



Weather of Appomattox Court House National Historical Park and Booker T. Washington National Monument

Mid-Atlantic Network Summary Report for 2017

Natural Resource Data Series NPS/MIDN/NRDS—2018/1164



ON THE COVER

“[Countryside](#)” — Appomattox Court House National Historical Park
Image courtesy of [Bill Dickinson](#) and licensed under [CC BY 2.0](#)

Weather of Appomattox Court House National Historical Park and Booker T. Washington National Monument

Mid-Atlantic Network Summary Report for 2017

Natural Resource Data Series NPS/MIDN/NRDS—2018/1164

John. E.B. Wofford

Mid-Atlantic Network
National Park Service
120 Chatham Lane
Fredericksburg, VA 22405

May 2018

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

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 a subject-matter expert who was 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.

Views, statements, findings, conclusions, recommendations, and data in this report do not necessarily reflect views and policies of the National Park Service, U.S. Department of the Interior. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. Government.

This report is available in digital format from the [NPS Mid-Atlantic Network website](#) and the [Natural Resource Publications Management website](#). If you have difficulty accessing information in this publication, particularly if using assistive technology, please email irma@nps.gov.

Please cite this publication as:

Wofford, J. E. B. 2018. Weather of Appomattox Court House National Historical Park and Booker T. Washington National Monument: Mid-Atlantic Network summary report for 2017. Natural Resource Data Series NPS/MIDN/NRDS—2018/1164. National Park Service, Fort Collins, Colorado.

Contents

	Page
Figures.....	iv
Tables.....	v
Abstract.....	vi
Introduction.....	1
Methods.....	2
Observing Stations.....	2
Climate Indicators and Climatological Normals	4
Drought Status	6
Data Processing and Quality Assurance	6
Results.....	7
Temperature Summary	7
Precipitation Summary	12
Literature Cited	19

Figures

	Page
Figure 1. Location of weather observing stations around Appomattox Court House National Historical Park and Booker T. Washington National Monument selected as most representative of the parks in 2017	2
Figure 2. Maps showing departure from average monthly maximum temperature in 2017 compared to the 30-year normal (1981–2010).....	8
Figure 3. Maps showing departure from average monthly minimum temperature in 2017 compared to the 30-year normal (1981–2010).....	9
Figure 4. Maps showing percent of average monthly precipitation in 2017 compared to the 30-year normal (1981–2010).....	13
Figure 5. Palmer Drought Severity Index (PDSI) for the Western Piedmont, 2015–2017.....	16
Figure 6. Mid-month values of the United States Drought Monitor (DM) - Drought Intensity Index for Virginia in 2017.	17
Figure 7. Mid-month values of the United States Drought Monitor (DM) - Drought Intensity Index for the Southeast in 2017.	18

Tables

	Page
Table 1. List of weather observing stations around Appomattox Court House National Historical Park and Booker T. Washington National Monument selected as most representative of the parks in 2017.	3
Table 2. Summary of 2017 monthly average temperatures for selected stations.	10
Table 3. Summary of 2017 departure from normal temperature based on the 30-year normal (1981-2010) for selected stations.....	10
Table 4. Status of 2017 temperature indicators compared to the 30-year normal (1981-2010) for selected stations.	11
Table 5. Seasonal and annual temperature and precipitation rankings for 2017 over 123 years for the Western Piedmont (NOAA 2018b).....	11
Table 6. Summary of 2017 monthly precipitation for selected stations.....	14
Table 7. Summary of 2017 percent of normal precipitation based on the 30-year normal (1981-2010) for selected stations.....	14
Table 8. Status of 2017 precipitation indicators compared to the 30-year normal (1981-2010) for selected stations.	15
Table 9. Top five wettest days and top five dry spells (consecutive days with a trace of less of liquid precipitation) during 2017 from all five selected stations.	16

Abstract

The Mid-Atlantic Network (MIDN) weather and climate monitoring protocol documents the current status and long-term trends in air temperature and precipitation at multiple temporal and spatial scales in MIDN parks. This report provides a concise weather and climate summary for Appomattox Court House National Historical Park (APCO) and Booker T. Washington National Monument (BOWA) for the time period of January 1 to December 31, 2017. APCO and BOWA are located in the Western Piedmont climate division of Virginia. In 2017, five weather stations were selected to report park weather and climate conditions, and a large suite of precipitation and temperature metrics were summarized. Ultimately, 2017 was a very warm year and tied as the 3rd warmest on record for the Western Piedmont. All seasons were warmer than normal, particularly the winter (3rd warmest since 1895). The year was also drier than normal, being the 83rd wettest out of 123 years of records. Moderate drought conditions occurred at the parks during the fall of 2017.

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 (Comiskey and Callahan 2008).

The purpose of this report is to provide a concise weather and climate summary for January 1 to December 31, 2017, 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 the Mid-Atlantic Network (MIDN) Weather and Climate Monitoring Protocol 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 relevant MIDN 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; these are the primary data sources used in the profile of 2017's climate summary.

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 (for the most recent trend report, see Knight et al. 2016) . These key indicators are summarized in this report and are further described in the protocol (Marshall et al. 2012).

Methods

Observing Stations

Five weather observing stations comprising two weather observing networks were selected as the most representative weather stations around APCO and BOWA (Figure 1, Table 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 (Marshall et al. 2012). Moreover, the percentage of time a station reports a particular parameter (e.g. temperature) can influence data inclusion. Appomattox Court House National Historical Park and Booker T. Washington National Monument lie in Virginia Climate Division 3, known as the “Western Piedmont.” 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>).

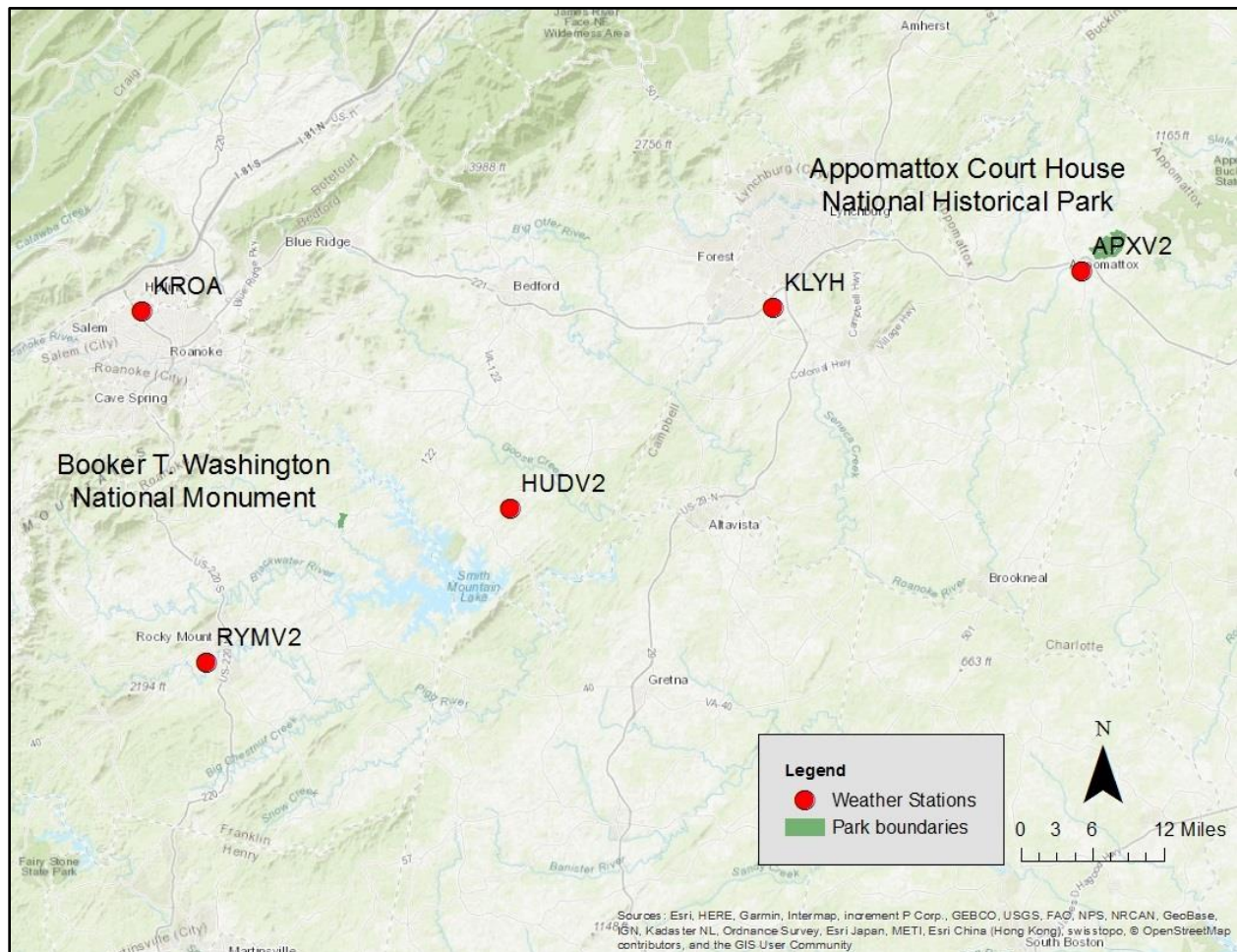


Figure 1. Location of weather observing stations around Appomattox Court House National Historical Park and Booker T. Washington National Monument selected as most representative of the parks in 2017. See Table 1 for station names.

Table 1. List of weather observing stations around Appomattox Court House National Historical Park and Booker T. Washington National Monument selected as most representative of the parks in 2017.

Station Name	Station	Observing Network ^A	Period of Record (POR)		Percentage of Time Reporting Temperature for 2017	Percentage of Time Reporting Precipitation for 2017	Percentage of Time Reporting Temperature for entire POR	Percentage of Time Reporting Precipitation for entire POR
Appomattox	APXV2	COOP	11/01/1937	Present	98.9	98.1	94.8 ^B	96.1
Huddleston 4 SW	HUDV2	COOP	01/01/1960	Present	-	100	-	99.2
Lynchburg Regional Airport/Preston Glenn Field	KLYH	ASOS	02/01/1945	Present	100	100	96.5	96.5
Roanoke Regional Airport/Woodrum Field	KROA	ASOS	02/01/1948	Present	100	100	96.2	96.2
Rocky Mt.	RYMV2	COOP	01/01/1951	Present	98.1	100	94.8	94.7

^AObserving networks are: ASOS—Automated Surface Observation System, COOP—National Weather Service Cooperative Observer Program.

^BPercentage of time reporting temperature for Appomattox is based upon a Period of Record beginning on 11/01/1961. The station did not report temperature prior to this date.

Climate Indicators and Climatological Normals

A suite of indicators were identified to provide a summary of weather and climate conditions (Marshall et al. 2012). The following are the climate indicators selected for each of the parks:

- Average Annual Mean Temperature—A measure of the composite mean temperature (averaging the maximum and minimum on a daily basis) for an entire year
- Average Annual Maximum Temperature—A measure of the average of the daily maximum temperature for an entire year
- Highest Annual Maximum Temperature—A measure of the individual highest maximum temperature each year
- Annual Number of Hot Days (maximum temperature equal to or exceeding 90°F (32°C)—A measure of warm season heat using a threshold of days with a 90°F (32°C) maxima
- Average Annual Minimum Temperature—A measure of the average of the daily minimum temperature for an entire year
- Lowest Annual Minimum Temperature—A measure of the individual lowest minimum temperature each year
- Annual Number of Cold Days (maximum temperature less than or equal to 32°F (0°C))—A measure of cold season chill using a threshold of days with a 32°F (0°C) maxima
- Annual Number of Subfreezing Days (minimum temperature less than or equal to 32°F (0°C))—A measure of cold season chill using a threshold of days with a 32°F (0°C) minima
- Annual Number of Subzero Days (minimum temperature less than or equal to 0°F (-17.8°C))—A measure of cold season chill using a threshold of days with a 0°F (-17.8°C) minima
- Growing Season Length (number of days between last freeze in spring and first freeze in fall)—A measure of the local growing season as tallied by the total number of days between the last 32°F (0°C) in the spring and the first 32°F (0°C) in the fall
- Annual Precipitation—A measure of total liquid (and its equivalent melted snow) for all days
- Autumn Precipitation (October 1 – December 31) - The three month total precipitation including rain and melted snow
- Annual Number of Heavy Precipitation Days (liquid equal to or greater than 1.0 in (25mm))—A measure of the frequency of heavy precipitation events during each year
- Annual Number of Extreme Precipitation Days (liquid equal to or greater than 2.0 in (50mm))—A measure of frequency of extreme precipitation events during each year

- Annual Number of Micro-droughts—A measure of micro-droughts for the year as the number of periods of 7+ days without rain
- Annual Snowfall—A measure of total solid precipitation (includes sleet and hail; does not include freezing rain)
- Annual Number of Measureable Snow Days—A measure of the severity of winter precipitation as the number of days receiving more than or equal to 0.1 in (0.3 cm) of solid precipitation (includes sleet and hail; does not include freezing rain)
- Annual Number of Moderate Snow Days— A measure of the severity of winter precipitation as the number of days receiving more than or equal to 3 in (7.6 cm) of solid precipitation (includes sleet and hail; does not include freezing rain)
- Annual Number of Heavy Snow Days— A measure of the severity of winter precipitation as the number of days receiving more than or equal to 5 in (12.7 cm) of solid precipitation (includes sleet and hail; does not include freezing rain)

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 2018) 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.

All five stations have a Period of Record (POR) sufficiently long for a 30-year normal (normals calculated from years 1981–2010); however, Huddleston lacks temperature data. Monthly averages and deviations from normal are presented for all five stations for precipitation, and for all except Huddleston for temperature. The full suite of climate indicators (as noted above) are calculated for stations at Appomattox, Lynchburg, and Roanoke for temperature and at Appomattox, Huddleston, Lynchburg, and Roanoke for precipitation.

Maps of multi-state departures of temperature and precipitation from long-term averages were derived 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. 2008). More information can be found at <http://www.prism.oregonstate.edu/>.

Drought Status

There are a number of drought indices used to estimate the severity of drought in an area. These indices use 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). Positive values indicate periods of above normal precipitation (0 to 2: near normal; 2 to 3: moderate moisture; >3 : very moist) and negative values indicate periods of drought (0 to -2: near normal; -2 to -3: moderate drought; <-3 : severe to extreme drought) (NOAA 2018a).

The DM – Drought Intensity Index is a synthesis of multiple indices (including the PDSI) and impacts, which represents a consensus of federal and academic scientists (NIDIS 2018). 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).

Data Processing and Quality Assurance

Data from selected stations are downloaded from relevant data streams such as the National Oceanic and Atmospheric Association Automated Surface Observation System (ASOS) or the National Weather Service Cooperative Observer Program (COOP). Variables are calculated using simple statistics (e.g. mean, minimum, maximum, etc.).

ASOS data have extensive quality assurance beginning at the point of gather (data-logger on site) and at additional levels as described in the respective user's manuals and specification documents. The COOP data quality control is extensive in real-time as the electronically submitted data passes through several levels of quality assurance and is in a final format within a few days of submission. See NOAA (2017) for a summary of ASOS and COOP quality control programs.

Data management procedures are fully outlined in Marshall, et al (2012).

Results

Temperature Summary

Almost all of the temperature metrics calculated from stations around APCO and BOWA indicate that 2017 was a warm year. In general, most months had higher than average temperatures (Figures 2 and 3, Tables 2 and 3). As such, average annual temperatures were also above normal at all of the reporting stations (Table 3). In addition, the number of hot days, average annual maximum temperatures, and average annual minimum temperatures were generally above average (Table 4). Growing season lengths ranged from two to more than four weeks longer than average (Table 4). All of the seasons ranked much warmer than average, and the winter of 2017 was a near-record season as the 3rd warmest since 1895 (Table 5). In total, 2017 tied with 1990 as the 3rd warmest year on record (Table 5).

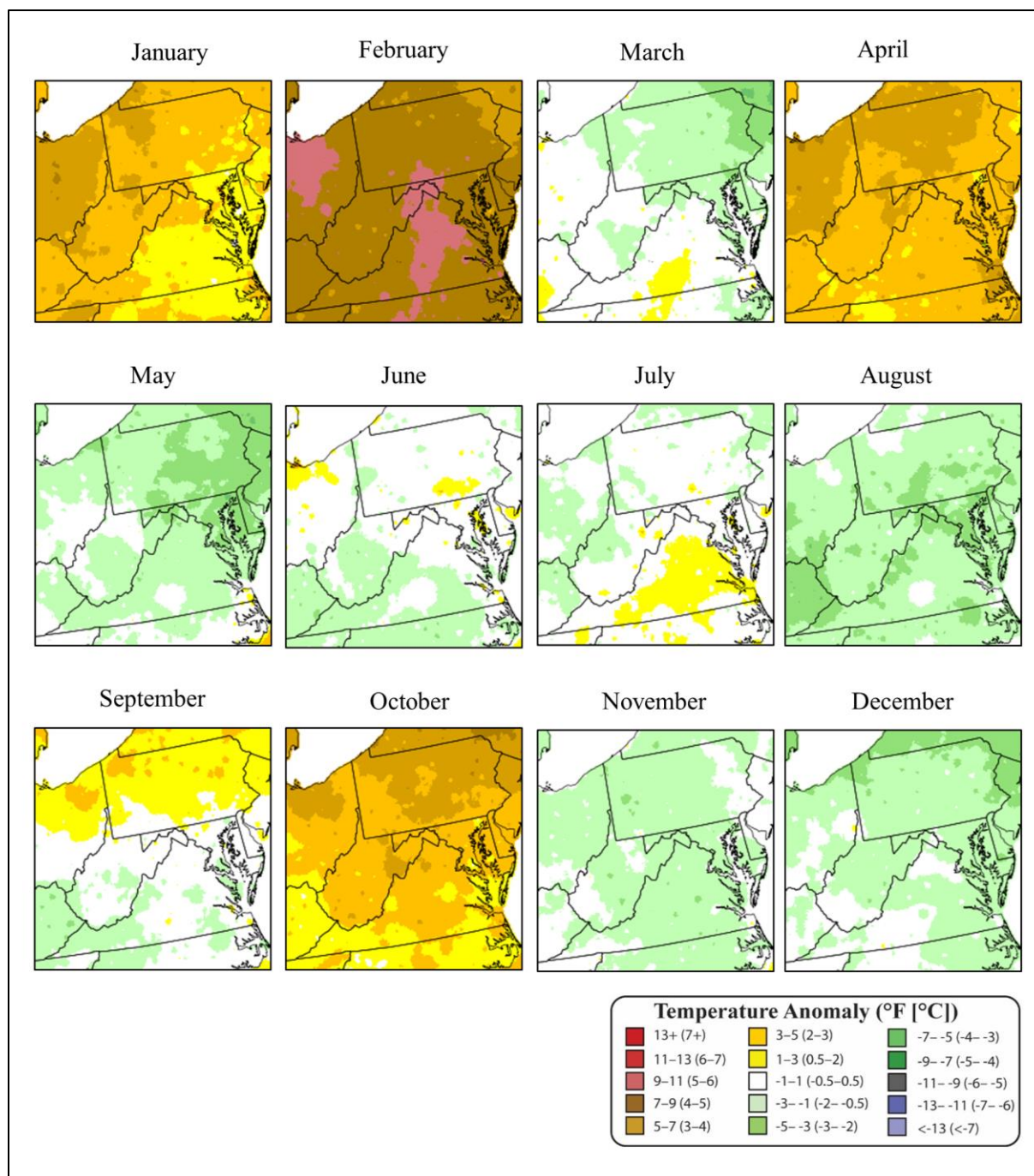


Figure 2. Maps showing departure from average monthly maximum temperature in 2017 compared to the 30-year normal (1981–2010).

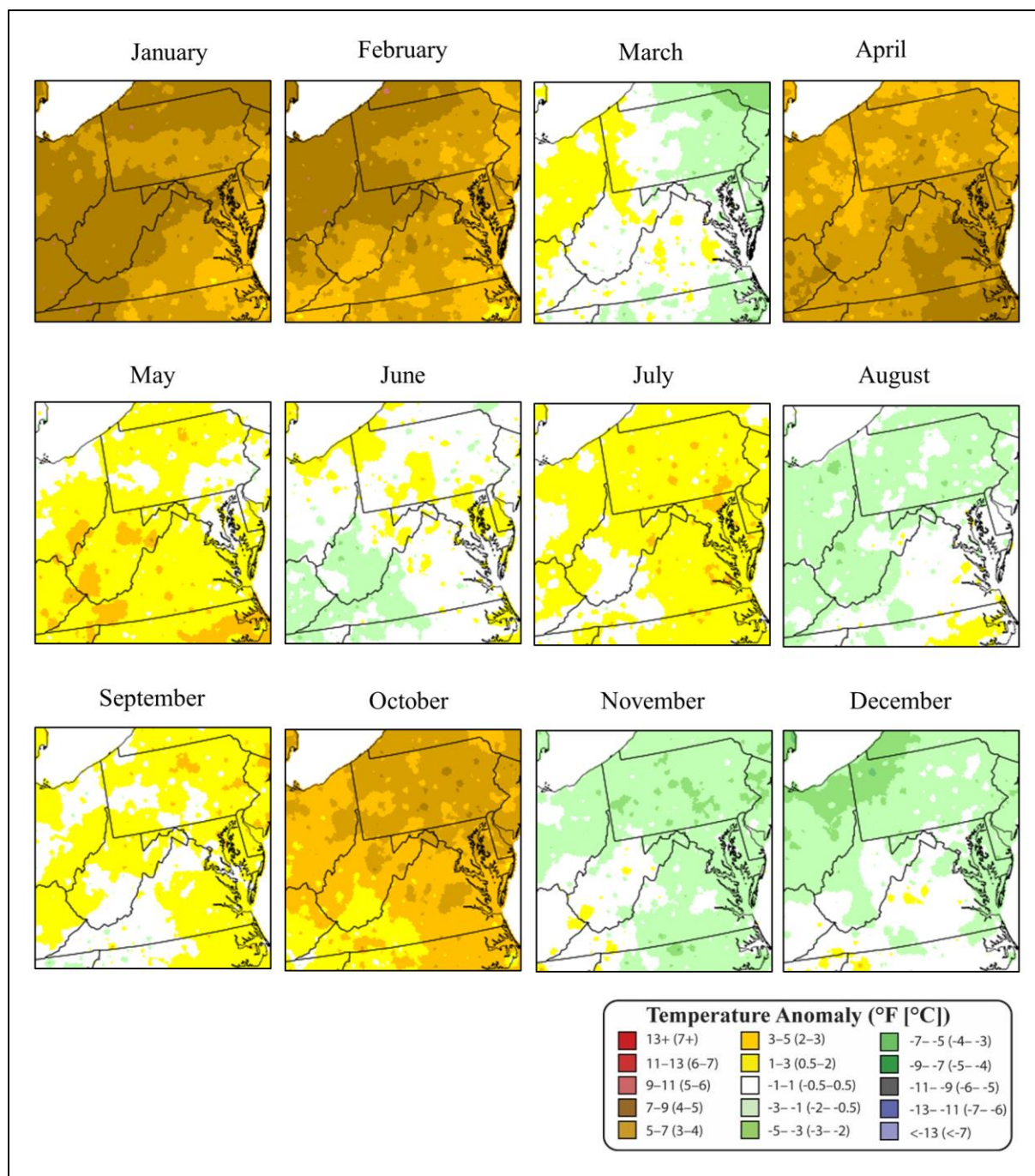


Figure 3. Maps showing departure from average monthly minimum temperature in 2017 compared to the 30-year normal (1981–2010).

Table 2. Summary of 2017 monthly average temperatures for selected stations.

Station	Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
APXV2	Appomattox	40.2°F 4.6°C	46.9°F 8.3°C	47.1°F 8.4°C	61.8°F 16.6°C	64.8°F 18.2°C	73.5°F 23.1°C	78.6°F 25.9°C	75.0°F 23.9°C	69.0°F 20.6°C	61.5°F 16.4°C	45.5°F 7.5°C	37.4°F 3.0°C	58.5°F 14.7°C
KLYH	Lynchburg Airport	40.5°F 4.7°C	48.1°F 8.9°C	47.2°F 8.4°C	61.2°F 16.2°C	64.3°F 17.9°C	71.7°F 22.1°C	76.5°F 24.7°C	73.3°F 22.9°C	67.4°F 19.7°C	59.7°F 15.4°C	45.5°F 7.5°C	37.5°F 3.1°C	57.8°F 14.3°C
KROA	Roanoke Airport	41.7°F 5.4°C	48.8°F 9.3°C	48.2°F 9.0°C	62.1°F 16.7°C	65.5°F 18.6°C	72.4°F 22.4°C	78.4°F 25.8°C	74.5°F 23.6°C	68.4°F 20.2°C	61.0°F 16.1°C	47.1°F 8.4°C	39.3°F 4.1°C	59.0°F 15.0°C
RYMV2	Rocky Mt.	40.7°F 4.8°C	46.0°F 7.8°C	46.8°F 8.2°C	60.2°F 15.7°C	64.2°F 17.9°C	71.3°F 21.8°C	77.3°F 25.2°C	72.8°F 22.7°C	66.8°F 19.3°C	59.4°F 15.2°C	45.9°F 7.7°C	38.7°F 3.7°C	57.6°F 14.2°C

Table 3. Summary of 2017 departure from normal temperature based on the 30-year normal (1981-2010) for selected stations.

Station	Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
APXV2	Appomattox	5.1°F 2.9°C	8.3°F 4.6°C	1.4°F 0.8°C	6.4°F 3.6°C	1.5°F 0.8°C	1.3°F 0.8°C	2.7°F 1.5°C	0.3°F 0.2°C	1.4°F 0.8°C	4.7°F 2.6°C	-1.7°F -0.9°C	-0.9°F -0.5°C	2.5°F 1.4°C
KLYH	Lynchburg Airport	5.4°F 3.0°C	9.9°F 5.5°C	1.3°F 0.7°C	5.8°F 3.2°C	1.2°F 0.6°C	0.1°F 0.1°C	1.2°F 0.6°C	-0.8°F -0.5°C	0.4°F 0.3°C	3.5°F 2.0°C	-1.3°F -0.7°C	-0.1°F 0.0°C	2.2°F 1.2°C
KROA	Roanoke Airport	5.1°F 2.8°C	9.2°F 5.1°C	0.9°F 0.5°C	5.4°F 3.0°C	0.9°F 0.5°C	-0.5°F -0.3°C	1.7°F 1.0°C	-0.9°F -0.5°C	0.3°F 0.1°C	3.3°F 1.8°C	-1.0°F -0.5°C	0.3°F 0.2°C	2.0°F 1.1°C
RYMV2	Rocky Mt.	5.1°F 2.8°C	7.7°F 4.3°C	1.4°F 0.8°C	5.5°F 3.1°C	1.6°F 0.9°C	0.2°F 0.1°C	2.4°F 1.4°C	-0.7°F -0.4°C	0.4°F 0.2°C	3.5°F 1.9°C	-0.7°F -0.4°C	0.8°F 0.4°C	2.3°F 1.3°C

Table 4. Status of 2017 temperature indicators compared to the 30-year normal (1981-2010) for selected stations.

Temperature Indicator	Appomattox 2017	Appomattox 1981–2010	Lynchburg Airport 2017	Lynchburg Airport 1981–2010	Roanoke Airport 2017	Roanoke Airport 1981–2010
Average Annual Temperature	58.5°F 14.7°C	56.0°F 13.3°C	57.8°F 14.3°C	55.6°F 13.1°C	59.0°F 15.0°C	57.0°F 13.9°C
Average Annual Maximum Temperature	69.2°F 20.7°C	67.4°F 19.7°C	68.9°F 20.5°C	67.1°F 19.5°C	69.5°F 20.8°C	67.3°F 19.6°C
Maximum Temperature	97.0°F 36.1°C	96.0°F 35.6°C	95.0°F 35.0°C	95.9°F 35.5°C	97.0°F 36.1°C	96.7°F 35.9°C
Hot Days (days with Tmax≥90°F/32°C)	38	23	22	22	31	25
Average Annual Minimum Temperature	47.8°F 8.8°C	44.5°F 6.9°C	46.6°F 8.1°C	44.1°F 6.7°C	48.8°F 9.3°C	46.6°F 8.1°C
Minimum Temperature	5.0°F -15.0°C	4.4°F -15.3°C	0.0°F -17.8°C	3.7°F -15.7°C	9.0°F -12.8°C	6.0°F -14.4°C
Cold Days (days with Tmax≤32°F/0°C)	5	6	6	6	5	7
Sub-freezing Days (days with Tmin≤32°F/0°C)	70	95	85	99	66	78
Sub-zero Days (days with Tmin≤0°F/-18°C)	0	1	1	0	0	0
Growing Season Length (days between last spring Tmin 32°F/0°C and first fall Tmin 32°F/0°C)	232	199	216	201	232	208

Table 5. Seasonal and annual temperature and precipitation rankings for 2017 over 123 years for the Western Piedmont (NOAA 2018b).

Parameter	VA Climate Division 3 Rankings — Western Piedmont				
	Jan–Feb–Mar WINTER	Apr–May–Jun SPRING	Jul–Aug–Sep SUMMER	Oct–Nov–Dec AUTUMN	Jan–Dec YEAR
Temperature-2017	3	8-T	45-T	30-T	3-T
Precipitation-2017	108	3	101	111	83

1 = warmest/wettest year and 123 = coldest/driest year. T = Tie between multiple years

Precipitation Summary

Monthly precipitation totals in 2017 were highly variable but annual totals were below normal (Figure 4, Tables 6 and 7). Most months had less than normal precipitation, with February being particularly dry (Tables 6 and 7). Monthly totals ranged from a low of 0.5 inches (13 mm) at Appomattox, Huddleston, and Roanoke Airport in February to a high of 9.0 inches (229 mm) at Rocky Mt. in May (Table 6). In all, annual precipitation ranged from 3.8 to 8.7 inches (97 to 221 mm) below average (Table 8). The wettest day occurred on May 5th when 2.1 inches (54 mm) of rain was observed (Table 9). The spring was very wet, ranking the 3rd wettest on record (Table 5). In contrast, the other three seasons were quite dry. In all, it was the 83rd wettest year since 1895.

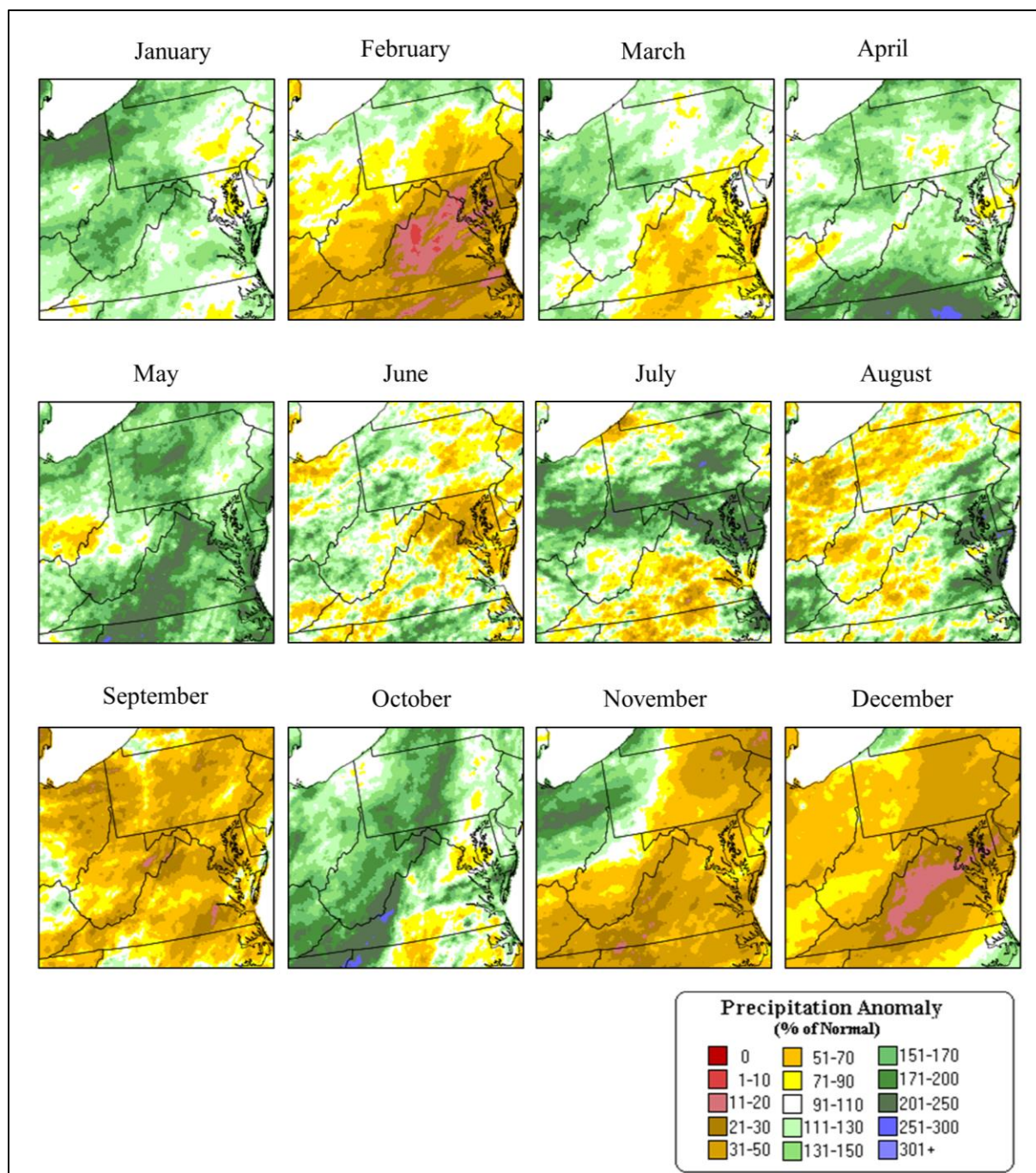


Figure 4. Maps showing percent of average monthly precipitation in 2017 compared to the 30-year normal (1981–2010).

Table 6. Summary of 2017 monthly precipitation for selected stations.

Station	Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
APXV2	Appomattox	4.3 in 109 mm	0.5 in 13 mm	2.7 in 69 mm	5.5 in 140 mm	8.0 in 203 mm	2.9 in 74 mm	4.3 in 109 mm	2.0 in 51 mm	2.5 in 64 mm	3.0 in 76 mm	1.4 in 36 mm	0.9 in 23 mm	38.1 in 968 mm
HUDV2	Huddleston 4 SW	3.6 in 91 mm	0.5 in 13 mm	2.6 in 66 mm	7.6 in 193 mm	8.8 in 224 mm	3.7 in 94 mm	1.4 in 36 mm	2.7 in 69 mm	2.1 in 53 mm	2.7 in 69 mm	1.1 in 28 mm	0.8 in 20 mm	37.5 in 952 mm
KLYH	Lynchburg Airport	3.8 in 97 mm	0.6 in 15 mm	2.7 in 69 mm	4.2 in 107 mm	7.9 in 201 mm	2.1 in 53 mm	3.3 in 84 mm	2.2 in 56 mm	1.9 in 48 mm	2.6 in 66 mm	1.0 in 25 mm	0.7 in 18 mm	32.9 in 836 mm
KROA	Roanoke Airport	4.1 in 104 mm	0.5 in 13 mm	2.3 in 58 mm	5.9 in 150 mm	8.1 in 206 mm	4.5 in 114 mm	2.1 in 53 mm	2.3 in 58 mm	2.4 in 61 mm	4.2 in 107 mm	0.7 in 18 mm	0.4 in 10 mm	37.5 in 952 mm
RYMV2	Rocky Mt.	4.2 in 107 mm	1.0 in 25 mm	3.1 in 79 mm	7.1 in 180 mm	9.0 in 229 mm	2.5 in 64 mm	2.9 in 74 mm	2.0 in 51 mm	3.3 in 84 mm	3.2 in 81 mm	0.9 in 23 mm	0.6 in 15 mm	39.9 in 1013 mm

Table 7. Summary of 2017 percent of normal precipitation based on the 30-year normal (1981-2010) for selected stations.

Station	Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
APXV2	Appomattox	139	16	68	162	167	72	90	50	58	79	35	26	82
HUDV2	Huddleston 4 SW	106	17	70	224	244	106	35	77	51	79	31	24	88
KLYH	Lynchburg Airport	123	21	75	127	214	58	75	67	49	84	29	22	79
KROA	Roanoke Airport	141	17	66	174	198	118	52	64	62	145	21	14	91
RYMV2	Rocky Mt.	124	32	72	187	220	56	59	47	72	100	25	17	85

Table 8. Status of 2017 precipitation indicators compared to the 30-year normal (1981-2010) for selected stations.

Precipitation Indicator	Appomattox 2017	Appomattox 1981–2010	Huddleston 4 SW 2017	Huddleston 4 SW 1981–2010	Lynchburg Airport 2017	Lynchburg Airport 1981–2010	Roanoke Airport 2017	Roanoke Airport 1981–2010
Annual Precipitation	38.1 in 968 mm	46.6 in 1,184 mm	37.5 in 952 mm	42.5 in 1,080 mm	32.9 in 836 mm	41.6 in 1,057 mm	37.5 in 952 mm	41.3 in 1,049 mm
Autumn (Oct, Nov, Dec) Precipitation	5.4 in 137 mm	11.2 in 284 mm	4.5 in 114 mm	10.3 in 262 mm	4.3 in 109 mm	9.8 in 249 mm	5.2 in 132 mm	9.2 in 234 mm
Heavy Precipitation Days (days with ≥ 1.0 in (25 mm) rain)	7	13	10	11	5	10	8	10
Extreme Precipitation Days (days with ≥ 2.0 in (51 mm) rain)	1	1	0	2	0	1	0	2
Micro-drought (periods of 7+ days without rain)	10	11	8	10	12	7	9	5
Annual Snowfall	14.1 in 35.8 cm	8.5 in 21.6 cm	12.5 in 31.8 cm	2.0 in 5.1 cm	7.4 in 18.8 cm	16.2 in 41.1 cm	6.1 in 15.5 cm	18.5 in 47.0 cm
Measurable Snow Days (days with ≥ 0.1 in (0.3 cm) snow)	4	3	4	1	4	8	4	9
Moderate Snow Days (days with ≥ 3.0 in (7.6 cm) snow)	2	1	1	0	1	2	1	2
Heavy Snow Days (days with ≥ 5.0 in (12.7 cm) snow)	1	1	1	0	0	1	0	1

Table 9. Top five wettest days and top five dry spells (consecutive days with a trace of less of liquid precipitation) during 2017 from all five selected stations.

Wettest Days in 2017	Dry Spells in 2017
May 05: 2.1 in (54 mm)	Sep 13 - Oct 07
Apr 24: 2.1 in (53 mm)	Nov 19 - Dec 08
Apr 25: 2.0 in (52 mm)	Dec 10 - Dec 22
May 25: 2.0 in (50 mm)	Jul 07 - Jul 18
Jan 23: 1.9 in (47 mm)	Jan 28 - Feb 08

Winter, summer, and fall seasons were all much drier than normal; in contrast, spring was much wetter than normal (Table 5). In all, 2017 was a moderately dry year, ranking as the 41st driest year on record (Table 5). APCO and BOWA entered “moderate drought” conditions briefly in February and March and again in December, as measured by the Palmer Drought Severity Index (Figure 5). Similarly, the Drought Intensity Index shows “abnormally dry” periods were encountered in 2017 near APCO and BOWA and in surrounding states, particularly as summer transitioned into fall (Figures 6 and 7).

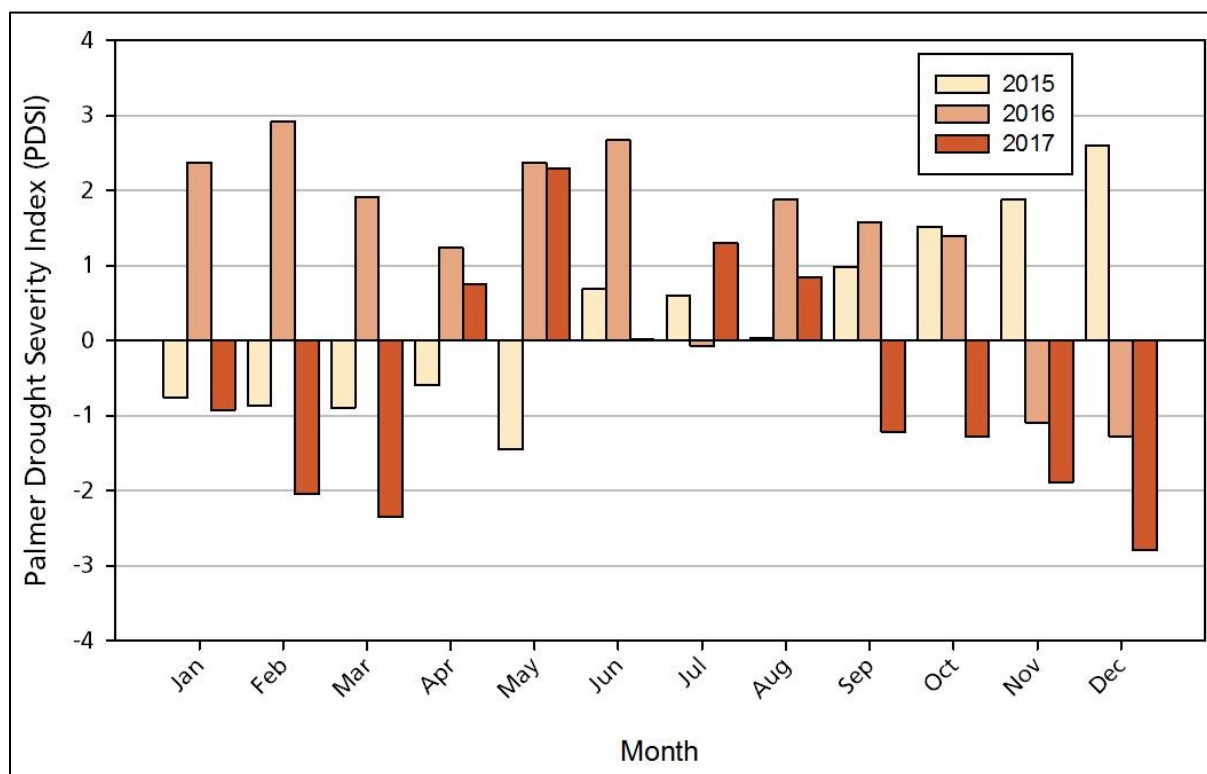


Figure 5. Palmer Drought Severity Index (PDSI) for the Western Piedmont, 2015–2017. Positive values indicate periods of above normal precipitation (0 to 2: near normal; 2 to 3: moderate moisture; >3: very moist) and negative values indicate periods of drought (0 to -2: near normal; -2 to -3: moderate drought; <-3: severe to extreme drought).

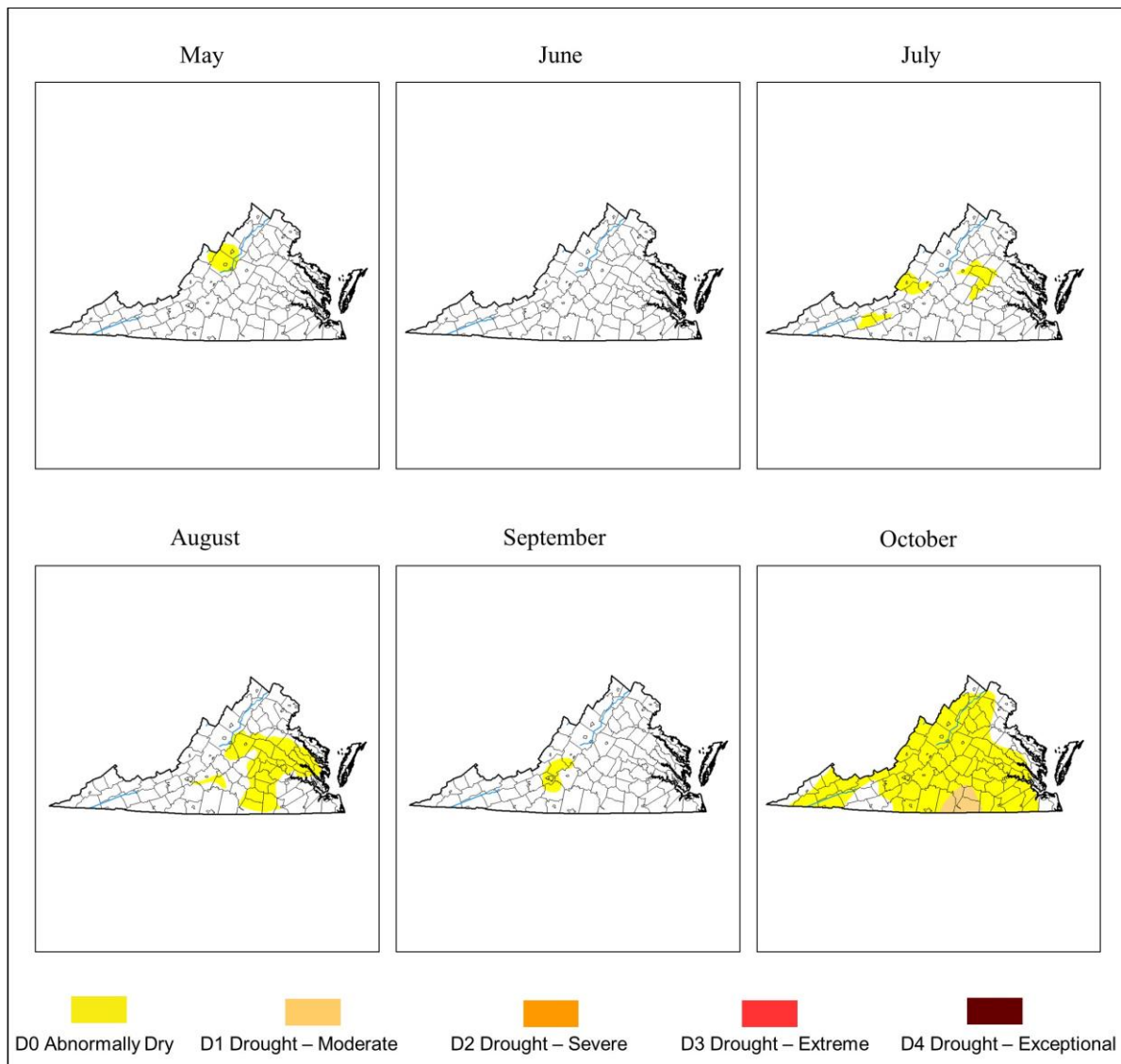


Figure 6. Mid-month values of the United States Drought Monitor (DM) - Drought Intensity Index for Virginia in 2017.

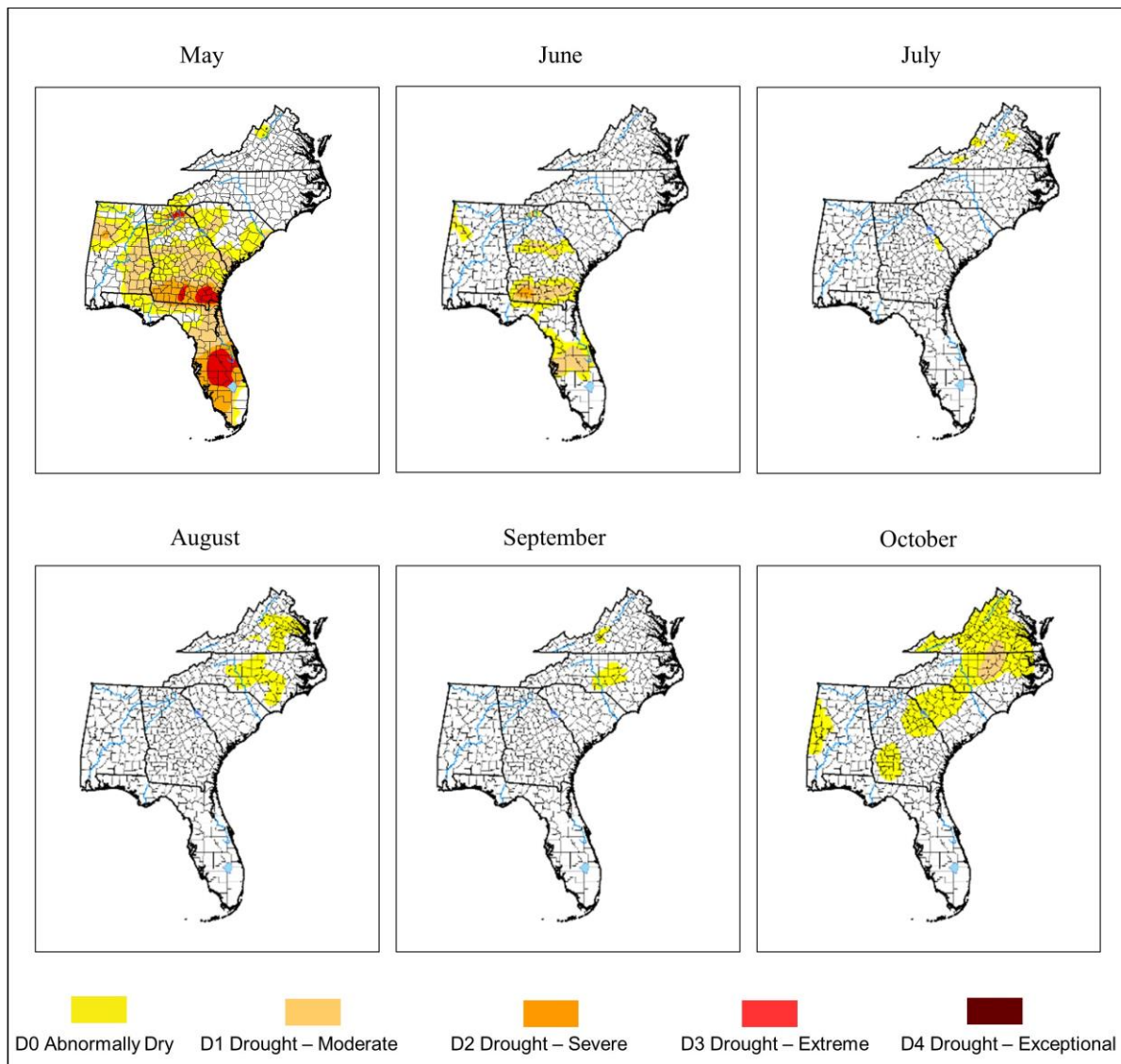


Figure 7. Mid-month values of the United States Drought Monitor (DM) - Drought Intensity Index for the Southeast in 2017.

Literature Cited

- Comiskey, J. A., and K. K. Callahan. 2008. Mid-Atlantic Network vital signs monitoring plan. Natural Resource Report NPS/MIDN/NRR—2008/071. National Park Service, Fort Collins, CO.
- Daly, C., M. Halbleib, J.I. Smith, W.P. Gibson, M.K. Doggett, G.H. Taylor, J. Curtis, and P.P. Pasteris. 2008. Physiographically sensitive mapping of climatological temperature and precipitation across the conterminous United States. *International Journal of Climatology*, 28: 2031-2064.
- Knight, P., K. Imhoff, and A. Person. 2016. Weather of Appomattox Court House National Historical Park and Booker T. Washington National Monument: Mid-Atlantic Network summary report for 2014. Natural Resource Data Series. NPS/MIDN/NRR—2016/1110. National Park Service. Fort Collins, Colorado
- Marshall, M., P. Knight, and J. Comiskey. 2012. Weather and climate monitoring protocol: Eastern Rivers and Mountains Network and Mid-Atlantic Network. Natural Resource Report NPS/ERMN-MIDN/NRR—2012/498. National Park Service, Fort Collins, Colorado.
- 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 Integrated Drought Information System (NIDIS). 2018. National Climate Data Center and United States Department of Agriculture. Available at: <http://droughtmonitor.unl.edu/Maps/MapArchive.aspx> (accessed 16 February 2018).
- National Oceanic and Atmospheric Administration (NOAA). 2017. National Weather Service Instruction 10-1305. Available at <http://www.nws.noaa.gov/directives> (accessed 23 April 2018).
- National Oceanic and Atmospheric Administration (NOAA). 2018a. National Centers for Environmental Information Historical Palmer Drought Indices. Available at: <https://www.ncdc.noaa.gov/temp-and-precip/drought/historical-palmers/> (accessed 16 February 2018).
- National Oceanic and Atmospheric Administration (NOAA). 2018b. National Centers for Environmental Information Climatological Rankings. Available at: <http://www.ncdc.noaa.gov/temp-and-precip/climatological-rankings/> (accessed 21 May 2018).

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS 340/145054, 404/145054, May 2018

National Park Service
U.S. Department of the Interior



[Natural Resource Stewardship and Science](#)

1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525