SC Drought Monitoring & Management

Broad River Basin Council

Elliot D. Wickham
South Carolina State Climatology Office
SC Department of Natural Resources
Thursday, June 9th, 2022
Past Droughts in South Carolina

South Carolina Annual *Palmer Drought Severity Index* Values: 1895-2020
Past Droughts in South Carolina (PDSI)

Notable Droughts
• 1925-1927
• 1930-1935
• 1950-1957
• 1985-1986
• 1998-2002
• 2007-2008
• 2010-2012
South Carolina Climate Divisions

1. Mountains
2. Northwest
3. North Central
4. Northeast
5. West Central
6. Central
7. Southern
Drought Monitoring and Response in SC

**South Carolina Drought Response Program** consists of legislation, regulations, and procedures that establish recommended and required response.

The **South Carolina Drought Response Act (2000)** and the **supporting regulations** formally establish and describe the responsibilities of the South Carolina State Climatology Office and the South Carolina Drought Response Committee, the major drought decision-making entities in the State.
Drought Monitoring and Response in SC

**Why:** To carefully and closely monitor, conserve, and manage the State’s water resources in the best interest of all South Carolinians.

**Who:** Drought Response Committee and Department of Natural Resources – State Climatology Office

**Statewide members**
- Forestry Commission
- Department of Agriculture
- Emergency Management Division
- Department of Health and Environmental Control
- Department of Natural Resources

**Local members (12 per DMA)**
- Water Utilities
- Regional Council of Governments
- Power Generation Facilities
- Soil and Water Conservation Districts
## Central Drought Management Area

Counties: Greenville, Spartanburg, Cherokee, York, Laurens, Union, Chester, Greenwood, Saluda, Newberry, Fairfield, Lexington, Richland, Calhoun, Sumter, Clarendon, Williamsburg, Georgetown

<table>
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Drought Monitoring and Response in SC

**How:** The State uses multiple indicators and indices to monitor drought and determine drought severity levels.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Description</th>
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<tbody>
<tr>
<td>Percent of Normal Rainfall</td>
<td>Cumulative dryness or wetness compared to long-term averages</td>
</tr>
<tr>
<td>Crop Moisture Index (CMI)</td>
<td>Agricultural growing season short-term (up to 4 weeks) dryness or wetness</td>
</tr>
<tr>
<td>Palmer Drought Severity Index (PDSI)</td>
<td>Prolonged (month, years) abnormally dry or wet conditions</td>
</tr>
<tr>
<td>Water Resources</td>
<td><em>Streamflow levels</em></td>
</tr>
<tr>
<td></td>
<td><em>Lake levels</em></td>
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<tr>
<td></td>
<td><em>Groundwater levels</em></td>
</tr>
<tr>
<td>Keetch-Byram Drought Index (KBDI)</td>
<td><em>Daily forest fire potential</em></td>
</tr>
<tr>
<td>U.S. Drought Monitor for South Carolina</td>
<td><em>General areas of drought, labeled by intensity on a weekly basis</em></td>
</tr>
</tbody>
</table>
SC Drought Response Act and Regulations

**SC DNR, SCO and DRC monitor conditions, share information, and make recommendations to manage drought.**

- Water utilities review drought plans and ordinances.
- State and federal agencies, water utilities, and reservoir managers monitor conditions.

**Moderate**
- Water levels continue to drop
- Number of wildfires increases
- Poor grazing and agricultural conditions

**Severe**
- Widespread impacts to agriculture, forestry, water utilities, and water dependent businesses

**Extreme**
- Water systems and citizens are without, or losing access to water.
- Public safety, health, and welfare are threatened.
- The State Emergency Response Team (SERT) is activated to lead state-level response to the water shortage emergency.

**As drought conditions and impacts become more severe, response actions increase accordingly.**

State agencies increase monitoring and communications. Citizens may see local notices for burn bans, boat ramp closings, and water use restrictions. The Governor may request voluntary or mandatory water conservation. The Governor may assist with managing impacts, including requesting disaster declarations by the US Dept. of Agriculture and activating the National Guard to assist with wildfire suppression.

**Conditions and Response**
- Incipient
  - Drier than normal
  - Soil moisture declines
  - Water demand increases

- Moderate
  - Water levels decrease
  - Crops and plants wither
  - Irrigation increases

- Severe
  - Water levels continue to drop
  - Number of wildfires increases
  - Poor grazing and agricultural conditions

- Extreme
  - Widespread impacts to agriculture, forestry, water utilities, and water dependent businesses
Components of South Carolina Drought Response Program

SC Department of Natural Resources:
- Chairs DRC & provides support
- Coordinates response
- Reviews variance requests
- Mediates disputes
- Administrative Law Judge hears appeals within 5 days

SC Drought Response Committee (state and local members):
- Consults with stakeholders
- Determines nonessential water use during severe and extreme droughts
- Issues nonessential water curtailment declaration

Public Water Suppliers:
- Water systems implement drought response ordinances or plans based on local triggers and conditions

Reservoir Managers:
- Follow dam operations and reservoir management plans

Emergency Operations Plan:
- Health & safety threatened, recommend actions to Governor
- Governor may declare drought emergency and issue water curtailment regulations
- Emergency Management Division and State Emergency Response Team are activated
Local Level Drought Plans

Model Drought Management Plan
and
Response Ordinance

(Provided by the South Carolina Department of Natural Resources as required by the South Carolina Drought Response Act of 2000.)

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Mount Pleasant Waterworks

Drought Management and Response Plan
Revised May 2020

D. Identification of Water System Specific Drought or Water Shortage Indicators: Operators of every water system must develop historical trends that are valuable indicators of a system’s ability to meet demand when demand begins to outpace supply. Mount Pleasant Waterworks has developed triggers for use during drought or demand water shortages that describe when specific phases of the Drought Response Plan are implemented. Staff will monitor triggers and recommend action. The system triggers are as follows:

**Incipient Drought Phase:**
1. Drought Response Committee declaration (considering droughts can be localized.)

**Moderate Drought Phase:**
1. Drought Response Committee declaration (considering droughts can be localized.)
2. Average system storage levels fall below 60% for 48 hours.
3. Well pumping levels less than 100’ above pump in one or more wells.

**Severe Drought Phase:**
1. Drought Response Committee declaration (considering droughts can be localized.)
2. Average system storage levels fall below 40% for 48 hours, and/or
3. Well pumping levels less than 75’ above pump in one or more wells.

**Extreme Drought Phase:**
1. Drought Response Committee declaration (considering droughts can be localized.)
2. Average system storage levels fall below 20% for 48 hours, and/or
3. Well pumping levels less than 50’ above pump in one or more wells.

Mount Pleasant Waterworks Drought Management and Response Plan Revised May 2020
### Severe Drought Phase

**Triggers:**
1. Drought Response Committee (DRC) declaration, OR
2. Average system storage levels fall below 40% for 48 hours, OR
3. Well pumping less than 75' above pump in one or more wells.
4. Rationing when water pressure has been reduced to 40 psi and water storage levels drop below 20% for 48 hours.

**Goals:**
- **To be implemented at Trigger #2 or #3 above**
  1. **40% Reduction** of all water use
  2. **Voluntary** reductions from customers in the use of water for all purposes
  3. **Mandatory** restrictions on non-essential usage and restrictions on times when certain water usage is allowed

**Note:** Actions may be time-based to prescribe certain activities. For example, the request for 40% reduction in water usage may only be necessary after 30 or 45 days within this drought stage depending on other factors.

### Administrative Actions

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<th>Assignee (ICS Position*)</th>
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<tr>
<td>Issue a Proclamation to be released to the local media, MPW customers, and to the South Carolina Department of Natural Resources Drought Information Center that severe drought conditions are present.</td>
<td>General Manager</td>
</tr>
<tr>
<td>Provide written notification to the South Carolina Department of Natural Resources Drought Information Center.</td>
<td>General Manager</td>
</tr>
<tr>
<td>Communicate with the Southern Drought Management Area (DMA) DRC representative on MPW’s drought conditions, impacts, and actions taken to DRC has this information when setting drought levels for the Southern DMA.</td>
<td>General Manager</td>
</tr>
<tr>
<td>Consider offering incentives to customers for finding and reporting leaks and/or for complying with voluntary restrictions.</td>
<td>General Manager</td>
</tr>
<tr>
<td>Communicate financial impacts of drought to Commissioners and customers.</td>
<td>General Manager</td>
</tr>
<tr>
<td>Provide written notification monthly to the South Carolina Department of Natural Resources Drought Information Center regarding the outcomes of the voluntary and mandatory restrictions.</td>
<td>General Manager</td>
</tr>
<tr>
<td>Encourage all residential water customers to voluntarily reduce overall monthly water usage to 60% of the customer’s monthly average. If voluntary reduction of usage is not successful, the Mount Pleasant Waterworks may, at its option, implement the excessive use rate schedule for water, included at the bottom of this table. (Note: this rate modification is based on a reduction from actual average usage/RFU vs. allocated capacity/RFU.)</td>
<td>General Manager</td>
</tr>
<tr>
<td>Analyze AMI and other data to determine actual water usage reduction vs. goal. Determine customers not meeting 40% goal and generate customized notification to encourage.</td>
<td>Customer Services Manager</td>
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<td>Monitor and track daily/weekly call volume in Call Center. Consider invoking Emergency Call Takers to work in Contact Center to handle increased call volume.</td>
<td>Customer Services Manager</td>
</tr>
<tr>
<td>Suspect cut-offs.</td>
<td>Customer Services Manager</td>
</tr>
<tr>
<td>Activate new tier charges in CIS when decision to implement is made by General Manager. When modified rate structures are implemented, a comparison of actual usage vs. target of modified tier structure should be included in customer bills.</td>
<td>Customer Services Manager</td>
</tr>
<tr>
<td>Follow communication guidelines outlined in Mount Pleasant Waterworks Crisis Communication Plan to inform Mount Pleasant Waterworks’ customers of the water system condition and voluntary and mandatory conservation measures that the customers are requested to follow during Severe drought conditions. See Appendix G for guidelines. Encourage self-policing by residents to alert the utility of system leaks.</td>
<td>PIO</td>
</tr>
<tr>
<td>Add bill inserts with conservation measures and updates on actual water usage reduction vs goal.</td>
<td>PIO</td>
</tr>
<tr>
<td>Collaborate and communicate with other water utilities and entities within the Southern Drought Management Area to ensure consistent messaging.</td>
<td>PIO</td>
</tr>
<tr>
<td>Work with CWS for consistent messaging to customers and public.</td>
<td>PIO</td>
</tr>
<tr>
<td>Develop and update ongoing list of Frequently Asked Questions (and answers) from Contact Center calls and Marketing/Communications.</td>
<td>PIO</td>
</tr>
<tr>
<td>Conduct regular (at least weekly) communications meetings between dispatch, customer service, and communications to review FAQ and develop consistent messaging.</td>
<td>PIO</td>
</tr>
<tr>
<td>Communicate to customers in advance when to expect higher water bills.</td>
<td>PIO</td>
</tr>
<tr>
<td>Publicize widely the penalties to be imposed for violations of mandatory restrictions and the procedures to be followed if a variance in the restrictions is requested.</td>
<td>PIO</td>
</tr>
<tr>
<td>Expand the use of education and public relations efforts and emphasize the penalties associated with violating the mandatory restrictions.</td>
<td>PIO</td>
</tr>
<tr>
<td>Conduct financial analysis of capacity buy-in vs. wholesale rates from CWS to determine the most cost-effective way to purchase additional water.</td>
<td>Finance Section Chief</td>
</tr>
<tr>
<td>Track and report billed revenues vs. collected revenues.</td>
<td>Finance Section Chief</td>
</tr>
<tr>
<td>Email and update all staff on current drought stage and conservation measures.</td>
<td>Planning Section Chief</td>
</tr>
<tr>
<td>Keep staff updated with current conditions on Canton display board.</td>
<td>Planning Section Chief</td>
</tr>
<tr>
<td>Report drought-related conditions and impacts weekly to the National Drought Mitigation Center: <a href="http://hsi.id/droughtcounter19">http://hsi.id/droughtcounter19</a></td>
<td>Planning Section Chief</td>
</tr>
<tr>
<td>Adjust regular meeting schedule (see schedule below).</td>
<td>Planning Section Chief</td>
</tr>
<tr>
<td>Attend DRC conference calls for updates.</td>
<td>Planning Section Chief</td>
</tr>
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</table>
Severe Drought Phase Excessive Use Rate Schedule

<table>
<thead>
<tr>
<th>Tier</th>
<th>Gallons/REU</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier I</td>
<td>0 - 3,000</td>
<td>Regular rate</td>
</tr>
<tr>
<td>Tier II</td>
<td>3,001 - 6,000</td>
<td>2 times regular rate</td>
</tr>
<tr>
<td>Tier III</td>
<td>6,001 - 9,000</td>
<td>3 times regular rate</td>
</tr>
<tr>
<td>Tier IV</td>
<td>Greater than 9,000</td>
<td>4 times regular rate</td>
</tr>
</tbody>
</table>

Meeting Schedule (Severe Drought):

<table>
<thead>
<tr>
<th>Day of Week</th>
<th>Time</th>
<th>Location</th>
<th>Attendees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mondays</td>
<td>10:00 AM</td>
<td>MPW Conference Room</td>
<td>MPW ICS Team, MPW Commissioners, Town Staff (e.g., Public Services), CWS representatives</td>
</tr>
<tr>
<td>Thursdays, as determined by DRC</td>
<td>TBD</td>
<td>Conference Call</td>
<td>Drought Response Committee, MPW IC, Planning Section Chief &amp; Operations Branch Director</td>
</tr>
<tr>
<td>Fridays</td>
<td>3:00 PM</td>
<td>Conference Call</td>
<td>MPW ICS Team, MPW Commissioners, Town Staff (e.g., Public Services), CWS representatives</td>
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Operations Actions:

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<tr>
<td>Utilize AMI and field inspections to identify water leaks and intensify maintenance efforts to correct water leaks in the distribution system.</td>
<td>Field Service Branch Director</td>
</tr>
<tr>
<td>Cease installation of new irrigation taps on the water system.</td>
<td>Field Service Branch Director</td>
</tr>
<tr>
<td>Contact all permitted hydrant users to cease using water until further notice. Notify all hydrant metered customers that meters will be pulled for the duration. Restoration of the meters will commence once conditions are favorable for normal use.</td>
<td>Field Service Branch Director</td>
</tr>
<tr>
<td>Communicate to all fire stations the reduction in pressures and procedures to follow to increase pressures during firefighting.</td>
<td>Field Service Branch Director</td>
</tr>
<tr>
<td>Adjust auto blowoffs to maintain minimum water quality goals.</td>
<td>Field Services Branch Director</td>
</tr>
<tr>
<td>Consider making provisions for emergency cooling/improved ventilation of critical machinery due to the stress increased demand and/or elevated environmental temperatures may place on the machinery.</td>
<td>Field Services Branch Director</td>
</tr>
<tr>
<td>Coordinate with Town, utilities and their associated contractors to enact/enforce restrictions on directional drilling to minimize damage risk to water lines during severe and/or extreme drought.</td>
<td>Field Services Branch Director</td>
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Task

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<tr>
<td>Maintain regular (at least weekly) contact with CWS to receive updates on their assets and operational conditions. Provide updates to MPW staff during regular team meetings.</td>
</tr>
<tr>
<td>Monitor usage, storage levels, and operation status of critical assets and report to regular management meetings.</td>
</tr>
<tr>
<td>Consider increase in blending of raw water to increase production as needed.</td>
</tr>
<tr>
<td>Reduce distribution pressures to ~40 psi. Per the AWWA M60 manual, lower water pressures typically result in an average of 6% reduction in water usage.</td>
</tr>
<tr>
<td>Backfill storage tanks at night from CWS.</td>
</tr>
<tr>
<td>Consider recycled water from wastewater treatment plants for commercial companies to collect and distribute to customers for irrigation.</td>
</tr>
<tr>
<td>Consider increasing the frequency of monitoring and testing of water quality.</td>
</tr>
<tr>
<td>Measure &amp; report water levels in each of the deep wells weekly.</td>
</tr>
<tr>
<td>Monitor fluoride levels for potential public notification.</td>
</tr>
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Assignee (ICS Position *): Operations Branch Director, Operations Branch Director, Operations Branch Director, Operations Branch Director, Operations Branch Director, Operations Branch Director, Water Supply Group Supervisor, Water Supply Group Supervisor.

* See Table 13.5 of the MPW Emergency Management Plan for the ICS Positions referenced above.
SC Drought and Water Shortage Tabletop Exercise
September 2017 and 2019 – SC Emergency Operations Center

2017
80
40
Attendees
Organizations

2019
93
48
Objectives of the Tabletop Exercise

1. Identify and understand the breaking points in the *SC Drought Response Act, SC Drought Regulations, SC Emergency Response Plan Drought Annex*, and local drought plans and procedures.

2. Improve awareness of local, state, and federal players in South Carolina’s drought response.

3. Identify key mission areas for Each State Emergency Support Function.

Lack of information (water system interconnections, economic effects) that would be helpful for planning and mitigation.

Many agencies unaware of the drought response process and their role in, and responsibilities for, drought response.

Lack of consistent messaging about drought conditions and water conservation, particularly across local communities.

DRC vacancies
EMD and Governor’s Office involved too
Late
Local plans need updating

Drought Monitor vs SC Drought Response Declaration
Lack of information (water system interconnections, economic effects) that would be helpful for planning and mitigation.

“Breaking Points”
Understanding the USDM and the South Carolina Drought Response Committee

United States Drought Monitor

South Carolina Drought Response Committee
Understanding the USDM and the South Carolina Drought Response Committee

**USDM**

https://droughtmonitor.unl.edu/

USDM authors work at NDMC, USDA, and NOAA. Authors take turns making the weekly map, which is based on drought indicators and input from contributions. Contributors include:

- NOAA
- USDA
- Other federal agencies
- State agencies
- Universities

Authors use a “convergence of evidence” approach to review and synthesize a wide range of information. The website lists the various products that are used to develop the weekly map.

The Drought Classification table shows numeric values for selected indicators and how they relate to USDM drought categories.

Five classifications:

- D0 = abnormally dry
- D1 = moderate
- D2 = severe
- D3 = extreme
- D4 = exceptional

**SC DRC**

http://www.scdrought.com/

SC Department of Natural Resources, State Climatology Office and the SC Drought Response Committee (DRC)

SC Drought Response Act (amended 2000); SC Drought Regulations (2001)

Drought Management Areas (DMAs) include representatives from:

- Local government
- Private and public water suppliers
- Power generation facilities
- Agricultural, industrial, and domestic water users
- Soil and Water Conservation Districts

The SC DRC convenes when conditions warrant. Drought Management Area committees make county drought designations.

SC Regulations specify the indicators to be used to monitor conditions and the numeric values that correspond to each drought alert phase.

- Drought Alert Phases:
  - Incipient
  - Moderate
  - Severe
  - Extreme
USDM vs SC DRC Drought Indicators

**USDM Inputs**
- Precipitation
- Soil Moisture
- Vegetation Health
- Surface Water
- Evaporation
- Groundwater
- Impacts & Condition Monitoring reports

**USDM Map 10/15/2019**

**SC Drought Declaration Map by County (10/17/2019)**

**Other Indicators used for SC**
- Palmer Drought Severity Index (PDSI)
- Crop Moisture Index (CMI)
- Standard Precipitation Index (SPI)
- Keetch-Byram Drought Index (KBDI)
- Average daily streamflow
- Groundwater Levels

**Intensity:**
- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

**SC DNR State Climatology Office**
Home Page

- 5 Main Tabs:
  - Conditions
  - Resources
  - Impacts
  - Conditions
  - Planning
SC Drought Resources

- Learn about drought
- Water Conservation Tips and infographics
- Drought Photos from the 2007, 2008, and 2011 droughts
- Publications from both the SC SCO and Carolinas Integrated Sciences and Assessments (CISA)
- Other resources from CISA, National Drought Monitoring Center (NDMC), National Integrated Drought Information System (NIDIS), and National Centers for Environmental Information (NIDIS)
South Carolina Drought Response Committee

The SC Drought Response Committee consists of state and local members and governs drought related issues and response in South Carolina. Local members are organized according to Drought Management Areas. The DRC is chaired and supported by the South Carolina Department of Natural Resources and the SC State Climatology Office. The DRC monitors climatic conditions, evaluates drought indicators, and consults with stakeholders to issue drought status updates. During severe or extreme drought, the DRC determines nonessential water use and issues declaration for water curtailment.

Drought Management Areas

- West Drought Management Area
- Central Drought Management Area
- Northeast Drought Management Area
- Southern Drought Management Area

Statewide Members

- State Agency Members

To learn more about how the committee monitors and identifies drought, visit the [South Carolina Drought 101 page](#).
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<td>Vacant</td>
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South Carolina Drought Planning

The South Carolina Drought Response Program consists of legislation, regulations, and procedures that establish recommended and required response at moderate, severe, and extreme drought alert phases. The South Carolina Drought Response Act and the supporting regulations formally establish and describe the responsibilities of the South Carolina Drought Response Committee (DRC), the major drought decision-making entity in the State. The DRC is composed of statewide and local members, and state agency members include:

- Emergency Management Division
- Department of Health and Environmental Control
- Department of Agriculture
- The Forestry Commission
- Department of Natural Resources

Watch an interview with South Carolina State Climatologist Hope Mizzell. Dr. Mizzell discusses the State Climate Office’s role in administration of the South Carolina Drought Response Act.

The Drought Response Act requires all public water suppliers to develop and implement local drought plans and ordinances. The Drought Regulations recognize that local governments have primary responsibility for alleviating drought impacts and encourage cooperation among neighboring water systems. DNR created a sample drought plan and ordinance for local governments and water systems to use in developing their own documents.

You can search for and view approved water system drought plans and ordinances through the Drought Management Plan and Response Ordinance Inventory.

The South Carolina Drought Response Plan is located in Appendix 10 of the State’s Emergency Operations Plan (EOP). The Drought Response Plan describes actions when drought conditions have reached a level of severity beyond the scope of the DRC and local communities. The South Carolina Emergency Management Division (EMD) maintains the EOP and leads multi-agency response to hazard events. Upon an activation of the EOP, EMD and the State Emergency Response Team (SERT) assemble in the South Carolina Emergency Operations Center to coordinate the State’s response.
Side Plug: Contribute to Drought / Condition Reporting!

https://droughtimpacts.unl.edu/Tools/ConditionMonitoringObservations.aspx
Side Plug: Contribute to Drought / Condition Reporting!

Drought Condition Monitoring Observations and Reports 2022

Selecione un idioma
Para utilizar este formulario en español, utilice el menú en la parte superior izquierda.

Introduction
Report drought-related conditions and impacts within the U.S. This is a nationwide service provided by the National Drought Mitigation Center, based at the University of Nebraska, developed in partnership with the National Integrated Drought Information System and the U.S. Department of Agriculture. Please note that this form is not part of the process to apply for assistance. To participate, you must legally be an adult, at least 18 years old in most states, 19 in Nebraska or Alabama, or 21 in Mississippi. By submitting information, you agree that it may be used in drought monitoring research. Questions? Please email DInfo@unl.edu.

Find your report(s) on the map
Information submitted via this form appears on a map and becomes part of a permanent public record. See your mapped reports at https://op.uiuc.edu/chnames

Where are you?*
Use the search box to enter the city or county of your observation. If you are using the mobile app, you have the option to enable location and use that instead. From a computer, clicking on the compass icon may work if you are not using a VPN, depending on your configuration.
Thank You!

Questions?

Email: wickhame@dnr.sc.gov
Cell: 803-465-1098