm Wind	50 kts.	0	0	0K	0K
PAZ042	2008-10-28	05:00 AM	Heavy Snow	N/A	0	0	2K	0K
PAZ004>006 - 010>012 - 017>019 - 027 - 037 - 041>042 - 045>046 - 049>053 - 058	2008-12-19	04:00 AM	Winter Storm	N/A	0	0	0K	0K
PAZ004>006 - 010>012 - 018>019 - 024>025 - 033>034 - 037 - 041>042 - 045>046 - 058	2008-12-21	23:00 PM	Extreme Cold/wind Chill	N/A	0	0	0K	0K
PAZ006 - 012 - 018 - 037 - 041>042 - 045	2008-12-23	22:00 PM	Ice Storm	N/A	0	0	0K	0K
Totals:					0	0	2K	0K

Mag: Magnitude; Dth: Deaths; Inj: Injuries; PrD: Property Damage; CrD: Crop Damage

Delaware County

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
PAZ070	2008-01-03	01:00 AM	Astronomical Low Tide	N/A	0	0	0K	0K
PAZ060 - 68 - 70 - 71	2008-01-17	01:00 PM	Winter Weather	N/A	0	0	0K	0K
PAZ067 - 69 - 70	2008-02-05	06:00 AM	Dense Fog	N/A	0	0	0K	0K
PAZ070	2008-02-10	07:00 PM	Astronomical Low Tide	N/A	0	0	0K	0K
PAZ070 - 71	2008-02-12	12:00 PM	Winter Storm	N/A	0	0	0K	0K
Chadds Ford	2008-02-13	12:00 PM	Flood	N/A	0	0	0K	0K
PAZ070 - 71	2008-02-22	02:00 AM	Winter Storm	N/A	0	0	0K	0K
PAZ062 - 70	2008-03-05	08:00 AM	Strong Wind	35 kts	0	0	2K	0K
Florida Park	2008-03-08	05:35 PM	Thunderstorm Wind	56 kts.	0	0	100K	0K
PAZ070 - 71	2008-05-12	07:15 AM	Strong Wind	43 kts.	0	0	10K	0K
lthan	2008-07-20	08:35 PM	Thunderstorm Wind	50 kts.	0	0	0K	
Boothwyn	2008-07-27	01:17 PM	Hail	0.75 in.	0	0	0K	0K
Boothwyn	2008-07-27	01:17 PM	Thunderstorm Wind	50 kts.	0	0	0K	0K
Marcus Hook	2008-08-10	11:32 AM	Hail	1 in.	0	0	0K	0K
Chadds Ford	2008-09-06	12:00 PM	Heavy Rain	N/A	0	0	0K	0K
PAZ070	2008-09-06	05:00 PM	Storm Surge/tide	N/A	0	0	0K	0K
Radnor	2008-09-09	09:00 AM	Thunderstorm Wind	50 kts.	0	0	0K	0K
Wayne	2008-09-28	12:00 PM	Flood	N/A	0	0	0K	0K
PAZ070	2008-11-21	04:00 AM	Winter Weather	N/A	0	0	0K	0K
Ridley Park	2008-12-12	01:57 AM	Flood	N/A	0	0	0K	0K
PAZ068>071	2008-12-21	04:00 AM	Winter Weather	N/A	0	0	0K	0K
PAZ067 - 70 - 71	2008-12-23	10:00 PM	Winter Weather	N/A	0	0	0K	0K
PAZ070	2008-12-31	07:00 PM	Astronomical Low Tide	N/A	0	0	0K	0K
TOTALS:					0	0	112K	0

Mag: Magnitude; Dth: Deaths; Inj: Injuries; PrD: Property Damage; CrD: Crop Damage

Orange County

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
NYZ067 - 068	2008-02-01	09:00 AM	Ice Storm	N/A	0	0	0K	0K
Cornwall	2008-02-01	20:27 PM	Flash Flood	N/A	0	0	0K	0K
NYZ067 - 068	2008-02-12	14:00 PM	Winter Storm	N/A	0	0	0K	0K
NYZ067>070	2008-02-22	08:00 AM	Heavy Snow	N/A	0	0	0K	0K
Middletown	2008-03-08	14:30 PM	Flash Flood	N/A	0	0	0K	0K
Montgomery	2008-03-08	15:00 PM	Flash Flood	N/A	0	0	0K	0K
Mechanicstown	2008-03-08	15:15 PM	Flash Flood	N/A	0	0	0K	0K
Montgomery Co Arpt	2008-03-08	15:20 PM	Flash Flood	N/A	0	0	0K	0K
NYZ067	2008-03-08	19:20 PM	High Wind	55 kts.	0	0	0K	0K
Allard Corners	2008-03-08	22:08 PM	Flood	N/A	0	0	0K	0K
Warwick	2008-05-27	13:30 PM	Hail	0.75 in.	0	0	0K	0K
Goshen	2008-06-10	19:40 PM	Thunderstorm Wind	61 kts.	0	0	2K	0K
Highland Falls	2008-06-10	19:59 PM	Thunderstorm Wind	61 kts.	0	0	6K	0K
New Windsor	2008-06-10	20:00 PM	Thunderstorm Wind	61 kts.	0	0	5K	0K
Newburgh Stewart Arp	2008-06-10	20:00 PM	Thunderstorm Wind	50 kts.	0	0	0K	0K
Orange Lake	2008-06-16	17:15 PM	Tornado	F0	0	0	40K	0K
Newburgh	2008-06-16	18:00 PM	Thunderstorm Wind	61 kts.	0	0	2K	0K
Highland Falls	2008-07-23	19:21 PM	Flash Flood	N/A	0	0	0K	0K
Cornwall	2008-07-23	22:30 PM	Flash Flood	N/A	0	0	0K	0K
New Windsor	2008-08-11	10:45 AM	Hail	0.75 in.	0	0	0K	0K
Warwick	2008-08-11	10:55 AM	Flash Flood	N/A	0	0	0K	0K
Newburgh	2008-08-11	11:05 AM	Hail	1.75 in.	0	0	0K	0K
Goshen	2008-08-14	13:13 PM	Hail	0.75 in.	0	0	0K	1K
Monroe	2008-08-14	13:47 PM	Hail	0.88 in.	0	0	0K	0K
NYZ067>081	2008-09-06	13:00 PM	Tropical Storm	N/A	0	0	4K	0K
Highland Falls	2008-09-06	16:30 PM	Flash Flood	N/A	0	0	0K	0K
Cornwall	2008-09-09	10:00 AM	Flash Flood	N/A	0	0	0K	0K
NYZ067	2008-12-11	07:00 AM	Ice Storm	N/A	0	0	0K	0K
NYZ067 - 069	2008-12-19	11:45 AM	Heavy Snow	N/A	0	0	0K	0K
Totals:					0	0	55K	1K

Mag: Magnitude; Dth: Deaths; Inj: Injuries; PrD: Property Damage; CrD: Crop Damage

Warren County

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
NJZ001 - 007>010 - 012 - 015 - 019	2008-01-09	10:00 AM	Strong Wind	40 kts.	0	0	1K	0K
NJZ007	2008-01-13	22:00 PM	Winter Weather	N/A	0	0	0K	0K
NJZ007 - 010 - 012 - 015	2008-01-17	15:00 PM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007	2008-01-29	10:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007>010 - 012	2008-01-30	09:00 AM	Strong Wind	40 kts.	0	0	2K	0K
NJZ001 - 007	2008-02-01	07:00 AM	Winter Storm	N/A	0	0	0K	0K
NJZ001 - 007	2008-02-01	07:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007 - 009	2008-02-05	03:00 AM	Dense Fog	N/A	0	0	0K	0K
NJZ001 - 007>010 - 012	2008-02-10	12:00 PM	High Wind	52 kts.	0	0	25K	0K
NJZ001 - 007>010 - 012	2008-02-10	12:00 PM	Strong Wind	40 kts.	0	0	2K	0K
NJZ007 - 008	2008-02-12	11:00 AM	Winter Storm	N/A	0	0	25K	0K
Millbrook	2008-02-13	07:45 AM	Flood	N/A	0	0	0K	0K
NJZ001 - 007>009 - 013	2008-02-22	01:00 AM	Winter Storm	N/A	0	0	0K	0K
NJZ001 - 007>009 - 013	2008-02-22	01:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007>010 - 012	2008-02-29	20:00 PM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007>010 - 012	2008-03-01	12:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007	2008-03-05	08:00 AM	Strong Wind	48 kts.	0	0	10K	0K
Martins Creek Station	2008-03-05	10:00 AM	Flood	N/A	0	0	0K	0K
Alpha	2008-03-08	13:00 PM	Flash Flood	N/A	0	0	0K	0K
NJZ007 - 009 - 012 - 014>015 - 017>020 - 026	2008-03-08	19:00 PM	High Wind	50 kts.	0	0	10K	0K
NJZ007 - 009 - 012 - 014>015 - 017>020 - 026	2008-03-08	19:00 PM	Strong Wind	43 kts.	0	0	5K	0K
NJZ001 - 007>010 - 012	2008-03-20	04:00 AM	Strong Wind	40 kts.	0	0	1K	0K
Blairstown	2008-04-01	20:00 PM	Thunderstorm Wind	52 kts.	0	0	0K	0K
Hazen	2008-04-01	20:10 PM	Thunderstorm Wind	52 kts.	0	0	0K	0K
NJZ001 - 007>010 - 012>023 - 026	2008-06-07	09:00 AM	Excessive Heat	N/A	0	10	0K	0K
Vienna	2008-06-14	17:10 PM	Thunderstorm Wind	50 kts.	0	0	0K	0K
Phillipsburg	2008-06-14	18:47 PM	Lightning	N/A	0	4	0K	0K
Franklin Grove	2008-06-16	16:55 PM	Thunderstorm Wind	52 kts.	0	0	0K	0K
NJZ001 - 007>010 - 012>013 - 015>023 - 027	2008-07-16	09:00 AM	Excessive Heat	N/A	0	0	0K	0K
Stewartville	2008-09-06	17:00 PM	Flood	N/A	0	0	0K	0K
Franklin Grove	2008-10-25	14:00 PM	Heavy Rain	N/A	0	0	0K	0K
NJZ001 - 007	2008-10-28	05:00 AM	Heavy Snow	N/A	0	0	0K	0K
NJZ001 - 007	2008-10-28	05:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007>010 - 012>020 - 022 - 025	2008-10-28	11:00 AM	Strong Wind	40 kts.	0	0	5K	0K

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
NJZ001 - 007>010 - 012	2008-12-07	11:00 AM	Strong Wind	48 kts.	0	0	1K	0K
Finesville	2008-12-11	17:00 PM	Heavy Rain	N/A	0	0	0K	0K
NJZ007	2008-12-16	17:00 PM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007 - 008	2008-12-19	10:00 AM	Winter Storm	N/A	0	0	0K	0K
NJZ007	2008-12-21	01:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ001 - 007 - 013>014 - 020 - 022	2008-12-21	22:00 PM	Strong Wind	47 kts.	0	0	1K	0K
NJZ001 - 007 - 008	2008-12-24	03:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ007 - 008	2008-12-27	18:00 PM	Dense Fog	N/A	0	0	0K	0K
NJZ007 - 013>014 - 019>020 - 026	2008-12-30	05:00 AM	Strong Wind	41 kts.	0	0	1K	0K
NJZ007	2008-12-31	07:00 AM	Winter Weather	N/A	0	0	0K	0K
NJZ007>010 - 012>015 - 018>020 - 026	2008-12-31	11:00 AM	Strong Wind	40 kts.	0	0	1K	0K
				TOTALS:	0	14	90K	0

Mag: Magnitude; Dth: Deaths; Inj: Injuries; PrD: Property Damage; CrD: Crop Damage

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NPS 620/105520, 647/105520, September 2010

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