National Park Service
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Natural Resource Stewardship and Science

Weather of
Allegheny Portage Railroad National Historic Site and Johnstown Flood National Memorial

Eastern Rivers and Mountains Network Summary Report for 2012

Natural Resource Data Series NPS/ERMN/NRDS—2013/560

ON THE COVER
Photo description: Summer sky at Allegheny Portage Railroad National Historic Site 2009.
Photograph by: Kathy Penrod.

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Natural Resource Data Series NPS/ERMN/NRDS—2013/560

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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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List of Key Acronyms

ALPO	Allegheny Portage Railroad National Historic Site
ASOS	Automated Surface Observing System
COOP	National Weather Service Cooperative Observer Program
CWOP	Citizen Weather Observer Program
ERMN	Eastern Rivers and Mountains Network
FAA	Federal Aviation Administration
GOES	Geostationary Operational Environmental Satellite
NHS	National Historic Site
IFLOWS	Integrated Flood Observing and Warning System
JOFL	Johnstown Flood National Memorial
NADP	National Atmospheric Deposition Program
NARR	North American Regional Reanalysis
NCDC	National Climatic Data Center
NOAA	National Oceanic and Atmospheric Administration
NMem	National Memorial
NPS	National Park Service
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
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, 2012, 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 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 the body of this report.

The Climate of the South Central Mountains

Allegheny Portage Railroad National Historic Site (NHS) and Johnstown Flood National Memorial (NMem) are located in Pennsylvania Climate Division 8, also known as the South Central Mountains. 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 is divided into 10 climate divisions.

The South Central Mountain region is generally considered to have a humid continental type of climate, but the elevated terrain and rolling mountains keep temperatures lower than surrounding areas. The prevailing westerly winds carry most of the weather disturbances that affect the region from the interior of the continent, with the Atlantic Ocean having only an occasional 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, though the air circulating southeastward from the Great Lakes dominates in the winter. Seldom do storms of tropical origin have an effect in this part of Pennsylvania, but the rough terrain has led to memorable severe floods in the warm half of the year (Gelber 2002).

Temperatures are moderately continental, with the tempering effects of the Great Lakes contributing to cloud production in the winter and mountain-valley circulation-induced clouds reducing the heat 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 Laurel Highlands. Allegheny Portage Railroad NHS tends to have greater daytime temperatures than Johnstown Flood NMem; however, Johnstown Flood NMem tends to have fewer sub-freezing nights than the Allegheny Portage Railroad NHS. The last freeze for the region typically occurs in May and the first frosts appear in late September or October.

Precipitation is fairly evenly distributed throughout the year. Annual amounts generally range between 36–54 in (914–1,371 mm), while the majority of places receive 40–46 in (1,016–1,168 mm). Greatest amounts usually occur in the spring and summer months, while February is the driest month, having about 2 in (51 mm) less than the wettest months. Precipitation tends to be somewhat greater in the higher terrain due to uplift and additional moisture from the Great Lakes. Based on long-term averages, annual precipitation amounts tend to be greater at Allegheny Portage Railroad NHS than at Johnstown Flood NMem.

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 between the equinoxes and reaches a peak near the summer solstice. Hail is relatively infrequent, but flash floods and damaging thunderstorm winds affect parts of the region each summer. On average, tornadoes pass through the area about once every two years. 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

Five weather observing stations, comprised of two observing networks, were selected around Allegheny Portage Railroad NHS and Johnstown Flood NMem. Representative stations within a 100-km range of each park were chosen based on several criteria, including proximity to the park, representativeness of the station to the park elevation profile, 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. The Dunlo station was excluded in 2012 for all months except January and February based on this criterion; therefore, only four stations were used for the majority of the report (Figure 1, Table 1).

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 2011) 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 "norma,l" 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.

The NCDC 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/gmaps/NPS_DEVELOPMENT/interface.php.

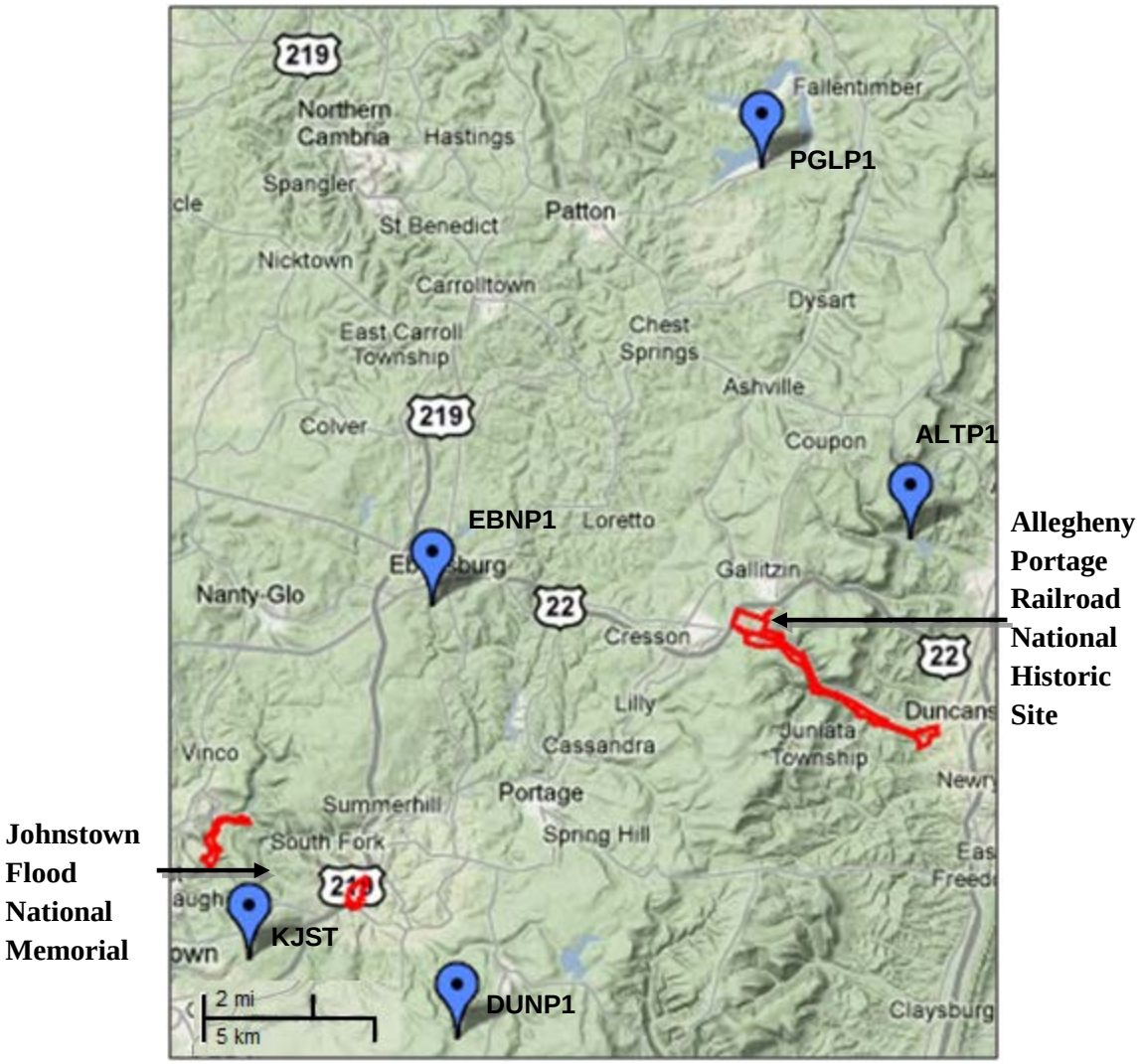

Figure 1. Location of weather observing stations around Allegheny Portage Railroad National Historic Site and Johnstown Flood National Memorial. See Table 1 for station names.

Table 1. List of weather observing stations around Allegheny Portage Railroad National Historic Site and Johnstown Flood National Memorial selected as best representative of the parks in 2012.

Station	Observing Network	Station Name	Period of Record (POR)		Percentage of Time Reporting Temperature for 2012	Percentage of Time Reporting Precipitation for 2012	Percentage of Time Reporting Temperature for entire POR	Percentage of Time Reporting Precipitation for entire POR
KJST	ASOS	John Murtha Johnstown-Cambria County Airport	01/01/1973	Present	98.4	98.4	99.6	41.0
ALTP1	COOP	Altoona 3 W	10/01/1967	Present	100.0	100.0	96.2	96.3
EBNP1	COOP	Ebensburg Sewage Plant	02/01/1964	Present	99.7	100.0	99.5	99.6
PGLP1	COOP	Prince Gallitzin State Park	09/01/1982	Present	100.0	100.0	95.8	97.5
DUNP1	COOP	Dunlo	02/01/1992	Present	-	16.2	-	95.2

Temperature Summary

Calendar year 2012 was warmer than average for the Allegheny Portage Railroad NHS and Johnstown Flood NMem region, with maximum temperatures averaging consistently between +2.4 to +3.0 degrees Fahrenheit (°F) (+1.4 to +1.7 degrees Celsius [°C]) from normal, and minimums were mild, too, ranging from +2.1°F (+1.1°C) to +2.5°F (+1.3°C) from normal (Figures 2 and 3, Table 2)[1].

Negative temperature departures in 2012 were quite limited, with only the eleventh month averaging below normal at all stations and seven of the other eleven months averaging above the long-term mean at all locations. January was mild, with readings more than 3.7°F (2.0°C) above average at Johnstown, PA (Tables 3 and 4). The lowest readings of the year occurred in January (4th), as temperatures dropped to -2°F (-18.9°C) in the Laurel Highlands (Table 2). Mean temperatures in February were even milder, with departures of +7.2°F (4.1°C) at Prince Gallitzin State Park (Table 4). Positive temperature anomalies reached their maximum in March, as readings averaged as much as 12.2°F (6.9°C) above normal (Table 4). The winter months of January–February–March were the warmest in the South Central Mountain Climate Division of Pennsylvania since records began in 1895 (59 is the mid-point; Table 5).

Spring was noted by above-normal temperatures at all stations in May (Table 4), but near-normal temperatures in the other months. The average temperature in Ebensburg, PA, during April was 46.5°F (8.1°C); -0.7°F (-0.4°C) below average and lower than March's readings (Tables 3 and 4). The first hot spell had daytime maxima above 85°F (29.6°C) from May 26–29. The last 32°F (0°C) reading of the spring occurred around May 11 (Table 2). The positive anomalies during May were not as high as March and slightly cooler nights in June led to a monthly departure of just 0.2°F (0.1°C) in Altoona, PA. In its entirety, temperatures in the spring were the 18th warmest in 118 years of record keeping (Table 5).

Warmer-than-average conditions continued into the summer months, which were the 44th warmest (Table 5) since records began in 1895, in part due to a very warm July, ranking the 11th warmest. More seasonable readings returned during August (Tables 3 and 4) and continued through September (Figures 2 and 3). The average temperature in July was 74.5°F (23.6°C) in Altoona, PA; 3.8°F (2.0°C) above average (Tables 3 and 4). The state experienced near- to below-seasonable readings in the late summer and then during October turned milder again with an average +1.5°F (0.8°C) temperature anomaly for the four stations. The highest temperature of the year occurred on July 8th in Ebensburg, PA, with a reading of 94.0°F (34.4°C) (Table 2). The first freeze of the autumn occurred on September 25th. November averaged well-below normal, the only month in 2012, and the fall of 2012 ranked the 33rd warmest for the South Central Mountain Climate Division. Calendar year 2012 featured notably less-than-normal frequency of cold days and near-normal number of hot days (Table 2). The total growing season length (days between last spring freeze and first fall freeze) ranged from 136–161 days or within a week of the long-term average (Table 2).

[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/.

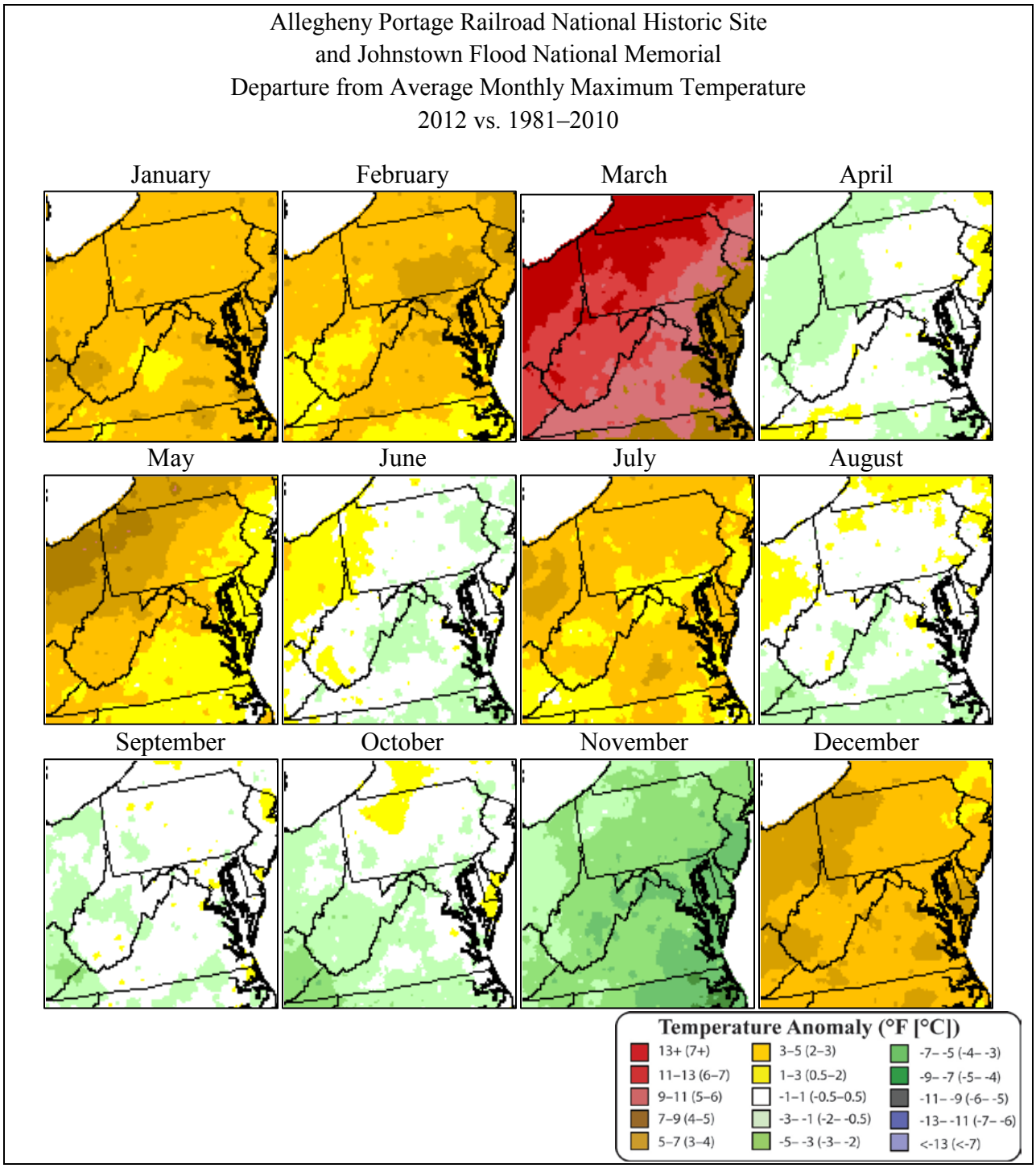

Figure 2. Maps showing departure from average monthly maximum temperature compared to the 30-year normal (1981–2010).

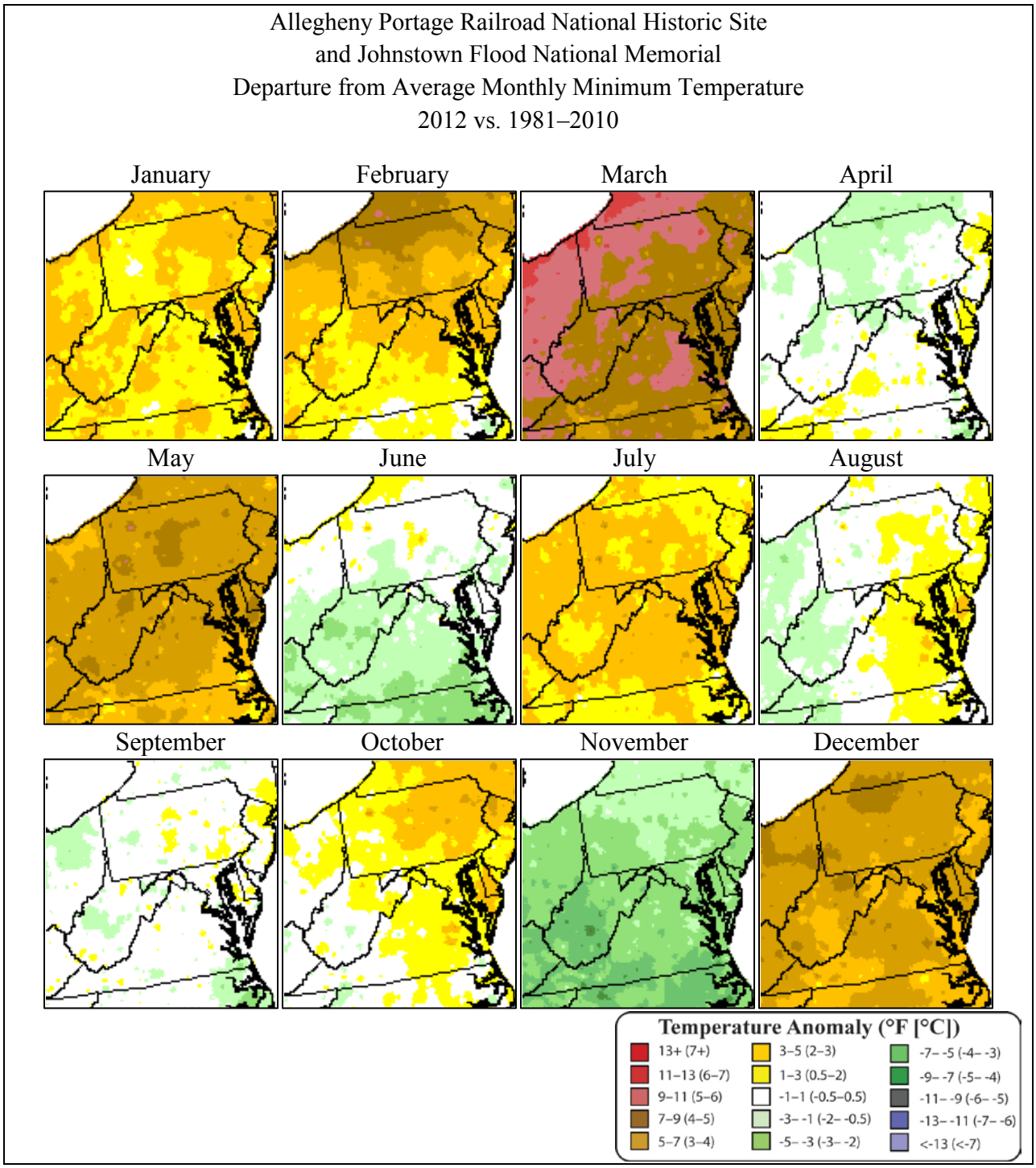

Figure 3. Maps showing departure from average monthly minimum temperature compared to the 30-year normal (1981–2010).

Table 2. Status of 2012 temperature indicators compared to the 30-year normal (1981–2010) at the Ebensburg Sewage Plant (EBNP1) and Johnstown Airport (KJST) stations.

Temperature Indicator	Ebensburg Sewage Plant, PA 2012	Ebensburg Sewage Plant, PA 1981–2010	Johnstown Airport, PA 2012	Johnstown Airport, PA 1981–2010
Average Annual Temperature	50.5°F 10.3°C	47.7°F 8.7°C	50.0°F 10°C	47.7°F 8.7°C
Average Annual Maximum Temperature	61.9°F 16.6°C	58.9°F 14.9°C	58.2°F 14.6°C	55.8°F 13.2°C
Maximum Temperature	94.0°F 34.4°C	90.6°F 32.6°C	91.0°F 32.8°C	86.9°F 30.5°C
Hot Days (days with Tmax≥90°F/32°C)	8	1	2	3
Average Annual Minimum Temperature	39.1°F 3.9°C	36.6°F 2.6°C	41.8°F 5.4°C	39.7°F 4.3°C
Minimum Temperature	-2.0°F -18.9°C	-11.7°F -24.3°C	2.0°F -16.7°C	-1.3°F -18.5°C
Cold Days (days with Tmax≤32°F/0°F)	19	38	31	50
Sub-freezing Days (days with Tmin≤32°F/0°C)	146	151	131	127
Sub-zero Days (days with Tmin≤0°F/-17.8°C)	1	7	0	1
Growing Season Length (days between last spring Tmin 32°F/0°C and first fall Tmin 32°F/0°C)	136	129	161	166

Table 3. Summary of monthly average temperatures for 2012 for the selected stations.

Station name	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Altoona 3 W	ALTP1	30.4°F	33.8°F	48.6°F	49.0°F	64.0°F	66.8°F	74.5°F	70.2°F	62.3°F	52.0°F	37.8°F	35.3°F	52.1°F
		-0.9°C	1°C	8.9°C	9.4°C	17.8°C	19.3°C	23.6°C	21.2°C	16.8°C	11.1°C	3.2°C	1.8°C	11.2°C
Ebensburg Sewage Plant	EBNP1	29.1°F	33.2°F	47.2°F	46.5°F	62.8°F	64.5°F	71.7°F	67.2°F	60.0°F	51.1°F	36.9°F	35.1°F	50.4°F
		-1.6°C	.7°C	8.4°C	8.1°C	17.1°C	18.1°C	22.1°C	19.6°C	15.6°C	10.6°C	2.7°C	1.7°C	10.2°C
Prince Gallitzin State Park	PGLP1	28.3°F	33.7°F	46.6°F	46.3°F	63.4°F	64.6°F	72.7°F	68.1°F	60.7°F	51.8°F	35.4°F	35.3°F	50.1°F
		-2.1°C	.9°C	8.1°C	7.9°C	17.4°C	18.1°C	22.6°C	20.1°C	15.9°C	11.0°C	1.9°C	1.8°C	10.1°C
Johnstown Airport	KJST	28.9°F	31.7°F	47.4°F	45.9°F	63.3°F	64.7°F	71.7°F	67.4°F	59.6°F	49.9°F	35.9°F	34.2°F	50.1°F
		-1.7°C	-.2°C	8.6°C	7.7°C	17.4°C	18.2°C	22.1°C	19.7°C	15.5°C	9.9°C	2.2°C	1.2°C	10.1°C

Table 4. Summary of 2012 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
Altoona 3 W	ALTP1	5.0°F	5.6°F	12.2°F	0.7°F	6.0°F	0.2°F	3.8°F	0.8°F	0.3°F	1.1°F	-3.1°F	3.2°F	3.2°F
		2.8°C	3.0°C	6.9°C	0.4°C	3.2°C	0.1°C	2.0°C	0.4°C	0.1°C	0.6°C	-1.8°C	1.8°C	1.8°C
Ebensburg Sewage Plant	EBNP1	3.7°F	5.4°F	11.3°F	-0.7°F	6.6°F	0.0°F	3.4°F	0.1°F	-0.4°F	1.4°F	-3.1°F	5.6°F	2.7°F
		2.0°C	2.9°C	6.2°C	-0.4°C	3.5°C	0.0°C	1.8°C	0.1°C	-0.2°C	0.8°C	-1.8°C	3.0°C	1.5°C
Prince Gallitzin State Park	PGLP1	4.0°F	7.2°F	12.0°F	0.1°F	7.5°F	-0.1°F	4.1°F	1.0°F	1.0°F	3.4°F	-3.8°F	6.8°F	3.1°F
		2.2°C	4.1°C	6.8°C	0.1°C	4.3°C	-0.1°C	2.2°C	0.6°C	0.6°C	1.9°C	-2.1°C	3.6°C	1.8°C
Johnstown Airport	KJST	3.7°F	4.6°F	11.9°F	-1.4°F	6.6°F	-0.1°F	2.4°F	-0.4°F	-0.2°F	0.2°F	-3.6°F	5.5°F	2.5°F
		2.0°C	2.4°C	6.7°C	-0.8°C	3.5°C	-0.1°C	1.4°C	-0.2°C	-0.1°C	0.1°C	-2.0°C	2.9°C	1.4°C

Table 5. Seasonal and annual temperature and precipitation rankings for 2012 over 118 years (1 = warmest/wettest year and 118 = coldest/driest year) for Pennsylvania Climate Division 8.

PA Climate Division 8 Rankings "South Central Mountains"	Jan–Feb–Mar WINTER	Apr–May–Jun SPRING	Jul–Aug–Sep SUMMER	Oct–Nov–Dec AUTUMN	Jan-Dec ANNUAL
Temperature-2012	1	T17	T44	33	T4
Precipitation-2012	85	58	20	30	28

T = "tie".

Precipitation Summary

Liquid precipitation (rain and melted snow, ice, sleet, etc.; hereafter precipitation) was slightly above normal in 2012 around Johnstown Flood NMem and Allegheny Portage Railroad NHS (Table 6), with five of the twelve months averaging above normal for all stations (Table 7). The winter was rather dry and the mid to late summer was wet; this allowed the year to rank as the 28th wettest in the South Central Mountain Climate Division of Pennsylvania since records began in 1895.

The beginning of the year featured below-normal precipitation from January through mid-March (Figure 4). However, the next six months of 2012 alternated between moist and dry months (Table 5). Between 14 and 16.8 in (356–425 mm) was tallied by the end of May (Tables 8 and 9); about 90 percent of normal. The start-of-the-year deficit began to be erased in the summer when an average of 150 percent of normal precipitation fell in the climate division. Snowfall was below the normal amount (Table 6), with a total of 60.1 in (152.7 cm) at Ebensburg Sewage Plant, which is more than 27 in (69 cm) below the long-term mean.

Spring was virtually normal across the region, with a ranking of 58th wettest in the South Central Mountain Climate Division with 118 years of records (Table 5) (59th is the mean). May provided the region with above-average rainfall at all reporting stations and June had below-normal rainfall at all sites (Table 9). The driest location was Prince Gallitzin during April when 1.54 in (39 mm) was measured (Table 8). Overall, April ranked as the 15th driest for the South Central Mountain Climate Division (Table 9).

The summer of 2012 had two faces, as it was quite dry in August, which ranked 45th driest in 118 years (Table 5); the other face became evident in July as heavy showers developed late in the month producing one of the wettest days of the year (2.60 in [66 mm]) on July 27th (Tables 7 and 9). There were no notable dry spells during the summer months (Table 7). September brought above-average rainfall, as 6.03 in (153mm) fell at Ebensburg (Table 8). There was one direct influence from tropical cyclones during this year with the area being affected by decaying Hurricane Sandy on October 30th. Total rainfall at Ebensburg, PA, was 3.44 in (87 mm) on October 30th, the wettest day of 2012 (Table 7).

Precipitation anomalies in the fall continued to be largely positive. October and December were both above normal; November brought the least precipitation (Figure 4). Prince Gallitzin tallied only 0.52 in (13 mm) which was 16% of normal (Table 8). Despite the very dry weather in November, the season concluded as the 30th wettest (Table 5). Two of the dry spells of 2012 occurred during this season (Table 7). As a whole, 2012 had more than the average number of excessive rain days and well below-normal number of snowy days (Table 6).

Table 6. Status of 2012 precipitation indicators compared to the 30-year normal (1981–2010) at the Ebensburg Sewage Plant (EBNP1) and Johnstown Airport (KJST) stations.

Precipitation Indicator	Ebensburg Sewage Plant, PA 2012	Ebensburg Sewage Plant, PA 1981-2010	Johnstown Airport, PA 2012	Johnstown Airport, PA 1981-2010
Annual Precipitation	50.8 in 1,290 mm	47.7 in 1,212 mm	42.9 in 1,090 mm	41.1 in 1,044 mm
Autumn (Oct, Nov, Dec) Precipitation	13.0 in 330 mm	11.2 in 284 mm	10.5 in 267 mm	9.3 in 236 mm
Heavy Precipitation Days (days with ≥1.0 in [25 mm] rain)	11	9	8	7
Extreme Precipitation Days (days with ≥2.0 in [51 mm] rain)	3	1	3	0
Micro-drought (strings of 7+ days without rain)	3	5	3	5
Annual Snowfall	60.1 in 152.6 cm	87.5 in 222 cm	M M	75.6 in* 192.0 cm*
Measurable Snow Days (days with ≥0.1 in [0.3 cm] snow)	25	40	M	39*
Moderate Snow Days (days with ≥3.0 in [7.6 cm] snow)	8	11	M	10*
Heavy Snow Days (days with ≥5.0 in [12.7 cm] snow)	4	4	M	3*

*Annual normal values were taken from Dunlo, PA (DUNP1) due to the lack of reporting snowfall at Johnstown Airport (KJST), but Dunlo had missing data for much of 2012 as well.

Table 7. Top five wettest days and top five dry spells (consecutive days with a trace or less of liquid precipitation) during 2012 from stations Ebensburg Sewage Plant (EBNP1) and Johnstown Airport (KJST).

Wettest Days in 2012	Dry Spells in 2012
Oct. 30: 3.44 in (87 mm)	Nov. 14–Nov. 24
May 27: 3.15 in (80 mm)	May 16–May 25
Oct. 29: 2.79 in (71 mm)	Nov. 3 –Nov. 11
July. 27: 2.60 in (66 mm)	Nov. 5–Nov. 12
July. 26: 2.16 in (55 mm)	Apr. 3–Apr. 9

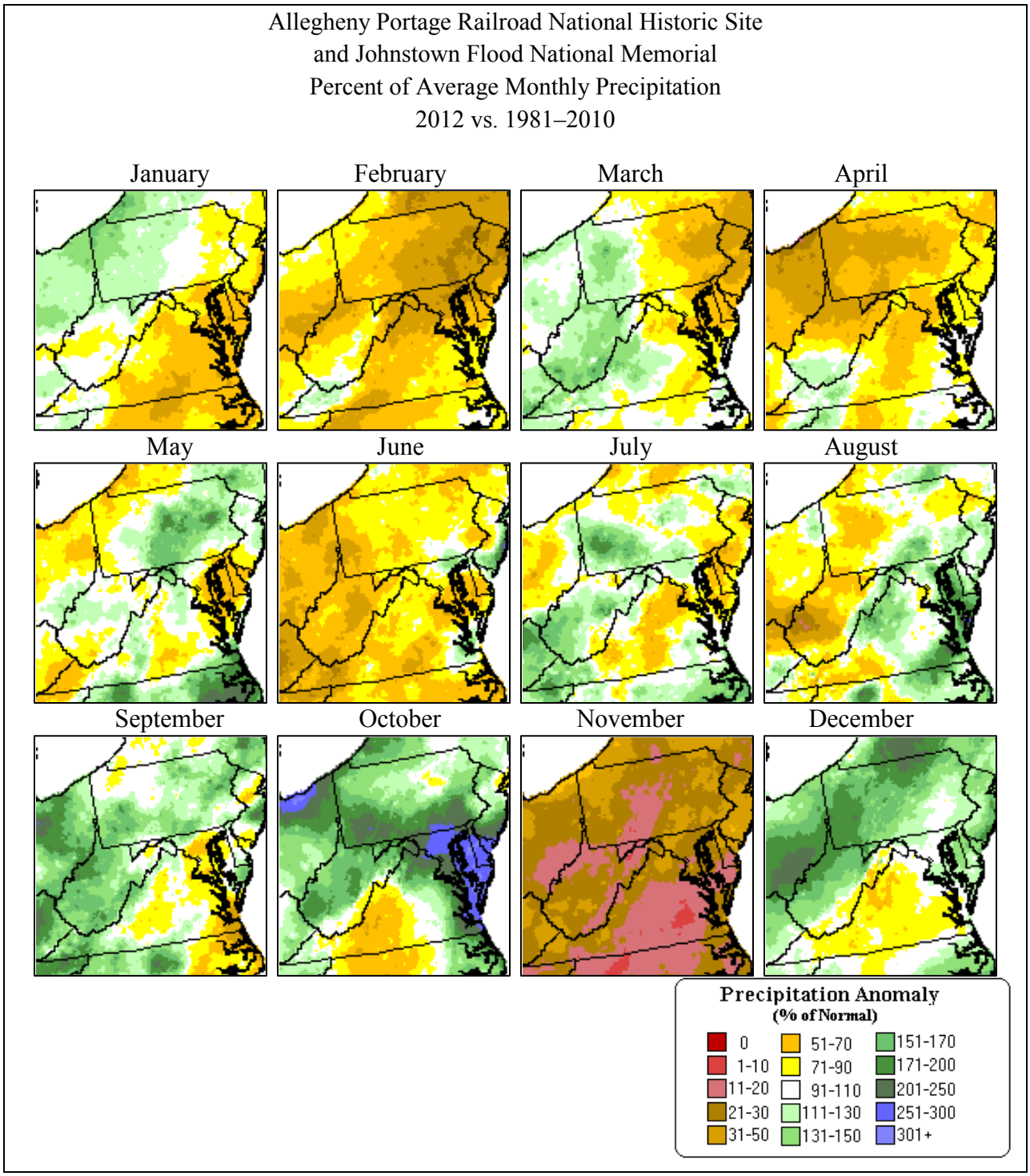

Figure 4. Maps showing percent of average monthly precipitation compared to the 30-year normal (1981–2010).

Table 8. Summary of 2012 monthly total precipitation for selected stations.

Station name	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Johnstown Airport	KJST	2.12 in	2.07 in	3.51 in	1.57 in	4.75 in	2.52 in	8.08 in	2.00 in	4.79 in	5.68 in	0.58 in	4.25 in	41.92 in
		54 mm	53 mm	89 mm	40 mm	121 mm	64 mm	205 mm	51 mm	122 mm	144 mm	15 mm	108 mm	1066 mm
Altoona 3 W	ALTP1	3.35 in	1.89 in	2.74 in	1.75 in	7.02 in	3.02 in	6.72 in	3.41 in	5.94 in	5.66 in	0.60 in	5.34 in	47.44 in
		85 mm	48 mm	70 mm	44 mm	178 mm	77 mm	171 mm	87 mm	151 mm	144 mm	15 mm	136 mm	1206 mm
Ebensburg Sewage Plant	EBNP1	4.72 in	1.93 in	4.07 in	2.14 in	6.03 in	2.99 in	7.24 in	2.66 in	6.03 in	6.09 in	0.99 in	5.87 in	50.76 in
		120 mm	49 mm	103 mm	54 mm	153 mm	76 mm	184 mm	68 mm	153 mm	155 mm	25 mm	149 mm	1289 mm
Prince Gallitzin State Park	PGLP1	3.38 in	1.07 in	3.72 in	1.54 in	5.18 in	2.74 in	7.67 in	1.42 in	3.80 in	4.40 in	0.52 in	4.22 in	30.66 in
		86 mm	27 mm	94 mm	39 mm	132 mm	70 mm	195 mm	36 mm	97 mm	112 mm	13 mm	107 mm	1008 mm
Dunlo	DUNP1	3.41 in	1.47 in	M	M	M	M	M	M	M	M	M	M	M
		87 mm	37 mm	M	M	M	M	M	M	M	M	M	M	M

Table 9. Summary of 2012 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
Johnstown Airport	KJST	74	88	107	44	105	62	210	53	140	186	16	165	102
Altoona 3 W	ALTP1	123	74	78	49	159	77	173	95	152	163	15	178	112
Ebensburg Sewage Plant	EBNP1	127	66	99	49	132	71	154	67	155	187	24	155	106
Prince Gallitzin State Park	PGLP1	124	45	111	45	140	72	205	38	104	146	16	172	78
Dunlo[1]	DUNP1	104	60	M	M	M	M	M	M	M	M	M	M	M

[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.

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 8 in 2012 are shown in Figure 5.

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 2012). 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 2012.

According to the PDSI, the value of this index in Climate Division 8 reflected the above-average rainfall that occurred during 2012. While values were in the "very moist" range during January and February, the effects of alternating below-normal precipitation during the spring and summer months lowered the PDSI to "normally moist" conditions. However, it turned drier during the first and last third of the summer, allowing the PDSI to approach "near-normal" levels by late August. However, the rain returned during September and even some flooding accompanied the remnants of Hurricane Sandy in late October. The very moist soil remained through the autumn, despite a parched November. There was no drought noted in the Allegheny Highlands during 2012 (Figure 5). When comparing 2012 with previous years, values of PDSI during the peak of the growing season (June–September) remained in the above-normal range in 2012 for the first time in this season. It is interesting to note that October–December, during the last three years, have been wetter than average.

The DM – Drought Severity Index for Pennsylvania (Figure 6) and the Northeast (Figure 7) show a similar pattern for the growing season (May through October); with no dry (D0) conditions during this period.

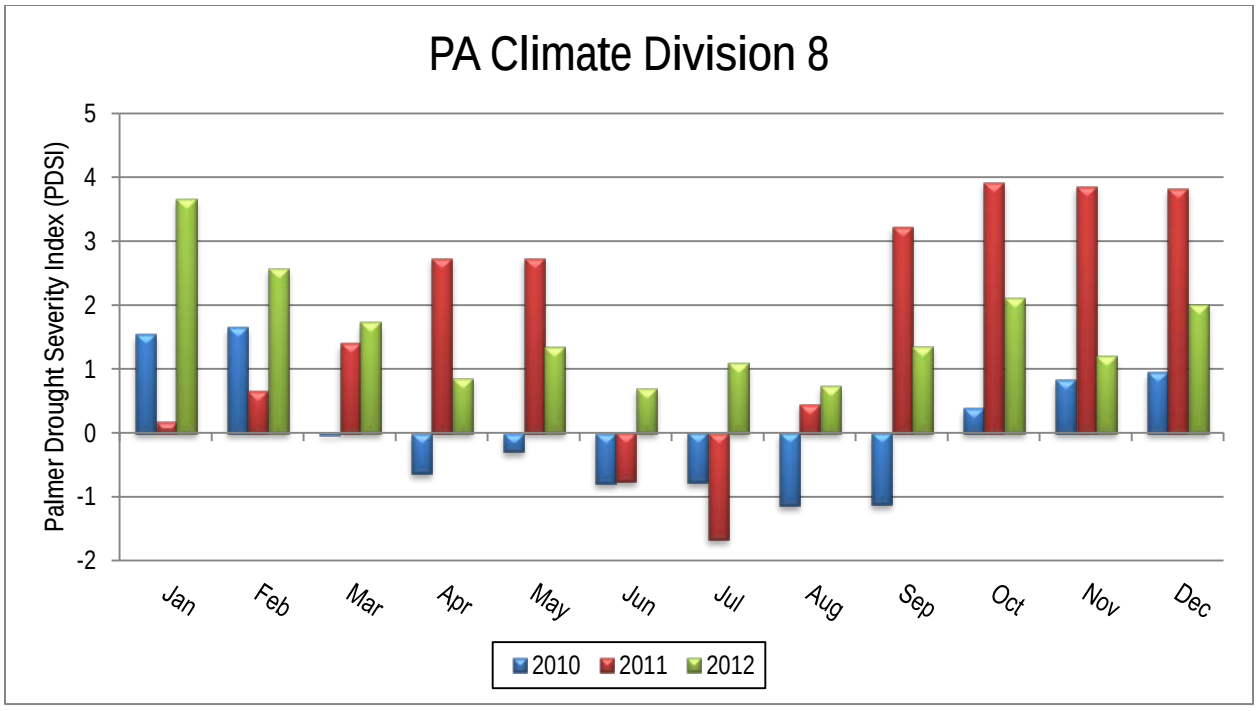

Figure 5. Monthly Palmer Drought Severity Index (PDSI) values for Pennsylvania Climate Division 8, 2010–2012.

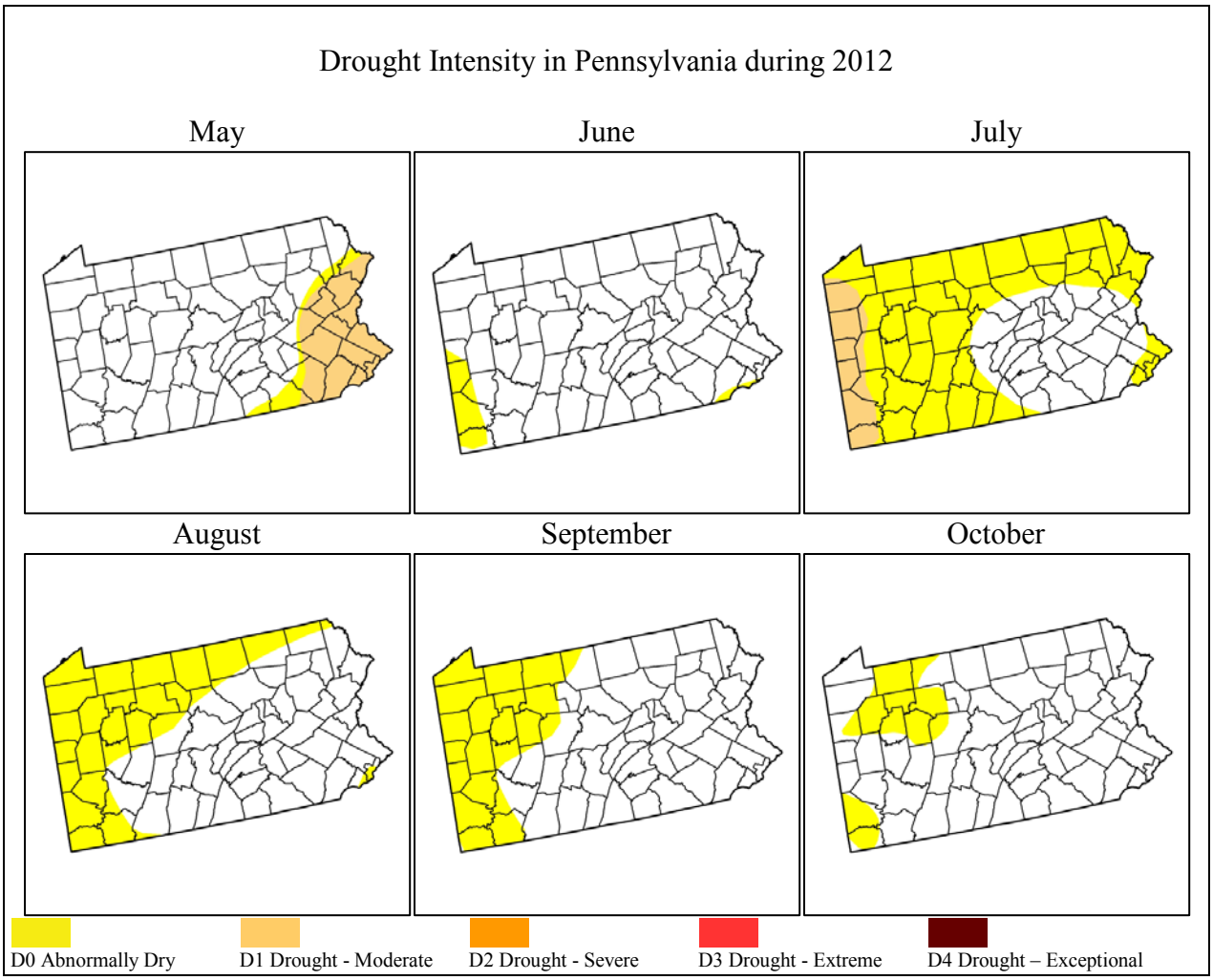

Figure 6. Mid-month values of the United States Drought Monitor (DM) - Drought Intensity Index for Pennsylvania in 2012.

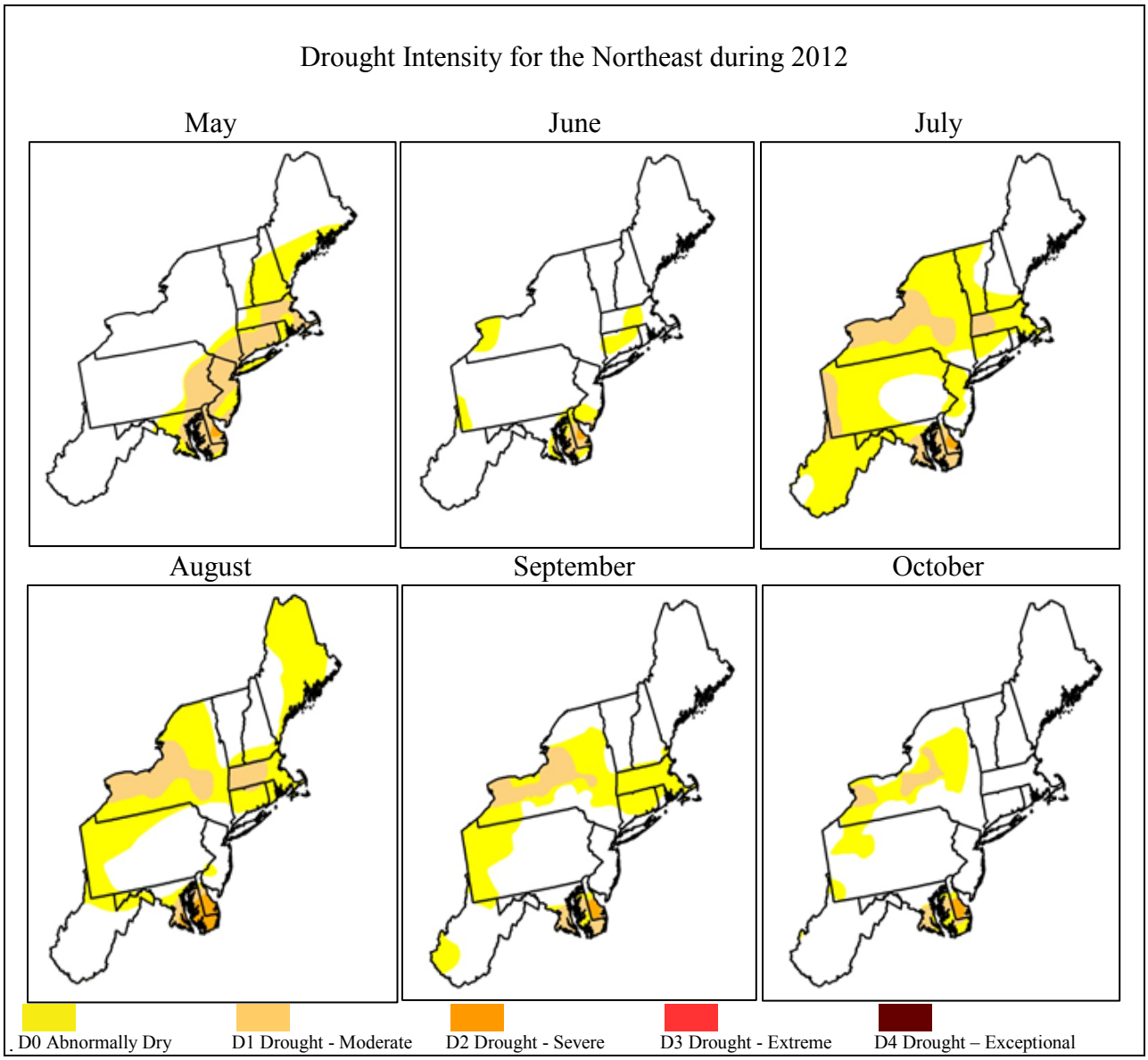

Figure 7. Mid-month values of the United States Drought Monitor (DM) - Drought Intensity Index for the Northeast in 2012.

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