

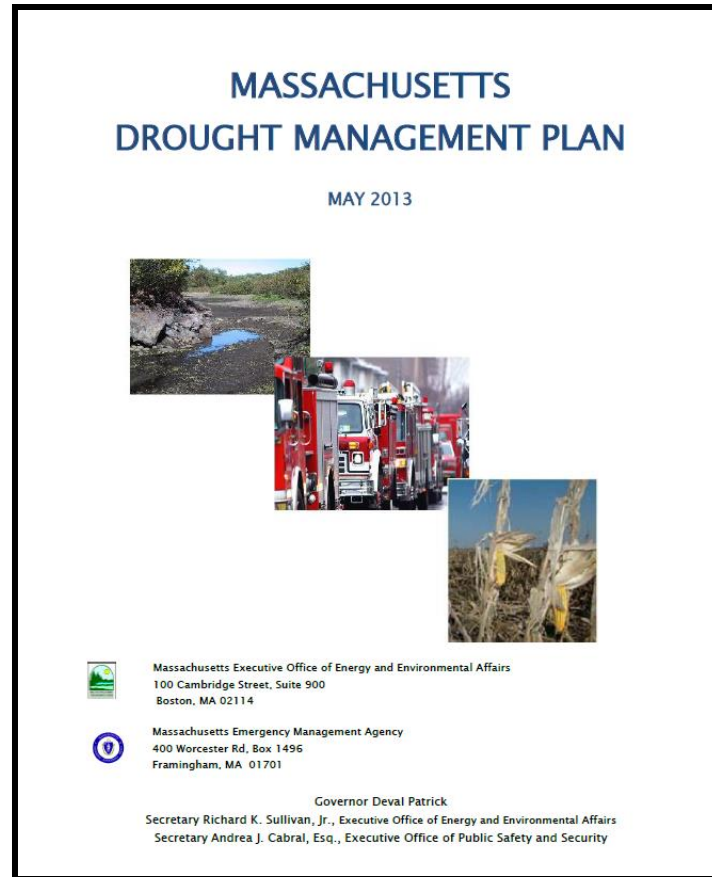
Current Hydrologic Conditions in Massachusetts

Drought Management Task Force

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

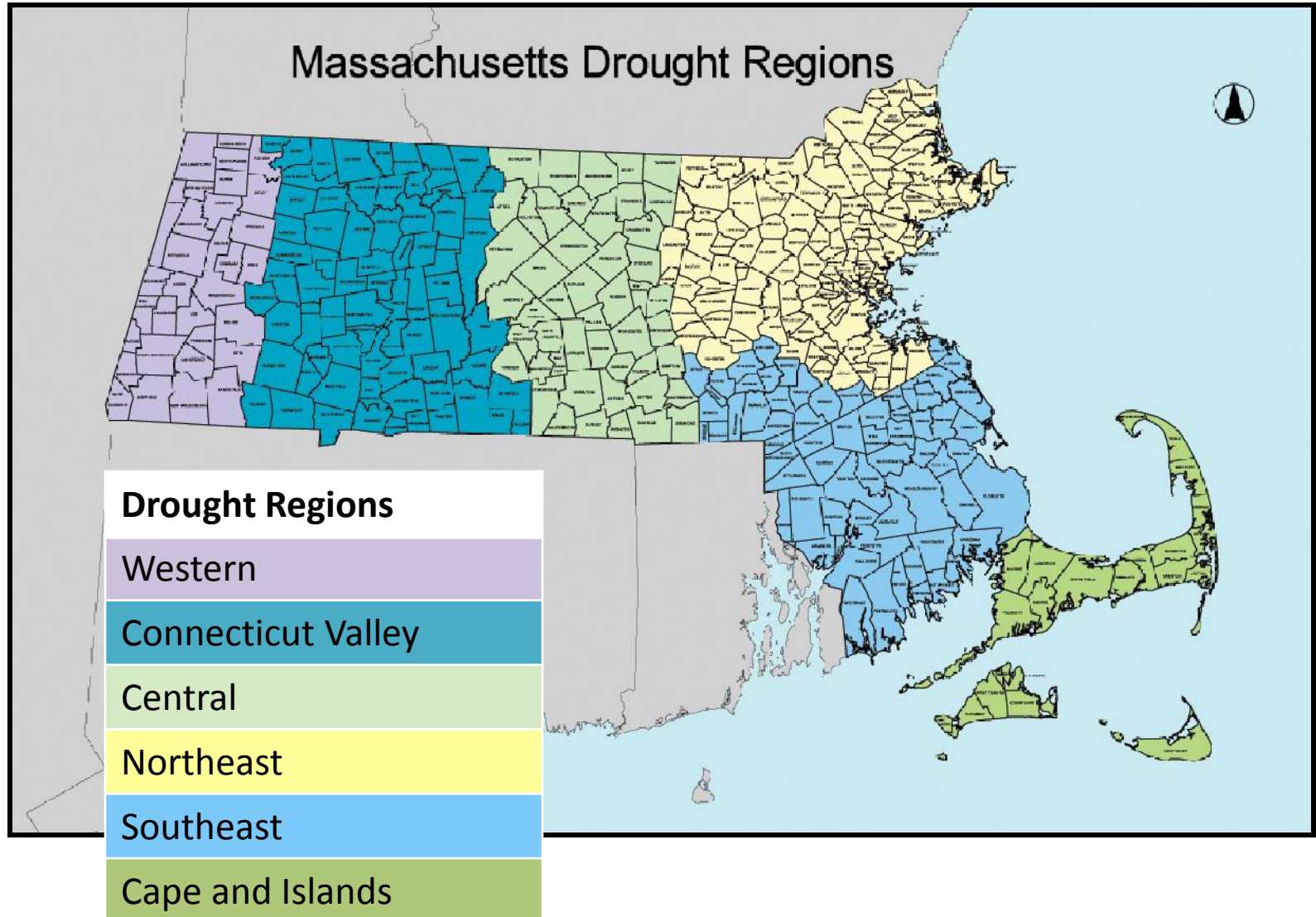
September 8, 2016

MA Drought Management Plan Summary / Review



www.mass.gov/eea/wrc-dmtf

Massachusetts Drought Regions



Massachusetts Drought Indicators and Levels

Drought Indicator	Indicator Type
Standardized Precipitation Index	Precipitation
Precipitation Percent Below Normal	Precipitation
Streamflow Months Below Normal	Streamflow
Groundwater Level Months Below Normal	Groundwater
Size of Reservoir (S, M, L) Below Normal	Reservoirs
Crop Moisture Index	Crop Moisture
Keetch-Byram Drought Index	Fire Danger

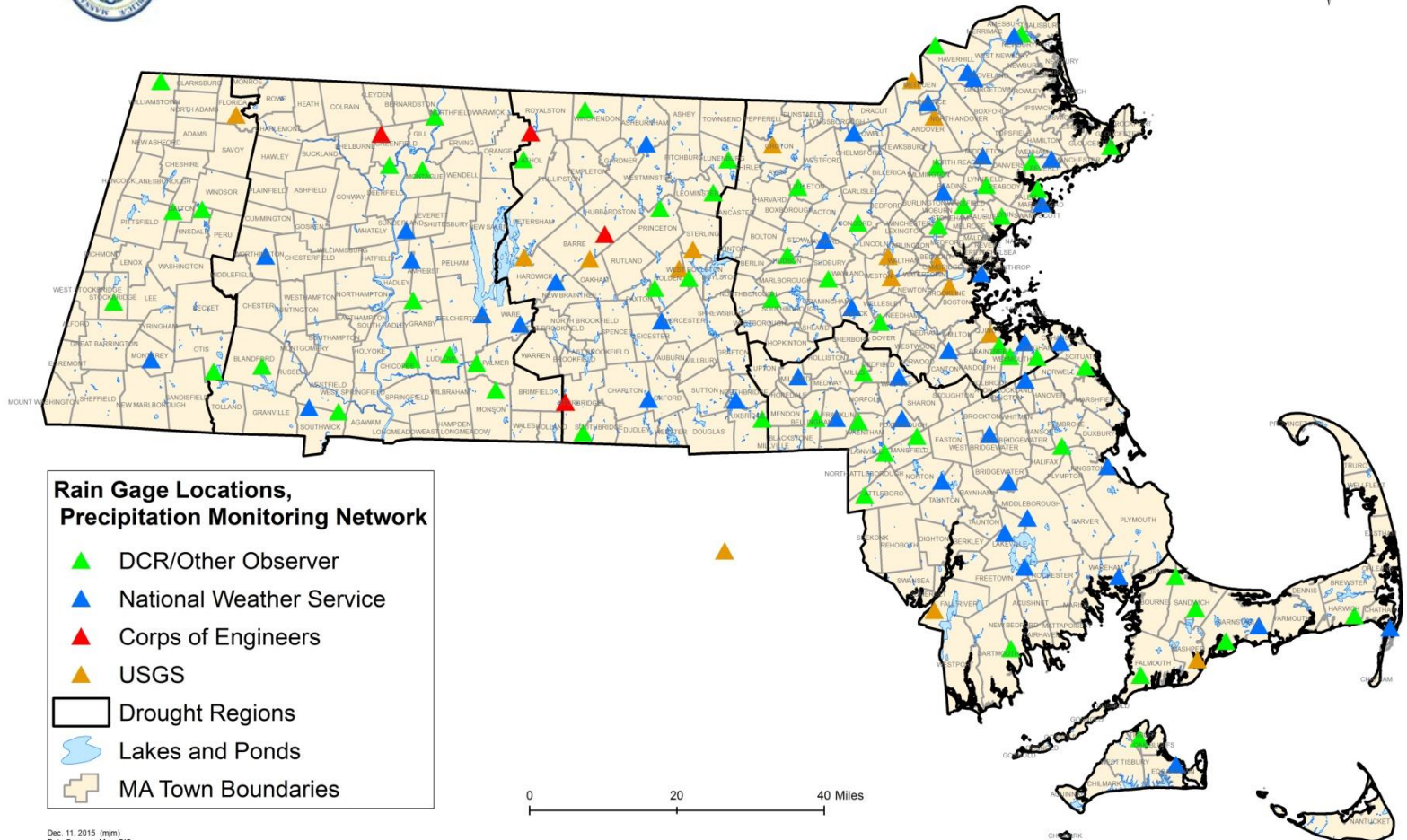
Drought Levels:
Normal
Advisory
Watch
Warning
Emergency

Drought declaration based on majority of indices

Precipitation Data Sources



Massachusetts Precipitation Monitoring Network



Monthly Precipitation Composite Estimate, August 2016

August, 2016	Normal	Actual	Percent Normal	Excess/ Deficit	-----Excess or Deficit Since Last-----								
					10/1/2015	2 Months	% Norm	3 Months	% Norm	6 Months	% Norm	12 Months	% Norm
State	3.97	2.81	71	-1.16	-6.63	-2.76	64	-3.62	68	-5.96	74	-6.09	87
Cape Cod and Islands	4.00	0.82	21	-3.18	-1.41	-3.92	43	-6.45	37	-7.18	68	-1.24	97
Central	4.06	3.94	97	-0.12	-9.18	-1.90	76	-3.73	68	-6.59	72	-8.89	81
Connecticut River	4.22	3.74	89	-0.48	-8.38	-2.25	73	-4.24	66	-7.79	67	-6.92	85
Northeast	3.58	2.16	60	-1.42	-11.13	-3.52	50	-5.49	48	-7.97	63	-10.18	77
Southeast	3.92	1.85	47	-2.07	-6.97	-3.73	49	-5.39	49	-7.71	65	-6.32	86
Western	4.15	3.89	94	-0.26	-3.01	-0.71	92	-1.89	85	-2.72	88	-2.46	94

Notes: Values are estimated pending receipt of additional data and final calculations.
Precipitation values are total rainfall and melted snow in inches.

Precipitation

Region	AUGUST Estimated Rainfall: Composite Sites Reporting (inches)	Departure from Normal (inches)	MA Drought Management Plan Levels	
			Standardized Precipitation Index (SPI)	Percent of Normal Index
Cape Cod & Islands	0.82	-3.18	Watch	Watch
Central	3.94	-0.12	Advisory	Normal
Connecticut River	3.74	-0.48	Watch	Watch
Northeast	2.16	-1.42	Watch	Warning
Southeast	1.85	-2.07	Watch	Watch
Western	3.89	-0.26	Normal	Normal

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

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

Reservoirs

General Reservoir Levels in Massachusetts at the end of August 2016			
Region	Number of Reservoirs Monitored	Reservoir Levels (majority)	MA Drought Management Plan Reservoir Index
Cape Cod & Islands	1	Normal	Normal
Central	3	Below Normal*	Watch*
Connecticut River	2	Normal	Normal
Northeast	6	Below Normal*	Watch*
Southeast	3	Below Normal	Watch
Western	2	Normal	Normal

*At least 1 reservoir at 2 standard deviations below normal

Streamflow Index

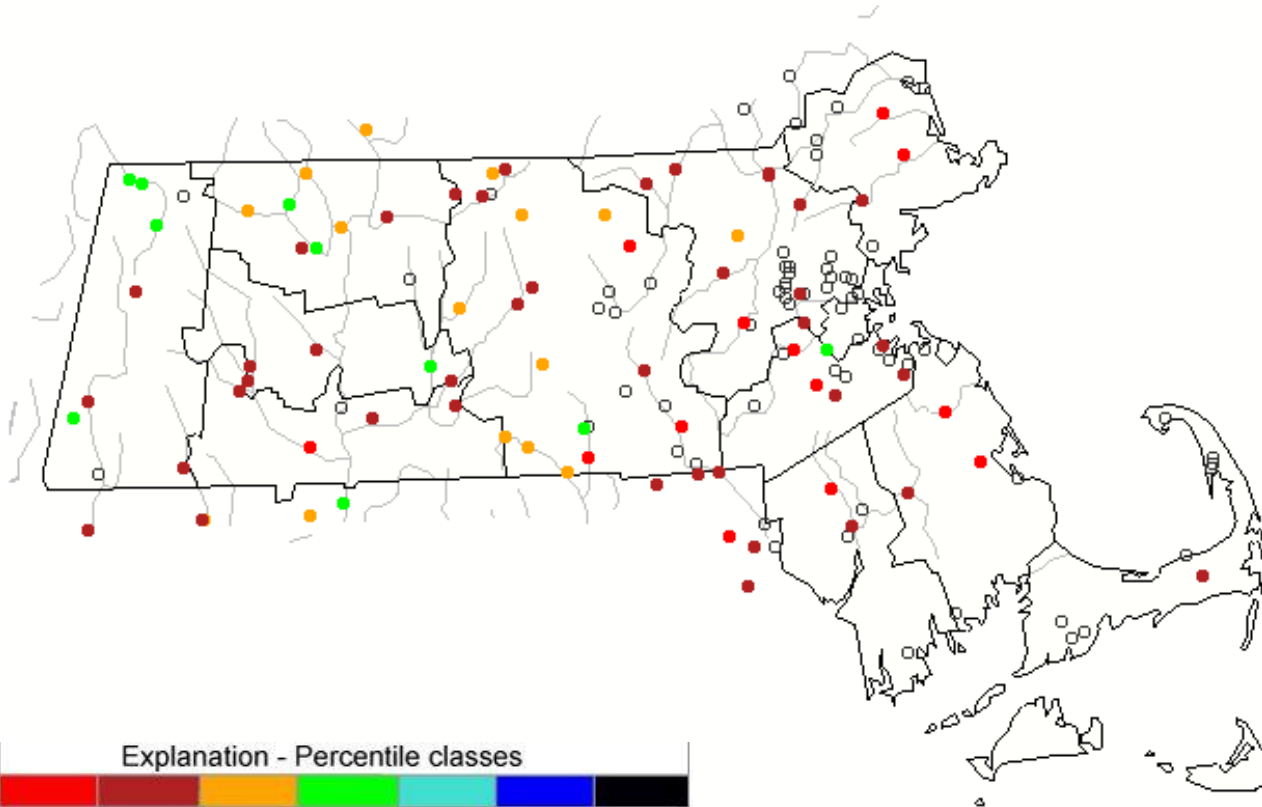
Drought Level	Streamflow Index
Normal	1 month below normal*
Advisory	At least 2 out of 3 consecutive months below normal*
Watch	At least 4 out of 5 consecutive months below normal*
Warning	At least 6 out of 7 consecutive months below normal*
Emergency	Greater than 7 months below normal*

*Below normal for streamflow is defined as being within the lowest 25th percentile of the period of record




Streamflow

August 2016 Streamflow Compared to Historical Streamflow for August

Wednesday, August 31, 2016 09:30ET



Explanation - Percentile classes

							
Low	<10	10-24	25-75	76-90	>90	High	
	Much below normal	Below normal	Normal	Above normal	Much above normal		

Ipswich River, North Reading



Ipswich River, 8/30/16



Martin's Brook, 8/31/16

Belchertown and Scituate



Montague Brook, 8/18/16



First Herring Brook, 8/31/16

Streamflow

General Streamflow Conditions in Massachusetts August 2016		
Region	Consecutive Months Below Normal	MA Drought Management Plan Streamflow Index
Cape Cod & Islands	Not Applicable	Not Applicable
Central	6	Warning
Connecticut River	5	Watch
Northeast	6	Warning
Southeast	4	Watch
Western	4	Watch

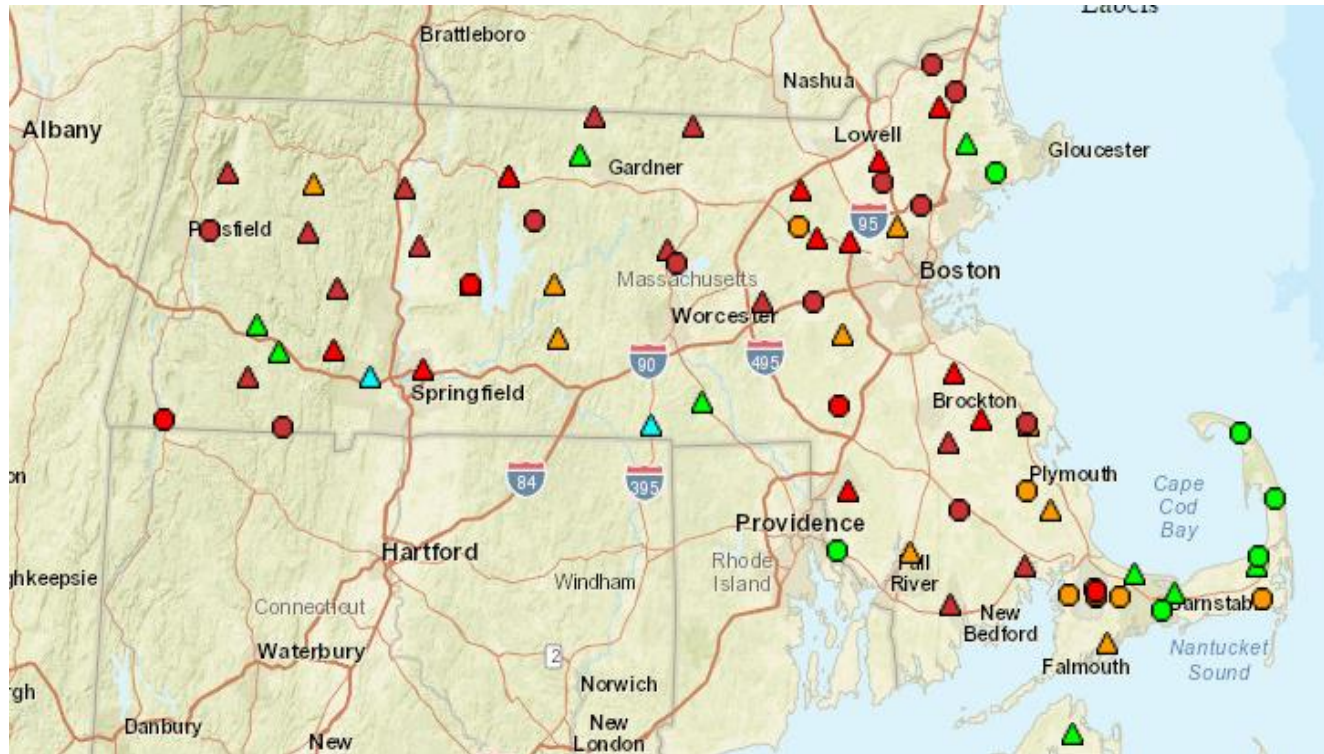
Groundwater Index

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 for groundwater is defined as being within the lowest 25th percentile of the period of record

Groundwater

August 30 2016 Real-Time Groundwater Conditions



Explanation - Percentile classes							
●	●	●	●	●	●	●	●
New	<10	10-24	25-75	76-90	>90	New High	Not Ranked
Low	Much Below Normal	Below Normal	Normal	Above Normal	Much Above Normal		

○	Real Time
□	Continuous
△	Periodic Measurements

Groundwater

Count of Consecutive Months Below Normal (majority of wells by region)

Region	Number of wells	March	April	May	June	July	August
Cape and Islands	13	0	0	0	0	0	1
Central	10	0	1	2	3	4	5
CT Valley	11	0	1	2	3	4	5
Northeast	17	0	1	2	3	4	5
Southeast	12	0	0	1	2	3	4
Western	5	1	2	3	4	5	6

Crop Moisture and Fire Danger Indices

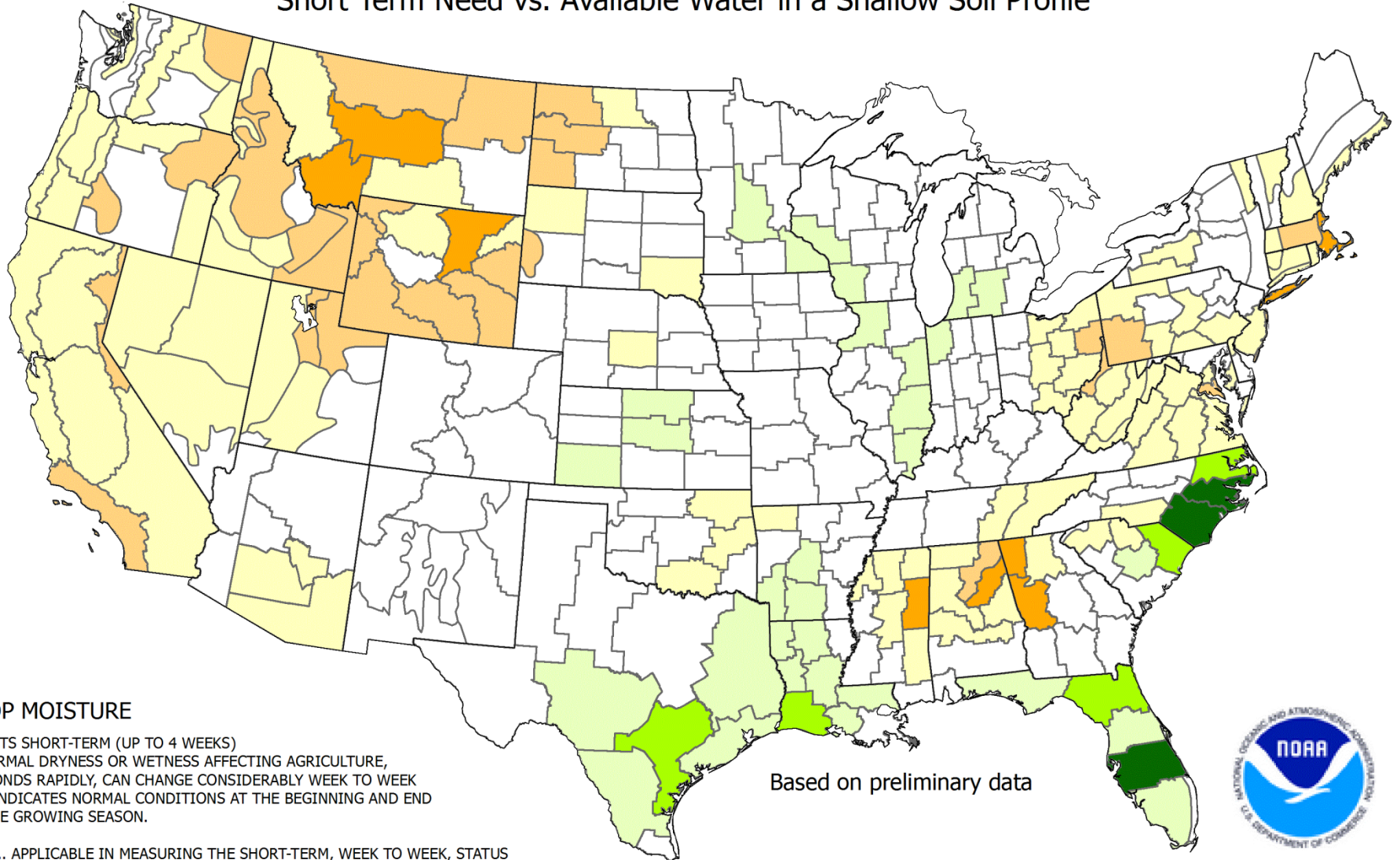
Drought Level	Crop Moisture Index*	Keetch-Byram Drought Index (KBDI)
Normal	0 to -1.0 Slightly dry	less than 200
Advisory	-1 to -1.9 Abnormally dry	200 to 400
Watch	-2 to -2.9 Excessively dry	400 to 600
Warning	< -2.9 Severely dry	600 to 800
Emergency	< -2.9 Severely dry	600 to 800

* 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 Index by Division

Weekly Value for Period Ending Sep 03, 2016

Short Term Need vs. Available Water in a Shallow Soil Profile



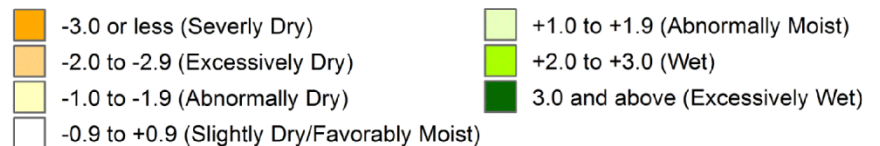
CROP MOISTURE

DEPICTS SHORT-TERM (UP TO 4 WEEKS) ABNORMAL DRYNESS OR WETNESS AFFECTING AGRICULTURE, RESPONDS RAPIDLY, CAN CHANGE CONSIDERABLY WEEK TO WEEK AND INDICATES NORMAL CONDITIONS AT THE BEGINNING AND END OF THE GROWING SEASON.

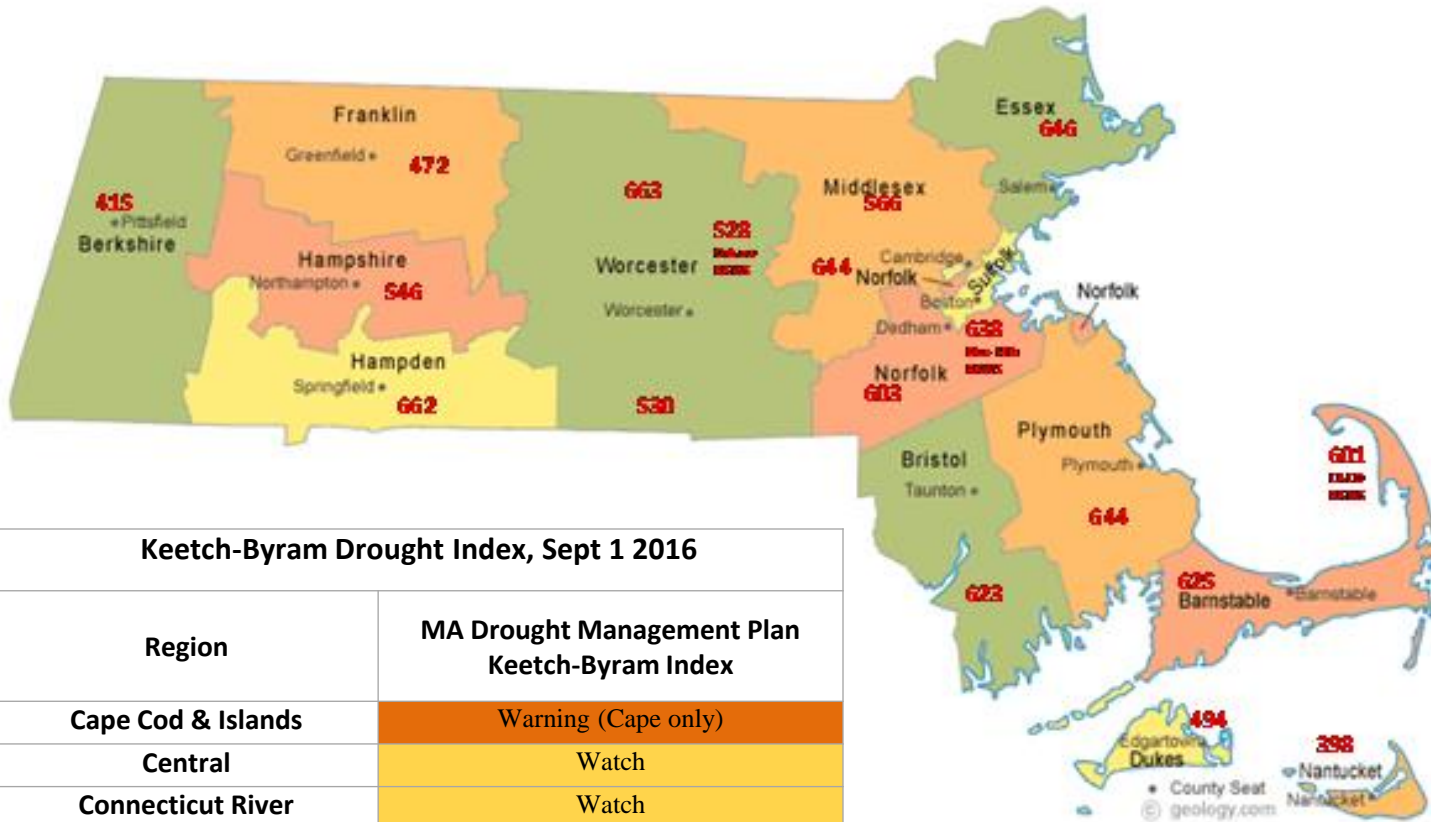
USES... APPLICABLE IN MEASURING THE SHORT-TERM, WEEK TO WEEK, STATUS OF DRYNESS OR WETNESS AFFECTING WARM SEASON CROPS AND FIELD OPERATIONS

LIMITATIONS... MAY NOT BE APPLICABLE TO GERMINATING AND SHALLOW ROOTED CROPS WHICH ARE UNABLE TO EXTRACT THE DEEP OR SUBSOIL MOISTURE FROM A SHALLOW SOIL PROFILE, OR FOR COOL SEASON CROPS GROWING WHEN TEMPERATURES ARE AVERAGING BELOW ABOUT 55F. IT IS NOT GENERALLY INDICATIVE OF THE LONG-TERM (MONTHS, YEARS) DROUGHT OR WET SPELLS WHICH ARE DEPICTED BY THE DROUGHT SEVERITY INDEX.

Based on preliminary data



Keetch-Byram Drought Index



Keetch-Byram Drought Index, Sept 1 2016

Region	MA Drought Management Plan Keetch-Byram Index
Cape Cod & Islands	Warning (Cape only)
Central	Watch
Connecticut River	Watch
Northeast	Warning
Southeast	Warning
Western	Watch

US Drought Monitor

U.S. Drought Monitor Massachusetts

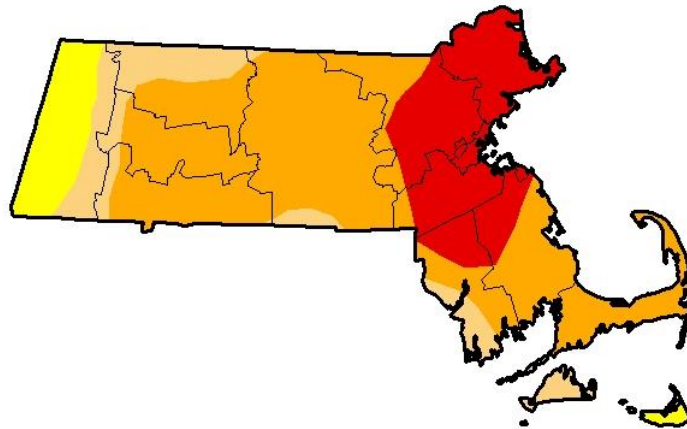
August 30, 2016

(Released Thursday, Sep. 1, 2016)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	91.12	77.38	22.67	0.00
Last Week 8/23/2016	0.00	100.00	91.12	72.22	16.86	0.00
3 Months Ago 5/31/2016	57.14	42.86	0.00	0.00	0.00	0.00
Start of Calendar Year 1/22/2015	22.85	77.15	26.34	0.00	0.00	0.00
Start of Water Year 9/29/2015	12.90	87.10	30.43	0.00	0.00	0.00
One Year Ago 9/1/2015	49.13	50.87	0.19	0.00	0.00	0.00



Intensity



The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:

Chris Fenimore
NCE/NESDIS/NOAA



<http://droughtmonitor.unl.edu/>

Agency Input and Discussion

Summary of Drought Indices as of September 1, 2016

Drought Indicator	Indicator Type	Drought Regions					
		West	CT River	Central	Northeast	Southeast	Cape and Islands
Standardized Precipitation Index (SPI)	Precipitation	Normal	Watch	Advisory	Watch	Watch	Watch
Precipitation % Below Normal	Precipitation	Normal	Watch	Normal	Warning	Watch	Watch
Months Below Normal	Streamflow	Watch	Watch	Warning	Warning	Watch	N/A
Months Below Normal	Groundwater	Warning	Watch	Watch	Watch	Watch	Normal
Size of reservoir below normal	Reservoirs	Normal	Normal	Watch	Watch	Watch	Normal
Crop Moisture Index	Crop Moisture	Advisory	Watch	Watch	Warning	Warning	Warning
Keetch-Byram Drought Index	Fire Danger	Watch	Watch	Watch	Warning	Warning	Watch

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 the Secretary of the Executive Office of Energy and Environmental Affairs.

Avoid Watering During a Drought¹

Limits on outdoor water use are critical to help ensure that enough water is available for essential needs, including drinking water and fire protection, crop irrigation, and our natural resources.

Drought Level	Recommended Water Use Restrictions for Everyone ^{1,2}
Advisory	<i>1 day per week at the most, outside the hours of 9AM – 5PM</i>
Watch	<i>hand-held only or drip irrigation outside the hours of 9AM – 5PM</i>
Warning	<i>Outdoor water use should be banned</i>

1. Certain water uses are not subject to mandatory restrictions, such as water used:

- for health or safety reasons;
- for the production of food and fiber;
- for the maintenance of livestock;
- to meet the core functions of a business (for example, irrigation by plant nurseries as necessary to maintain stock).

2. If your water supplier has stricter restrictions in place, abide by those.