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Providing Services and Support during Drought Conditions***

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Providing Services and Support during Drought Conditions

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1. Introduction. The purpose of this supplement is to define regional policy and service in regards to drought. In addition, it provides information on best practices procedures.

Drought is a normal, recurrent feature of climate. It occurs in virtually all climatic zones, but its characteristics vary significantly from one region to another. Therefore, defining

drought is difficult and depends on differences in regional topography, needs, and disciplinary perspectives. In the most general sense, drought originates from a deficiency of water over an extended time period, resulting in an impact due to a water shortage for some activity, group, or environmental sector. While drought can be defined as a climate phenomenon, its impacts on humans and the environment can be extreme in both short and long time scales.

According to the National Climatic Data Center, the U.S. has sustained 62 weather-related disasters between 1980 and 2004 in which overall damages reached or exceeded \$1 billion. Ten of these events were drought related. These droughts accounted for \$90 billion in damage (not adjusted for inflation). Due to this potential economic loss and other potential impacts (e.g. water resource, fire danger, agricultural) from drought events in Central Region, it is essential as an agency that we place an increased importance on drought monitoring.

The public, media, governmental agencies (local, state, and federal), and private users involved in water management, fire management, energy and agriculture rely on the NWS for hydrometeorological information and drought outlooks in their area.

2. Drought Procedures.

2.1 Role of the CR WFOs during Drought Conditions. The role of the CR field office during drought conditions is to provide pertinent hydrometeorological information to the public and other government agencies. The NWS does not declare when drought begins or ends. Close coordination between the Weather Forecast Offices (WFOs), the River Forecast Centers (RFCs), Central Region Headquarters (CRH), U.S. Drought Monitor group, and locally impacted entities (e.g., state Cooperative Extension Service, state climate offices, USDA Farm Service Agency, water management agencies, U.S. Army Corps of Engineers, U.S. Geological Survey) is critical to ensure that consistent information is gathered and disseminated.

During drought conditions, WFOs may provide additional information to our stakeholders and partners through the attendance of state, county, city, and user group meetings related to the drought. CR field offices may become involved in state and local government meetings to provide input on hydrologic and climate information in regards to drought. Several states in the Central Region already have action plans that invite NWS field office personnel to their drought meetings to present weather and hydrologic information.

2.2 WFO Drought Plans. Each Central Region (CR) WFO will develop a drought plan to ensure that the office's responsibilities outlined in this supplement are met. The drought plan will describe procedures to be followed during drought conditions to ensure that the office is prepared to provide the necessary service and support. A drought plan should be filed in the Station Duty Manual (SDM). **Appendix B** contains a list of items to include in a WFO drought plan as well as an example of one.

2.3 Drought Focal Point (DFP). Each Meteorologist-In-Charge/Hydrologist-In-Charge (MIC/HIC) should designate a DFP. The Climate Services Focal Point (CSFP), Service Hydrologist (SH), or Hydrology Focal Point (HFP) is a likely candidate to serve as DFP. However anyone in the office with the interest and experience may serve in this capacity. Once a DFP is determined the name should be sent to the regional Climate Services Program Manager (CSPM).

The DFP is responsible for monitoring hydrometeorological conditions; providing input as needed to the U.S. Drought Monitor; coordinating with adjacent WFOs, the CSPM, and external federal, state and local agencies as needed; meeting customer and partner needs; and ensuring that the appropriate products are issued (see **Section 4**). The DFP is also responsible for developing and updating the office drought plan and ensuring the staff training on drought issues and procedures in coordination with the science operation officer (SOO/DOH) in each office.

2.4 Local Drought Team. Droughts (especially D2 or worse) may create additional workload for the WFO (e.g., increased media contacts and interaction with customers and partners). As a result, it might be advantageous for both the WFO and the DFP to form a local drought team to assist with the aforementioned responsibilities. At a minimum, the drought team will ensure drought information is available to all operational staff.

2.5 Provide Input to the U.S. Drought Monitor. The DFP should sign up with the Drought Monitor list server by filling out the “Subscribing to Drought” section at the following web address:

<http://drought.unl.edu/mailman/listinfo/drought>

The DFP will receive a confirmation email from the U.S. Drought Monitor once they have been officially added to the U.S. Drought Monitor list server.

After signing up, the DFP should:

- a) Provide local drought information as early in the week as possible (Sunday through Tuesday). This should include what has happened in the DFP’s county warning area (CWA) during the past week and whether the drought conditions are improving, deteriorating, or remaining the same. Remember that the cutoff time for precipitation used in the U.S. Drought Monitor each week is **Tuesday at 7 am Central Time**. Also, the DFP should include any actions that are to be taken by local or state governmental agencies to address drought conditions. Media stories or summations are of great interest as well to the group.
- b) Provide comments/recommendations as needed on the various drafts of U.S. Drought Monitor map. The first draft is typically sent out on Monday afternoon with the final draft sent out to the participants late Wednesday afternoon or evening.

- c) All feedback and suggestions should be sent in by 1 pm Central Time Wednesday.

2.6 Provide Input to the Drought Impact Reporter (DIR). WFOs are encouraged to submit local reports of impacts, news stories and other information pertinent to the DIR (Drought Impact Reporter). This information can be anything from formal media articles to information from local growers and stakeholders. Coordinate with the Warning Coordination Manager (WCM) and/or Storm Data Focal Point to gather drought articles and information provided by the local media. Web links may be entered into the DIR from media sources. Paper copies of articles from news clipping services or any local media may be faxed or scanned for submission.

2.7 Onset of Drought Related Services and Support. The WFOs will provide additional information to customers, and may attend drought-related meetings as requested by local government agencies, when:

- a) A drought has been indicated by the U.S. Drought Monitor (D2 or greater), or a drought has been declared by state, county, or other officials in the hydrologic services area (HSA). For the latter, this information should be relayed to the U.S. Drought Monitor as soon as possible.
- b) Conditions are dry enough to cause elevated concern among the public, the media, or other agencies with water resources interests. This occurs when impacts from drought begin to affect the public or environment in some adverse manner.

2.8 Methods for Providing Services and Support During Drought Conditions.

- a) WFOs will issue drought information statements, as required. Further details about these statements are contained in *Section 4*.
- b) Drought-related information and links should be posted on the WFO web page. An example web template can be found in *Appendix D*.
- c) The MIC or designee should attend local and state meetings related to drought and provide information at the meetings as necessary.
- d) During high impact droughts (D3 or D4), a WFO may want to consider holding a news conference in conjunction with state and local partners (such partners may include the state climate office, U.S. Geological Survey (USGS), U.S. Army Corp of Engineers (USACE), state extension services, etc). The entire affair would need to be coordinated across WFO and regional boundaries. In addition, a WFO may want to issue press releases. See *Appendix D* for an example.

2.9 Termination of Drought-Related Services and Support. The WFOs may terminate their drought-related activities when the drought intensity drops below the D2 level on the U.S. Drought Monitor in their area of responsibility. It is important, however, to

recognize the interest level from the public, media, and other agencies when determining the need for support. This may be evaluated on a case by case basis.

3. Threshold Criteria for Issuance/Expiration.

3.1 Criteria for Issuance. WFOs will begin to issue Drought Information Statements based on any of the following criteria and after the U.S. Drought Monitor issuance:

- a) The current week's U.S. Drought Monitor depicts a D2 or worse in the CWA.
- b.) Local office assessments of hydrometeorological conditions based on various drought-related information sources (e.g., local, state, and federal agencies) indicate the need for such support.

3.2 Optional Issuance Criteria. WFOs may issue an extended stream flow (ESF) and public information statement (PNS) based on any of the following criteria:

- a) This current week's U.S. Drought Monitor depicts abnormally dry (D0) or moderate drought (D1) in the CWA.
- b) When conditions or impacts are extreme enough to warrant such a statement in a localized area. This may occur with fast onset droughts (flash droughts) or anytime the WFO feels it necessary.

3.3 Expiration Criteria. WFOs should discontinue issuing ESF/PNS based on local assessments of drought-related information sources. This includes, but is not limited to:

- a) When the U.S. Drought Monitor indicates drought severity to be less than D2; and
- b) Other drought related information sources from governmental (local, state, or federal) agencies indicate drought conditions have subsided, and
- c) There is a lack of media interest and/or local impacts.

4. Product Issuance, Frequency, and Content.

4.1 Issuance Guidance. In accordance with **Section 3.1**, the ESF/PNS will be issued on a weekly to monthly basis. The ESF/PNS frequency will be based upon local office discretion. More frequent issuances may be based on the following:

- a. Media attention.
- b. Partner and customer needs. For example, a WFO may issue an ESF/PNS more frequently during growing or navigation seasons; when it severely impacts

ground water supplies; and when there is high or greater fire danger.

c. Drought Severity Classification changes in the U.S. Drought Monitor. Since it is rather rare for the US Drought Monitor to show more than a one category change during a week, this refers to either the drought worsening (e.g., D2 to D3) or improving (e.g., D2 to D1).

d. Whenever forecast and outlook changes would be of interest to the public and media.

4.2 Issuance Timing. This product should be issued as soon as possible following the release of the U.S. Drought Monitor, preferably on Thursday or Friday the week of the release. If it is known prior that this statement cannot be issued in a timely manner, it should be noted in the *.Next Issuance...* section of this product (See *Appendix C*) with the date that it will be issued.

4.3 PIL Headers. WFOs will issue an ESF as a Hydrologic Outlook (cccESFxxx). In order to reach our partners and customers who normally do not read this product, it is suggested that WFOs also issue them under Public Information Statements (cccPNSxxx) header. This can be done by simply copying the ESF content into a PNS format and sending it out. The product format and sample products are contained in *Appendix C*. Note, when issuing a PNS you should change the product name from “Hydrologic Outlook” to “Drought Statement”.

4.4 Content. At a minimum, the drought information statement should contain the following sections:

1. Headline
2. Synopsis
3. Local area affected
4. Climate summary
5. River and streamflow conditions
6. Precipitation/temperature outlook
7. Questions or comments
8. Related web sites
9. Acknowledgement
10. Next issuance

In addition, WFOs may want to refer to the Climate Prediction Center’s (CPC’s) U.S. Seasonal Drought Outlook. For more details on these sections, refer to *Appendix C*. The outlook portion should focus on the upcoming 2-week period and include the CPC’s monthly and seasonal temperature/precipitation outlooks. In addition, WFOs may want to refer to CPC’s [U.S. Seasonal Drought Outlook](#) when describing the potential for improvement or deterioration in drought conditions. When this outlook refers to some improvement, it is referring to at least a one category improvement in the Drought Severity Classification.

4.5 Use of Impact Information. WFOs should use local discretion whether to include information regarding drought impacts, emergency response/actions (e.g. implementation of drought contingency plans, drought disaster declarations), and/or state, county or municipal restrictions (e.g. water rationing, burning bans). The decision to include this information should be based on its availability, significance, and level of media attention.

4.6 Attribution. WFOs will include source attribution to agencies whose drought information is contained in their Drought Information Statements.

4.7 Other Content Considerations. The US Drought Monitor is not drawn to the county level. Thus, it is often difficult to determine the actual “D” level of a particular locality or county. The WFO should to use ranges (e.g. D1 to D2) to discuss drought in areas not clearly defined in a particular Drought Severity Classification. This is important to remember when communicating with our users and partners and when writing the *Local Area Affected Section* in the Drought Information Statement.

Precipitation input for each week’s US Drought Monitor ends at 7 a.m. Central Time on Tuesdays. This creates problems when precipitation falls between this time and its issuance at 7 a.m. Central Time on Thursdays. Since it takes time to interpret the effects of precipitation, it is best to inform users in the drought statement of this possibility. For example, one may say in the *Synopsis Section* that “Recent precipitation will help the drought situation, but to what extent is unclear at this time.”

Information and graphics which indicate the amount of precipitation needed to end a drought should not be used in either writing the statement or on web pages. This is usually based on the Palmer Drought Severity Index which may not be representative of the local drought situation for a myriad of reasons. Thus the values indicated may be very misleading and confusing to the stakeholder.

4.8 Internet Information Delivery. WFOs should post a link from their home page to the latest Drought Information Statement. An example web template can be found in *Appendix D*. The left-hand column is used for current or forecast drought information. The right-hand column includes information where the user may find additional information if needed.

APPENDIX A: Drought Background Information

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1. Types of Droughts. Below is a list of the more common types of droughts:
 - a. **Meteorological Drought** is defined usually on the basis of the degree of dryness (in comparison to some “normal” or average amount) and the duration of the dry period. There are many ways to define a meteorological drought.
 - b. **Agricultural Drought** is defined as conditions that result in adverse crop responses, usually because plants cannot meet potential transpiration as a result of high atmospheric demand and/or limited soil moisture.
 - c. **Hydrological Drought** is defined as a prolonged period of below-normal precipitation, causing deficiencies in water supply, as measured by below-normal streamflow, lake and reservoir levels, groundwater levels, and depleted soil moisture content.
 - d. **Socioeconomic Drought** occurs when the demand for an economic good exceeds supply as a result of a weather-related shortfall in water supply. Socioeconomic definitions of drought associate the supply and demand of some economic good with elements of meteorological, hydrological, and agricultural drought.

2. Drought Monitoring and Outlook.

2.1 U.S. Drought Monitor. The U.S. Drought Monitor (USDM) is a weekly collaborative effort of the U.S. Department of Agriculture (USDA), various NOAA entities, including NWS WFOs, Climate Prediction Center (CPC), and National Climatic

Data Center (NCDC), and the National Drought Mitigation Center (NDMC) located in Lincoln, NE. It provides a national assessment of drought conditions by integrating numerous drought indices, news accounts, and input from local experts, including NWS field offices, into a single depiction. It is intended to provide an objective measure of dryness and drought using a suite of indicators. These indicators include agricultural, meteorological, and hydrological measures of dryness/drought.

The U.S. Drought Monitor is issued every Thursday at 7am Central Time. It is based on data through 1200 UTC on the previous Tuesday. *Please Note: The map is drawn to the climate division scale and not county scale, so one should be careful when attempting to infer high spatial detail from the map.* This information is found at the following web link:

<http://www.drought.unl.edu/dm/monitor.html>

2.2 North American Drought Monitor. The North American Drought Monitor (NA-DM) is a cooperative effort among drought experts in Canada, Mexico, and the United States to monitor drought across the continent on an ongoing monthly basis. Major U.S. participants in the NA-DM program include NCDC, CPC, USDA, and NDMC. Major participants in Canada and Mexico include Agriculture and Agrifood Canada, the Meteorological Service of Canada, and the National Meteorological Service of Mexico (SMN - *Servicio Meteorologico Nacional*). This product can be found at the following web link:

<http://www.ncdc.noaa.gov/oa/climate/monitoring/drought/nadm/index.html>

2.3 Drought Impact Reporter. The Drought Impact Reporter (DIR) is an interactive tool developed by the NDMC to collect, quantify, and map reported drought impacts for the United States. The tool was created in response to the need for a national drought impact database. Information for the impact report database comes from a variety of sources, including on-line drought-related news stories and scientific publications which are reviewed by NDMC staff; members of the public who visit the website and submit a drought-related impact; members of the media; and members of government agencies such as NOAA (including WFOs) and USDA. All field offices are encouraged to use this simple interface to relay pertinent drought impacts in their area. The DIR is updated daily and can be found at the following web link:

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

2.4 U.S. Seasonal Drought Outlook. CPC issues this outlook on the third Thursday each month. This outlook can be found at the following web link:

http://www.cpc.ncep.noaa.gov/products/expert_assessment/seasonal_drought.html

When “some improvement” is indicated, it means that the outlook is for improvement of at least one category in the drought.

3. Drought Severity Classification. Drought intensity categories are based on six key and numerous supplementary indicators. The drought severity classification table below shows the ranges for each indicator for each dryness level. Due to the complexities of drought, the U.S. Drought Monitor author will base their final decision upon blends of these indicators and others, and the information that is received from local experts.

Drought Severity Classification						
Category	Possible Impacts	Indices Ranges				
		Palmer Drought Index	CPC Soil Moisture Model (Percentiles)	USGS Weekly Streamflow (Percentiles)	Standardized Precipitation Index	Satellite Vegetation Health Index
D0	Going into drought: short-term dryness slowing planting, growth of crops or pastures; fire risk above average. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered. (Frequency of occurrence: 20 to 30%)	-1.0 to -1.9	21-30	21-30	-0.5 to -0.7	36-45
D1	Some damage to crops, pastures; fire risk high; streams, reservoirs, or wells low, some water shortages developing or imminent, voluntary water use restrictions requested. (Frequency of occurrence: 10 to 20%)	-2.0 to -2.9	11-20	11-20	-0.8 to -1.2	26-35
D2	Crop or pasture losses likely; fire risk very high; water shortages common; water restrictions imposed. (Frequency of occurrence: 5 to 10%)	-3.0 to -3.9	6-10	6-10	-1.3 to -1.5	16-25
D3	Major crop/pasture losses; extreme fire danger; widespread water shortages or restrictions. (Frequency of occurrence: 2 to 5%)	-4.0 to -4.9	3-5	3-5	-1.6 to -1.9	6-15
D4	Exceptional and widespread crop/pasture losses; exceptional fire risk; shortages of water in reservoirs, streams, and wells, creating water emergencies. (Frequency of occurrence: 2% or less)	-5.0 or less	0-2	0-2	-2.0 or less	1-5

4. Drought Tools. The use of indices and experimental blends have aided in the monitoring drought. Some of these tools are discussed in this appendix.

4.1 Drought Indices. The most common drought indices are the Palmer Drought Severity Index (PDSI), Crop Moisture Index (CMI), Standardized Precipitation Index (SPI), and the Satellite Vegetation Health Index (SVHI). As with all indices, they have their strengths and limitations.

4.1.1 Palmer Drought Severity Index (PDSI). The PDSI is updated weekly by the Climate Prediction Center (CPC). It is based on rainfall, temperature and historic data, and is computed based on a complex formula devised by W.C. Palmer in 1965. The PDSI

is the main drought index used by many U.S. government agencies and states to trigger drought relief.

Palmer Drought Severity Index (PDSI)			
Values	Classification	Values	Classification
-4.0 or less	Extreme drought	0.5 to 0.99	Incipient wet spell
-3.0 to -3.99	Severe drought	1.0 to 1.99	Slightly wet
-2.0 to -2.99	Moderate Drought	2.0 to 2.99	Moderately wet
-1.0 to -1.99	Mild drought	3.0 to 3.99	Very wet
-0.5 to -0.99	Incipient dry spell	4.0 or more	Extremely wet
0.49 to -0.49	Near normal		

Weekly maps can be found at the following CPC link:

http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/regional_monitoring/palmer.gif

Strengths of the PDSI:

Useful as a drought monitoring tool because it:

1. Provides decision makers with a measurement of the abnormality of recent weather for a region.
2. Provides an opportunity to place current conditions in historical perspective.
3. Provides spatial and temporal representations of historical droughts (NCDC has calculated PDSI back to 1895 for every climate division in the United States).

Limitations of the PDSI:

1. Done strictly for climatological zones (does not take in account differences due to local precipitation amounts, different time periods, and soil types).
2. Slow to detect fast-emerging droughts (values may lag emerging droughts by several months).
3. Built-in unspecified time scale that can be misleading.
4. Snowfall, snow cover, and frozen ground are not included in the index. All precipitation is treated as rain, so that the timing may be inaccurate in the winter and spring months in regions where snow occurs.
5. The natural lag between when precipitation falls and the resulting runoff is not considered. In addition, no runoff is allowed to take place in the model until the water capacity of the surface and subsurface soil layers is full, leading to an underestimation of runoff.
6. Not well suited for mountainous land or areas of frequent climatic extremes.
7. Decision makers rely on it too much in triggering drought relief programs (usually too slow to respond during the onset of drought).

4.1.2 Crop Moisture Index (CMI). The CMI is a derivative of the Palmer Drought Severity Index, designed to reflect quickly changing soil moisture conditions.

Crop Moisture Index (CMI)			
Values	Category	Values	Category
-3.0 or Less	Severely Dry	1.0 to 1.9	Abnormally Moist
-2.0 to -2.9	Excessively Dry	2.0 to 2.9	Wet
-1.0 to -1.9	Abnormally Dry	3.0 and above	Excessively Wet
-0.9 to 0.9	Slightly Dry/Favorably Moist		

Weekly maps can be found at the following CPC link:

http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/regional_monitoring/cmi.gif

Strengths of the CMI:

1. Identifies potential agricultural droughts.

Limitations of the CMI:

1. Responds too rapidly to short-term conditions. For example, a beneficial rainfall during a drought may allow the CMI value to indicate adequate moisture conditions, while the long-term drought at that location persists.
2. Typically begins and ends each growing season near zero. This limitation prevents it from being used outside the general growing season, especially in droughts that extend over several years.
3. May not be applicable during seed germination.

4.1.3 Standardized Precipitation Index (SPI). The SPI is a relatively new drought index based only on precipitation. The SPI can be calculated for a variety of time scales. This flexibility allows the SPI to be useful in both short-term agricultural and long-term hydrological applications. It is generated from National Climatic Data Center (NCDC) data. Both the Western Regional Climate Center (WRCC) and National Drought Mitigation Center (NDMC) issue this monthly.

Standardized Precipitation Index (SPI)			
Values	Category	Values	Category
-2.0 and less	Extremely Dry	1.0 to 1.49	Moderately Wet
-1.5 to -1.99	Severely Dry	1.5 to 1.99	Very Wet
-1.0 to -1.49	Moderately Dry	2.0 and above	Extremely Wet
-0.99 to 0.99	Near Normal		

These data can be obtained from either of the following web links:

NDMC: <http://www.drought.unl.edu/monitor/currspi.htm>

Western Regional Climate Center: <http://www.wrcc.dri.edu/spi/spi.html>

Strengths of the SPI:

1. Can be computed for different time scales. This time scale flexibility allows it to be useful in both short-term agricultural and long-term hydrological applications.
2. Can provide early warning of drought.
3. Helps assess drought severity.
4. Much less complex than the Palmer Drought Severity Index (PDSI).

Limitations of the SPI:

1. Precipitation values are based on preliminary data from the National Climatic Data Center that may change.
2. Based on Climatic Divisions which may be too broad to reflect soil type.

4.1.4 Satellite Vegetative Health Index (SVHI). The SVHI is a combination of the chlorophyll and moisture content in vegetation combined with surface thermal changes. A Vegetation and Temperature condition Index (VT) is produced characterizing change in vegetation conditions from extremely poor (0) to excellent (100). This index can be found at the following NESDIS web sites:

<http://www.orbit.nesdis.noaa.gov/smcd/emb/vci/current.html>

or <http://www.orbit.nesdis.noaa.gov/smcd/emb/vci/usavhcd.html>

Strengths of SVHI:

1. Good spatial coverage of vegetative health of agriculture applications.
2. Useful for early drought detection.
3. Not adversely affected by bad surface observations.

Limitations of the SVHI:

1. Useful only during the growing season.

4.2. Experimental Objective Drought Blends. Since there is no single drought index which handles drought completely, two types of model blends were developed by the Climate Prediction Center (CPC) to aid in drought diagnostics. They are:

1. Short-Term Model Blend: This method approximates drought-related impacts that respond to precipitation (and other secondary factors noted below) on time scales ranging from a few days to a few months, such as wildfire danger, non-irrigated agriculture conditions, topsoil moisture, range and pasture conditions, and unregulated stream flows. This blend is composed of: 35% Palmer Z-Index; 25% 3-Month Precipitation; 20% 1-Month Precipitation; 13% Climate Prediction Center

Soil Moisture Model; and 7% Palmer (Modified) Drought Index.

2. Long-Term Model Blend: This approximates drought-related impacts that respond to precipitation on time scales ranging from several months to a few years, such as reservoir stores, irrigated agriculture, groundwater levels, and well water depth. This blend is composed of: 25% Palmer Hydrologic Drought Index (30% in Western U.S.); 20% 12-Month Precipitation (10% in Western U.S.); 20% 24-Month Precipitation (10% in Western U.S.); 15% 6-Month Precipitation (10% 12-Month Precipitation in Western U.S.); 10% 60-Month Precipitation (30% in Western U.S.); and 10% Climate Prediction Center Soil Moisture Model.

Both of these experimental products are generated using the CPC's real-time daily and weekly climate division data, and the National Climatic Data Center's monthly climate division data archive, back to 1932. Like drought indices, the experimental drought blends do not handle all aspects of drought completely and should not be interpreted literally.

APPENDIX B – Drought Plan Guidelines for the Station Duty Manual

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1. Introduction. The drought plan outlines procedures to follow during drought conditions in a WFO’s area of responsibility. The plan should include, at a minimum, the following types of information.

2. Local Impacts of Drought (D1 to D4).

Climate and water interests vary greatly across Central Region, and therefore each WFO is the expert on what drought impacts are in their CWA. Awareness of drought impacts by the field office is critical to the success of how the information is ultimately used by the public. Characteristics of these droughts should be summarized to give decision makers an idea of what has happened in the past.

3. Products to be issued during Drought Conditions.

The plan should describe when to start and stop issuing drought-related products as described in this supplement, the frequency of issuance of these products, and the format and contents of the products. An example of a drought-related ESF and PNS should be included as well.

4. Coordination.

The plan should include with whom to coordinate and a list of typical agencies involved with drought assessment/response in the WFO’s service area. This may include a state drought task force, state climatologist, and surroundings NWS offices.

RFC Support: The plan should describe what services are available from the supporting RFCs during D1 or worse. Specific RFC services to support drought should be coordinated with the RFCs by the drought focal point.

5. Example.

National Weather Service La Crosse, WI Drought Plan

Last Updated: February 13, 2006

1. Local Impacts of Drought (D1 to D4)

Dry spells that impact the La Crosse County Warning area most commonly occur during the growing season. If these dry spells occur coincidentally with above normal temperatures, flash droughts may develop. These types of droughts can intensify quickly in the sandy river valleys. If the drought extends beyond a couple of weeks, it can become an agricultural drought.

The effect upon agriculture is highly dependent upon when the drought occurs. The corn crop can be severely affected in July during its tasselling and silking stages. Meanwhile soybean crop yields can be lowered dramatically if drought affects the area in August. A great example of this occurred during July 2003 when precipitation abruptly shut off. Abnormally dry conditions were first reported in the July 29, 2003 U.S. Drought Monitor (USDM) and rapidly deteriorated to extreme drought (D3) by the September 30, 2003 USDM issuance. With the lack of precipitation starting in mid July, corn was able to develop ears, but these ears were severely stunted by the lack of precipitation during the remainder of the growing season. In addition, soybean yields were severely reduced and many shallow rooted plants died.

Multi-year droughts were rather frequent from the 1931 through 1940 and from 1948 through 1959. Since 1960, there have only been three multi-year droughts (1976-77, 1988-90, and 2003-04). These droughts ranged from moderate to extreme intensity. The last extreme drought in our area occurred during the 2003-04 drought.

2. Products to be issued and frequency during Drought Conditions

When abnormally dry (D0) or moderate drought (D1) conditions appear in the U.S. Drought Monitor, our office may issue Drought Information Statements (ESF/PNS). For severe droughts (D2) or worse, our office will issue these statements on a weekly basis during the growing season, bi-weekly during the early spring and late autumn, and monthly (on the 3rd Thursday of the month – in coordination with CPC's seasonal drought outlook) during the remainder of the year.

ESF/PNSs will be issued under the MKEPNSARX and MKEESFARX product identifiers. In addition, we will update our local drought web site when these statements are issued.

3. Coordination

Whenever it is pertinent, the Drought Focal Point will provide statistics and other local information to the U.S. Drought Monitor and Drought Impact Reporter (DIR). In addition, we should keep the state climatology offices from Minnesota, Wisconsin, and Iowa informed of the latest information on our local drought conditions.

Iowa State Climatologist Phone #: (515) 281-8981

Minnesota State Climatologist Phone #: (651) 296-4214

Wisconsin State Climatologist Phone #: (608) 263-2374

Appendix C - Product Content and Format - Drought Information Statement

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1. Drought Information Statement Format.

ZCZC cccESFxxx ALL (also send as PNS)
TTAA00 Kxxx ddhmm
UGC (use county FIPS form of the UGC)

HYDROLOGIC OUTLOOK
NATIONAL WEATHER SERVICE [office city and state]
[Date/Time Group]

HEADLINE - (Required)

.SYNOPSIS... (Required) A general description of the U.S. Drought Monitor ratings and brief overview of climate/hydrological conditions (e.g., rain or lack thereof, temperatures, river levels and trends) since the last statement was issued. Rainfall deficits can be expressed as either a percent of normal or as an absolute value showing the departure of normal, or both. The period of record of the data should clearly be stated to put into historical context

.LOCAL AREA AFFECTED... (Required) A more specific explanation of the areas under the various Dx categories. Start with the areas experiencing the most severe conditions and finish with areas in the lowest category. Since the U.S. Drought Monitor is drawn to climate divisions and not county level, the WFO should use ranges (e.g., D1 to D2) for counties which are not clearly within one Drought Severity Classification.

.STATE AND LOCAL ACTIONS... (Local Discretion) State, county or local declarations of drought or disaster areas, water restrictions, water quality issues, and burn bans. Sources: local media, state and local government web pages/press releases.

.CLIMATE SUMMARY... (Required) Climate data, primarily rainfall, rainfall deficits and/or percent of normal which help illustrate the impact of the drought. Include various time frames as appropriate (e.g., year to date, growing season, month-to-date). One may also want to include temperature data (e.g., extremes, records), lack of snowfall, and information putting these deficits/extremes into historical perspective. Focus on F-6 locations, but other sites may be added as need, time and data availability (via xmACIS) permit.

.SOIL MOISTURE CONDITIONS... (Local Discretion) This section contains general information on topsoil and subsoil moisture status and trends. The following web sites provide soil moisture information:

CPC: <http://www.cpc.noaa.gov/products/soilmst/w.shtml>
Midwestern Regional Climate Center: <http://mrcc.sws.uiuc.edu/cliwatch/drought/moisture.htm>
State USDA Crop Progress Reports:

http://www.nass.usda.gov/Publications/State_Crop_Progress_and_Condition/index.asp
 Princeton University: <http://hydrology.princeton.edu/~luo/research/FORECAST/current.php>
 University of Washington: <http://www.hydro.washington.edu/forecast/monitor/index.shtml>

.GROUND WATER IMPACTS... (Local Discretion) Ground water information can be included when known and appropriate. One source of this data is the USGS Ground-Water Climate Response Network web site:

<http://groundwaterwatch.usgs.gov/>

.RIVER AND STREAMFLOW CONDITIONS... (Required) This section will typically include streamflow percentiles as they relate to normal. It is also appropriate to include seasonal flow probability information. If seasonal low flow information is available it should be used. This data can be obtained from the following USGS Water Watch web site:

<http://water.usgs.gov/waterwatch>

For current and forecast streamflow conditions go here:

<http://www.weather.gov/ahps/>

Other impacts as discussed with our hydrological partners (e.g. COE for dredging operations, river closures) may also be included in this section too.

.RESERVOIR AND LAKE LEVELS... (Local Discretion) This section will relate reservoir and lake levels to normal. These levels can be obtained at the following web sites:

U.S. Corps Army of Engineers' Corps Lakes Gateway:
<http://corpslakes.usace.army.mil/visitors/states.cfm?state=xx> where xx is a state ID
 U.S. Department of Interior Bureau of Reclamation's Current Reservoir and River Data Center:
<http://www.usbr.gov/gp/water/rflow.cfm>

.AGRICULTURAL IMPACTS... (Local Discretion) Impacts on crop growth, development, and yield can be found at the following USDA web site:

State USDA Crop Progress Reports:
http://www.nass.usda.gov/Publications/State_Crop_Progress_and_Condition/index.asp

.FIRE DANGER IMPACTS... (Local Discretion) Drought can have a dramatic effect upon the fire danger. These conditions can change rapidly as hot, dry, and windy conditions develop or worsen. Fire danger can be determined through either the 10-hour and 100-hour fuel moistures, or the **Keetch-Byram Drought Index (KBDI)**. The KBDI is a drought index that is specifically related to fire potential. The KBDI is broken into four categories which indicate the susceptibility of ground fuels to fire danger. Below are the four categories and a brief description of each:

Keetch-Byram Drought Index (KBDI)	
KBDI Value	Description of Fire Potential
0 to 200	Low - Wet with little danger of fire initiation
201 to 400	Moderate - Drying occurring with some fire danger
401 to 600	High - Ground cover dry and will burn readily
601 to 800	Extreme - Dead and live fuels will burn readily

KBDI and Dead Fuel Moisture data can be found on the Wildland Fire Assessment System (WFAS) web site at:

<http://www.fs.fed.us/land/wfas/wfas10.html>

Another method of monitoring fire danger conditions is through state department of natural resources' web sites. There you can look for news or press releases. In some states, they will actually have their own fire danger conditions.

.PRECIPITATION/TEMPERATURE OUTLOOK... (Required) A summary of the forecast from today through the next three months focusing on precipitation and temperature as they may impact drought conditions. This includes the week one forecast and CPC's week two, 30-day and 90-day outlooks.

<http://www.cpc.ncep.noaa.gov/products/predictions/>

.QUESTIONS OR COMMENTS... (Required) This section supplies our users and partners a way to contact us in case they have any questions or would like to pass on recommendations to improve this product to suit their needs. See example below:

IF YOU HAVE ANY QUESTIONS OR COMMENTS ABOUT THIS DROUGHT INFORMATION PLEASE CONTACT...

NAME
DROUGHT FOCAL POINT or CLIMATE SERVICES FOCAL POINT
NATIONAL WEATHER SERVICE
CITY STATE ZIPCODE
TELEPHONE NUMBER
E-MAIL ADDRESS

.RELATED WEB SITES... (Required) This provides a summary of web sites used to generate the ESF/PNS. See example below.

LOCAL WEATHER...CLIMATE AND WATER INFORMATION -
Local NWS site

ADDITIONAL RIVER INFORMATION -
USGS - <http://water.usgs.gov>
COE - <http://www.mvr.usace.army.mil>

U.S. DROUGHT MONITOR -
<http://www.drought.unl.edu/dm/index.html>

CLIMATE PREDICTION CENTER -
<http://www.cpc.ncep.noaa.gov>

.ACKNOWLEDGEMENTS... (Required) Include acknowledgements for other agencies that provided input to this product, either directly or indirectly. This would include agencies whose web sites were accessed to gather information in addition to personal contacts. See example below:

THE DROUGHT MONITOR IS A MULTI-AGENCY EFFORT INVOLVING NOAA/S
NATIONAL WEATHER SERVICE AND NATIONAL CLIMATIC DATA CENTER...THE
USDA...STATE AND REGIONAL CENTER CLIMATOLOGISTS AND THE NATIONAL
DROUGHT MITIGATION CENTER. INFORMATION FOR THIS STATEMENT HAS BEEN
GATHERED FROM NWS AND FAA OBSERVATION SITES...STATE COOPERATIVE
EXTENSION SERVICES...THE USDA...COE AND USGS.

.NEXT ISSUANCE... (Required) This allows our users and partners to know when we plan on issuing the next update on this product. In cases where the drought has ended and you are not sure of a date, you should state that "THIS PRODUCT WILL BE ISSUED AGAIN WHEN DROUGHT CONDITIONS ONCE AGAIN DEVELOP IN OUR HYDROLOGIC SERVICE AREA."

2. Example Drought Information Statement I.

DROUGHT STATEMENT
NATIONAL WEATHER SERVICE LA CROSSE WI
421 AM CDT FRI OCT 28 2005

...DROUGHT STILL EXISTS IN PARTS OF THE AREA...

.SYNOPSIS...

FROM OCTOBER 11TH THROUGH OCTOBER 25TH...LESS THAN A QUARTER INCH OF PRECIPITATION FELL ACROSS MUCH OF THE AREA. THE GREATEST PRECIPITATION AMOUNT WAS THREE TENTHS OF AN INCH AT THE NATIONAL WEATHER SERVICE OFFICE IN LA CROSSE WISCONSIN. NORMALLY NINE TENTHS OF INCH OF PRECIPITATION FALLS DURING THIS PERIOD...THEREFORE...THE PRECIPITATION DEFICITS HAVE INCREASED ACROSS THE AREA. MODERATE /D1/ DROUGHT STILL EXISTS ACROSS PARTS OF GRANT COUNTY IN SOUTHWEST WISCONSIN AND CLAYTON COUNTY IN NORTHEAST IOWA. ABNORMALLY DRY CONDITIONS /D0/ STILL EXISTS ACROSS NORTH CENTRAL...CENTRAL...AND SOUTHWEST WISCONSIN...AND NORTHEAST IOWA.

IN THE OCTOBER 25TH RELEASE OF THE U.S. DROUGHT MONITOR...ABNORMALLY DRY /D0/ CONDITIONS COVERED MUCH OF NORTHERN AND SOUTHWEST WISCONSIN...AND MODERATE /D1/ TO EXTREME DROUGHT /D3/ EXTENDED FROM SOUTHWEST IOWA NORTHEAST INTO SOUTH CENTRAL LOWER MICHIGAN.

.LOCAL AREA AFFECTED...

ABNORMALLY DRY /D0/ TO MODERATE /D1/ DROUGHT EXIST ACROSS GRANT COUNTY IN SOUTHWEST WISCONSIN AND CLAYTON COUNTY IN NORTHEAST IOWA.

ABNORMALLY DRY /D0/ CONDITIONS EXIST ACROSS CLARK AND TAYLOR COUNTIES IN NORTH CENTRAL WISCONSIN...ADAMS AND JUNEAU COUNTIES IN CENTRAL WISCONSIN...CRAWFORD...RICHLAND...AND VERNON COUNTIES IN SOUTHWEST WISCONSIN...AND ALLAMAKEE...CHICKASAW...FAYETTE...FLOYD...AND WINNESHIEK COUNTIES IN NORTHEAST IOWA.

.STATE AND LOCAL ACTIONS...

NO KNOWN STATE OR LOCAL ACTIONS ARE CURRENTLY TAKING PLACE.

.CLIMATOLOGICAL SUMMARY...

SINCE MARCH 1 2005...PRECIPITATION DEFICITS RANGED FROM TWO TO FOUR INCHES ACROSS PORTIONS OF NORTHEAST IOWA...AND WESTERN AND NORTHERN WISCONSIN...AND FROM FOUR TO AS MUCH AS TWELVE INCHES ACROSS SOUTHERN AND EASTERN WISCONSIN.

.SOIL MOISTURE CONDITIONS...AS OF OCTOBER 25TH...THE MIDWESTERN REGIONAL CLIMATE CENTER /MRCC/ INDICATED SOIL MOISTURE DEFICITS UP TO TWO AND HALF INCHES ACROSS PORTIONS OF THE SOUTHERN WISCONSIN...NORTHERN ILLINOIS...AND NORTHEAST AND SOUTHERN IOWA.

.GROUNDWATER CONDITIONS...THE CURRENT WELL WATER LEVEL IS 6.97 FEET BELOW GROUND LEVEL AS OF 7 AM ON OCTOBER 25TH JUST WEST OF TOMAH WISCONSIN IN MONROE COUNTY. THIS LEVEL IS SLIGHTLY LOWER THAN THE 6.72 FEET BELOW GROUND LEVEL AS OF 7 AM ON OCTOBER 11TH. NORMALLY THE WATER LEVEL SHOULD 4.95 FEET BELOW GROUND LEVEL. THE LOWEST LEVEL ON RECORD IN OCTOBER WAS 8.62 FEET BELOW THE

GROUND LEVEL IN OCTOBER 1987. THE HIGHEST LEVEL ON RECORD WAS 1.94 FEET BELOW GROUND LEVEL IN OCTOBER 1972. THE PERIOD OF RECORD EXTENDS FROM OCTOBER 1949 THROUGH THE PRESENT.

.RIVER AND STREAM FLOW CONDITIONS...

WITH PRECIPITATION DURING THE PAST TWO WEEKS BEING BELOW NORMAL...RIVER FLOWS HAVE DECREASED ACROSS THE REGION. WHEN COMPARED TO CLIMATOLOGY...THE LOWEST FLOWS ARE REPORTED ALONG THE BLACK AND WISCONSIN RIVERS IN WESTERN WISCONSIN...AND BLOODY RUN CREEK AND LITTLE CEDAR RIVER IN NORTHEAST IOWA.

.AGRICULTURE IMPACTS...

RECENT DRY WEATHER HAS CAUSED SOME DETERIORATION IN THE TOP AND SUB SOIL MOISTURE CONDITIONS. THE FOLLOWING EXCERPT IS FROM USDA/S WISCONSIN CROP WEATHER ON OCTOBER 24 2005...

IN GRANT COUNTY...THE CORN HAS VERY GOOD QUANTITY AND QUALITY. COMBINES ARE RUNNING REALLY SLOW...BECAUSE VERY LARGE YIELDS IN OUR AREA. SOYBEANS ARE ALSO A LARGER CROP THEN WAS EXPECTED. A LITTLE WINTER WHEAT HAS BEEN PLANTED AND EMERGED... BUT NOT A LOT HAS BEEN PLANTED. TOP SOIL IS VERY DRY.

.FIRE DANGER HAZARDS...

AS OF THE MORNING OF OCTOBER 25TH...THE DEPARTMENT OF NATURAL RESOURCES REPORTED MODERATE FIRE DANGER ACROSS SOUTHWEST WISCONSIN...AND LOW FIRE DANGER ACROSS CENTRAL...WEST CENTRAL... AND NORTH CENTRAL WISCONSIN AND SOUTHEAST MINNESOTA.

CITIZENS SHOULD ALWAYS CHECK WITH LOCAL OFFICIALS IN THEIR AREA BEFORE UNDERTAKING ANY OUTSIDE BURNING. CITIZENS ARE LIABLE FOR DAMAGES AND SUPPRESSION COSTS OF ANY WILDFIRE THEY MAY START.

.PRECIPITATION/TEMPERATURE OUTLOOKS...

FROM OCTOBER 25TH THROUGH NOVEMBER 1ST...TEMPERATURES WILL AVERAGE AT OR ABOVE NORMAL AND PRECIPITATION WILL BE BELOW NORMAL. DURING THIS TIME FRAME...THE DAILY AVERAGE TEMPERATURE IS AROUND 45 DEGREES AND THE NORMAL PRECIPITATION IS JUST UNDER A HALF INCH.

BEYOND THIS TIME FRAME THE 8 TO 14 DAY FORECAST FROM THE CLIMATE PREDICTION CENTER /CPC/ FOR THE PERIOD NOVEMBER 2ND TO NOVEMBER 8TH CALLS FOR ABOVE NORMAL TEMPERATURES AND BELOW NORMAL PRECIPITATION. DURING THIS TIME FRAME...THE DAILY AVERAGE TEMPERATURE IS AROUND 40 DEGREES AND THE NORMAL PRECIPITATION IS JUST OVER A HALF INCH.

BOTH THE 30 AND 90 DAY OUTLOOKS CALL FOR EQUAL CHANCES FOR BELOW...ABOVE...AND NEAR NORMAL TEMPERATURES AND PRECIPITATION.

.QUESTIONS OR COMMENTS...

IF YOU HAVE ANY QUESTIONS OR COMMENTS ABOUT THIS DROUGHT INFORMATION PLEASE CONTACT...

NAME
DROUGHT FOCAL POINT
NATIONAL WEATHER SERVICE
LA CROSSE WI 54601-3038
TELEPHONE 608-784-8275
E-MAIL ADDRESS

.RELATED WEB SITES...ALL LINKS SHOULD BE IN SMALL LETTERS

LOCAL DROUGHT SITE...
LOCAL WEB SITE ADDRESS FOR DROUGHT PAGE
U.S. DROUGHT MONITOR...
[HTTP://WWW.DROUGHT.UNL.EDU/DM/MONITOR.HTML](http://WWW.DROUGHT.UNL.EDU/DM/MONITOR.HTML)
NOAA DROUGHT PAGE...
[HTTP://WWW.DROUGHT.NOAA.GOV/](http://WWW.DROUGHT.NOAA.GOV/)

MIDWESTERN REGIONAL CLIMATE CENTER /MRCC/...
HTTP://MCC.SWS.UIUC.EDU/INDEX.JSP
ADDITIONAL RIVER INFORMATION...
NWS - HTTP://WWW.WEATHER.GOV/AHPS/
USGS - HTTP://WATER.USGS.GOV/
COE - HTTP://WWW.MVR.USACE.ARMY.MIL/
CLIMATE PREDICTION CENTER /CPC/...
HTTP://WWW.CPC.NCEP.NOAA.GOV/

.ACKNOWLEDGEMENTS...

THE DROUGHT MONITOR IS A MULTI-AGENCY EFFORT INVOLVING NOAA/S NATIONAL WEATHER SERVICE AND NATIONAL CLIMATIC DATA CENTER...THE USDA...STATE AND REGIONAL CENTER CLIMATOLOGISTS AND THE NATIONAL DROUGHT MITIGATION CENTER. INFORMATION FOR THIS STATEMENT HAS BEEN GATHERED FROM NWS AND FAA OBSERVATION SITES...STATE COOPERATIVE EXTENSION SERVICES...THE USDA...COE AND USGS.

.NEXT ISSUANCE...

THIS PRODUCT WILL BE UPDATED ON THURSDAY NOVEMBER 11TH.
\$\$

NAME

3. Example Drought Information Statement II.

DROUGHT STATEMENT
NATIONAL WEATHER SERVICE SPRINGFIELD MO
1259 PM CST THU NOV 3 2005

...ABNORMALLY DRY CONDITIONS REMAIN IN PORTIONS OF THE OZARKS DESPITE RECENT RAINS...

.SYNOPSIS...A PROGRESSIVE UPPER LEVEL PATTERN WILL ALLOW A SURFACE LOW TO MAKE ITS WAY EAST ACROSS THE CENTER OF THE COUNTRY THROUGH MONDAY. SOME MOISTURE IS ASSOCIATED WITH THIS SYSTEM BUT THE AMOUNTS MAY BE MUCH LIGHTER THAN WHAT WAS RECEIVED ACROSS THE OZARKS ON HALLOWEEN. AFTER THE LOW LIFTS TO THE NORTHEAST NEXT WEEK...SURFACE HIGH PRESSURE AND DRY CONDITIONS LOOK TO MAKE A RETURN VISIT TO THE REGION AHEAD OF ANOTHER SYSTEM BY MIDWEEK.

MOST SMALL STREAMS...CREEKS AND LARGER RIVERS CONTINUE TO FEEL THE IMPACT OF OVERALL BELOW NORMAL RAINFALL...AND ARE RUNNING NEAR TO BELOW NORMAL ACROSS SOUTHERN MISSOURI. A FEW STREAMS WERE BEGINNING TO DROP TO NEAR RECORD LOW FLOWS. WATER TABLE LEVELS WERE STILL SLIGHTLY BELOW NORMAL FOR MANY LOCATIONS.

.LOCAL AREAS AFFECTED...ABNORMALLY DRY /D0/ CONDITIONS CONTINUE TO AFFECT PORTIONS OF EXTREME SOUTHEASTERN KANSAS AND SOUTHWESTERN AND SOUTH CENTRAL MISSOURI. THE COUNTIES INCLUDE...

IN KANSAS...

CHEROKEE.

IN MISSOURI...

JASPER...MCDONALD...NEWTON...STONE...BARRY...LAWRENCE...TANEY...DOUGLAS...OZARK...HOWELL...OREGON...BARTON...DADE.

FOR THE LATEST DROUGHT MONITOR INFORMATION GO TO...

HTTP://WWW.DROUGHT.UNL.EDU/DM/MONITOR.HTML

.STATE AND LOCAL ACTIONS...THE STATE OF MISSOURI DROUGHT ADVISORY COMMITTEE CONTINUES TO MONITOR THE DRY CONDITIONS IN THE STATE.

ADDITIONAL INFORMATION CAN BE OBTAINED FROM THE MISSOURI DEPARTMENT OF NATURAL RESOURCES WEB SITE AT...

[HTTP://WWW.DNR.MO.GOV/ENV/WRC/DROUGHTUPDATE.HTM](http://www.dnr.mo.gov/env/wrc/droughtupdate.htm)

.CLIMATE SUMMARY...THE MEDIUM RANGE OUTLOOK FOR THE 6-10 AND 8-14 DAY TIME FRAMES INDICATE ABOVE NORMAL TEMPERATURES AND BELOW NORMAL RAINFALL DURING THE 6-10 DAY PERIOD... TRANSITIONING INTO ABOVE NORMAL TEMPERATURES AND RAINFALL FOR THE 8-14 DAY PERIOD. BELOW ARE CURRENT RAINFALL CONDITIONS FROM SELECTED STATIONS ACROSS MISSOURI:

LOCATION	PRECIPITATION /INCHES/			PRECIPITATION /INCHES/		
	SINCE JAN 1	NORMAL	DEP	SINCE SEPT 1	NORMAL	DEP
SPRINGFIELD	32.22	37.60	-5.38	7.77	8.56	-0.79
JOPLIN	31.17	39.31	-8.14	5.89	9.42	-3.53
WEST PLAINS	31.75	37.69	-5.94	7.01	7.70	-0.69
VICHY/ROLLA	35.87	33.69	+2.18	9.20	7.00	+2.20
COLUMBIA	39.18	34.56	+4.62	8.57	6.82	+1.75
ST. LOUIS	33.28	32.40	+0.88	6.82	5.94	+0.88
KANSAS CITY	41.26	34.30	+6.96	7.71	8.32	-0.52
ST. JOSEPH	40.46	31.90	+8.56	6.70	7.45	-0.75

.SURFACE MOISTURE CONDITIONS...SOIL MOISTURE OVER ALL BUT THE EXTREME SOUTHWESTERN PORTIONS OF THE MISSOURI OZARKS WERE NEAR NORMAL IN RESPONSE TO THE RAINFALL DURING THE PAST MONTHS. HOWEVER...CURRENT READINGS INDICATE THAT LOCATIONS IN THE EXTREME SOUTHWESTERN MISSOURI OZARKS ARE 1 TO 3 INCHES BELOW NORMAL FOR THIS TIME OF YEAR. ADDITIONAL INFORMATION CAN BE OBTAINED FROM THE CLIMATE PREDICTION CENTER'S (CPC) WEB SITE AT...

[HTTP://WWW.CPC.NCEP.NOAA.GOV/SOILMST/W.SHTML](http://www.cpc.ncep.noaa.gov/soilmst/w.shtml)

.RIVER AND STREAM FLOW CONDITIONS...SOME MUCH NEEDED RAINS FELL OVER ALL BUT EXTREME SOUTHEAST KANSAS AND SOUTHWEST MISSOURI AT THE END OF OCTOBER. THIS ALLOWED SOME RIVERS AND STREAMS ACROSS THE MISSOURI OZARKS TO RISE TO NEAR NORMAL LEVELS. CURRENTLY THE BIG ELK RIVER...LINDLEY CREEK...AND CEDAR CREEK ARE RUNNING BELOW NORMAL. ADDITIONAL INFORMATION FOR YOUR AREA CAN BE OBTAINED FROM THE USGS WATER WATCH WEB SITE...WHICH INCLUDES INFORMATION ON CURRENT FLOW AND HOW IT RELATES TO NORMAL. IT CAN BE FOUND AT THE FOLLOWING WEB SITES...

[HTTP://WATER.USGS.GOV/WATERWATCH/](http://water.usgs.gov/waterwatch/)
[HTTP://WWW.WEATHER.GOV/AHPS/](http://www.weather.gov/ahps/)

.AGRICULTURAL IMPACTS...HARVESTING OF FALL CROPS CONTINUED TO MOVE AHEAD OF NORMAL...AS DRY WEATHER PREVAILED THROUGHOUT THE STATE. TOPSOIL MOISTURE RATINGS ARE REPORTED AS 18 PERCENT VERY SHORT...27 PERCENT SHORT...53 PERCENT ADEQUATE AND 2 PERCENT SURPLUS...A SLIGHT DECLINE FROM A WEEK EARLIER IN THE MOST AREAS.

SUBSOIL MOISTURE RATINGS ARE REPORTED AS 20 PERCENT VERY SHORT...34 PERCENT SHORT...45 PERCENT ADEQUATE AND 1 PERCENT SURPLUS. THE SOUTHERN THIRD OF THE STATE CONTINUES TO BE THE DRIEST AREA...WITH THE MOST SIGNIFICANT SHORTAGES REPORTED IN THE SOUTHWEST DISTRICT. FARMERS AVERAGED 6.4 DAYS SUITABLE FOR FIELD WORK. PASTURE CONDITION RATINGS AVERAGED 18 PERCENT VERY POOR...23 PERCENT POOR...36 PERCENT FAIR...21 PERCENT GOOD AND 2 PERCENT EXCELLENT...SIMILAR TO A WEEK EARLIER. RATINGS CONTINUE TO BE THE LOWEST IN THE SOUTHWEST DISTRICT...WITH 98 PERCENT AVERAGING POOR OR VERY POOR...FOLLOWED BY THE NORTHEAST AND SOUTHEAST DISTRICTS AT 50 PERCENT OR MORE IN THOSE CATEGORIES. STOCK WATER SUPPLIES WERE RATED AS 21 PERCENT VERY SHORT...23 PERCENT SHORT...55 PERCENT ADEQUATE AND 1 PERCENT SURPLUS. ADDITIONAL INFORMATION CAN BE OBTAINED FROM THE USDA WEB SITE AT...

[HTTP://WWW.NASS.USDA.GOV/WEATHER/CPCURR/MO-CROP-WEATHER](http://www.nass.usda.gov/weather/cpcurr/mo-crop-weather)

.FIRE DANGER IMPACTS...THE KEETCH-BYRAM DROUGHT INDEX (KDBI) IS A DROUGHT INDEX THAT IS SPECIFICALLY RELATED TO FIRE POTENTIAL. THE KDBI IS BROKEN INTO FOUR CATEGORIES WHICH INDICATE THE SUSCEPTIBILITY OF GROUND FUELS TO FIRE DANGER. BELOW ARE THE FOUR CATEGORIES AND A BRIEF DESCRIPTION OF EACH.

KDBI 0 TO 200 - LOW.....WET WITH LITTLE DANGER OF FIRE INITIATION
KDBI 201 TO 400 - MODERATE..DRYING OCCURRING WITH SOME FIRE DANGER
KDBI 401 TO 600 - HIGH.....GROUND COVER DRY AND WILL BURN READILY
KDBI 601 TO 800 - EXTREME...DEAD AND LIVE FUELS WILL BURN READILY

THE CURRENT KDBI FOR THE MISSOURI OZARKS IS...

EXTREME SOUTHEAST KANSAS AND SOUTHWEST MISSOURI...HIGH
THE REMAINDER OF THE MISSOURI OZARKS...MODERATE

RECENT RAINFALL HELPED MITIGATE THE DRY CONDITIONS OVER ALL BUT EXTREME SOUTHEAST KANSAS AND SOUTHWEST MISSOURI WHERE LITTLE BENEFICIAL RAIN FELL. THE 100 AND 1000 HOUR DEAD FUEL STICK MOISTURES INDICATED DRY CONDITIONS ACROSS MUCH OF THE OZARKS. 100-H FUEL STICKS ACROSS THE REGION WERE GREATER THAN 20 PERCENT. 1000-H FUEL STICKS ACROSS THE AREA ARE ALSO GREATER THAN 20 PERCENT. ADDITIONAL INFORMATION FOR OTHER PARTS OF MISSOURI AND KANSAS CAN BE OBTAINED FROM THE WILDLAND FIRE ASSESSMENT SYSTEM (WFAS) WEB SITE AT...

[HTTP://WWW.FS.FED.US/LAND/WFAS/WELCOME.HTM](http://www.fs.fed.us/land/wfas/welcome.htm)

.PRECIPITATION/TEMPERATURE OUTLOOKS...THE 30 DAY OUTLOOK INDICATES ABOVE NORMAL TEMPERATURES AND EQUAL CHANCES FOR ABOVE...BELOW OR NORMAL RAINFALL. THE 90 DAY PRECIPITATION AND TEMPERATURE OUTLOOK FOR THE PERIOD OCTOBER THROUGH DECEMBER INDICATES ABOVE NORMAL TEMPERATURES AND ABOVE NORMAL CHANCES FOR PRECIPITATION FOR EXTREME SOUTHWEST MISSOURI AND SOUTHEAST KANSAS. ADDITIONAL INFORMATION CAN BE OBTAINED FROM THE CLIMATE PREDICTION CENTERS (CPC) OUTLOOK WEB SITE AT...

[HTTP://WWW.CPC.NCEP.NOAA.GOV/PRODUCTS/PREDICTIONS/30DAY/](http://www.cpc.ncep.noaa.gov/products/predictions/30day/)

.ACKNOWLEDGEMENTS...THE DROUGHT MONITOR IS A MULTI-AGENCY EFFORT INVOLVING NOAA/S NATIONAL WEATHER SERVICE AND NATIONAL CLIMATIC DATA CENTER...THE USDA...STATE AND REGIONAL CENTER CLIMATOLOGISTS AND THE NATIONAL DROUGHT MITIGATION CENTER. INFORMATION FOR THIS STATEMENT HAS BEEN GATHERED FROM NWS AND FAA OBSERVATION SITES...COOPERATIVE AND VOLUNTEER OBSERVATIONS...USDAFS...THE USDA AND USGS.

.QUESTIONS OR COMMENTS...IF YOU HAVE ANY QUESTIONS OR COMMENTS ABOUT THIS INFORMATION PLEASE CONTACT:

NAME
CLIMATE SERVICES FOCAL POINT
NATIONAL WEATHER SERVICE
CITY STATE
E-MAIL ADDRESS

Appendix D – Other Available Drought Media

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1. Introduction. Two additional means of addressing drought and providing a service are through the Internet and through press releases. The following two sections provide examples of these forms of information delivery.

2. Web Drought Template Example.

Precipitation Still Needed

Updated on Thursday, November 10, 2005 - [Author](#)
 Next Scheduled Update on Friday, November 25, 2005

Summary:

From October 25th through November 8th, a half to one inch of precipitation fell from the Oelwein and Strawberry Point areas in northeast Iowa northeast to the Mather and Wisconsin Dells areas in central Wisconsin. The greatest precipitation total in this area was reported in Cuba City, Wisconsin (Grant County) where 1.02 inches of precipitation fell. Meanwhile the remainder of the area saw less than a quarter inch. Normally an inch of precipitation falls during this time period; therefore, the precipitation deficits continued to increase across the region. Drought conditions still exist across parts of Grant County in southwest Wisconsin and Clayton County in northeast Iowa. Meanwhile abnormally dry (**D0**) conditions are still reported across much of north-central, central, and southwest Wisconsin and northeast Iowa.

In the November 8th release of the U.S. Drought Monitor, abnormally dry (**D0**) conditions covered much of northern and southwest Wisconsin; and first level (**D1**) to extreme drought (**D3**) extended from southwest Iowa northeast into southern Lower Michigan.

The **U.S. Drought Monitor** is a weekly collaborative effort between a number of federal agencies including NOAA/NWS, U.S. Department of Agriculture and the National Drought Mitigation Center. Details and explanations of the Drought Monitor can found at the web site:

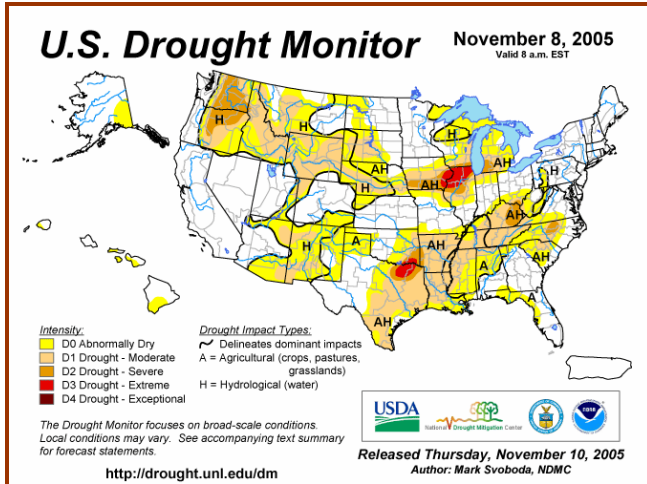
<http://www.drought.unl.edu/dm/monitor.html>

The categories of drought are defined as follows:

Abnormally Dry (D0) - Going into drought: short-term dryness slowing planting, growth of crops or pastures; fire risk above average. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered.

Moderate Drought (D1) - Some damage to crops, pastures; fire risk high; streams, reservoirs, or wells low, some water shortages developing or imminent, voluntary water use restrictions requested.

Severe Drought (D2) - Crop or pasture losses likely; fire risk very high; water shortages common; water restrictions



imposed.

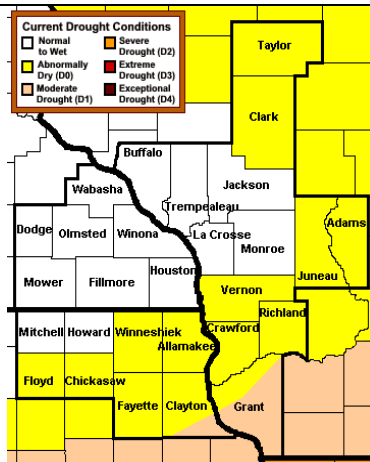
Extreme Drought (D3) - Major crop/pasture losses; extreme fire danger; widespread water shortages or restrictions.

Exceptional Drought (D4) - Exceptional and widespread crop/pasture losses; exceptional fire risk; shortages of water in reservoirs, streams, and wells, creating water emergencies.

Local Area Affected:

Abnormally dry (D0) to moderate drought (D1) exists across Grant County in southwest Wisconsin and Clayton County in northeast Iowa.

Meanwhile abnormally dry (D0) conditions still exist across Clark and Taylor Counties in north-central Wisconsin; Adams and Juneau Counties in central Wisconsin; Crawford, Richland, and Vernon Counties in southwest Wisconsin; and Allamakee, Chickasaw, Fayette, Floyd, and Winneschick Counties in northeast Iowa.



State and Local Actions:

No known state or local actions are currently taking place.

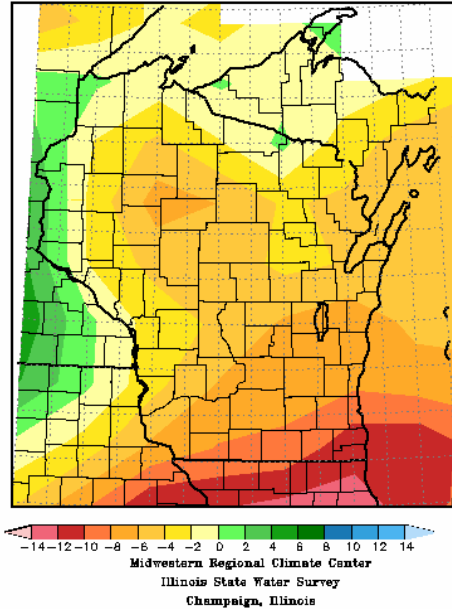
Climatological Summary:

Since March 1, 2005, precipitation deficits ranged from two to four inches across portions of northeast Iowa; and western and northern Wisconsin; and from four to as much as ten inches across southern and eastern Wisconsin.

The image below is compliments of the Midwestern Regional Climate

Center (MRCC) and it provides more specifics on where these precipitation deficits exist.

Total Precipitation Departure from Mean in Inches
March 1, 2005 to November 8, 2005



Soil Moisture Conditions:

As of November 8th, the Midwestern Regional Climate Center (MRCC) indicated soil moisture deficits up to two and half inches across portions of the southern Wisconsin; northern Illinois; and northeast and southern Iowa. The image below is from the MRCC.

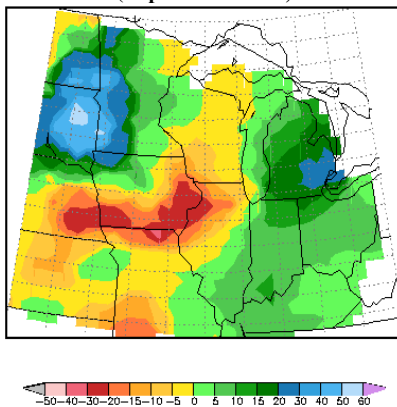
Additional information about **soil moisture conditions** can be found either at the **Midwestern Regional Climate Center (MRCC)** at:

<http://mcc.sws.uiuc.edu/cliwatch/drought/moisture.htm>

or at the **NWS Climate Prediction Center (CPC)** web site at:

<http://www.cpc.noaa.gov/products/soilmst/w.html>

Current Soil Moisture Deviation as of November 8th
(Depth 0-72 inches)



Ground Water Impacts:

On November 8th, the well water level just west of Tomah, Wisconsin (Monroe County) was 7.15 feet below ground level. This level is slightly lower than the 6.96 feet below ground level on October 25th.

Additional information about **ground levels** can be found either at the **USGS Ground-Water Climate Response**

Normally the water level should be 5.00 feet below ground level. The lowest water level on record was 8.62 feet below the ground level on October 7, 1987. The highest water level on record was 0.48 feet below ground level on September 29, 1965. The period of record extends from October 1949 through the present.

Network at:

<http://groundwaterwatch.usgs.gov/>

River and Stream Flow Conditions:

With precipitation during the past two weeks being generally below normal, river flows have decreased some across the region. When compared to climatology, the lowest flows are reported along the Black and Wisconsin Rivers in western Wisconsin and Little Cedar River in northeast Iowa.

Hourly and forecast river stages out to 90 days can be found at the **National Weather Service's (NWS) Advanced Hydrologic Prediction Service (AHPS)** web page:

<http://www.crh.noaa.gov/cgi-bin/ahps.cgi?arx>

Listed below are some current (November 8th) river and stream flows versus long term mean in cubic feet per second (cfs). These are for selected rivers and streams in our service area with long periods of record as measured by the United States Geological Survey (USGS).

Additional Current stream and river stages may be viewed at the following **USGS web site:**

<http://water.usgs.gov/waterwatch/>

USGS River Flow Values as of November 8, 2005				
River	Location	Flow (cfs)	Long-term mean for this date (cfs)	Percent of Normal Flow
Black	Galesville, WI*	504	1370	36.8
	Neillsville, WI*	67	410	16.3
Cedar	Charles City, IA*	348	474	73.4
Grant	Burton, WI*	104	139	74.8
Kickapoo	La Farge, WI*	121	154	78.6
	Steuben, WI*	369	429	86.0
Little Cedar	Ionia, IA	48	112	42.9
Platte	Rockville, WI*	51	71.2	57.6
Trempealeau	Dodge, WI*	374	384	97.4
Turkey	Garber, IA*	355	562	63.2
Upper Iowa	Decorah, IA*	193	219	88.1
	Dorchester, IA*	318	372	85.5
Wisconsin	Muscodia, WI*	4100	8004	51.2

* These sites have current stage and even forecast out to 90 days can be viewed at the [National Weather Service's Advanced Hydrologic Prediction Service \(AHPS\) web page.](#)

Agriculture Impacts:

With below normal precipitation during the past two weeks, there has been some deterioration in the top and subsoil moisture conditions. In the table below, there is a summary of the topsoil moisture supply across Wisconsin, and top and subsoil moisture supply in Iowa from the USDA National Agricultural Statistics Service (NASS) summary.

Soil moisture supply measures how much moisture is present in cropland topsoil during the week. Soil moisture is reported as a percentage. The categories very short, short, adequate and surplus must add up to 100%.

Very Short - Soil moisture supplies are

NASS Soil Moisture Supply in Iowa & Wisconsin							
State	Subsoil or TopSoil	Region	Percent				Conditions as of
			Very Short	Short	Adequate	Surplus	
Iowa	TopSoil	North Central	2	25	58	15	November 6th
		Northeast	12	18	69	1	
		State	26	32	39	3	
	SubSoil	North Central	2	15	69	14	
		Northeast	22	26	49	3	
		State	30	30	38	2	
Wisconsin	Topsoil	North Central	0	21	78	1	November 4th
		West Central	2	21	74	3	
		Central	0	10	80	10	
		South west	3	14	83	0	
		State	6	26	65	3	

significantly less than what is required for normal plant development. Growth has been stopped, or nearly so, and plants are showing visible signs of moisture stress. Under these conditions, plants will quickly suffer irreparable damage.

Short - Soil dry. Seed germination and/or normal crop growth and development would be curtailed.

Adequate - Soil moist. Seed germination and/or crop growth and development would be normal or unimpeded.

Surplus - Soil wet. Fields may be muddy and will generally be unable to absorb additional moisture. Young developing crops may be yellowing from excess moisture.

The following excerpt is from [USDA's Wisconsin Crop Weather](#) on November 7, 2005:

“In Grant County, the corn yields are very good at 160 to 210 bushels. Soybeans also have very high yields. Moisture is way down in corn and soybeans. Most of the problem is storage for a very good crop of corn. Cribs are full, and the rest has to be shelled. Prices are very low for both corn and soybeans. No real hard frost yet; however, there has been some white frost from time to time. Most alfalfa fields are green and some fourth crop hay was made this week. Not much fall tillage has been done yet. There is not much topsoil moisture. A little rain fell on Sunday, but not much.”

The map below lists the Agricultural Districts in southeast Minnesota, western Wisconsin, and northeast Iowa.



For additional information on agriculture impacts may be viewed at the **United States Department of Agriculture (USDA) National Agricultural Statistics Service NASS** web site:

http://www.nass.usda.gov/Publications/State_Crop_Progress_and_Conditions/index.asp

Fire Danger Hazards:

As of the afternoon of November 8th, very high fire danger was reported across southwest Wisconsin. Moderate fire danger was reported across central and west-central Wisconsin; and southeast Minnesota. Finally, low to moderate fire danger was reported in north central Wisconsin.

The current Keetch-Byram Drought Index (KBDI) for southwest Wisconsin is moderate and it is low across the remainder of the northeast Iowa, southeast Minnesota, and western Wisconsin.

Below normal precipitation during the past 2 weeks has caused both the

For updated **DNR Fire Conditions** consult the following web sites:

In Minnesota:

<http://www.dnr.state.mn.us/forestry/fire/index.html>

In Wisconsin:

http://workplan.org/forestry/firereport/public/reports/wdnr-fire_report.asp

The **Keetch-Byram Drought Index**

100 and 1000 hour dead fuel stick moistures (16 to 20 percent) to continue to gradually dry out across the region.

As a reminder, citizens should always check with local officials in their area before undertaking any outside burning. Citizens are liable for damages and suppression costs of any wildfire they may start.

(KBDI) is a drought index that is specifically related to fire potential. The KBDI is broken into four categories which indicate the susceptibility of ground fuels to fire danger. Below are the four categories and a brief description of each.

Keetch-Byram Drought Index (KBDI)	
KBDI Value	Description of Fire Potential
0 to 200	Low - Wet with little danger of fire initiation
201 to 400	Moderate - Drying occurring with some fire danger
401 to 600	High - Ground cover dry and will burn readily
601 to 800	Extreme - Dead and live fuels will burn readily

KBDI and Dead Fuel Moisture data can be found on the Wildland Fire Assessment System (WFAS) web site at:

<http://www.fs.fed.us/land/wfas/wfas10.html>

Precipitation/Temperature Outlooks:

From November 10th to 16th, temperatures will average at or above normal and precipitation will be below normal. During this time frame, the daily average temperature ranges from 35 to 40 degrees and the normal precipitation is around a half inch.

Beyond this time frame the 8 to 14 day forecast from the Climate Prediction Center (CPC) for the period November 16th to November 22nd calls for equal chances of below, above, and near normal temperatures and precipitation. During this time frame, the daily average temperature ranges from 30 to 35 degrees and the normal precipitation is around a half inch.

Both the 30 and 90 day outlooks call for equal chances for below, above, and near normal temperatures and precipitation.

For updated temperature and precipitation probabilities consult the following **Climate Prediction Center (CPC)** web sites:

8 to 14 Day Outlook:

<http://www.cpc.ncep.noaa.gov/products/predictions/814day/>

30 Day Outlook:

<http://www.cpc.ncep.noaa.gov/products/predictions/30day/>

90 Day Outlook:

http://www.cpc.ncep.noaa.gov/products/predictions/long_range/lead01/off_index.html

Questions or Comments:

If you have any questions or comments about this drought information please contact:

Name
Drought Focal Point
National Weather Service
City, State 99999-9999

Telephone: 999-999-9999
E-mail: Name@noaa.gov

3. Drought Press Release Example.



National Weather Service News Release

FOR IMMEDIATE RELEASE

contact: Jim Allsopp
815-834-0600, ext 726

SEVERE TO EXTREME DROUGHT CONTINUES FOR MUCH OF NORTHERN ILLINOIS

Romeoville, IL – Much of northern Illinois continues to suffer one of the worst droughts on record. The U.S. Drought Monitor, released today, indicates that much of northern Illinois remains in severe to extreme drought. The Drought Monitor is produced by the U.S. Department of Agriculture's National Drought Mitigation Center. The Climate Prediction Center (CPC), a part of the National Oceanic and Atmospheric Administration's (NOAA) National Weather Service (NWS), indicates that in addition to normal rainfall, six to nine more inches of rain is needed during the next several weeks or months to end the drought over Illinois. The drought has severely impacted agriculture in the state.

According to Dr. Jim Angel, Illinois State Climatologist with the Illinois State Water Survey in Champaign, statewide rainfall since March was 15.72 inches, 7.11 inches below normal, making this the seventh driest March-August since 1895 in Illinois. During this same period, northeast Illinois received 13.25 inches, 8.94 inches below normal, making it the third driest March-August on record. "While all of Illinois experienced a dry spring", says Dr. Angel, "southern Illinois received beneficial rains from the remains of tropical storms Arlene in June, Dennis in July, and Katrina in August. As a result, southern Illinois was above normal this summer while central and northern Illinois were much below normal." Statewide summer rainfall was 9.85 inches, 1.71 inches below normal.

Specifically at Rockford, only 3.92 inches of rain fell during the spring months of March, April and May. It was the third driest spring on record. Precipitation data for Rockford goes back to 1906. The summer months of June, July, and August brought 9.00 inches bringing the total for spring and summer to 12.92 inches, more than 10 inches below normal. It was the fourth driest spring-summer ever. At Chicago O'Hare there was 5.00 inches of rain in spring – Chicago's fifth driest ever, and 5.18 in summer – the third driest ever. The spring and summer total of 10.18 inches was the fourth driest ever and 7.91 inches below normal. Chicago weather records go back to 1871 but the official observing site has moved from downtown to the University of Chicago to Midway to

O'Hare. Looking just at Midway data, which goes back to 1928, the summer of 2005 was the driest ever with only 4.58 inches. Spring and summer combined was also the driest on record at Midway with 9.75 inches. To put it in perspective, this summer was drier than 1988 and the dust bowl years of 1934 and 1936 in Chicago.

Dr. Angel said "Because the drought was concentrated in the growing season this year, the majority of the impacts have been in agriculture." At the end of August, pasture was rated as 54 percent poor to very poor and corn was rated as 57 percent poor to very poor. Soybeans fared a little better with only 32 percent rated as poor to very poor. The wheat crop was not injured by the dry weather. In fact, the dry weather tended to reduce the occurrence of plant disease. As a result, wheat yields are estimated to be the second highest on record.

Chris Krause, climate program leader at NWS Chicago explained "The reason for the drought is that during the spring and summer seasons, several Canadian high pressure systems moved southeast across the Great Lakes and Upper Mississippi valley. This type of set up brought in dry Canadian air. In addition, an upper-level ridge of high pressure was persistent over the Great Plains and Midwest much of the summer, which brought spells of dry and very warm temperatures into northern Illinois." On a few occasions, when potential storm-producing fronts did traverse the area, they arrived in the late night and morning hours when the atmosphere is cooler, more stable, and less conducive to producing significant rains.

Although substantial rain fell in mid-August, it has been dry again over northern Illinois since August 20. No rain is forecast through early next week. The eight-to fourteen-day outlook from the CPC, which is valid from September 6 through 12, indicates a 33% chance of seeing either above, below, or near normal precipitation. CPC's outlook for the month of September indicates no specific trend in precipitation. This means there are equal chances of above normal, near normal, and below normal temperature and precipitation. Additionally, the September through November 90-day outlook indicates no specific trend in temperature or precipitation.

Water Survey studies of past droughts in Illinois indicate that most droughts are ended by a month or more of significantly above-normal rainfall followed by an extended period of normal rainfall. "A month or two with rainfall one to two inches above normal this fall will not eliminate the rainfall deficit of almost 9 inches but it may well set the pattern for a drought recovery" said Dr. Angel

For more information from the CPC visit <http://www.cpc.ncep.noaa.gov>. For Chicago or Rockford climate data go to <http://weather.gov/chicago> and click on local climate. For more information from USDA's Drought Monitor go to <http://drought.unl.edu/dm>. For more information on the state climatologists office go to <http://www.sws.uiuc.edu/atmos/statecli/>