

# **Current Hydrologic Conditions in Massachusetts**

## **Drought Management Task Force**

Jonathan Yeo, Anne Carroll and Viki Zoltay  
DCR Office of Water Resources  
Division of Water Supply Protection

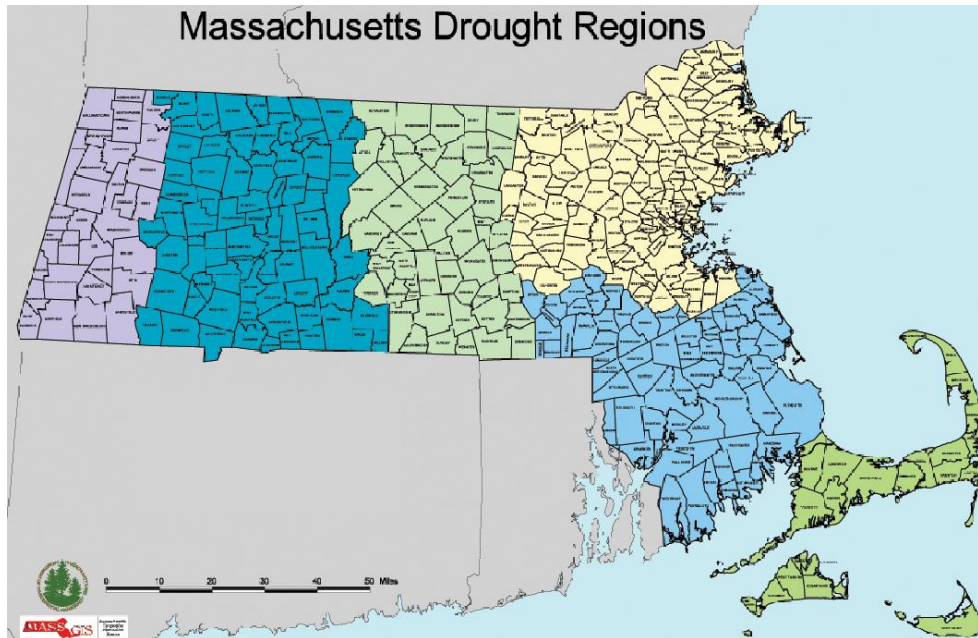
May 9, 2017

# MA Drought Management Plan

Drought Indicators
Precipitation
Precipitation
Streamflow
Groundwater
Reservoirs
Crop Moisture
Fire Danger



Drought Levels
Normal
Advisory
Watch
Warning
Emergency

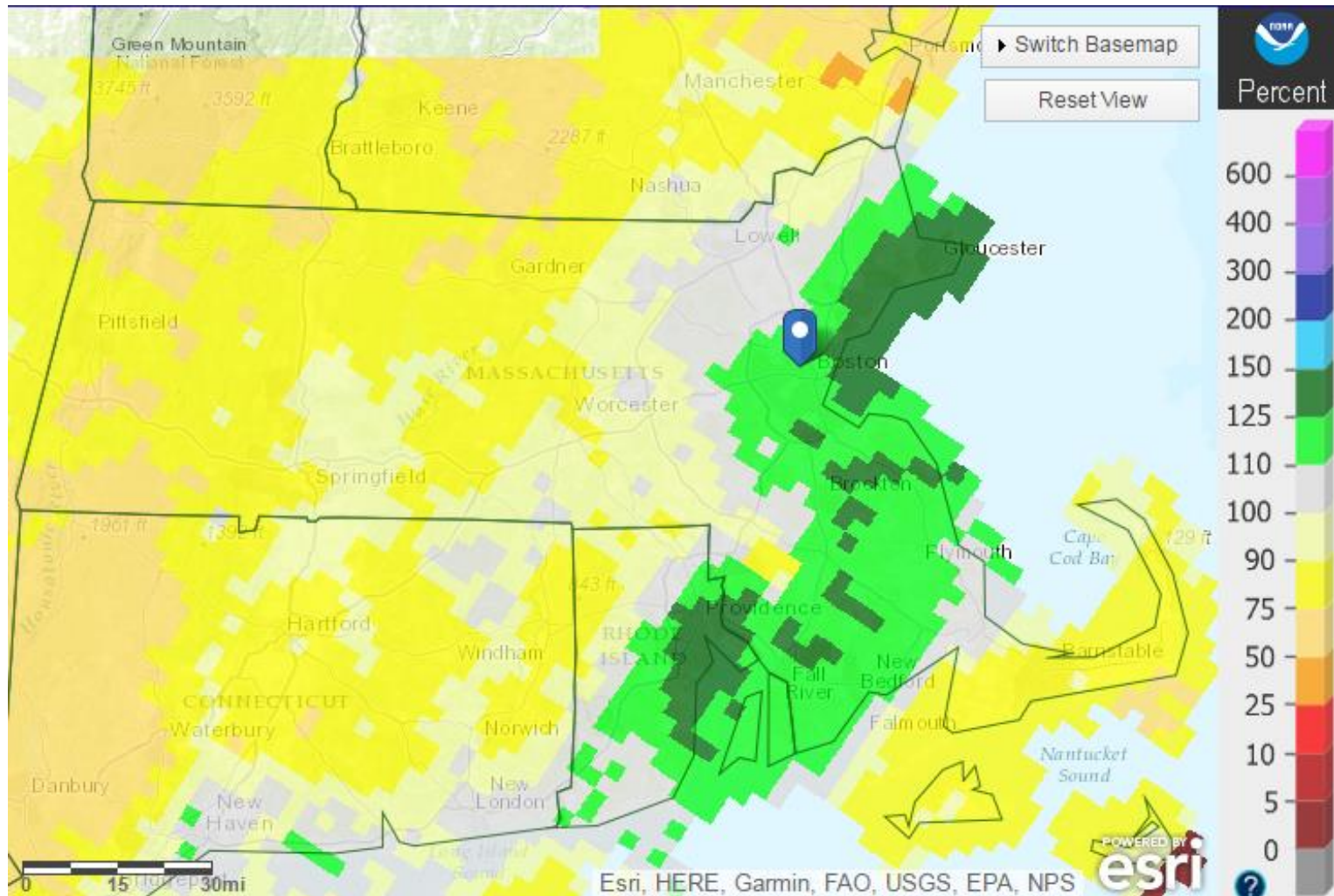


Western
Connecticut River Valley
Central
Northeast
Southeast
Cape and Islands

# 2013 DMP – End of Drought

- **A majority of the indices are not used to determine an end of a drought because many of the indices will tend to return to normal at some point during the year.** For example, the Crop Moisture Index returns to normal at the end of the growing season. The Fire Danger season ends with snowfall. In addition, the end of a drought is easily defined by rainfall and groundwater levels, which have the most significant impact on the other indices.
- **In order to return to a normal status, groundwater levels must be in the normal range and/or one of two precipitation measures must be met.** The precipitation measures are:
  - 1) three months of precipitation that is cumulatively above normal, and
  - 2) long-term cumulative precipitation above normal. The period for long-term cumulative precipitation ranges from 4 to 12 months, depending on the time of year.

# April Precipitation as Percent of Normal



# Precipitation

Region	Estimated Rainfall (inches)	Departure from Average April (inches)	MA Drought Plan Levels	
			Standardized Precipitation Index (SPI)	Percent of Normal Index
West	3.24	-0.27	Normal	Normal
CT River Valley	4.56	1.00	Advisory (12 mo)	Normal
Central	4.93	1.11	Advisory (12 mo)	Normal
Northeast	6.52	2.91	Normal	Normal
Southeast	7.17	3.27	Normal	Normal
Cape Cod & Islands	6.39	2.36	Normal	Normal

# Streamflow Index

Drought Level	Streamflow Index*
Normal	1 month below normal
Advisory	At least 2 out of 3 consecutive months below normal
Watch	At least 4 out of 5 consecutive months below normal
Warning	At least 6 out of 7 consecutive months below normal
Emergency	Greater than 7 months below normal

\*Below normal = within the lowest 25<sup>th</sup> percentile of the period of record for a given month



# Streamflow Compared to Historical

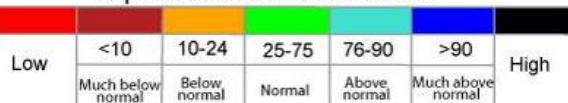


## Average Monthly

## Average Daily

March

Explanation - Percentile classes

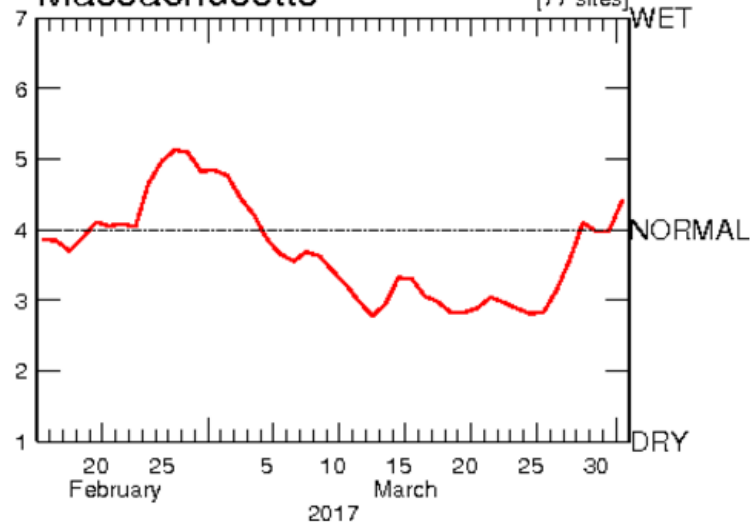


April

Massachusetts

[77 sites]

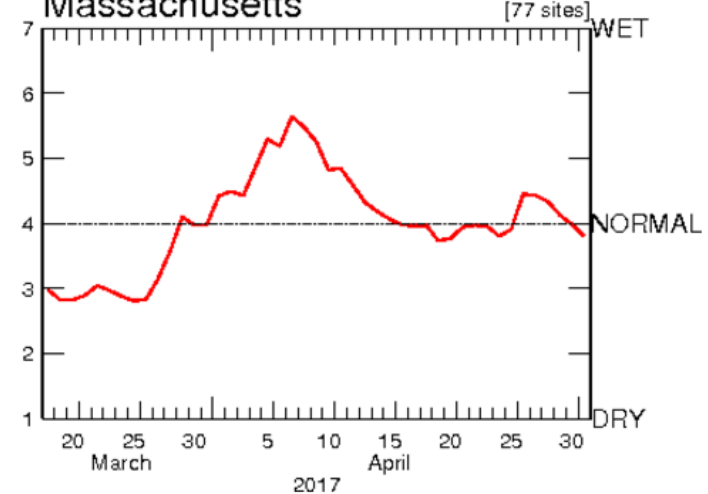
Average streamflow index



Massachusetts

[77 sites]

Average streamflow index



# Streamflow

Region	Month	Number of gages				MA Drought Plan Index (# consecutive months majority <25 <sup>th</sup> percentile)
		Total Reporting	<25 <sup>th</sup> to 10 <sup>th</sup> percentile	<10 <sup>th</sup> percentile to above record low	Record low	
Western	March	7	0	0	0	0/ Normal
	April	7	0	0	0	0/Normal
CT River Valley	March	10	4	1	0	1/ Normal
	April	14	0	0	0	0/Normal
Central	March	12	8	2	0	1/Normal
	April	11	0	0	0	0/Normal
Northeast	March	19	12	3	1	1/Normal
	April	19	0	0	0	0/Normal
Southeast	March	6	2	4	0	1/Normal
	April	6	0	0	0	0/Normal

Notes: Gage counts are non-cumulative except for “total reporting”. Not all gages report in all months due to ice, beaver dams or other conditions. Streamflow index is not applicable to Cape Cod and the Islands.



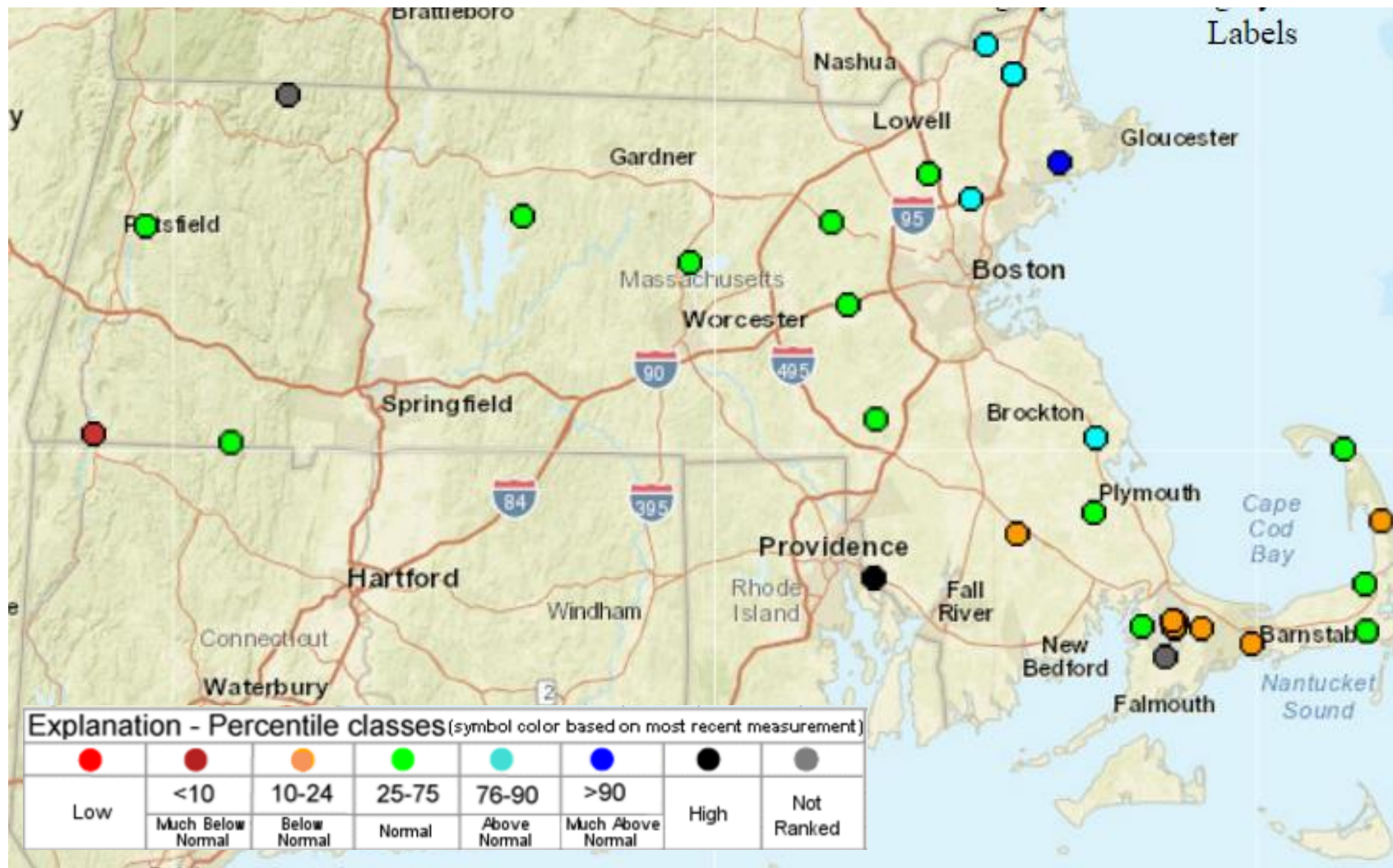
# Groundwater Index

Drought Level	Groundwater Index*
Normal	2 consecutive months below normal
Advisory	3 consecutive months below normal
Watch	4 to 5 consecutive months below normal
Warning	6 to 7 consecutive months below normal
Emergency	Greater than 8 months below normal

\*Below normal = within the lowest 25<sup>th</sup> percentile of the period of record for a given month

# Groundwater

Real-Time Wells Only, 4/30/17



# Groundwater

Region	Month	Number of wells				MA Drought Plan Index (# consecutive months majority below 25 <sup>th</sup> percentile)
		Total Reporting	<25th to 10th percentile	<10th percentile to above record low	Record Low	
Western	March	5	0	1*	0	0/Normal
	April	5	0	1*	0	0/Normal
CT River Valley	March	10	1	1	1	0/Normal
	April	10	2	0	0	0/Normal
Central	March	10	4	0	0	0/Normal
	April	10	1	0	0	0/Normal
Northeast	March	16	1	1	1	0/Normal
	April	17	0	0	0	0/Normal
Southeast	March	11	5	3	0	1/Normal
	April	12	1	0	0	0/Normal
Cape and Islands	March	12	6	1	0	1/Normal
	April	12	4	0	0	0/Normal

Notes: Wells counts are non-cumulative except for “total reporting”. Not all data are available in time for reporting.

\*Well is recovering but not fast enough relative to past years.

# Reservoir Index

Drought Level	Reservoir Index*
Normal	Reservoir levels at or near normal for the time of year
Advisory	Small index reservoirs below normal
Watch	Medium index reservoirs below normal
Warning	Large index reservoirs below normal
Emergency	Continuation of previous month's conditions

Below normal = 1 standard deviation from the average value in the same months in other years in the period of record

\*Water suppliers should be consulted to determine if below normal reservoir conditions are due to operational issues

# Reservoirs-April

<b>Region</b>	<b>Number of Reservoirs Reporting</b>	<b>Reservoir Levels</b>	<b>MA Drought Management Plan Reservoir Index</b>
<b>West</b>	1	Normal	Normal
<b>CT River Valley</b>	2	Near Normal	Warning <sup>1</sup>
<b>Central</b>	2	Normal	Normal
<b>Northeast</b>	6	Below (Cambridge)	Watch
<b>Southeast</b>	2	Normal	Normal
<b>Cape Cod &amp; Islands</b>	1	Below	Advisory

1 Quabbin reservoir is below normal. This is an exceptionally large reservoir which jumps the index to warning. However, the other monitored reservoir in the CT River Valley region has returned to and remains normal. It is a medium reservoir system.

# Crop Moisture and Fire Danger Indices

Drought Level	Crop Moisture Index*	Keetch-Byram Drought Index (KBDI)
Normal	0 to -1.0 Slightly dry	less than 200
Advisory	-1 to -1.9 Abnormally dry	200 to 400
Watch	-2 to -2.9 Excessively dry	400 to 600
Warning	< -2.9 Severely dry	600 to 800
Emergency	< -2.9 Severely dry	600 to 800

\* The Crop Moisture Index is subject to frequent change. The drought level for this indicator is determined based on the repeated or extended occurrence at a given level.



# Crop Moisture



Region	MA Drought Plan Index
Western	Normal
CT River Valley	Normal
Central	Normal
Northeast	Normal
Southeast	Normal
Cape and Islands	Normal

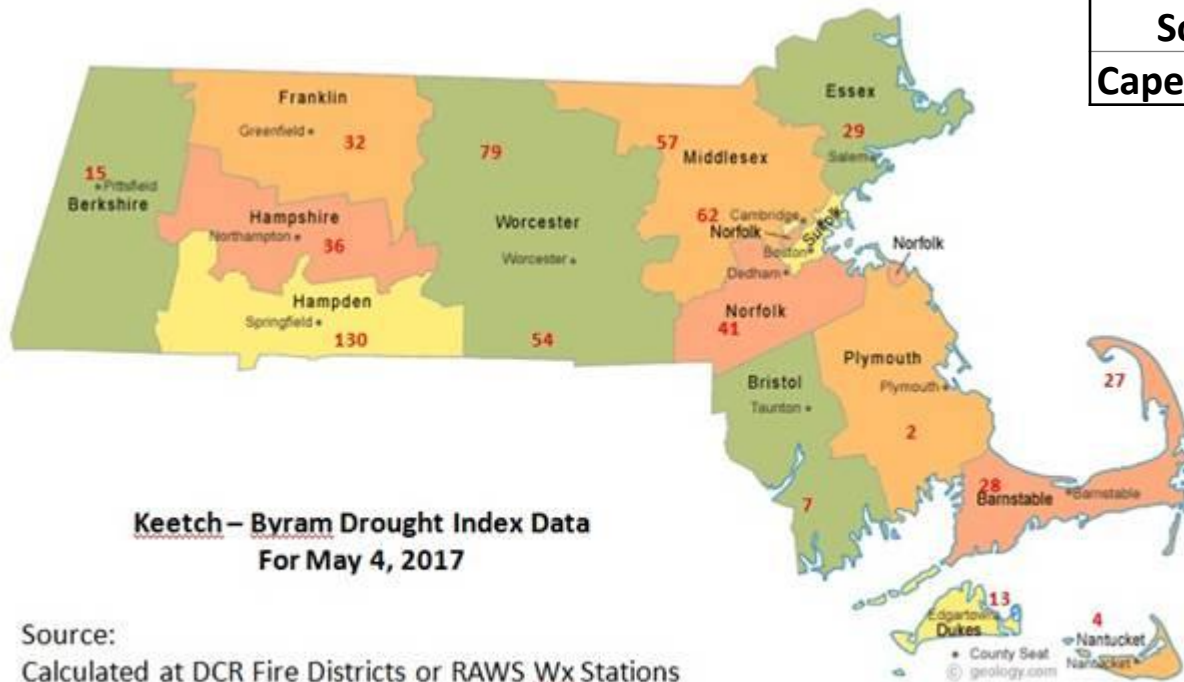


\* The Crop Moisture Index is subject to frequent change. The drought level for this indicator is determined based on the repeated or extended occurrence at a given level. This indicator is most relevant during the growing season.

# Keetch-Byram Drought Index

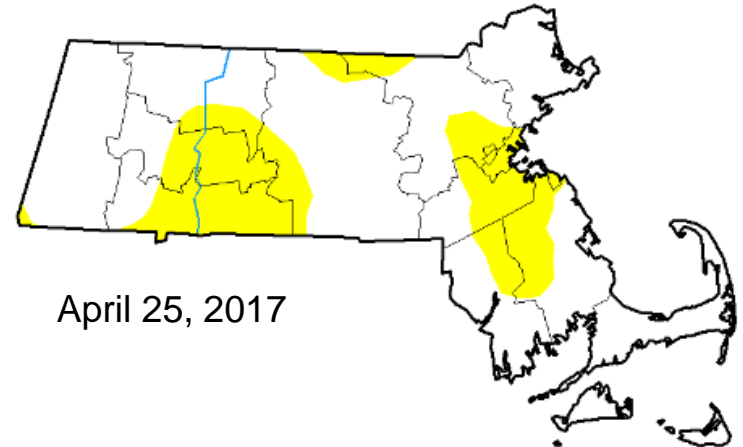
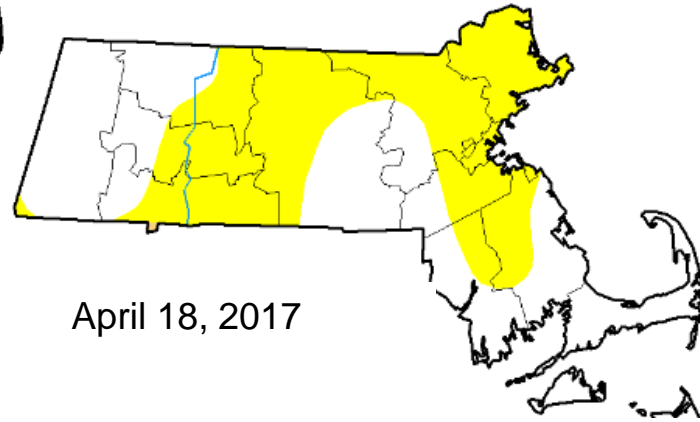
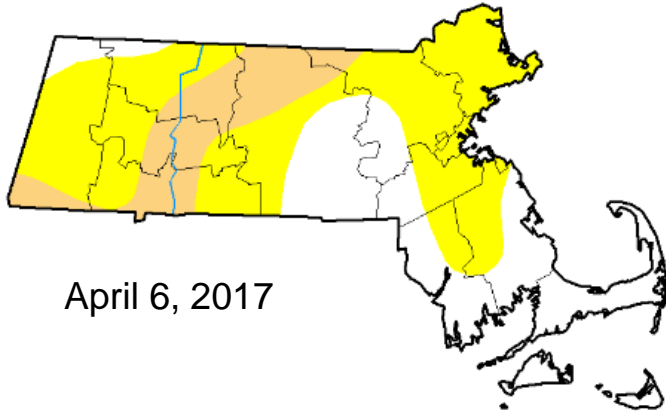
No fire concerns at any of the 13 reporting districts related to ground fuel conditions. –Dave Celino

Region	MA Drought Plan Index
Western	Normal
CT River Valley	Normal
Central	Normal
Northeast	Normal
Southeast	Normal
Cape and Islands	Normal








Source:  
Calculated at DCR Fire Districts or RAWs Wx Stations

# US Drought Monitor



**Intensity:**

-  D0 (Abnormally Dry)
-  D1 (Moderate Drought)
-  D2 (Severe Drought)
-  D3 (Extreme Drought)
-  D4 (Exceptional Drought)

# Summary of Drought Indices

Drought Indicator	West	CT River Valley	Central	Northeast	Southeast	Cape and Islands
Standardized Precipitation Index	Normal	Advisory	Advisory	Normal	Normal	Normal <sup>1</sup>
Percent of Normal Precipitation	Normal	Normal	Normal	Normal	Normal	Normal
Streamflow	Normal	Normal	Normal	Normal	Normal	N/A
Groundwater	Normal	Normal	Normal	Normal	Normal	near Normal <sup>2</sup>
Reservoir	Normal	Warning <sup>3</sup>	Normal	Watch	Normal	Advisory
Crop Moisture Index	Normal	Normal	Normal	Normal	Normal	Normal
KBDI - Fire danger	Normal	Normal	Normal	Normal	Normal	Normal
<i>March</i>	Normal	Advisory	Advisory	Advisory	Advisory	Advisory
<i>Recommended April</i>	Normal	Normal	Normal	Normal	Normal	Normal

1 Note: 12-month SPI is very close to Advisory level

2 Some wells remain below normal; however, since the majority of wells in the region are not below normal, a drought level is not triggered

3 Quabbin reservoir is below normal. This is an exceptionally large reservoir which jumps the index to warning. However, the other monitored reservoir in the CT River Valley region has returned to and remains normal. It is classified medium.

This summary is provided for informational purposes. No changes in drought status are official until the Drought Management Task Force convenes and makes a recommendation accepted by Secretary of the Executive Office of Energy and Environmental Affairs. Data are preliminary and not final until all data are reported. N/A indicates Not Applicable