

A Retrospective Analysis of the 2016-2017 Drought in Massachusetts

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Partners/Contributors



Overview

- Drought Characteristics and Progression
 - Analysis of drought indices and data
- Drought Management Task Force
 - Meetings and drought declarations
- State Response to Drought Conditions
- Sector Impacts
 - Agriculture, water supply, public health, fisheries, etc.

Drought Management Task Force

- First convened on July 7, 2016 due to dry conditions
- Drought Watch: Central and Northeast regions
Advisory: Southeast and CT River Valley regions

2016-2017 Drought Declarations by Region

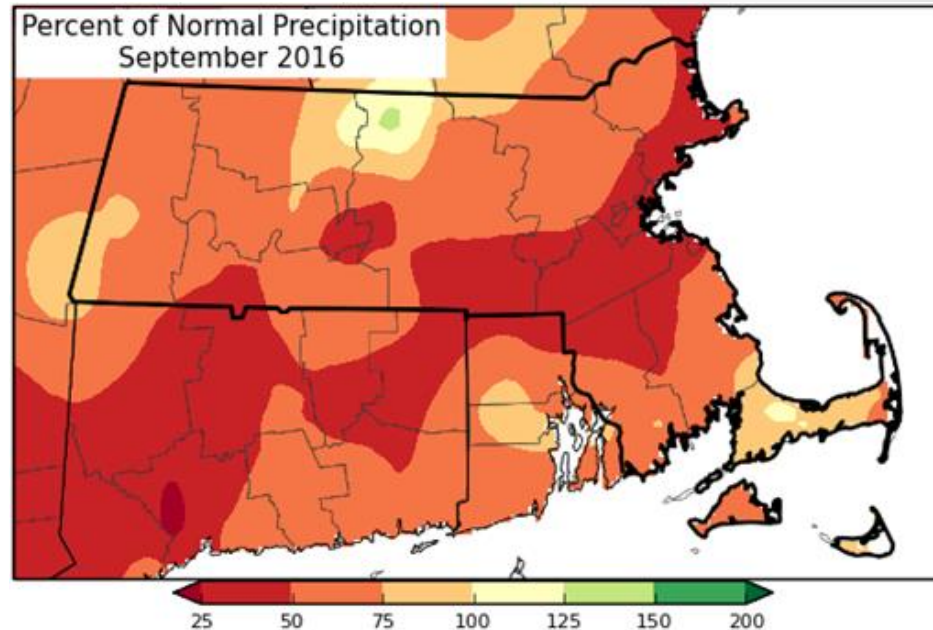
	West	CT River	Central	Northeast	Southeast	Cape & Islands
Jul-16	Normal	Advisory	Watch	Watch	Advisory	Normal
Aug-16	Advisory	Watch	Warning	Warning	Watch	Advisory
Sep-16	Advisory	Watch	Warning	Warning	Warning	Watch
Oct-16	Watch	Warning	Warning	Warning	Warning	Watch
Nov-16	Warning	Warning	Warning	Warning	Warning	Advisory
Dec-16	Warning	Warning	Warning	Warning	Warning	Advisory
Jan-17	Warning	Warning	Warning	Watch	Warning	Advisory
Feb-17	Watch	Warning	Watch	Advisory	Warning	Advisory
Mar-17	Advisory	Watch	Advisory	Advisory	Watch	Advisory
Apr-17	Normal	Advisory	Advisory	Advisory	Advisory	Advisory
May-17	Normal	Normal	Normal	Normal	Normal	Normal

Normal
Advisory
Watch
Warning
Emergency

- May 2017: All regions return to Normal

Precipitation

- Lowest precip amounts in CY 2016 (NRCC: -11.73")
- NCEI: 2016 water year was 13th driest and 2nd warmest for MA overall
- September 2016: most severe drought levels



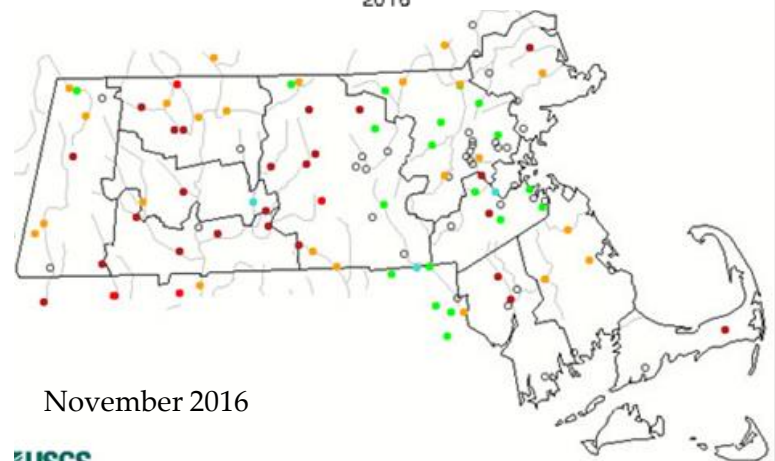
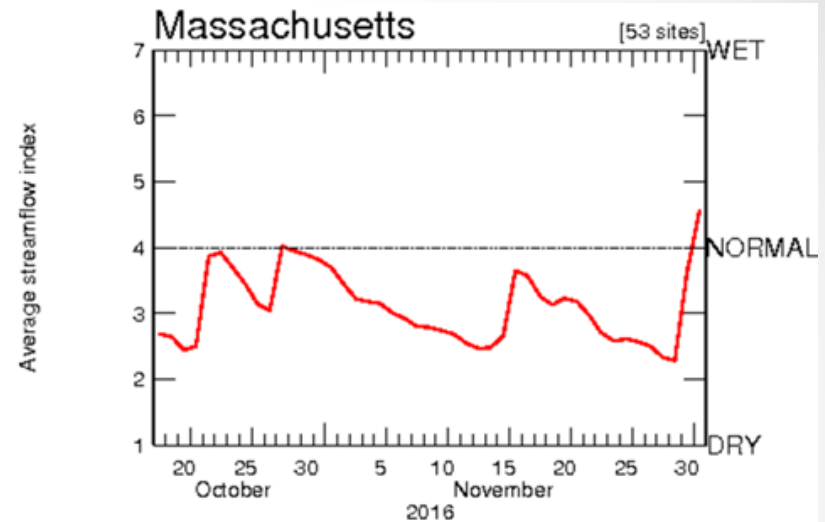
Map from NRCC

	West	CT River	Central	Northeast	Southeast	Cape & Islands
Jun-16	Normal	Watch	Watch	Watch	Normal	Advisory
Jul-16	Normal	Watch	Watch	Watch	Advisory	Advisory
Aug-16	Normal	Watch	Advisory	Warning	Watch	Watch
Sep-16	Normal	Watch	Watch	Emergency	Warning	Watch
Oct-16	Normal	Watch	Advisory	Advisory	Normal	Advisory
Nov-16	Normal	Watch	Advisory	Advisory	Advisory	Watch
Dec-16	Normal	Watch	Advisory	Advisory	Advisory	Advisory

Streamflow

- Severe impacts in 2016
- 3 of 5 regions reached Emergency status
- Sept. 2016: 15 gages at POR low flows
- Drought levels worst in November 2016 (2 lows)

	West	CT River	Central	Northeast	Southeast
Jun-16	Advisory	Advisory	Watch	Watch	Advisory
Jul-16	Watch	Watch	Watch	Watch	Watch
Aug-16	Watch	Watch	Warning	Warning	Watch
Sep-16	Watch	Warning	Warning	Warning	Warning
Oct-16	Warning	Warning	Emergency	Warning	Warning
Nov-16	Warning	Emergency	Emergency	Warning	Warning
Dec-16	Advisory	Warning	Warning	Normal	Emergency



November 2016

USGS

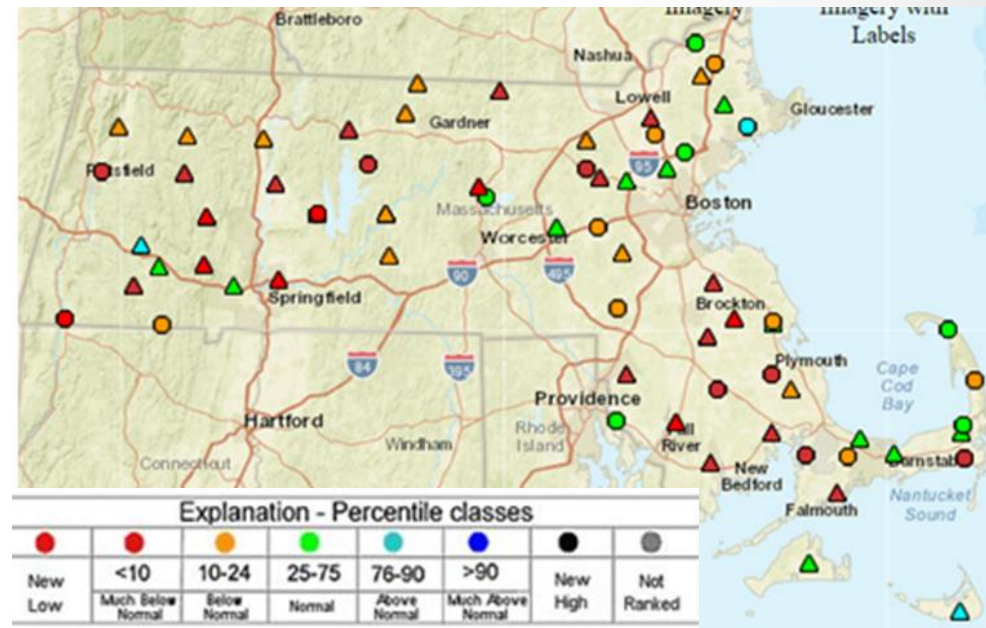
Explanation - Percentile classes



Groundwater

- 2016: worst impacts
- 4 of 6 regions reached Emergency status
- Sept. 2016: 14 wells at POR lows
- Drought levels worst in October (13 lows) and November 2016 (8 lows)

Groundwater Conditions at end of November 2016



	West	CT River	Central	Northeast	Southeast	Cape & Islands
Jun-16	Watch	Advisory	Advisory	Advisory	Advisory	Normal
Jul-16	Watch	Watch	Watch	Watch	Advisory	Normal
Aug-16	Warning	Watch	Watch	Watch	Watch	Normal
Sep-16	Warning	Warning	Warning	Warning	Watch	Normal
Oct-16	Emergency	Warning	Warning	Warning	Warning	Normal
Nov-16	Emergency	Emergency	Emergency	Normal	Warning	Normal
Dec-16	Emergency	Emergency	Normal	Normal	Emergency	Normal

Reservoirs

- Lowest levels in 2016
- >2 SD below normal:
Cambridge (18%, 10/2016),
Lynn, Taunton, Worcester (47%,
11/2016)
- Drought levels worst in Nov/Dec
2016 (Nov: 14 of 19 below
normal)



Scituate Reservoir, August 2016
(photo: Qainat Khan/WBUR)

West CT River Central Northeast Southeast Cape & Islands

	West	CT River	Central	Northeast	Southeast	Cape & Islands
Jun-16	Normal	Normal	Watch	Watch	Watch	Normal
Jul-16	Normal	Normal	Watch	Watch	Watch	Normal
Aug-16	Normal	Normal	Watch	Watch	Watch	Normal
Sep-16	Normal	Normal	Watch	Watch	Watch	Normal
Oct-16	Watch	Watch	Watch	Warning	Watch	Normal
Nov-16	Watch	Warning	Watch	Watch	Watch	Advisory
Dec-16	Watch	Warning	Watch	Watch	Watch	Advisory

- Scituate (not in DMP network): 21.4% full 9/2016

State Response to Drought

Communication/Information Sharing:

- Governor Baker/Secretary Beaton press conference 8/18/2016 at Smolak Farms, N. Andover
- EEA/MEMA – coordinated 8/19/16 conference call with state agencies and municipal officials
- EEA – drought website with water conservation tips, private well info, disaster assistance for businesses, etc.
- MEMA – Situational Awareness emails, provided guidance/assistance to communities requesting it
- DEP – monthly letters to PWS



State Response to Drought

Financial Assistance:

- **State** - September 2016, Baker-Polito Administration: MA Drought Emergency Loan Fund
 - micro-loans for small businesses and farmers impacted by the drought
 - capacity to provide up to \$1 million in micro-loans
- **State** - FY2018, MDAR: Agricultural Climate Resiliency & Efficiencies (ACRE) Program
 - reimbursement for projects that address the sector's vulnerability to climate change, improve economic resiliency
 - In its first year the program awarded 16 projects totaling \$500,000
- **Federal** - U.S. Small Business Administration: Economic Injury Disaster Loans
 - small businesses, agricultural cooperatives, and aquaculture operations, and private nonprofit organizations
 - Essex, Middlesex and Worcester counties
 - low-interest, long-term loans for damage caused by a declared disaster

Agricultural Impacts

Economic Impact of 2016 Drought on Massachusetts by Crop

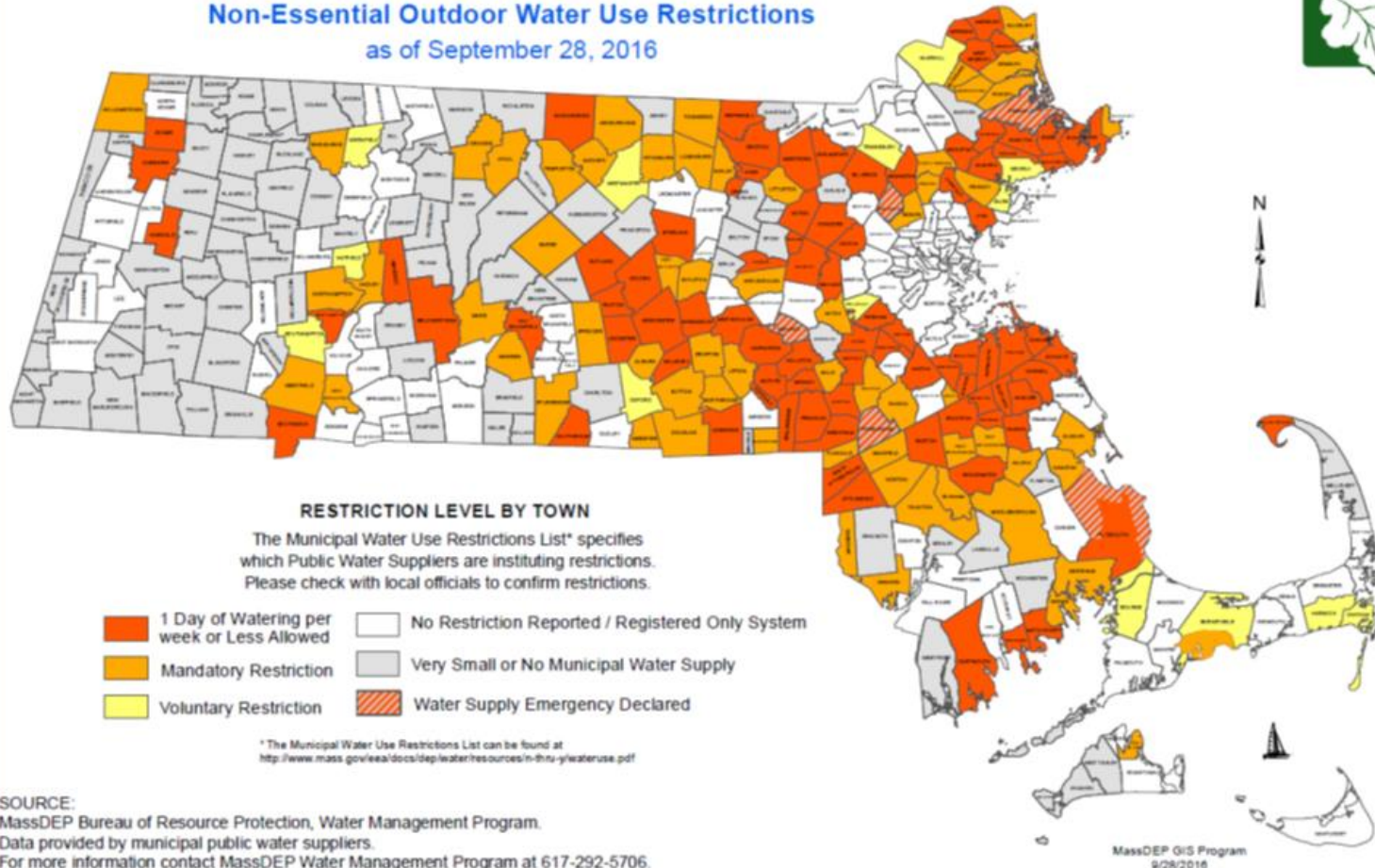
Crop	Farm Acres Affected	Estimated Crop Loss (\$)
Blueberries	132	483,760
Cabbage	27	49,133
Cranberries	75	380,250
Corn- Grain	415	96,114
Corn- Silage	6,289	2,344,016
Corn- Sweet	1,094	1,892,261
Cucumbers	0	434
Eggplant	1	3,266
Mixed Forage	31,090	5,277,550
Mixed Forage- Pasture	10,375	718,788
Peppers	38	157,139
Potatoes	3,677	4,244,574
Pumpkins	359	354,354
Squash	320	1,026,293
Strawberries	50	460,877
Tomatoes	85	683,950
TOTAL	54,027	18,172,759

Sourced from loss assessment reports from each individual county committee.

Water Supply Impacts

CURRENT MUNICIPAL WATER USE RESTRICTIONS

Non-Essential Outdoor Water Use Restrictions
as of September 28, 2016

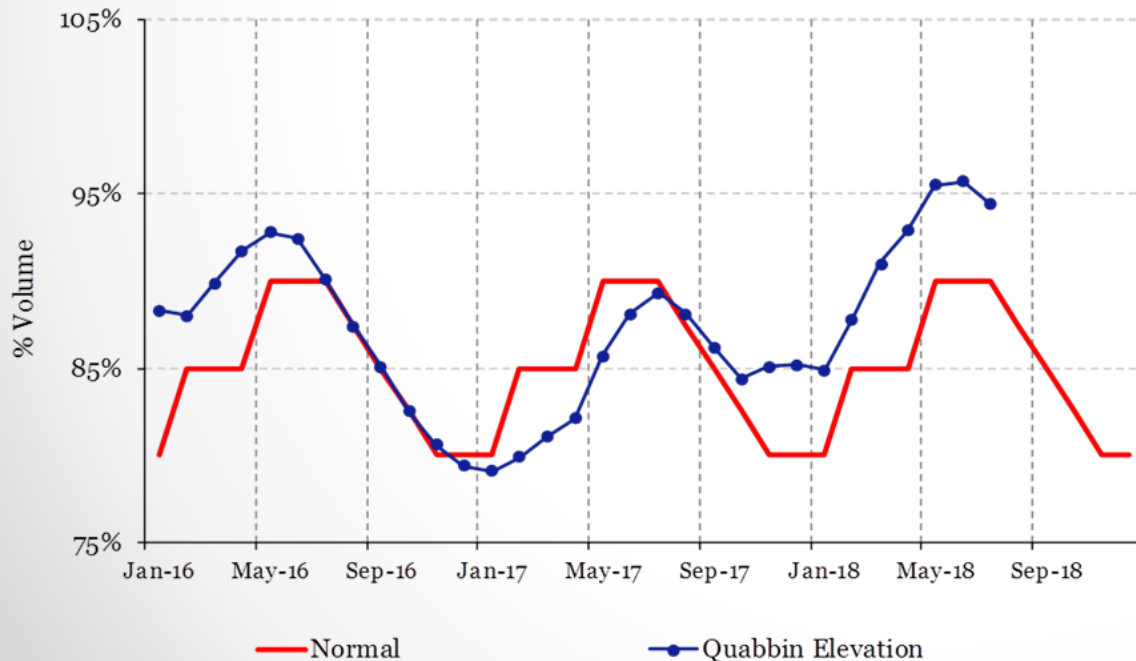


SOURCE:
MassDEP Bureau of Resource Protection, Water Management Program.
Data provided by municipal public water suppliers.
For more information contact MassDEP Water Management Program at 617-292-5706.

Water Supply Impacts

- Communities that took water from MWRA:
 - Ashland
 - Burlington
 - Cambridge
 - Worcester

Quabbin Reservoir Volume 2016-2018



- Quabbin never reached “Drought Warning” stage (50-75% full) according to MWRA drought plan
- “Below Normal” from 11/12/16 thru mid-June 2017

DCR Private Well Survey

- DCR OWR created a survey to gather info on drought impacts to private wells
- Worked with DPH to distribute to local health depts. in May 2017
- 87 respondents
 - 45 respondents (52%) aware of private well impacts in their municipality
 - Total estimate of 220 incidents
 - Low or no water
 - Need to improve/replace well
 - Poor water quality
- Four municipalities reported dry wells to MEMA
 - None of the four responded to the survey

DCR Private Well Survey

4. What could state agencies provide to help municipalities and private well owners manage future droughts? Please check all that apply. *

- Educational materials for private well owners (e.g., Preparing for and managing drought conditions)
- Resources for private well owners (e.g., List of certified well drillers, list of emergency water tank providers)
- A centralized online system for reporting drought impacts to understand the extent of these impacts
- Other: _____

- Educational materials: 84%
- Resources for well owners: 68%

- Online reporting system: 64%
- Written responses
 - Do private wells impact public water supplies?
 - What are municipal powers to regulate private well use during droughts?
 - \$ or low interest loans for well replacements
 - List of water testing laboratories

Questions?



*Martins Brook, North Reading, August 31, 2016
Photo: MA Division of Ecological Restoration*