National Park Service
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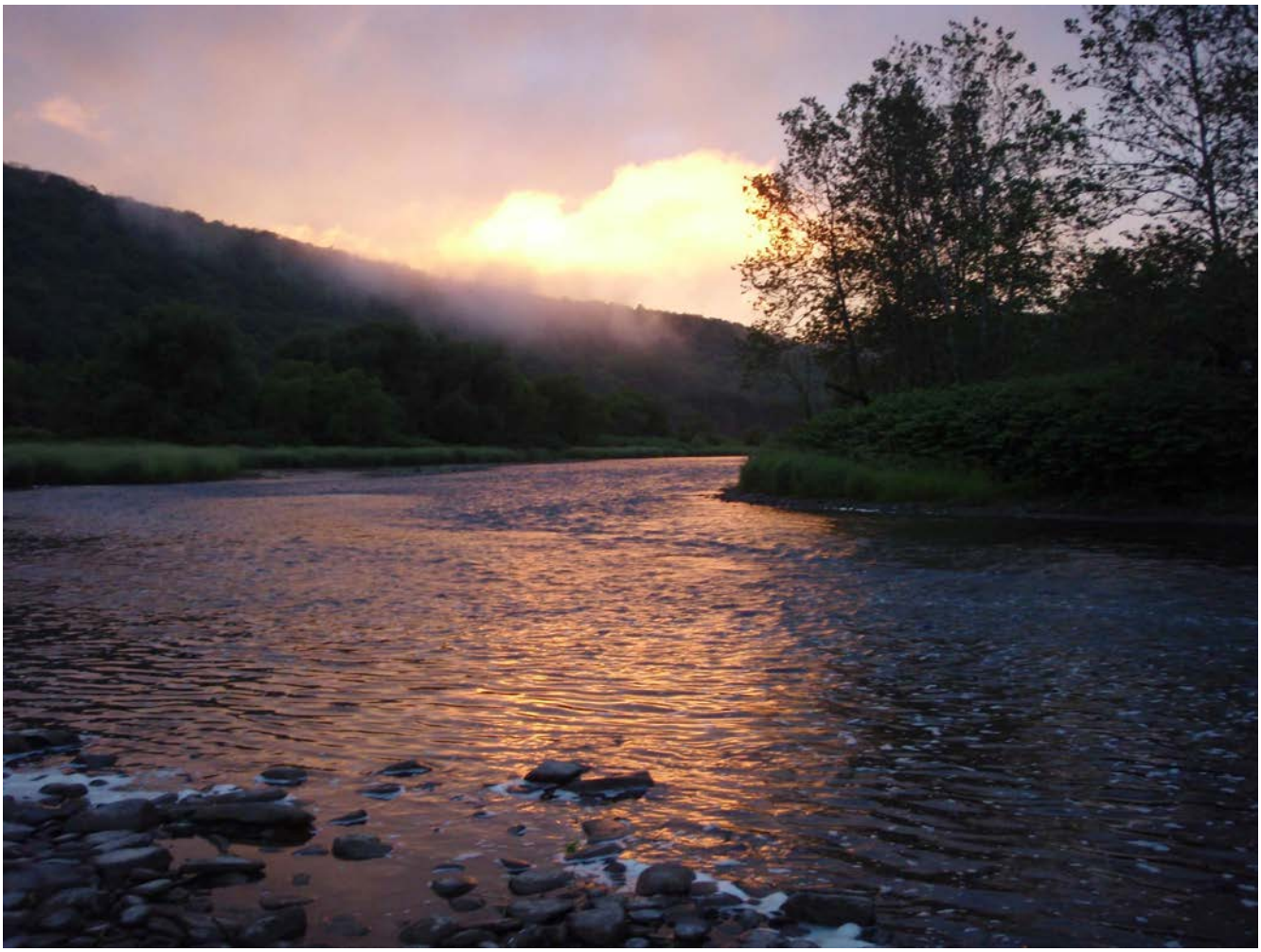
Natural Resource Stewardship and Science

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

Eastern Rivers and Mountains Network Summary Report for 2015

Natural Resource Data Series NPS/ERMN/NRDS—2016/1049



ON THE COVER
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—2016/1049

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The National Park Service, Natural Resource Stewardship and Science office in Fort Collins, Colorado, publishes a range of reports that address natural resource topics. These reports are 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 the 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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This report is available from Eastern Rivers and Mountains Network (http://science.nature.nps.gov/im/units/ERMN) and the Natural Resource Publications Management website (http://www.nature.nps.gov/publications/NRPM). To receive this report in a format optimized for screen readers, please email irma@nps.gov.

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List of Key Acronyms

ASOS	Automated Surface Observing System
COOP	National Weather Service Cooperative Observer Program
CWOP	Citizen Weather Observer Program
DEWA	Delaware Water Gap National Recreational Area
ERMN	Eastern Rivers and Mountains Network
FAA	Federal Aviation Administration
GOES	Geostationary Operational Environmental Satellite
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
NPS	National Park Service
NRA	National Recreation Area
NWS	National Weather Service
PDSI	Palmer Drought Severity Index
POR	Period of Record
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

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 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, 2015, and to place current patterns and trends in an appropriate historical and regional context (Marshall et al. 2012). It is our intention that this report will satisfy an inherent interest in meteorological phenomena and meet a portion of the Eastern Rivers and Mountains Network (ERMN) Weather and Climate Monitoring objective:

- Document current status and long-term trends in air temperature and precipitation at multiple temporal scales (e.g., daily, monthly, seasonal, annual, and decadal) and spatial scales (e.g., individual stations and aggregated stations such as climate divisions) utilizing existing weather and climate monitoring programs and datasets.

To accomplish this objective, 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 the Mid-Atlantic Network of the National Park Service (Marshall et al. 2012). 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 weather 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 (Marshall et al. 2012) and summarized in this report.

Climate of the Pocono Mountains and Eastern Plateau

Delaware Water Gap National Recreation Area (NRA) lies in Pennsylvania Climate Division 1 "Pocono Mountains" and New Jersey Climate Division 1 "Northern NJ," while Upper Delaware Scenic and Recreational River (SRR) lies within 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/usclimdivs/data/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 (Gelber 2002).

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 (864–1,320 mm), while the majority of places receive 38–46 in (965–1,168 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

Twelve weather observing stations, comprised of three observing networks, were selected around Delaware Water Gap NRA and Upper Delaware SRR. 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 parks' elevation profile, the type and frequency of observations, the period of record of the data, and data availability (Marshall et al. 2012). Moreover, the percentage of time a station reports particular parameters (e.g., temperature) can influence its data inclusion. Using this criteria, 11 of the 12 stations were used for this report, with the exception being Deposit, NY which did not report data in 2015; nearby station, Walton 2 (WALN6), was used as its replacement.

The average value of a climate element over 30 years is defined as a climatological normal, which is calculated and established by NOAA's National Climatic Data Center (NCDC). Every ten years, NCDC computes new thirty-year climate normals for selected temperature and precipitation elements for a large number of U.S. climate and weather stations. The current (as of 2015) normals cover the period 1981–2010. In this report, the 30-year normals established by NCDC are used as the baseline for comparisons (e.g., departures from normal). In cases where data for the 30-year normal period are not available, we use alternative comparisons, such as the new pseudo-normal from NCDC or a recent 10-year period. In some cases, sufficient data may simply not be available to calculate normals. For metrics that NCDC may not routinely calculate a normal, such as the number of days with more than 2 in (55 mm) of rain or liquid equivalent, normals are calculated using the same time period (e.g., 1981−2010) as the current NCDC standard. Throughout the report, descriptions of a station's values as compared to the normals are described as a difference from the "average", "mean", "typical", "long-term value", as well as "normal", to improve the readability of the document. However, all of these terms are comparing a value from one year at that station to that station's normal, whether it be the 30-year normal or the pseudo-normal calculated on a shorter time frame.

NOAA's National Centers for Environmental Information (NCEI) also calculates and provides climatological ranks for selected temperature and precipitation elements (http://www.ncdc.noaa.gov/temp-and-precip/ranks.php). Data and statistics are as of January 1895 providing a substantial period of record to place the current year in historical context.

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/NPS/interface.php.

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

Table 1. List of weather observing stations around the Upper Delaware Scenic and Recreational River and Delaware Water Gap National Recreation Area selected as most representative of the parks in 2015.

Station	Observing Network	Station Name	Period of Record (POR)		Percentage of Time Reporting Temperature for 2015	Percentage of Time Reporting Precipitation for 2015	Percentage of Time Reporting Temperature for entire POR	Percentage of Time Reporting Precipitation for entire POR
PJRN6	COOP	Port Jervis	01/01/1893	Present	100.0	100.0	97.0	94.0
EQNP1	COOP	Equinunk 2 NW	03/01/1957	Present	-	28.5	-	98.0
HAWP1	COOP	Hawley 1 E	11/01/1897	Present	99.7	100.0	76.8[1]	81.2
DEPN6	COOP	Deposit	05/01/1953	Present	-	-	95.3	95.4
SDBP1	COOP	Stroudsburg	12/01/1910	Present	100.0	100.0	90.9	91.6
KFWN	ASOS	Sussex Airport	12/27/2000	Present	100.0	99.7	98.7	98.7
K12N	ASOS	Aeroflex-Andover Airport	10/25/2000	Present	95.9	95.9	85.5	80.2
RKHN6	COOP	Rock Hill 3 SW	05/01/1953	Present	63.0	63.0	97.9[2]	98.1
PLEP1	COOP	Pleasant Mount 1W	10/01/1924	Present	100.0	100.0	98.7[3]	98.0
MLAP1	COOP	Milanville	08/01/1945	Present	100.0	66.6	35.0[4]	43.2
TS717	RAWS	Blue Mountain Lakes	12/11/2007	Present	100.0	-	85.6	64.8
LOLP1	RAWS	Loch Lomond	01/01/2005	Present	100.0	100.0	88.8	88.8

Temperature Summary

Calendar year 2015 averaged virtually at the long-term mean temperature (Tables 2 – 4). Annual average temperature departures from normal ranged from -0.1°F (-0.1°C) at Port Jervis to +2.5°F (+1.4°C) at Milanville (Table 4). Recall that the station departures are based on the most recent 30 years (1981-2010).

The winter months of 2015 were very cold compared to normal across the region encompassing the Delaware Water Gap NRA and Upper Delaware SRR. All three months of January, February, and March averaged below normal across all reporting stations (Figures 2 and 3, Tables 3 and 4). The coldest month, by far, was February when monthly readings were as low as 9.2°F (-12.7°C) at Pleasant Mount (Table 3). Temperature departures from normal were greater than 10°F (5°C) below average across all reporting stations for February (Table 4). Readings below 0°F were common during the month, but the coldest mornings were on February 6th and 24th, the latter of which brought a morning low temperature of -20°F (-28.9°C) at Pleasant Mount (Table 2). As a result, sub-zero days for the entire year were over double the long-term average across the observing stations (Table 2). In 121 years of records, the winter months were one of the top 4 coldest across all three climate divisions (Table 5).

The spring months were bookended by near seasonal temperatures, but May was a very mild month in the region (Figures 2 and 3, Tables 3 and 4). The mild temperatures during early to mid-Spring resulted in an earlier start to the growing season than normal and longer growing seasons over the region for the calendar year as compared to normal (Table 2). Temperatures during May averaged between +5.0 to +6.5°F (+2.8 to +3.6°C) above the 1981–2010 long-term mean (Table 4). The entire season ranked the 4th or 15th warmest since records began in 1895.

The summer period began with near seasonal temperatures during the months of July and August, with the largest temperature departure from normal just +2.1°F (+1.2°C) at Milanville during the month of August (Tables 3 and 4). September was a different story, as very mild temperatures brought positive temperature anomalies in excess of 4°F (2°C) across all reporting stations during the month (Table 4). Because of the very mild September, the season ranked between the 3rd and 11th warmest in 121 years (Table 5).

The most impressive warmth of the year occurred during the final season of the month. Autumn temperatures began near seasonal levels but increasingly got warmer over the final two months of the year (Tables 3 and 4; Figures 2 and 3). In fact, temperatures were so mild during the month of December that averages during the month were near the readings measured during November (Table 3). December temperature departures were between +11.7 to +13.0°F (+6.5 to +7.2°C, Table 4). Autumn was the warmest on record at all three climate divisions in 121 years of records (Table 5).

[1] 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/.

Table 2. Status of 2015 temperature indicators compared to the 30-year normal (1981–2010) at the Port Jervis (PJRN6), Hawley 1 E (HAWP1), and Pleasant Mount 1 W (PLEP1) stations.

Temperature Indicator	Port Jervis, NY 2015	Port Jervis, NY 1981-2010	Hawley 1 E, PA 2015	Hawley 1 E, PA 1981-2010	Pleasant Mount 1 W, PA 2015	Pleasant Mount 1 W, PA 1981-2010
Average Annual Temperature	48.5°F 9.2°C	48.6°F 9.2°C	46.7°F 8.2°C	46.5°F 8.1°C	44.1°F 6.7°C	43.9°F 6.6°C
Average Annual Maximum Temperature	59.9°F 15.5°C	59.9°F 15.5°C	58.6°F 14.8°C	57.7°F 14.3°C	54.4°F 12.4°C	53.6°F 12.0°C
Maximum Temperature	92.0°F 33.3°C	95.2°F 35.1°C	91.0°F 32.8°C	92.1°F 33.4°C	86.0°F 30.0°C	88.3°F 31.3°C
Hot Days (days with Tmax>=90°F/32°C)	6	8	3	4	0	0
Average Annual Minimum Temperature	37.1°F 2.8°C	37.3°F 2.9°C	34.6°F 1.4°C	35.3°F 1.8°C	33.8°F 1.0°C	34.1°F 1.2°C
Minimum Temperature	-13.0°F -25.0°C	-5.4°F -20.8°C	-17.0°F -27.2°C	-9.5°F -23.1°C	-20.0°F -28.9°C	-12.0°F -24.4°C
Cold Days (days with Tmax<=32°F/0°C)	44	31	53	40	72	61
Sub-freezing Days (days with Tmin<=32°F/0°C)	139	148	155	162	154	169
Sub-zero Days (days with Tmin<=0°F/-17.8°C)	22	6	23	10	31	12
Growing Season Length (days between last spring Tmin 32°F/0°C and first fall Tmin 32°F/0°C)	173	158	155	145	140	136

Table 3. Summary of monthly average temperatures for 2015 for the selected stations.

Station name	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Port Jervis	PJRN6	19.9°F	13.1°F	28.2°F	45.8°F	63.3°F	66.2°F	71.2°F	69.9°F	66.1°F	50.5°F	44.3°F	41.1°F	48.5°F
		-6.7°C	-10.5°C	-2.1°C	7.7°C	17.4°C	19.0°C	21.8°C	21.1°C	18.9°C	10.3°C	6.8°C	5.1°C	9.2°C
Hawley 1 E	HAWP1	19.0°F	12.0°F	26.5°F	43.7°F	60.8°F	65.0°F	68.2°F	66.9°F	64.1°F	47.9°F	42.1°F	40.1°F	46.7°F
		-7.2°C	-11.1°C	-3.1°C	6.5°C	16.0°C	18.3°C	20.1°C	19.4°C	17.8°C	8.8°C	5.6°C	4.5°C	8.2°C
Deposit*	DEPN6*	16.4°F	9.6°F	22.8°F	41.1°F	58.9°F	62.1°F	65.5°F	65.5°F	63.5°F	46.8°F	42.1°F	39.5°F	44.7°F
		-8.7°C	-12.4°C	-5.1°C	5.1°C	14.9°C	16.7°C	18.7°C	18.6°C	17.5°C	8.2°C	5.6°C	4.2°C	7.1°C
Pleasant Mount 1 W	PLEP1	15.6°F	9.2°F	22.7°F	40.2°F	59.6°F	61.7°F	65.5°F	64.7°F	62.7°F	46.0°F	40.5°F	38.0°F	44.1°F
		-9.1°C	-12.7°C	-5.2°C	4.6°C	15.3°C	16.5°C	18.6°C	18.2°C	17.1°C	7.8°C	4.7°C	3.3°C	6.7°C
Milanville	MLAP1	19.6°F	13.5°F	27.4°F	44.1°F	61.9°F	64.9°F	69.7°F	68.5°F	65.8°F	49.7°F	44.6°F	40.7°F	47.7°F
		-6.9°C	-10.3°C	-2.6°C	6.7°C	16.6°C	18.3°C	20.9°C	20.3°C	18.8°C	9.8°C	7.0°C	4.8°C	8.7°C
Stroudsburg	SDBP1	23.6°F	17.0°F	32.3°F	49.7°F	64.8°F	67.6°F	71.9°F	70.7°F	67.1°F	50.9°F	46.2°F	43.5°F	50.6°F
		-4.7°C	-8.3°C	0.2°C	9.8°C	18.2°C	19.8°C	22.2°C	21.5°C	19.5°C	10.5°C	7.9°C	6.4°C	10.3°C
Rock Hill 3 SW	RKHN6	M	M	M	M	60.1°F	62.4°F	67.1°F	66.4°F	M	M	41.7°F	M	M
		M	M	M	M	15.6°C	16.9°C	19.5°C	19.1°C	M	M	5.4°C	M	M
Sussex Airport,	KFWN	23.2°F	15.9°F	31.8°F	48.8°F	63.8°F	67.0°F	72.1°F	70.5°F	66.5°F	50.3°F	45.5°F	43.2°F	50.1°F
		-4.9°C	-8.9°C	-0.1°C	9.3°C	17.7°C	19.4°C	22.3°C	21.4°C	19.2°C	10.2°C	7.5°C	6.2°C	10.1°C
Aeroflex-Andover Airport	K12N	23.1°F	15.8°F	M	48.8°F	64.3°F	67.5°F	72.3°F	70.8°F	67.3°F	51.0°F	46.5°F	M	50.8°F
		-4.9°C	-9.0°C	M	9.3°C	17.9°C	19.7°C	22.4°C	21.6°C	19.6°C	10.6°C	8.1°C	M	10.4°C
Blue Mountain Lakes	TS717	21.3°F	17.4°F	30.8°F	48.2°F	63.5°F	65.3°F	70.7°F	69.6°F	65.7°F	49.6°F	45.4°F	42.1°F	49.1°F
		-5.9°C	-8.1°C	-0.7°C	9.0°C	17.5°C	18.5°C	21.5°C	20.9°C	18.7°C	9.8°C	7.5°C	5.6°C	9.5°C
Loch Lomond	LOLP1	23.3°F	17.9°F	32.3°F	47.9°F	63.2°F	66.5°F	71.7°F	70.4°F	66.2°F	50.8°F	46.7°F	43.0°F	50.0°F
		-4.8°C	-7.8°C	0.2°C	8.8°C	17.4°C	19.2°C	22.1°C	21.3°C	19.0°C	10.4°C	8.2°C	6.1°C	10.0°C

*Deposit did not report during the calendar year 2015. Nearby station, Walton 2, NY, was used instead.

M = missing data (Monthly statistics are reported as' M' if greater than 4 days of data are missing).

Table 4. Summary of 2015 departure from normal temperature based on 30-year normal (1981–2010) for the selected stations.

Station name	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Port Jervis	PJRN6	-4.7°F	-14.6°F	-7.9°F	-2.2°F	5.0°F	-0.5°F	0.0°F	0.4°F	4.4°F	0.5°F	4.3°F	11.7°F	-0.1°F
		-2.6°C	-8.1°C	-4.4°C	-1.2°C	2.8°C	-0.3°C	0;0°C	0.2°C	2.4°C	0.3°C	2.4°C	6.5°C	-0.1°C
Hawley 1 E	HAWP1	-3.7°F	-13.1°F	-7.1°F	-1.5°F	5.2°F	0.6°F	-0.3°F	-0.2°F	4.5°F	-0.4°F	3.4°F	12°F	0.3°F
		-2.1°C	-7.3°C	-3.9°C	-0.8°C	2.9°C	0.3°C	-0.2°C	-0.1°C	2.5°C	-0.3°C	1.9°C	6.7°C	0.2°C
Deposit*	DEPN6*	-4.3°F	-14.4°F	-8.8°F	-2.5°F	5.4°F	0.1°F	-0.2°F	0.3°F	5.3°F	-0.1°F	4.6°F	12.5°F	0.0°F
		2.4°C	-8.0°C	-4.9°C	-1.4°C	3.0°C	0.1°C	-0.1°C	0.2°C	2.9°C	-0.1°C	2.6°C	6.9°C	0.0°C
Pleasant Mount 1 W	PLEP1	-4.3°F	-13°F	-7.4°F	-2.0°F	6.5°F	-0.4°F	-0.6°F	-0.1°F	5.7°F	0.0°F	4.2°F	12.7°F	0.3°F
		-2.4°C	-7.3°C	-4.1°C	-1.1°C	3.6°C	-0.2°C	-0.3°C	-0.1°C	3.2°C	0.0°C	2.3°C	7.1°C	0.2°C
Milanville[1]	MLAP1[1]	-2.0°F	-8.9°F	-5.8°F	-0.1°F	6.2°F	1.1°F	1.1°F	2.1°F	6.3°F	1.2°F	6.1°F	12.7°F	2.5°F
		-1.1°C	-4.9°C	-3.2°C	-0.1°C	3.4°C	0.6°C	0.6°C	1.2°C	3.5°C	0.7°C	3.4°C	7.1°C	1.4°C
Stroudsburg	SDBP1	-2.2°F	-11.5°F	-4.7°F	0.9°F	6.1°F	-0.1°F	0.0°F	0.5°F	4.7°F	0.3°F	5.8°F	13.0°F	1.2°F
		-1.3°C	-6.4°C	-2.6°C	0.5°C	3.4°C	-0.1°C	0.0°C	0.3°C	2.6°C	0.2°C	3.2°C	7.2°C	0.7°C
Rock Hill 3 SW	RKHN6	M	M	M	M	3.2°F	-3.0°F	-2.0°F	-1.8°F	M	M	3.5°F	M	M
		M	M	M	M	1.8°C	-1.7°C	-1.1°C	-1.0°C	M	M	1.9°C	M	M
Sussex Airport	KFWN	-3.0°F	-13.0°F	-5.7°F	0.2°F	5.4°F	0.2°F	1.2°F	0.5°F	5.1°F	-0.3°F	4.4°F	12.3°F	0.8°F
		-1.7°C	-7.2°C	-3.2°C	0.1°C	3.0°C	0.1°C	0.7°C	0.3°C	2.8°C	-0.2°C	2.4°C	6.8°C	0.5°C
Aeroflex-Andover Airport	K12N	-3.2°F	-13.4°F	M	-0.9°F	5.1°F	-0.2°F	0.0°F	0.1°F	4.3°F	-0.8°F	4.6°F	M	0.7°F
		-1.8°C	-7.4°C	M	-0.5°C	2.8°C	-0.1°C	0.0°C	0.1°C	2.4°C	-0.4°C	2.6°C	M	0.4°C

[1] Indicates a station's Period of Record is ten or more years but less than 30 years. In these cases, the departure from normal values were calculated with normals derived from data spanning the length of the station's period of record. Stations with a Period of Record of less than 10 years were not included in this table.

* Deposit did not report during the calendar year 2015. Nearby station, Walton 2, NY and its normals were used for departure calculations.

M = missing data (Monthly statistics are reported as' M' if greater than 4 days of data are missing).

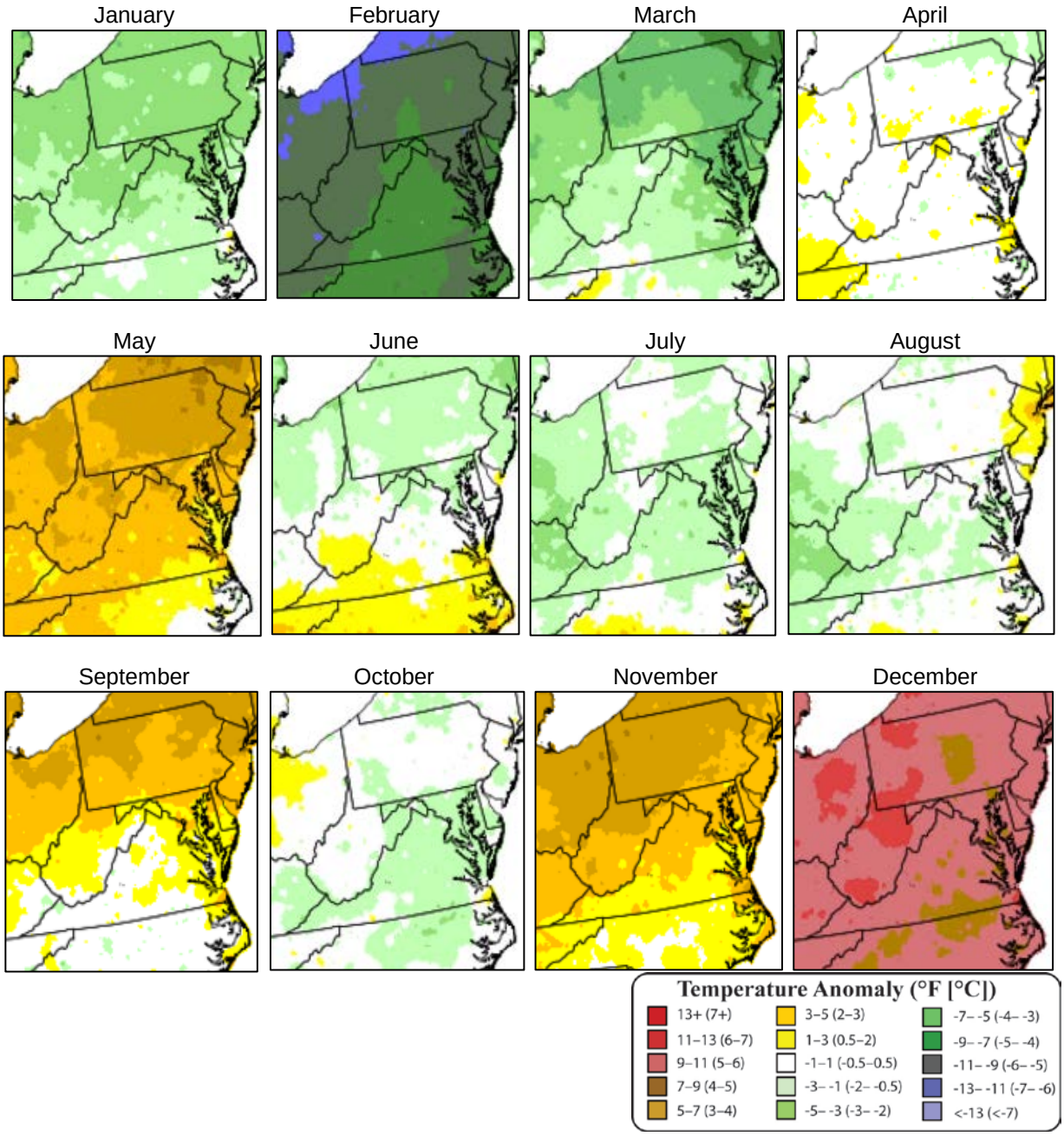

Figure 2. Maps showing departure from average monthly maximum temperature compared to the 30-year normal (1981–2010).

Delaware Water Gap National Recreation Area
and Upper Delaware Scenic and Recreational River
Departure from Average Monthly Minimum Temperature
2015 vs. 1981–2010

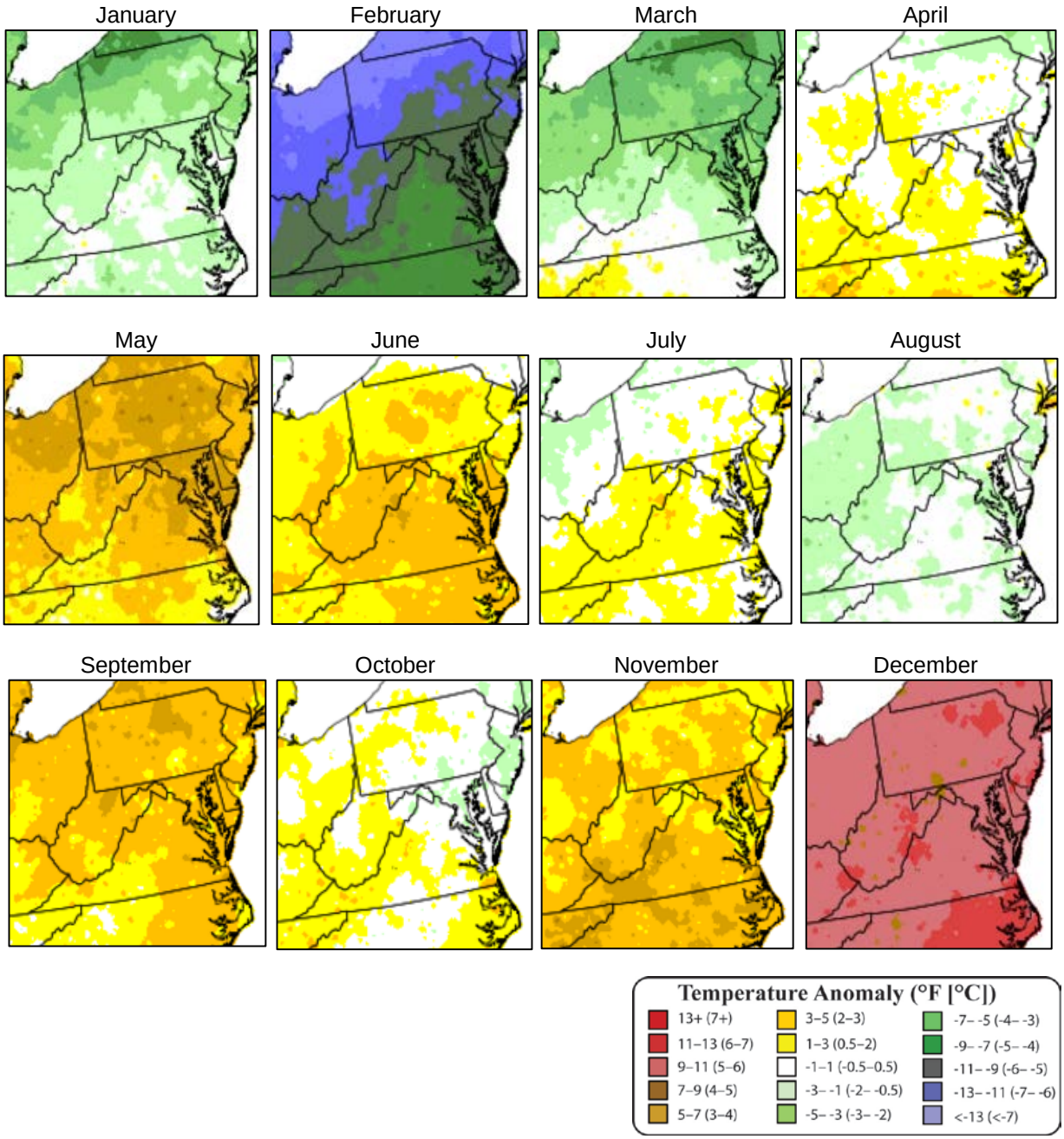

Figure 3. Maps showing departure from average monthly minimum temperature compared to the 30-year normal (1981–2010).

Table 5. Seasonal and annual temperature and precipitation rankings for 2015 over 121 years (1 = warmest/wettest year and 121 = coldest/driest year) for Pennsylvania Climate Division 1 (top), New Jersey Climate Division 1 (middle), and New York Climate Division 2 (bottom). T = Tie.

PA Climate Division 1 Rankings "Pocono Mountains"	**Jan–Feb–Mar WINTER**	**Apr–May–Jun SPRING**	**Jul–Aug–Sep SUMMER**	**Oct–Nov–Dec AUTUMN**	**Jan–Dec ANNUAL**
Temperature-2015	118	T4	T11	1	17
Precipitation-2015	112	37	78	66	84
NJ Climate Division 1 Rankings "Northern NJ"	**Jan–Feb–Mar WINTER**	**Apr–May–Jun SPRING**	**Jul–Aug–Sep SUMMER**	**Oct–Nov–Dec AUTUMN**	**Jan–Dec ANNUAL**
Temperature-2015	118	5	3	1	T12
Precipitation-2015	68	76	96	74	99
NY Climate Division 2 Rankings "Eastern Plateau"	**Jan–Feb–Mar WINTER**	**Apr–May–Jun SPRING**	**Jul–Aug–Sep SUMMER**	**Oct–Nov–Dec AUTUMN**	**Jan–Dec ANNUAL**
Temperature-2015	121	14	11	1	T28
Precipitation-2015	113	25	53	63	60

Precipitation Summary

Annual precipitation (rain and melted snow, ice, sleet, etc.; hereafter precipitation) for calendar year 2015 averaged near to slightly below normal across the region (Tables 6 and 9). The number of heavy and extreme precipitation, days, however, were at or above each station's respective long-term averages (Table 6).

The year began with below-normal precipitation during much of January, February and March (Figure 4). The first three months of 2015 were ranked as one of the top 10 driest in 121 years of record keeping in both Pennsylvania and New York (Table 5). New Jersey, however, saw a bit more precipitation during the season and ranked as just the 53rd driest (61 is the mid-point, Table 5). All reporting stations reported below-average precipitation (rain and snow) during the months of January, February and March, with the only above normal amount (103 percent) tallied at Aeroflex-Andover Airport in January (Table 9).

Spring began with widely varying precipitation amounts during the month of April, with monthly totals between 51 and 136 percent of normal (Table 9). May was exceptionally dry across the region, with 7 of the 9 observing stations that reported that month measuring less than half of the long-term monthly average (Table 9). The dry weather did not last, however, as June was exceptionally wet, with as much as 11.0 in (278 mm) tallied at Stroudsburg, PA during the month (Table 8). After the back-and-forth of wet and dry weather for the season, spring ranked from the 25th to 76th wettest in 121 years for the three climate divisions encompassing the parks (Table 5).

While some variability existed in summer 2015 precipitation across the parks, the season was generally close to long-term average accumulations for the three-month period of July, August and September (Tables 8 and 9). Some heavy rains did fall during this period as 4 of the top 5 wettest days of the year occurred during this period (Table 7). Overall, summer 2015 had varied rankings between 53rd wettest in eastern NY to 26th driest in northern NJ (Table 5).

The autumn season was near to below normal, with total precipitation ranging from 8.5–12.7 in (216–323 mm) (Table 6). Of the three months, November was the driest with just 1.8 in (46 mm) measured at Stroudsburg, only 43 percent of the long-term mean (Tables 8 and 9). The last month of the year was relatively wet, with precipitation amounts ranging between 97 and 125 percent of normal across the observing stations near the parks (Table 9). Precipitation during the last three months of 2015 ranked between 48th to 59th driest in 121 years of records (Table 5), going against the long-term trend of increasing precipitation amounts during autumn. Precipitation for the entire year fell between 77 and 101 percent of normal across the reporting stations near the parks (Table 9).

Table 6. Status of 2015 precipitation indicators compared to the 30-year normal (1981–2010) at the Port Jervis (PJRN6), Hawley 1 E (HAWP1), and Pleasant Mount 1 W (PLEP1) stations.

Precipitation Indicator	Port Jervis, NY 2015	Port Jervis, NY 1981-2010	Hawley 1 E, PA 2015	Hawley 1 E, PA 1981-2010	Pleasant Mount 1 W, PA 2015	Pleasant Mount 1 W, PA 1981-2010
Annual Precipitation	43.9 in 1115 mm	46.4 in 1,179 mm	39.5 in 1,003 mm	42.9 in 1,090 mm	45.4 in 1,153 mm	49.5 in 1,257 mm
Autumn (Oct, Nov, Dec) Precipitation	8.5 in 216 mm	11.8 in 300 mm	10.1 in 256 mm	10.6 in 269 mm	12.7 in 323 mm	12.7 in 323 mm
Heavy Precipitation Days (days with ≥1.0 in (25 mm) rain)	12	11	10	10	10	11
Extreme Precipitation Days (days with ≥2.0 in (51 mm) rain)	4	2	2	1	2	2
Micro-drought (strings of 7+ days without rain)	11	8	9	5	6	5
Annual Snowfall (inches)	39.5 in 100.3 cm	42.5 in 108.0 cm	43.1 in 109.5 cm	44.2 in 112.3 cm	64.9 in 140.7 cm	68.5 in 174.0 cm
Measurable Snow Days (days with ≥0.1 in (0.3 cm) snow)	19	20	26	20	34	28
Moderate Snow Days (days with ≥3.0 in (7.6 cm) snow)	5	5	5	5	8	8
Heavy Snow Days (days with ≥5.0 in (12.7 cm) snow)	3	2	2	3	1	4

Table 7. Top five wettest days and top five dry spells (consecutive days with a trace or less of liquid precipitation) during 2015 from the Port Jervis (PJRN6), Hawley 1 E (HAWP1) and Pleasant Mount 1 W (PLEP1) stations.

Wettest Days in 2015	Dry Spells in 2015
Jul. 1: 2.90 in (74 mm)	Aug. 26 – Sept. 10
Oct. 29: 2.89 in (73 mm)	Sept. 14 – 29
Sept. 30: 2.58 in (65 mm)	Oct. 15 – 28
Jul. 27: 2.22 in (56 mm)	Apr. 24 – May 5
Aug. 11: 1.70 in (43 mm)	Dec. 4 – 14

Table 8. Summary of 2015 monthly total precipitation for selected stations.

Station name	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Port Jervis	PJRN6	2.7 in	1.3 in	2.7 in	2.6 in	1.6 in	8.3 in	7.9 in	3.5 in	4.8 in	3.2 in	1.6 in	3.7 in	43.9 in
		69 mm	34 mm	68 mm	67 mm	41 mm	211 mm	200 mm	90 mm	121 mm	81 mm	41 mm	93 mm	1115 mm
Equinunk 2 NW	EQNP1	2.4 in	2.0 in	2.3 in	4.8 in	M	M	M	M	M	M	M	M	M
		61 mm	52 mm	58 mm	122 mm	M	M	M	M	M	M	M	M	M
Hawley 1 E	HAWP1	2.0 in	1.7 in	2.3 in	3.3 in	1.7 in	7.1 in	3.4 in	3.4 in	4.5 in	3.7 in	2.3 in	4.1 in	39.5 in
		50 mm	42 mm	58 mm	85 mm	43 mm	181 mm	86 mm	86 mm	114 mm	94 mm	58 mm	105 mm	1002 mm
Deposit*	DEPN6*	2.4 in	2.5 in	2.4 in	4.1 in	1.7 in	7.8 in	5.6 in	3.6 in	3.3 in	5.1 in	3.1 in	4.0 in	45.5 in
		60 mm	62 mm	60 mm	105 mm	44 mm	198 mm	141 mm	92 mm	83 mm	130 mm	78 mm	102 mm	1154 mm
Rock Hill 3 SW	RKHN6	M	M	M	M	2.0 in	7.6 in	6.2 in	4.1 in	M	M	2.8 in	M	M
		M	M	M	M	51 mm	192 mm	158 mm	104 mm	M	M	70 mm	M	M
Pleasant Mount 1 W	PLEP1	2.3 in	2.6 in	2.3 in	5.2 in	2.1 in	7.7 in	3.3 in	3.8 in	3.6 in	5.0 in	3.4 in	4.3 in	45.5 in
		59 mm	65 mm	57 mm	131 mm	54 mm	195 mm	84 mm	97 mm	91 mm	126 mm	85 mm	110 mm	1154 mm
Milanville	MLAP1	2.0 in	1.8 in	2.0 in	3.3 in	1.9 in	6.3 in	3.2 in	3.6 in	4.3 in	3.2 in	M	3.6 in	38.0 in
		53 mm	45 mm	52 mm	83 mm	49 mm	161 mm	80 mm	90 mm	108 mm	82 mm	M	91 mm	965 mm
Stroudsburg	SDBP1	2.4 in	2.1 in	3.3 in	2.7 in	4.3 in	11.0 in	5.2 in	3.1 in	5.7 in	4.3 in	1.8 in	4.8 in	50.5 in
		61 mm	52 mm	83 mm	68 mm	108 mm	278 mm	131 mm	78 mm	145 mm	109 mm	45 mm	123 mm	1282 mm
Sussex Airport	KFWN	2.7 in	1.2 in	2.8 in	2.1 in	2.0 in	8.0 in	2.1 in	2.8 in	3.9 in	2.5 in	2.2 in	3.9 in	36.2 in
		70 mm	30 mm	70 mm	53 mm	52 mm	203 mm	53 mm	72 mm	100 mm	63 mm	55 mm	99 mm	919 mm
Aeroflex-Andover Airport	K12N	3.3 in	1.9 in	M	2.3 in	2.4 in	6.9 in	2.9 in	3.5 in	4.2 in	2.9 in	1.8 in	M	37.8 in
		84 mm	48 mm	M	58 mm	60 mm	175 mm	74 mm	89 mm	105 mm	74 mm	46 mm	M	959 mm
Blue Mountain Lakes	TS717	M	M	M	M	M	M	M	M	M	M	M	M	M
		M	M	M	M	M	M	M	M	M	M	M	M	M
Loch Lomond	LOLP1	2.5 in	0.8 in	2.6 in	2.6 in	2.3 in	9.9 in	2.8 in	4.8 in	4.7 in	3.6 in	2.2 in	4.1 in	42.8 in
		64 mm	20 mm	66 mm	65 mm	58 mm	252 mm	71 mm	122 mm	119 mm	92 mm	55 mm	103 mm	1088 mm

*Deposit did not report during the calendar year 2015. Nearby station, Walton 2, NY, was used instead.

M = missing data (Monthly statistics are reported as' M' if more than 4 days of data are missing).

Table 9. Summary of 2015 percent of normal precipitation based on 30-year normal (1981–2010) for selected stations.

Station name	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Port Jervis	PJRN6	85	45	73	65	40	189	201	91	105	73	45	97	95
Equinunk 2 NW	EQNP1	77	79	67	136	M	M	M	M	M	M	M	M	M
Hawley 1 E	HAWP1	64	61	74	88	44	160	91	94	111	99	65	125	92
Deposit*	DEPN6*	68	93	73	111	44	184	127	91	77	129	81	123	101
Rock Hill 3 SW	RKHN6	M	M	M	M	44	161	148	100	M	M	67	M	M
Pleasant Mount 1 W	PLEP1	72	90	64	129	45	155	71	93	74	105	79	117	92
Milanville[1]	MLAP1[1]	65	62	58	82	41	128	68	87	88	68	M	97	77
Stroudsburg	SDBP1	69	67	85	66	95	226	110	70	114	91	43	117	99
Sussex Airport	KFWN	88	46	80	51	48	196	47	66	101	60	59	116	80
Aeroflex-Andover Airport	K12N	103	62	M	50	57	154	66	98	91	64	52	M	79

[1] Indicates a station's Period of Record is 10 years or more but less than 30 years. In these cases, the departure-from-normal values were calculated with normals derived from data spanning the length of the station's period of record. Stations with a Period of Record of less than 10 years were not included in this table.

* Deposit did not report during the calendar year 2015. Nearby station, Walton 2, NY and its normals were used for percent of normal calculations.

M = missing data (Monthly statistics are reported as' M' if more than 4 days of data are missing). *pro-rated for months available

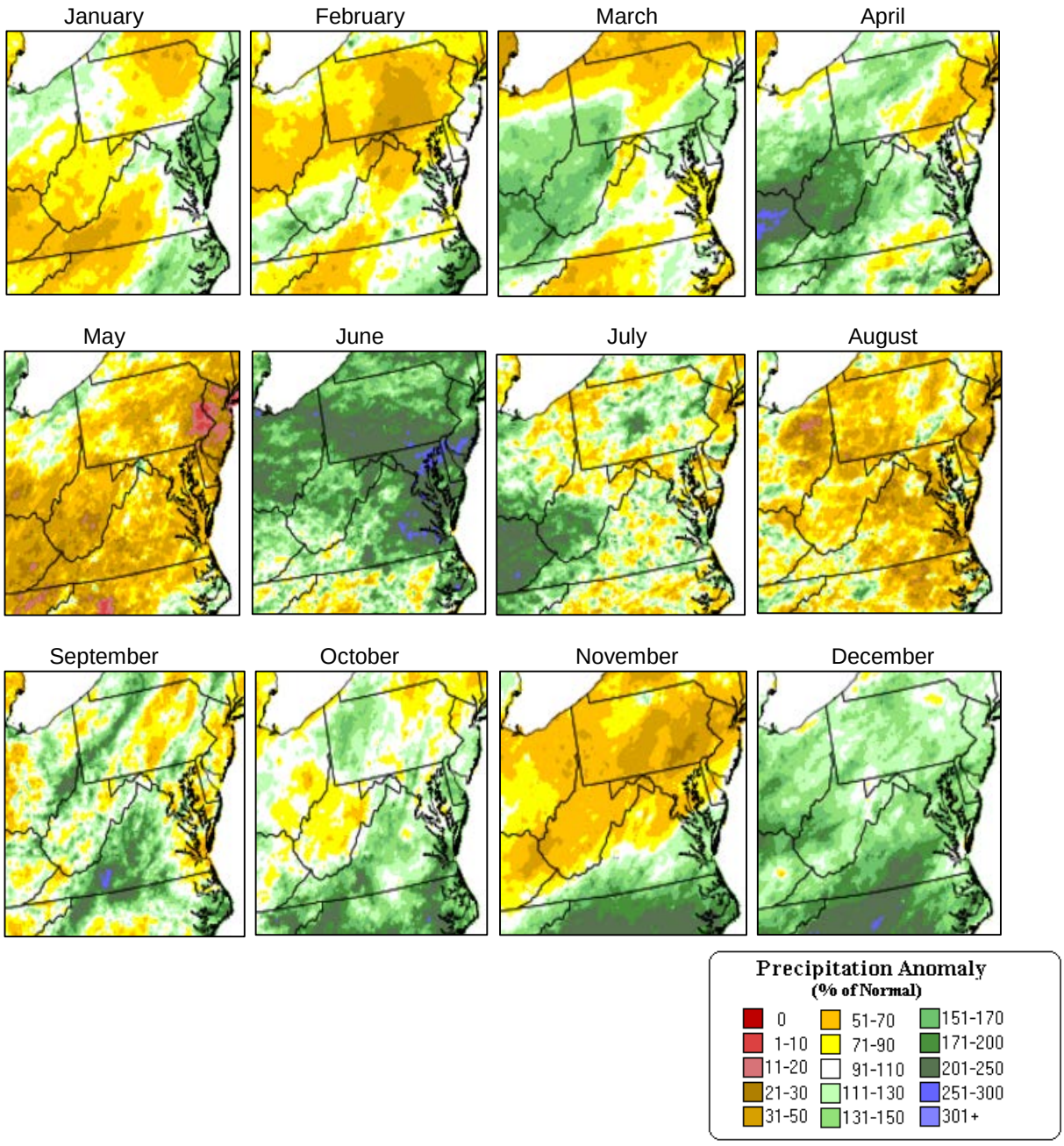

Figure 4. Maps showing percent of average monthly precipitation compared to the 30-year normal (1981–2010).

Drought Status

There are a number of drought indices used to estimate the severity of drought in an area using algorithms that incorporate recent temperatures, rainfall, soil moisture, and other information (http://www.drought.gov). The main indices we report are the Palmer Drought Severity Index (PDSI) and the United States Drought Monitor (DM) – Drought Intensity Index. While both indices provide excellent summary information on broad-scale conditions, local conditions (such as at the park scale) may vary.

The PDSI is a soil moisture algorithm calibrated for relatively homogeneous regions and is calculated on a monthly basis using precipitation and temperature data, as well as the water content of the soil. The values vary between extremely moist (>4.0) and extreme drought (<-4.0), with "normal" values ranging between -1.9 and 1.9. Monthly PDSI values for Pennsylvania Climate Division 1 in 2015 are shown in Figure 5.

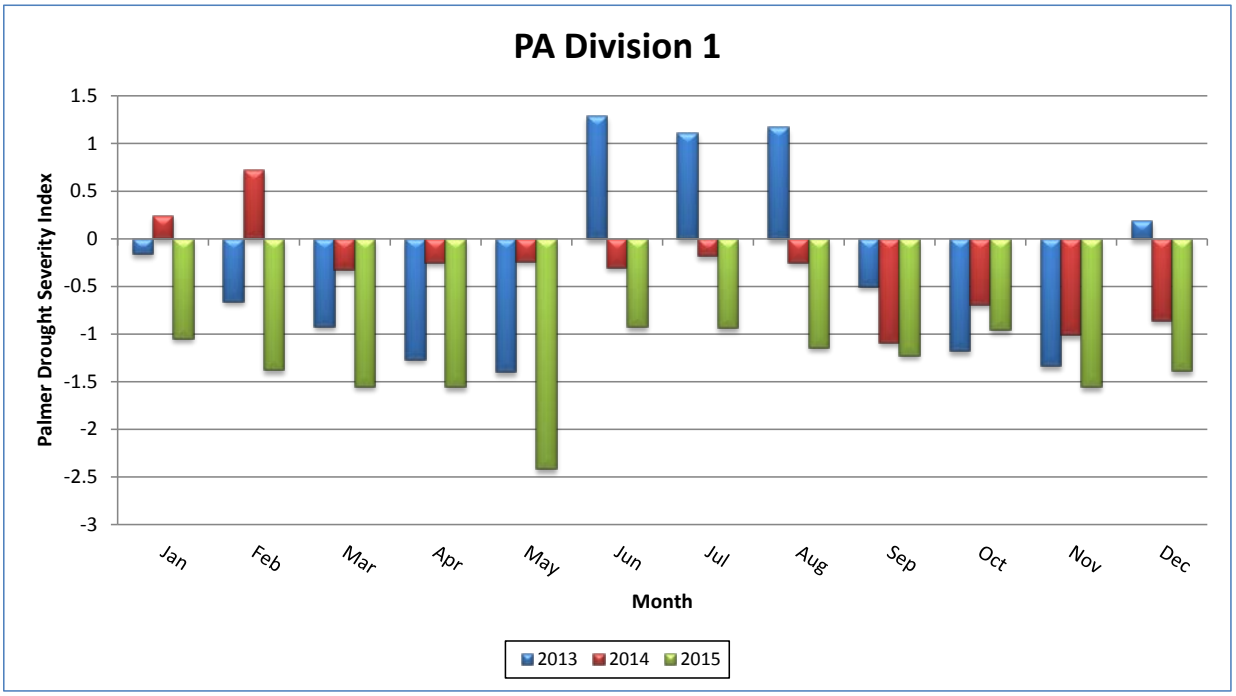

Figure 5. Monthly Palmer Drought Severity Index (PDSI) values for Pennsylvania Climate Division 1 2013–2015.

The DM – Drought Intensity Index is a synthesis of multiple indices (including the PDSI) and impacts, and represents a consensus of federal and academic scientists (NIDIS 2013). The DM produces a summary map of drought intensity for the nation and all states each week. It is on a scale ranging from abnormally dry (D0) to exceptional drought (D4). Mid-month (i.e., the second or third week) values for Pennsylvania (Figure 6) and the Northeast (Figure 7) are shown for 2015.

According to the PDSI for PA Climate Division 1, every month during 2015, except May when abnormally dry conditions were noted, was within the normal range. The summer season would have

looked drastically different had June not been an exceptionally wet month that brought some reprieve from the very dry conditions. When compared with the past few years, 2015 has continued the trend of persistently below normal PDSI values (except for the abnormally moist conditions during summer 2013).

The DM – Drought Severity Index for Pennsylvania (Figure 6) and the Northeast (Figure 7) shows a similar pattern for the growing season (May through October); with dry weather noted in May, September and October.

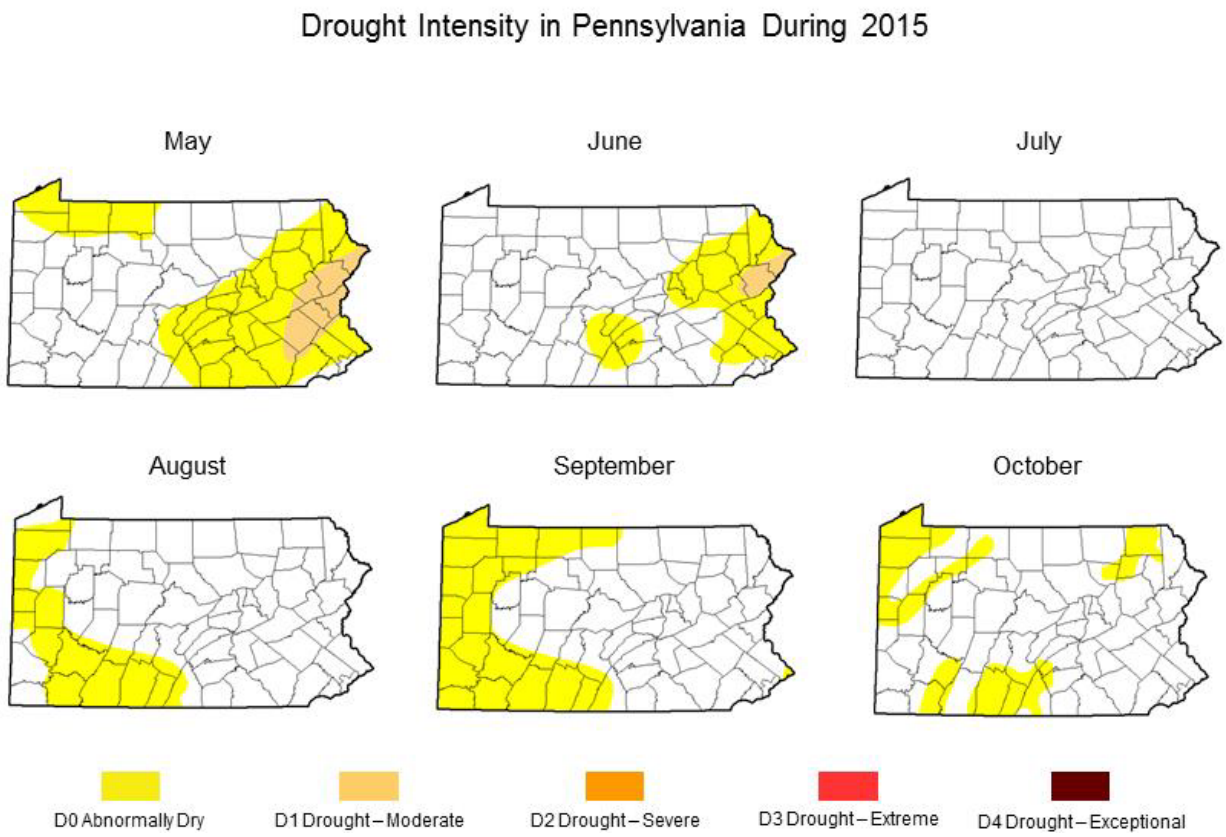

Figure 6. Mid-month values of the United States Drought Monitor (DM) - Drought Intensity Index for Pennsylvania in 2015.

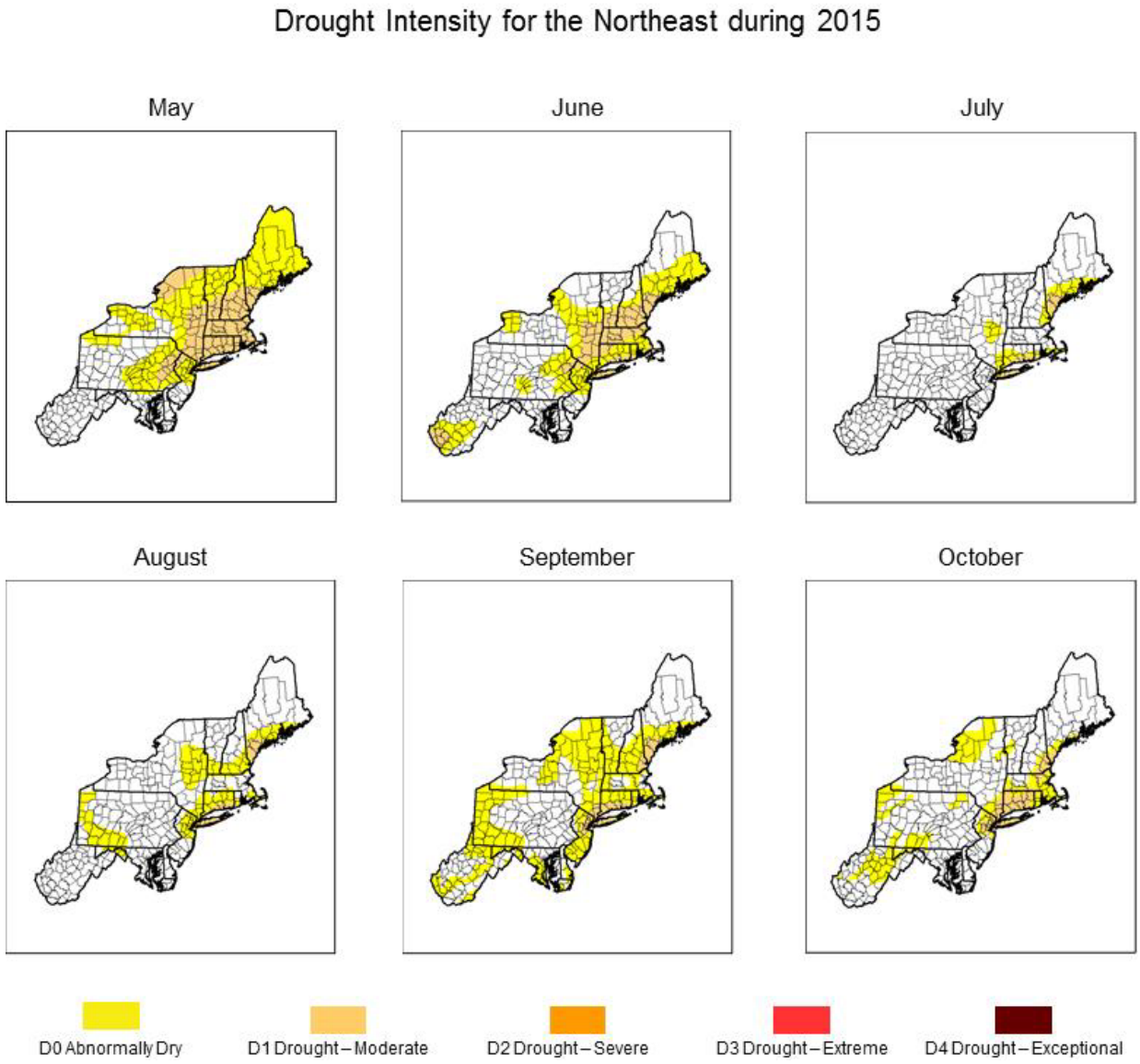

Figure 7. Mid-month values of the United States Drought Monitor (DM) - Drought Intensity Index for the Northeast in 2015.

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