

# *2017 Montana Drought The Effect of Timing*



Milk River at the confluence of the Missouri

Governor's Drought & Water Supply Advisory Committee  
September 19, 2017

Michael Downey  
MT DNRC, Water Planner

**Hydrologic Drought:** associated with the effects of precipitation shortfalls on surface or subsurface water supply (i.e., streamflow, reservoir and lake levels, groundwater). The frequency and severity of hydrological drought is often defined on a watershed or river basin scale.

**Agricultural Drought:** agricultural drought links various characteristics of meteorological drought to agricultural impacts, focusing on precipitation shortages, differences between actual and potential evapotranspiration, soil water deficits, reduced groundwater, reservoir levels, etc.

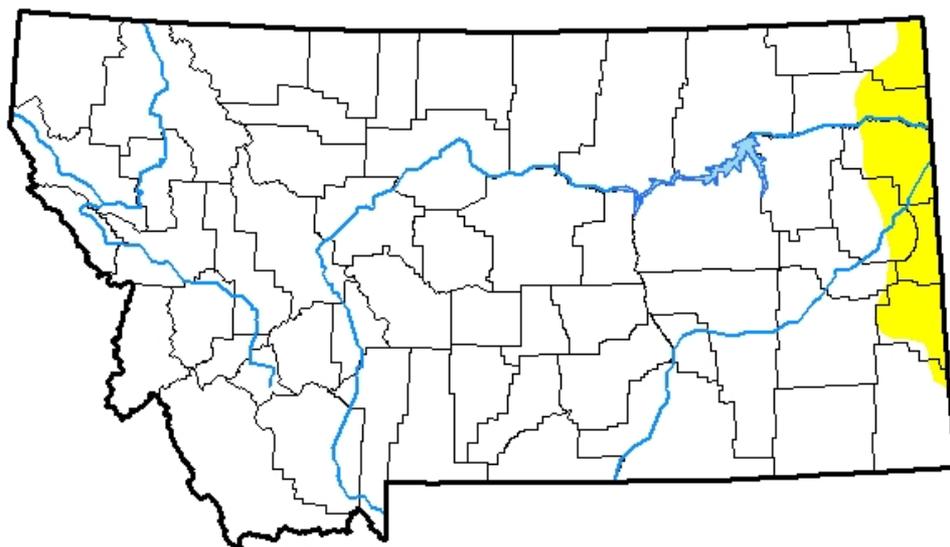


# U.S. Drought Monitor Montana

**May 23, 2017**  
(Released Thursday, May. 25, 2017)  
Valid 8 a.m. EDT

*Drought Conditions (Percent Area)*

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
<b>Current</b>	95.12	4.88	0.00	0.00	0.00	0.00
<b>Last Week</b> <i>05-16-2017</i>	98.45	1.55	0.00	0.00	0.00	0.00
<b>3 Months Ago</b> <i>02-21-2017</i>	82.26	17.74	2.73	0.00	0.00	0.00
<b>Start of Calendar Year</b> <i>01-03-2017</i>	74.25	25.75	4.87	0.00	0.00	0.00
<b>Start of Water Year</b> <i>09-27-2016</i>	55.14	44.86	25.49	5.86	0.33	0.00
<b>One Year Ago</b> <i>05-24-2016</i>	77.72	22.28	7.84	0.00	0.00	0.00



Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

*The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.*

Author:

Brad Rippey  
U.S. Department of Agriculture



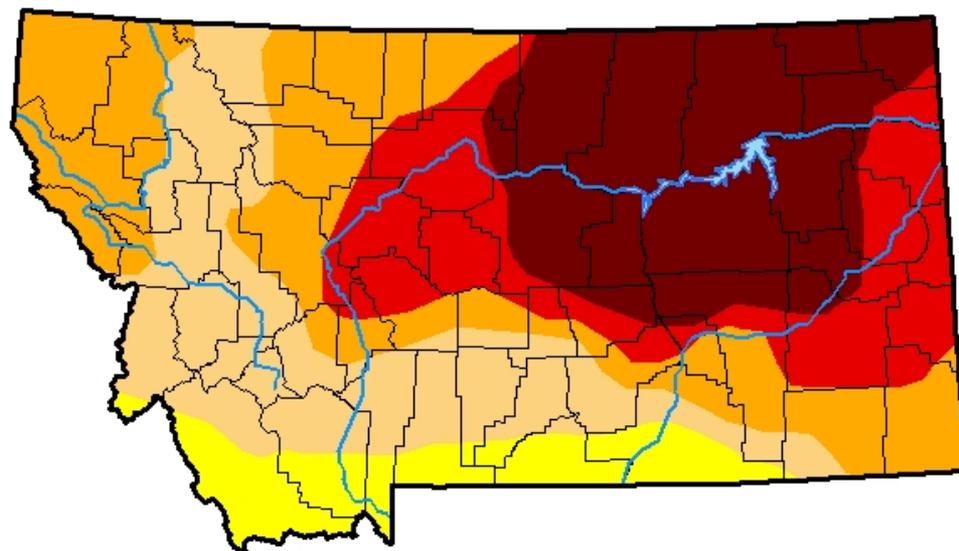
<http://droughtmonitor.unl.edu/>

# U.S. Drought Monitor Montana

**September 5, 2017**  
(Released Thursday, Sep. 7, 2017)  
Valid 8 a.m. EDT

*Drought Conditions (Percent Area)*

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
<b>Current</b>	0.00	100.00	91.22	68.77	43.68	25.97
<b>Last Week</b> <i>08-29-2017</i>	0.03	99.97	90.20	66.01	39.42	24.55
<b>3 Months Ago</b> <i>06-06-2017</i>	63.31	36.69	16.56	0.00	0.00	0.00
<b>Start of Calendar Year</b> <i>01-03-2017</i>	74.25	25.75	4.87	0.00	0.00	0.00
<b>Start of Water Year</b> <i>09-27-2016</i>	55.14	44.86	25.49	5.86	0.33	0.00
<b>One Year Ago</b> <i>09-06-2016</i>	43.00	57.00	24.93	8.08	0.48	0.00



Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

*The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.*

Author:

Deborah Bathke  
National Drought Mitigation Center



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

# U.S. Drought Monitor Montana

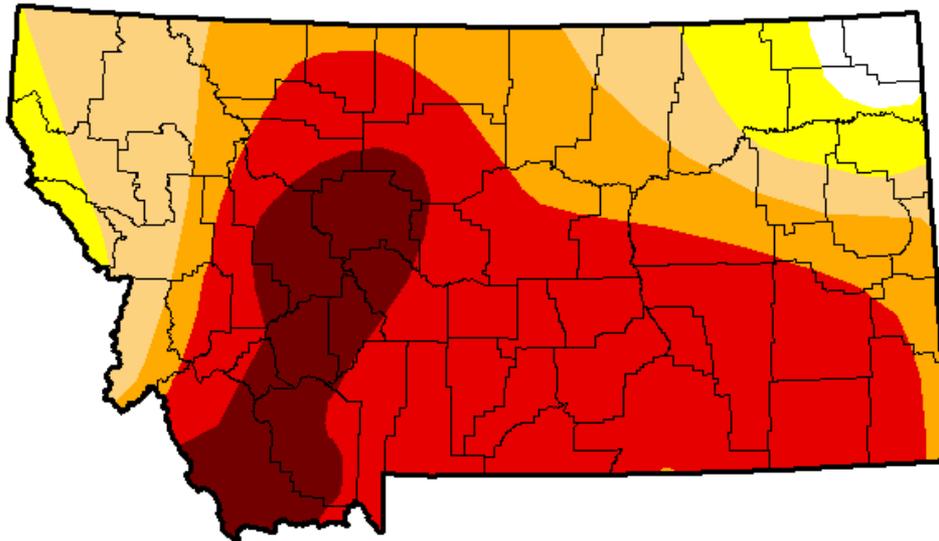
**May 11, 2004**

*(Released Thursday, May. 13, 2004)*

Valid 7 a.m. EST

*Drought Conditions (Percent Area)*

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
<b>Current</b>	2.21	97.79	90.07	74.96	55.62	12.39
<b>Last Week</b> <i>5/4/2004</i>	2.24	97.76	90.07	74.96	55.50	12.39
<b>3 Months Ago</b> <i>2/10/2004</i>	0.00	100.00	89.00	70.23	37.94	6.15
<b>Start of Calendar Year</b> <i>12/30/2003</i>	0.00	100.00	96.96	76.74	40.03	13.21
<b>Start of Water Year</b> <i>9/30/2003</i>	0.00	100.00	96.83	81.36	60.03	12.83
<b>One Year Ago</b> <i>5/13/2003</i>	17.81	82.19	67.34	40.86	2.34	0.00



Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

*The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.*

**Author:**

*David Miskus  
NOAA/NWS/NCEP/CPC*



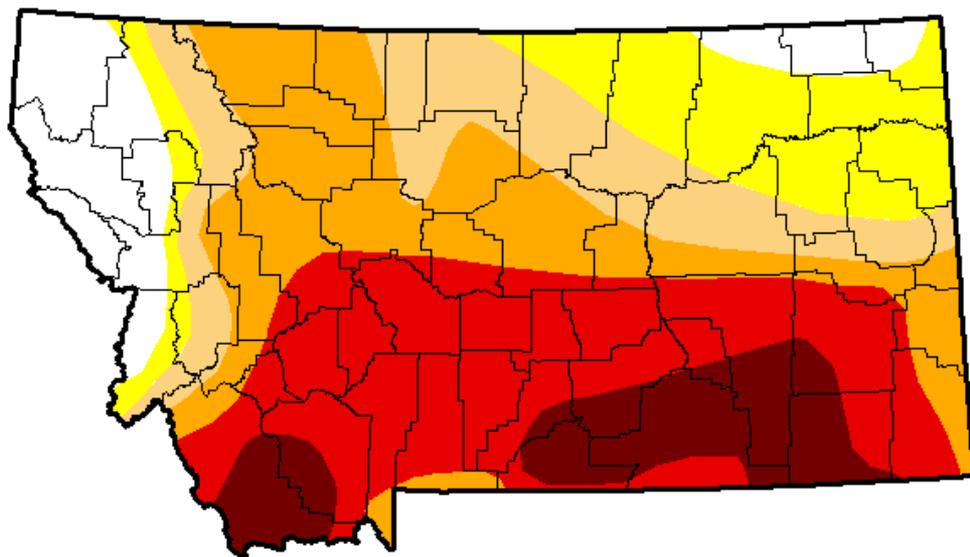
<http://droughtmonitor.unl.edu/>

# U.S. Drought Monitor Montana

**September 7, 2004**  
(Released Thursday, Sep. 9, 2004)  
Valid 7 a.m. EST

*Drought Conditions (Percent Area)*

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
<b>Current</b>	10.75	89.25	74.56	59.28	37.60	10.88
<b>Last Week</b> <i>8/31/2004</i>	10.65	89.35	74.56	59.28	37.50	10.88
<b>3 Months Ago</b> <i>6/6/2004</i>	11.63	88.37	79.38	60.82	37.71	2.97
<b>Start of Calendar Year</b> <i>12/30/2003</i>	0.00	100.00	96.96	76.74	40.03	13.21
<b>Start of Water Year</b> <i>9/30/2003</i>	0.00	100.00	96.83	81.36	60.03	12.83
<b>One Year Ago</b> <i>9/9/2003</i>	0.00	100.00	95.84	88.34	64.12	13.65



***Intensity:***

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

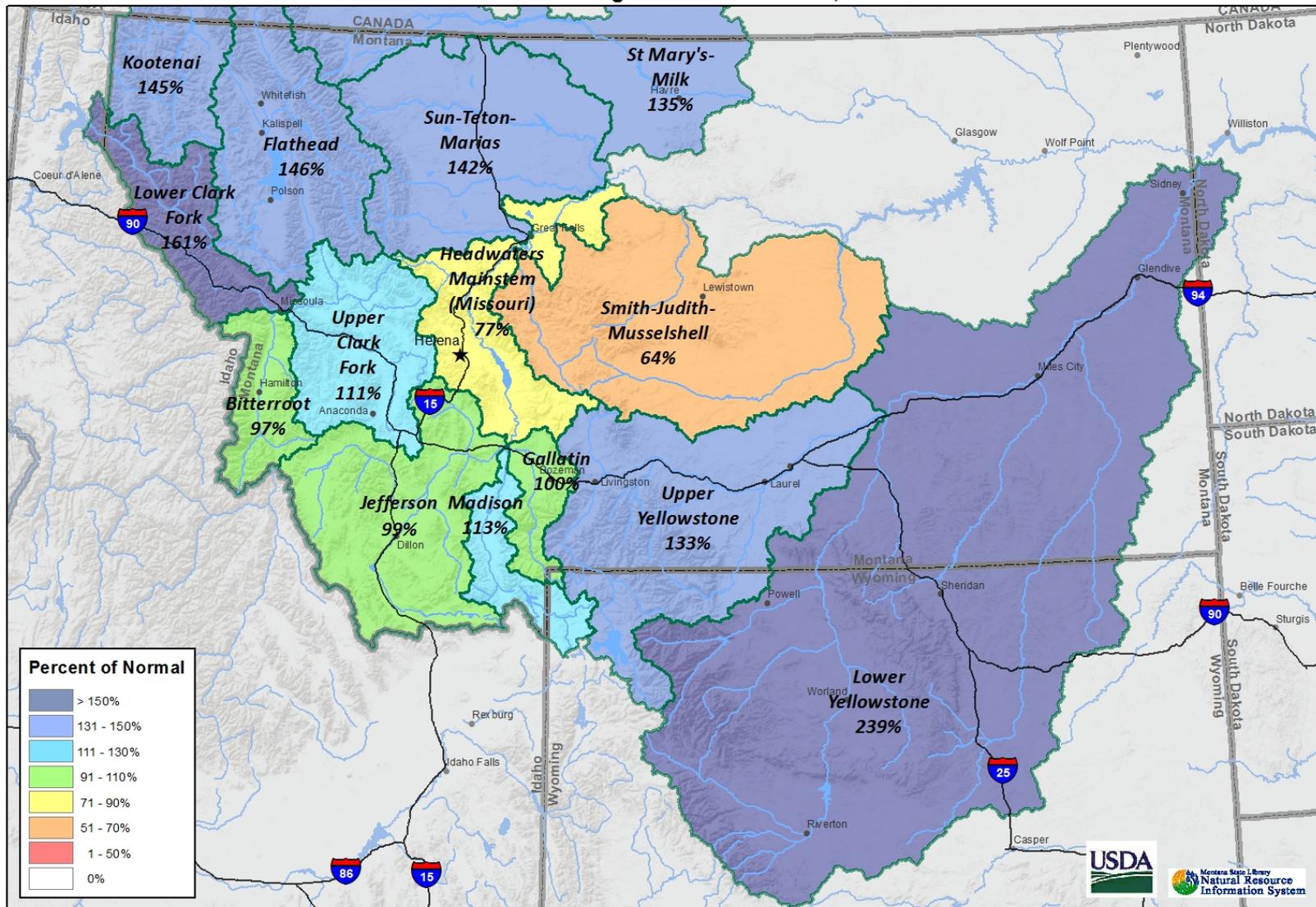
*The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.*

**Author:**  
*Douglas Le Comte*  
CPC/NOAA



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

**Montana Data Collection Office  
Current Snow Water Equivalent  
Basin Percentage of Normal - June 1, 2017**

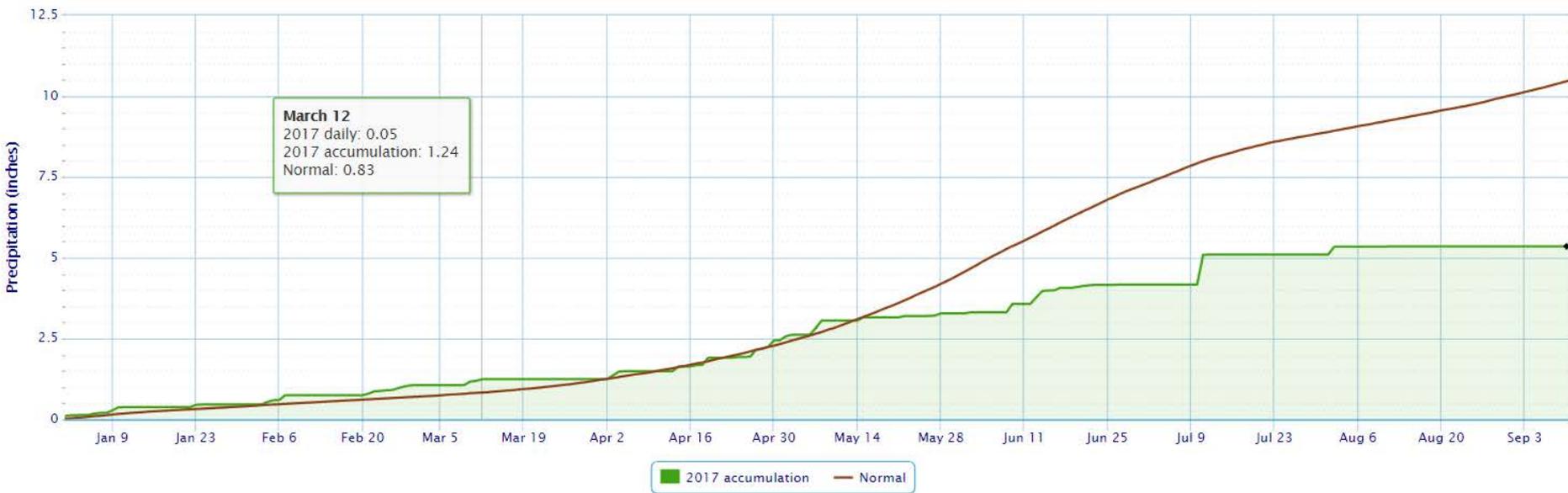


Note: Data includes SNOTEL and Snow course Measurements on June 1, 2017

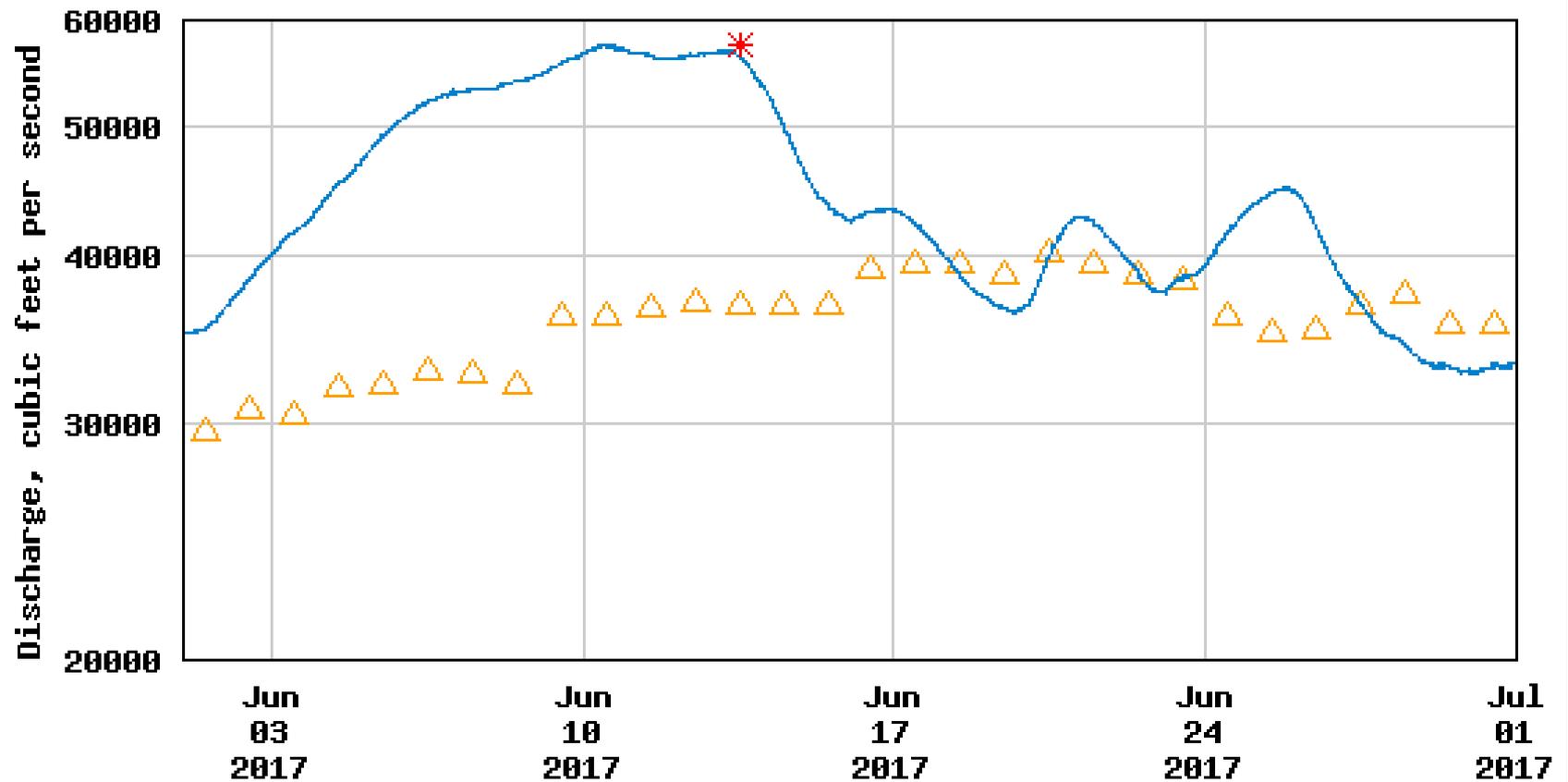


### Accumulated Precipitation - MALTA, MT

Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



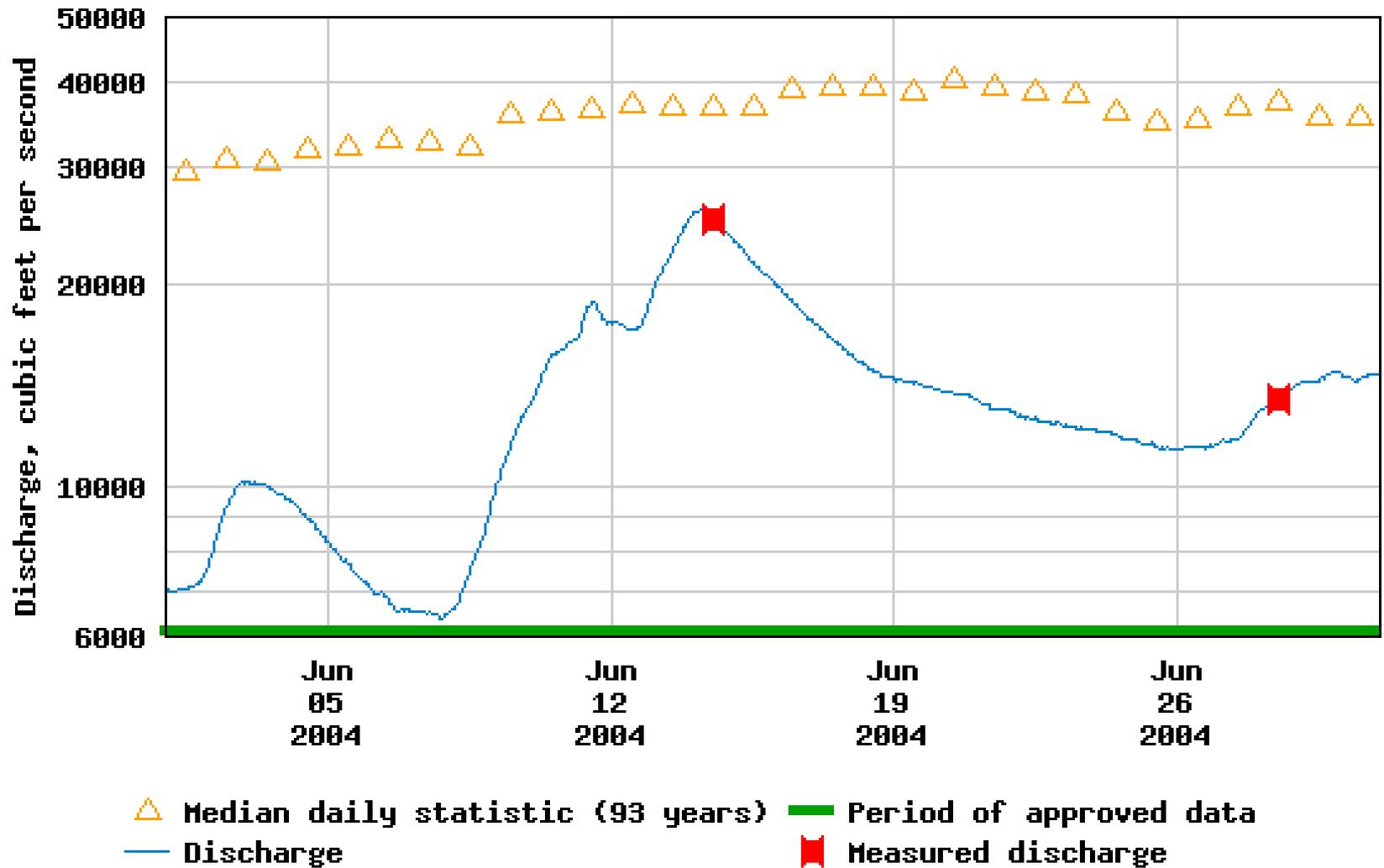
## USGS 06329500 Yellowstone River near Sidney MT



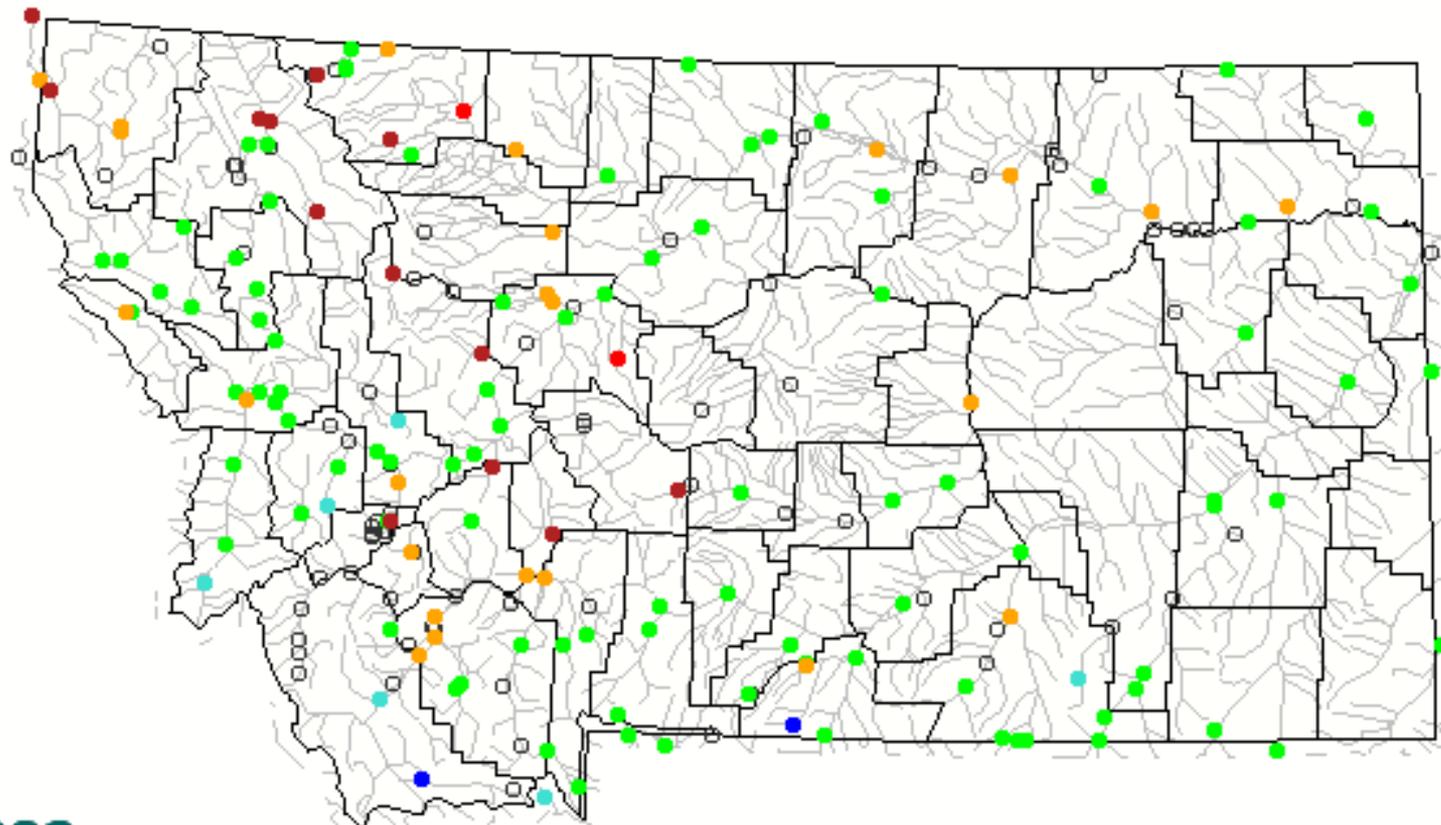
---- Provisional Data Subject to Revision ----

- △ Median daily statistic (93 years) \* Measured discharge
- Discharge

### USGS 06329500 Yellowstone River near Sidney MT

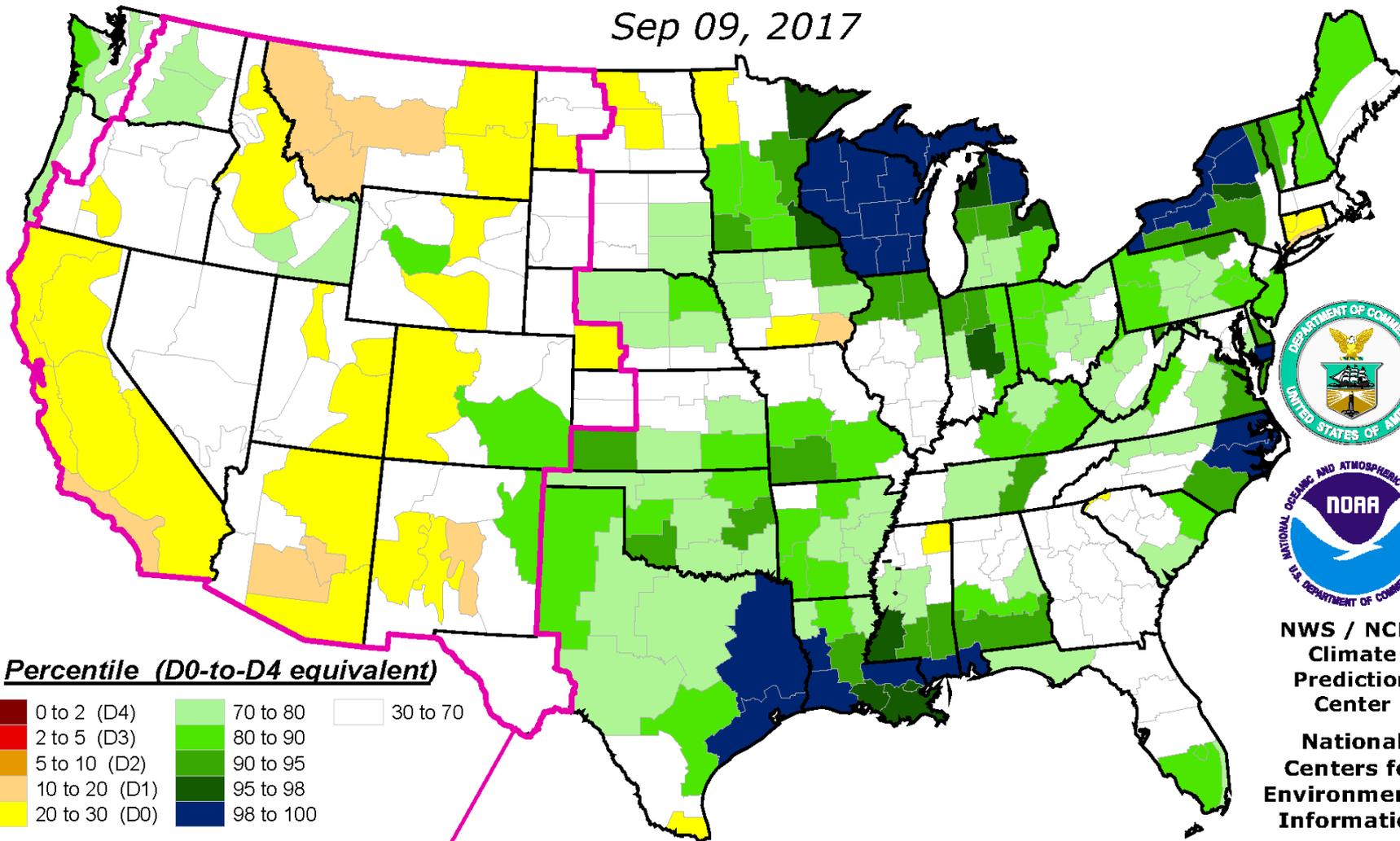


Monday, September 11, 2017 16:30ET



# Objective Long-Term Drought Indicator Blend Percentiles

Sep 09, 2017

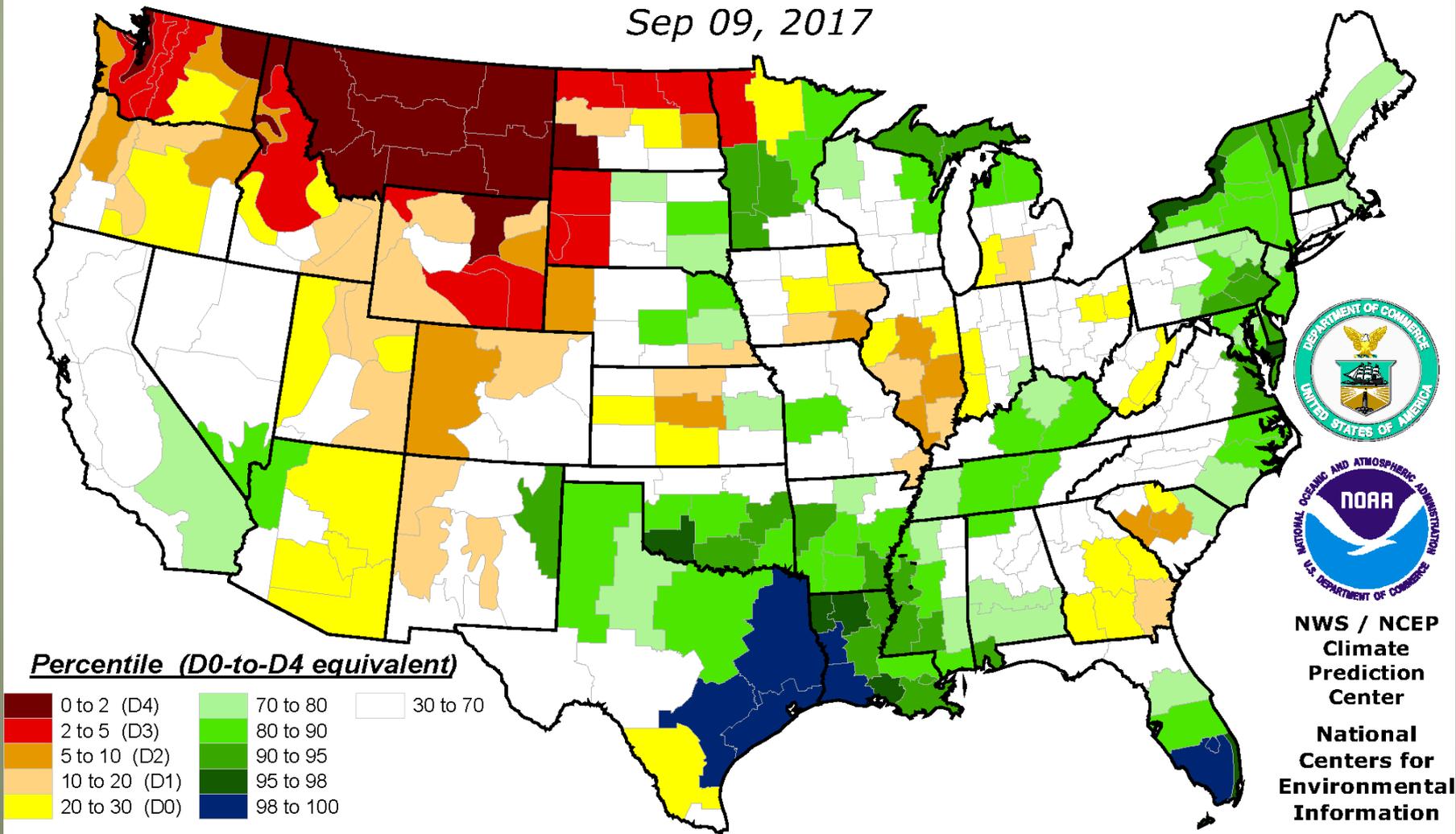


This map approximates impacts responding to precipitation over the course of several months to a few years, such as reservoir content, groundwater, and lake levels. **HOWEVER, THE RELATIONSHIP BETWEEN INDICATORS AND WATER SUPPLIES CAN VARY MARKEDLY WITH LOCATION, SEASON, SOURCE, AND MANAGEMENT PRACTICE.** Do not interpret this map too literally.

This map is based on preliminary climate division data. Local conditions and/or final data may differ. See the detailed product suite description for more details.

# Objective Short-Term Drought Indicator Blend Percentiles

Sep 09, 2017



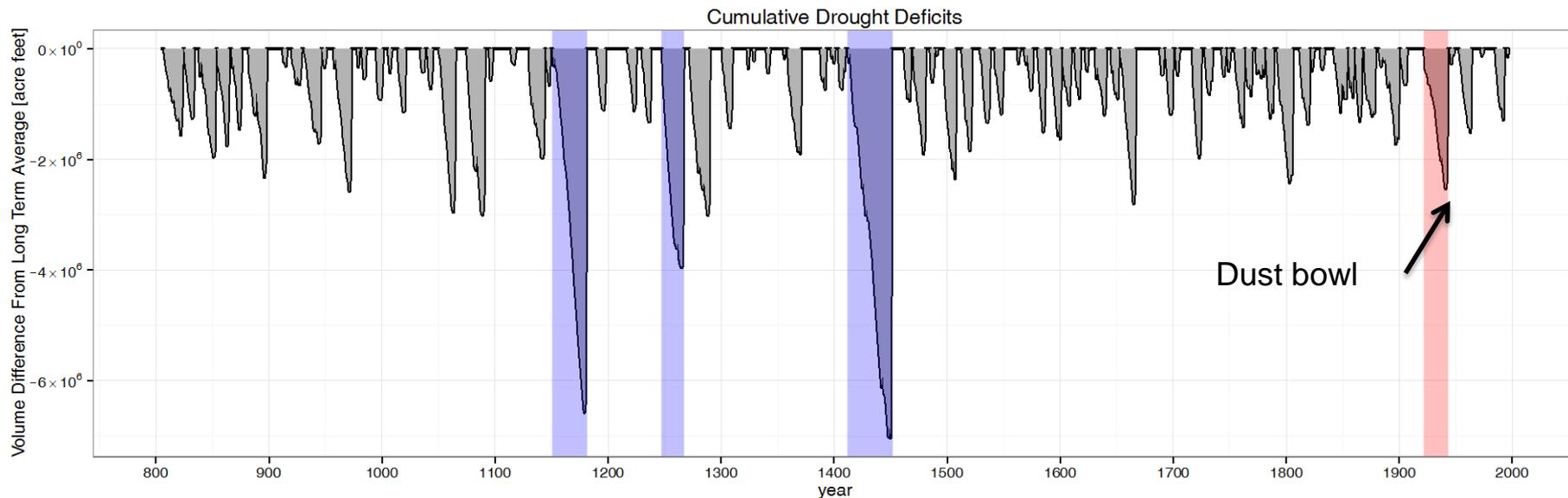
## Inputs (as percentiles):

- 35% Palmer Z-Index
- 25% 3-Month Precipitation
- 20% 1-Month Precipitation
- 13% CPC Soil Moisture Model
- 7% Palmer Drought Index

This map approximates impacts that respond to precipitation over several days to a few months, such as agriculture, topsoil moisture, unregulated streamflows, and most aspects of wildfire danger. The relationship between indicators and impacts can vary significantly with location and season. Do not interpret this map too literally.

This map is based on preliminary climate division data. Local conditions and/or final data may differ. See the detailed product suite description for more details.

# Musselshell River at Mosby: Low-Flow Periods

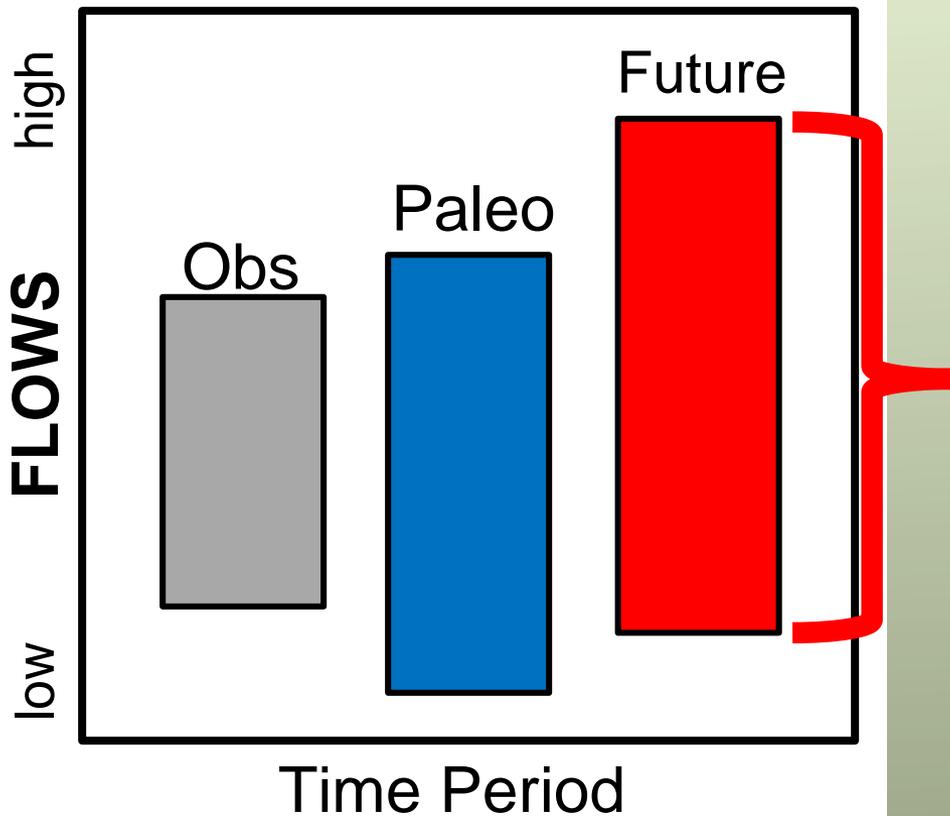


gage	drought_category	rank	cumulative_deficit [acre_feet]	start_year	end_year	drought_length
Musselshell River at Mosby MT	35-39 yr	1	-7032975.091	1412	1450	39
Musselshell River at Mosby MT	30-34 yr	2	-6357219.242	1151	1180	30
Musselshell River at Mosby MT	15-19 yr	3	-3902113.926	1248	1266	19
Musselshell River at Mosby MT	15-19 yr	4	-2968516.656	1272	1289	18
Musselshell River at Mosby MT	15-19 yr	5	-2789477.522	1075	1090	16
Musselshell River at Mosby MT	10-14 yr	6	-2569424.495	1653	1666	14
Musselshell River at Mosby MT	15-19 yr	7	-2487900.349	1050	1064	15
Musselshell River at Mosby MT	20-24 yr	8	-2367465.954	1922	1942	21
Musselshell River at Mosby MT	10-14 yr	9	-2345449.933	1497	1507	11
Musselshell River at Mosby MT	15-19 yr	10	-2322771.475	957	972	16
Musselshell River at Mosby MT	10-14 yr	11	-2273812.872	1792	1805	14
Musselshell River at Mosby MT	10-14 yr	12	-1895487.495	1359	1370	12
Musselshell River at Mosby MT	10-14 yr	13	-1872474.517	1130	1143	14
Musselshell River at Mosby MT	5-9 yr	14	-1836763.124	1717	1724	8
Musselshell River at Mosby MT	5-9 yr	15	-1628373.743	1592	1600	9
Musselshell River at Mosby MT	5-9 yr	16	-1572684.862	1513	1521	9
Musselshell River at Mosby MT	5-9 yr	17	-1407923.979	1754	1762	9
Musselshell River at Mosby MT	5-9 yr	18	-1371967.438	1580	1586	7



# Potential for Future Variability Outside Range of Observations

## Generalized Runoff Regimes



Paleo streamflow records show the potential for runoff variability outside the bounds of observations (wetter, dryer or both)

Future climate scenarios suggest a future of higher average and extreme flows, and a substantially shifted hydrograph under all scenarios

*After Lutz et al. 2011 and  
Littell et al. in press*



Questions/Comments?

<http://dnrc.mt.gov/divisions/water/drought-management>

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