

Northeast Regional Climate Center

# NORTHEAST DROUGHT ASSESSMENTS 2016-2017

## BUILDING DROUGHT EARLY WARNING CAPACITY

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# Coping with drought and its aftermath in the Northeast

## INTRODUCTION

Mark Twain once said, “There is a sumptuous variety about the New England weather that compels the stranger’s admiration—and regret.” Known best for the autumn foliage, thick forests, rocky soils, and abundant freshwater resources, the northeastern United States is characterized by a diverse climate that is not often associated with drought. However, in 2016, New York and New England experienced historic drought conditions not seen there since the 1960s. In the hardest hit areas of western and central New York, Massachusetts, and southern New Hampshire, drought conditions intensified during the summer of 2016, with extreme drought (D3) introduced for the first time since U.S. Drought Monitor data began in 2000.

The National Integrated Drought Information System

### WHAT IS NIDIS?

The National Oceanic and Atmospheric Administration’s (NOAA) National Integrated Drought Information System (NIDIS) was authorized by Congress in 2006 (Public Law 109-430) with an interagency mandate to develop and provide a national drought early warning information system, by coordinating and integrating drought research, and building upon existing federal, tribal, state, and local partnerships.

(NIDIS), in partnership with the National Oceanic and Atmospheric Administration (NOAA), the Northeast Regional Climate Center (NRCC), U.S. Representative Seth Moulton’s (MA-6) office, and the American Association of State Climatologists (AASC), hosted a Northeast Drought and Climate Outlook Forum in Boston, Massachusetts on October 11, 2016. The forum brought together nearly 100 stakeholders from around the region and across federal, state, local, private, and nonprofit sectors to discuss the drought conditions in New England and New York, the impacts of the drought, existing response and preparedness resources, and climate outlooks for the coming seasons.

As the drought continued and expanded southward in Connecticut and Rhode Island, NOAA, NIDIS, and the NRCC hosted two more meetings in New York (February 27, 2017) and Massachusetts (March 1, 2017). The purpose of these follow-up meetings was to assess the 2016 drought, understand the additional resources that would have strengthened drought resilience through the drought period, and identify what drought indicators and early warning capacity could be integrated into a Northeast Drought Early Warning System. More than 100 community leaders representing sectors from water resource management and agriculture to local government and community watershed groups shared insights on information gaps they experienced. Discussion during the meetings suggested that there are several actions that could be taken to improve

impact data collection, enhance observation and monitoring systems, and support drought preparedness and response in the region.

In this report, we present the opportunities and challenges participants identified, as well as the impacts of the 2016 drought and recommendations for better understanding and addressing drought in the future.

## DROUGHT IMPACTS

The impacts identified at the October 2016 Drought and Climate Outlook Forum and the Drought Assessment meetings in February and March of 2017 ranged from low reservoir levels to fish kills to parched topsoil and more intense wildfires.

### Agriculture

One of the biggest impacts of the 2016 drought was on farming. The Northeast is home to about 175,000 farms that produce more than \$21 billion per year (USDA, 2015). Diversified farms are commonplace; crop insurance and irrigation are not. During the 2016 drought, crop yields were down for many producers, and field crops like hay and corn suffered, affecting dairy farmers and others who graze animals. Topsoil was the driest it has been in 20 years, with southern New England having the greatest percent of topsoil rated short to very short nationwide in mid-August. Compounding these stresses were relatively positive farming conditions across the rest of the country, driving commodity prices to multi-year lows. However, for some farmers with access to water, the dry conditions also led to less disease in crops, and sweeter, more intense flavors in fruits.

### WHAT IS A “DEWS”?

A Drought Early Warning System (DEWS) utilizes new and existing networks of federal, tribal, state, local, and academic partners to make climate and drought science accessible and useful for decision makers; and to improve the capacity of stakeholders to monitor, forecast, plan for, and cope with the impacts of drought.

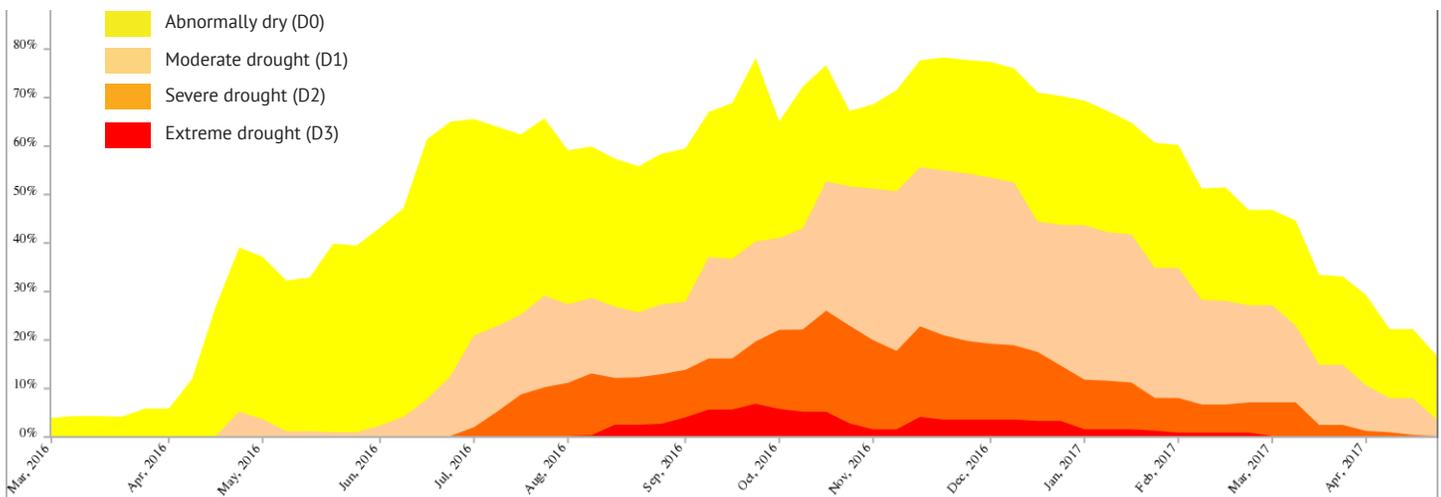
### Water resources

Large areas of New England and New York experienced below-normal precipitation, with many waterways setting record-low stream flows. Major reservoirs such as the Quabbin and Wachusett Reservoirs in Massachusetts store water for multiple years, and were less affected by the 2016 drought. In New York, the upstate reservoirs in the Catskills that feed into New York City were impacted at various levels, with the overall system functioning at 64% capacity as of December 30, 2016, compared to the normal 87.5% (NCDC, 2016). Yet, smaller systems in the region were heavily impacted, resulting in mandatory restrictions, water purchases, and other conservation measures.

### Fisheries

The low stream flows in New England rivers impacted fish species from the river herring, which lives at sea but returns to freshwater to spawn, to the American eel, which lives in freshwater but spawns at sea. These fish became marooned along portions of some rivers in Massachusetts due to low water levels. Waterways with dams and without fish ladders became particularly problematic, trapping fish below dams in low-oxygen conditions. Fish kills were observed

## HOW DROUGHT PROGRESSED IN THE NORTHEAST, 2016-2017



Time series from the U.S. Drought Monitor shows the percentage of land affected by drought between March 2016 and May 2017. States included are Maine, New Hampshire, Vermont, New York, Massachusetts, Connecticut, Rhode Island, New Jersey, Pennsylvania, Delaware, Maryland and West Virginia.



These photos compare the water level in a reservoir in Worcester, Massachusetts, with the one at the right showing the impact of the 2016 drought. Photo: City of Worcester Department of Public Works and Parks

## Water and drought in the Northeast

### **Private well water supply is difficult to monitor and observe for drought impacts.**

About 2.3 million New Englanders, or 20 percent of the New England population, and as many as 4 million New York State residents get their water from private wells (EPA, 2017; NYS, 2017). Private wells are often regulated by local health departments and districts. Drought conditions can have wide-ranging impacts on groundwater supply, and wells placed along water tables can dry up as a result. Because these local water systems lack coordinated monitoring infrastructure, drought impacts are hard to collect and drought planning to account for private well water supply is challenging.

### **Diverse water resources and dense populations add layers to drought planning efforts.**

Sixty-four million people are concentrated in the Northeast (NCA, 2014), and the region contains a large network of supporting water infrastructure. Coordination of water management actions at a state or regional level are complicated by diverse private and public land ownership, a high-density urban coastal corridor, and diverse water resources ranging from snowpack and coastal waters, to reservoirs and large watersheds like the Connecticut River and Penobscot River Basins and the Great Lakes Basins.

### **Home rule and strong municipal governments limit State influence in drought response.**

The Northeast (WV, MD, DE, NJ, PA, NY, CT, RI, MA, VT, NH, and ME) is home to several “home rule states” where

local towns may self-govern so long as they remain within the boundaries of state and federal constitutions, and towns rather than counties are the primary unit of local government.

Therefore, strong municipal governments and water districts are central to drought response in the region. Commonly, towns or water districts may act independently, or in conjunction with state agencies, in managing water resources during droughts. For example, a state’s Drought Management Task Force may recommend drought declarations. And specific agencies may also require municipal water departments to comply with drought-based water use restrictions, depending on the severity of the drought and the ability of supplies to meet necessary needs.

However, water systems may implement voluntary water conservation at any time, and there are limitations on when they can institute mandatory conservation, unless written specifically into agreements with their local customers.

### **Irrigation infrastructure is insufficient to deal with extreme drought.**

Throughout the Northeast, plentiful natural resources for water translate to many crops growing without irrigation. Large farms have the greatest irrigation capacity, but most lack the ability to cope with extreme drought conditions.

Investments in modern irrigation systems that help farmers respond to variable climatic conditions, along with possible changes in crop management, are important considerations for managing drought risk in the years to come.

throughout Massachusetts, and some states, including Connecticut, closed portions of rivers to fishing to protect fish.

**DROUGHT INFORMATION GAPS: CHALLENGES AND OPPORTUNITIES**

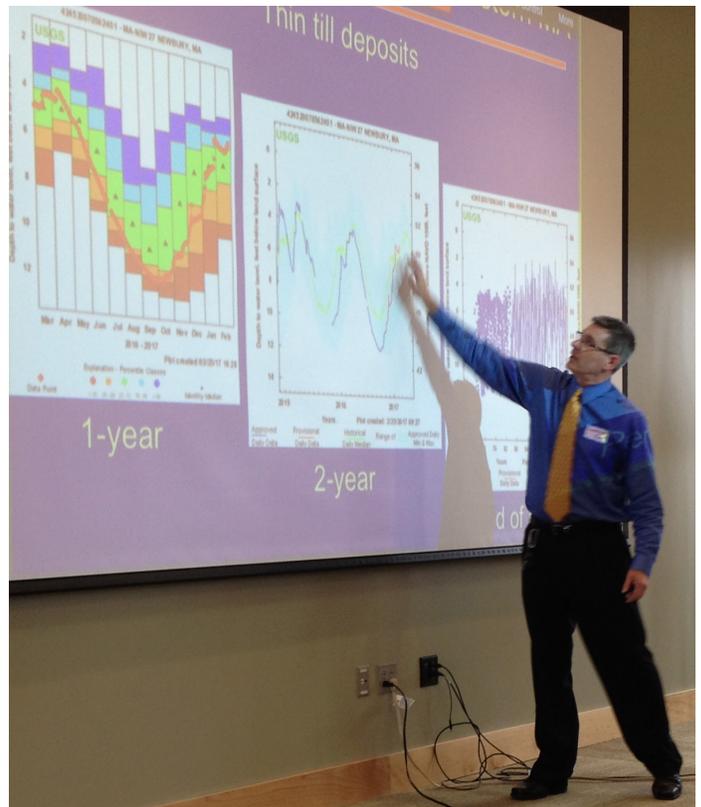
During the 2017 Drought Assessment meetings in New York and Massachusetts, participants explored ways to inform drought early warning and planning in the future by considering the impacts from the 2016 drought and identifying information gaps. For example, attendees at all three meetings highlighted the need for increased public awareness and outreach to effectively communicate drought forecasts, drought conditions, and drought impacts to decision makers, agricultural producers, and the public. Other challenges and opportunities identified for addressing drought in the Northeast included the following:

**Challenges**

- Many farmers lacked irrigation equipment, crop insurance, information on available resources and assistance, accurate long-range forecasts, and access to available data and products that could have informed better crop management decisions.
- Localized observations and drought monitoring efforts suffered from the loss of several U.S.G.S. monitoring wells along with the deterioration of existing, older wells used to monitor groundwater.
- Conflicting information on drought conditions among observed groundwater levels, the U.S. Drought Monitor, and locally observed data led to confusion among decision makers, the media, and the public.
- Observations at private wells are critical to gathering drought early warning information as well as monitoring conditions in rural areas, but the region lacks an adequate inventory of existing private wells (drilled vs. bedrock) or real-time surveys of impacts.
- Lack of information on the impact of low flows on recreational use of rivers.

**Opportunities**

- Planning efforts could be strengthened by longer-term historical views of drought indices. Portions of the Northeast experienced drier-than-normal conditions starting in 2015, and snowpack, soil moisture, and other observations across longer time horizons may have revealed red flags for future drought conditions.
- Decision-makers would benefit from more accurate and timely predictions for response planning and budget cycles (60-day lead time), as well as advance knowledge of where to expect stressors, and where slight variations in climate would leave a community particularly vulnerable.
- Agricultural producers could respond better to



**Gardner Bent, U.S. Geological Survey, New England Water Science Center, presents information on groundwater and surface water conditions at the March 1, 2017 assessment meeting in Westborough, Massachusetts.**

changing conditions with improved access to and delivery of existing short-term forecasting tools, like those that warn of flash droughts, thunderstorms, and frost.

- Partnerships with Extension Services would help provide better access to timely climate information for agricultural stakeholders, provided it is presented in a way that is user-friendly and easy to understand. Existing newsletters receive wide circulation.

**NEXT STEPS AND RECOMMENDATIONS**

Discussions during the meetings suggest that there are several actions that could be taken to improve impact data collection, enhance observation and monitoring systems, and support drought preparedness and response in the region, including:

- Work with states and other partners to provide timely drought information to those who rely on private wells, including surveys of current observations and impacts.
- Encourage efforts to crowd-source observations for more detailed geographic coverage through existing partners like the Community Collaborative Rain, Hail, and Snow Network or social media applications for reporting real-time observations.

- Develop a centralized, consistent starting point for integrated drought messaging at the regional level, employing social media, app technology, highway signage, text messaging, and/or other partner communication vehicles to define drought in actionable terms for the public.
- Add soil moisture sensors to existing observation networks, using standard depths – a valuable measurement for fire managers, watershed managers, and agricultural specialists.
- Build upon existing partnerships to provide tailored, accessible, sector-based drought information and resources. Potential partners may include planning commissions, Extension Services, well drilling companies, and watershed associations

Together, the recommendations shared by meeting participants will help to inform next steps among engaged partners to build drought early warning capacity and drought resilience in New England and New York.

## BUILDING DROUGHT EARLY WARNING CAPACITY

The National Integrated Drought Information System (NIDIS) was authorized by Congress in 2006 (P.L. 109-430) and reauthorized in 2014 with an interagency mandate to

develop and provide a drought early warning information system for the nation, by coordinating and integrating drought research, and building upon existing federal, tribal, state, and local partnerships. Across the country, NIDIS is working toward this objective incrementally through regions of the country to allow for responsiveness to particular geographic and hydrologic circumstances, as well as value-added information needs specific to stakeholders in the respective areas.

Each one of the eight existing regional drought early warning system (DEWS) focuses on improving early warning capacity for and resilience to drought, including examining the role of extreme weather events and climate variability in drought. While authority lies with the states to manage water resources, NIDIS facilitates local stakeholder-driven activities including: cultivating an understanding of existing observation and monitoring networks as well as decision-support tools; identifying research, data collection, and monitoring gaps and needs; planning for and mitigating the effects of climate extremes; and conducting education and outreach through webinars, workshops, and other resources for decision makers, resource managers, the private sector, and the general public. To complete a national drought early warning system, NIDIS will continue to develop regional DEWS in watersheds and regions across the country, including in the Northeast.

### Partners

We are grateful for the many agencies represented at the October 2016 Drought Outlook Forum and the 2017 Drought Assessment meetings, including:

NOAA/National Integrated Drought Information System	<a href="http://www.drought.gov">www.drought.gov</a>
NOAA/National Weather Service	<a href="http://www.weather.gov">www.weather.gov</a>
NOAA/NESDIS/National Centers for Environmental Information	<a href="http://www.ncei.noaa.gov">www.ncei.noaa.gov</a>
NOAA/Office of Oceanic and Atmospheric Research	<a href="http://www.research.noaa.gov">www.research.noaa.gov</a>
NOAA/Fisheries	<a href="http://www.nmfs.noaa.gov">www.nmfs.noaa.gov</a>
Northeast Regional Climate Center	<a href="http://www.nrcc.cornell.edu">www.nrcc.cornell.edu</a>
Cornell Cooperative Extension	<a href="http://cce.cornell.edu">cce.cornell.edu</a>
National Drought Mitigation Center	<a href="http://drought.unl.edu">drought.unl.edu</a>
U.S. Representative Seth Moulton	<a href="http://www.moulton.house.gov">www.moulton.house.gov</a>
Northeast Region State Climatologists	<a href="http://www.stateclimate.org">www.stateclimate.org</a>
U.S. Department of Agriculture/NRCS, FSA, and Northeast Climate Hub	<a href="http://www.usda.gov/wps/portal/usda/usdahome">www.usda.gov/wps/portal/usda/usdahome</a>
U.S. Geological Survey/New England Water Science Center	<a href="http://www.usgs.gov">www.usgs.gov</a>
FEMA Region 1, Mitigation Division	<a href="http://www.fema.gov/region-i-mitigation-risk-analysis">www.fema.gov/region-i-mitigation-risk-analysis</a>
Massachusetts Water Resources Authority	<a href="http://www.mwra.com">www.mwra.com</a>
City of Worcester, Public Works and Parks	<a href="http://www.worcesterma.gov/dpw">www.worcesterma.gov/dpw</a>
University of Massachusetts Boston	<a href="http://www.umb.edu">www.umb.edu</a>
State Agencies from New York and New England	
Massachusetts Division of Fisheries and Wildlife	<a href="http://www.mass.gov/eea/agencies/dfg/dfw">www.mass.gov/eea/agencies/dfg/dfw</a>
UMass Extension	<a href="http://ag.umass.edu">ag.umass.edu</a>
Cornell University's Atkinson Center for a Sustainable Future	<a href="http://www.acsf.cornell.edu">www.acsf.cornell.edu</a>
New York State Water Resources Institute	<a href="http://wri.cals.cornell.edu">wri.cals.cornell.edu</a>