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Understanding Groundwater Part 2: How drought is defined and why it matters for private wells

BY SHARON MCCARTHY AND CHRIS MITCHELL | May 19, 2023

Editor's Note: "Understanding Groundwater" is the second of three articles on water use in Harvard. The third will focus on protecting our water resources..

Droughts happen in Massachusetts, although we don't think about them often because our local environment—from grass lawns and rolling fields to towering trees—is usually green.

However, those droughts that do occur in Massachusetts can have lasting effects on our water supply. Since 1999, when appropriate data were first recorded, the longest drought in Massachusetts lasted from June 2016 to May 2017.

Then in the summer of 2022, there was another drought extending across the entire state, with 40% of the state—including Harvard— in the "extreme drought" category in August. The United States Geological Survey drought monitoring well for our area is in Berlin; it took from November 2022 until March 2023 for this well to return to its pre-drought level of early 2022.

A drought is a period of dry weather that causes serious problems, such as crop damage, water supply shortages, and habitat loss. Droughts are classified into four levels of severity based on the water deficit, the duration of the dry period, and the size of the affected area, with level 0 defined as normal conditions. Levels of drought are based on a monthly review of indices for precipitation, streamflow, groundwater levels, reservoir levels, fire danger, and crop moisture (see "Drought levels in Massachusetts).

In the period leading up to the official declaration of drought lasting from 2016 to 2017, there were significant drying conditions in 2015; for example, spring and fall had rainfall 50% to 18% below normal, depending on the area of the state.

This drought was followed by additional drought conditions in various parts of the state in 2019, 2020, 2021, and 2022.

In February 2023, the Office of Energy and Environmental Affairs (EEA) changed the drought status of the last three regions of Massachusetts still considered to be in "mild drought" to "normal." These three regions were: Northeast, (which includes our adjacent towns of Ayer, Littleton, and Boxborough), Cape Cod, and the Islands. The EEA noted that the Northeast region has suffered a nearly 10-inch deficit in rainfall since the beginning of the drought in May 2022 (that is the date when the Northeast region was first considered to be in a level 2, or significant, drought). Determining if a drought exists in Massachusetts and its severity resides with the Drought Management Task Force, chaired by the EEA and the Massachusetts Emergency Management Agency (MEMA). The task force consists of state and federal agencies, professional organizations, and representatives of public health and safety.

Seven drought regions, four levels

The Drought Management Task Force makes a recommendation to EEA for a drought declaration based on current conditions, on the ground impacts, relative severity of indices, and forecast of climatological and hydrological conditions. These recommendations are specific to the seven regions of the state, as shown in "Massachusetts drought regions." The seven drought regions represent broad geographic areas based on watersheds, with bound-



Source: Massachusetts Department of Conservation and Recreation, Office of Water Resources

aries adjusted to align with county boundaries and to facilitate communication channels.

Drought affects all users of water, from reservoirs and groundwater levels to lakes, ponds, rivers, streams, wetlands, including the myriad wildlife that depends on these sources of water for their existence. It is critical to conserve water as drought conditions persist so that there is enough water for the environment, fire protection and safety, and the community.

To offset the impacts of drought, EEA has developed water use restrictions for the different levels of drought, as shown in the accompanying table.

These restrictions are recommended for nonessential water use for all Massachusetts residents regardless of their water source. Nonessential outdoor water use is defined as every use that is not specifically defined as essential (310 CMR 36.03). See the sidebar on page 19 for a list of outdoor water uses that are not restricted under the Massachusetts Water Resources Management Program; all other water uses are considered nonessential and therefore restricted during a drought. At level 1, the emphasis is on conservation education. In level 2, conditions are significantly drier, and the emphasis is on conservation and watering restrictions. In level 3, water resources are under critical strain, and mandatory conservation measures are necessary. Level 4 is so severe that local or regional drinking water supplies may fail, and the objective restrictions are to protect public health and safety and critical environmental resources.

Drought condition level	Restriction on nonessential outdoor water use
0 (none)	None
1 (mild)	One day per week between 5 p.m. and 9 a.m.
2 (significant)	Hand-held hoses or cans between 5 p.m. and 9 a.m.
3 (critical)	Ban
4 (emergency)	Ban

At Harvard's Annual Town Meeting in 2022 a new bylaw was adopted "to protect, preserve, and maintain the public health, safety, welfare, and the environment whenever there is in force a state of water supply conservation, drought, or water supply emergency by ensuring an adequate supply of water for drinking and fire protection and to protect the quality and quantity of water in local aquatic habitats such as ponds, rivers, and wetlands." This bylaw empowers the Water Commission or Board of Health to adopt and enforce restrictions on outdoor water use whenever drought-related conditions are declared by EEA.

The impact of drought in Harvard has been seen in our fire ponds, a critical defense for our Fire Department. The droughts of 2016–17, 2020, and 2022 led to half of the fire ponds being dry. This was at a time when conditions were favorable for wildfires. The Board of Health did not receive reports of private wells going dry during this period; however it's entirely possible, with more drought conditions forecasted, that this will occur in the future. Droughts are a part of the changing climate; we need to be resilient and change old habits.

The third and final article in this series will dis-

cuss how to conserve water to protect your private well and the community resource that is our groundwater.

For more information

Information for private well owners during a drought can be found at www.mass.gov/info-de-tails/information-for-pri vate-well-owners-during-a-drought.

The state's latest drought management plan contains a wealth of detailed information on droughts in Massachusetts. It lays out how the state can maximize its ability to prepare for and respond to drought conditions at www.mass.gov/doc/massachusetts-drought-management-plan/download.

The droughts of 2016–17, 2020, and 2022 led to half of the fire ponds in town being dry. For more information see "Harvard Climate Action Plan, 2022" on the Climate Initiative Committee's page of the town website.

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Outdoor water uses that are not restricted during drought declaration

- Health and safety, including public facilities for cooling (pools and splash pads); washing of boats or marine equipment to prevent negative saltwater impacts or the transfer of invasive aquatic species.
- Food production, including privately owned vegetable gardens.
- Maintenance of livestock.
- Core functions of a business, such as plant nurseries maintaining stock or golf courses maintaining greens.
- Irrigation of public parks and public and private recreation fields before 9 a.m. and after 5 p.m.
- Establishment of a new lawn to stabilize soil after new construction or to repair a Title 5 system.

For a comprehensive list of allowed uses during a drought, click the pdf link at https://www.mass.gov/doc/guidance-on-nonessential-outdoor-water-use-for-wma-registrants

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