Acknowledgements

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Cover Pictures: USDA and UW-Extension Dane County
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Introduction

Purpose

The purpose of this drought toolkit is to provide information to local governments, health departments, and citizens in Wisconsin about preparing for and responding to drought events. The toolkit provides background information, practical guidance, strategies, media releases, talking points, definitions, and useful reference materials on this topic.

The guides in this toolkit may be copied onto your agency letterhead for distribution to residents and visitors affected by drought. Additional resources may be found in Appendix B.

Background

Drought occurs when the levels of rainfall and other precipitation are lower than average for an extended period of time. Drought is a slowly progressing event that can affect any county throughout the United States, and can last from weeks to years in some parts of the country. Annually, drought conditions can occur even after a wet period in late winter and spring, when the summer and fall months contain an extended period of warming and drought. These conditions may lead to reduced drinking water availability, food insecurity, and respiratory distress from dust, pollen, and airborne particulates.

Wisconsin is susceptible to drought, and has experienced severe drought during the summer months, most recently in 1988 and 2012. In the summer of 2012, 23 Wisconsin counties were declared natural disaster areas due to drought, and many other Wisconsin counties were considered to be areas of great to severe drought. Wisconsin’s economy has strong roots in agriculture and agriculture-based businesses. When a drought becomes severe, there is an adverse effect on the state’s economy. In 2012, this prolonged period of drought and sustained heat resulted in crop loss, heat-related fatalities, and health concerns throughout Wisconsin.
Climate Trends

Long-term trend analysis of Wisconsin’s climate indicates that the state is becoming warmer. After analyzing historical climate data from 1950 to 2006 and developing downscaled local climate models, University of Wisconsin climate scientists created potential climate projections based on the historical trends and scientifically validated models.³ Climate projections appear to support the scenario of heavy, intense precipitation events in the late winter and spring, and then an extended period of warming and drought. Several of the modeled outcomes suggest that drought periods may become more likely and longer lasting in the future. Warmer temperatures are expected to lengthen the growing season, but yields of corn and soybeans may decrease due to heat stress and drought conditions in late summer and early fall.

Health Impacts

Ongoing drought conditions will place a strain on human health. Drought conditions may lead to food insecurity resulting from crop failures or market demands driving up food costs, and respiratory distress from dust, pollen, and airborne particulates. Further, drought can potentially threaten drinking water quality and quantity for all water users. Residents depending on groundwater for drinking water may notice water with different tastes or odors due to changes in water chemistry, and may be at risk for consuming heavy metals, organics, and other groundwater contaminants. Similar to the impacts of heat extremes, drought can negatively affect agriculture through crop failures, livestock water shortages, and the resulting economic losses to farmers, food processors, and the trucking industry. Drought conditions will also place a stronger demand on groundwater resources, as farmers look to irrigate valuable crops.

There is also a strong correlation between drought conditions and the occurrence of wildfires,⁴ which are associated with injury or death, eye irritation, and exacerbation of asthma and other respiratory diseases.²
Emergency planning must consider drought-related needs and impacts on infrastructure, water conservation plans, agricultural impacts, and the economic and societal stresses caused by drought.

**Drought Response and Recovery Guidance**

Under the Wisconsin “Home Rule” principle, drought preparedness and response are considered local activities. The local or county Emergency Management office, health agency, or police/fire first responders will be the lead agency during a drought event. However, when requested, state resources will be provided to assist and support the local response.
Aquifer - An area that contains large amounts of water under the surface of the earth

Drought - A deficiency in precipitation over an extended period. Drought is a normal, recurrent feature of climate that occurs in virtually all climate zones.

Agricultural Drought - A drought that is based on the impacts to agriculture by factors such as rainfall deficits, soil water deficits, reduced groundwater, or reduced reservoir levels due to the need for irrigation.

Hydrological Drought - A drought that is based on the impact of rainfall deficits on the water supply such as reduced stream flow, lowered reservoir and lake levels, and groundwater table decline.

Meteorological Drought - A drought that is based on the degree of dryness (rainfall deficit) and the length of the dry period.

Socioeconomic Drought - A drought that is based on the impact of drought conditions (meteorological, agricultural, or hydrological drought) on supply and demand of some economic goods, and occurs when the demand for an economic good exceeds supply as a result of a weather-related deficit in water supply.

Groundwater - Water that is found underground in pore spaces in soil, sand, or rock fractures.

Reservoirs - Water that is collected and stored in natural or manmade lakes, or in other containment vessels.

Runoff - Water from rain, melting snow, or irrigation that flows over the land and into streams or other surface waters instead of being absorbed into the ground.

Xeriscaping - Landscaping that uses native plants with lower water requirements than exotic vegetation and turfgrass.
Guide 1: Measuring Drought

Drought can be difficult to measure because of the many variables involved with the causes and the duration of drought. Several indices and measurements have been developed in order to gain a better picture of a drought’s severity.

Palmer Drought Severity Index (PDSI)

The Palmer Drought Severity Index (PDSI) calculates its values using a supply and demand concept of the water balance equation, and factors temperature and precipitation into the equation to determine the soil moisture conditions of an area.

PDSI is the most widely used method of measurement. Its calculations run from +4 or more (extremely wet conditions) to -4 or less (extreme drought).

Standard Precipitation Index (SPI)

The Standard Precipitation Index (SPI) considers precipitation only in its calculation. It is calculated based on the probability of precipitation for any time scale.

The numbers calculated represent whether there will be there will be wet or dry conditions. The index shows a negative number where drought conditions are present (redder colors, -3) and a positive value for wetter conditions (blue to purple colors, +3).
## Guide 2: Categories of Drought Severity

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Possible Impacts</th>
<th>PDSI*</th>
<th>SPI**</th>
</tr>
</thead>
<tbody>
<tr>
<td>D0</td>
<td>Abnormally Dry</td>
<td>Going into drought: short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered.</td>
<td>-1.0 to -1.9</td>
<td>-0.5 to -0.7</td>
</tr>
<tr>
<td>D1</td>
<td>Moderate Dry</td>
<td>Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent; voluntary water-use restrictions requested</td>
<td>-2.0 to -2.9</td>
<td>-0.8 to -1.2</td>
</tr>
<tr>
<td>D2</td>
<td>Severe Drought</td>
<td>Crop or pasture losses likely; water shortages common; water restrictions imposed</td>
<td>-3.0 to -3.9</td>
<td>-1.3 to -1.5</td>
</tr>
<tr>
<td>D3</td>
<td>Extreme Drought</td>
<td>Major crop/pasture losses; widespread water shortages or restrictions</td>
<td>-4.0 to -4.9</td>
<td>-1.6 to -1.9</td>
</tr>
<tr>
<td>D4</td>
<td>Exceptional Drought</td>
<td>Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies.</td>
<td>-5.0 or less</td>
<td>-2.0 or less</td>
</tr>
</tbody>
</table>

* Palmer Drought Severity Index  
** Standard Precipitation Index

Table Source: United States Drought Monitor (USDM)
### Guide 3: Drought: Human Health Signs and Symptoms

#### Watch for Signs and Symptoms of Drought

<table>
<thead>
<tr>
<th>Concern</th>
<th>Signs and Symptoms</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Extreme Heat</strong></td>
<td>• Heat exhaustion</td>
<td>• Stay cool</td>
</tr>
<tr>
<td></td>
<td>• Heat stroke</td>
<td>• Stay hydrated</td>
</tr>
<tr>
<td></td>
<td>• Stay informed</td>
<td>• Stay informed</td>
</tr>
<tr>
<td><strong>Diminished Food Supply</strong></td>
<td>• Drought-damaged crops</td>
<td>• Maintain the healthiest diet possible</td>
</tr>
<tr>
<td></td>
<td>• Healthy foods not readily available or more expensive</td>
<td>• Seek services of food banks or other resources if necessary</td>
</tr>
<tr>
<td><strong>Poor Air Quality</strong></td>
<td>• Breathing problems</td>
<td>• Stay indoors</td>
</tr>
<tr>
<td></td>
<td>• Worsening asthma or other respiratory conditions</td>
<td>• Avoid strenuous outdoor activity</td>
</tr>
<tr>
<td></td>
<td>• Fatigue with exertion</td>
<td>• Take prescribed medications</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Talk to your health care provider if symptoms worsen</td>
</tr>
<tr>
<td><strong>Limited Water Supply</strong></td>
<td>• Lower lake and river levels</td>
<td>• Listen for local government officials’ directions on how to conserve water</td>
</tr>
<tr>
<td></td>
<td>• Lower water levels in aquifers, thus affecting private wells</td>
<td>• Continue practicing proper sanitation</td>
</tr>
<tr>
<td></td>
<td>• Public restrictions on water use</td>
<td>• Use recycled water for non-sanitary purposes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Avoid swimming in warm, shallow waters</td>
</tr>
<tr>
<td><strong>Mental Health</strong></td>
<td>• Stress and Anxiety</td>
<td>• Consult with a mental health provider and/or your doctor</td>
</tr>
</tbody>
</table>

*Table Source: Centers for Disease Control and Prevention*
Guide 4: Disease and Drought

**Chronic Disease**
Conditions associated with drought can adversely affect people with certain chronic health conditions such as asthma and some immune disorders. Drought-related changes in air can irritate eyes, lungs, and respiratory systems of individuals with chronic respiratory conditions. Changes in water quality can threaten people whose immune systems are compromised.

**Diseases Transmitted by Insects and Animals**
In periods of limited rainfall, both human and animal behavior can change in ways that increase the likelihood of human contact with wildlife, the insects they host, and the diseases they carry. Drought reduces the size of water bodies and causes them to become stagnant. This provides additional breeding grounds for certain types of mosquitoes. Outbreaks of West Nile Virus have occurred under such conditions. Inadequate water supply can cause people to collect rainwater, leading to collections of stagnant water that can become manmade mosquito breeding areas.

**Infectious Disease**
- **Viruses, protozoa, and bacteria** can pollute groundwater and surface water when rainfall decreases. People who get their drinking water from private wells may be at higher risk for drought-related infectious disease. Lowered groundwater levels can concentrate contaminants such as nitrates and arsenic.
- **Acute respiratory** and **gastrointestinal illnesses** are more easily spread from person to person when handwashing is compromised by a perceived or real lack of available water.
- **E. coli** and **Salmonella** are examples of bacteria that can more readily contaminate food and cause infectious disease.
- **Other infectious disease threats** arise when drought leads to the contamination of surface waters and other types of water that are used for recreational purposes.
**Guide 5: Water Conservation Tips**

Efficient use of water, through behavioral, operational, or equipment changes, if practiced broadly, can help mitigate the effects of drought.

### Indoor Water Conservation Tips

- Do not let the water run while shaving or brushing teeth.
- Take short showers instead of tub baths. Turn off the water while soaping or shampooing.
- Keep drinking water in the refrigerator instead of letting the faucet run until the water is cold.
- Do not use water to defrost frozen foods; thaw in the refrigerator overnight.
- Scrape, rather than rinse, dishes before loading into the dishwasher; wash only full loads.
- Wash only full loads of laundry or use the appropriate water level or load size.
- Repair all leaks. To detect leaks in the toilet, add food coloring to the tank water. If the colored water appears in the bowl, the toilet is leaking.

### Outdoor Water Conservation Tips

- Detect and repair all leaks in irrigation system.
- Water the lawn or garden during the coolest part of the day (early morning is best). Do not water on windy days.
- Set sprinklers to water the lawn or garden only – not the street or sidewalk.
- Use a shut-off nozzle on your hose, so that water flows only as needed. When finished, turn it off at the faucet to avoid hose connection leaks.
- Raise the lawn mower blade to at least three inches, or to its highest level. A higher cut encourages grass roots to grow deeper, shades the roots and holds soil moisture.
- Use mulch around shrubs and garden plants to reduce evaporation from the soil surface and to cut down on weed growth.
Guide 6: Agriculture and Drought

Drought can have devastating consequences on Wisconsin's agricultural community. The following table is a list of resources for farmers to prepare for the possibility of drought and for those already impacted by drought.

<table>
<thead>
<tr>
<th>Agency</th>
<th>Tool</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disaster Assistance</td>
<td>Access to disaster help and resources</td>
<td><a href="http://www.disasterassistance.gov">www.disasterassistance.gov</a></td>
</tr>
<tr>
<td>United States Department of Agriculture (USDA): Farm Service Agency</td>
<td>Emergency Conservation Program (ECP)</td>
<td><a href="http://www.fsa.usda.gov/FSA">www.fsa.usda.gov/FSA</a></td>
</tr>
<tr>
<td></td>
<td>Livestock Forage Disaster Program</td>
<td><a href="http://www.fsa.usda.gov/FSA">www.fsa.usda.gov/FSA</a></td>
</tr>
<tr>
<td></td>
<td>Noninsured Crop Disaster Assistance Program</td>
<td><a href="http://www.fsa.usda.gov/FSA">www.fsa.usda.gov/FSA</a></td>
</tr>
<tr>
<td></td>
<td>Wisconsin Service Center Locator</td>
<td>offices.sc.egov.usda.gov</td>
</tr>
<tr>
<td></td>
<td>Emergency Haying and Grazing</td>
<td><a href="http://www.fsa.usda.gov/FSA">www.fsa.usda.gov/FSA</a></td>
</tr>
<tr>
<td>UW-Extension, Cooperative Extension</td>
<td>Farmer to Farmer Pasture Rental</td>
<td>farmertofarmer.crowdmap.com</td>
</tr>
<tr>
<td></td>
<td>Resources for farmers who are feeding with drought-stressed feed and for farmers who need to purchase feed</td>
<td><a href="http://www.uwex.edu">www.uwex.edu</a></td>
</tr>
<tr>
<td>Wisconsin Office of the Commissioner of Insurance</td>
<td>Crop Insurance</td>
<td>oci.wi.gov</td>
</tr>
</tbody>
</table>
Guide 7: Boil Water Notices

Boil water notices are issued when an event has occurred allowing the possibility for the water distribution system to be contaminated. Bacteria in drinking water may cause illness. Typical symptoms may include:

- Diarrhea
- Cramps
- Nausea
- Yellowed eyes and skin (jaundice), with headaches or fatigue.

Note that these symptoms may be caused by factors other than unsafe water. If you become ill with the above symptoms during a boil water notice, you should talk to your doctor or call your local health department.

Use only SAFE water until “All Clear” notice is given.

Examples of bacteriologically safe water include:
- Commercially bottled water.
- Packaged ice from an approved source.
- Water that has been at a rolling boil for one minute.
- Another public water supply system that is safe. Any transport container, whether it is a bucket or gallon jug, must be washed and sanitized before filling with safe, clean water.
- Sanitize by immersing for one minute in a solution of one teaspoon of chlorine bleach (5.25%, unscented) per gallon of clean water.
- Clear water to which 1/8 teaspoon (or cloudy water to which ¼ teaspoon) of bleach has been added to a gallon of water and the water has been allowed to sit for 30 minutes.

While under the notice, you may use your current water for the following:
- Bathing (except infants), showering, washing hands, and washing dishes. Rinse dishes as instructed above (“Sanitize”).
- Washing dishes in automatic dishwashers that use a heating element to dry dishes.
- Washing cars and watering lawns.

Use only SAFE water for the following purposes:
- Drinking, cooking, making baby formula, coffee, juices, other beverages or ice.
- Washing ready-to-eat fruits and vegetables.
- Bathing infants, washing open wounds, brushing teeth, or watering pets.
- Rinsing dishes; see sanitizing instructions below.
- DO NOT use ice cubes from your freezer or any beverages made with unsafe water.

Guide 7: Boil Water Notices12

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- Washing ready-to-eat fruits and vegetables.
- Bathing infants, washing open wounds, brushing teeth, or watering pets.
- Rinsing dishes; see sanitizing instructions below.
- DO NOT use ice cubes from your freezer or any beverages made with unsafe water.
Guide 8: Heat Awareness Tips

- Never leave individuals with disabilities, children or pets in a parked car - even briefly.
  
  On an 80°F day, the temperature inside a car, even with the windows cracked slightly, can reach 100°F in less than 10 minutes!

- Keep your living space cool or seek shelter at a cooling center.
  
  If you have an air conditioner, use it! If you don’t have an air conditioner and the temperature is above 95°F, go to a community cooling center because using a fan will not prevent heat-related illnesses at this temperature.

- Slow down and limit physical activity.
  
  Plan outings or exercise for the early morning or after dark, when temperatures are cooler.

- Drink plenty of water and eat lightly.
  
  Don’t wait for thirst, but instead drink plenty of water throughout the day. Avoid alcohol and caffeine and stay away from hot, heavy meals.

- Wear lightweight, loose-fitting, light-colored clothing.
  
  Add a hat or umbrella to keep your head cool...and don’t forget sunscreen!

- Don’t stop taking medication unless your doctor says you should.
  
  Take extra care to stay cool, and ask your doctor or pharmacist for any special heat advice.

- Taking a cool shower or bath will cool you down.
  
  A cool shower or bath will actually work faster at reducing your body temperature than an air conditioner. Apply cold, wet rags to your head and neck to quickly cool down.

For more information, visit: http://readywisconsin.wi.gov/heat/
# Guide 9: Vulnerable Populations and Drought Related Implications

<table>
<thead>
<tr>
<th>Drought Related Implication</th>
<th>Potential Vulnerable Populations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quantity and Quality of Potable Water</strong></td>
<td>Persons relying on private wells for their drinking water, children, the elderly, athletes, persons with compromised immune systems, and persons on dialysis.</td>
</tr>
<tr>
<td><strong>Food and Nutrition</strong></td>
<td>Persons consuming raw produce or produce grown using recycled water, economically disadvantaged persons, persons with compromised immune systems, children, and the elderly.</td>
</tr>
<tr>
<td><strong>Energy</strong></td>
<td>Persons susceptible to extreme temperatures (e.g., the elderly, children), person who live in institutional settings (e.g., nursing homes), and persons who rely on electronic equipment for survival or well-being (e.g., ventilators).</td>
</tr>
<tr>
<td><strong>Air Quality</strong></td>
<td>Persons with allergies, asthma, or other chronic respiratory conditions that make them more susceptible to particulate matter or allergens in the air.</td>
</tr>
<tr>
<td><strong>Recreation</strong></td>
<td>Persons who engage in water-related recreational activities and persons with compromised immune systems.</td>
</tr>
<tr>
<td><strong>Mental and Behavioral Health</strong></td>
<td>Persons who rely on water for their economic livelihood (e.g., farmers, landscapers, horticulturists, recreational facility operators) and persons with underlying physical and mental health conditions, including those with compromised immune systems.</td>
</tr>
<tr>
<td><strong>Infectious Disease</strong></td>
<td>Persons who rely on private wells to obtain their drinking water, persons who have both a septic tank and a groundwater well, and persons with underlying health conditions, including those with compromised health conditions.</td>
</tr>
<tr>
<td><strong>Chronic Disease</strong></td>
<td>Persons with certain chronic health conditions, such as asthma, allergies, other respiratory conditions, and immune disorders.</td>
</tr>
</tbody>
</table>

Table Source: CDC
Guide 10: Talking Points for Drought-related Fatality

If you are approached by the media regarding a reported drought health risk in your jurisdiction, the following talking points may be used.

1. We were notified by the Medical Examiner/Coroner about a fatality possibly due to extreme drought conditions. Our condolences go out to the family.

2. Out of respect for the family, we are unable to share any details.

   or

3. We have not been notified of any recent fatalities linked to extreme drought conditions.

Any of the above can be followed up by these points:

4. Drought can be long lasting and result in many adverse health effects.

   People should remain safe by:

   a. Monitoring drought and fire hazard conditions in your area.

   b. Checking on family, friends and neighbors who do not have air conditioning, who spend much of their time alone or who are more likely to be affected by the heat and the drought.

   c. Conserving water.

   For more information visit [insert relevant website].
Guide 11: Message Maps about Drought Safety

Message mapping is one of the most important risk communication tools that public health agencies can employ. The goal of a message map is to convey important information in a concise and easy-to-understand fashion.

General guidelines to follow when creating a message map include:

- Stick to three key messages or one key message with three parts for each underlying concern or specific question.
- Keep key messages brief. The reader should ideally spend less than 10 seconds per line.
- Develop messages that are easily understood by the target audience. (For communications with the general public, use a 6th to 8th grade readability level.)
- Place messages within a message set. The most important messages should occupy the first and last positions.
- Develop key messages that cite credible third parties.
- Use graphics and other visual aids to enhance key messages.
- Keep a positive tone. Messages should be solution oriented and constructive. Try to balance negative messages with positive ones.
- Avoid unnecessary use of the words no, not, never, nothing, and none.\(^5\)
The following is a message map that could be used when addressing the general public regarding drought safety.

<table>
<thead>
<tr>
<th>Key Messages (3 key messages)</th>
<th>Supporting Information (3 items of supporting information for each key message)</th>
</tr>
</thead>
</table>
| **Message 1:** Monitor drought conditions in your area | **Supporting Information 1**  
Wisconsin can experience drought. It most commonly occurs during late summer.  

**Supporting Information 2**  
Drought can be long-lasting or short term. It is important to be prepared for drought of any duration.  

**Supporting Information 3**  
Heed drought warnings in your area and stay up-to-date on conditions with the [U.S. Drought Monitor](https://www.drought.gov/). |
| **Message 2:** Conserve your water supply during a drought. | **Supporting Information 1**  
Be conscious of your water use. Limit the amount of water you use both inside and outside your home.  

**Supporting Information 2**  
Recycle/reuse water when you can. For example, use leftover drinking water to water plants.  

**Supporting Information 3**  
If there is a boil water notice, follow the guidelines for safe water practices and use your water only for approved purposes. |
| **Message 3:** If you must be out during the hottest times of the day during drought, be alert for signs of heat illness. | **Supporting Information 1**  
Symptoms include feeling hot, weak, dizzy or faint, cramping/muscle spasms, nausea, or rapid pulse.  

**Supporting Information 2**  
Protect yourself by limiting physical activities, drinking plenty of water, and wearing light, loose-fitting clothing.  

**Supporting Information 3**  
Call 9-1-1 or seek medical attention if you or someone you know develops heat illness. |


3. Climate projections in this toolkit come from Wisconsin’s Changing Climate: Impacts and Adaptation. 2011. Wisconsin Initiative on Climate Change Impacts. Nelson Institute for Environmental Studies. UW-Madison and Wisconsin Department of Natural Resources, Madison, WI.


Appendix B: Additional Resources
Wisconsin Department of Health Services
   608-266-1120

Wisconsin Department of Natural Resources
   http://dnr.wi.gov/topic/water.html

National Drought Mitigation Center
   http://drought.unl.edu/Home.aspx

National Integrated Drought Information System
   http://www.drought.gov/drought/

Ready Wisconsin
   http://readywisconsin.wi.gov/drought/

Environmental Protection Agency (EPA)
   http://epa.gov/naturaldisasters/drought.html

Centers for Disease Control and Prevention (CDC)
   http://www.cdc.gov/nceh/drought/default.htm

List of Wisconsin Local Public Health Departments
   http://www.dhs.wisconsin.gov/localhealth/

List of Wisconsin Tribal Health Directors
   http://www.dhs.wisconsin.gov/localhealth/