

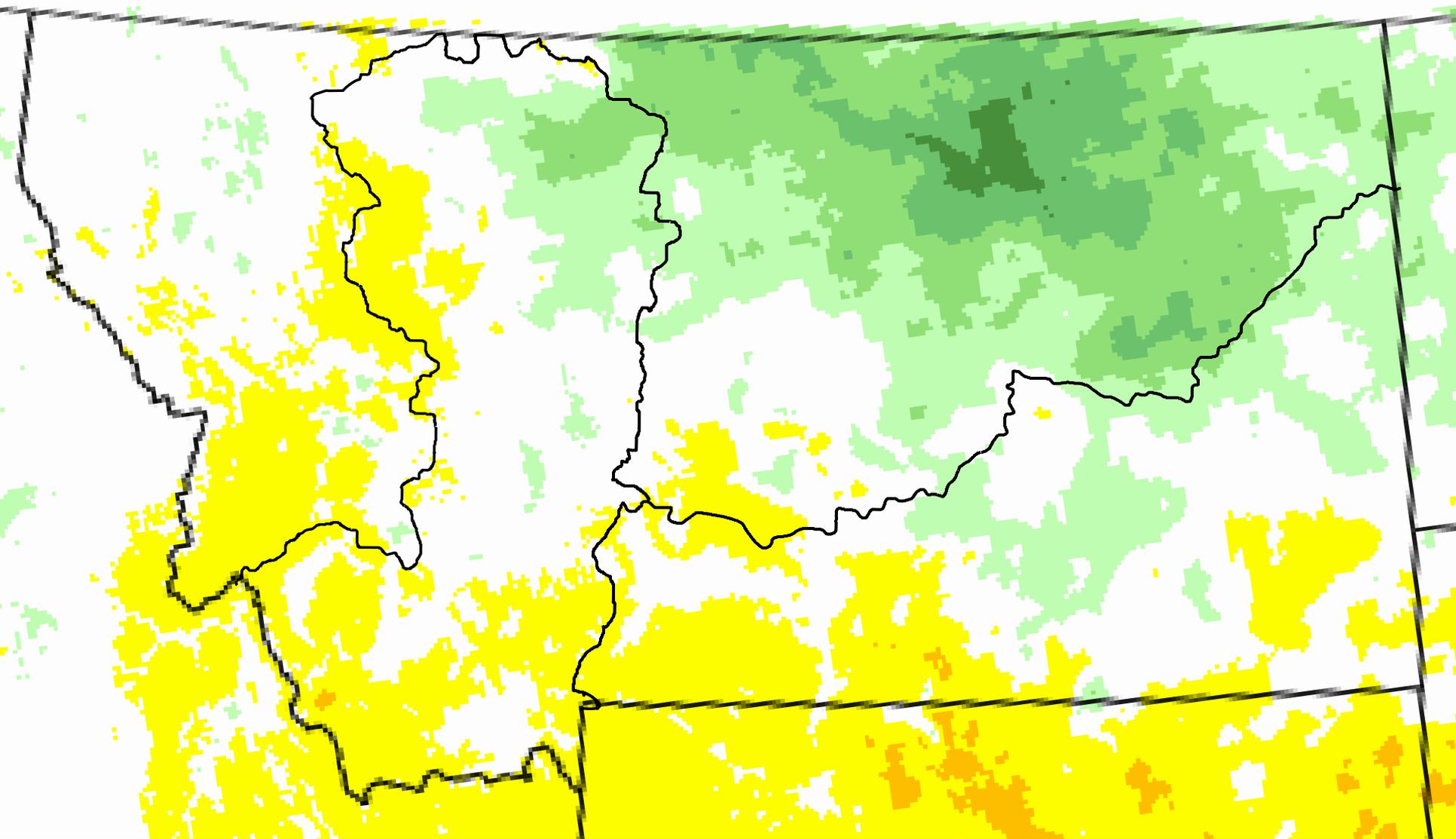
Montana Drought & Water Supply Advisory Committee

September 15, 2016

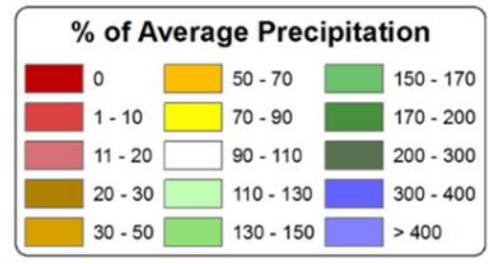
National Weather Service

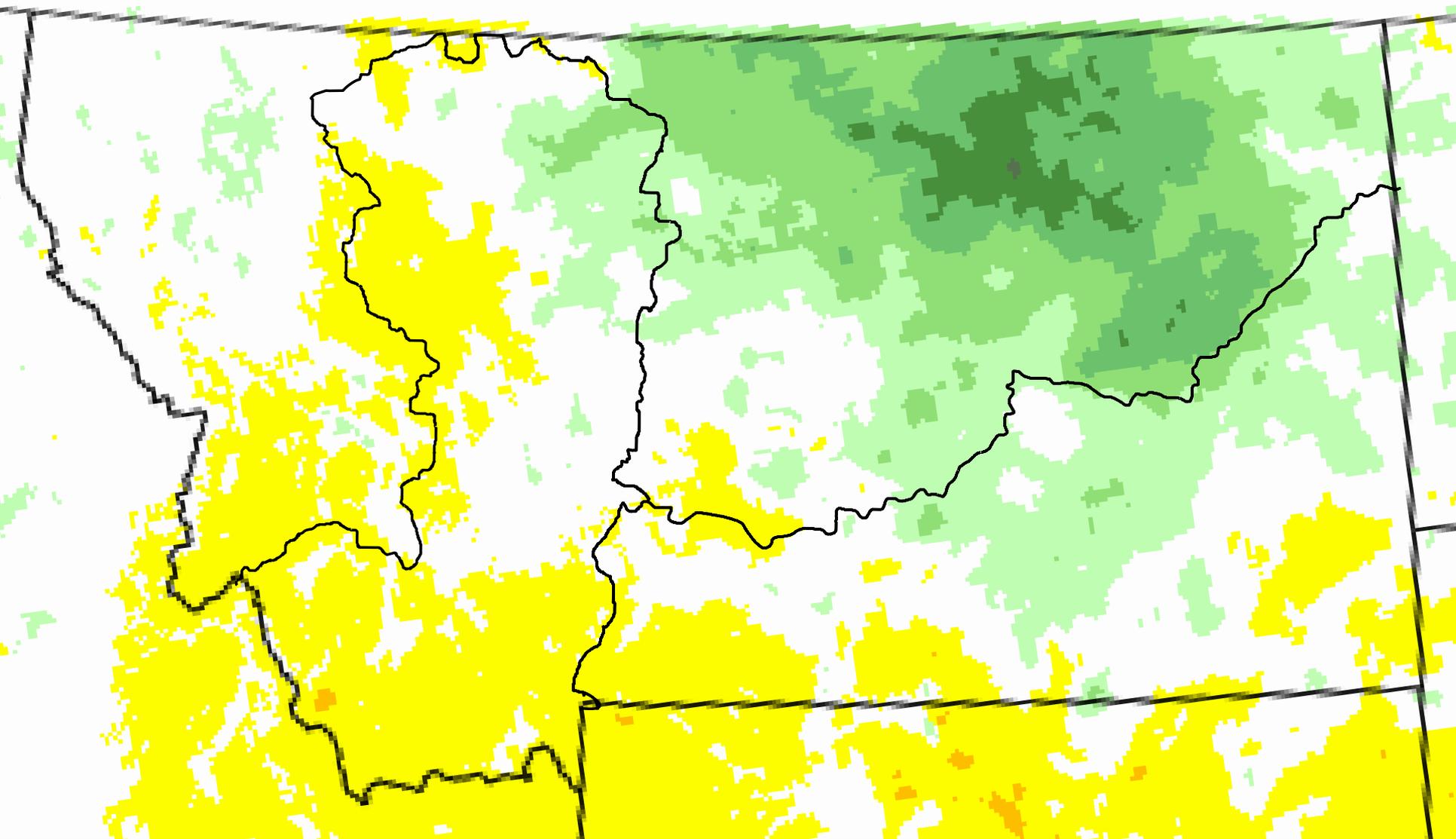
Donald Britton – Meteorologist-in-Charge

MOISTURE...



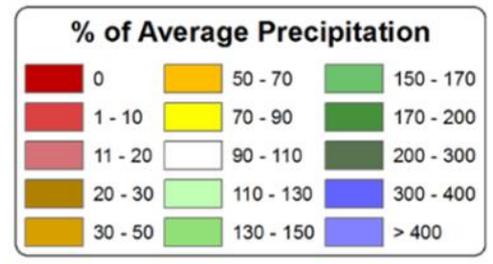
12-Month Precipitation Anomaly Sep 15 – Aug 16

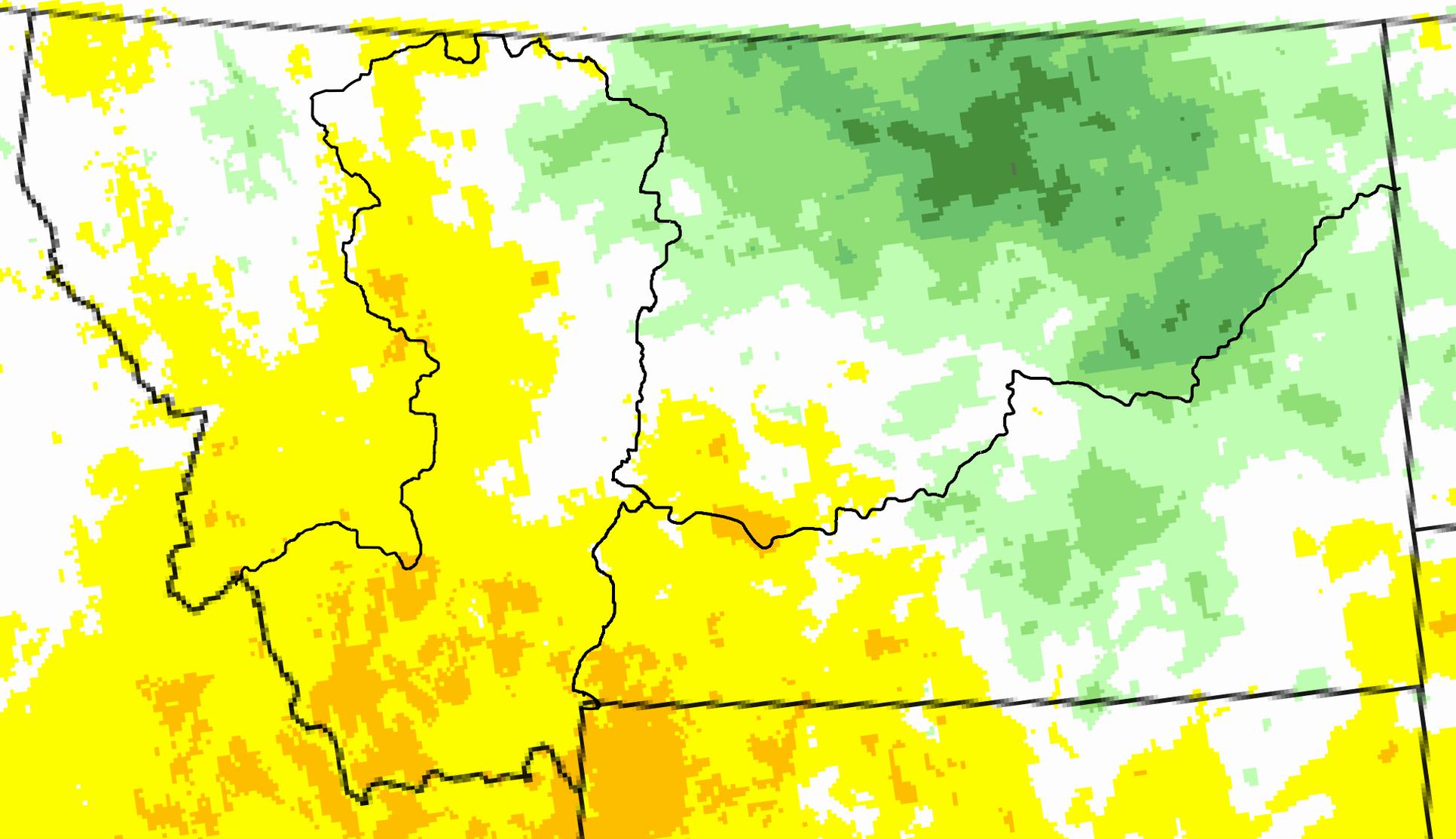




Water Year Precip Anomaly

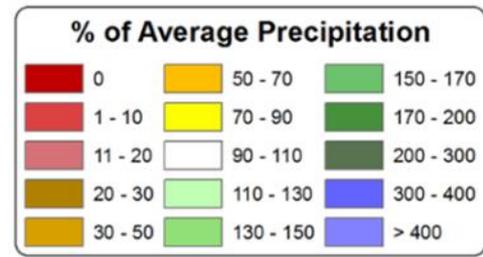
Oct 15 – Aug 16

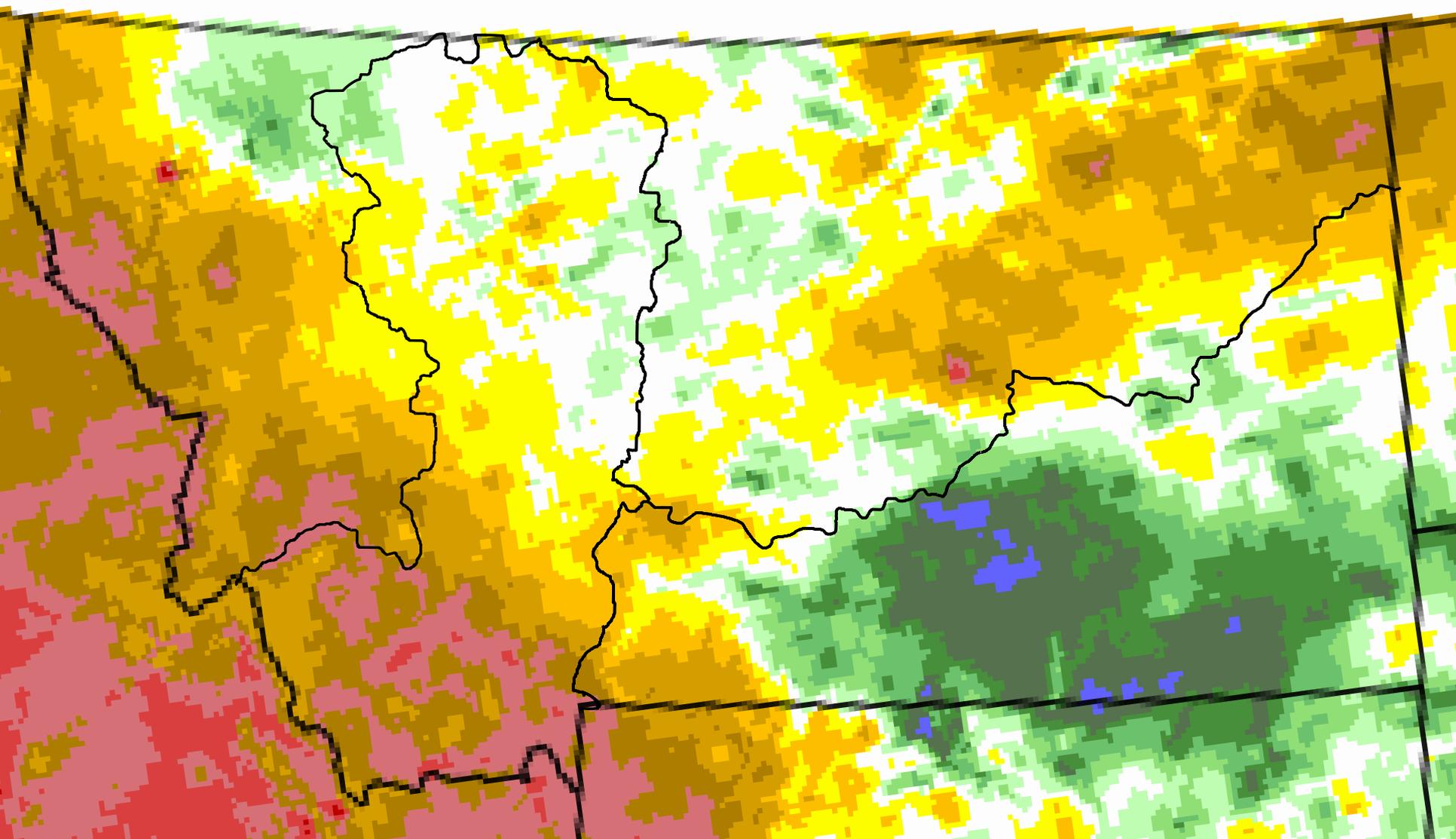




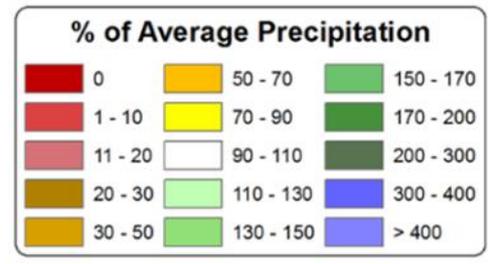
Calendar Year Precip Anomaly

Jan - Aug



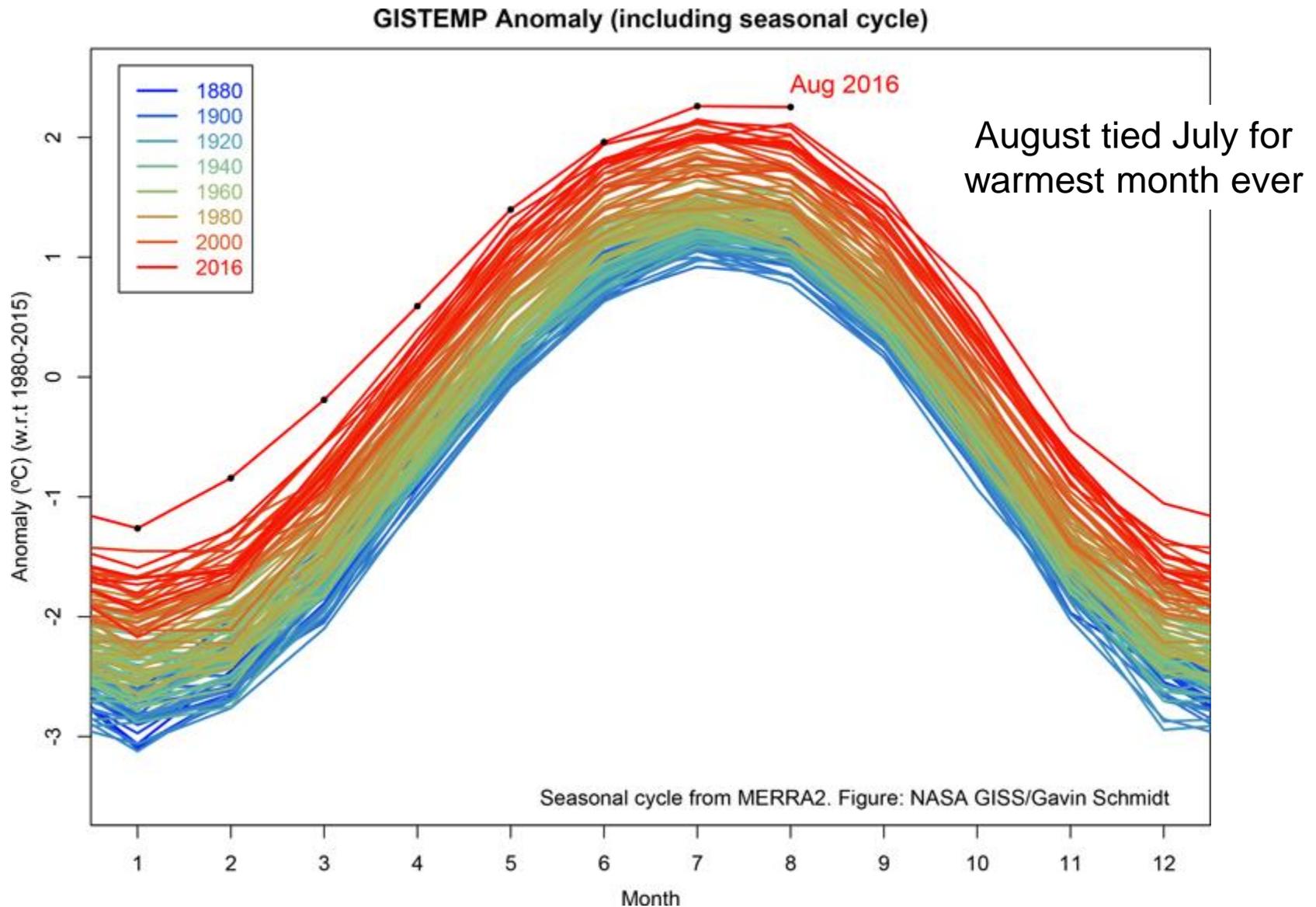


Monthly Precipitation Anomaly August 2016



TEMPERATURE...

NASA: August Warmest on Record



Montana: Sep 2015 – Aug 2016

Warmest on Record

Avg Temp	20 th Century Average	Departure
45.2°F	41.1°F	4.1°F

Precipitation Just Above Normal (56th Wettest)

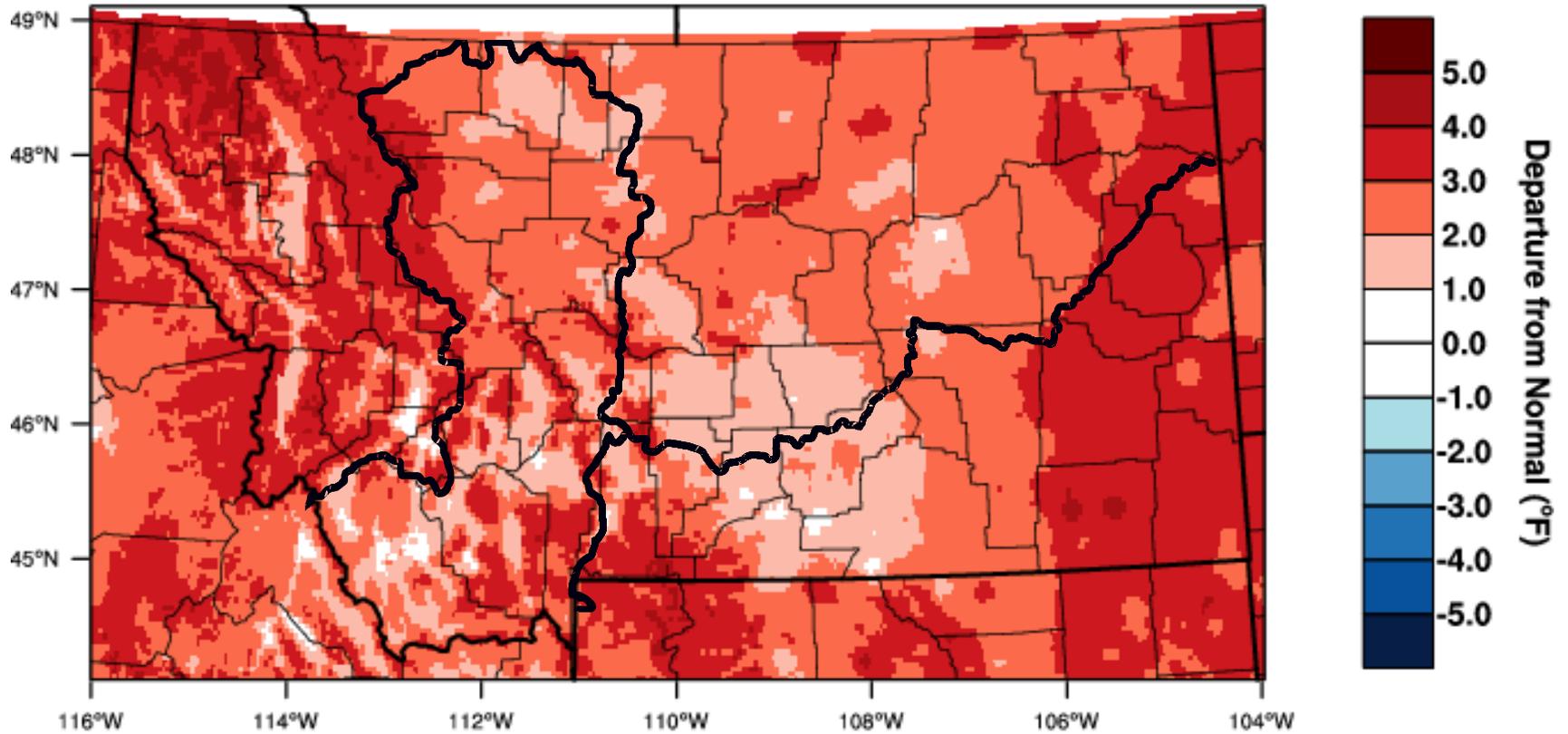
Precip	20 th Century Average	Departure
18.73"	18.66"	0.07"

Mean Temperature

Water Year 2016

Montana - Mean Temperature

October-August 2016 Departure from 1981-2010 Normal



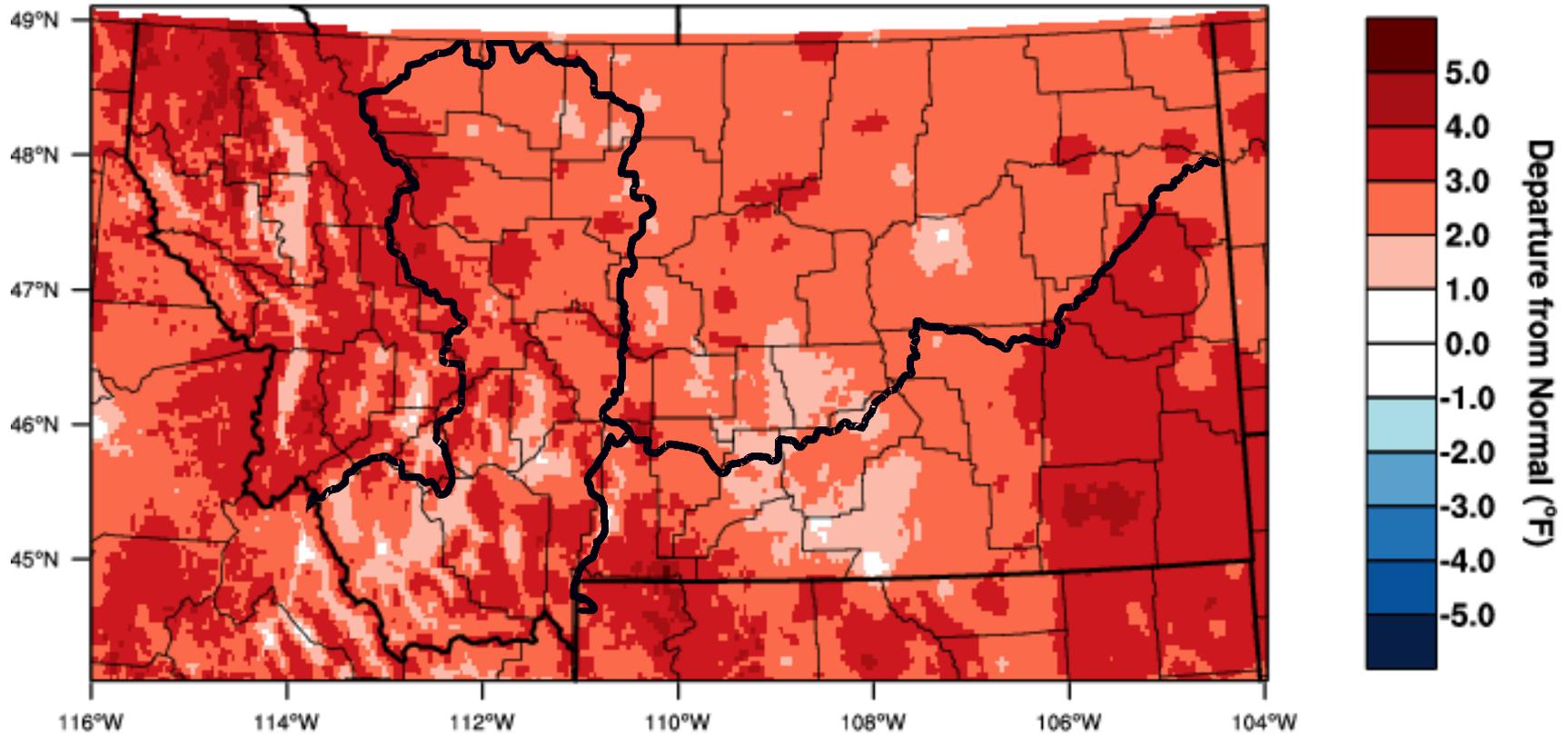
WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 11 SEP 2016

Mean Temperature

Calendar Year 2016

Montana - Mean Temperature

January-August 2016 Departure from 1981-2010 Normal



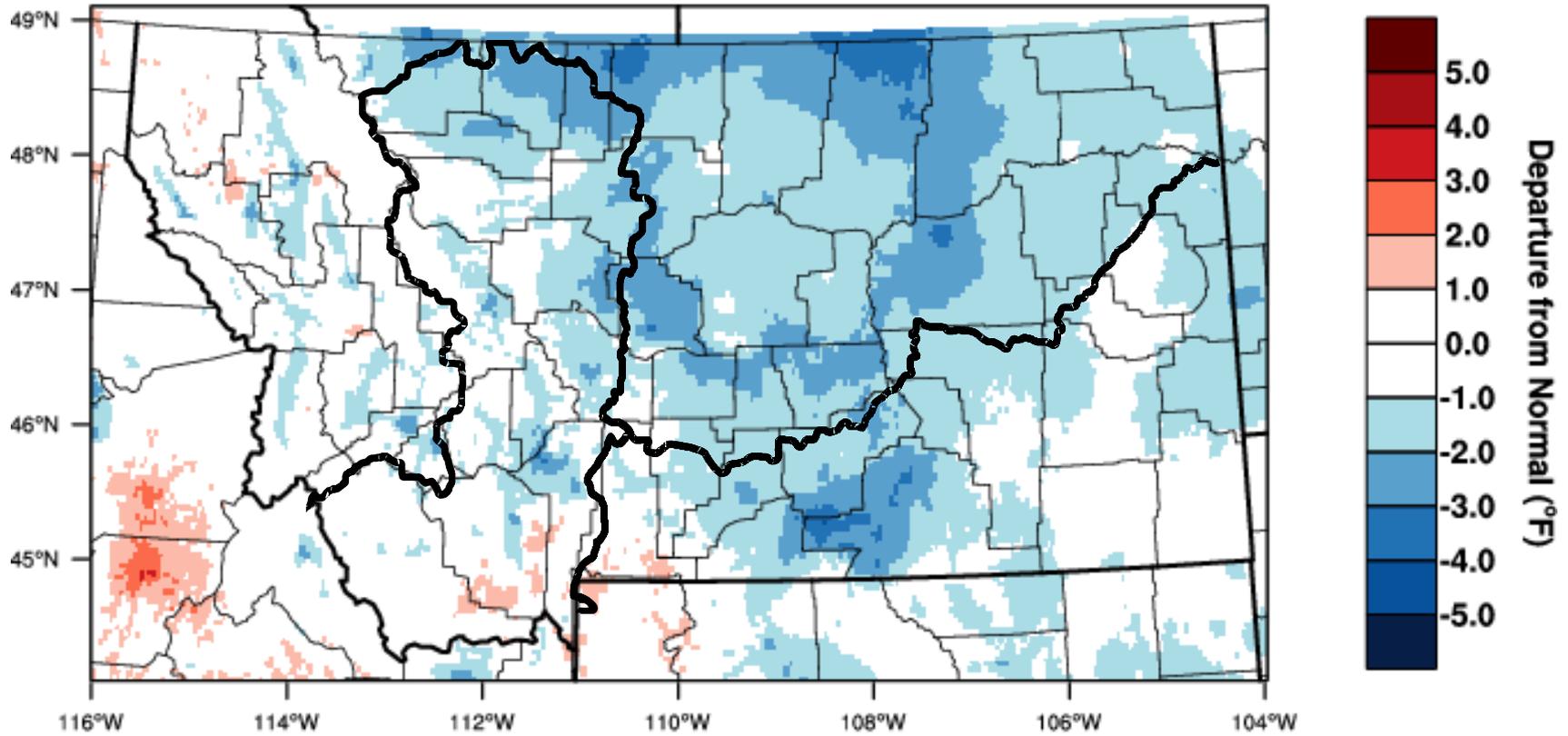
WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 11 SEP 2016

Mean Temperature

August 2016

Montana - Mean Temperature

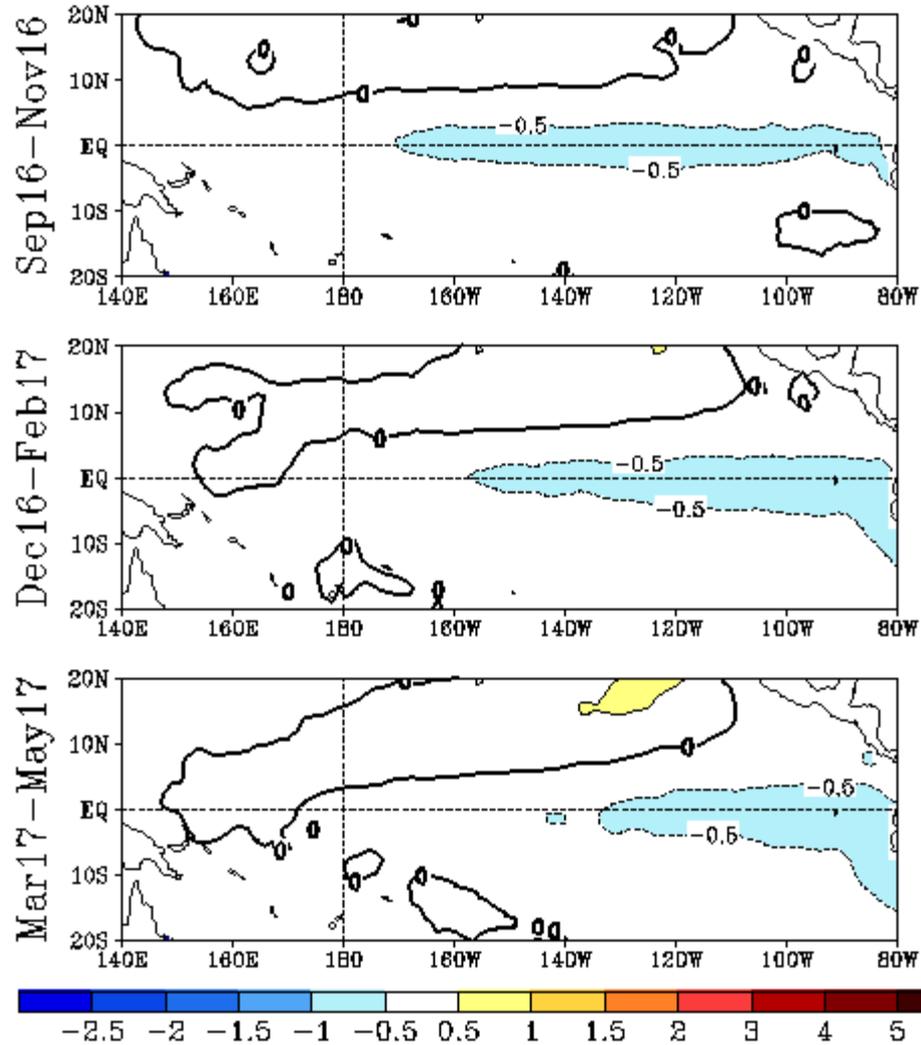
August 2016 Departure from 1981-2010 Normal



WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 11 SEP 2016

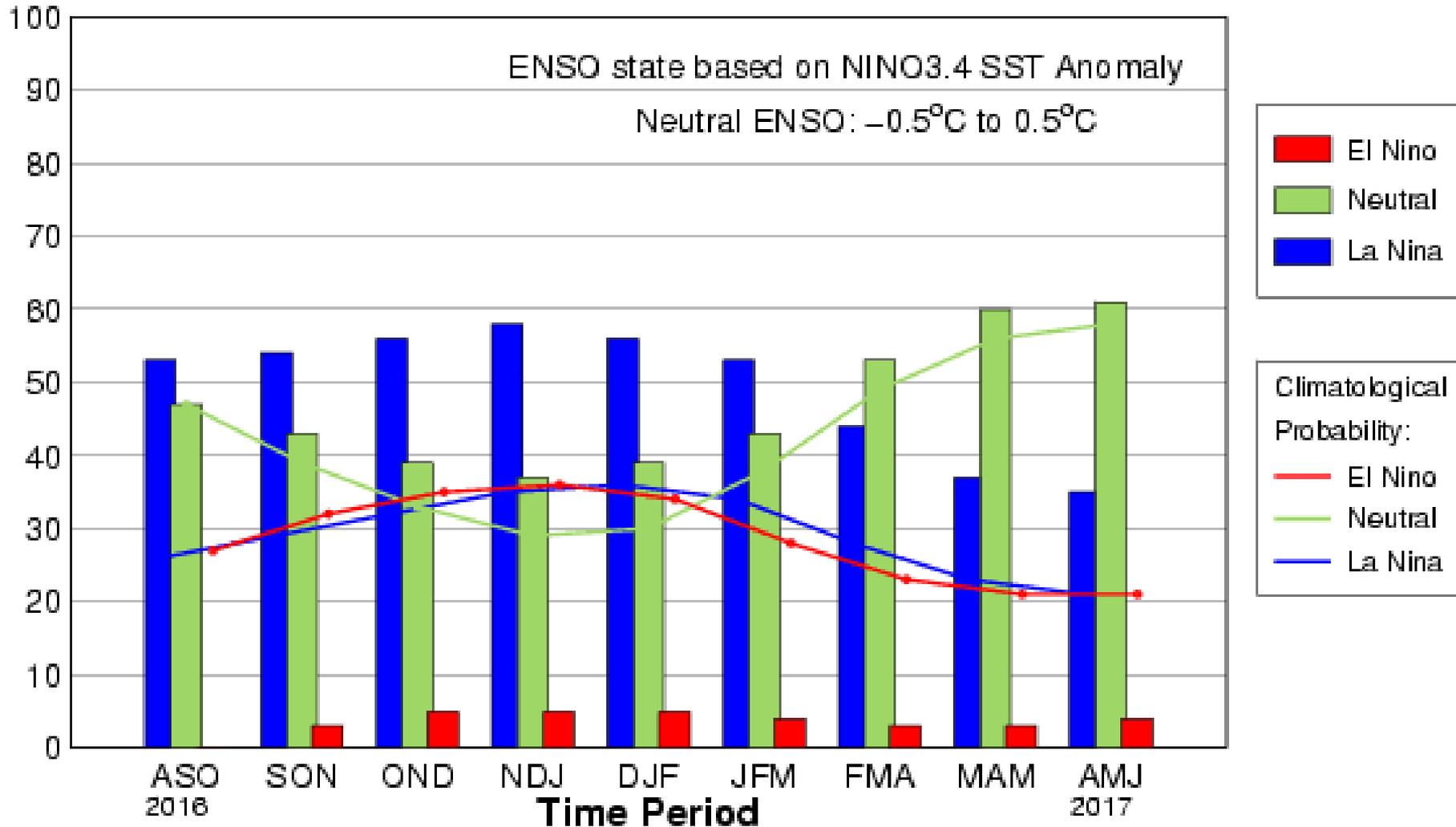
CLIMATE...

El Niño / La Niña

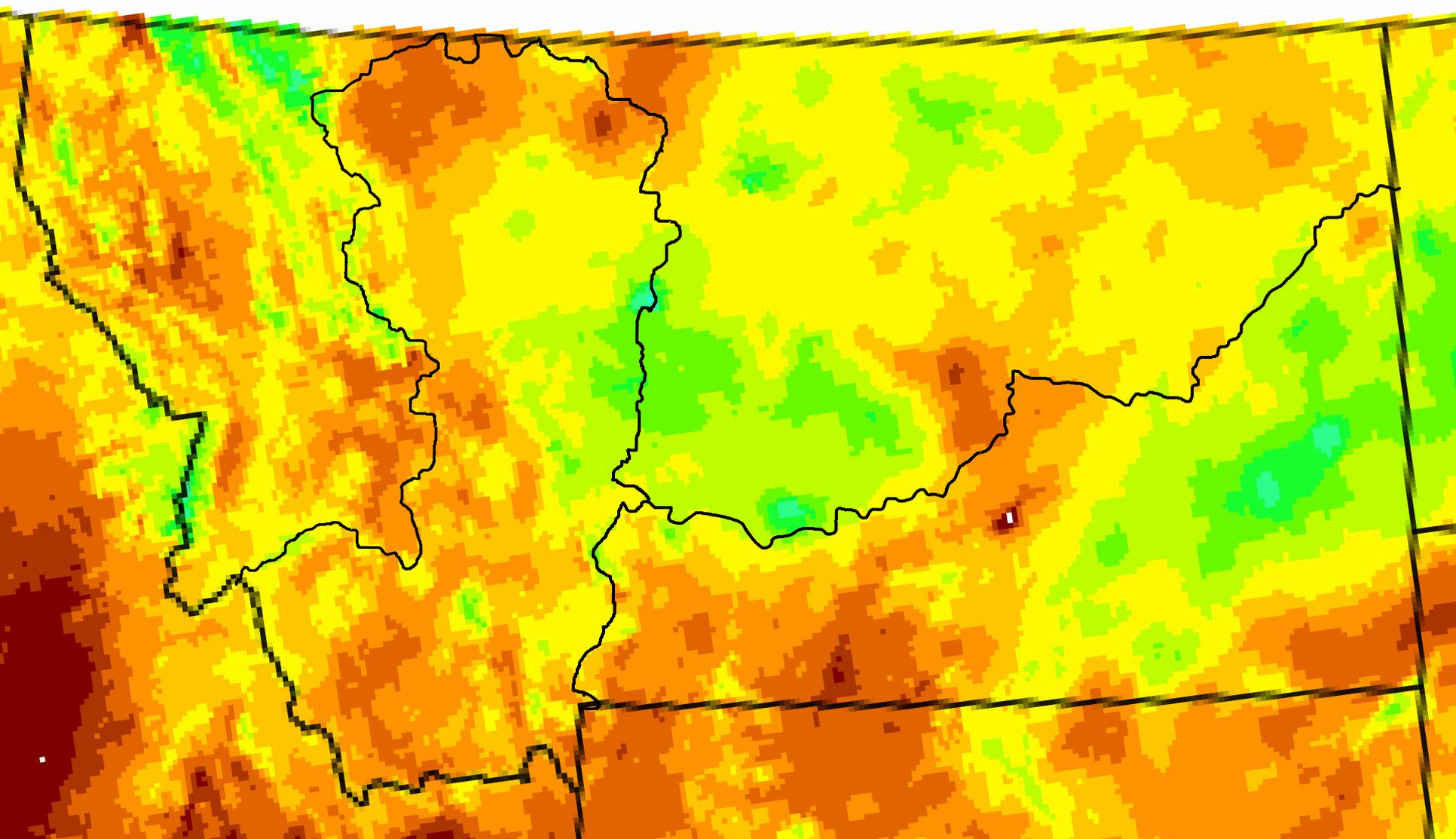


El Niño / La Niña

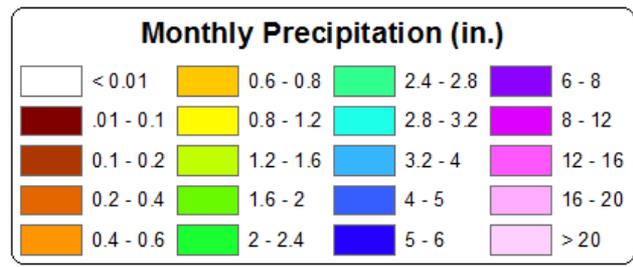
Mid-Aug IRI/CPC Model-Based Probabilistic ENSO Forecast

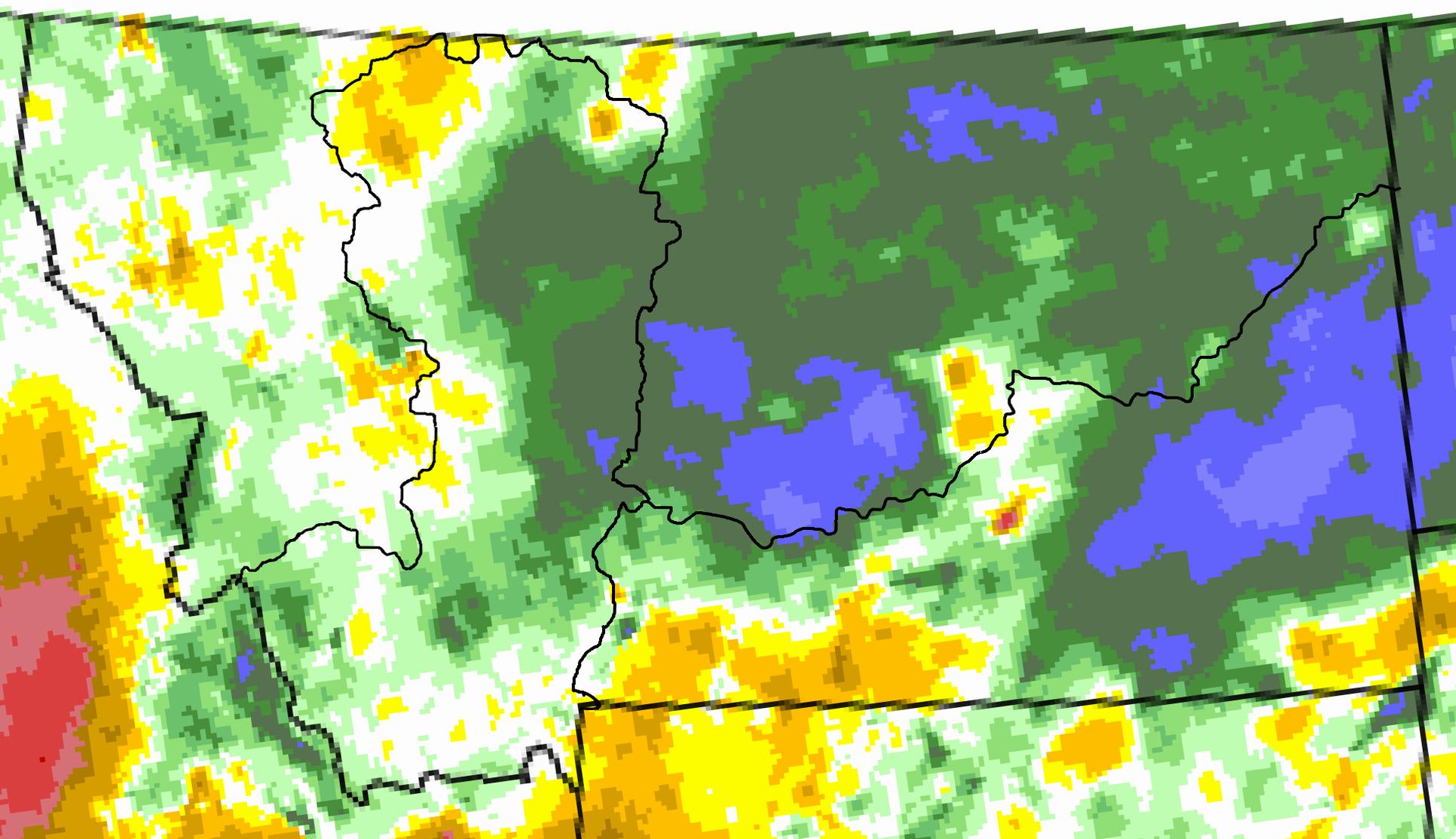


THIS MONTH SO FAR...

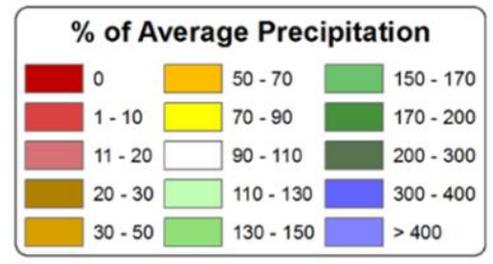


Monthly Precipitation thru 9/11 2016





Monthly Precip Anomaly thru 9/11 2016

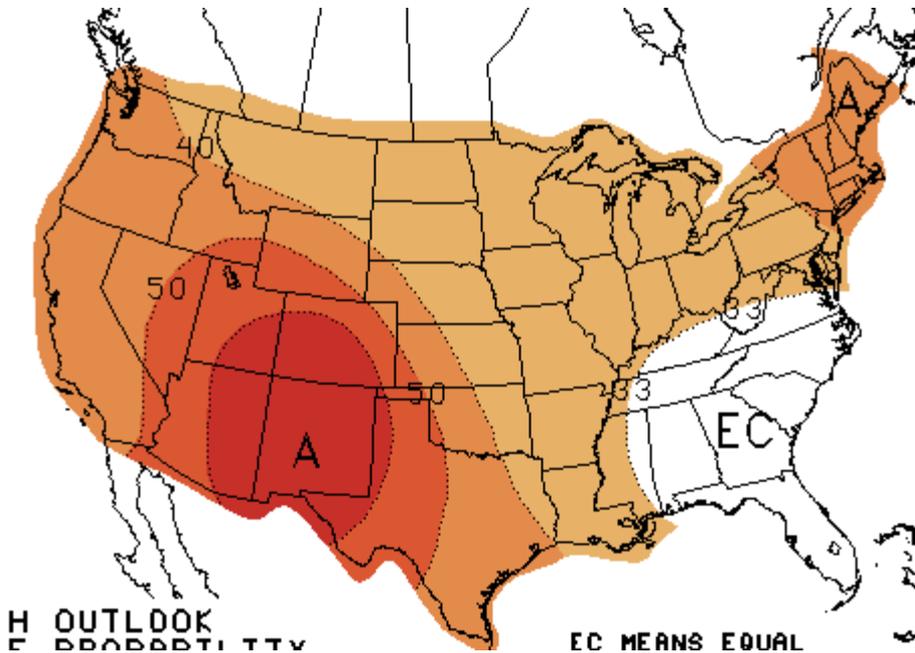


FORECAST...

October – December Outlook

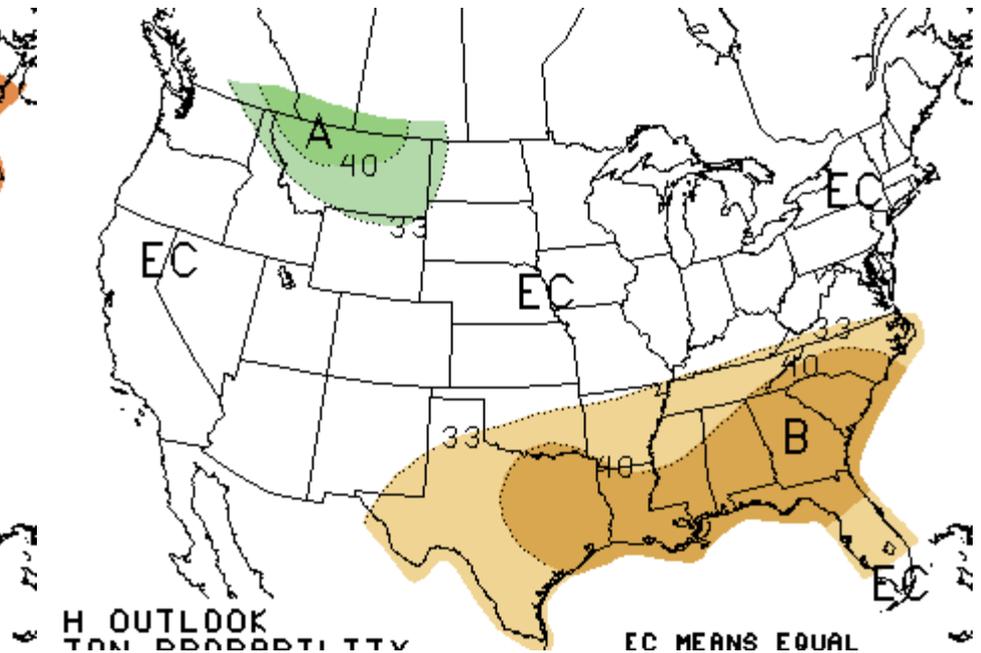
Created September 15

Temperature



33% chance of above normal temperatures over most of Montana, but 40% chance of above normal over extreme southwest Montana

Precipitation

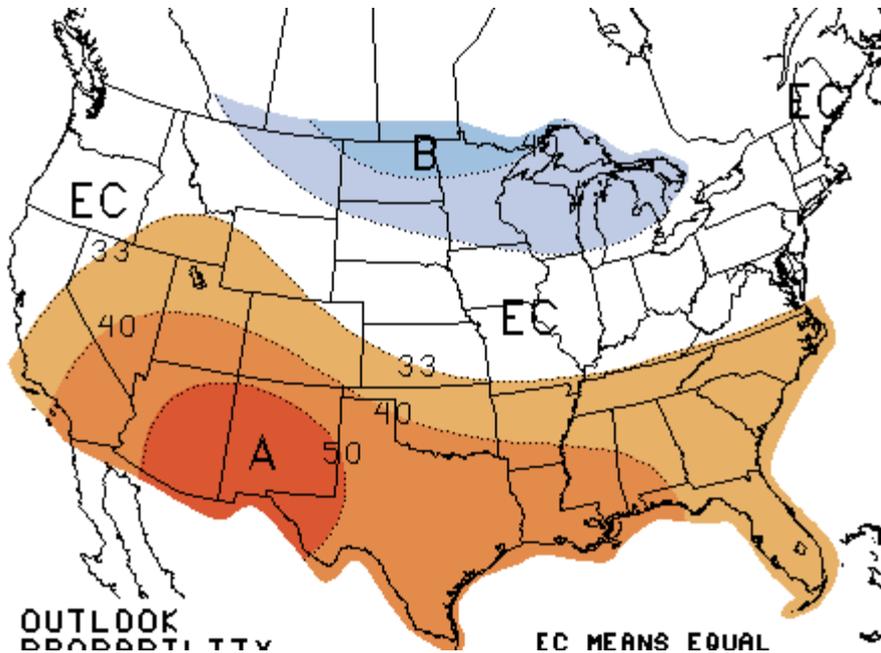


> 33% chance of above normal precipitation over most of Montana, but equal chances of above or below normal precipitation extreme western Montana

January – March Outlook

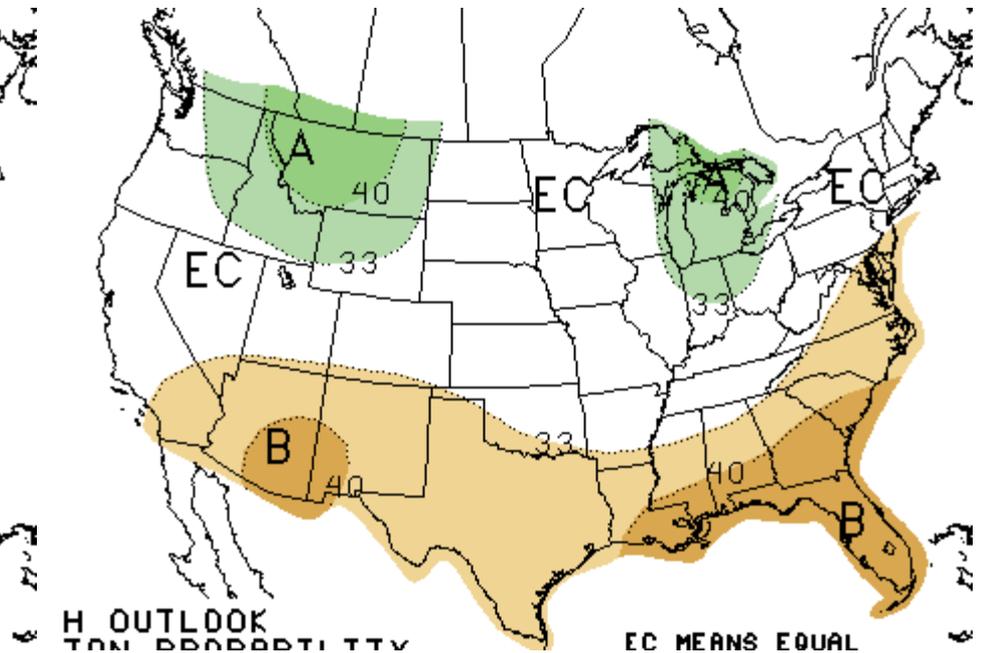
Created September 15

Temperature



33% chance of below normal temperatures across northeast half of Montana, equal chances of above or below elsewhere

Precipitation

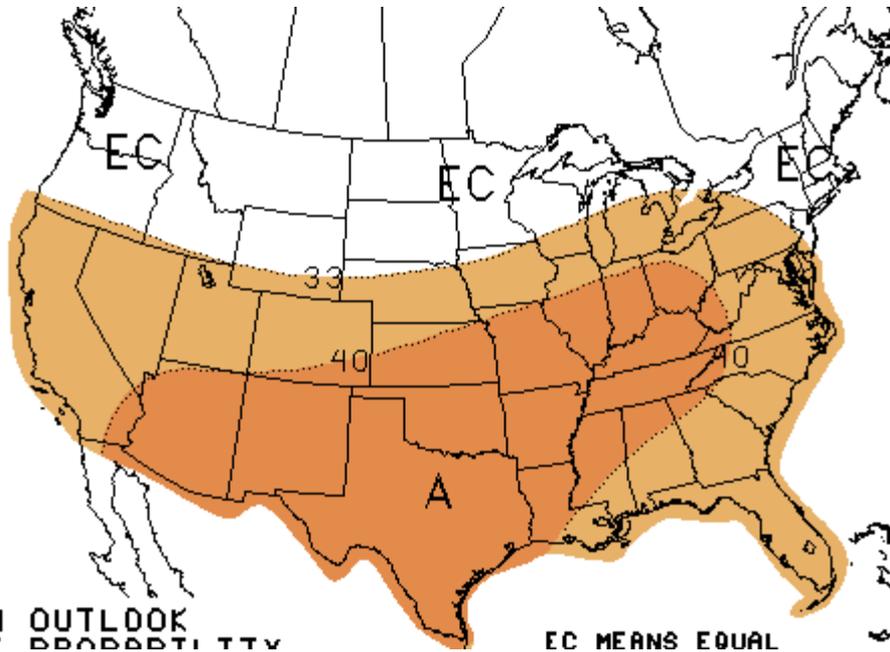


40% chance of above normal precipitation over most of Montana

April – June Outlook

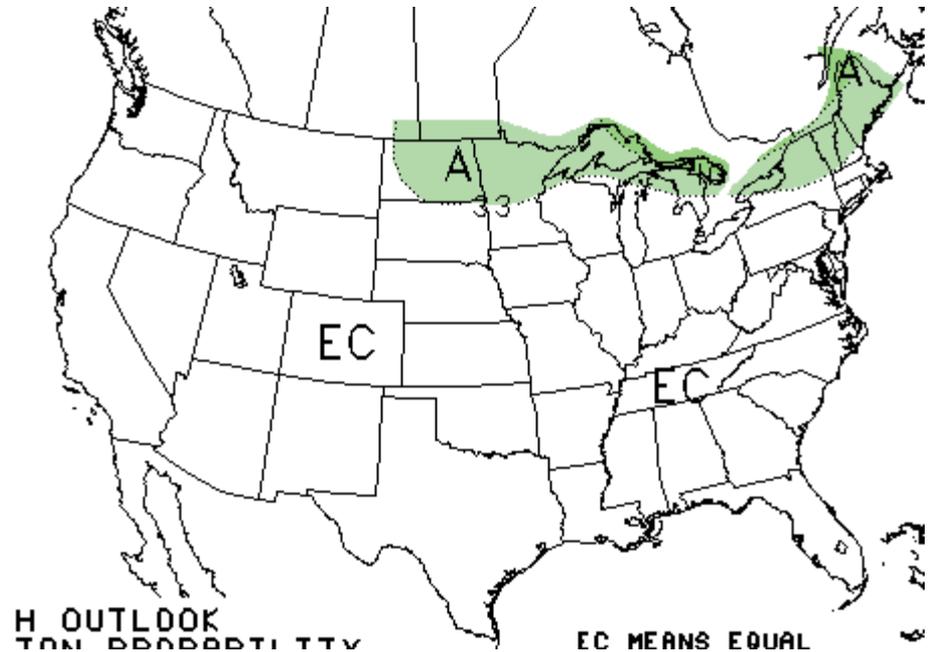
Created September 15

Temperature



Equal chances of above, below or normal temperatures statewide

Precipitation

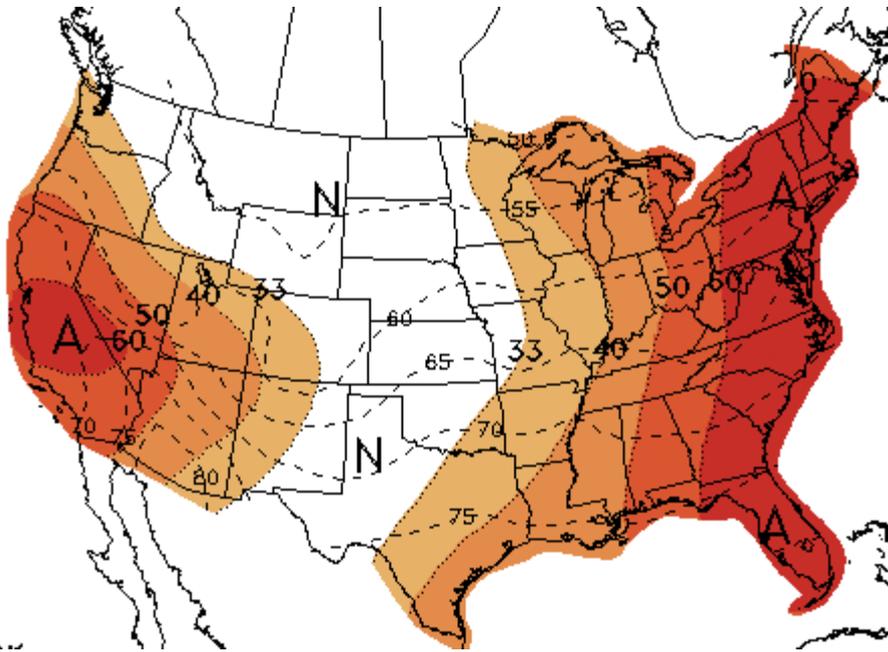


Equal chances of above, below or near normal precipitation statewide

8 – 14 Day Outlook

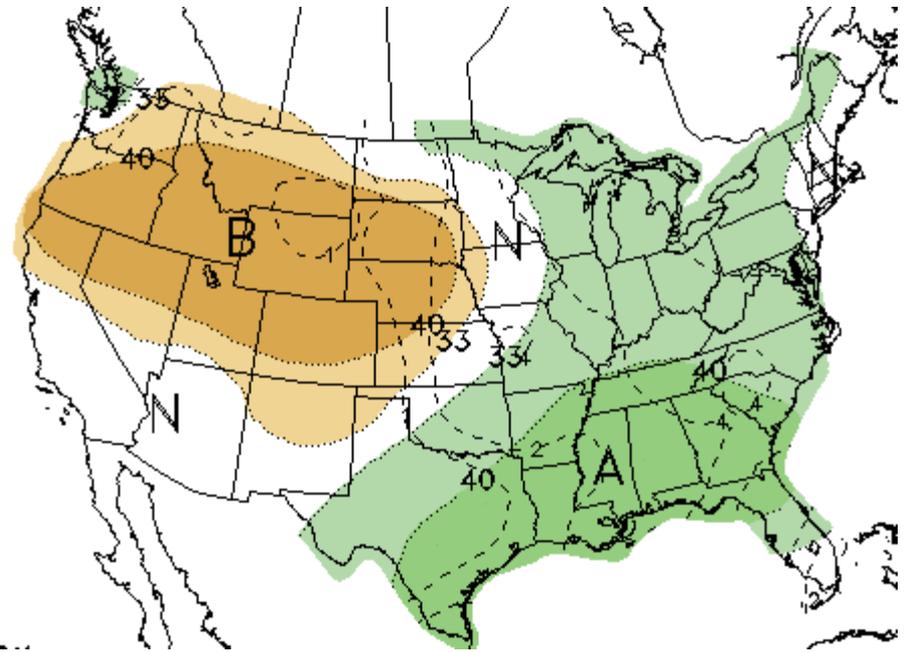
September 22 - 28

Temperature



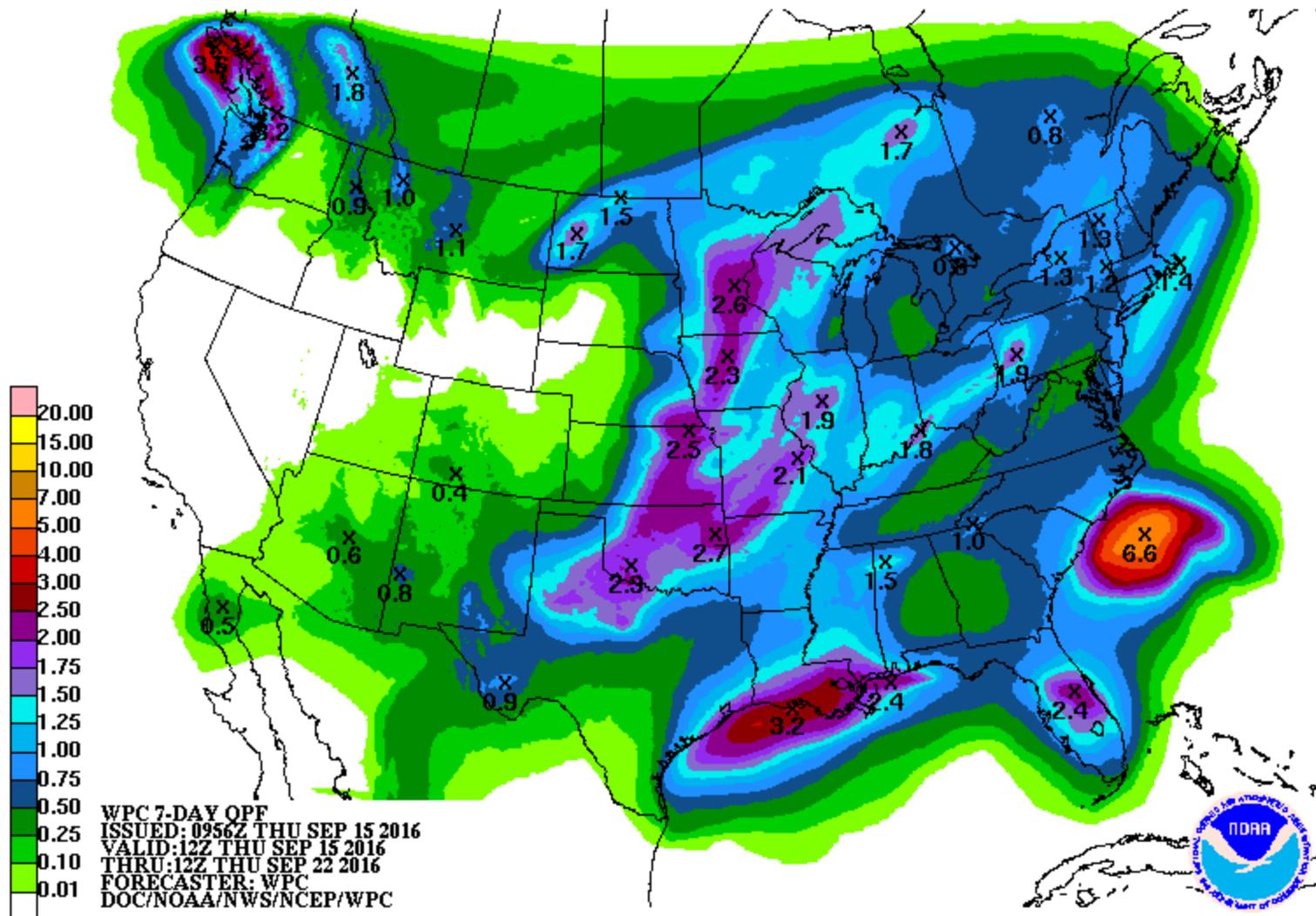
Equal chances of above, below or near normal temperatures statewide

Precipitation

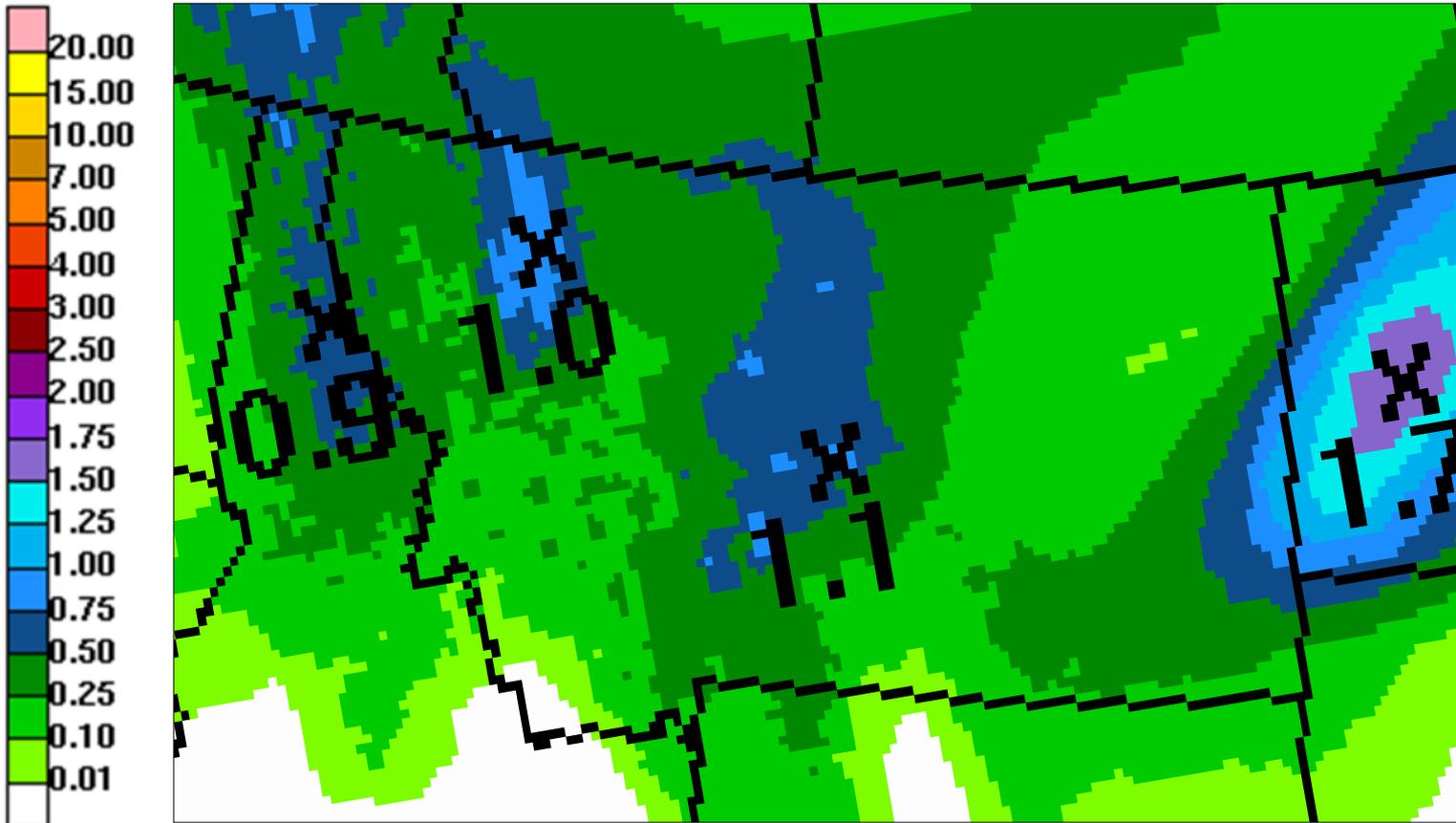


33% chance of below normal precipitation statewide, but 40% chance of below normal precipitation over southern Montana

7-Day WPC Precipitation Forecast



7-Day WPC Precipitation Forecast





[weather.gov](https://www.weather.gov)

[weather.gov/billings](https://www.weather.gov/billings)

[weather.gov/glasgow](https://www.weather.gov/glasgow)

[weather.gov/missoula](https://www.weather.gov/missoula)

[weather.gov/greatfalls](https://www.weather.gov/greatfalls)



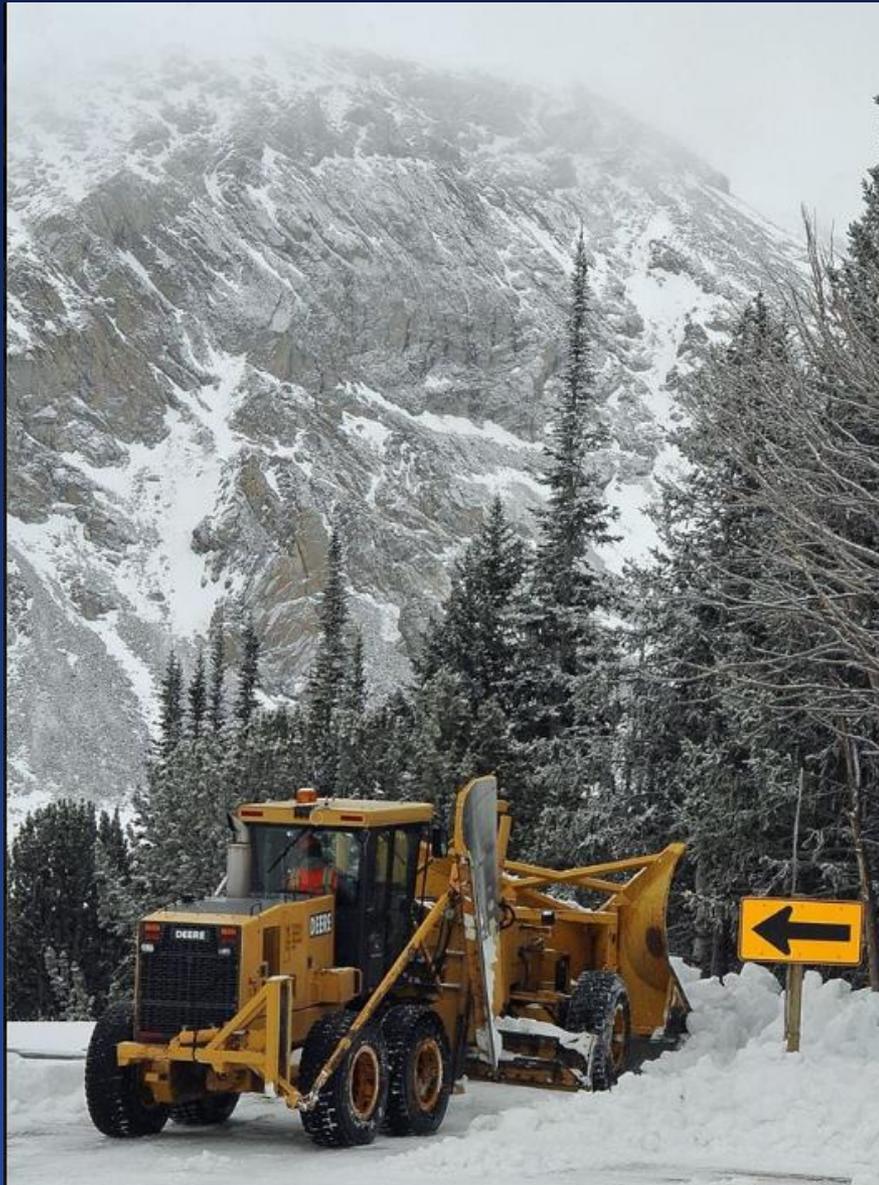
Governor's Drought Advisory Committee Soil Moisture and Forecast Review September 15th, 2016

Lucas Zukiewicz
Water Supply Specialist (Snow Hydrologist)
USDA-NRCS
Montana Snow Surveys
Lucas.Zukiewicz@mt.usda.gov
406-587-6843

<http://www.nrcs.usda.gov/wps/portal/nrcs/main/mt/snow/>

4" of new snow on Sept. 12th, 2016 at the Black Bear SNOTEL site in southwest Montana. "Summer" maintenance of the SNOTEL system is wrapping up.

Snow!



Montana Department of Transportation

Like This Page · Yesterday · Edited ·

UPDATE: The Beartooth Highway has reopened on the Montana side to Vista Point. Travelers will be unable to pass Vista Point when traveling from Red Lodge at this time due to snow, ice and wind. It is unknown at this time when the rest of the highway will reopen. Stay tuned for updates: www.mdt.mt.gov/travinfo

(Photo courtesy of Brett French, Billings Gazette, 2016)

Edward Scott, Schalene Darr, Julie Rossignol and 738 others like this.

Chronological ▾

3,683 shares

154 Comments

[View previous comments](#)

6 of 154



Tracey Fries One of the most beautiful rides in the country!

👍 1 · 1 hr



CarolAnne Mabson My goodness! That's the storm that caused my brother to be blown off the lake yesterday morning. He'd gone fishing...waves too high! Blown right off the lake!

1 hr



Nancy Ginn WOW. Already??? Beautiful.

👍 1 · 1 hr



Randy Wiediger Snow already

1 hr

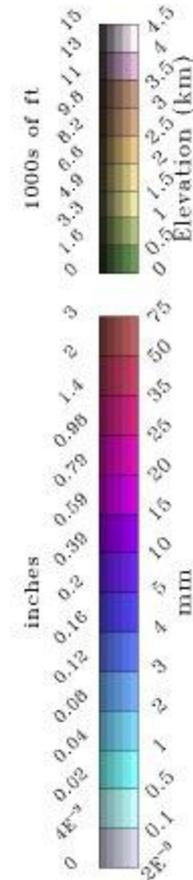
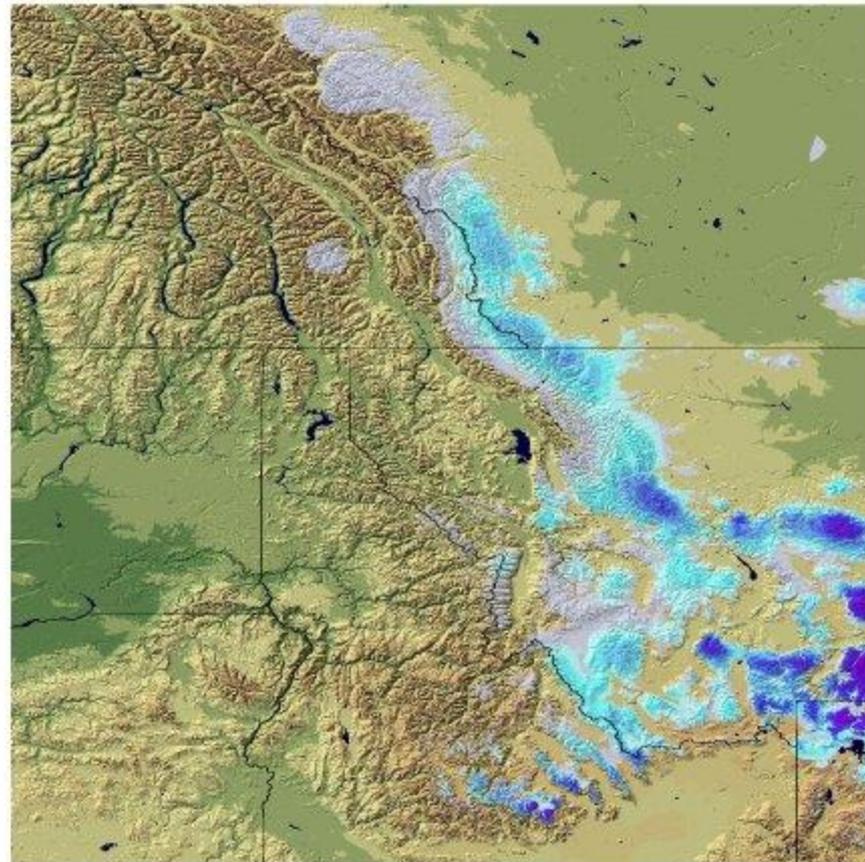


MikeandCathy Lamothe Wow! I hope that Carolyn Collis and John Collis are not planning a trip up there!



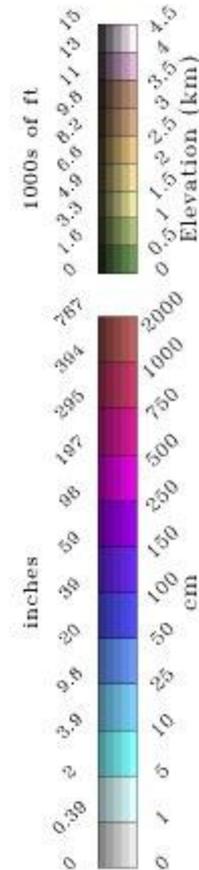
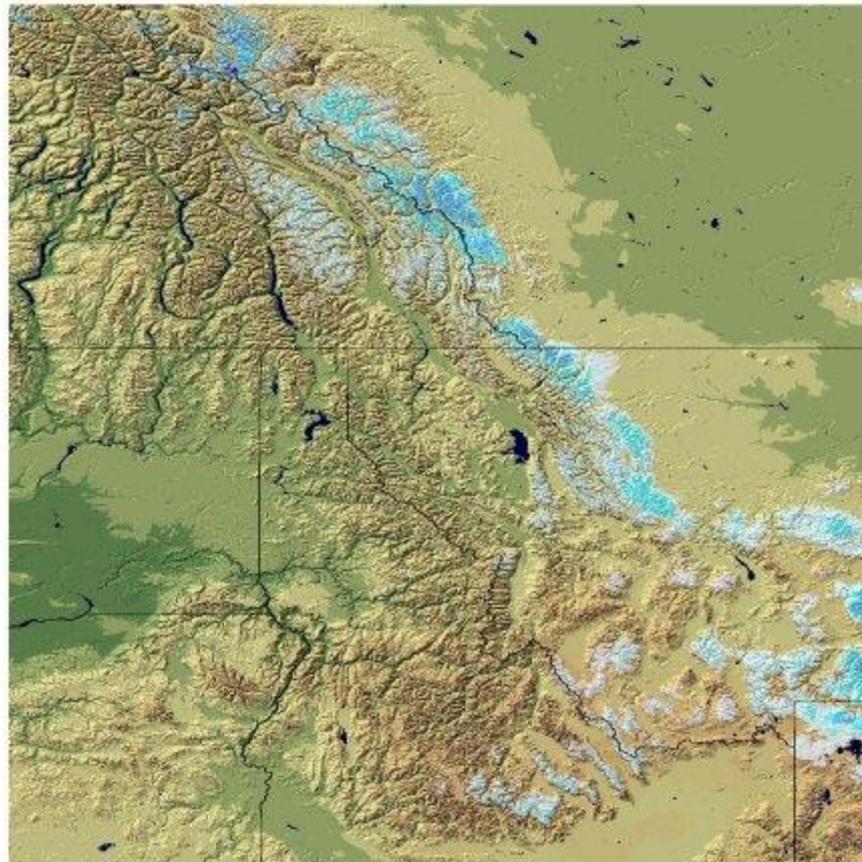
Scaled Snow Precipitation

24-Hour Total Ending 2016-09-13 06 UTC



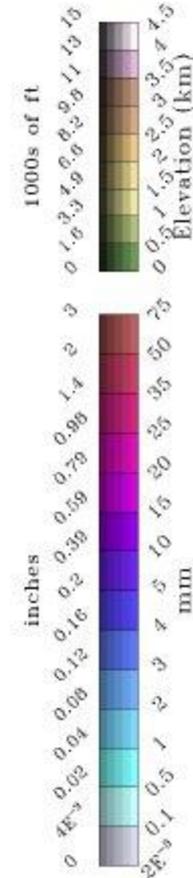
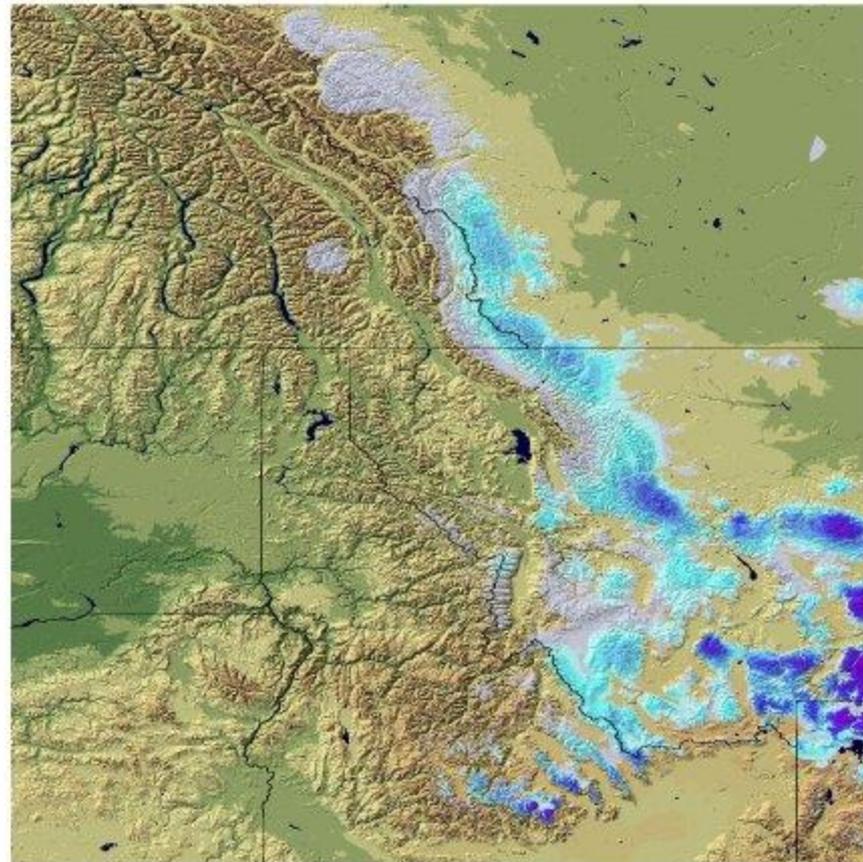
Snow Depth

2016-09-13 06 UTC



Scaled Snow Precipitation

24-Hour Total Ending 2016-09-13 06 UTC

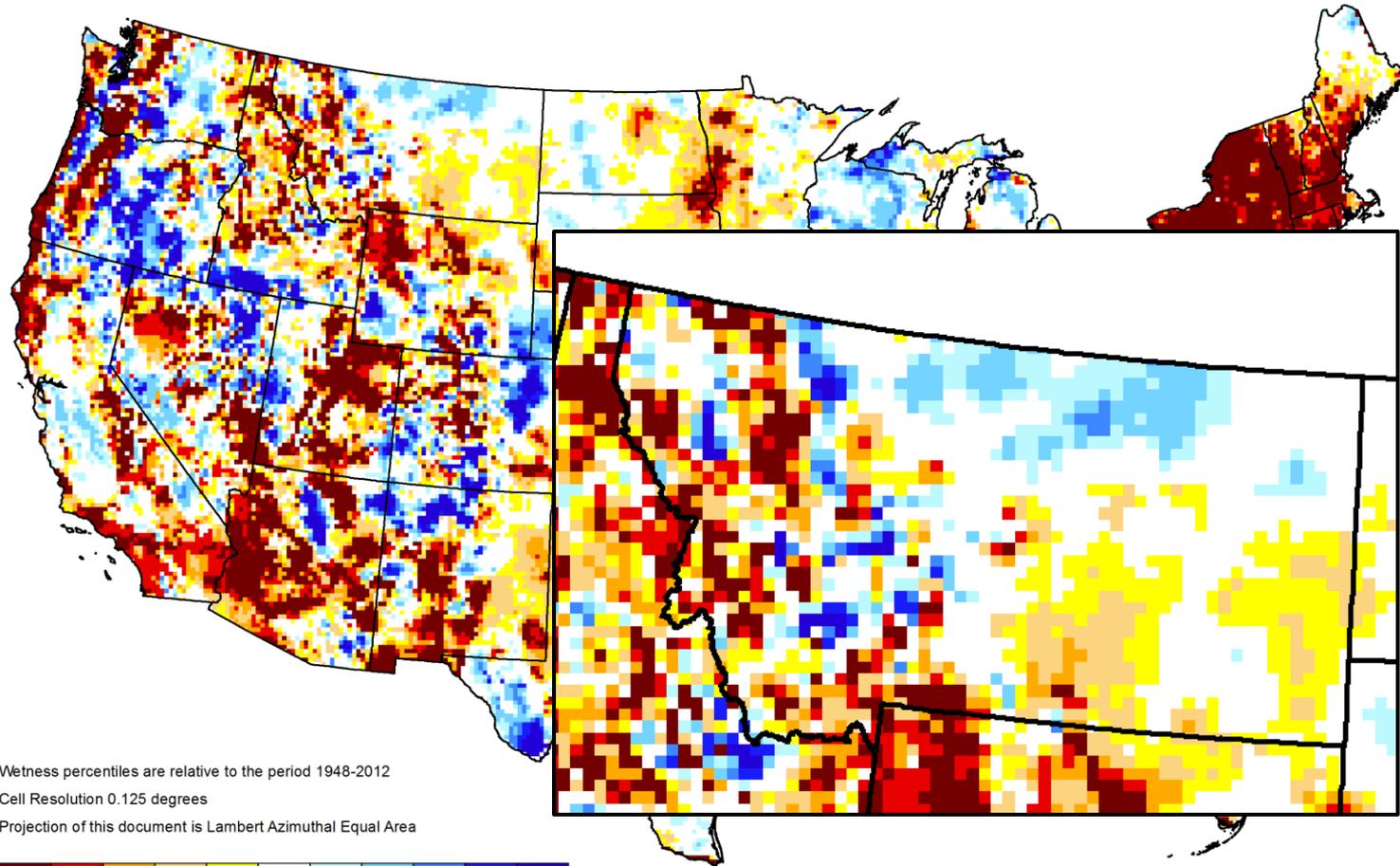


Soil Moisture



GRACE-Based Shallow Groundwater Drought Indicator

September 05, 2016



Wetness percentiles are relative to the period 1948-2012

Cell Resolution 0.125 degrees

Projection of this document is Lambert Azimuthal Equal Area

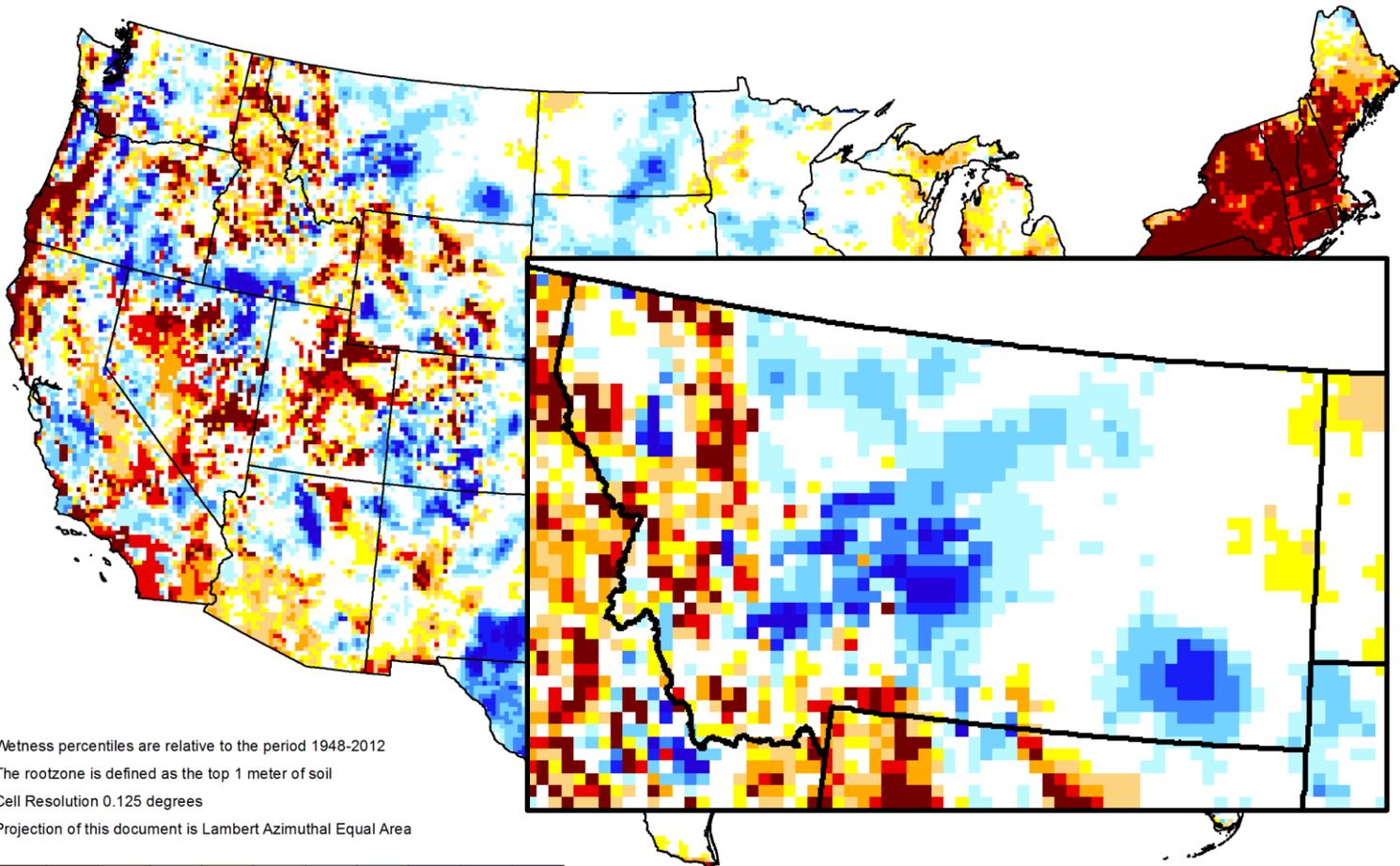


<http://drought.unl.edu/MonitoringTools/NASAGRACEDataAssimilation.aspx>

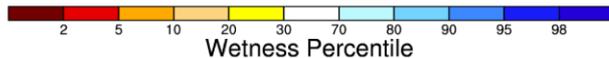


GRACE-Based Root Zone Soil Moisture Drought Indicator

September 05, 2016

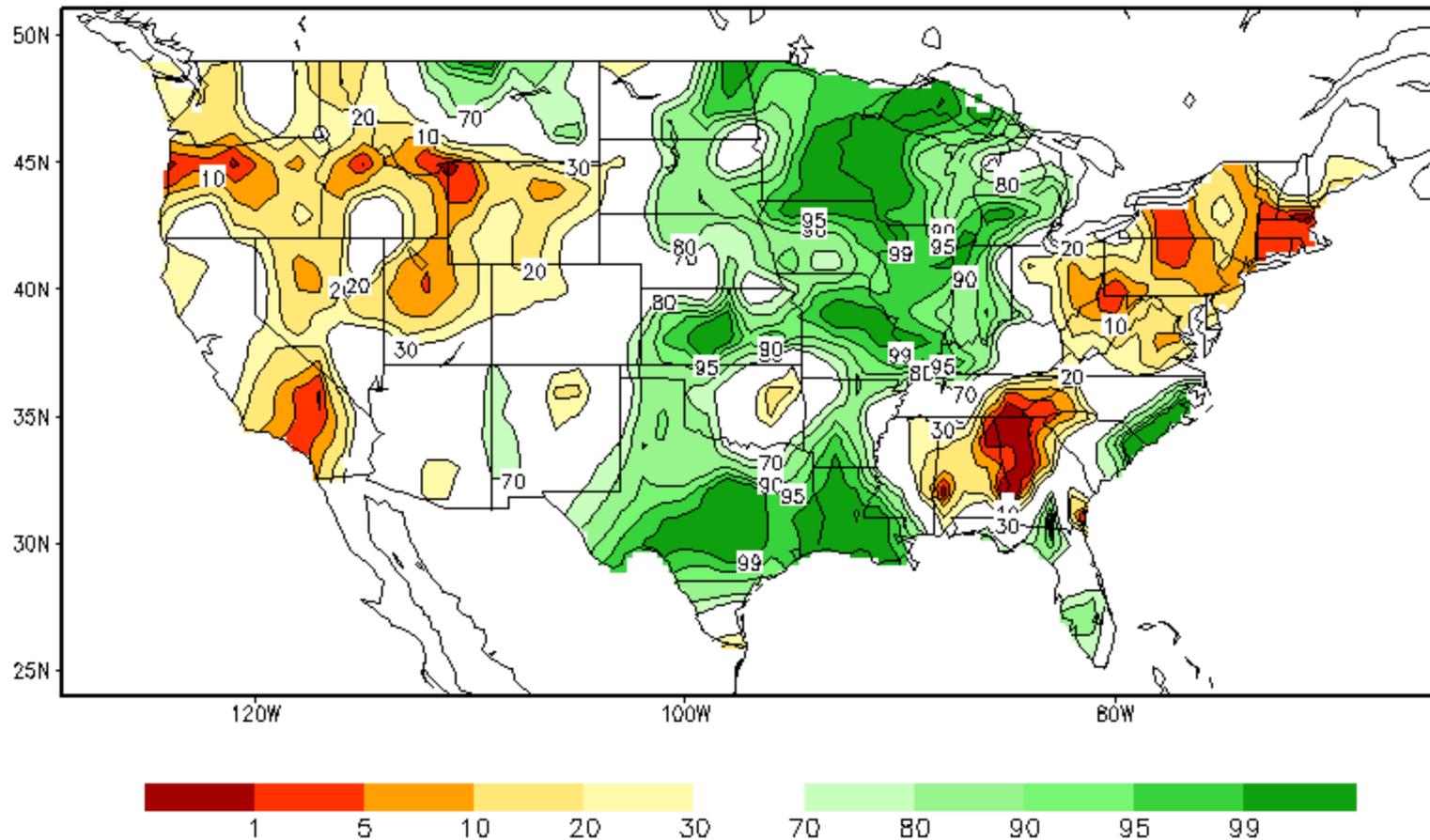


Wetness percentiles are relative to the period 1948-2012
The rootzone is defined as the top 1 meter of soil
Cell Resolution 0.125 degrees
Projection of this document is Lambert Azimuthal Equal Area



<http://drought.unl.edu/MonitoringTools/NASAGRACEDataAssimilation.aspx>

Calculated Soil Moisture Ranking Percentile SEP 12, 2016

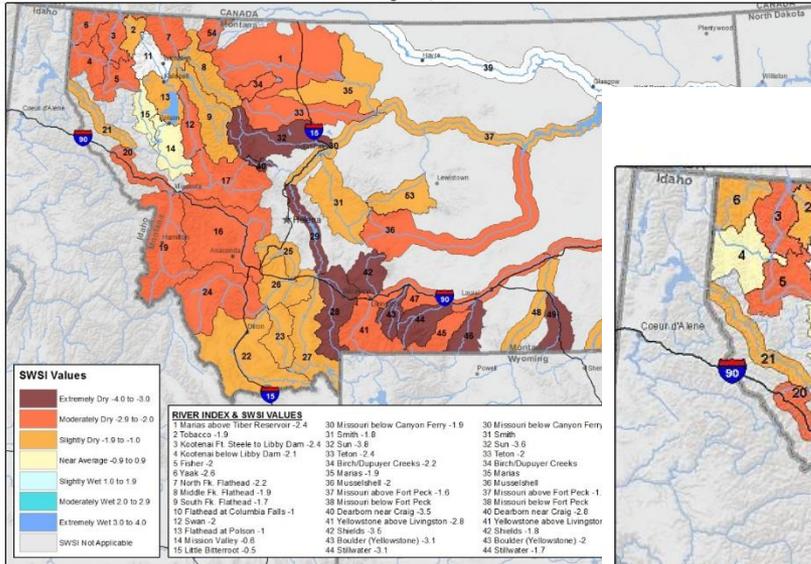


Surface Water Supply Index

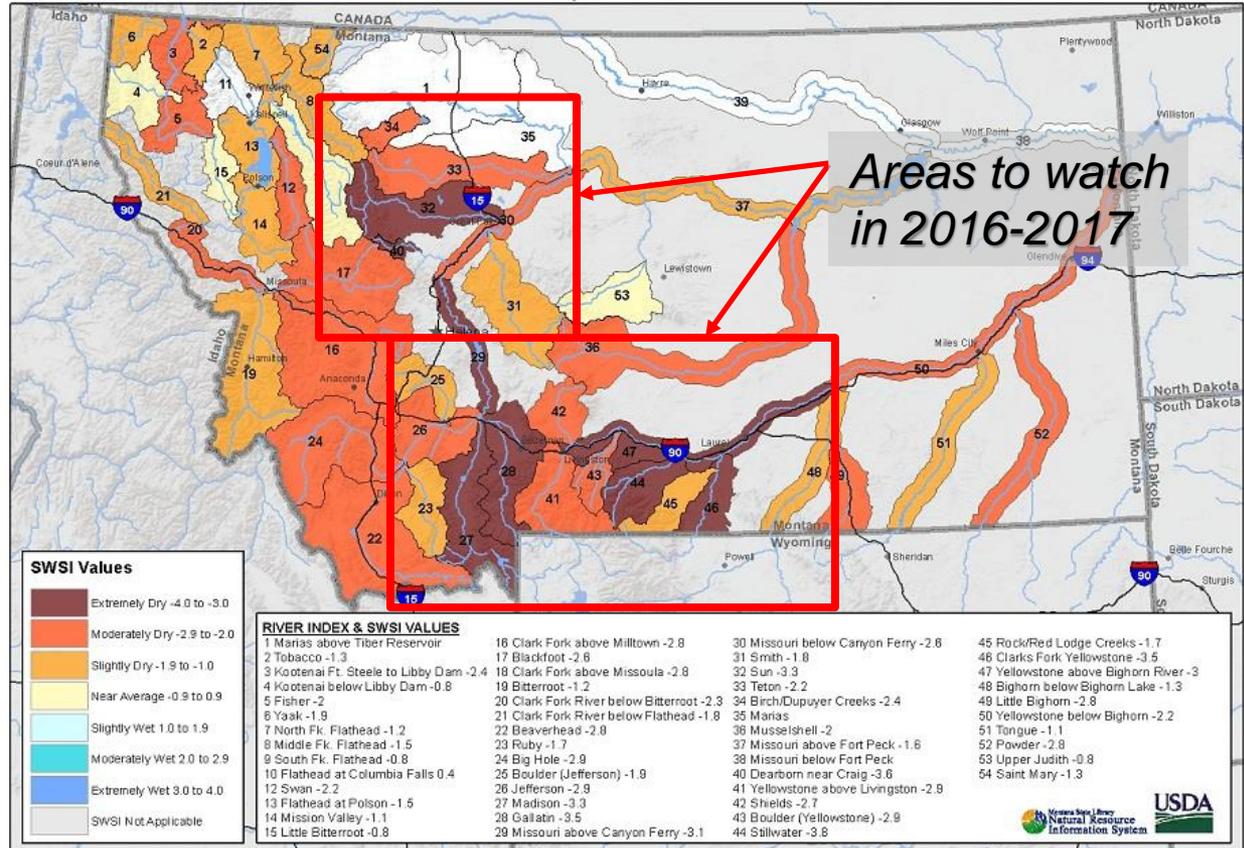
Surface Water Supply Index

September 2016

Montana Data Collection Office
Surface Water Supply Index (SWSI)
August 1, 2016



Montana Data Collection Office
Surface Water Supply Index (SWSI)
September 1, 2016

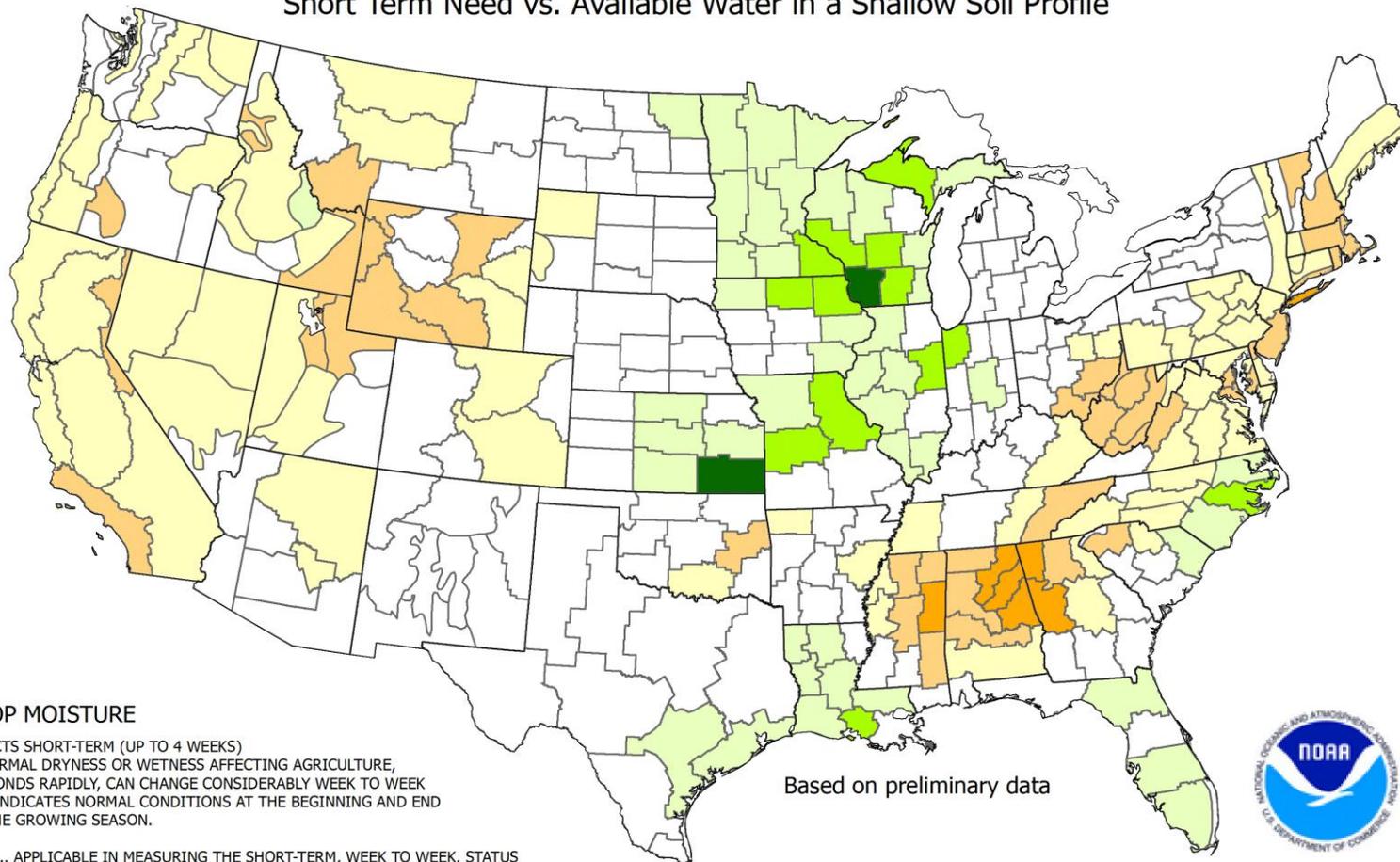


Areas to watch
in 2016-2017

August 2016

Surface Water & Soil Indices

Crop Moisture Index by Division
 Weekly Value for Period Ending Sep 10, 2016
 Short Term Need vs. Available Water in a Shallow Soil Profile



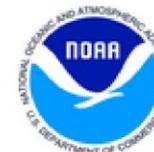
CROP MOISTURE

DEPICTS SHORT-TERM (UP TO 4 WEEKS) ABNORMAL DRYNESS OR WETNESS AFFECTING AGRICULTURE, RESPONDS RAPIDLY, CAN CHANGE CONSIDERABLY WEEK TO WEEK AND INDICATES NORMAL CONDITIONS AT THE BEGINNING AND END OF THE GROWING SEASON.

USES... APPLICABLE IN MEASURING THE SHORT-TERM, WEEK TO WEEK, STATUS OF DRYNESS OR WETNESS AFFECTING WARM SEASON CROPS AND FIELD OPERATIONS

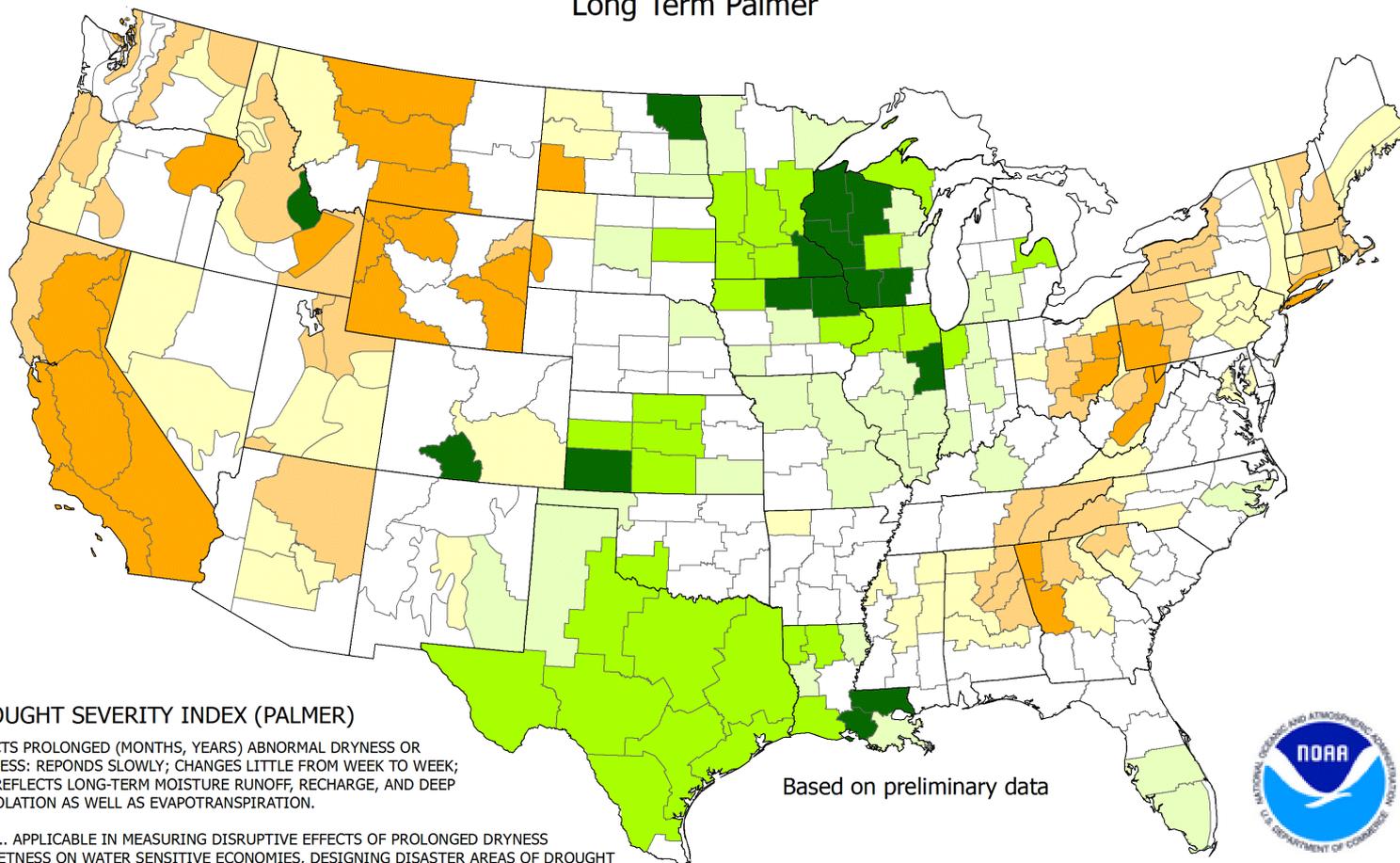
LIMITATIONS... MAY NOT BE APPLICABLE TO GERMINATING AND SHALLOW ROOTED CROPS WHICH ARE UNABLE TO EXTRACT THE DEEP OR SUBSOIL MOISTURE FROM A SHALLOW SOIL PROFILE, OR FOR COOL SEASON CROPS GROWING WHEN TEMPERATURES ARE AVERAGING BELOW ABOUT 55F. IT IS NOT GENERALLY INDICATIVE OF THE LONG-TERM (MONTHS, YEARS) DROUGHT OR WET SPELLS WHICH ARE DEPICTED BY THE DROUGHT SEVERITY INDEX.

Based on preliminary data



- | | |
|---|---------------------------------|
| -3.0 or less (Severly Dry) | +1.0 to +1.9 (Abnormally Moist) |
| -2.0 to -2.9 (Excessively Dry) | +2.0 to +3.0 (Wet) |
| -1.0 to -1.9 (Abnormally Dry) | 3.0 and above (Excessively Wet) |
| -0.9 to +0.9 (Slightly Dry/Favorably Moist) | |

Drought Severity Index by Division Weekly Value for Period Ending Sep 10, 2016 Long Term Palmer



DROUGHT SEVERITY INDEX (PALMER)

DEPICTS PROLONGED (MONTHS, YEARS) ABNORMAL DRYNESS OR WETNESS; REponds SLOWLY; CHANGES LITTLE FROM WEEK TO WEEK; AND REFLECTS LONG-TERM MOISTURE RUNOFF, RECHARGE, AND DEEP PERCOLATION AS WELL AS EVAPOTRANSPIRATION.

USES... APPLICABLE IN MEASURING DISRUPTIVE EFFECTS OF PROLONGED DRYNESS OR WETNESS ON WATER SENSITIVE ECONOMIES, DESIGNING DISASTER AREAS OF DROUGHT OR WETNESS; AND REFLECTING THE GENERAL LONG-TERM STATUS OF WATER SUPPLIES IN AQUIFERS, RESERVOIRS AND STREAMS.

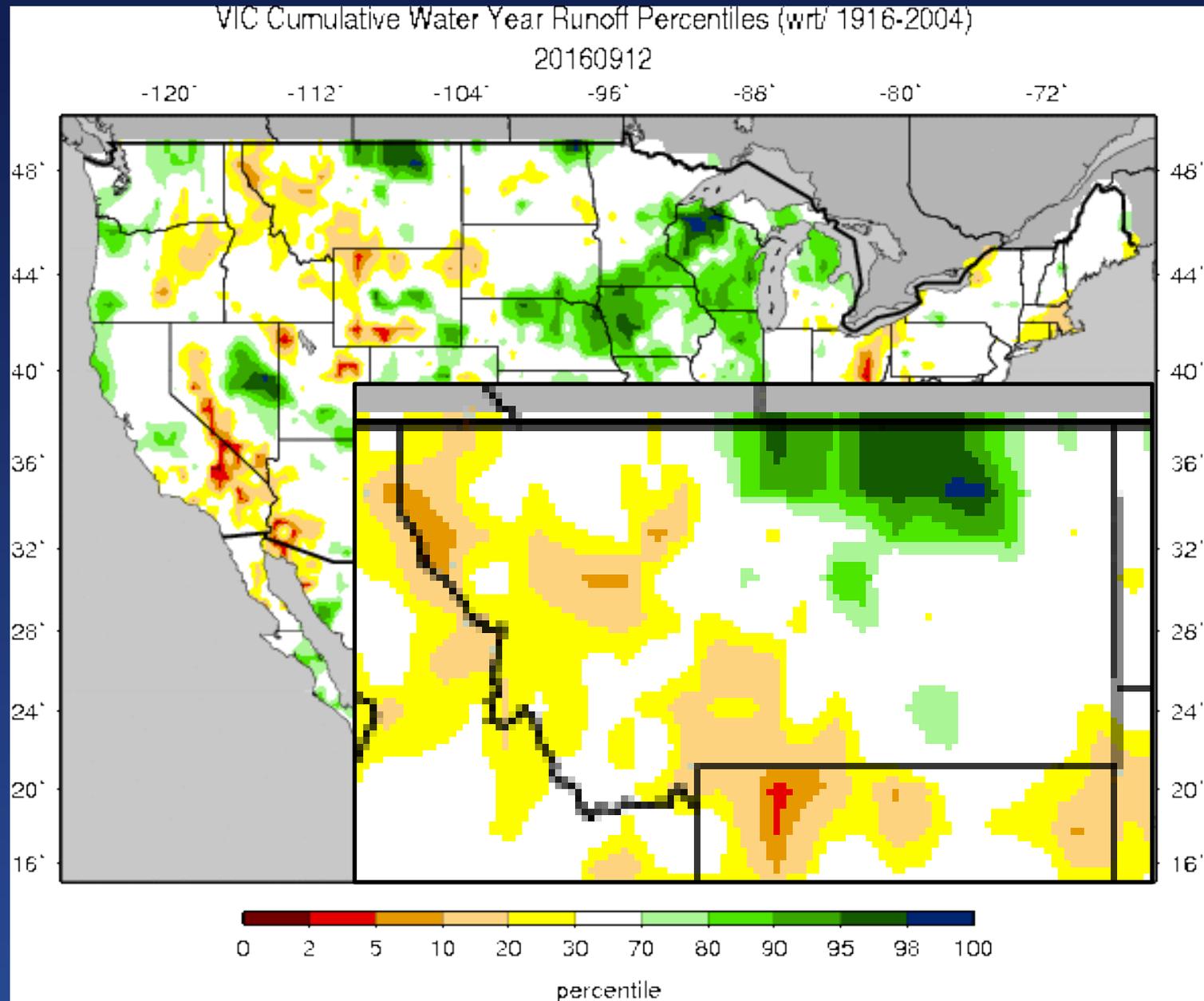
LIMITATIONS... IS NOT GENERALLY INDICATIVE OFFSHORT-TERM (FEW WEEKS) STATUS OF DROUGHT OR WETNESS SUCH AS FREQUENTLY AFFECTS CROPS AND FIELD OPERATIONS (THIS IS INDICATED BY THE CROP MOISTURE INDEX).

Based on preliminary data



- 4.0 or less (Extreme Drought)
- +2.0 to +2.9 (Unusual Moist Spell)
- 3.0 to -3.9 (Severe Drought)
- +3.0 to +3.9 (Very Moist Spell)
- 2.0 to -2.9 (Moderate Drought)
- +4.0 and above (Extremely Moist)
- 1.9 to +1.9 (Near Normal)

Water Year Runoff



Find more information:

Snowpack, Mountain Precipitation, Soil
Moisture and Water Supply

<http://tinyurl.com/MontanaSnowSurvey>

Lucas Zukiewicz

Water Supply Specialist (Snow Hydrologist)

USDA-NRCS

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406-587-6843

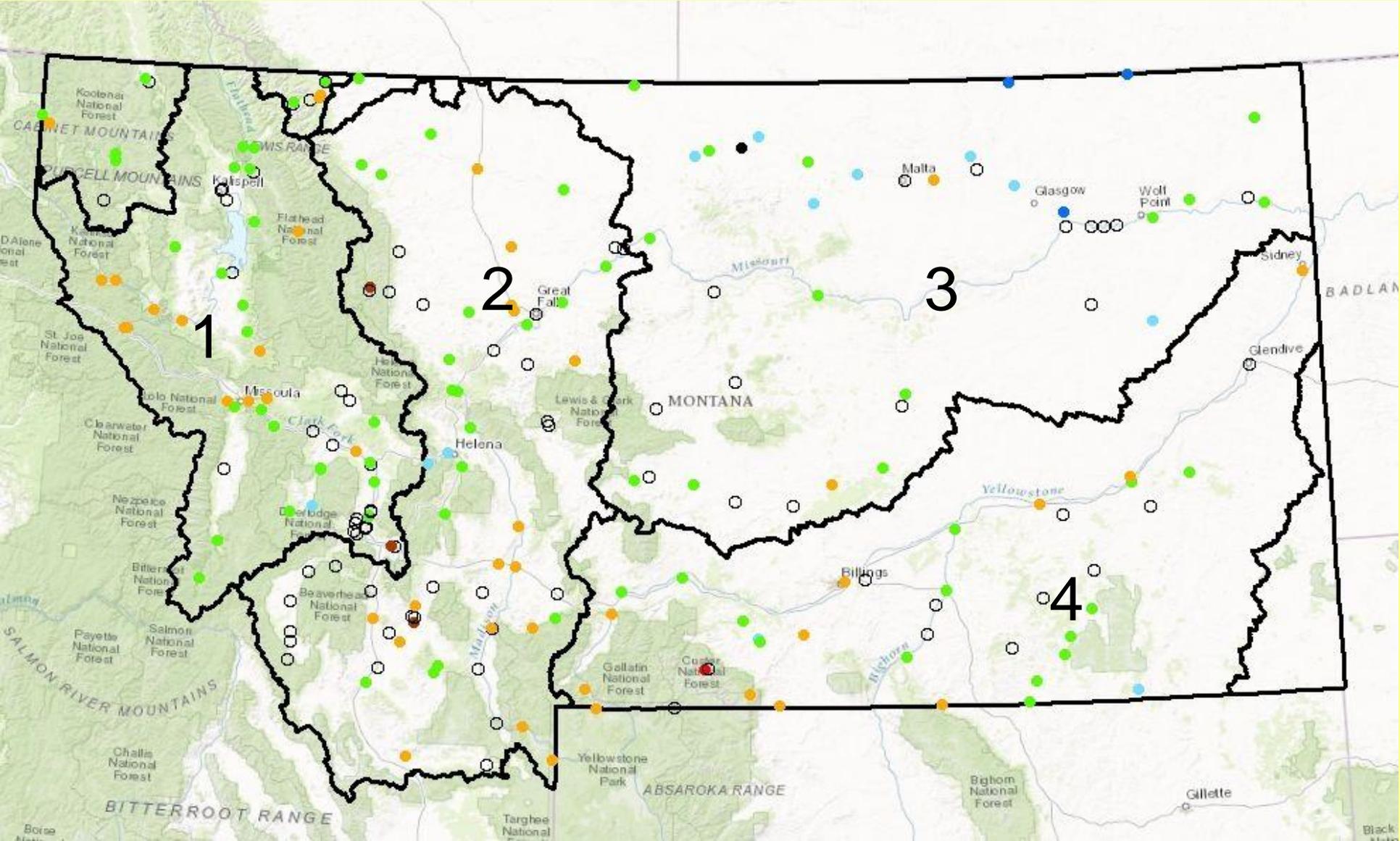
**[http://www.nrcs.usda.gov/wps/portal/nrcs/main/
mt/snow/](http://www.nrcs.usda.gov/wps/portal/nrcs/main/mt/snow/)**



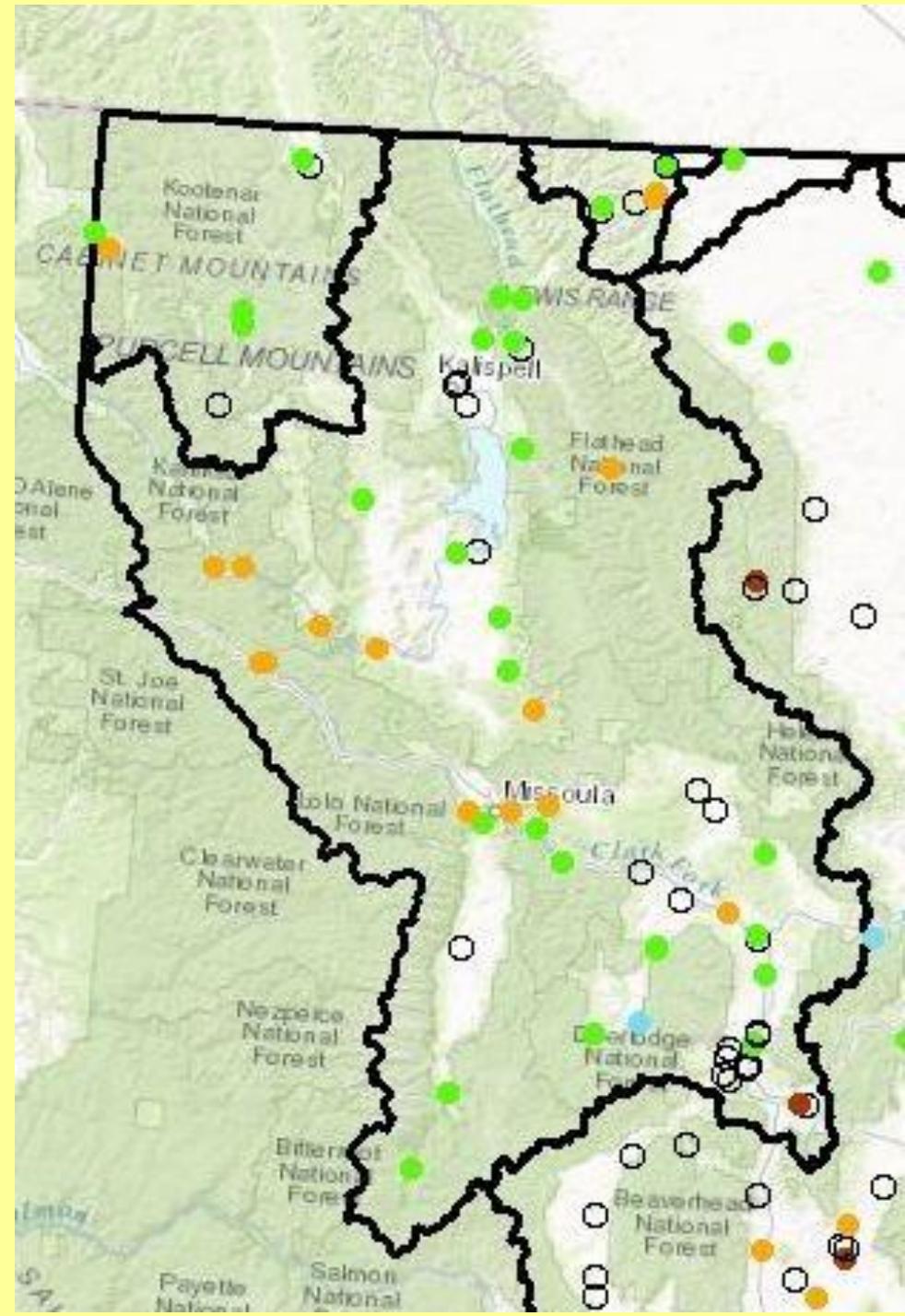
USGS Streamflows September 13, 2016



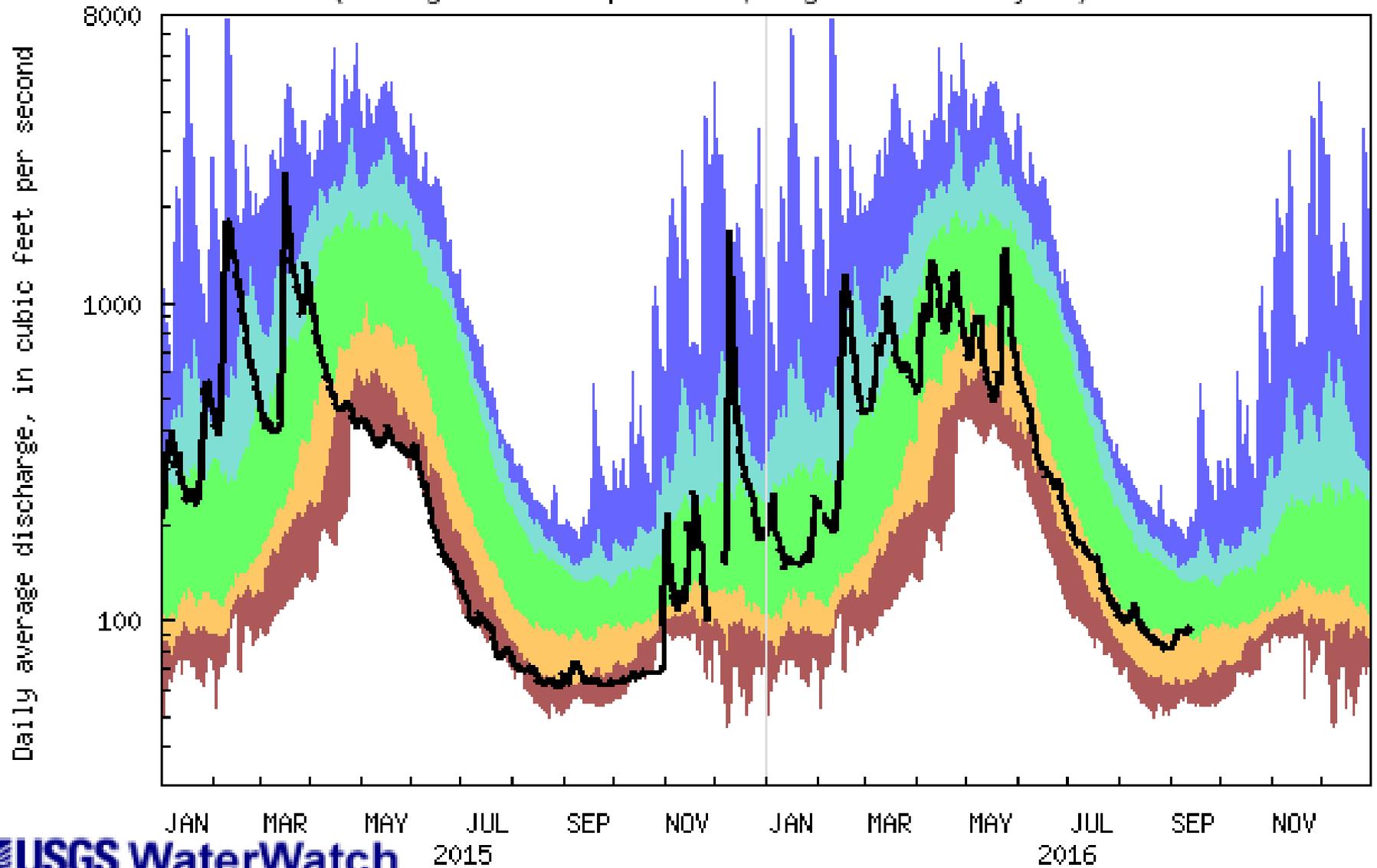
Major Drainage Basins



Kootenai – Clark Fork Basins

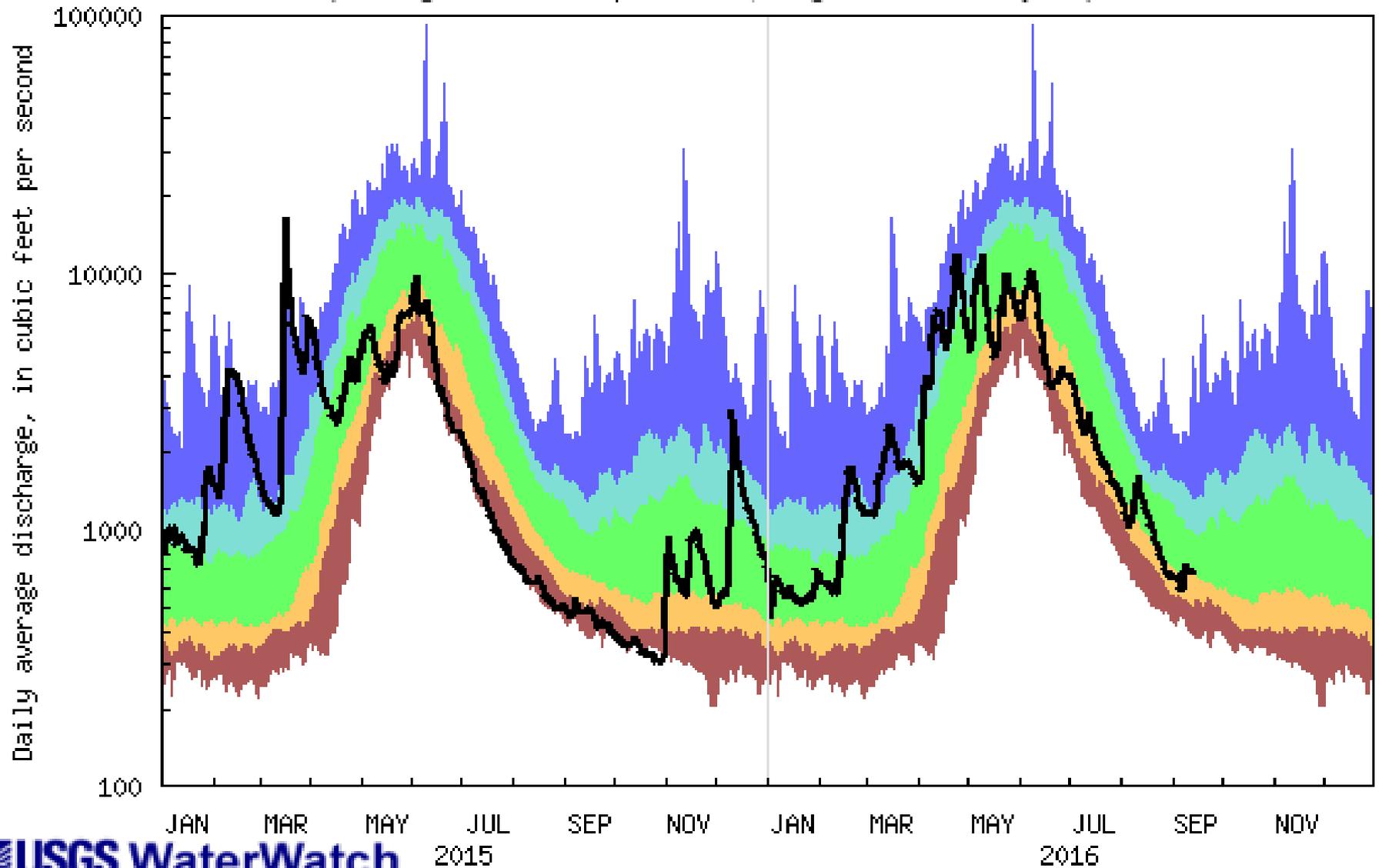


USGS 12302055 Fisher River near Libby MT
 (Drainage Area: 842 square miles, Length of Record: 48 years)



Explanation - Percentile classes				
lowest-10th percentile	10-24	25-75	76-90	90th percentile-highest
Much below normal	Below normal	Normal	Above normal	Much above normal

USGS 12358500 M F Flathead River near West Glacier MT
 (Drainage Area: 1125 square miles, Length of Record: 76 years)



USGS WaterWatch

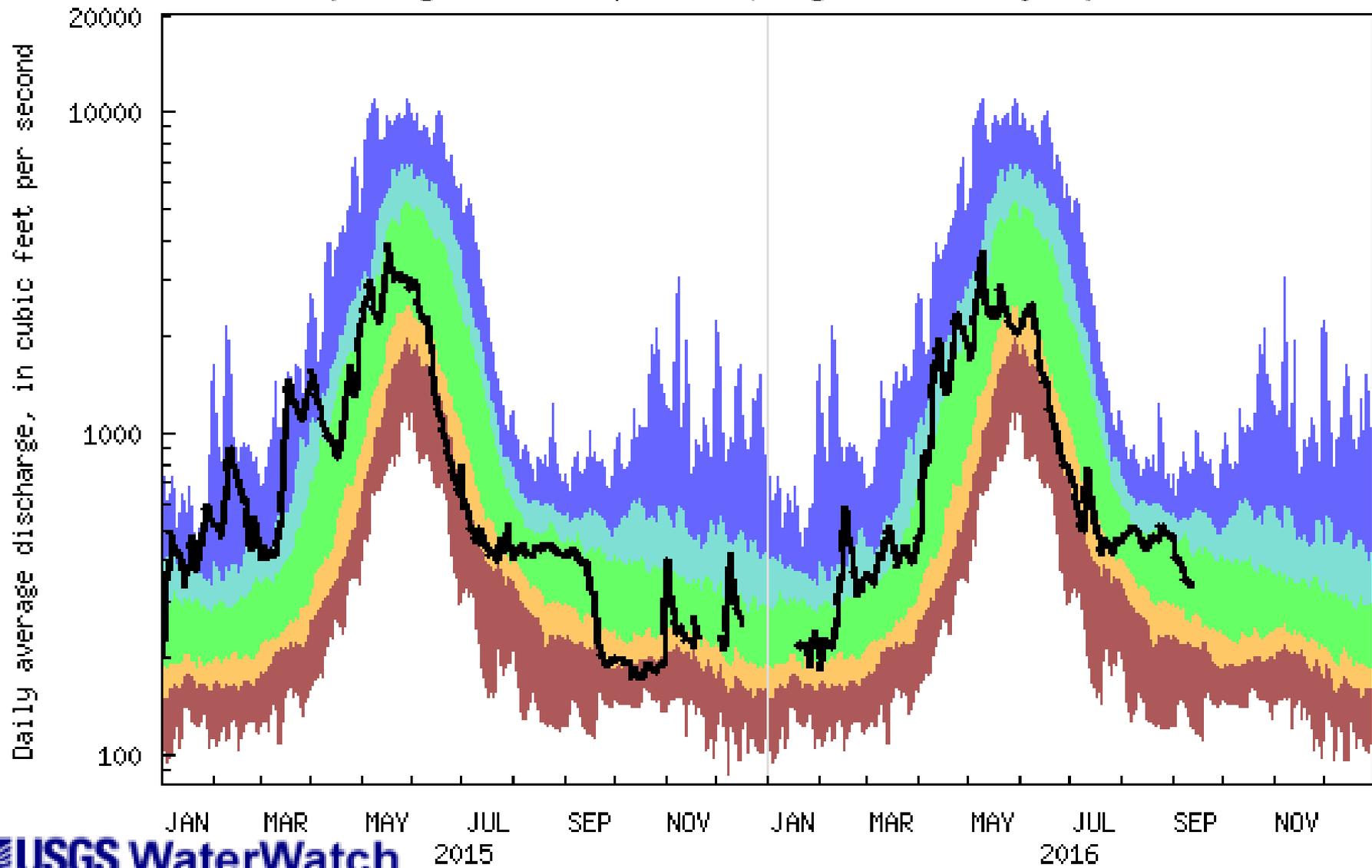
2015

2016

Last updated: 2016-09-14

Explanation - Percentile classes					
lowest-10th percentile	10-24	25-75	76-90	90th percentile-highest	Flow
Much below normal	Below normal	Normal	Above normal	Much above normal	

USGS 12344000 Bitterroot River near Darby MT
 (Drainage Area: 1050 square miles, Length of Record: 78 years)



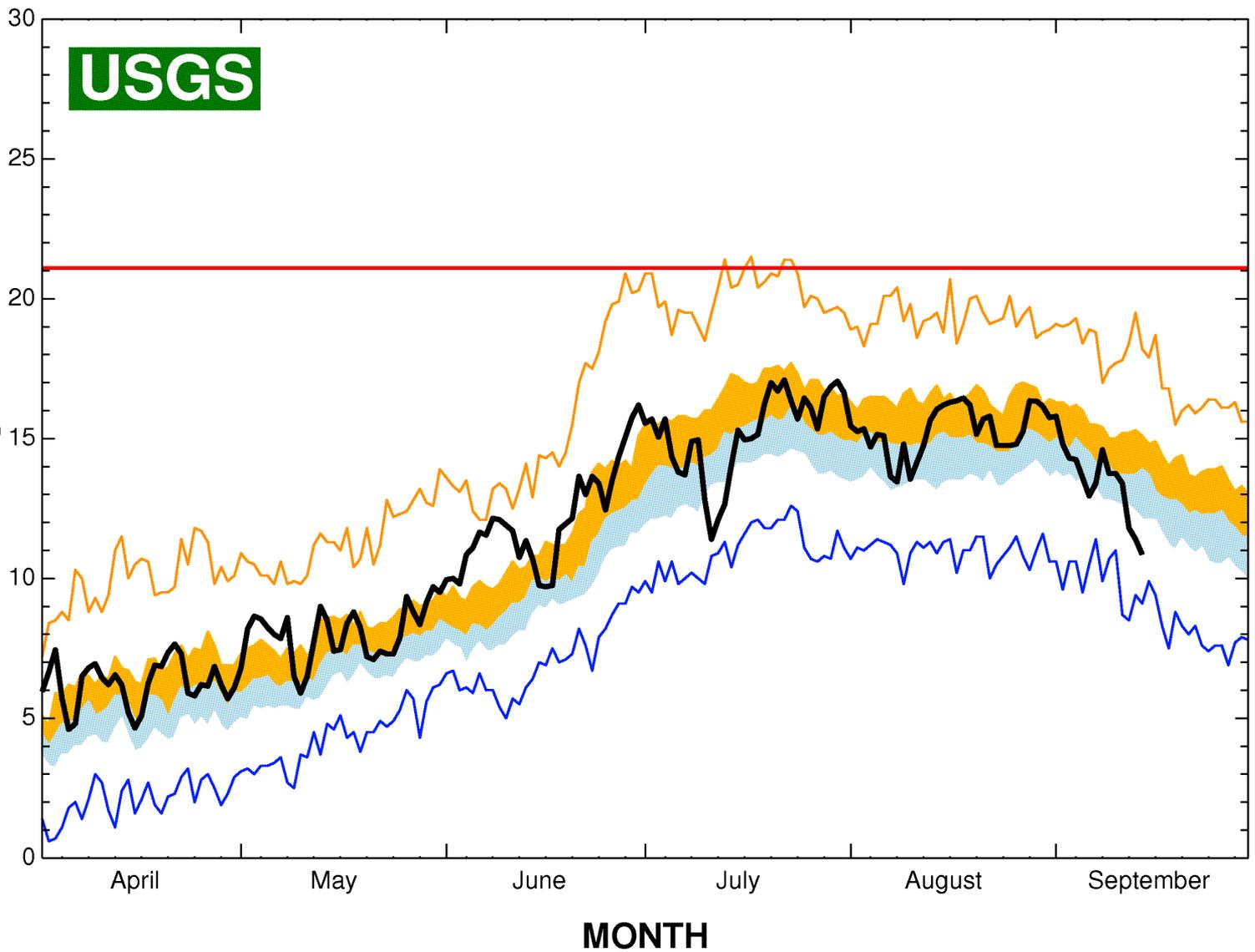
USGS WaterWatch

Last updated: 2016-09-14

Explanation - Percentile classes					
lowest-10th percentile	10-24	25-75	76-90	90th percentile-highest	Flow
Much below normal	Below normal	Normal	Above normal	Much above normal	

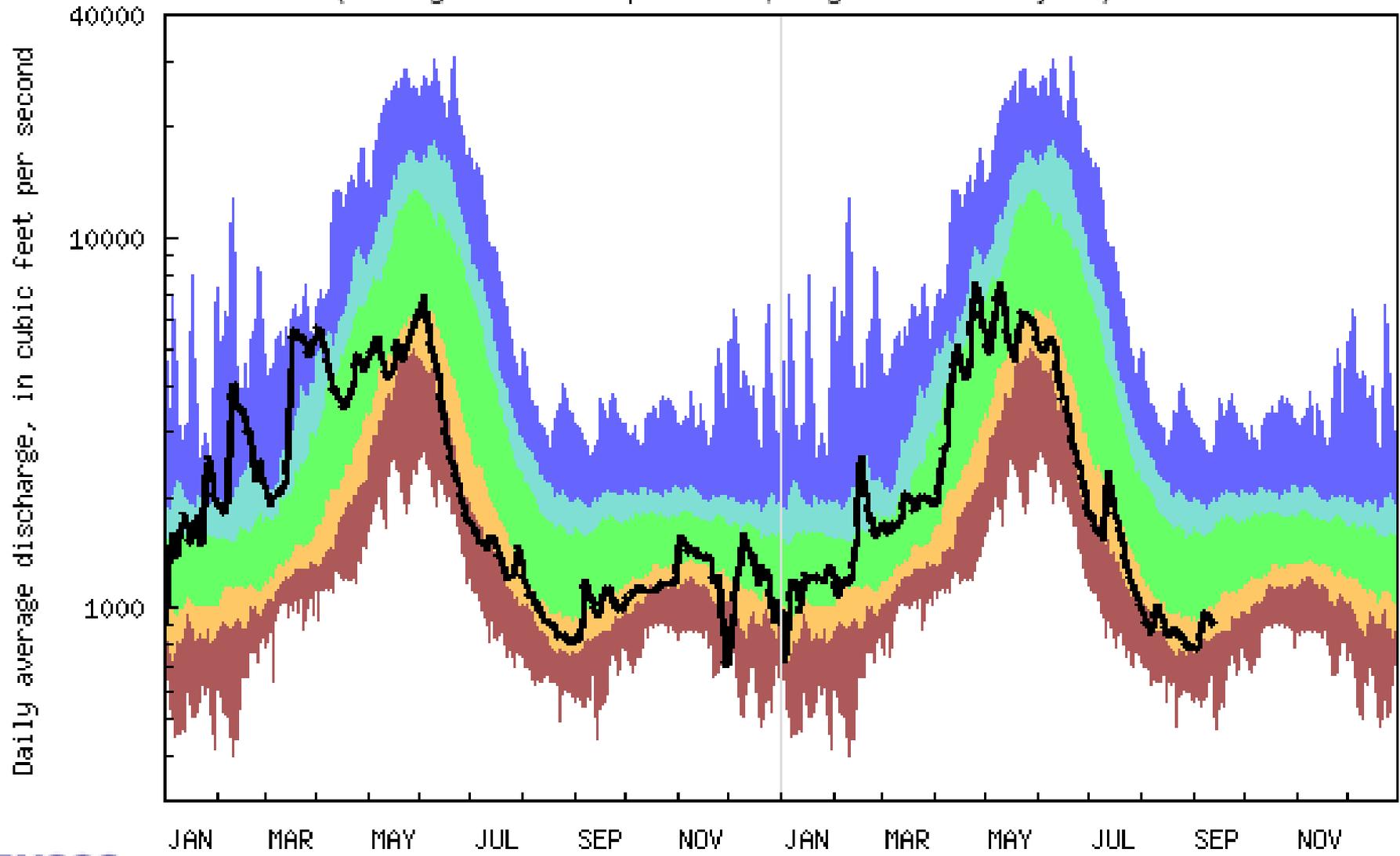
USGS

**WATER
TEMPERATURE,
IN DEGREES
CELSIUS**



12344000 Bitterroot River near Darby MT

USGS 12340500 Clark Fork above Missoula MT
 (Drainage Area: 6021 square miles, Length of Record: 86 years)



USGS WaterWatch

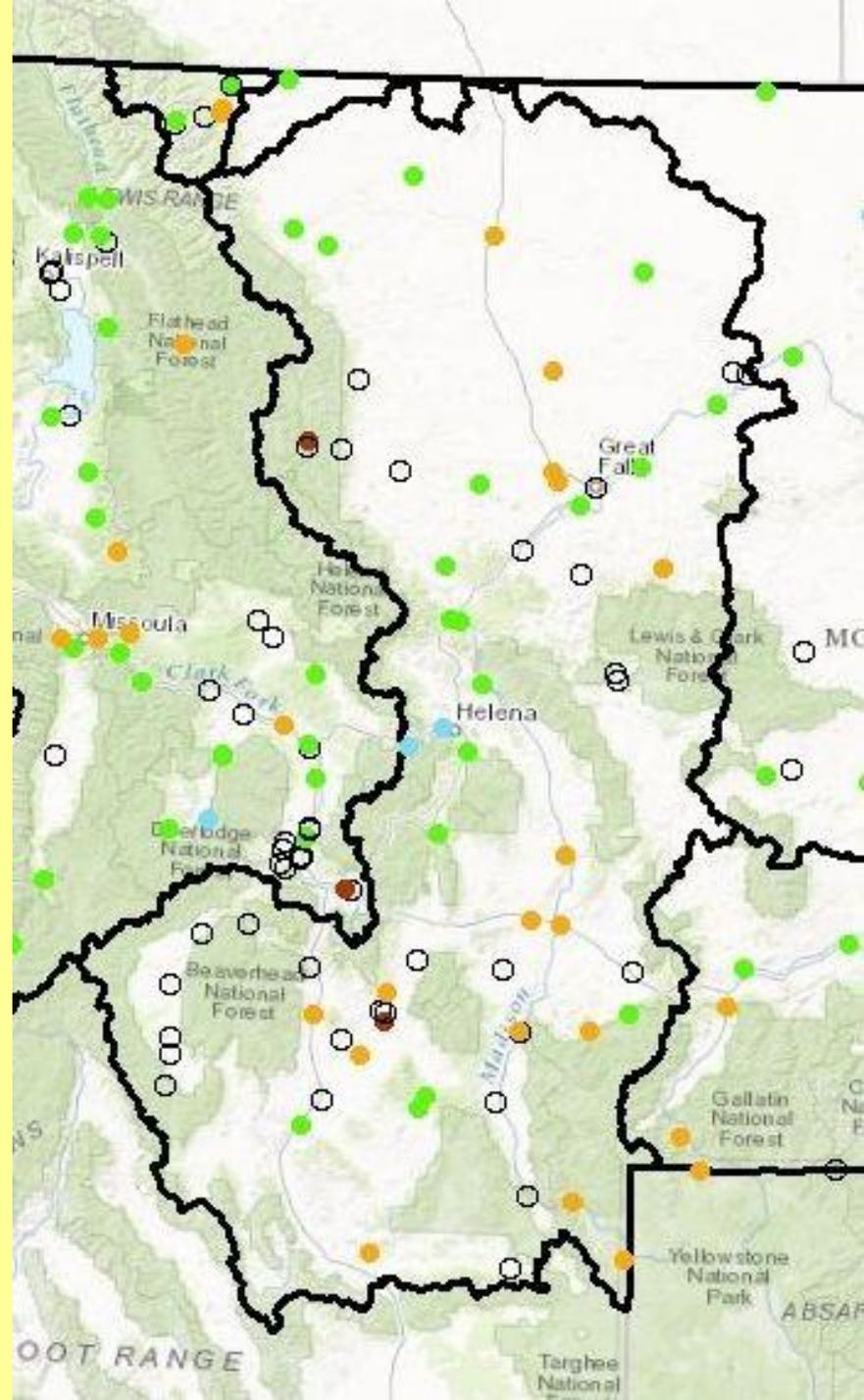
2015

2016

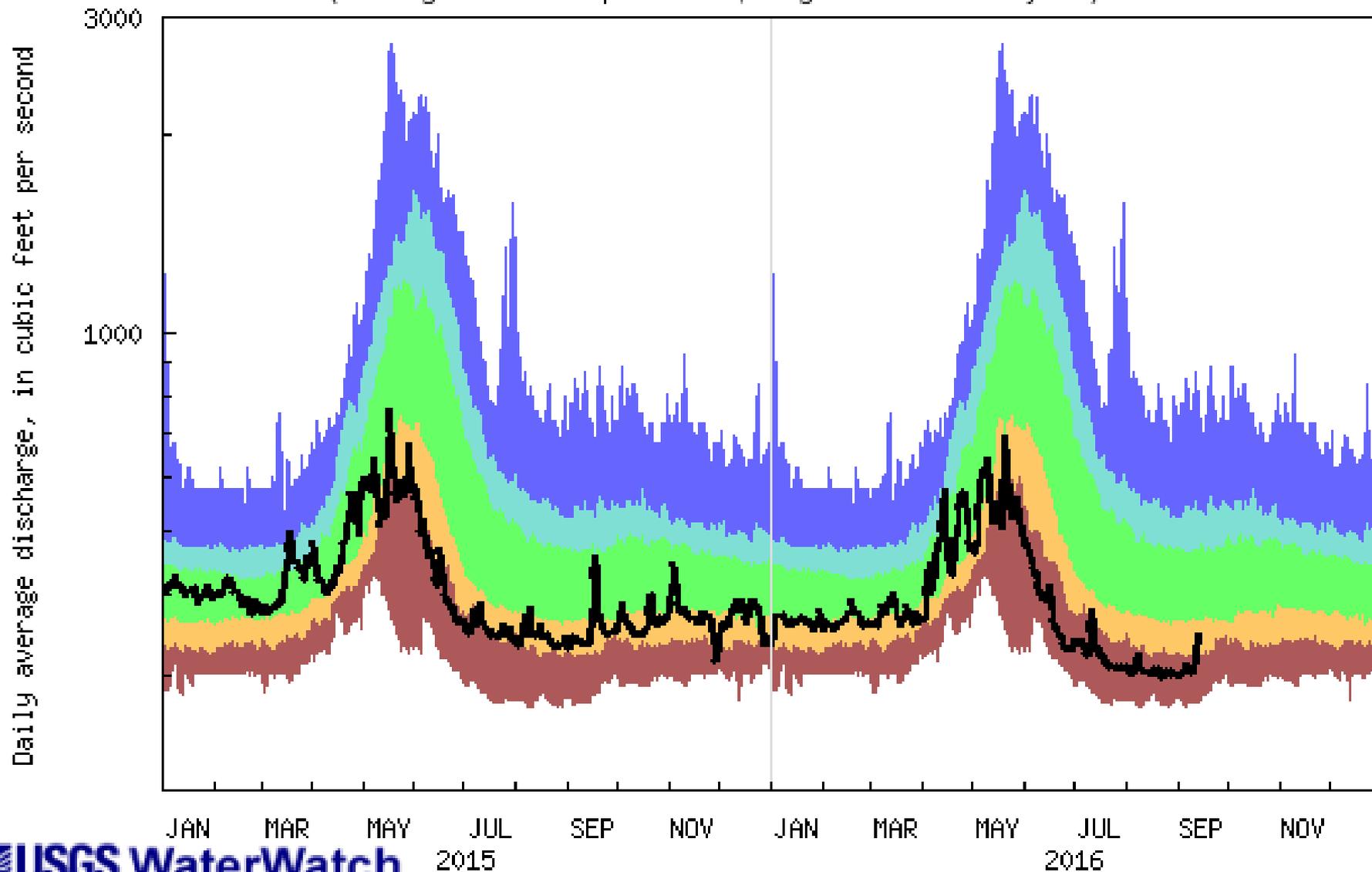
Last updated: 2016-09-14

Explanation - Percentile classes					
lowest-10th percentile	10-24	25-75	76-90	90th percentile-highest	Flow
Much below normal	Below normal	Normal	Above normal	Much above normal	

Upper Missouri River Basin



USGS 06037500 Madison River near West Yellowstone, MT
 (Drainage Area: 435 square miles, Length of Record: 102 years)

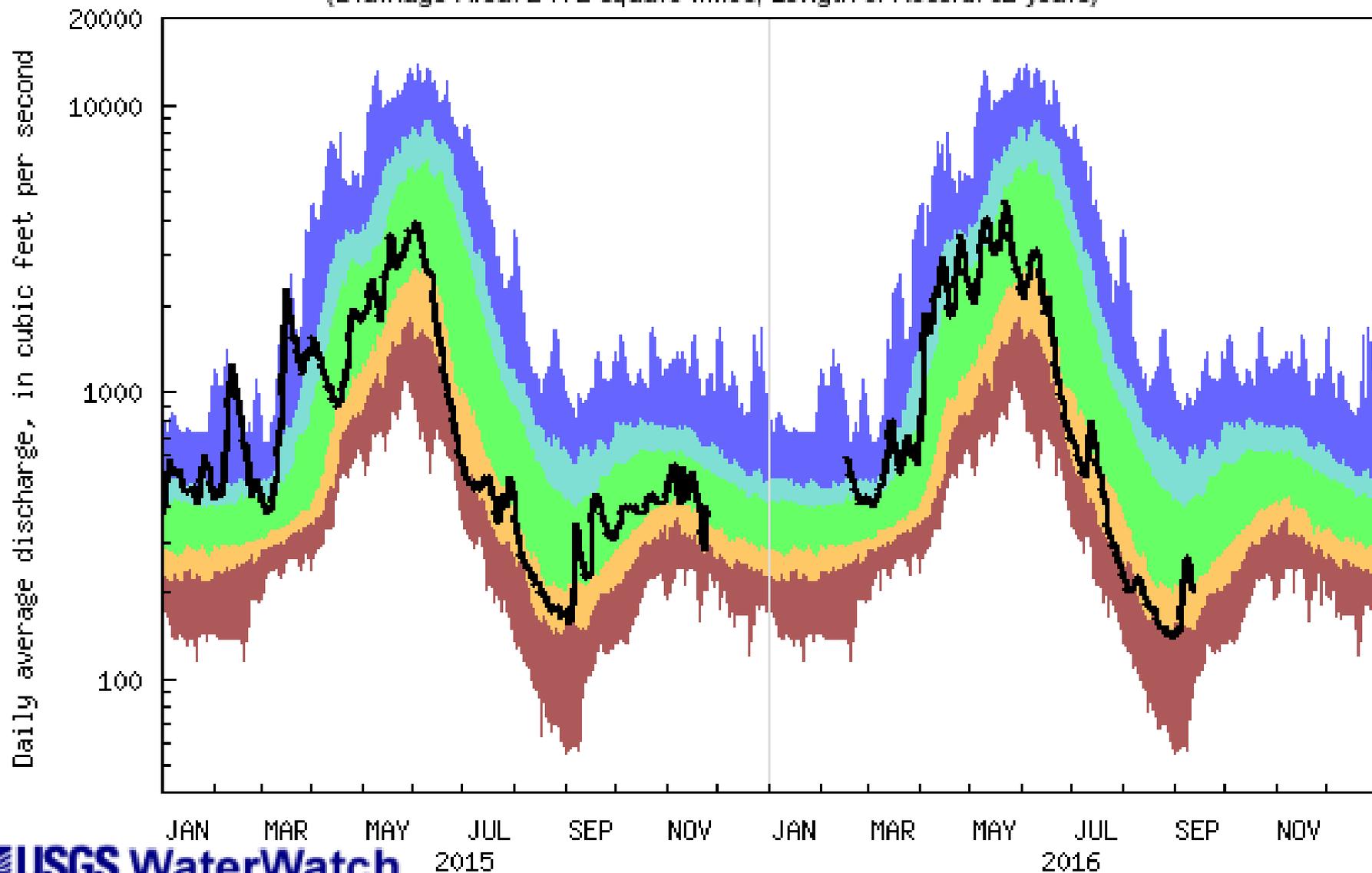


USGS WaterWatch

Last updated: 2016-09-14

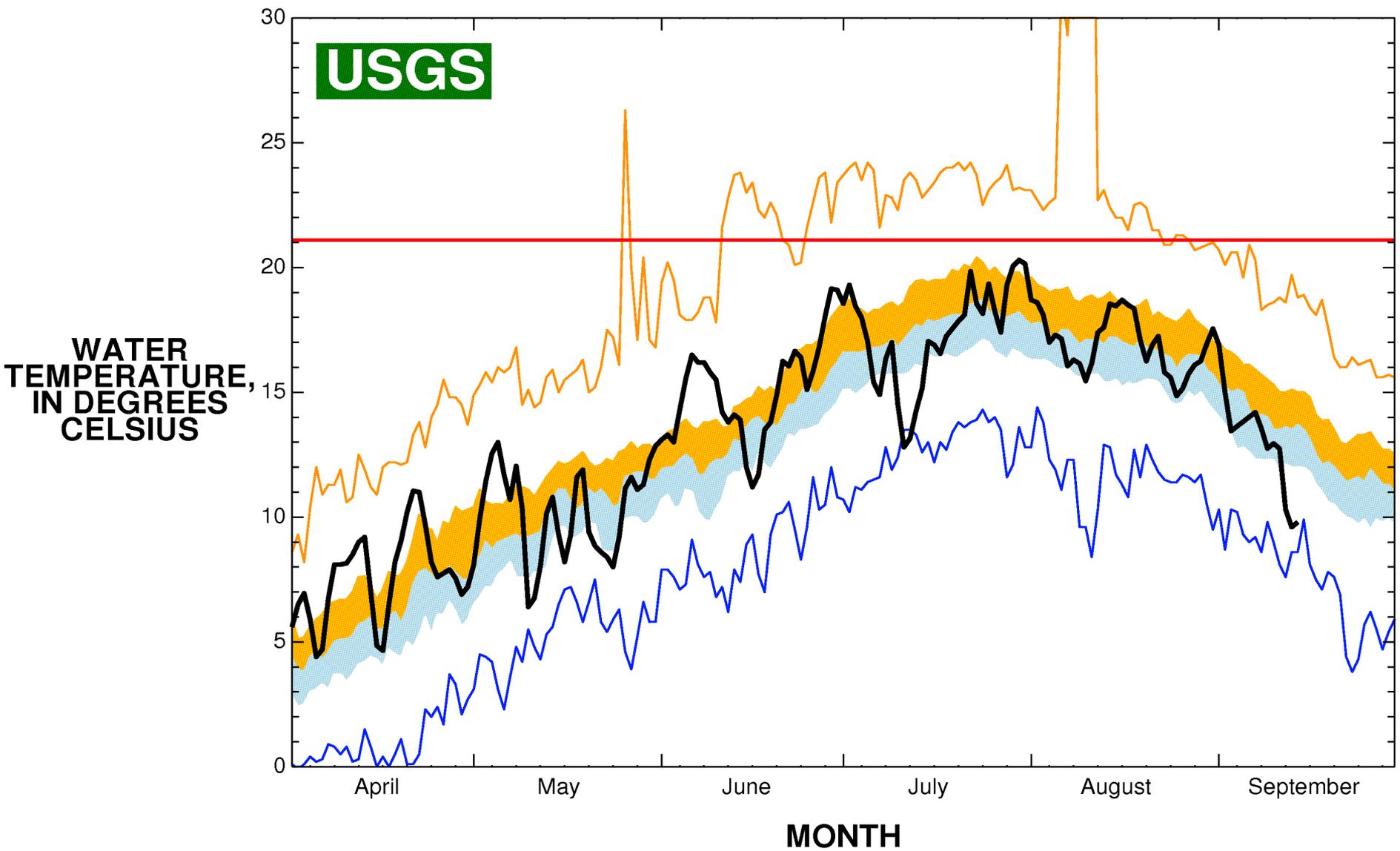
Explanation - Percentile classes					
lowest-10th percentile	10-24	25-75	76-90	90th percentile-highest	Flow
Much below normal	Below normal	Normal	Above normal	Much above normal	

USGS 06025500 Big Hole River near Melrose MT
 (Drainage Area: 2472 square miles, Length of Record: 92 years)



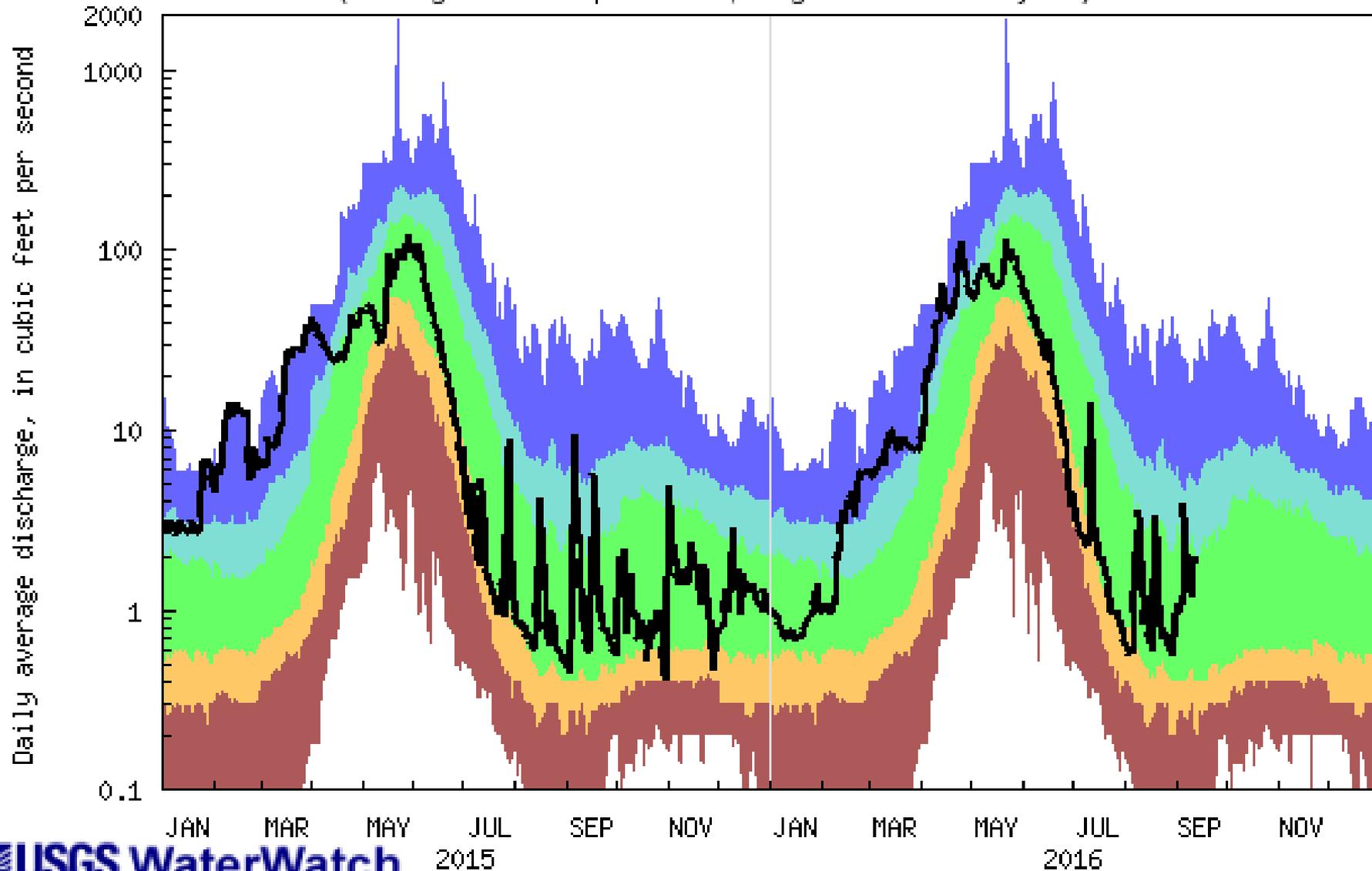
Explanation - Percentile classes				
lowest-10th percentile	10-24	25-75	76-90	90th percentile-highest
Much below normal	Below normal	Normal	Above normal	Much above normal

Flow



06025500 Big Hole River near Melrose MT

USGS 06062500 Tenmile Creek near Rimini MT
 (Drainage Area: 33 square miles, Length of Record: 101 years)



USGS WaterWatch

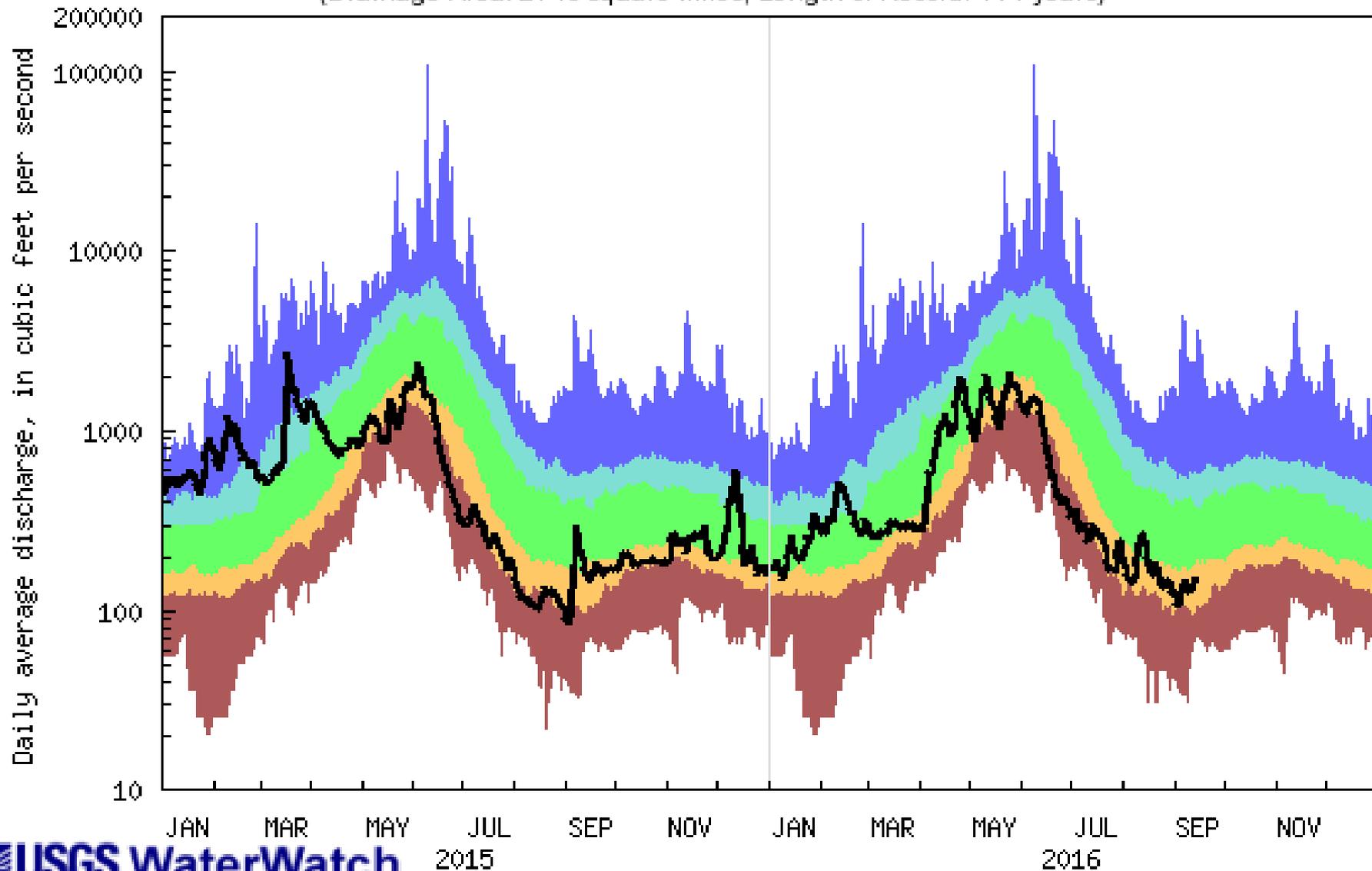
2015

2016

Last updated: 2016-09-14

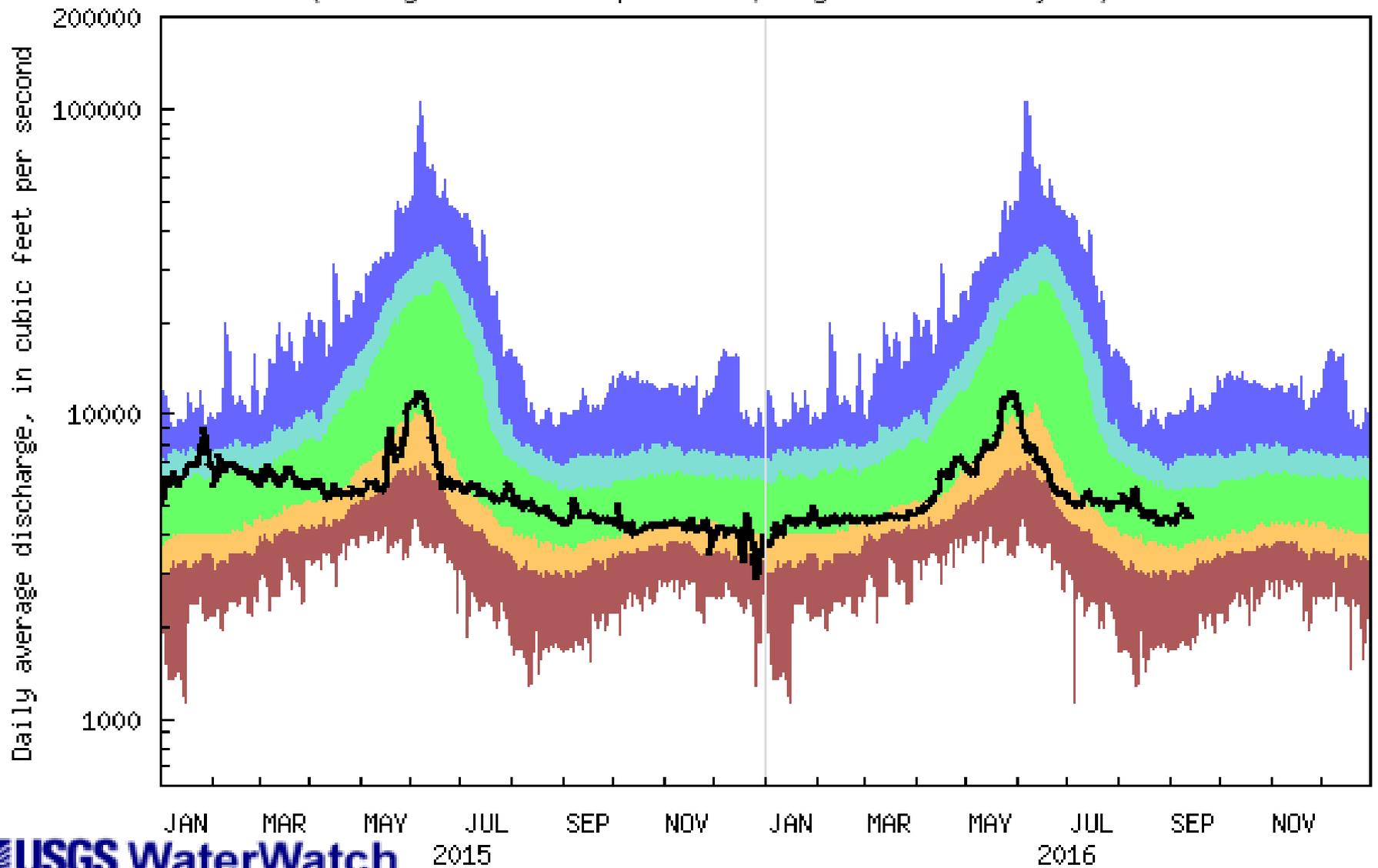
Explanation - Percentile classes					
lowest-10th percentile	10-24	25-75	76-90	90th percentile-highest	Flow
Much below normal	Below normal	Normal	Above normal	Much above normal	

USGS 06099500 Marias River near Shelby MT
 (Drainage Area: 2716 square miles, Length of Record: 114 years)



Explanation - Percentile classes					
lowest-10th percentile	10-24	25-75	76-90	90th percentile-highest	Flow
Much below normal	Below normal	Normal	Above normal	Much above normal	

USGS 06090800 Missouri River at Fort Benton MT
 (Drainage Area: 24297 square miles, Length of Record: 125 years)

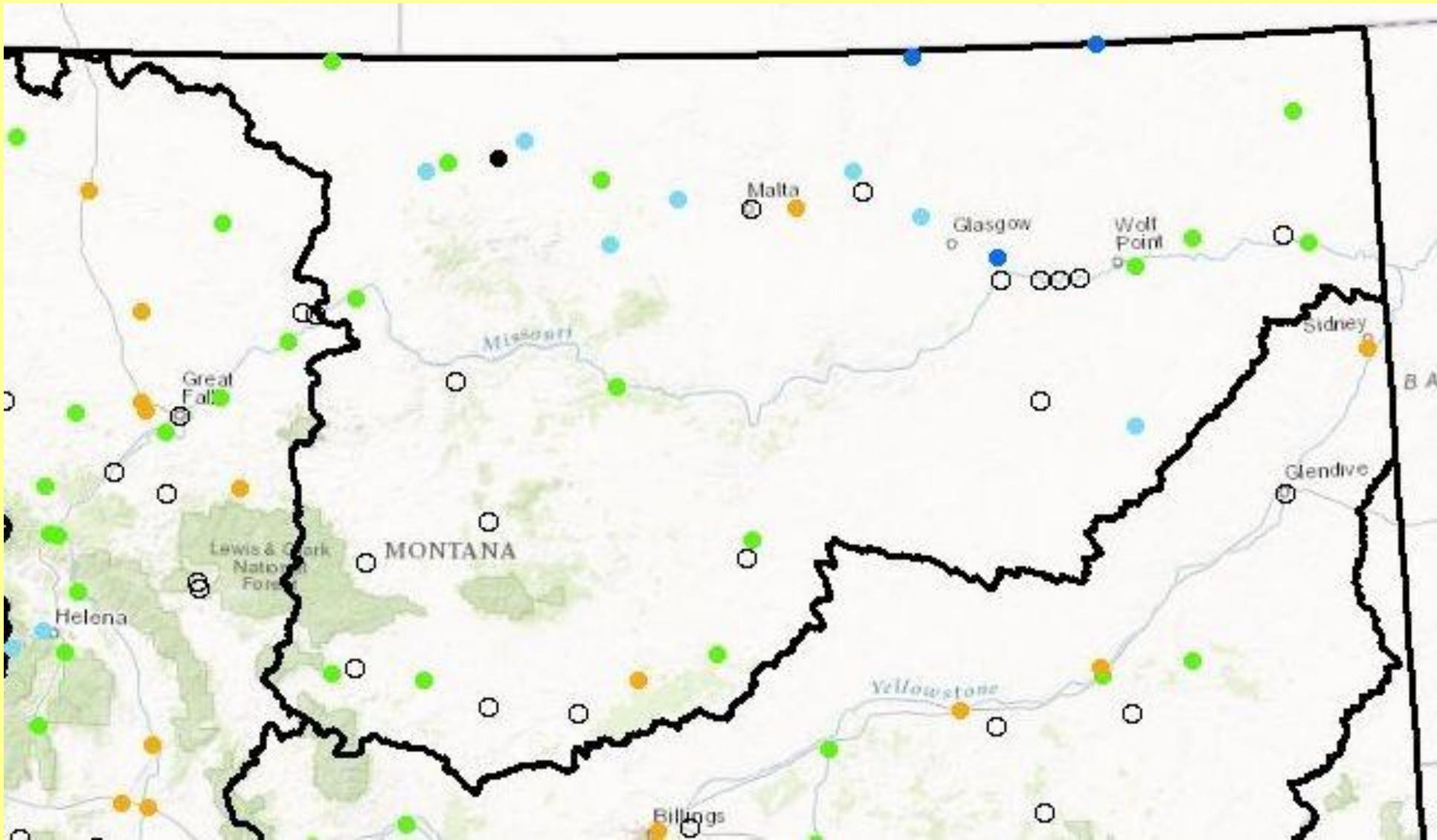


USGS WaterWatch

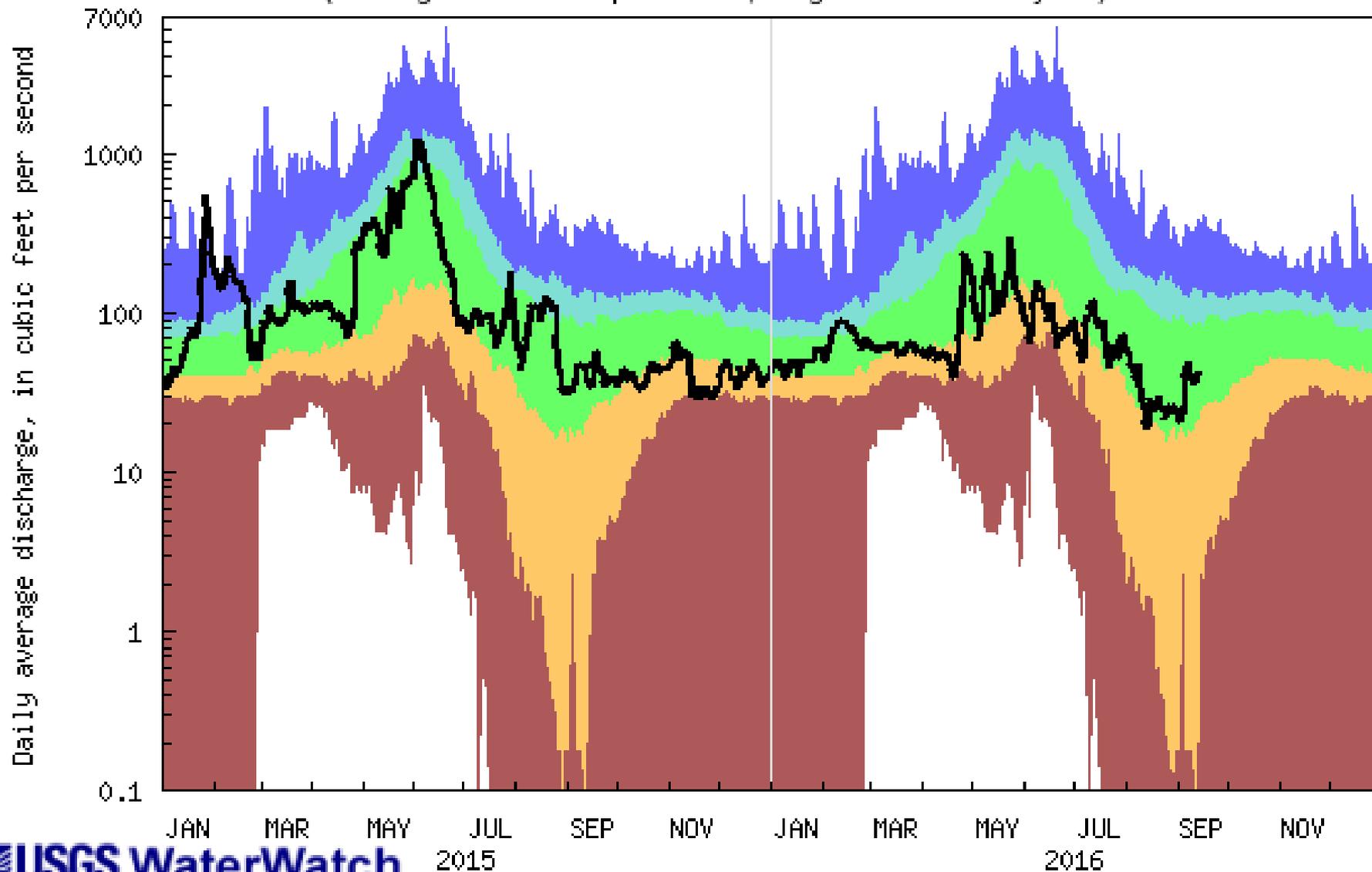
Last updated: 2016-09-14

Explanation - Percentile classes					
lowest-10th percentile	10-24	25-75	76-90	90th percentile-highest	Flow
Much below normal	Below normal	Normal	Above normal	Much above normal	

Lower Missouri River Basin



USGS 06120500 Musselshell River at Harlowton MT
 (Drainage Area: 1108 square miles, Length of Record: 108 years)

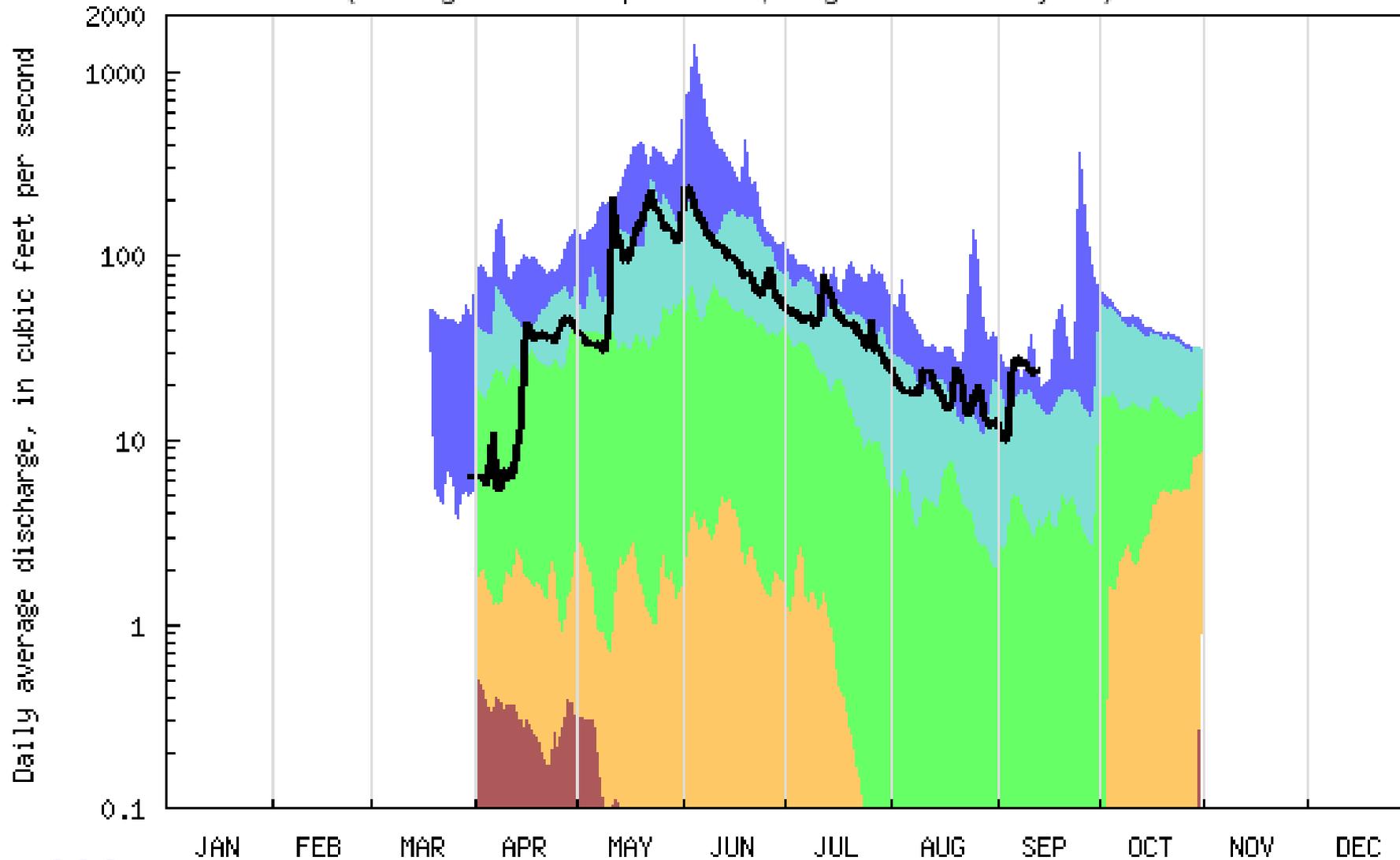


USGS WaterWatch

Last updated: 2016-09-14

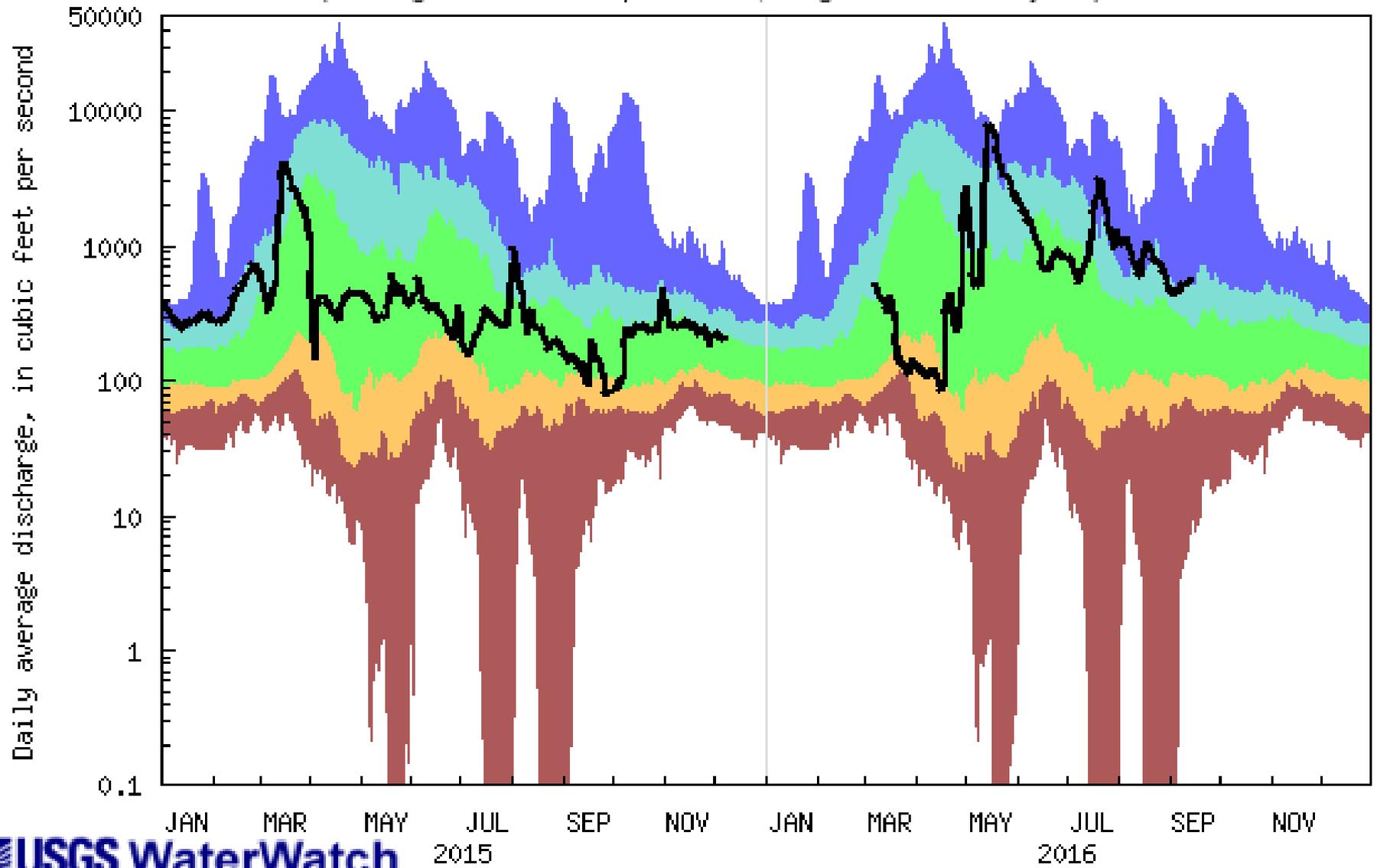
Explanation - Percentile classes					
lowest-10th percentile	10-24	25-75	76-90	90th percentile-highest	Flow
Much below normal	Below normal	Normal	Above normal	Much above normal	

USGS 06142400 Clear Creek near Chinook MT
 (Drainage Area: 135 square miles, Length of Record: 31 years)



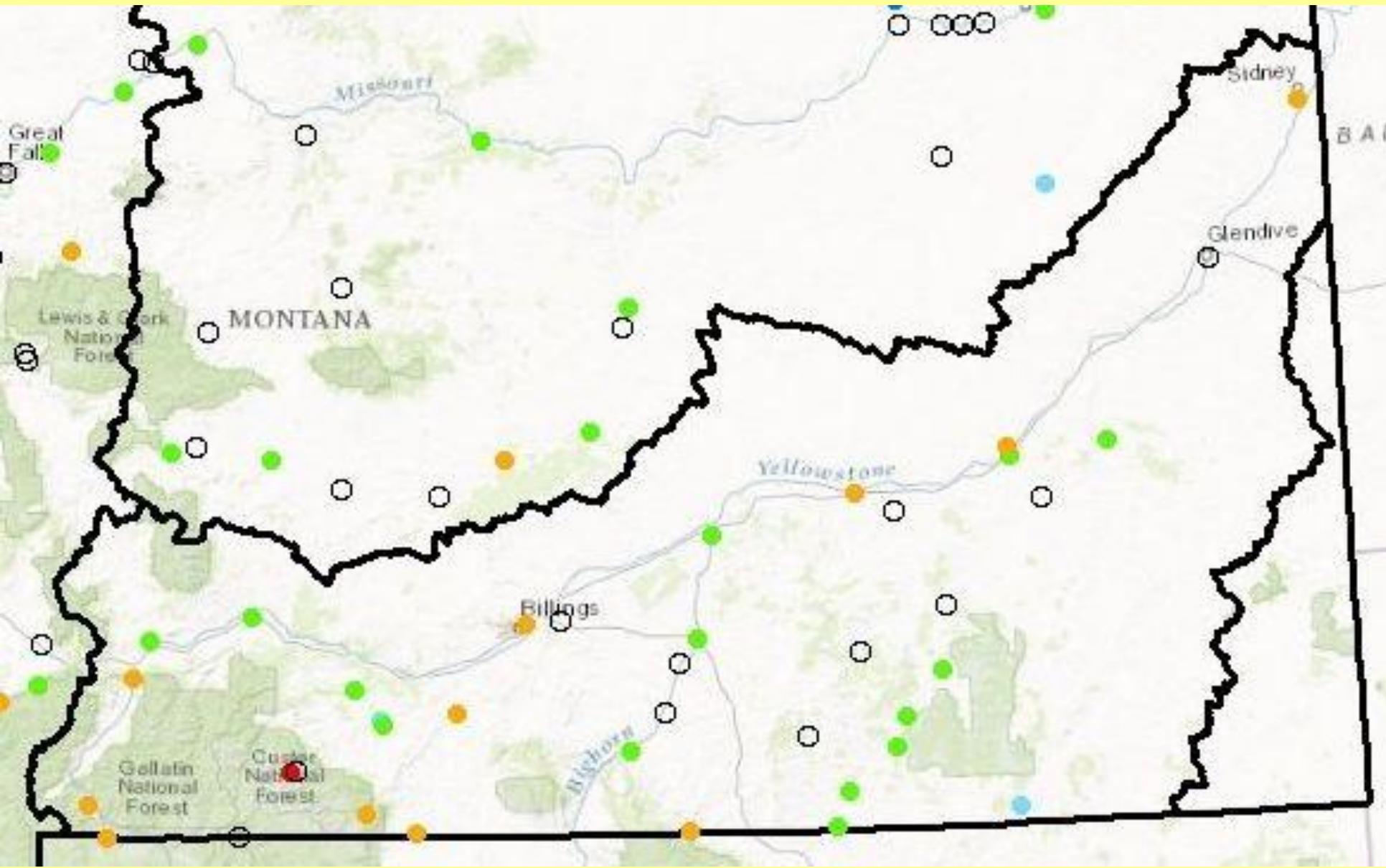
Explanation - Percentile classes					
lowest-10th percentile	10-24	25-75	76-90	90th percentile-highest	Flow
Much below normal	Below normal	Normal	Above normal	Much above normal	

USGS 06174500 Milk River at Nashua MT
 (Drainage Area: 22452 square miles, Length of Record: 76 years)

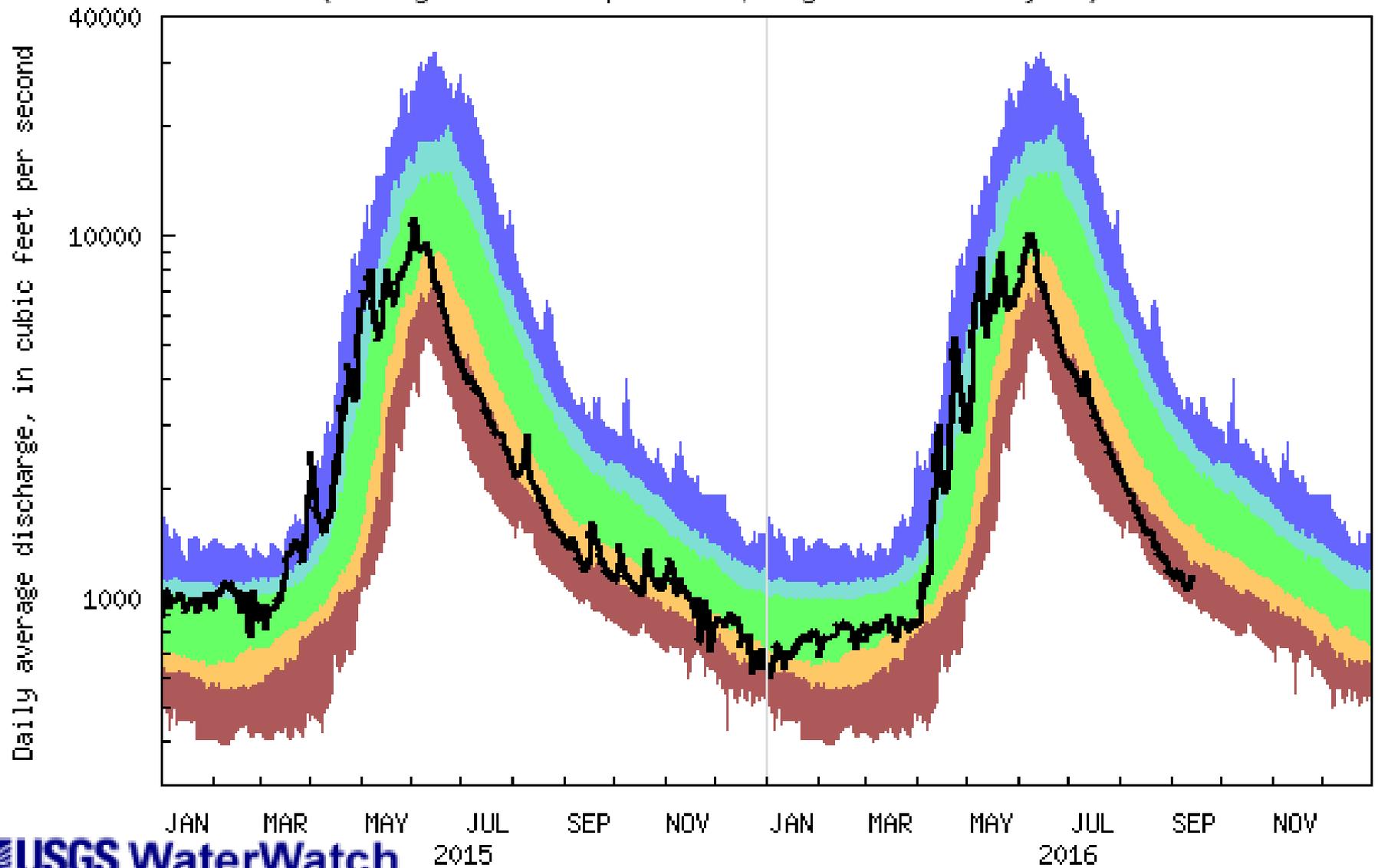


Explanation - Percentile classes					
lowest-10th percentile	10-24	25-75	76-90	90th percentile-highest	Flow
Much below normal	Below normal	Normal	Above normal	Much above normal	

Yellowstone River Basin



USGS 06191500 Yellowstone River at Corwin Springs MT
 (Drainage Area: 2616 square miles, Length of Record: 126 years)



USGS WaterWatch

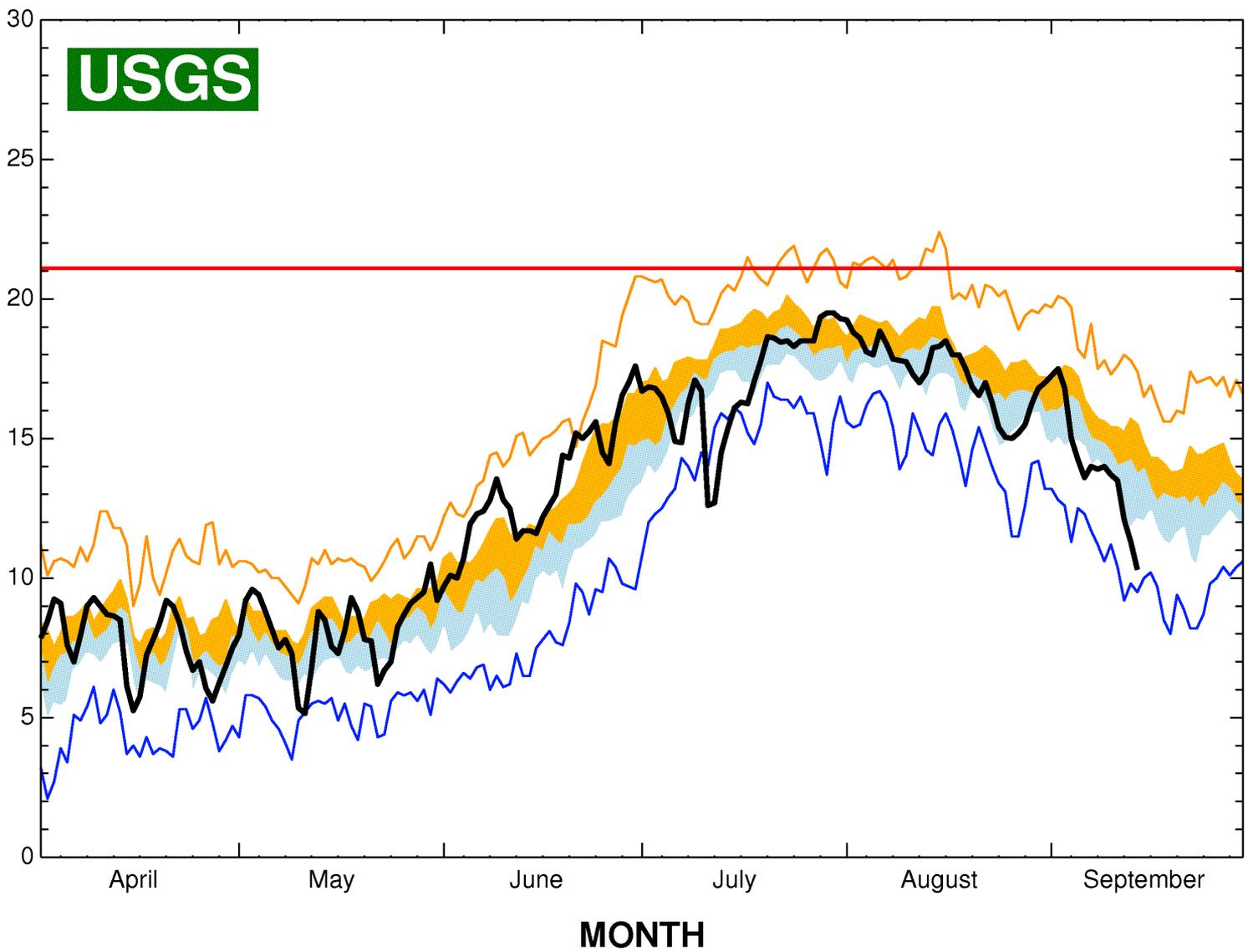
Last updated: 2016-09-14

Explanation - Percentile classes				
lowest-10th percentile	10-24	25-75	76-90	90th percentile-highest
Much below normal	Below normal	Normal	Above normal	Much above normal

Flow

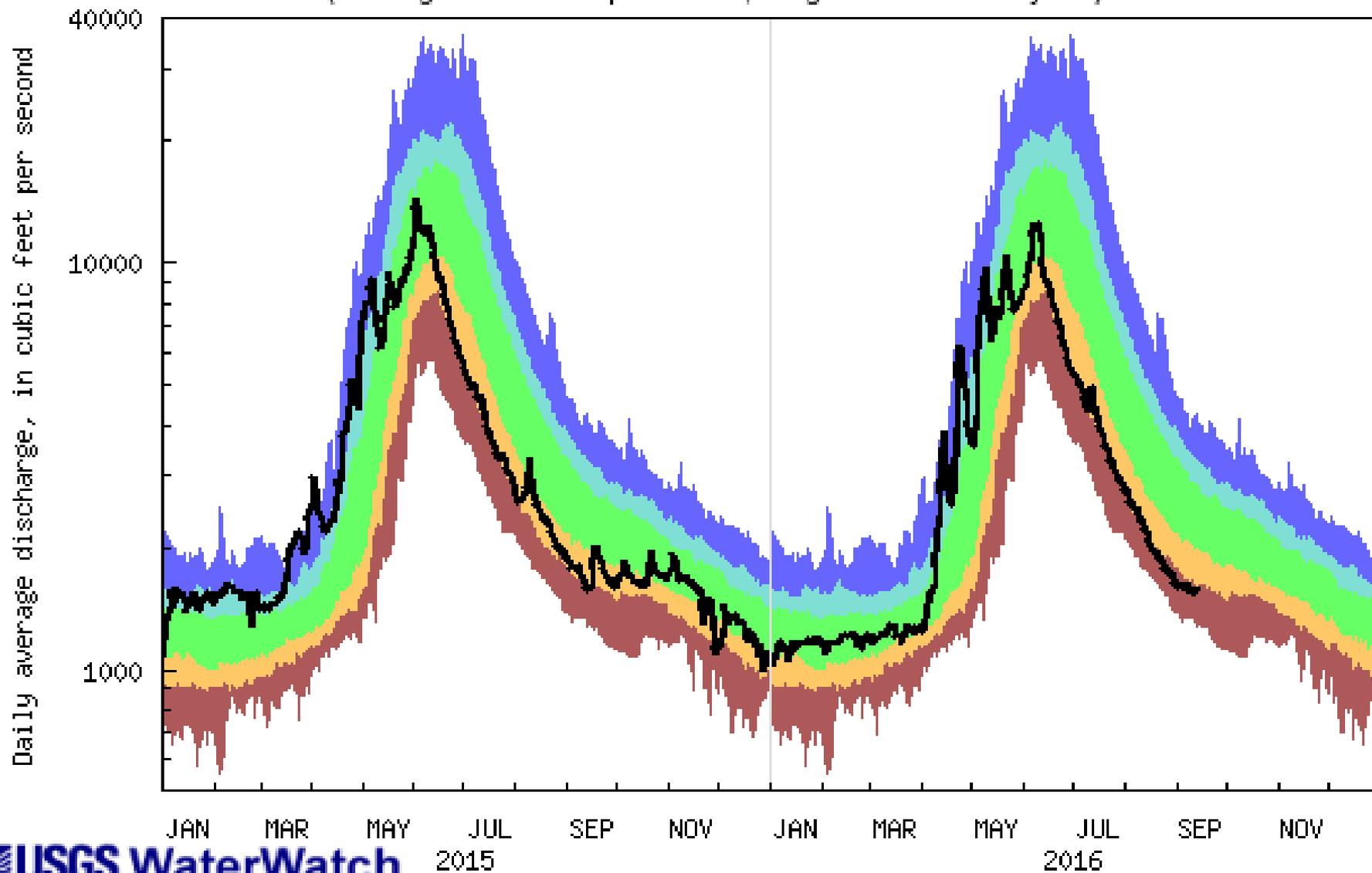
USGS

**WATER
TEMPERATURE,
IN DEGREES
CELSIUS**



06191500 Yellowstone River at Corwin Springs MT

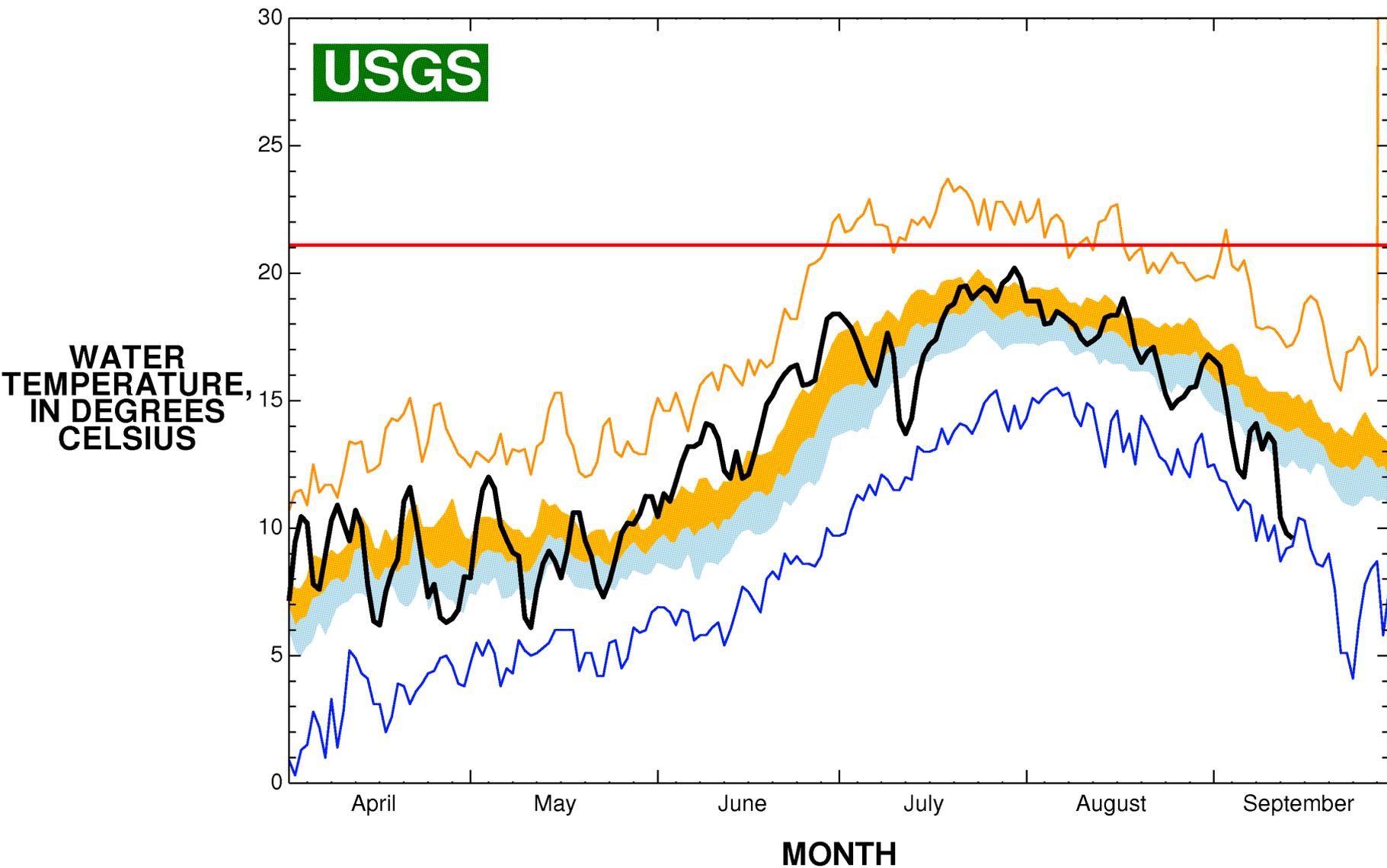
USGS 06192500 Yellowstone River near Livingston, MT
 (Drainage Area: 3551 square miles, Length of Record: 118 years)



Last updated: 2016-09-14

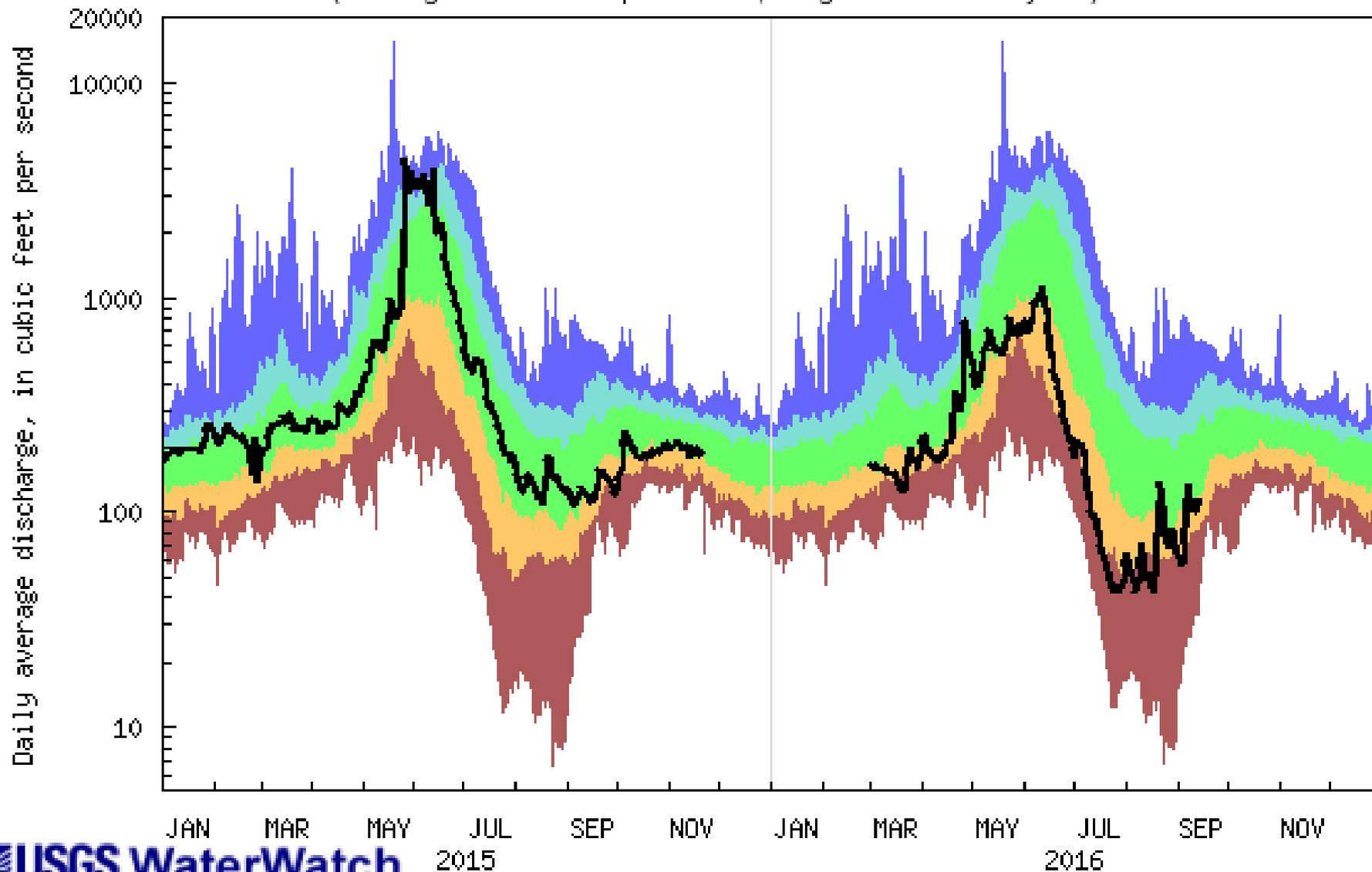


Explanation - Percentile classes					
lowest-10th percentile	10-24	25-75	76-90	90th percentile-highest	Flow
Much below normal	Below normal	Normal	Above normal	Much above normal	



06192500 Yellowstone River near Livingston, MT

USGS 06306300 Tongue River at State Line nr Decker MT
 (Drainage Area: 1451 square miles, Length of Record: 55 years)



USGS WaterWatch

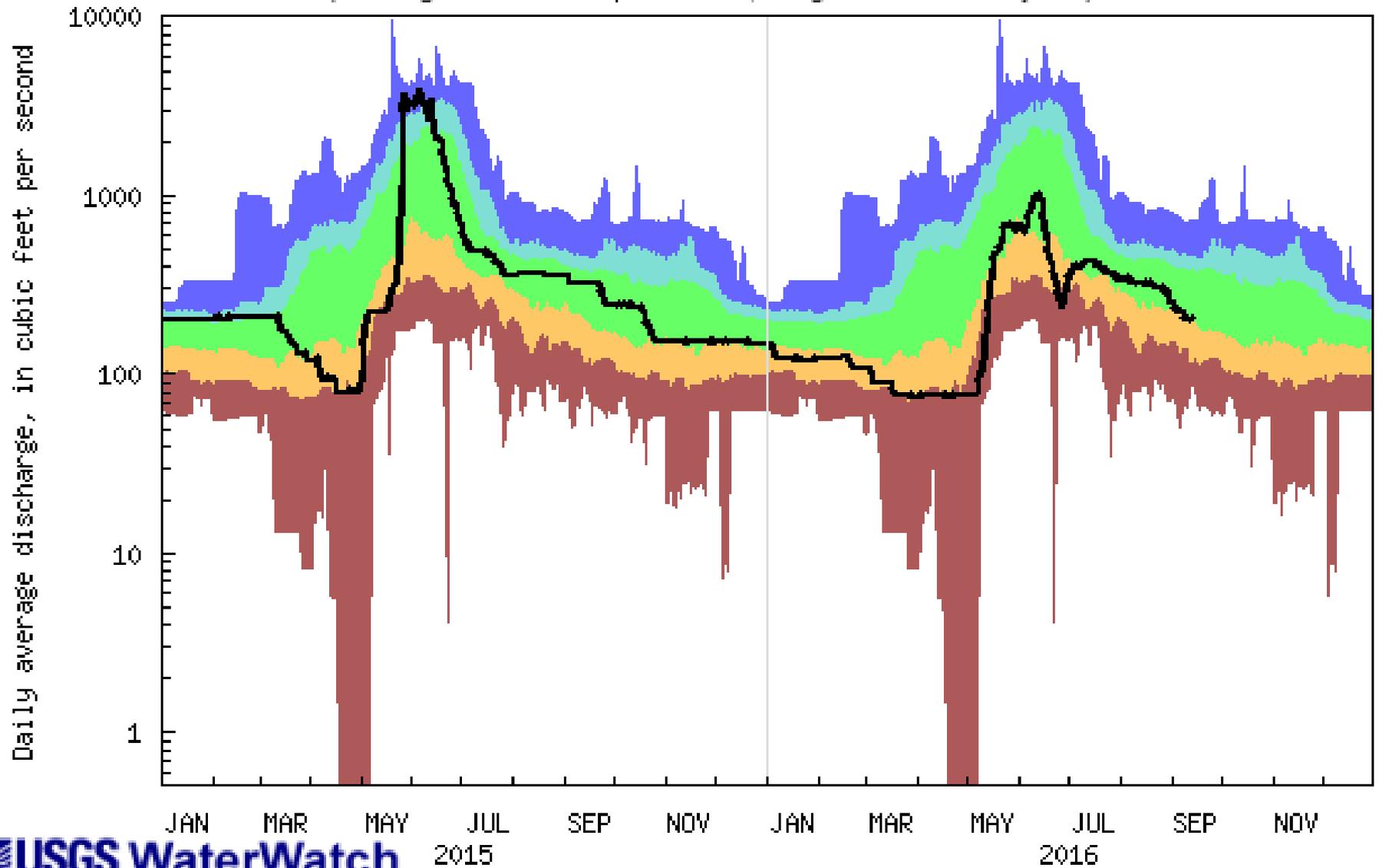
2015

2016

Last updated: 2016-09-14

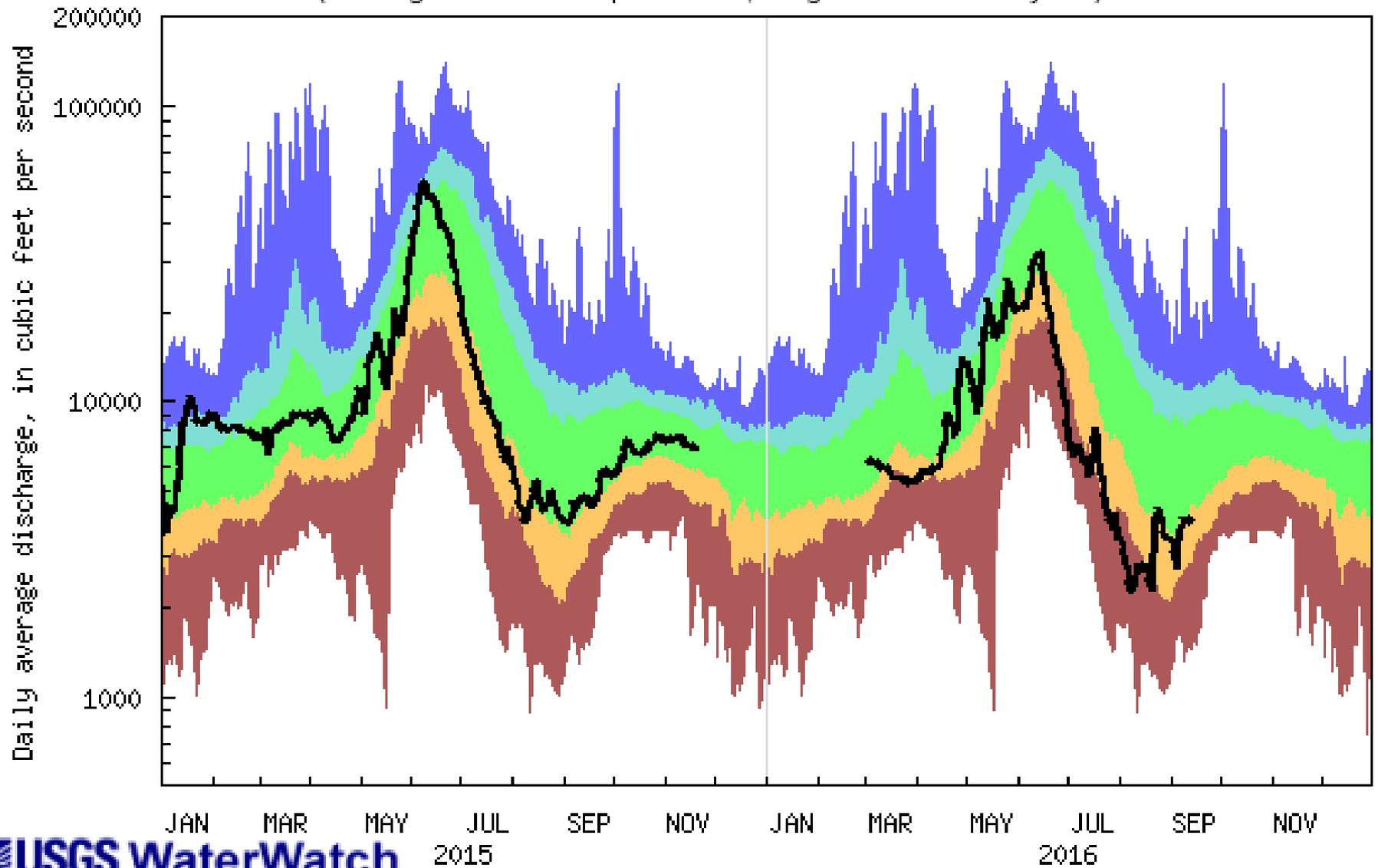
Explanation - Percentile classes					
lowest-10th percentile	10-24	25-75	76-90	90th percentile-highest	Flow
Much below normal	Below normal	Normal	Above normal	Much above normal	

USGS 06307500 Tongue River at Tongue R Dam nr Decker MT
 (Drainage Area: 1783 square miles, Length of Record: 76 years)



Explanation - Percentile classes					
lowest-10th percentile	10-24	25-75	76-90	90th percentile-highest	Flow
Much below normal	Below normal	Normal	Above normal	Much above normal	

USGS 06329500 Yellowstone River near Sidney MT
 (Drainage Area: 69099 square miles, Length of Record: 105 years)



USGS WaterWatch

Last updated: 2016-09-14

Explanation - Percentile classes				
lowest-10th percentile	10-24	25-75	76-90	90th percentile -highest
Much below normal	Below normal	Normal	Above normal	Much above normal

Flow



USGS Home Page: <http://usgs.gov>

NwisWeb: <http://water.usgs.gov/mt/nwis>

Access to streamflow (realtime and historical), water quality, and ground water information.

Wyoming-Montana WSC Home Page: <http://wy-mt.water.usgs.gov/>

Montana Current Streamflow Conditions

<http://waterdata.usgs.gov/mt/nwis/current/>

Governor's Drought & Water Supply Advisory Committee August NRCC Update



Harold Gammell, Direct Protection Fire Coordinator
DNRC

hgemzell@mt.gov 406 329-4996



Copper King Fire, Thompson Falls
28,553 acres



Colorado Gulch Fire, Missoula
12 acres

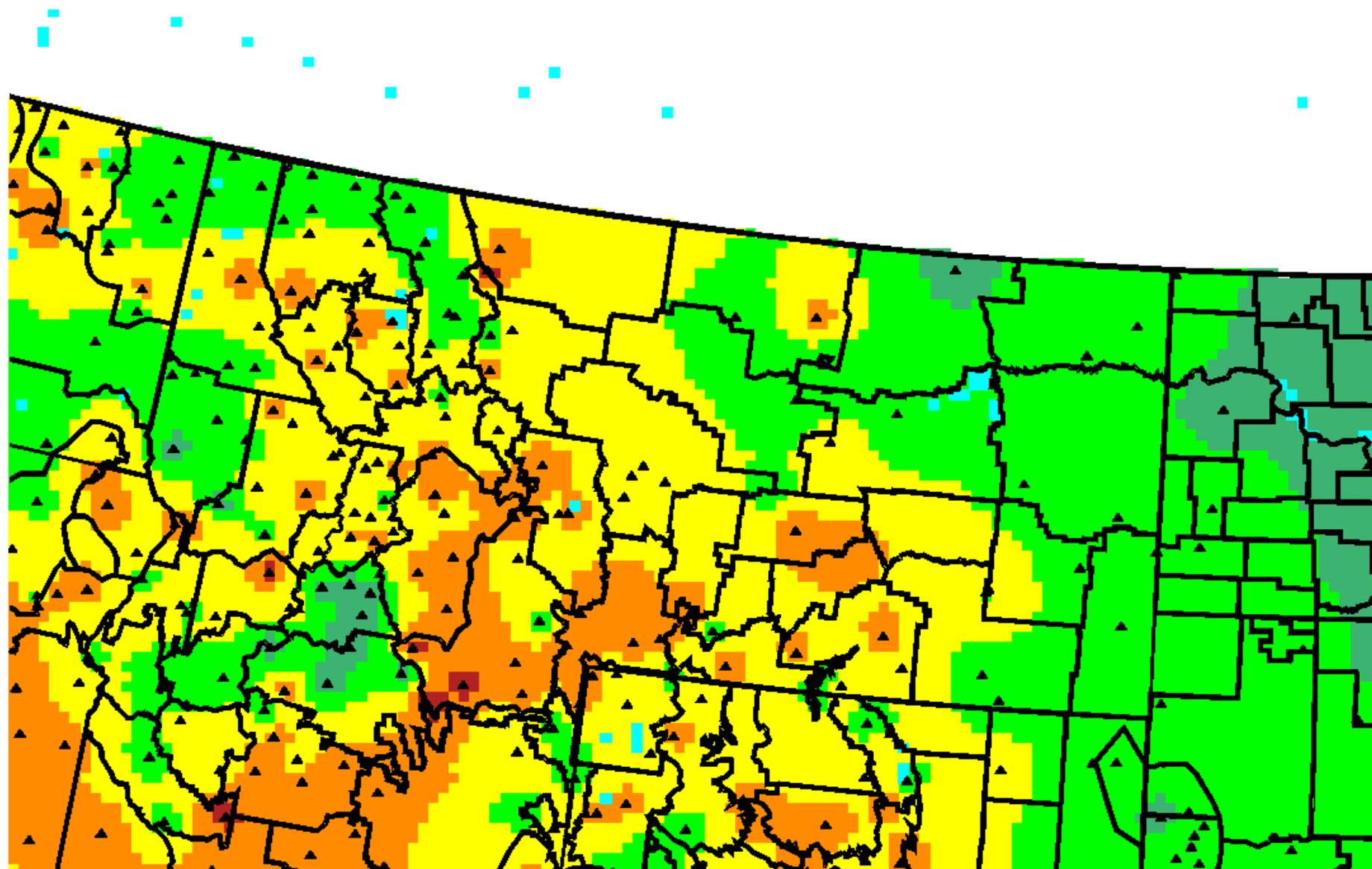


Nez Perce Fire, Elk Park
687 acres

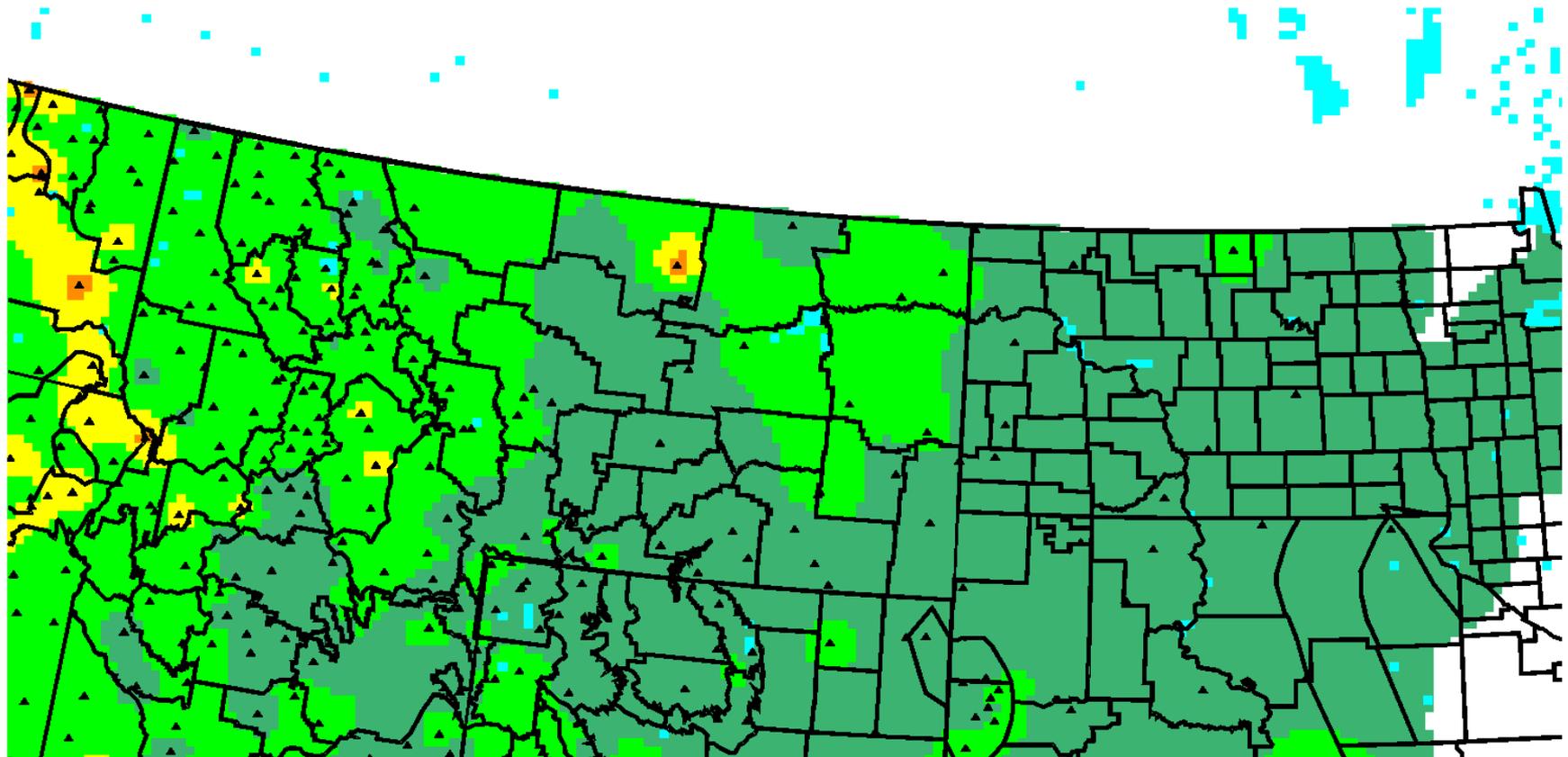


Flagstaff Fire, Sheridan County
8634 acres

Northern Rockies Observed Fire Danger Class: 16-Aug-16 (Fire Weather Zones)



Northern Rockies Observed Fire Danger Class: 13-Sep-16 (Fire Weather Zones)



LEGEND

- | | |
|--|---|
|  Low |  Extreme |
|  Moderate |  Water |
|  High | |
|  Very High | |

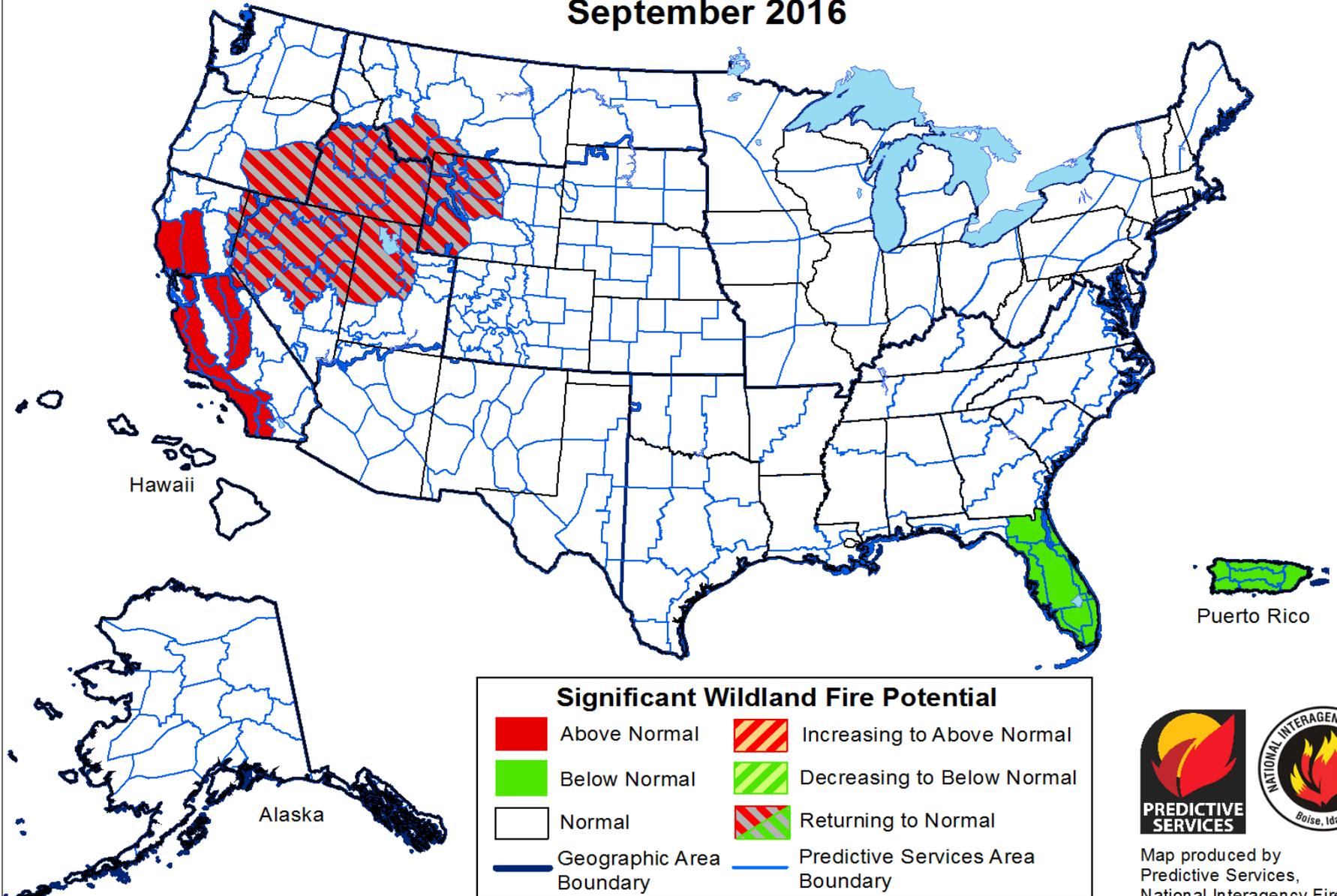
FireLab
MISSOULA, MONTANA



WFAS-MAPS National Interagency Fire Center



Significant Wildland Fire Potential Outlook September 2016

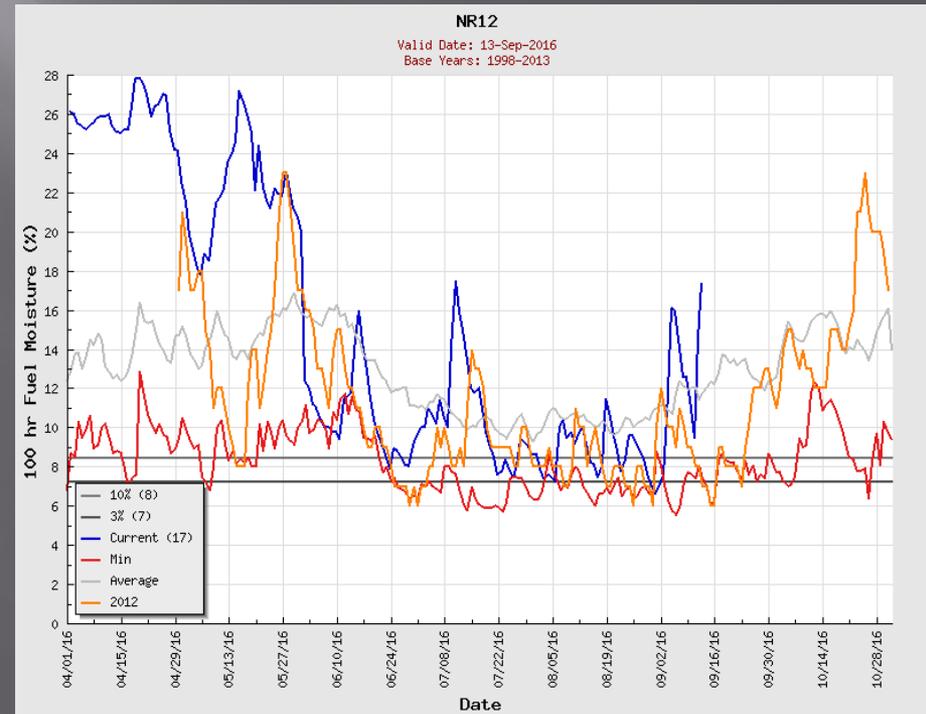
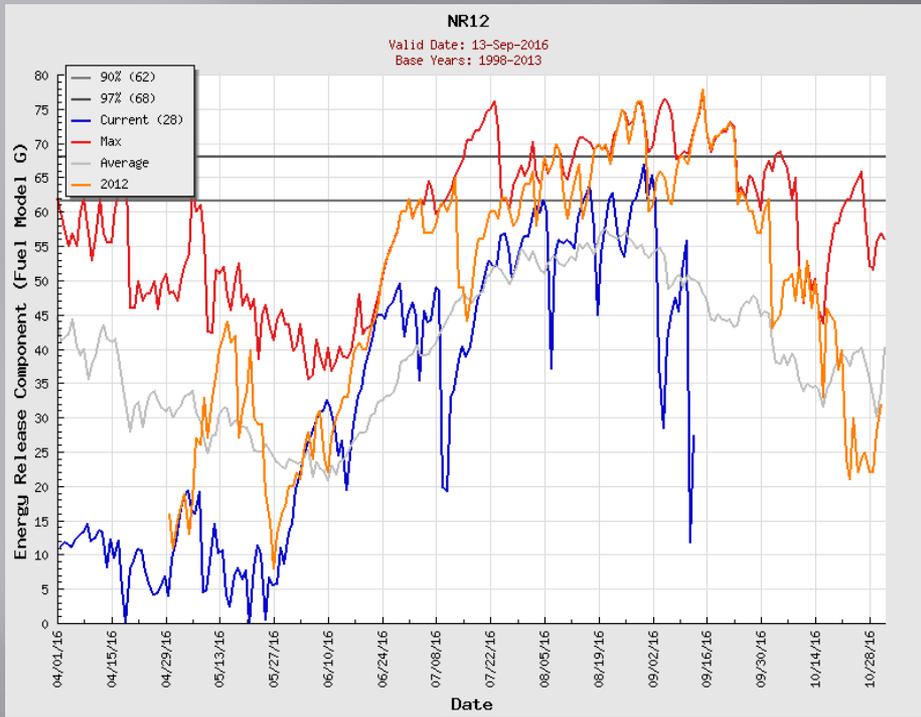


Above normal significant wildland fire potential indicates a greater than usual likelihood that significant wildland fires will occur. Significant wildland fires should be expected at typical times and intervals during normal significant wildland fire potential conditions. Significant wildland fires are still possible but less likely than usual during forecasted below normal periods.



Map produced by
Predictive Services,
National Interagency Fire Center
Boise, Idaho
Issued September 1, 2016
Next issuance October 1, 2016

South Central Montana and Yellowstone Park



Through 09/14/2016

256 Fires (direct & county assist)

23722.52 Acres

115 mutual aid incidents (MA)

53 false alarms

424 Incidents (total fires, MA, false alarms)

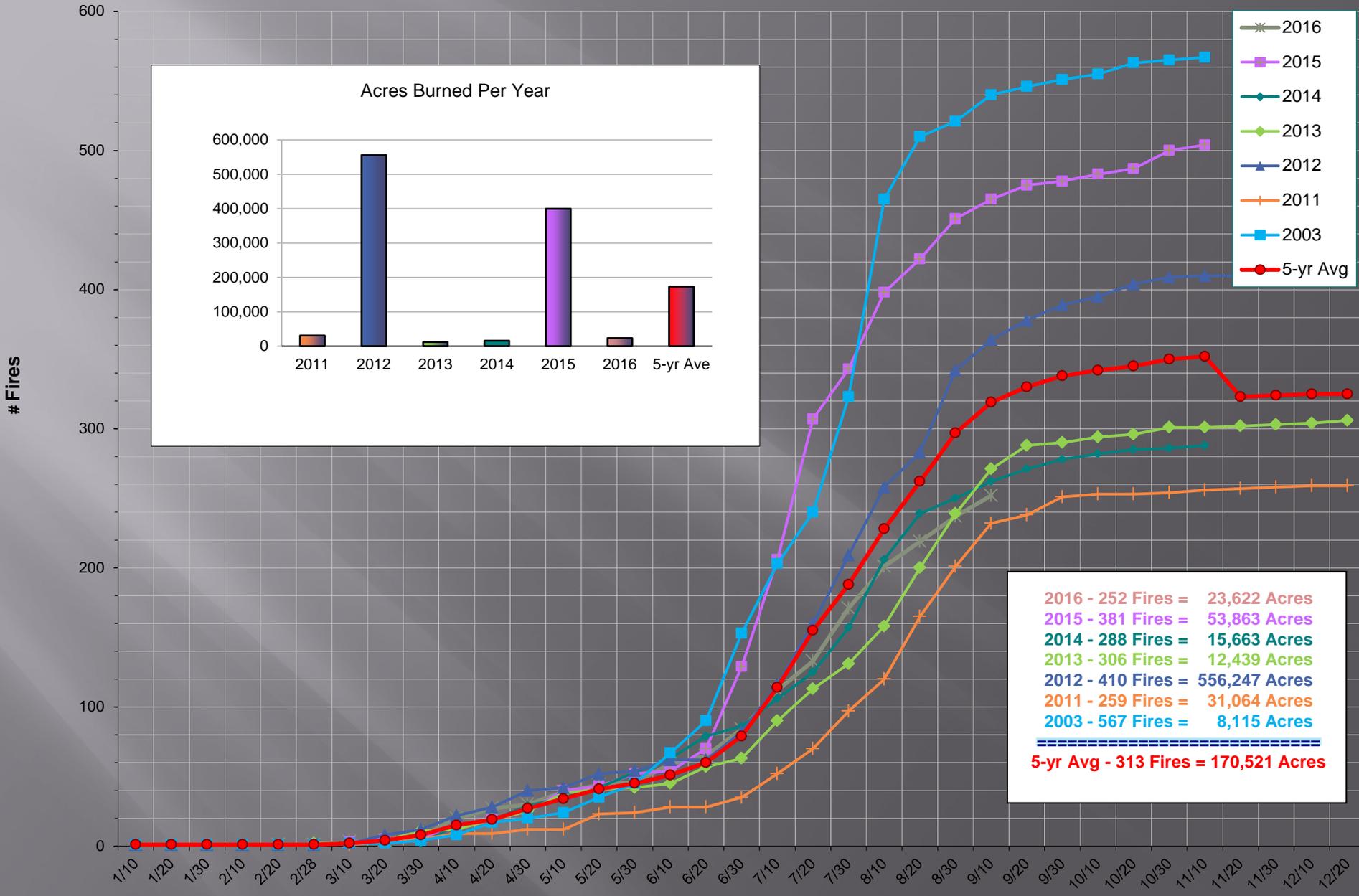
57% Human, 41% Lightning, 2% Unknown

5-yr average: (on this day)

298.40 Fires

130387.61 Acres

Fire Burned Summary - 2016



Happy Trails!!





Wednesday, May 22, 2013

INCIDENT INFORMATION

PREDICTIVE SERVICES

- Intelligence
- Weather
- Fuels/Fire Danger
- Outlooks

LOGISTICS / DISPATCH

- Dispatch Operations
- Aviation
- Crews
- Equipment/Supplies
- Overhead

ADMINISTRATIVE

- Northern Rockies Coordinating Group
- Policy and Reports
- Incident Business Management
- Safety Management
- Software Applications
- Training

RELATED LINKS

- National
- Area

Welcome to the NORTHERN ROCKIES COORDINATION CENTER

The Northern Rockies Coordination Center (NRCC) is the interagency focal point for coordinating the mobilization of resources for wildland fire and other all-hazard incidents throughout the Northern Rockies Area and, when necessary, for assignment throughout the United States. Located in Missoula, Montana, the Center also provides Intelligence and Predictive Services related products for use by the wildland fire community for purposes of wildland fire and incident management decision-making.

There are five primary components to the NRCC website.

- [Incident Information](#) provides general information on large wildland fires, fire restrictions and closures, and other relevant activity throughout the Geographic Area.
- [Predictive Services](#) provides operational products and links to incident situation information, maps, resources, current fire weather conditions, forecasts, fuels, fire behavior as well as daily, weekly and monthly fire weather/fire danger outlooks.
- [Logistics/Dispatch](#) provides detailed operation and information links for aviation, crews, equipment and overhead, including Incident Management Teams.
- [Administrative](#) provides fire and incident management tools and links including policies and reports, business management, safety, software applications, and training.
- [Related Links](#) component provides links to related Internet websites within the Northern Rockies Area and nationally.



BULLETIN BOARD

SITUATION

PREPAREDNESS LEVELS

Northern Rockies PL: **1**
National PL: **1**

[Situation Reports](#)

[Year-to-Date & Historical Wildfire Data](#)

••• [Restrictions & Closures](#) •••

SAFETY ALERTS

[NRGA Landscape Mortality Safety Alert](#)
[NRGA Landscape Mortality Pocket Card](#)

[Coal Seam Fires Safety](#)

COOPERATING FEDERAL, STATE AND OTHER AGENCIES IN THE NORTHERN ROCKIES AREA



STILLWATER COUNTY DROUGHT ADVISORY MEETING

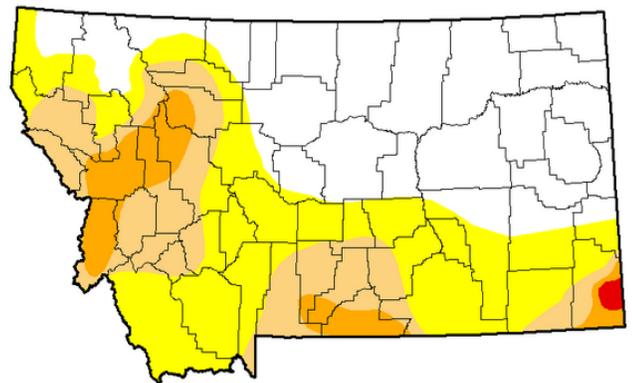
9/1/2016

Minutes.

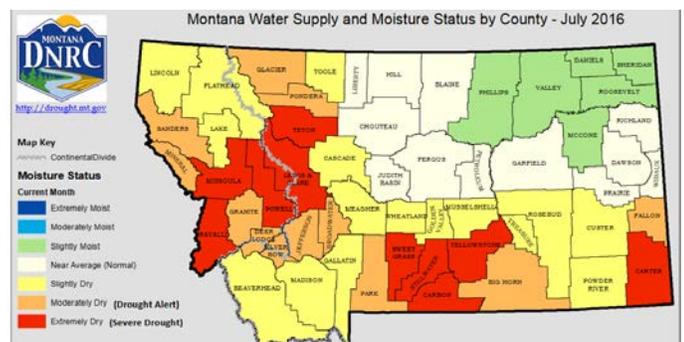
Called to order 3:30 PM

Announcements

- Governors Drought Advisory meeting in Billings
 - September 7, 3-4:30pm Billings Public Library 510 N. Broadway
 - The Governor's Drought and Water Supply Advisory Committee, wants input from local communities on steps the state can take to help them prepare for and respond to drought. Cooney and the Committee are in the process of updating the State's current Drought Response Plan
 - State Drought Meeting September 15th Helena
- Update of current situation.
 - Local level:
 - NRCS
 - FSA
- How can we Prepare for Continued Drought?
 - Discussed
- Other items of interest
 - Montana Climate Office- Kelsey Jensco, Nic Silverman Putting in about 20 stations throughout montana with soil moisture. Also some remote sensing
 - National Soil Moisture Network – Met in may there should be a lot of useful tools come from that group in the near future
 - CoCoRAHS The Community Collaborative Rain, Hail and Snow Network
 - Stillwater's Weather Stations



What are the conditions out there? (Reverse Side)



Conditions update from across County as of 9-1-2016

Average of 10 sites around the county.

	Spring	Winter	Range	Dryland	Irrigated	Stock	Ground	Other
	Wheat	Wheat		Hay	Hay	water	Moisture	Crops
	% normal	% normal	% very short	% normal				
South area	50	90	50-70%	30-40%		30-50%	90	
North area	70	90	30-50%	5-25%		30-50	95	

Comments:

Cattle movement is 1-2 months ahead. Are using reserves and winter pasture as of September 1. Consensus is listed in the averages above. Other contributing factors include stock water springs and wells drying up or low flow making pastures use difficult because of poor distribution or at most unusable. Also the grass is dry and brittle. Much of the grass is being lost do to trampling and breaking off. Many are hauling water. Some reports of cattle coming off the range 2-3 months early. Most are purchasing an additional amount of hay. There was good carryover of hay from last year but many are purchasing considerable percent of what was needed from this year's production. Range is the same way. Most producers have reserves built into their grazing systems to take care of 1 year or poor conditions. They will make it through this year with out much destocking, however, high hay prices and continued poor conditions at the beginning of next year will cause destocking and extreme hardship.

Recent storms this week have brought good moisture, however it may be too late to help with fall feed. It will soften standing senesced grasses and that will help with plant trampling and breakage.

Respectfully submitted

Lee Schmelzer

Stillwater County Extension Agent

431 Quarry Rd

Columbus, MT 59019

(406) 322-8038

(406) 780-1637

lees@montana.edu

As always, please do not hesitate to contact me with further questions.



The U.S. Department of Agriculture (USDA), Montana State University and Montana State University Extension prohibit discrimination in all of their programs and activities on the basis of race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, and marital and family status. Issued in furtherance of cooperative extension work in agriculture and home economics, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Jeff Bader, Director of Extension, Montana State University, Bozeman, MT 59717

City of Bozeman Drought Resiliency Planning



Nixon Bridge East Gallatin

September 15, 2016

Drought Resiliency Planning

- City of Bozeman Integrated Water Resources Plan (IWRP) (2013)
- City of Bozeman Water Conservation Program (2014)
- City of Bozeman Drought Management Plan(pending)
- Montana State Water Plan (2015)

What is Drought?

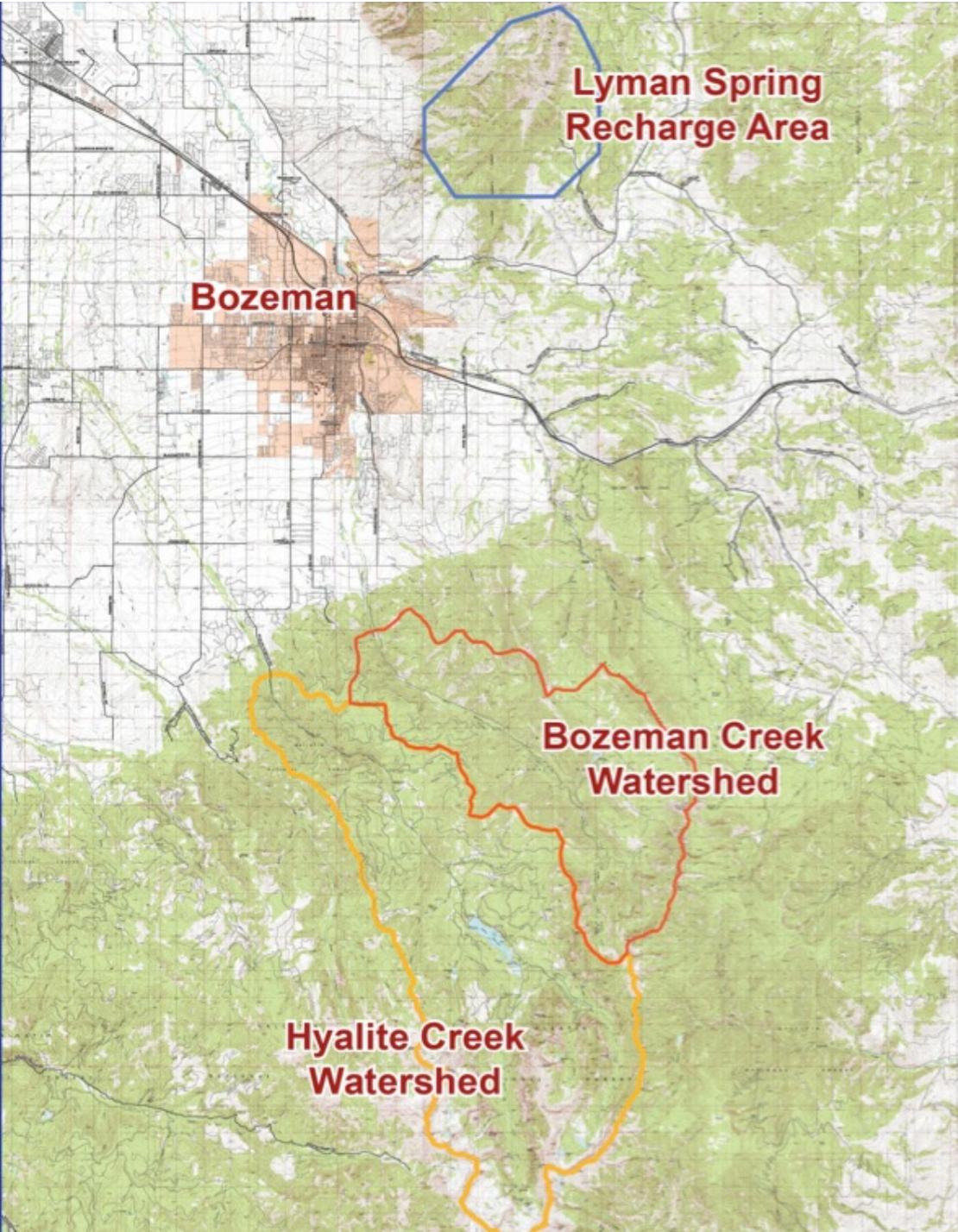
- Meteorological: period below normal precipitation
- Hydrological: reduces streamflows, and lakes, reservoirs and groundwater tables below normal levels
- Socio-Economic: Impacts human activities
- Security/Environment: Interplay between climate and water-dependent processes

City of Bozeman Drought Management Plan

- Vulnerability Assessment
- Drought Monitoring
- Drought Mitigation (long term)
- Drought Response (short term)
- Operational/Administrative Framework
- Drought Communications Plan (on-going)

Drought Vulnerability Assessment





**Lyman Spring
Recharge Area**

Bozeman

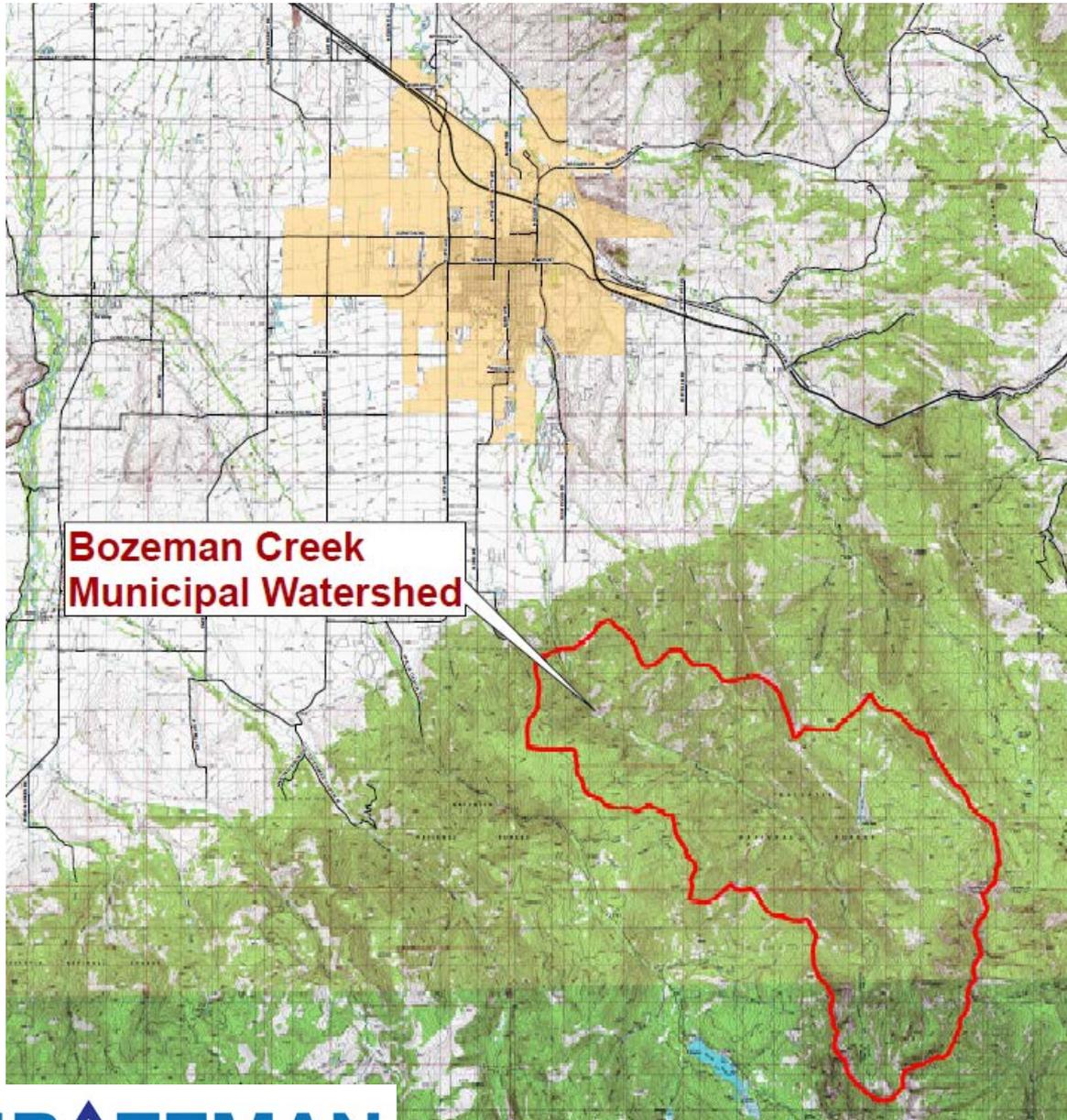
**Bozeman Creek
Watershed**

**Hyalite Creek
Watershed**

Bozeman's Water Supply

17 acre-feet/day

- Hyalite Creek (40%)
- Bozeman Creek (40%)
- Lyman Creek (20%)



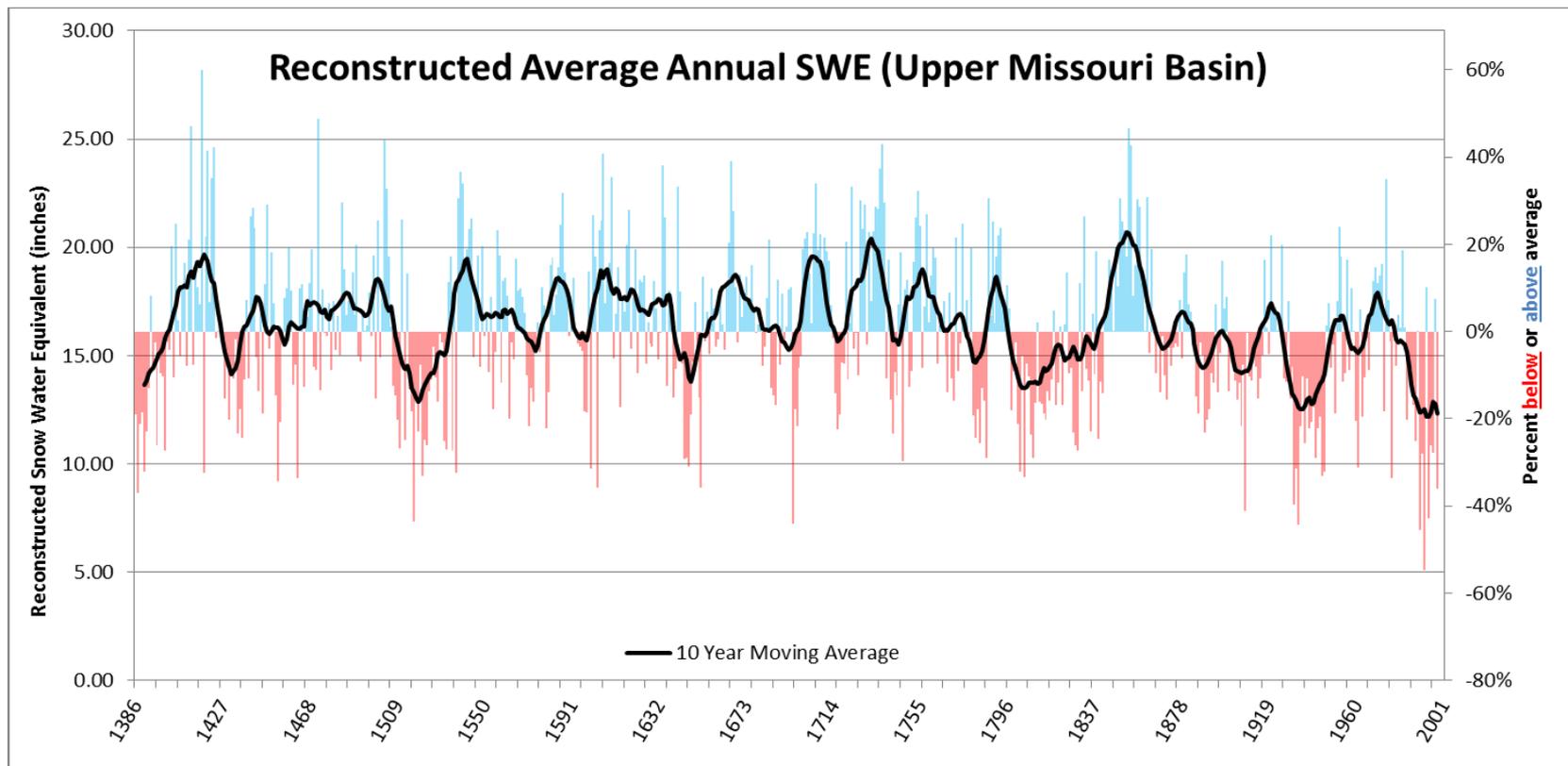
Bozeman Creek Watershed

- 29 sq. mi. area (municipal)
- No reservoir storage
- 10 cfs dry period flow
- 6.6 cfs municipal water right

Drought Monitoring

- Past
- Present
- Future





Historical Streamflow and Snow Water Equivalent Trends from Tree-Ring Data for the Upper Missouri Basin

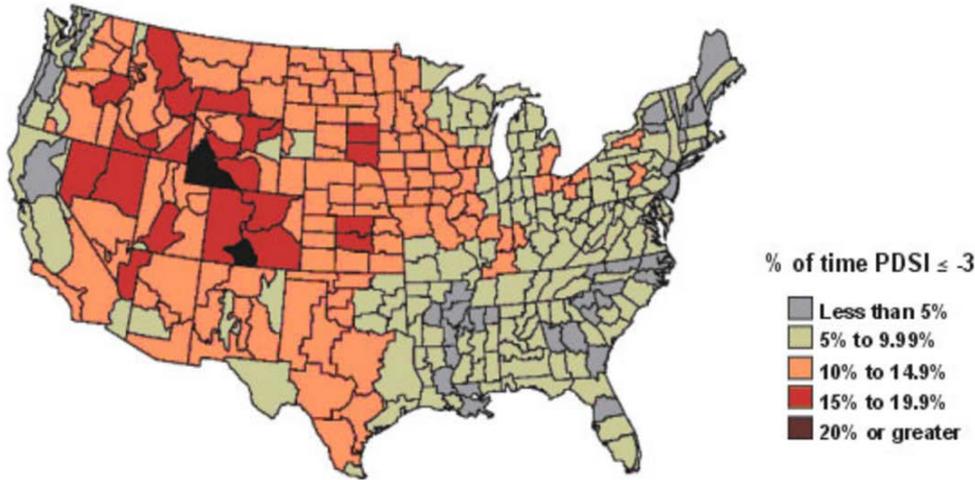
- Dust Bowl drought was the fifth driest 5-year period from 1676-1996
- Prolonged and severe drought in the area is chronic
- Preparing for such periods is necessary to increase water resiliency for the City of Bozeman

Drought in Bozeman

Palmer Drought Severity Index

1895–1995

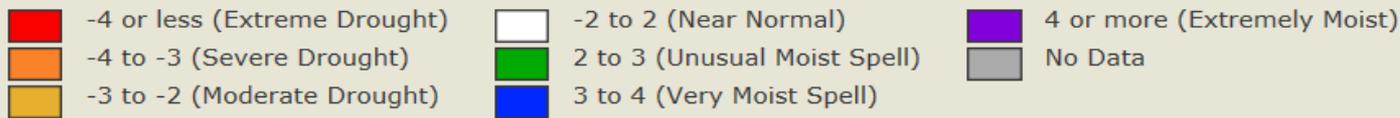
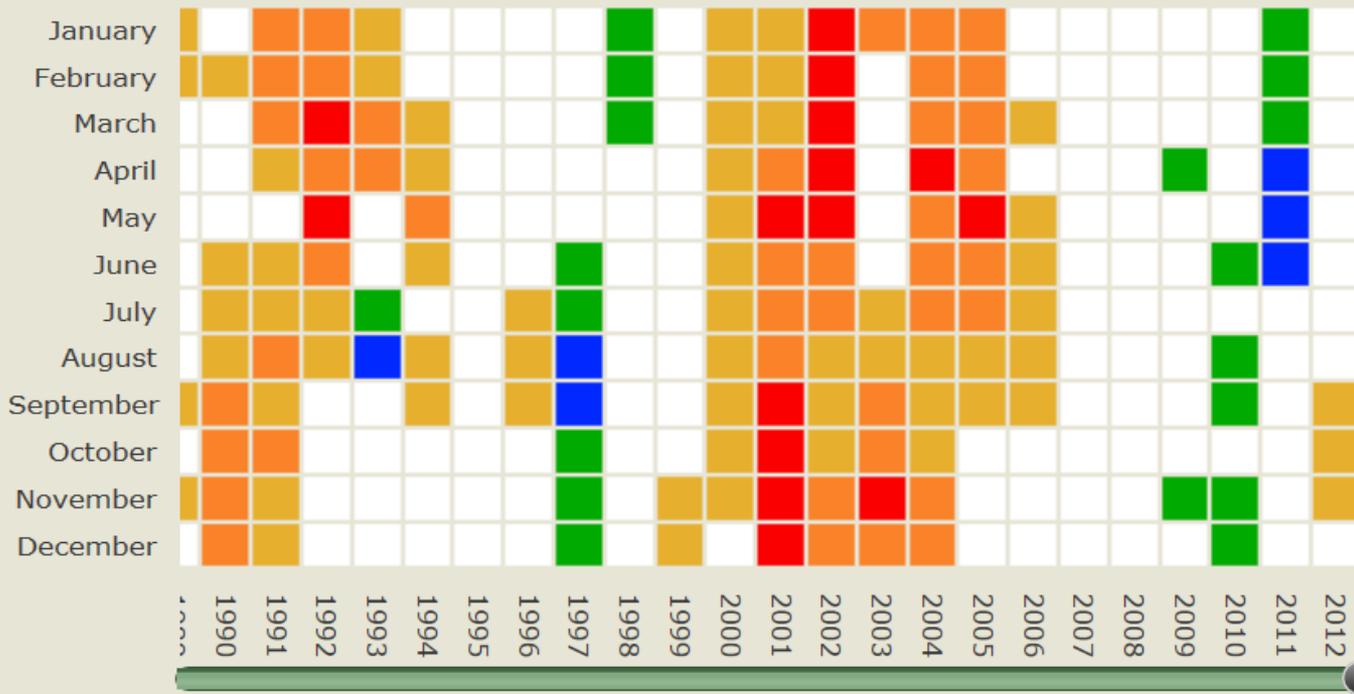
Percent of time in severe and extreme drought



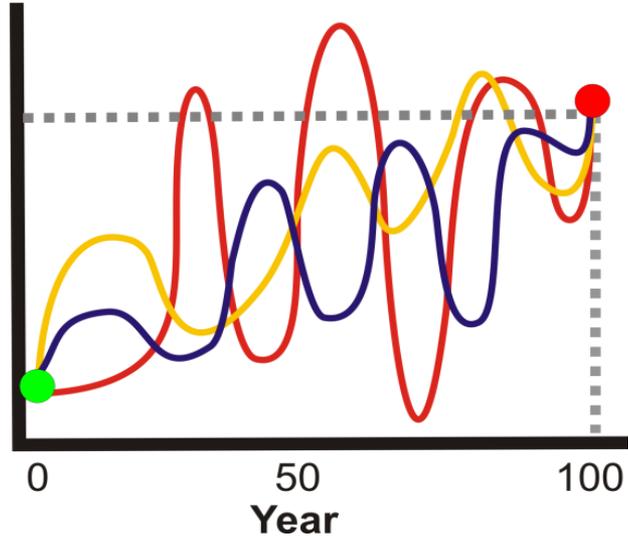
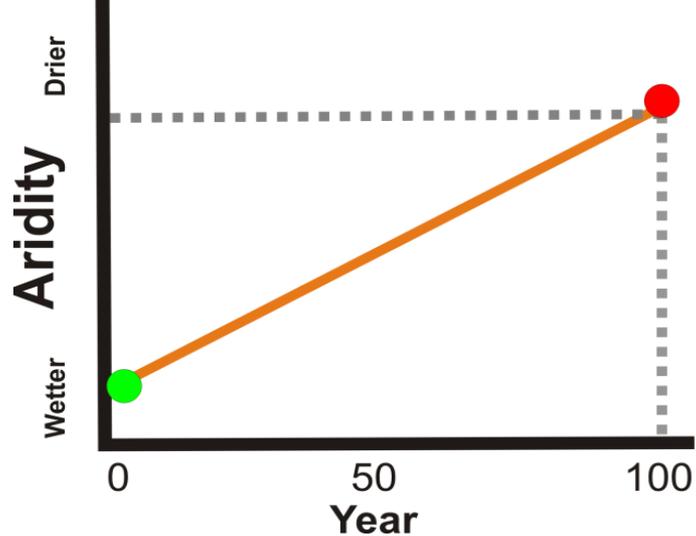
- Southwestern Montana was in severe or extreme drought 15% to 19.9% of time between 1895 and 1995
- Only southwest Wyoming and south central Colorado are more susceptible to drought conditions.

SOURCE: McKee et al. (1993); NOAA (1990); High Plains Regional Climate Center (1996)
Albers Equal Area Projection; Map prepared at the National Drought Mitigation Center

Monthly PDSI for Bozeman Region (1990 – 2012).



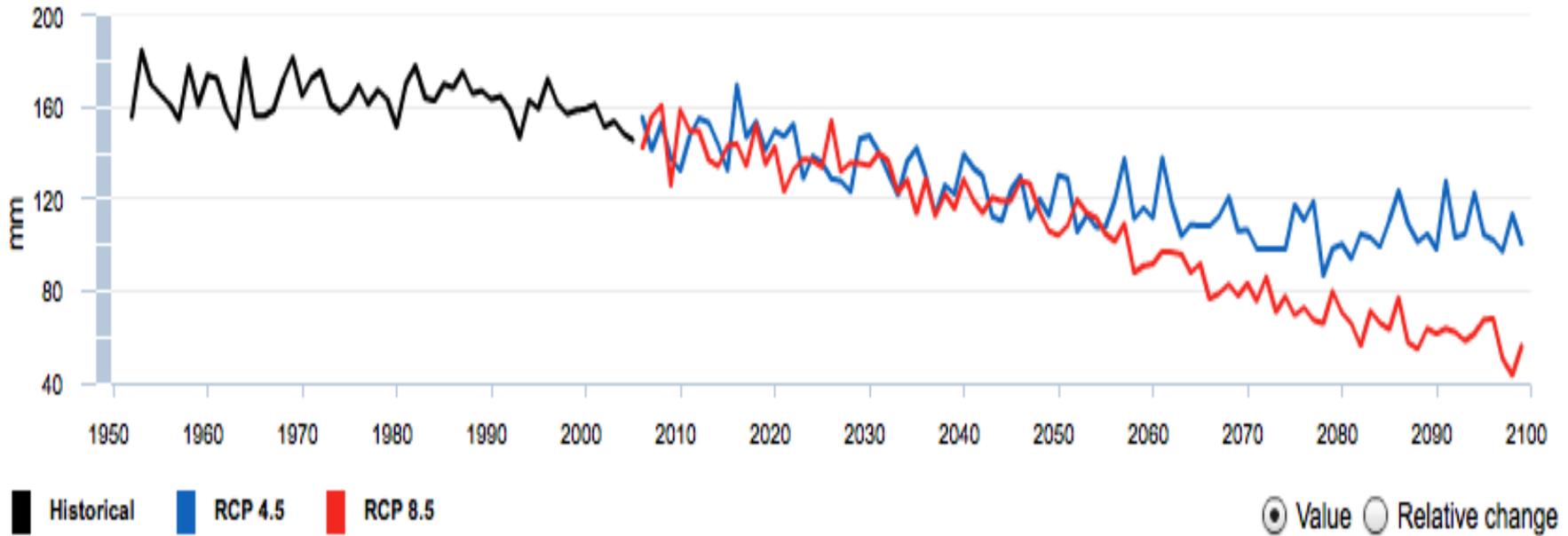
- Moderate to extreme drought in several months between 2000 and 2006.
- Late spring/early summer precipitation and evapotranspiration rates correlate to Bozeman water demand.



Future Climate Projections

- Warming in the region and longer dry spells
- Reduced annual snowfall and changes in precipitation patterns
- Earlier melting of snowpack and shifts in peak runoff
- Increasing evapotranspiration
- Reduced stream flows in the late spring and summer months
- Increased climate variability rather than a linear trend
- Bozeman's reliance on snowpack and limited storage, will result in significant impacts from even a severe short-term drought

April Snow for Missouri Headwaters, Missouri Region (Mean Model)



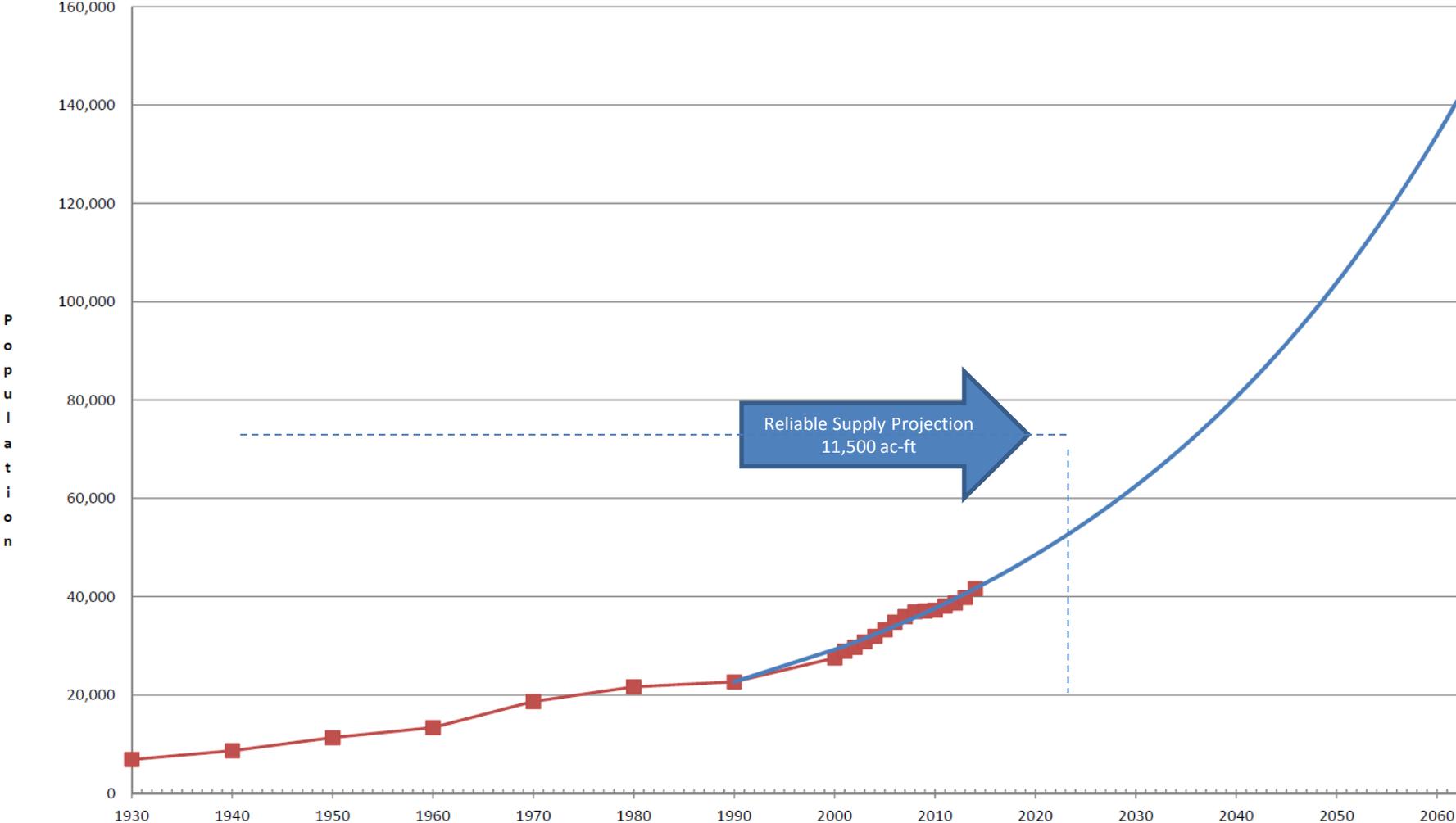
- Historical April snowpack for the Missouri River headwaters area
- USGS projection of future snowpack, based on two levels of solar radiation.

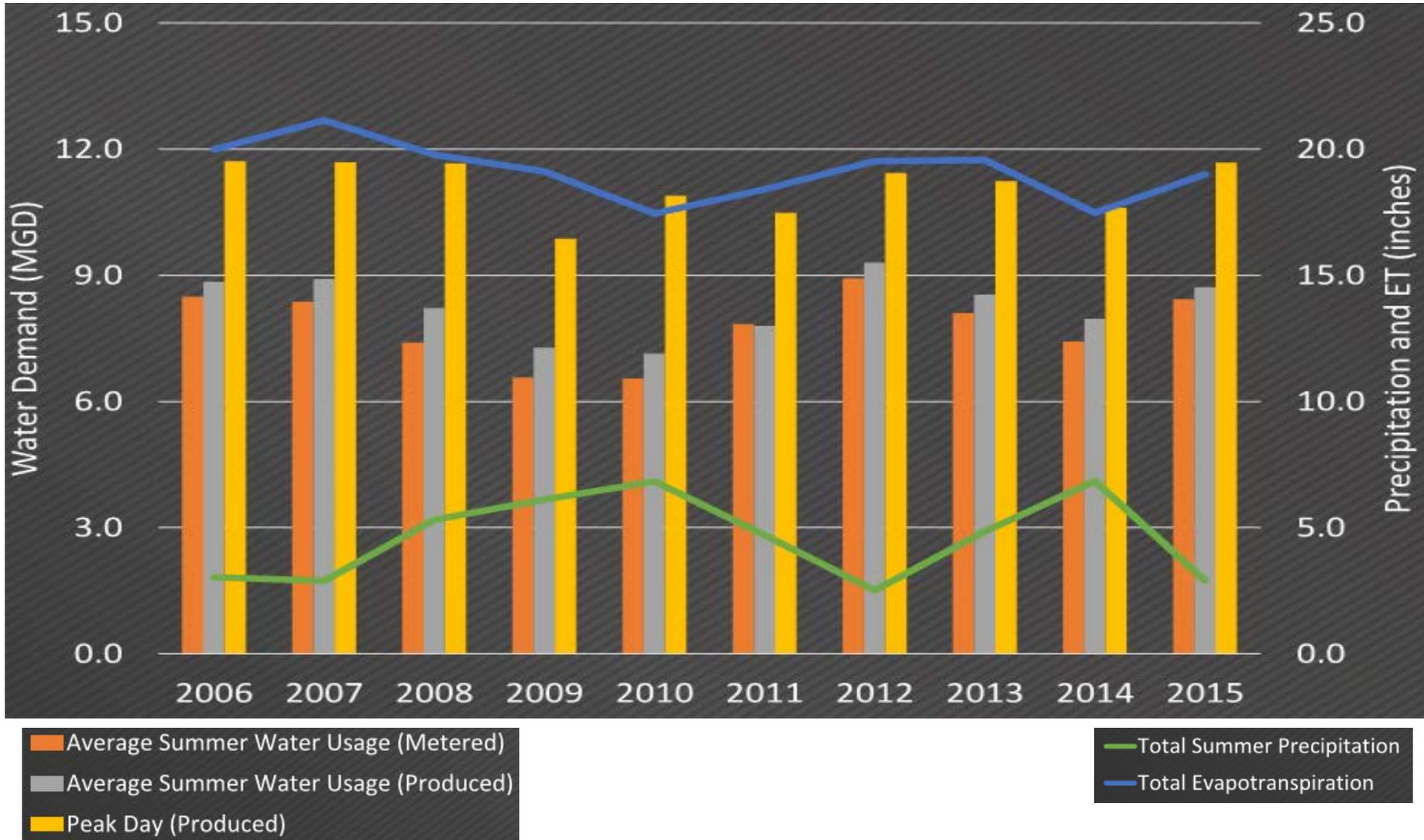
Drought Mitigation

- On-going
- Long term



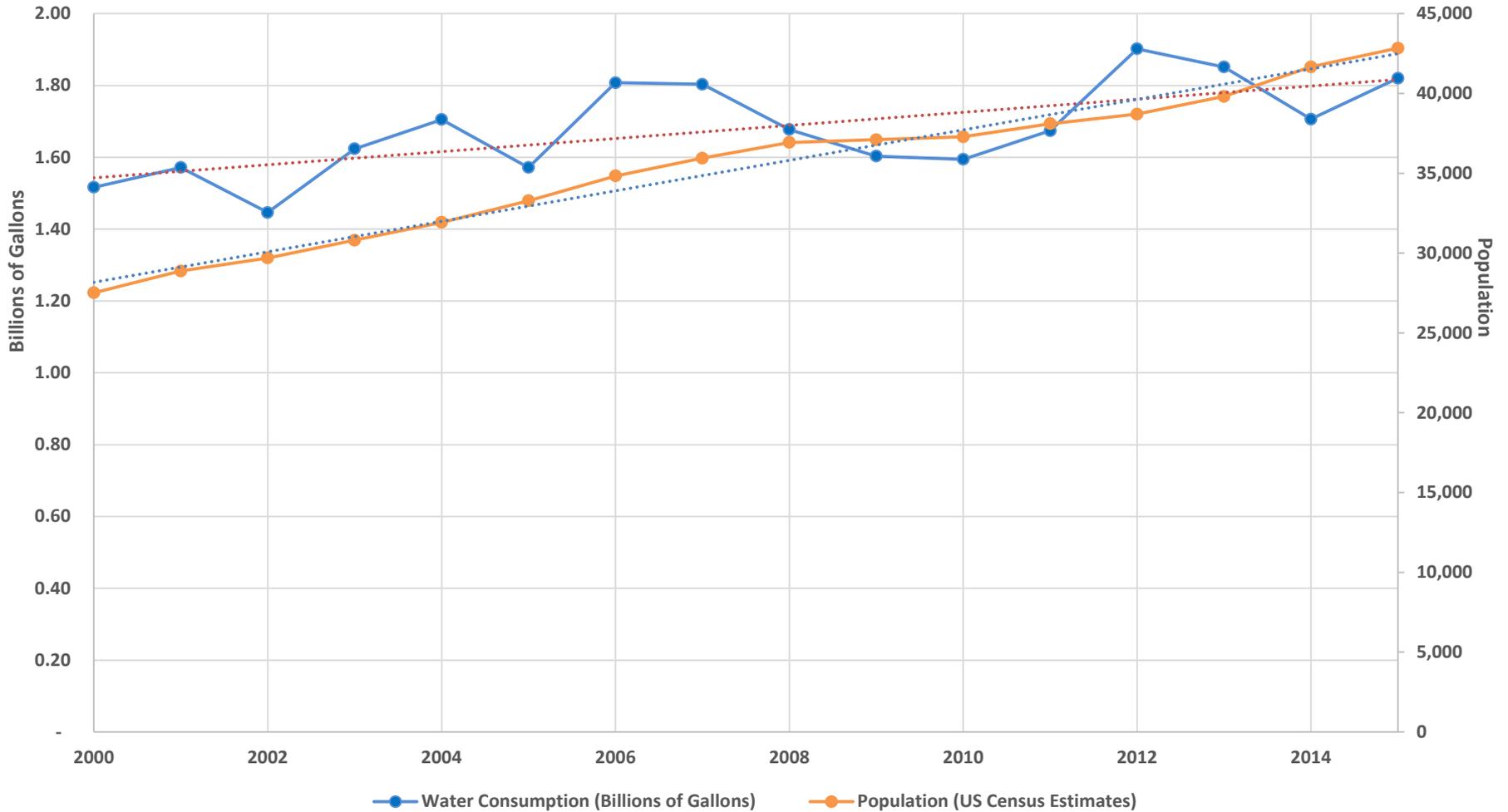
Figure-2: Historical Population and Future Projections





- Correlation between ET and water use is typical but the opposite desired reaction during a drought event.
- Reduction of outdoor water use by an additional 10% via education and irrigation system efficiency rebate programs, will result in 50 million gallons of water (153 ac-ft) saved annually.
- That is less than 3% of Bozeman’s total water demand.

Population & Water Use Over Time



Drought Mitigation Project



Bozeman Creek Project

Drivers

- Functioning wetlands is a vital component for biological and hydrological health of the stream.
- Where floodplain wetlands are disconnected from the stream floodplain wetland storage is unavailable to absorb and slow flood flows and support base flows in streams during drought.
- Risks of significant socio-economic impacts to properties within the City of Bozeman will remain/increase without mitigation projects.

Project Objectives

- Reconnecting overbank areas to floodplain
- Increase the volume of storage in riparian wetlands, the wet area of a wetland, and the time that wetlands contain water
- Restore/expand wet areas to recharge groundwater and raise groundwater table—particularly in the summer
- Improve summer and dry season stream flows, wildlife habitat, and water quality
- Monitor and quantify benefits

Response Plan



Response Plan

Drought Stage and Demand Reduction Goal	Watch 10%	Advisory 20%	Warning 30%	Emergency 40%
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Demand-Side Measures City of Bozeman Water Utility

Outdoor Irrigation	Standard irrigation practices on City-owned properties and public right-of-ways that promote efficient water use	Standard irrigation practices on City-owned properties and public right-of-ways that promote efficient water use	Restrict turf irrigation on City parks, open spaces, public right-of-ways, facility landscaping. Sports fields, trees and shrubs and other identified prioritized green areas specified by City staff and/or community feedback may be irrigated on a pre-determined limited basis	Eliminate all turf irrigation on City parks, open spaces, public right-of-ways and facility landscaping until drought is declared over. Limited irrigation of trees with a hand-held hose or non-spray device is permitted to ensure survival.
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Thank You!





<http://drought.mt.gov>

Montana Water Supply and Moisture Status by County - August 2016

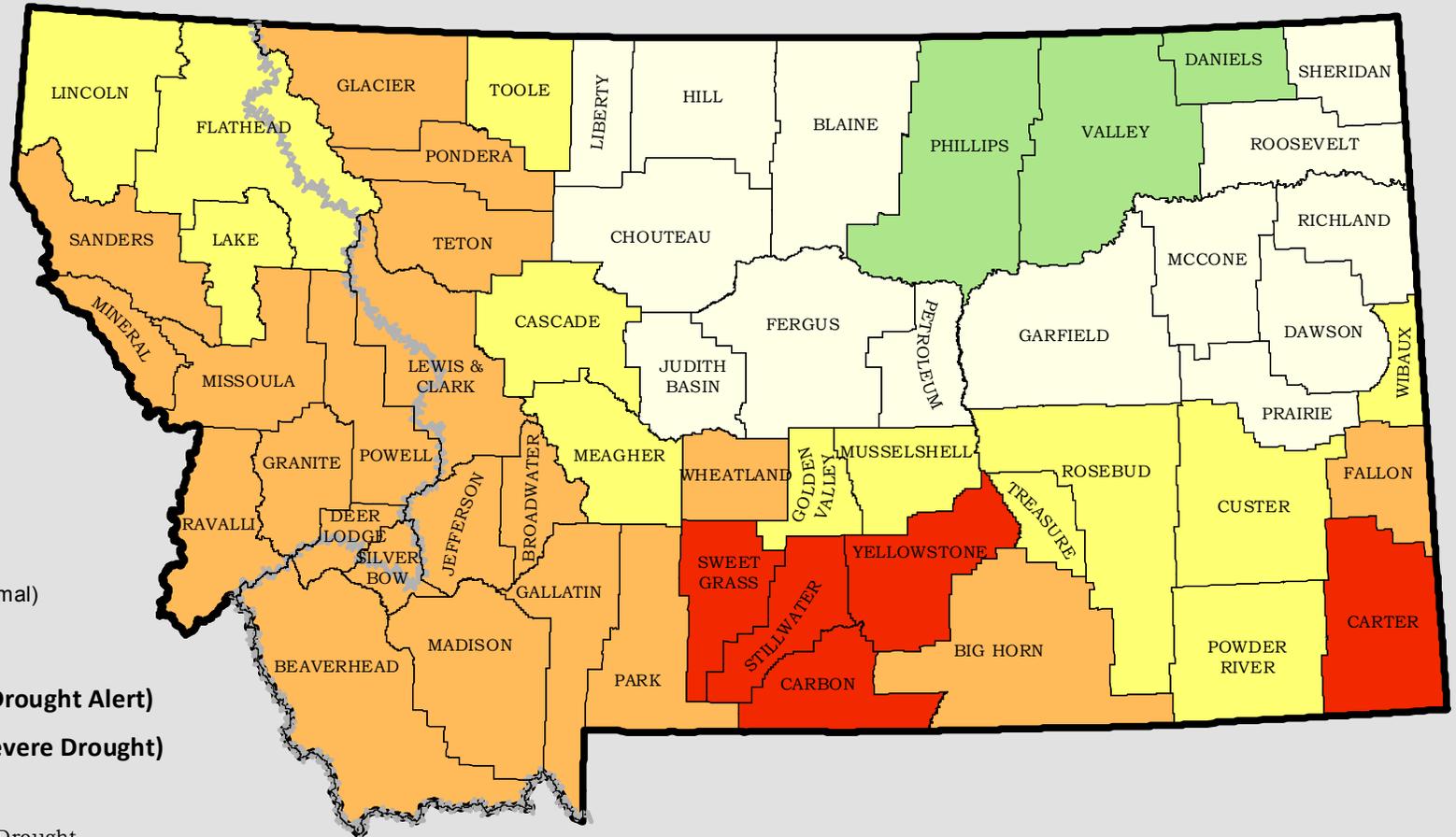
Map Key

Continental Divide

Moisture Status

Current Month

- Extremely Moist
- Moderately Moist
- Slightly Moist
- Near Average (Normal)
- Slightly Dry
- Moderately Dry (**Drought Alert**)
- Extremely Dry (**Severe Drought**)



Drought Alert - Governor's Drought Advisory Committee strongly encourages local officials to convene local drought committees.

Severe Drought - Local officials should have local drought planning efforts underway or should reconvene the local drought committee at the earliest opportunity. For recommended responses, see the Montana Drought Plan

Map created Sept 8, 2016 based on data from the month of August

This map was created using the US Drought Monitor and the monthly NRCS Surface Water Supply Index (SWSI) as a guide. In general, a county was assigned a Moisture Status based on the highest drought category intersecting any part of the county. The map was then compared to the monthly SWSI, PRISM, and other precipitation products. The Montana Governor's Drought and Water Supply Advisory Committee, made up of experts from the National Weather Service, the Natural Resource Conservation Service, the Farm Service Agency, United States Department of Agriculture, the Montana Department of Natural Resources and Conservation, the Montana State Library, and the Montana Bureau of Mines and Geology, reviewed the map.



<http://nris.mt.gov/drought>