



# DNRC Regional Office Observations of Drought on the Rocky Mountain Front

**Matt Miles**, Deputy Regional Manager,  
DNRC Havre Regional Office





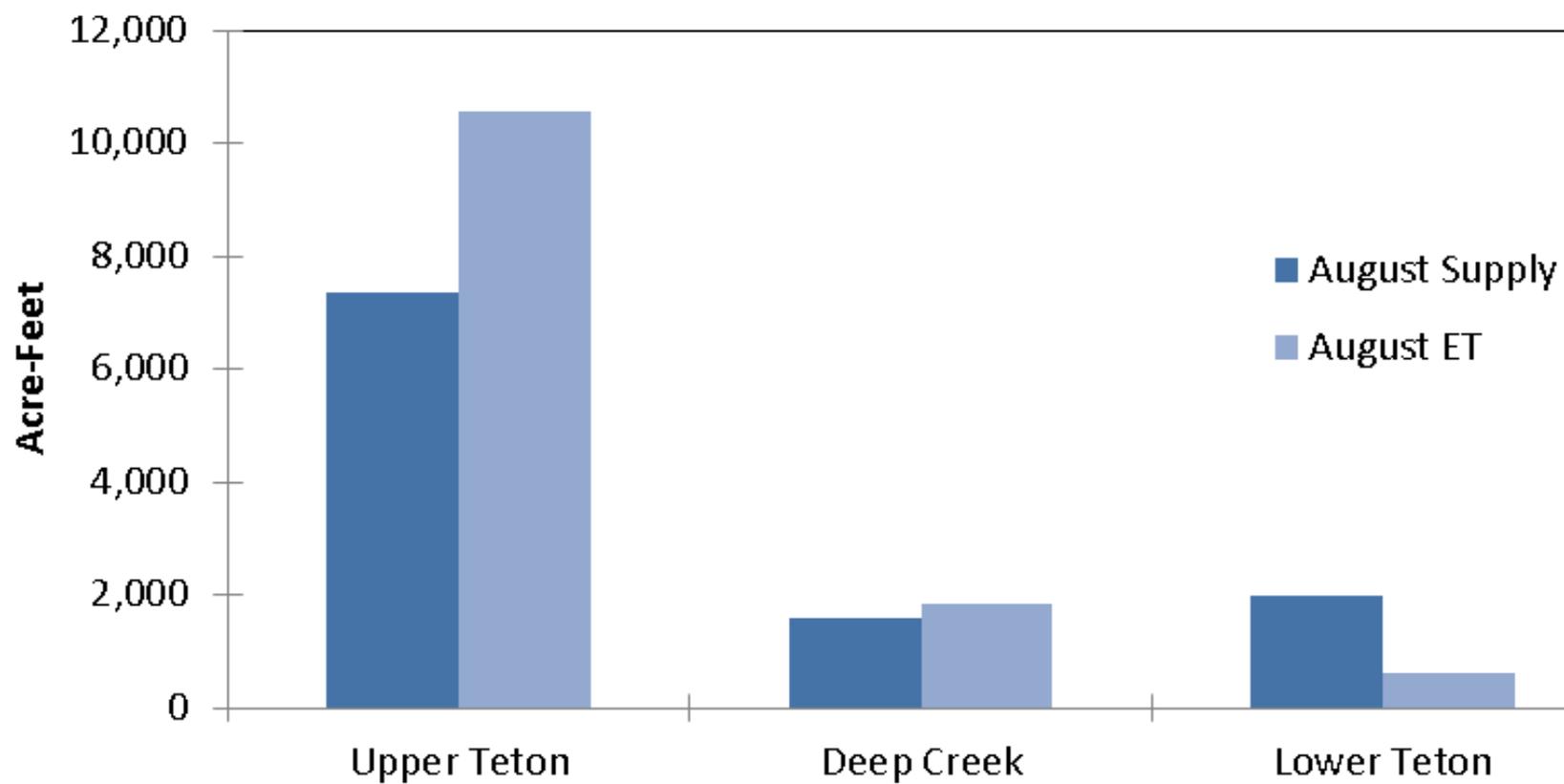




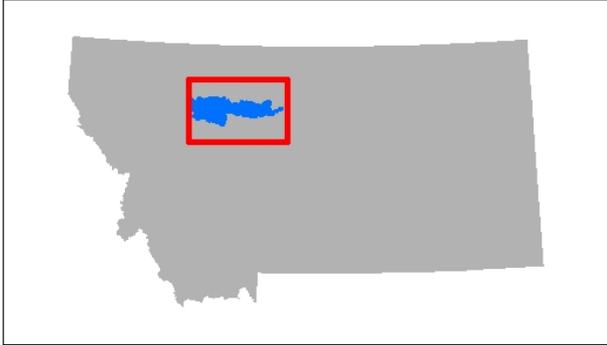




# August Water Supply and Demand

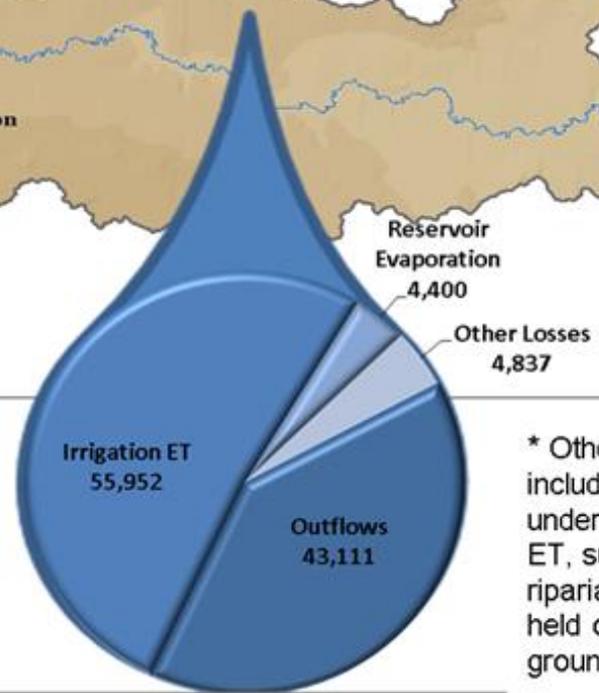
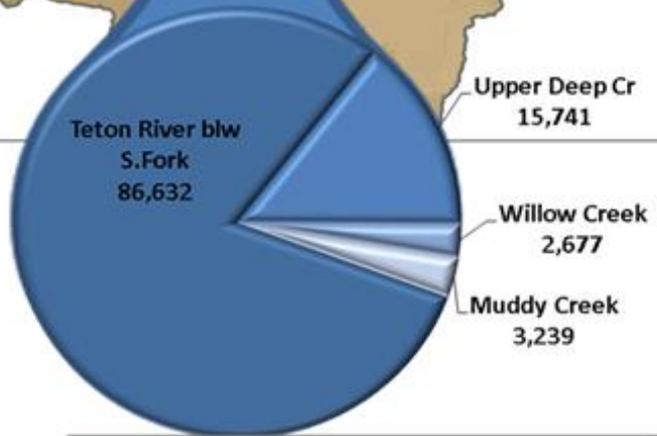
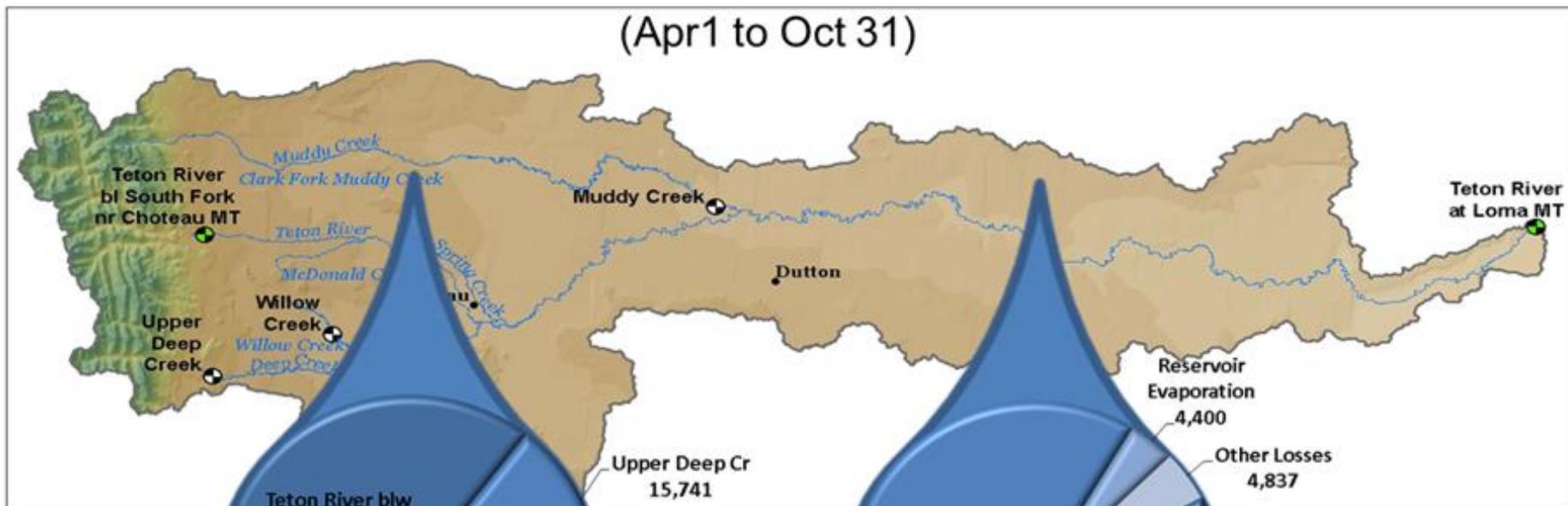


# Teton Watershed



# Teton Watershed Balance

(Apr 1 to Oct 31)



\* Other Losses could include a combination of: underestimated Irrigation ET, sub-irrigated crop lands, riparian ET, storage water held over or losses to the ground water.

## Watershed Inflows (acre-feet)

Teton River and Tributary Inflows	108,289
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## Watershed Outflows and Losses (acre-feet)

Watershed Outflow	43,111
Irrigation ET	55,952
Reservoir Evaporation	4,400
Other Losses*	4,837
<b>Total</b>	<b>108,289</b>

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# Montana Drought & Water Supply Advisory Committee

June 16, 2016

National Weather Service

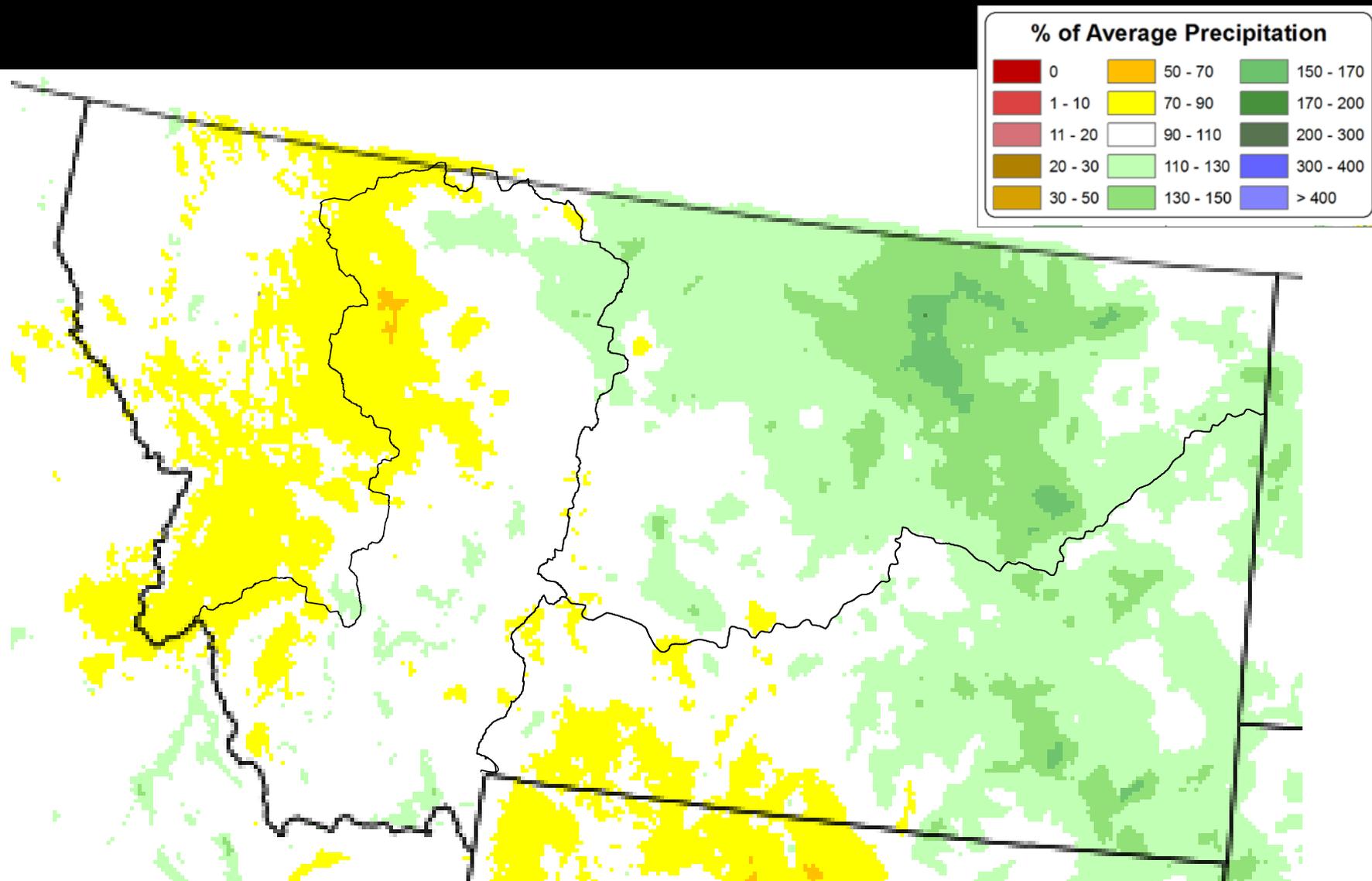
*Donald Britton – Meteorologist-in-Charge*



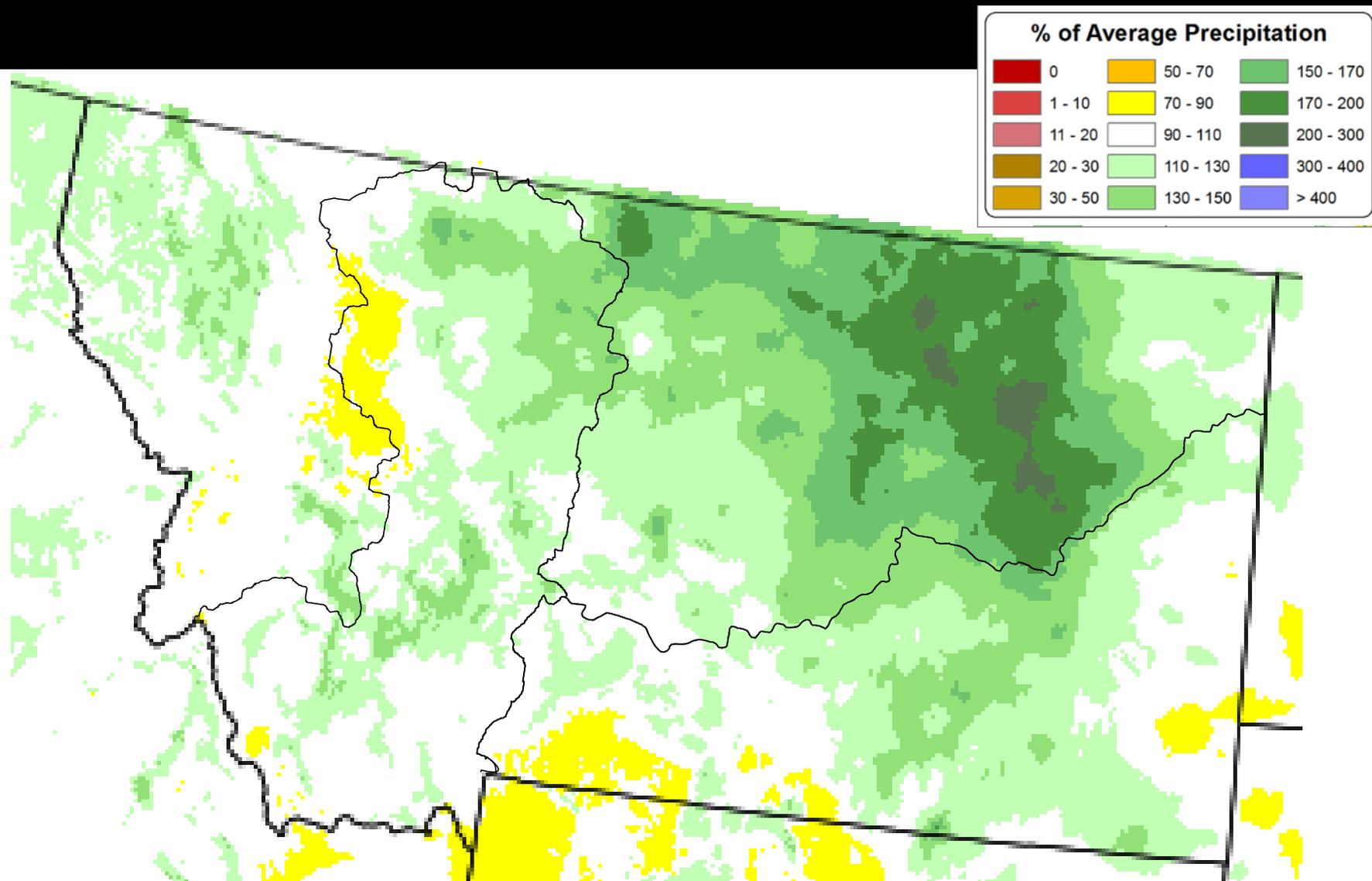
# MOISTURE...



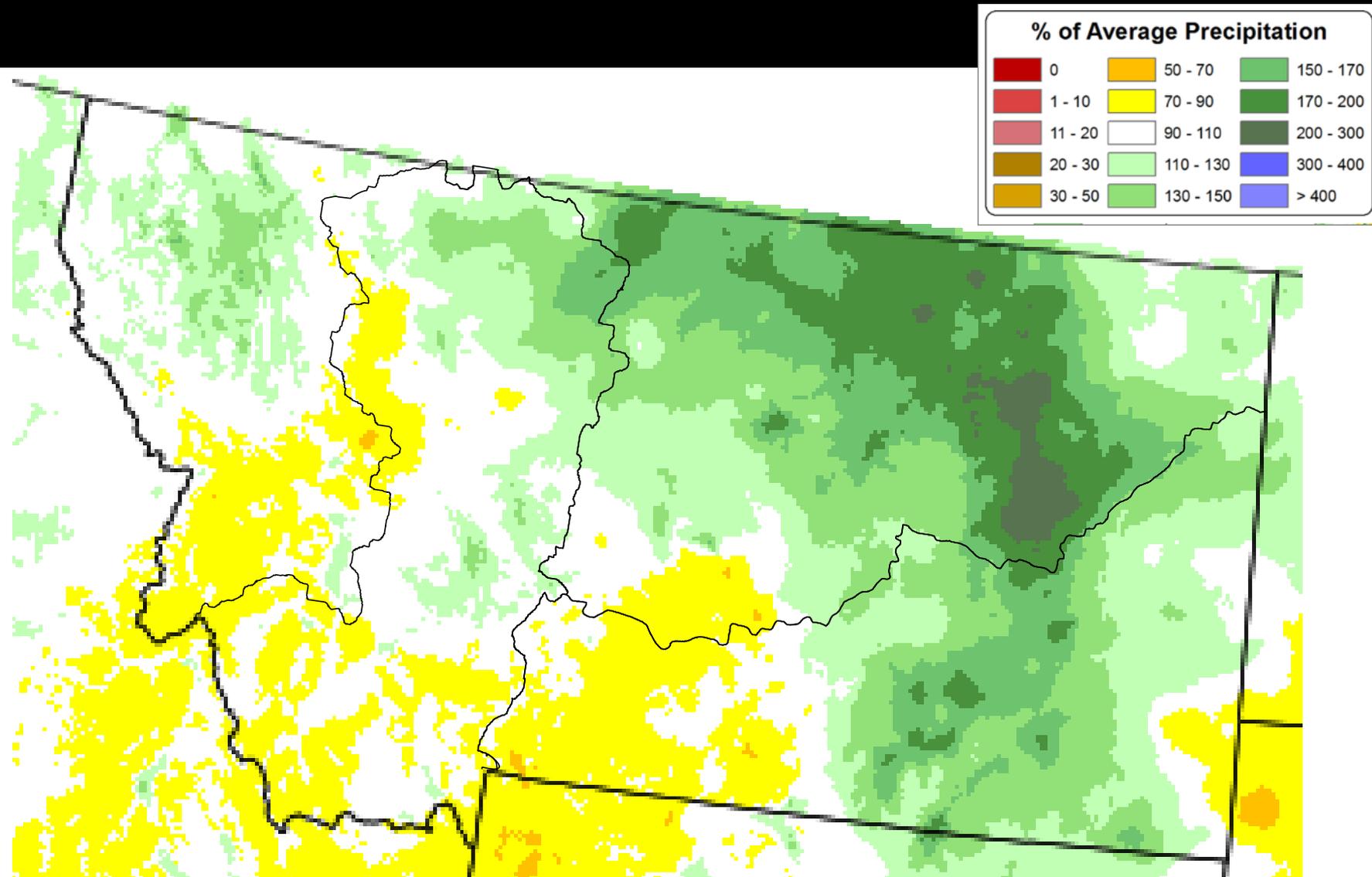
# Precipitation Anomaly Jun 15–May 16



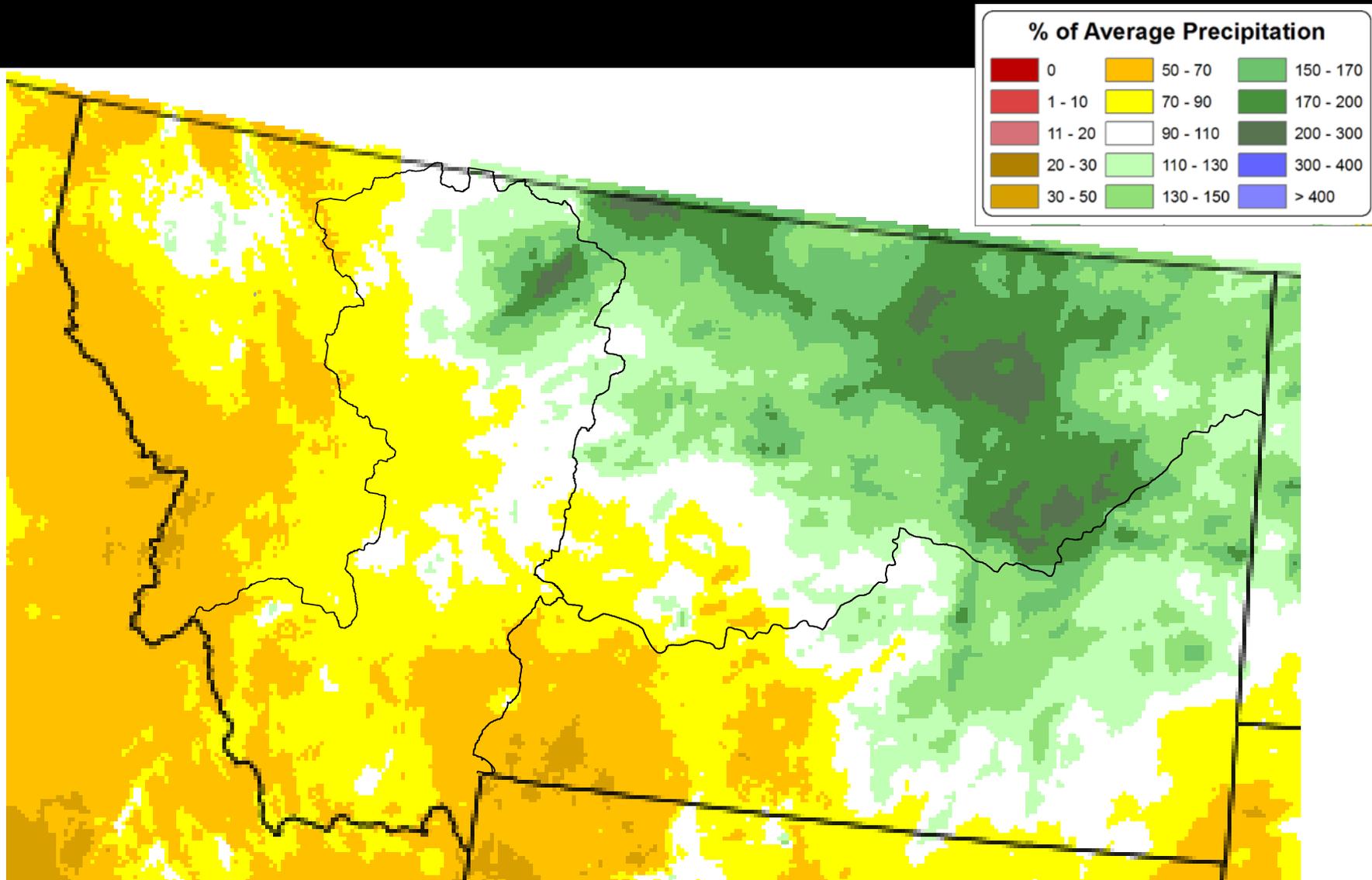
# Precipitation Anomaly Oct 15–May 16



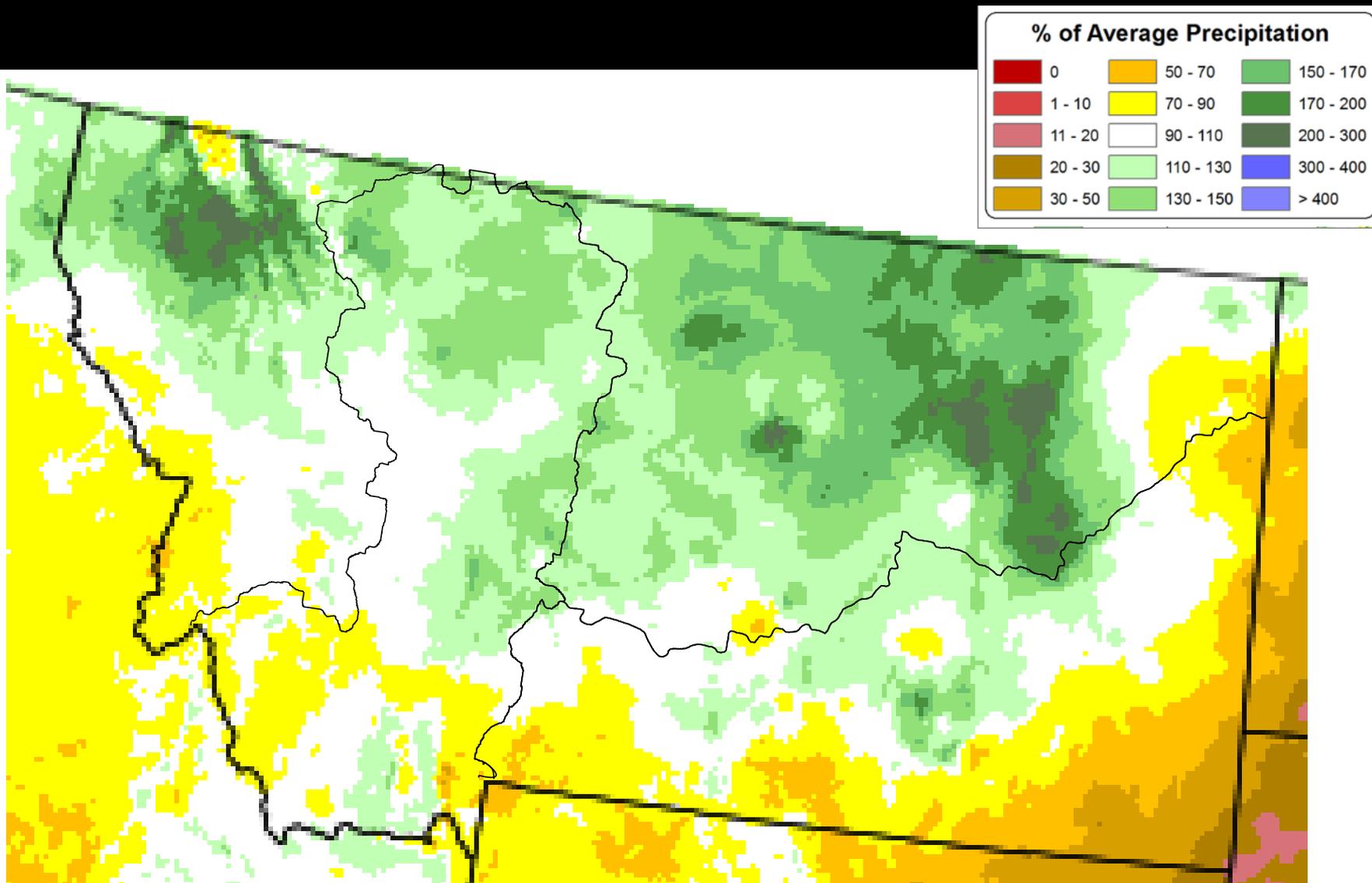
# Precipitation Anomaly Jan–May



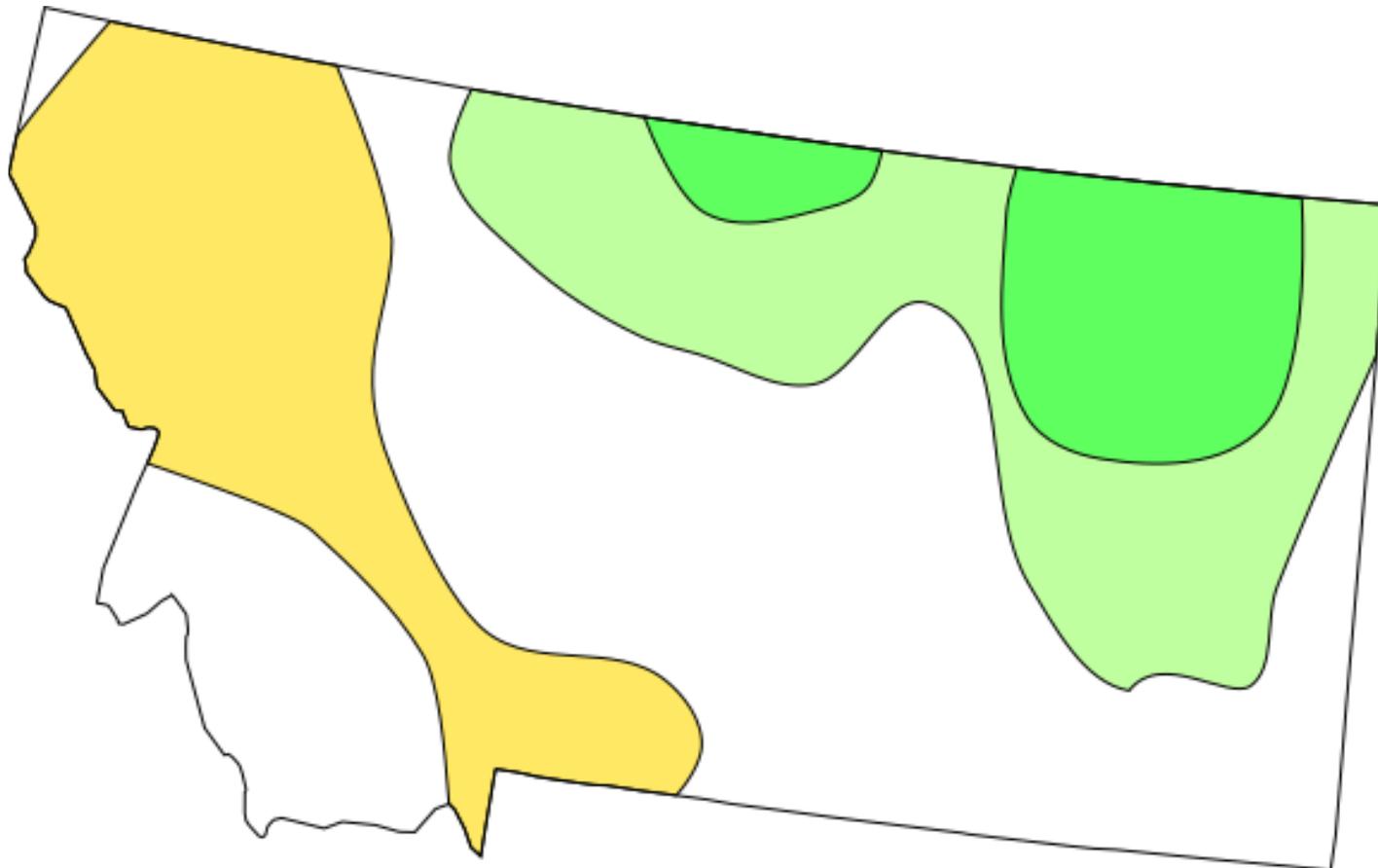
# Precipitation Anomaly Crop Year Apr–Jun



# Precipitation Anomaly May 16



# Soil Moisture Anomaly

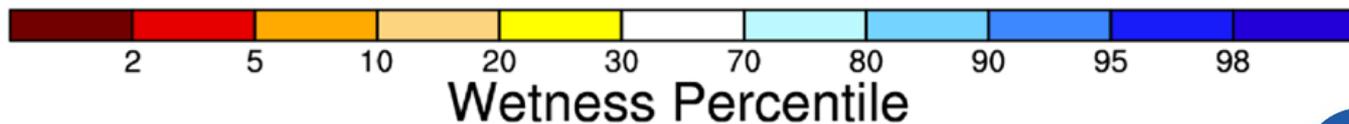
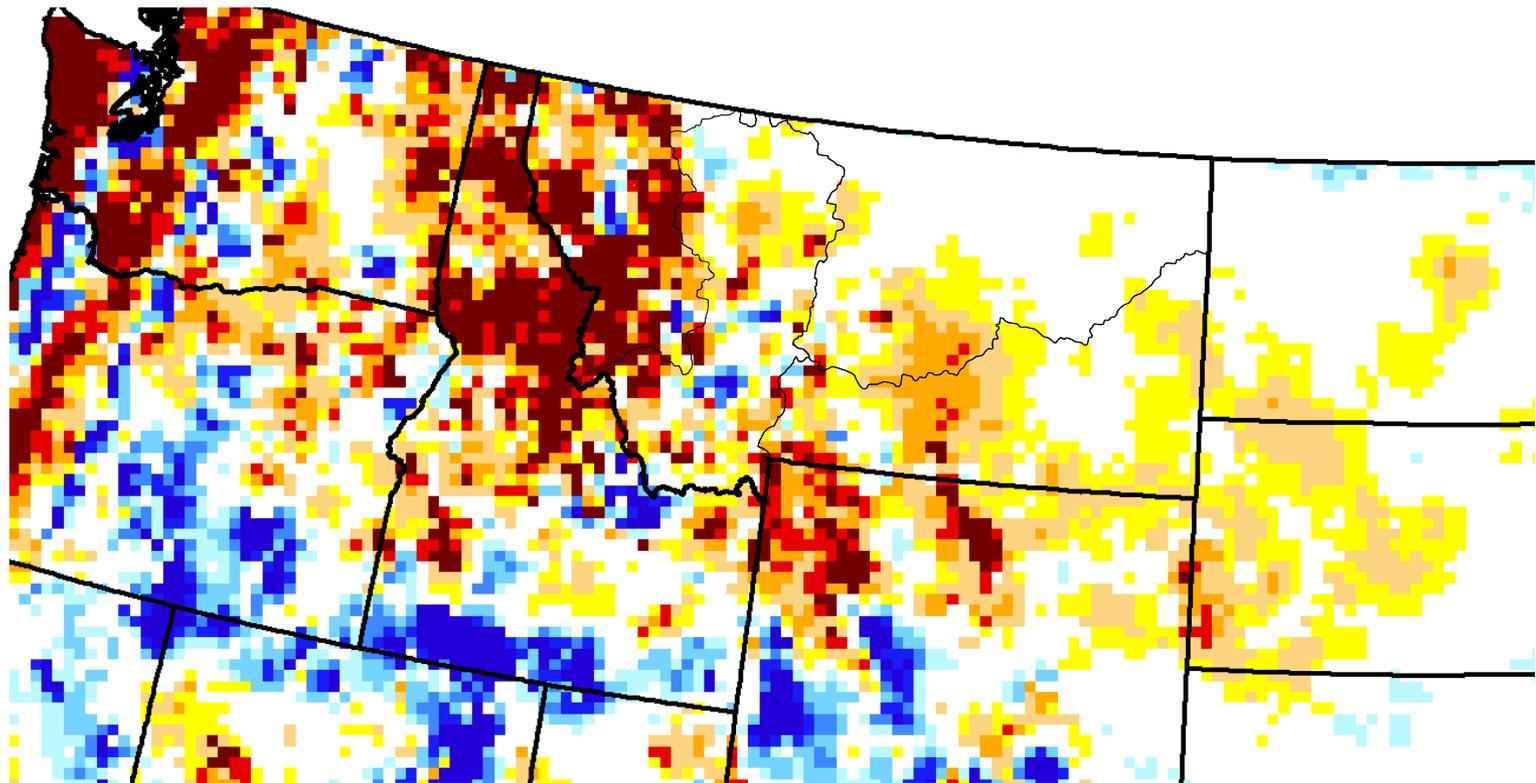


May 31, 2016

mm of moisture per meter of soil



# GRACE Root Zone Soil Moisture



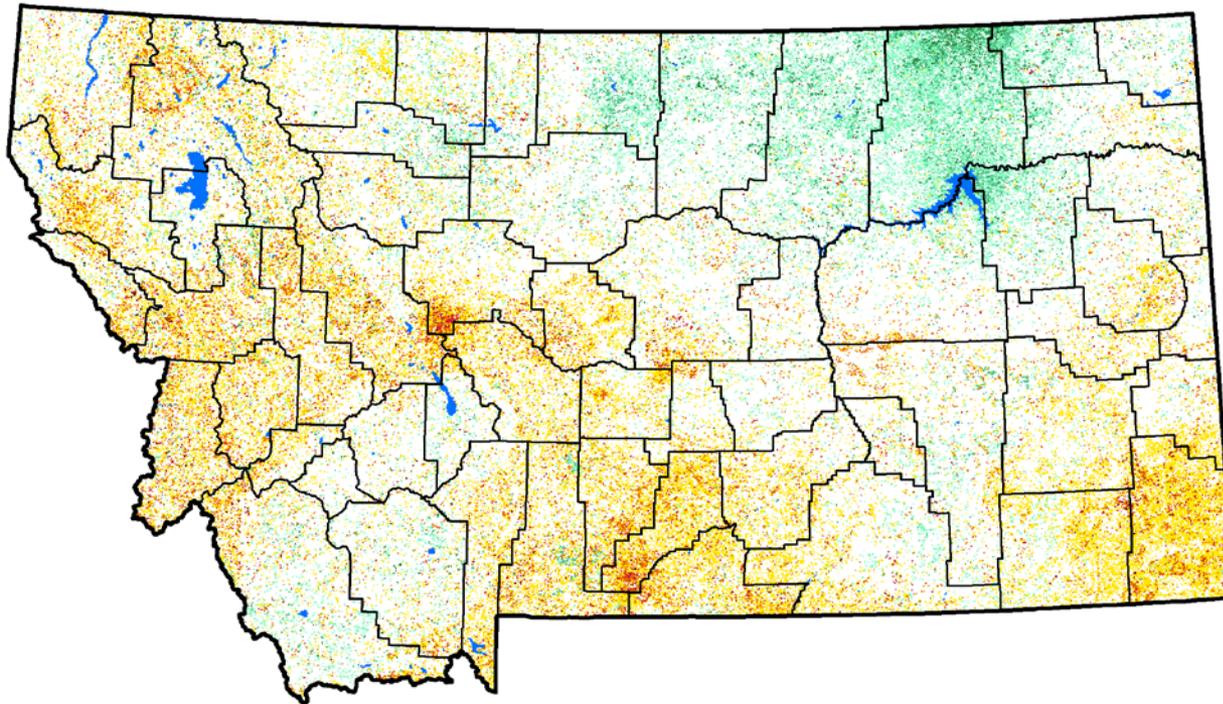
# Vegetation Drought Response Index

Complete: Montana

June 12, 2016

## Vegetation Condition

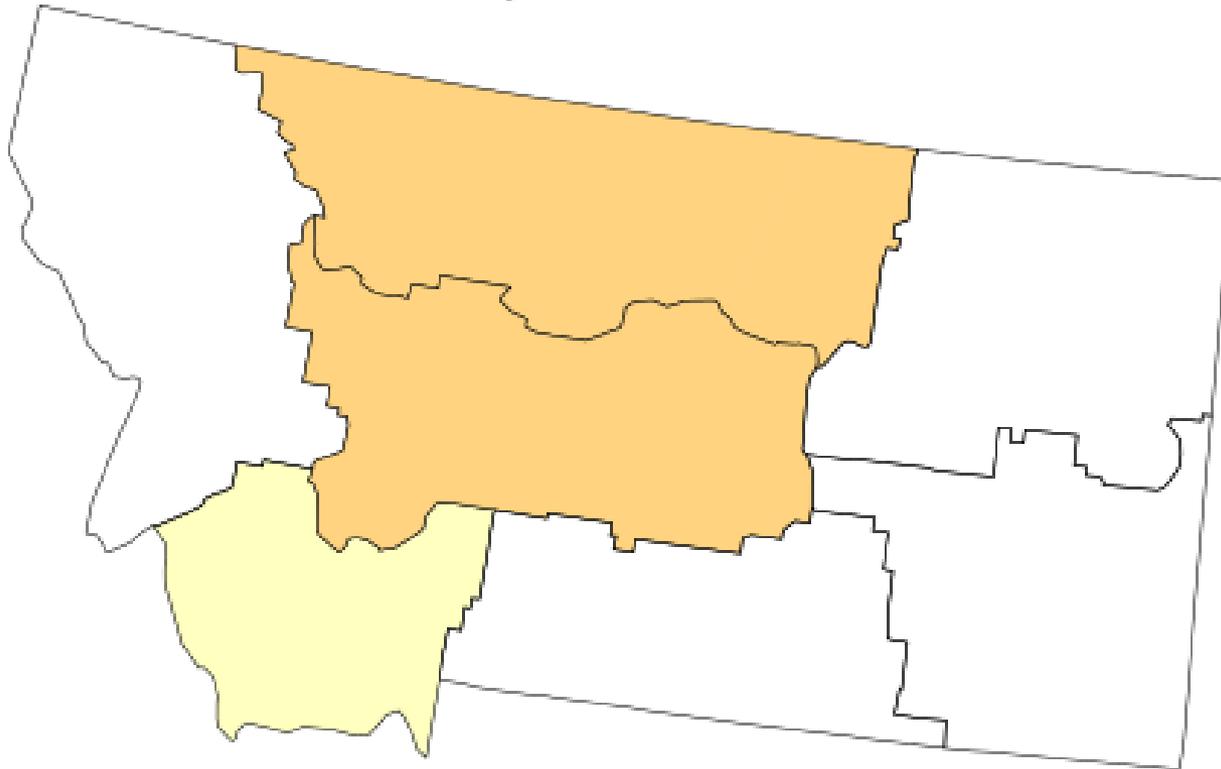
- Extreme Drought
- Severe Drought
- Moderate Drought
- Pre-drought stress
- Near Normal
- Unusually Moist
- Very Moist
- Extreme Moist
- Out of Season
- Water



# Crop Moisture Index

## Short-Term Need vs Available Shallow Soil Water

Ending Week of Jun 11

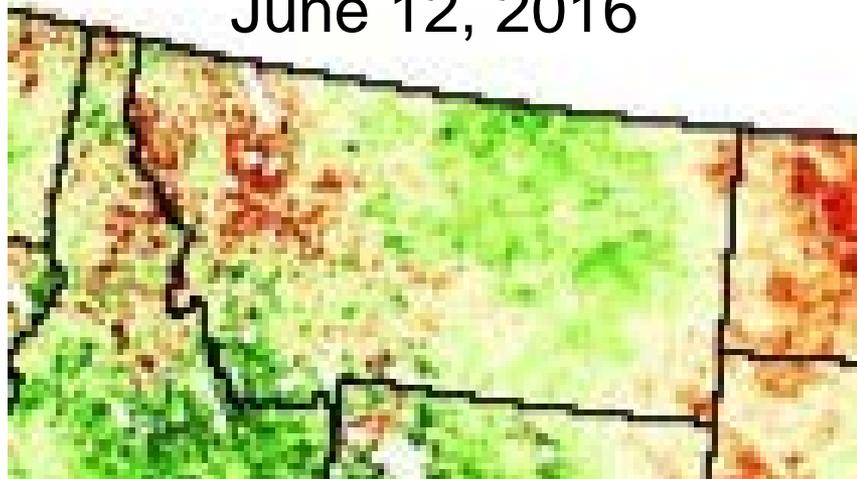




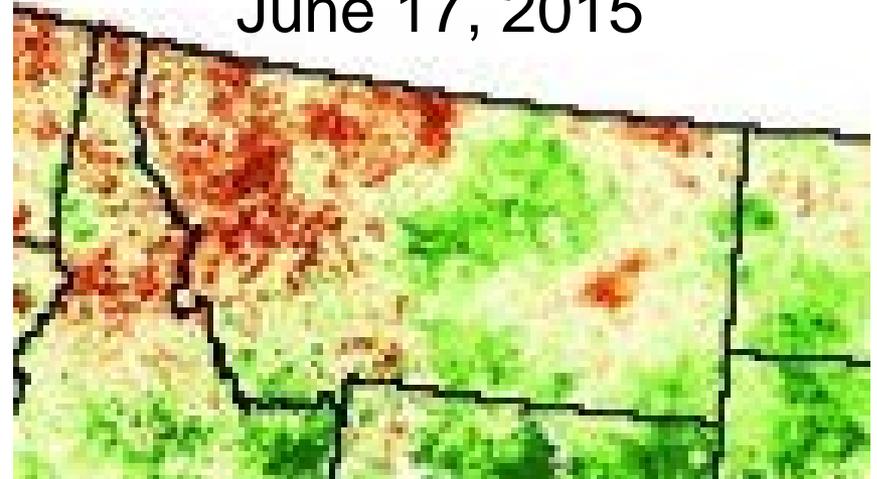
# Evaporative Stress Index 4km

1 month composite ending June 12, 2016

June 12, 2016



June 17, 2015



Standardized ET/PET anomalies



# TEMPERATURE...



# Montana: Jun 2015 – May 2016

## Warmest on Record

Avg Temp	20 <sup>th</sup> Century Average	Departure
45.5°F	41.1°F	4.4°F

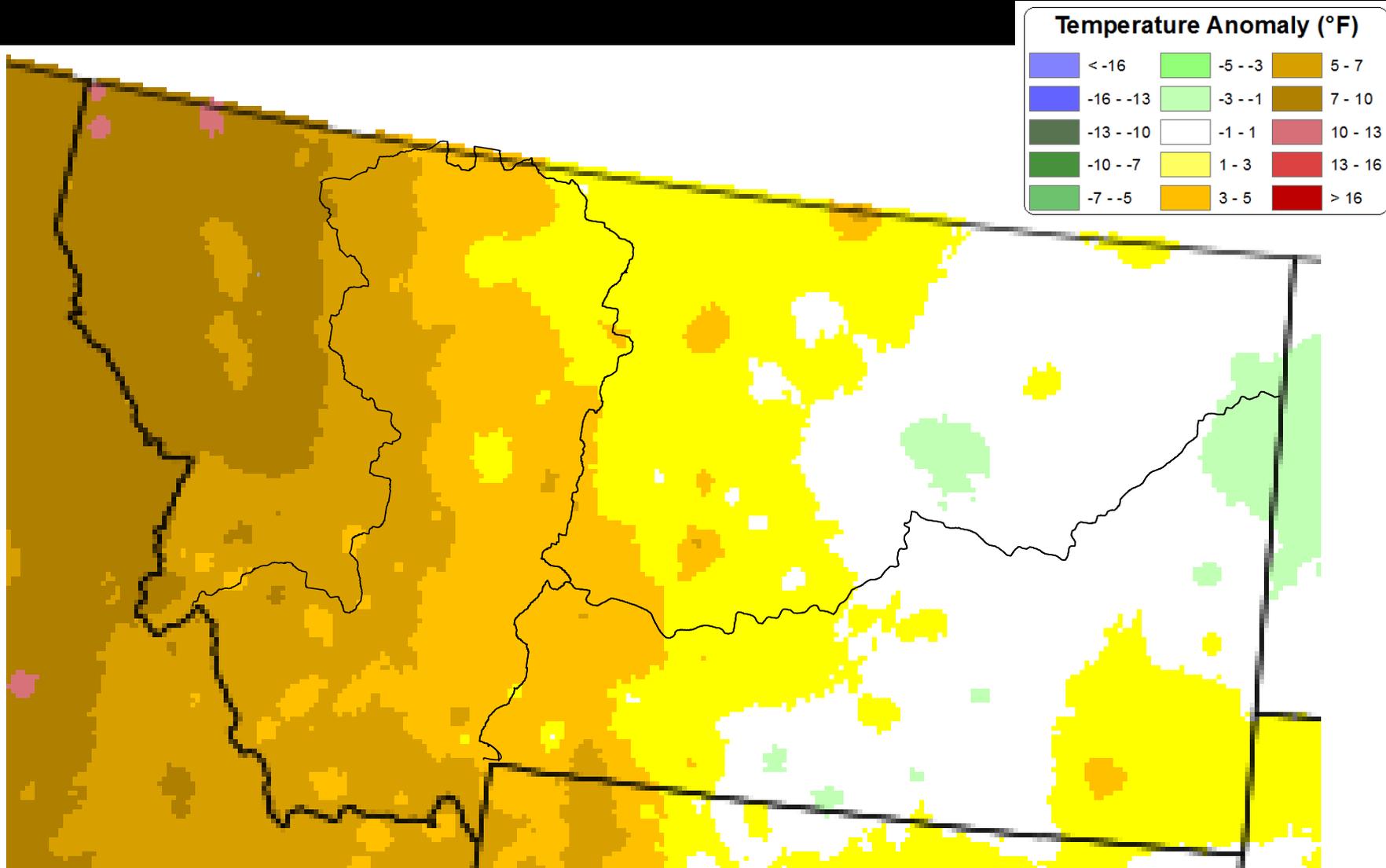
## Precipitation Just Above Normal (62<sup>nd</sup> Wettest)

Precip	20 <sup>th</sup> Century Average	Departure
18.82"	18.66"	0.17"



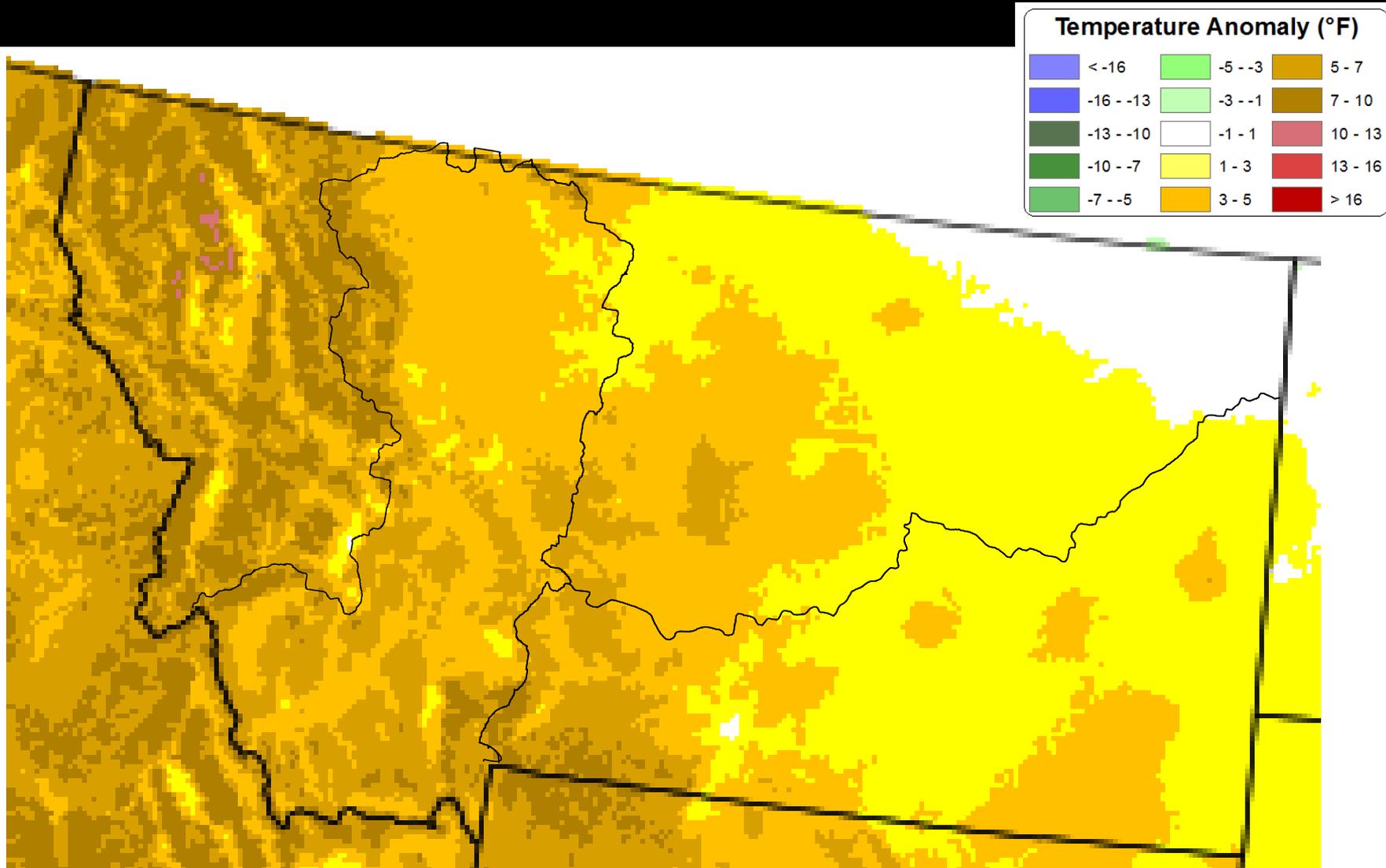
# May Maximum Temperatures

## Warmest Anomalies West of the Divide



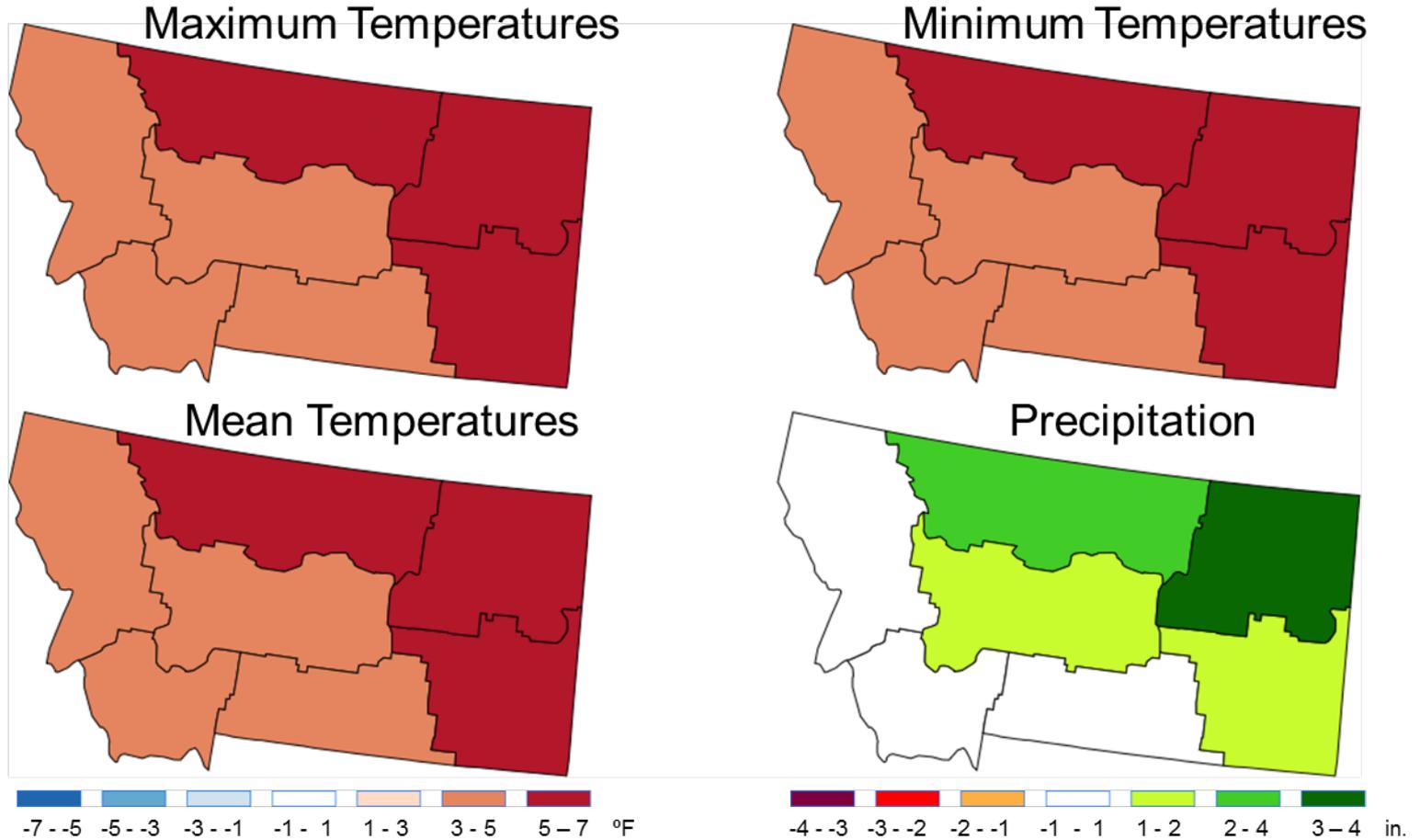
# May Minimum Temperatures

## Warm Anomalies Statewide



Oct 2015 – May 2016

# Climate Division Anomalies

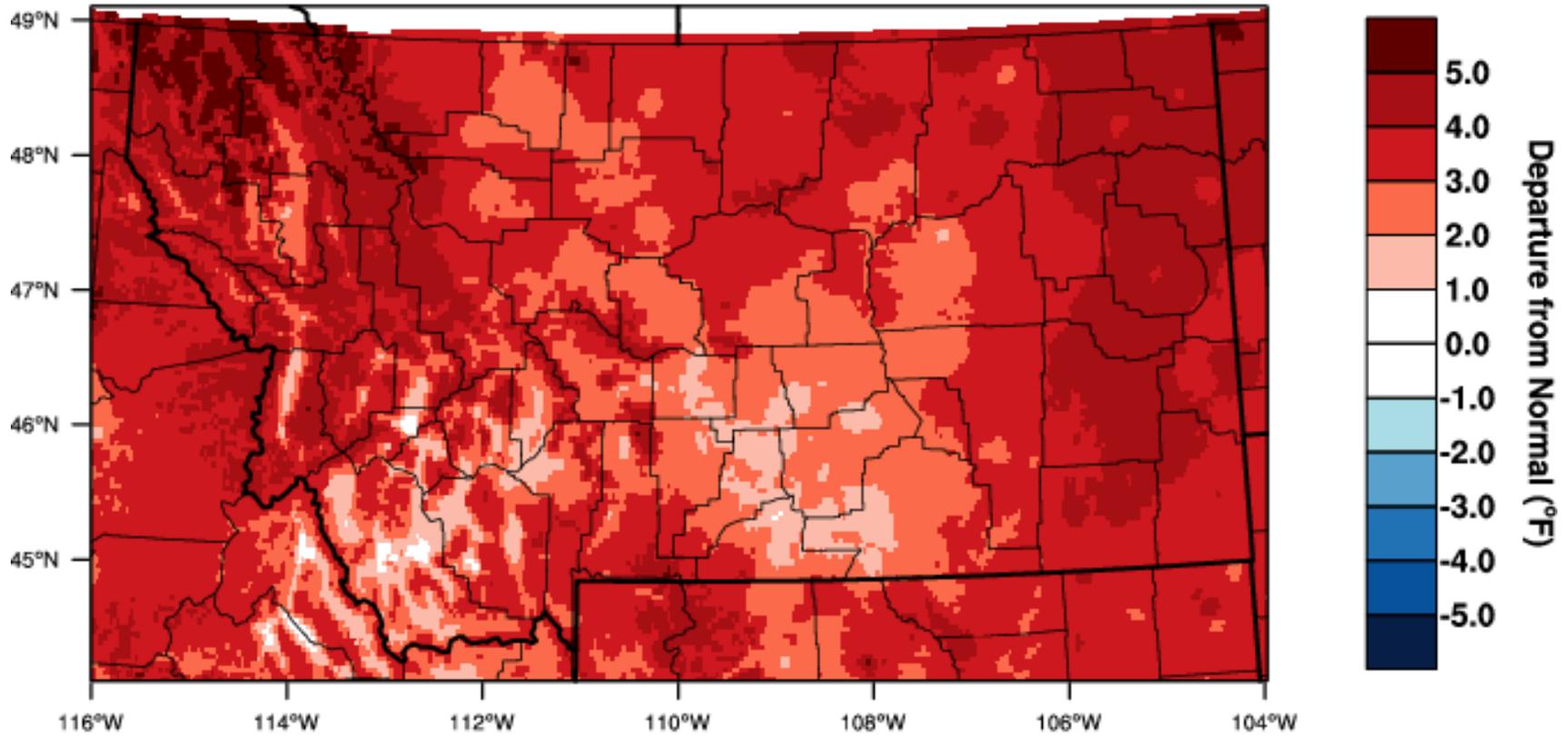


# Mean Temperature

## Water Year 2016

### Montana - Mean Temperature

October-May 2016 Departure from 1981-2010 Normal



WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 7 JUN 2016

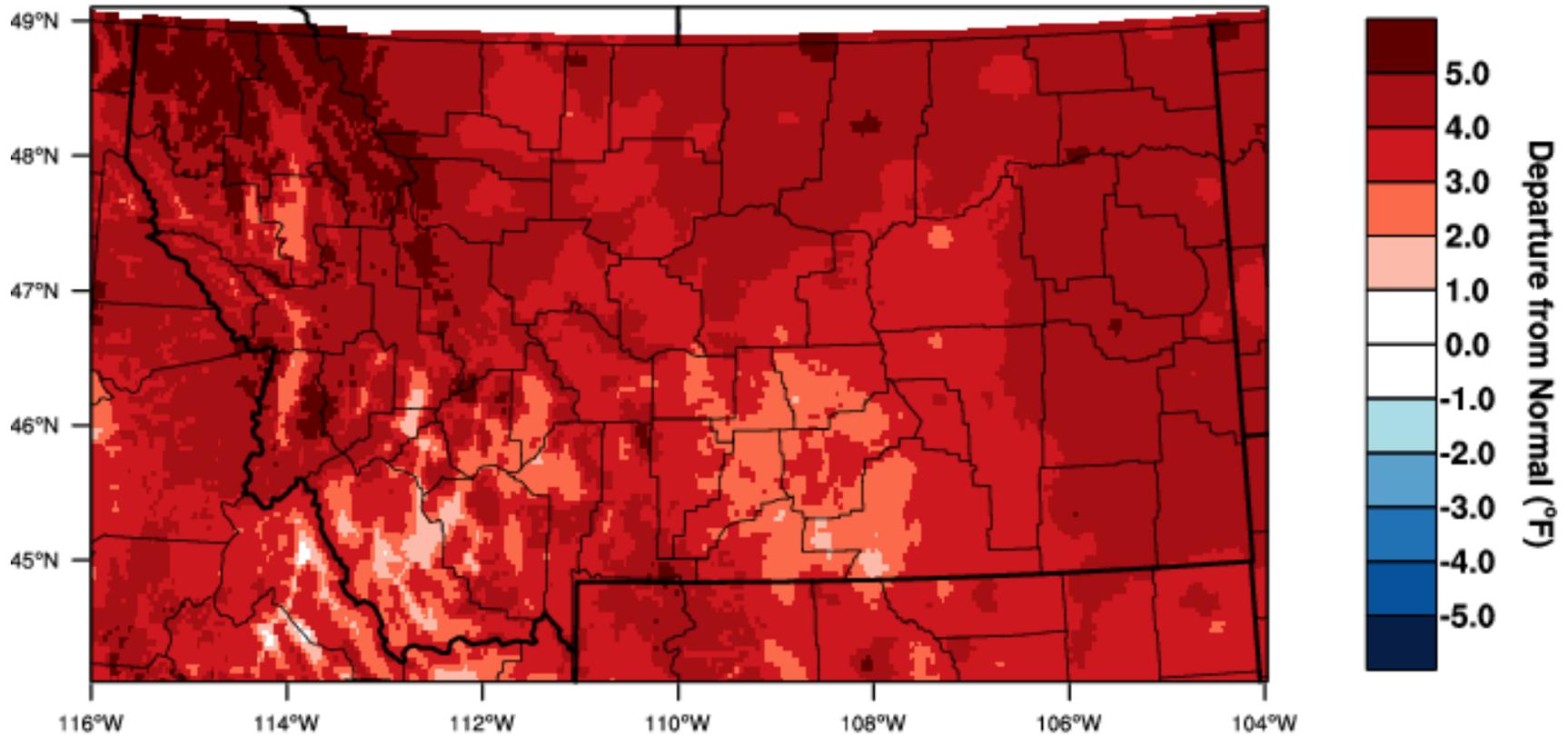


# Mean Temperature

## Calendar Year 2016

### Montana - Mean Temperature

January-May 2016 Departure from 1981-2010 Normal

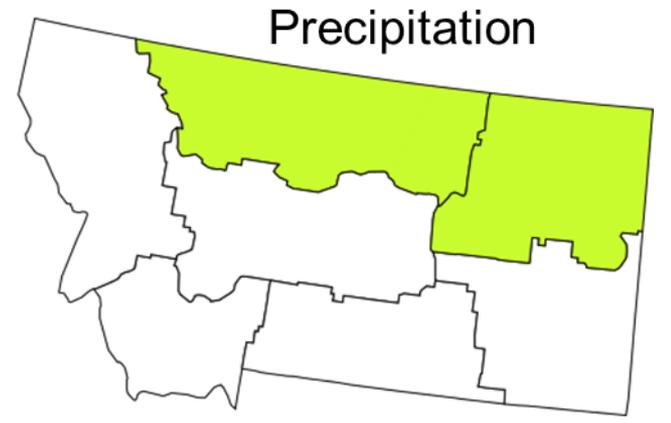
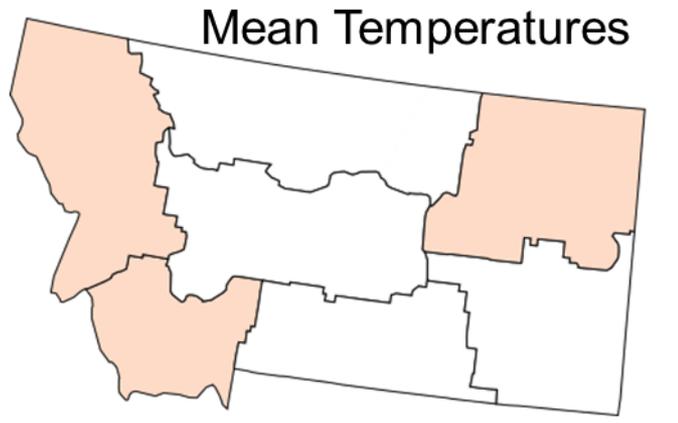
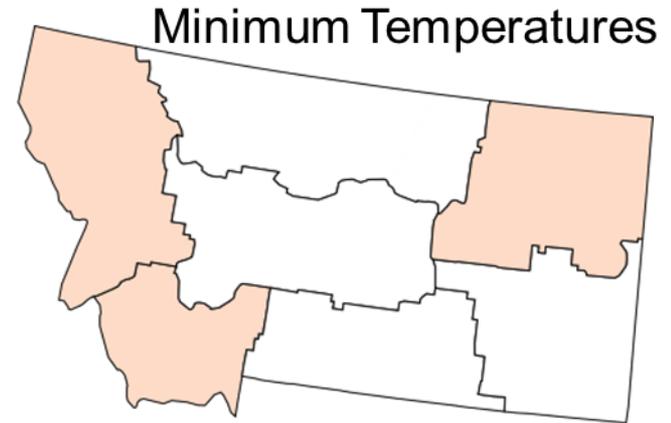
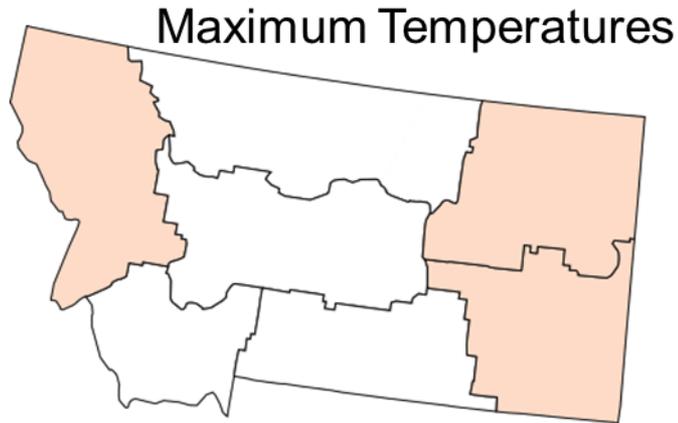


WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 7 JUN 2016



# Climate Division Anomalies

May 2016

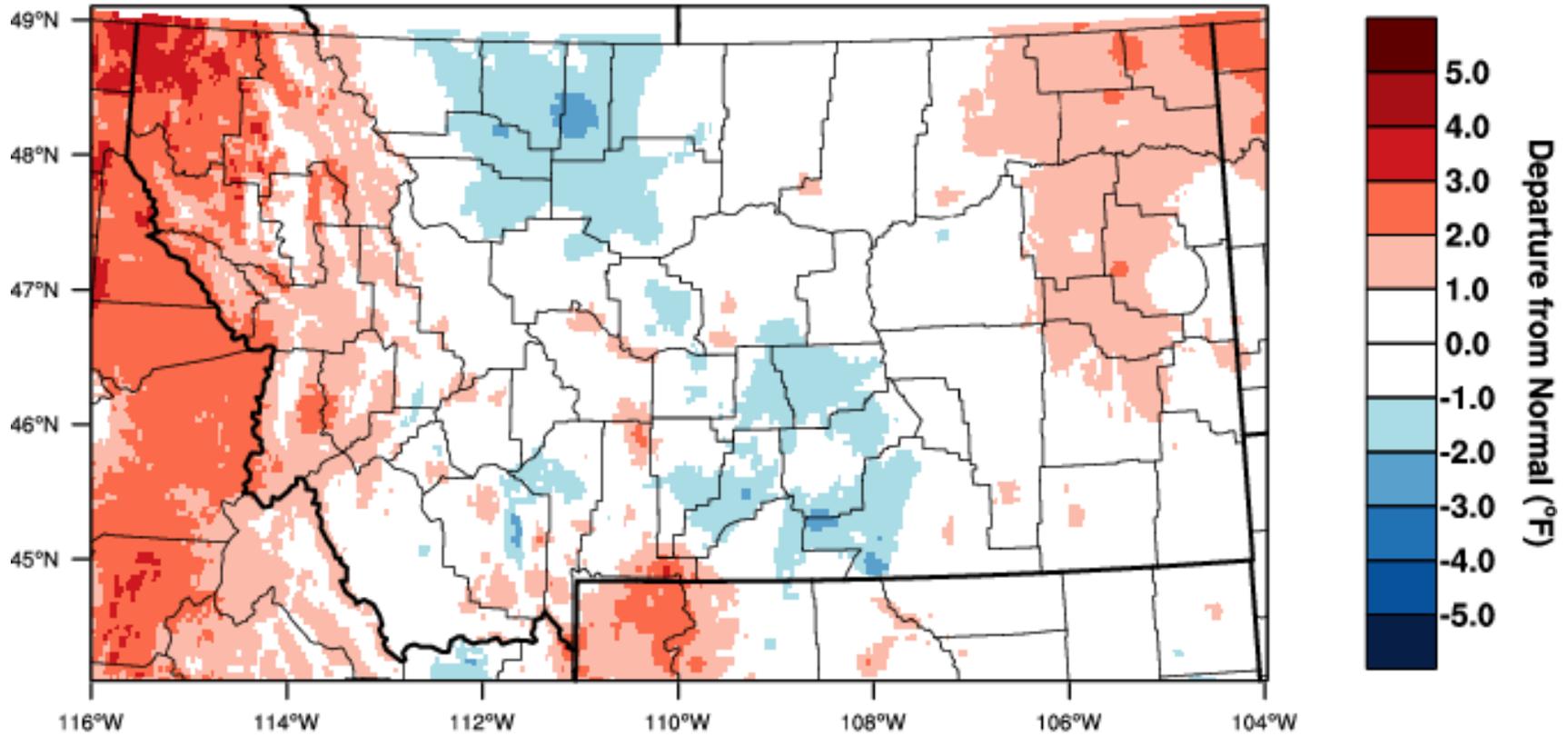


# Mean Temperature

## May 2016

### Montana - Mean Temperature

May 2016 Departure from 1981-2010 Normal



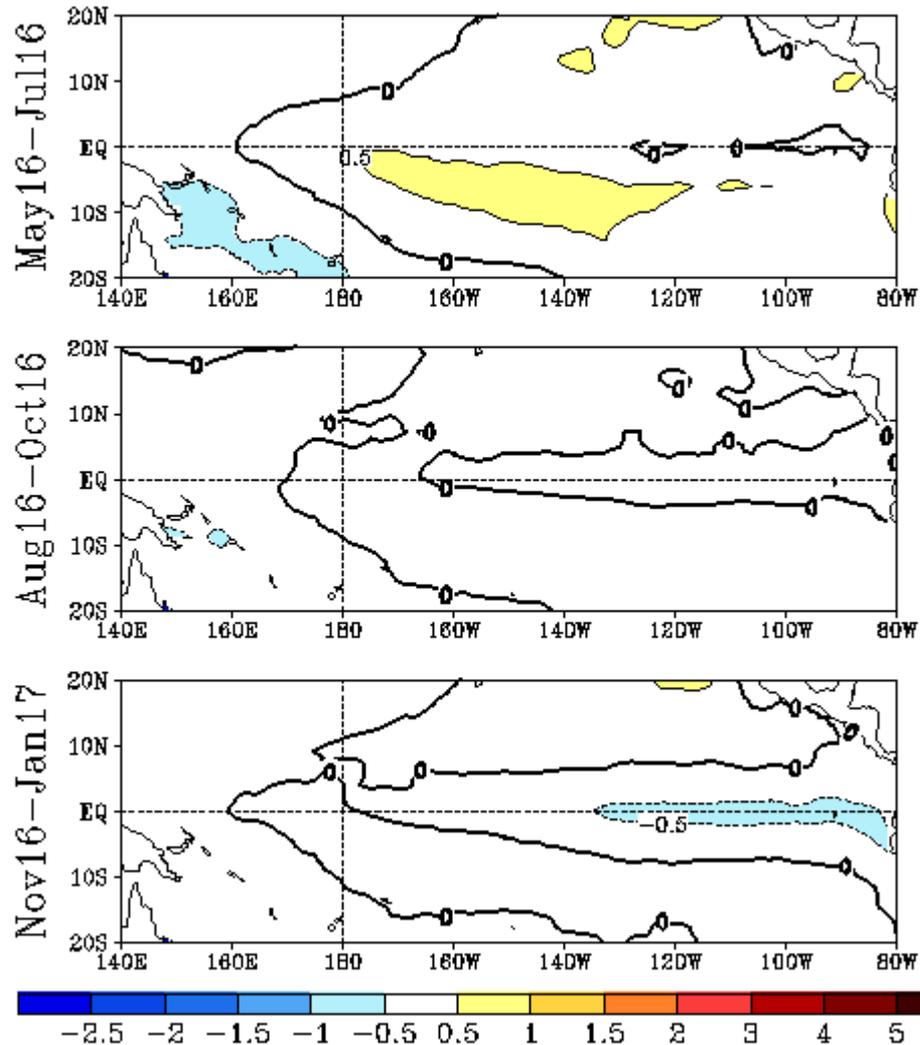
WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 7 JUN 2016



# CLIMATE...

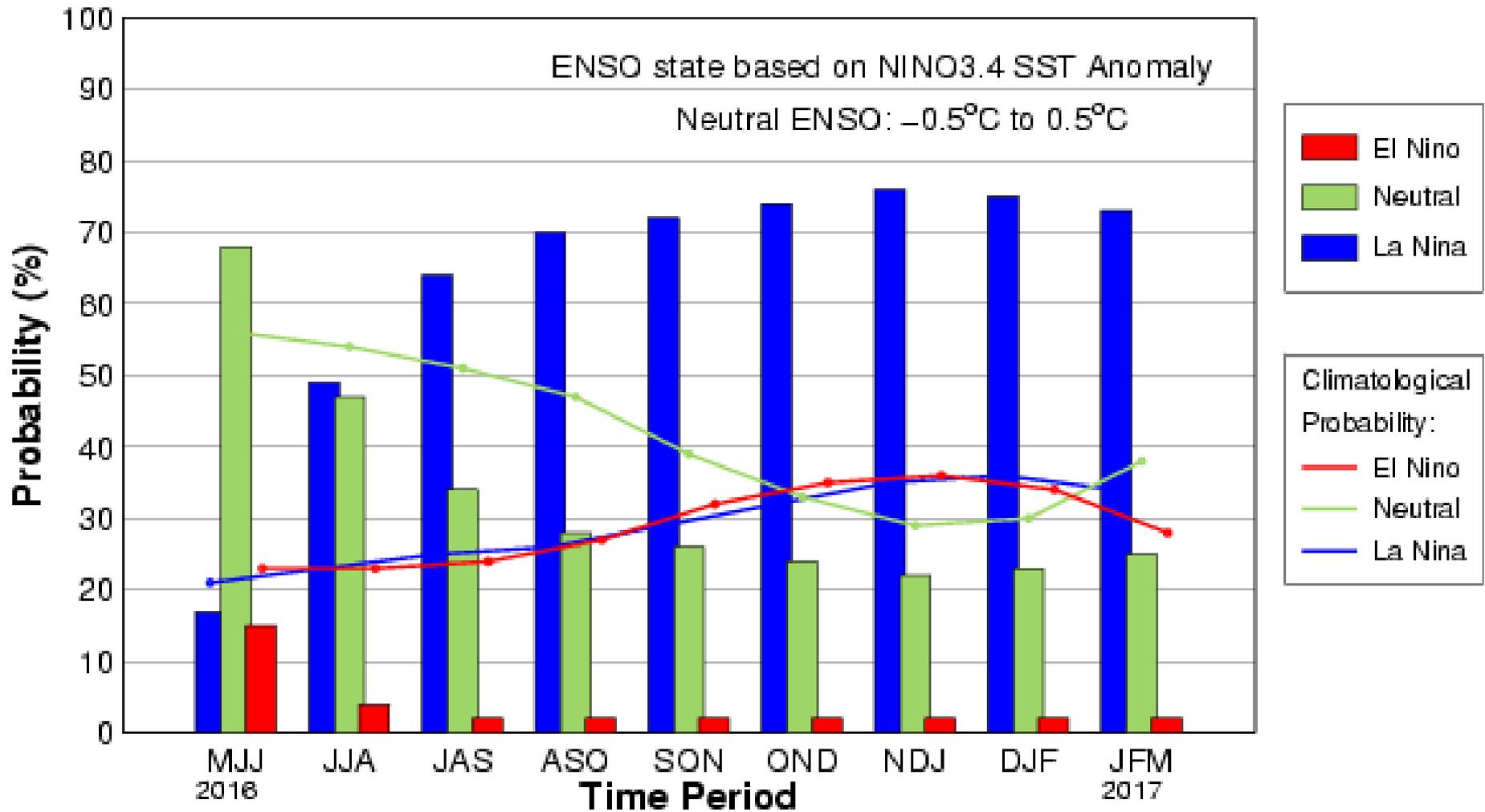


# El Niño / La Niña



# El Niño / La Niña

## Early-Jun CPC/IRI Official Probabilistic ENSO Forecast

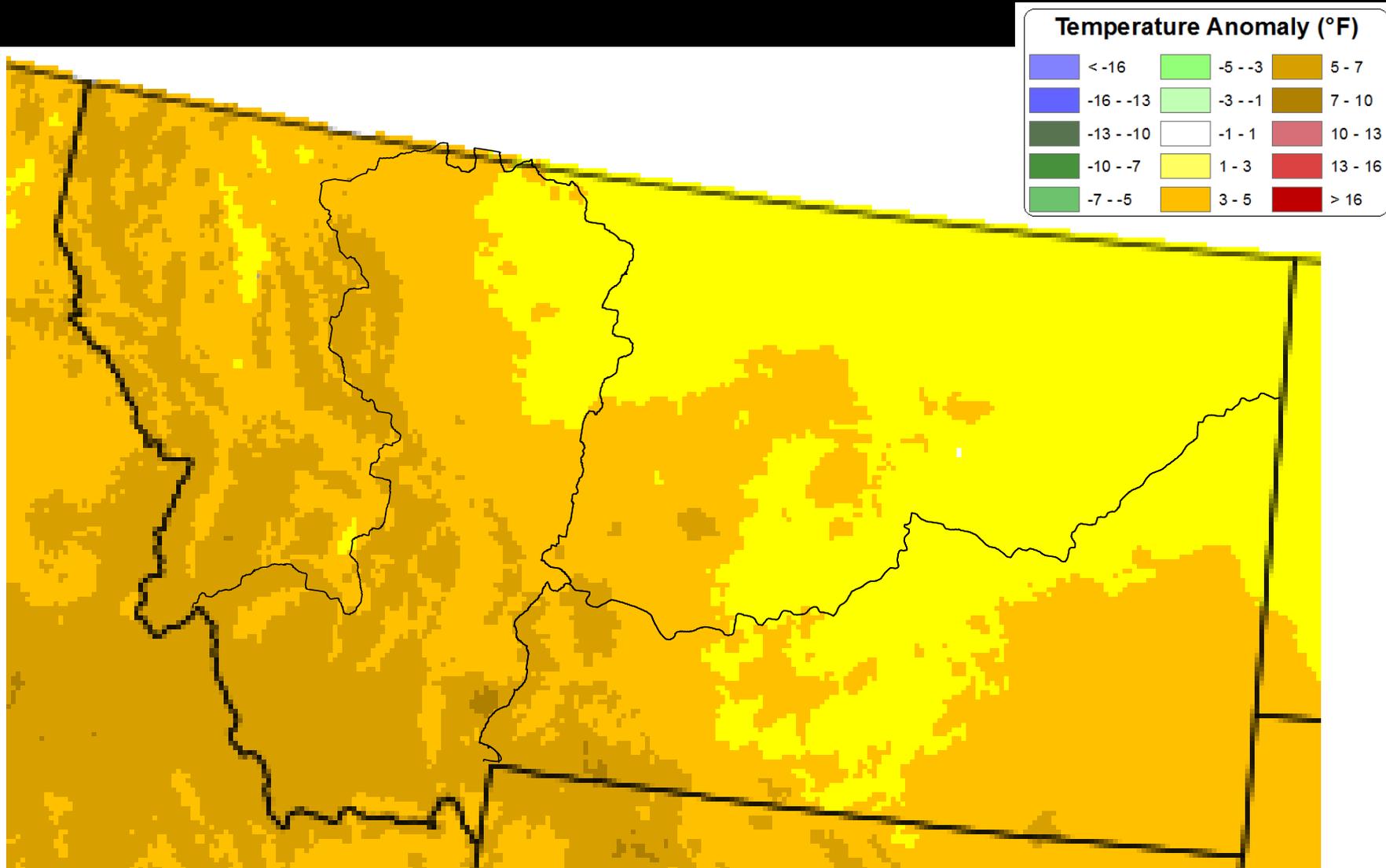


THIS MONTH SO FAR...

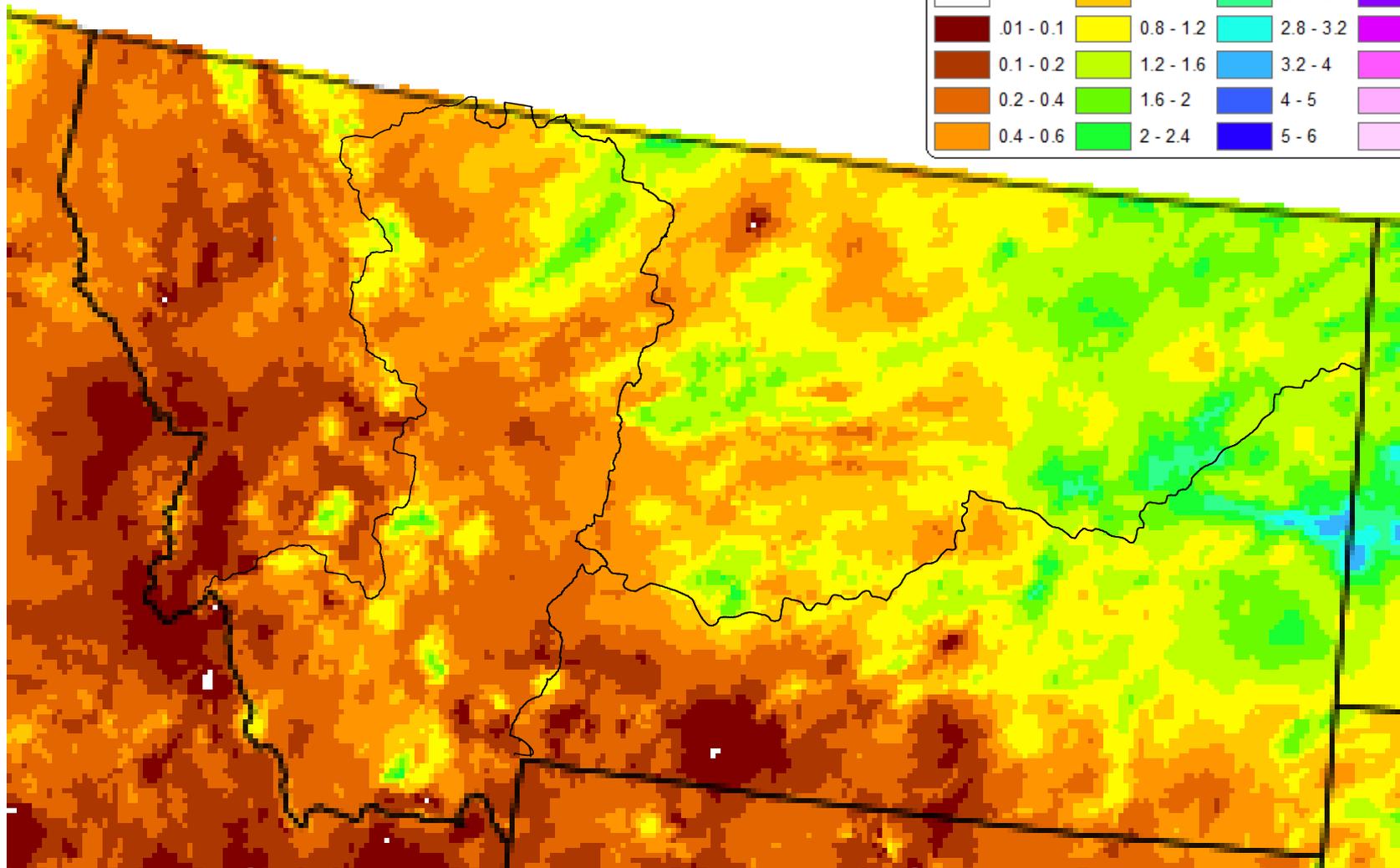
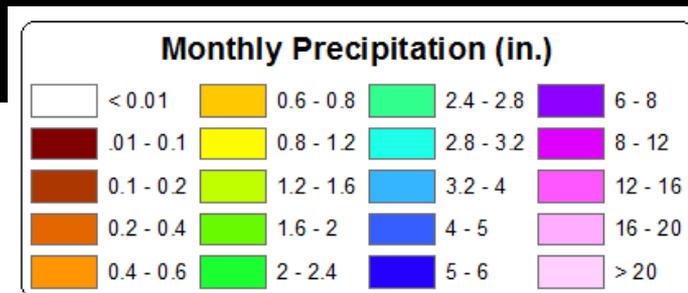


# June Mean Temperatures

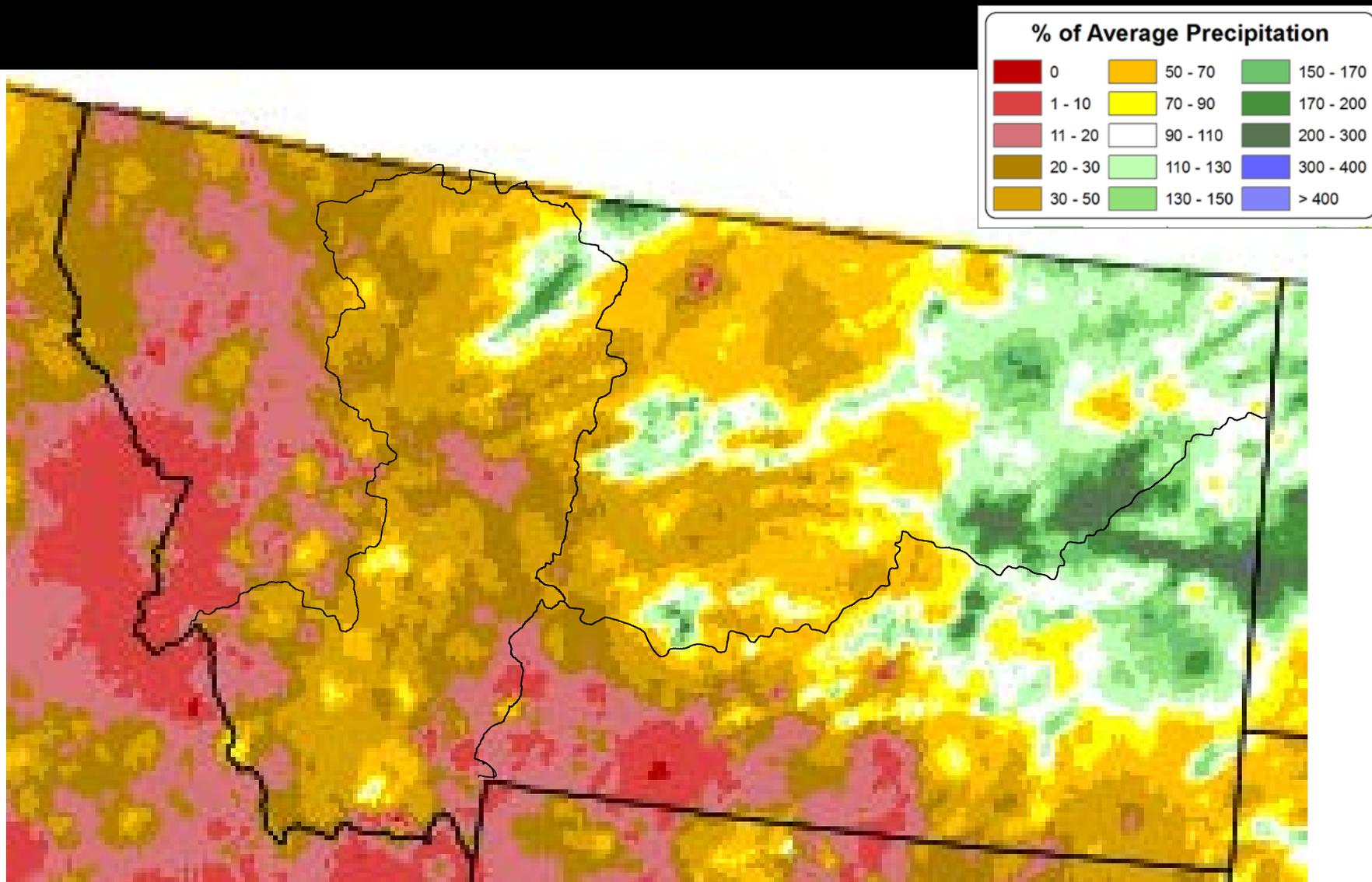
## Warm Anomalies Statewide



# Precipitation Thru Jun 14



# Precip Anomalies thru June 14

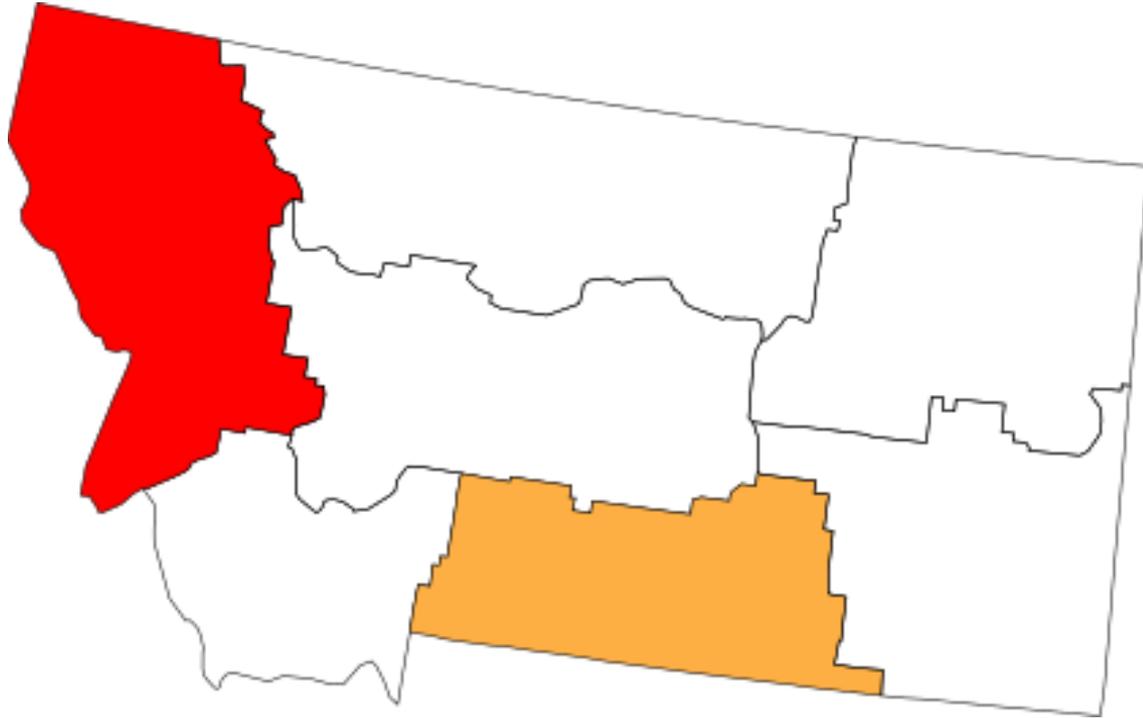
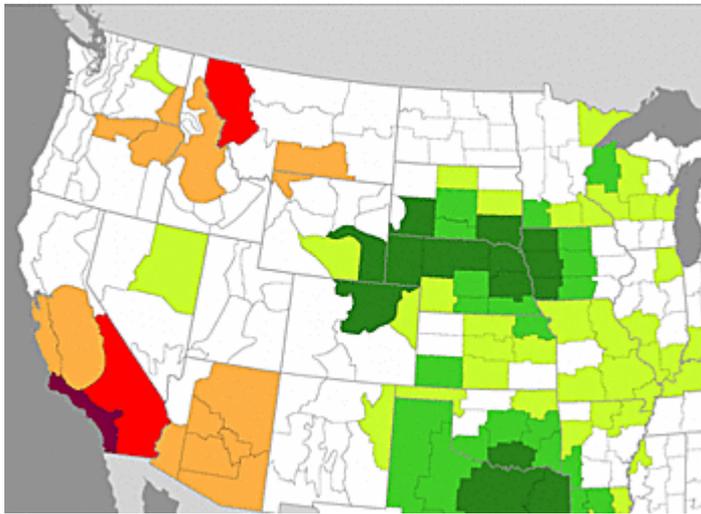


# DROUGHT MONITOR...



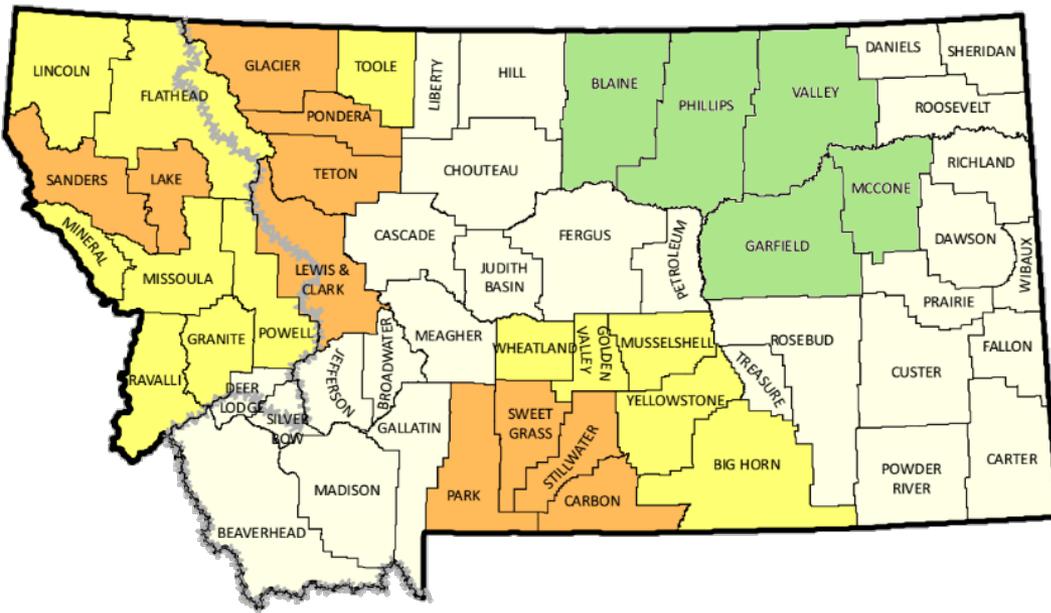
# Latest Palmer Drought Severity Index

## May 2016

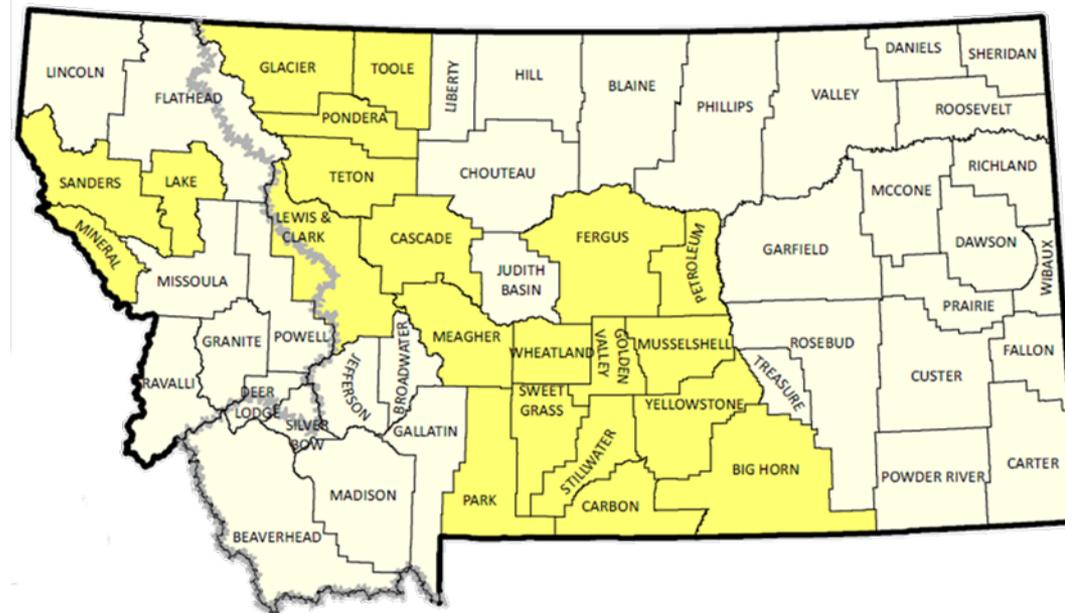


# Montana Drought Status

## May vs April



Montana Water Supply and Moisture Status by County - April 2016



### Moisture Status

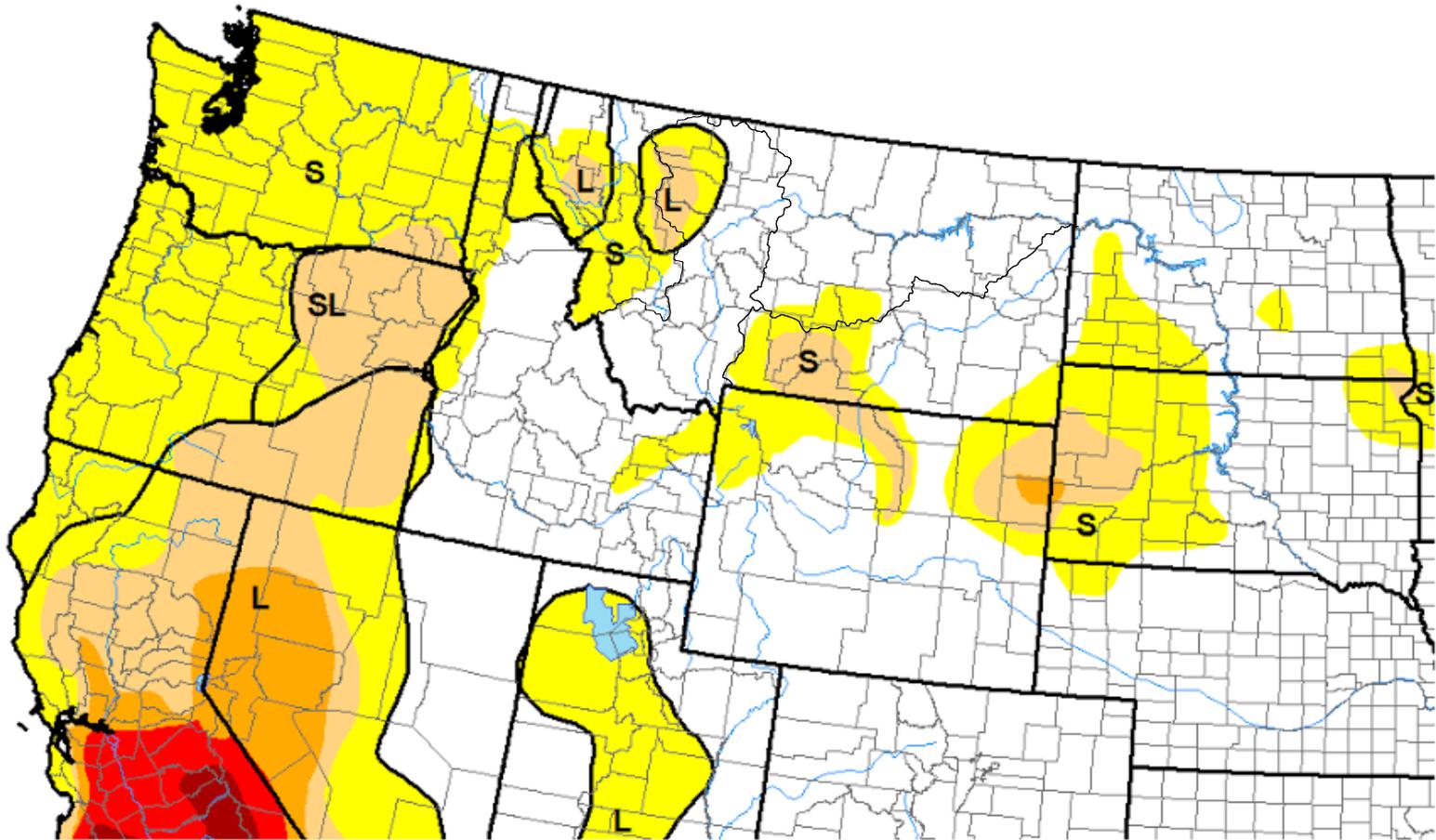
#### Current Month

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



# U.S. Drought Monitor

June 14, 2016  
Valid 8 a.m. EDT



Intensity:

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

Drought Impact Types:

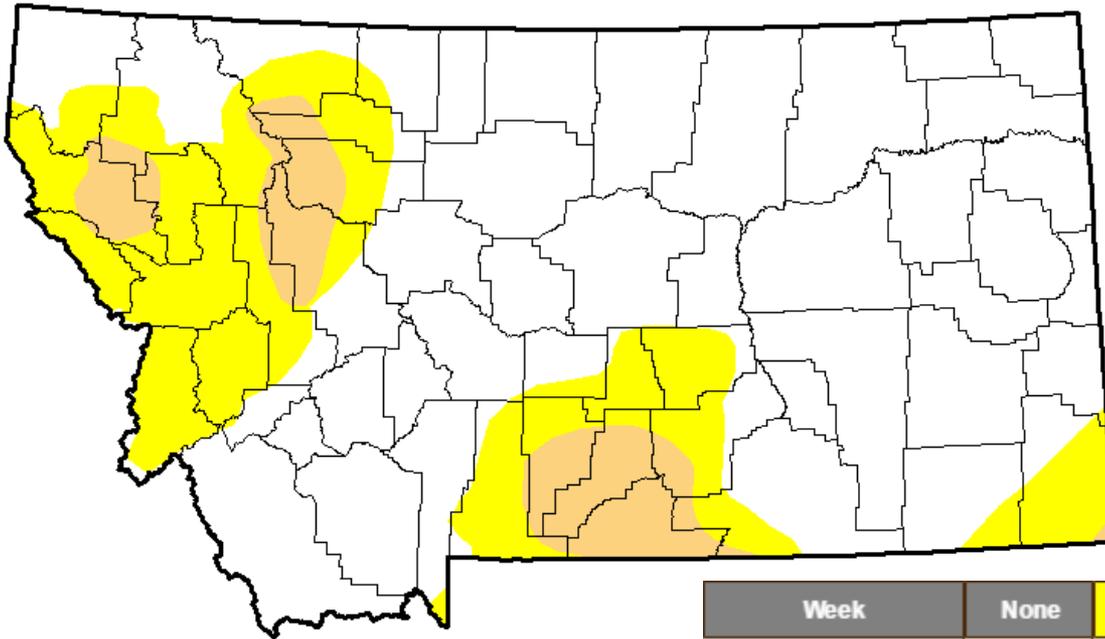
-  Delineates dominant impacts
- S = Short-term, typically <6 months  
(e.g. agricultural, grasslands)
- L = Long-term, typically >6 months  
(e.g. hydrological, ecology)
- (No type = Both impacts)



**Released Thursday, June 16, 2016**  
**Author: Chris Fenimore, NOAA/NESDIS/NCEI**



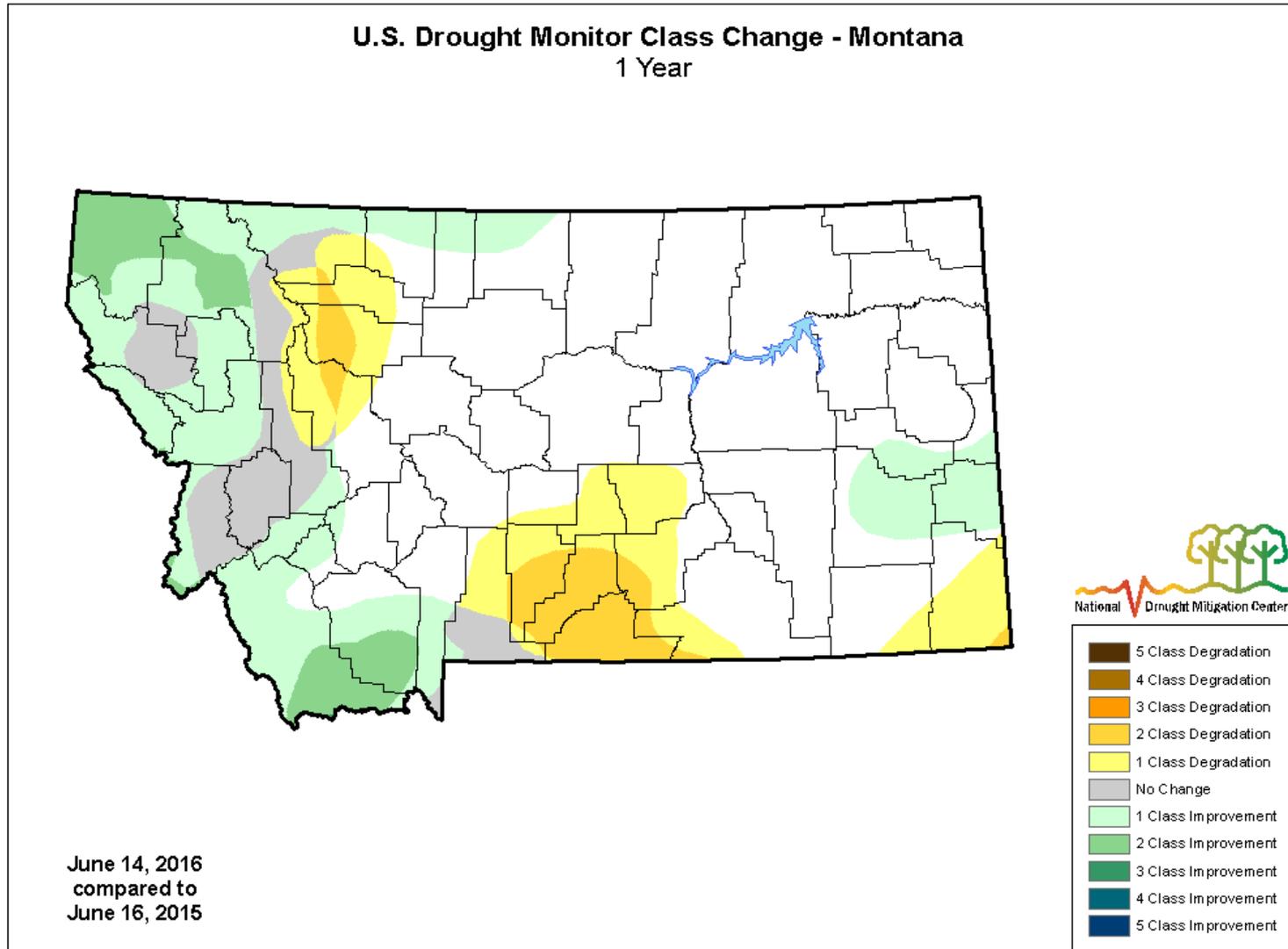
# Drought Monitor - Montana June 14, 2016



Week	None	D0	D1	D2	D3	D4
Current <a href="#">2016-06-14</a>	71.54	20.78	7.69	0.00	0.00	0.00
Last Week <a href="#">2016-06-07</a>	77.41	14.97	7.62	0.00	0.00	0.00
3 Months Ago <a href="#">2016-03-15</a>	44.46	42.64	9.34	3.56	0.00	0.00
Start of Calendar Year <a href="#">2015-12-29</a>	48.55	20.52	9.98	17.42	3.54	0.00
Start of Water Year <a href="#">2015-09-29</a>	30.55	31.27	9.40	11.86	16.92	0.00
One Year Ago <a href="#">2015-06-16</a>	68.12	19.40	12.47	0.01	0.00	0.00



# Drought Monitor - Montana June 14, 2016



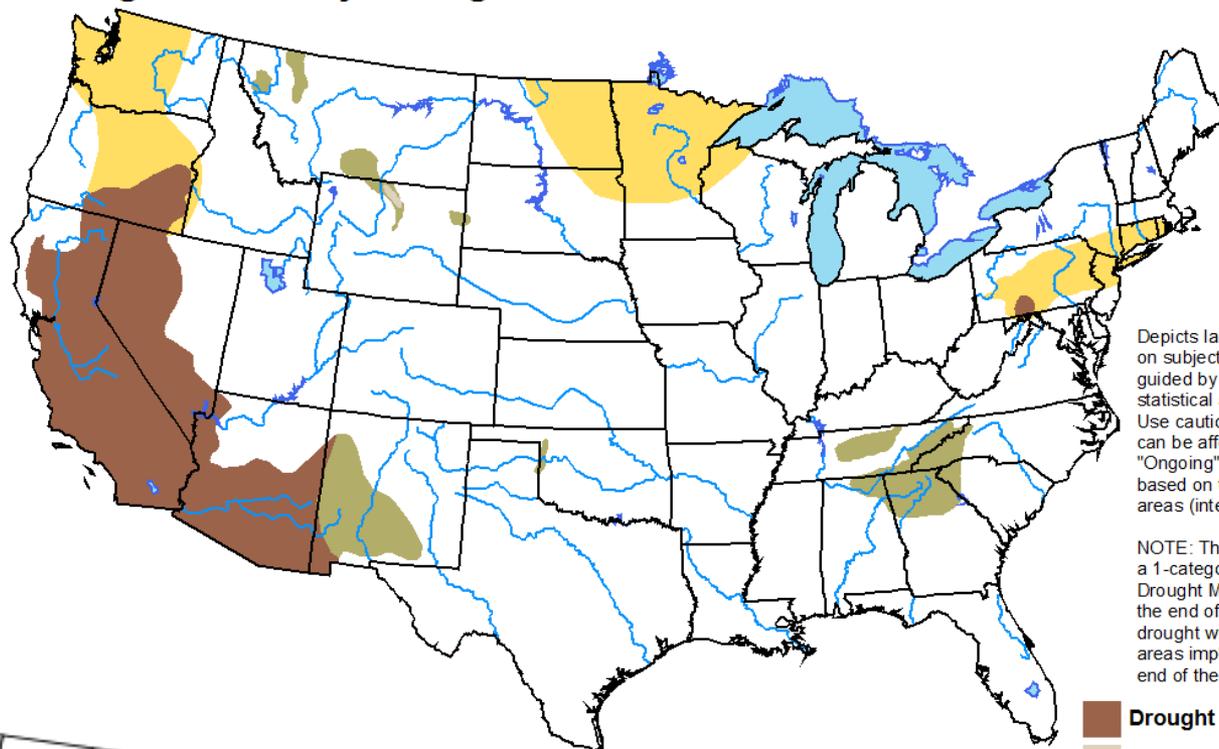
<http://droughtmonitor.unl.edu>



# U.S. Seasonal Drought Outlook

## Drought Tendency During the Valid Period

Valid for May 19 - August 31, 2016  
Released May 19, 2016



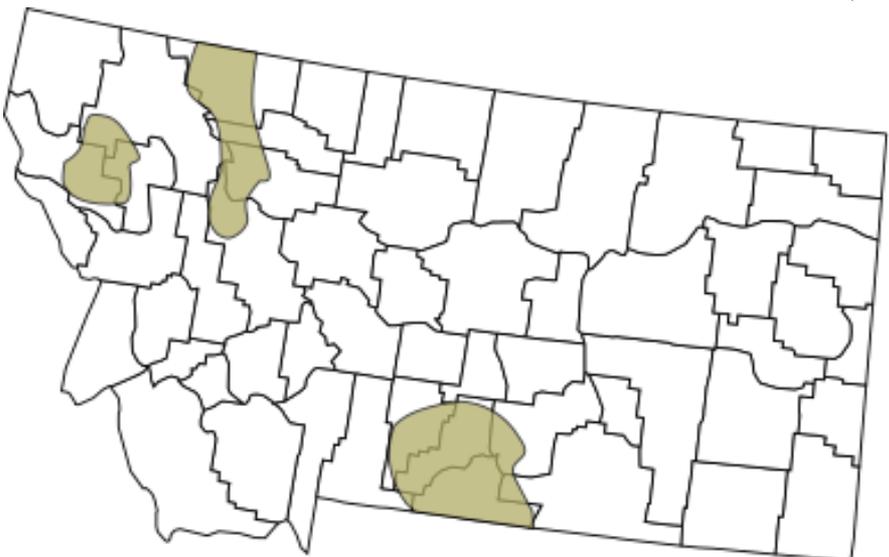
Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Use caution for applications that can be affected by short lived events. "Ongoing" drought areas are based on the U.S. Drought Monitor areas (intensities of D1 to D4).

NOTE: The tan areas imply at least a 1-category improvement in the Drought Monitor intensity levels by the end of the period, although drought will remain. The green areas imply drought removal by the end of the period (D0 or none).

-  Drought persists
-  Drought remains but improves
-  Drought removal likely
-  Drought development likely



<http://go.usa.gov/3eZ73>



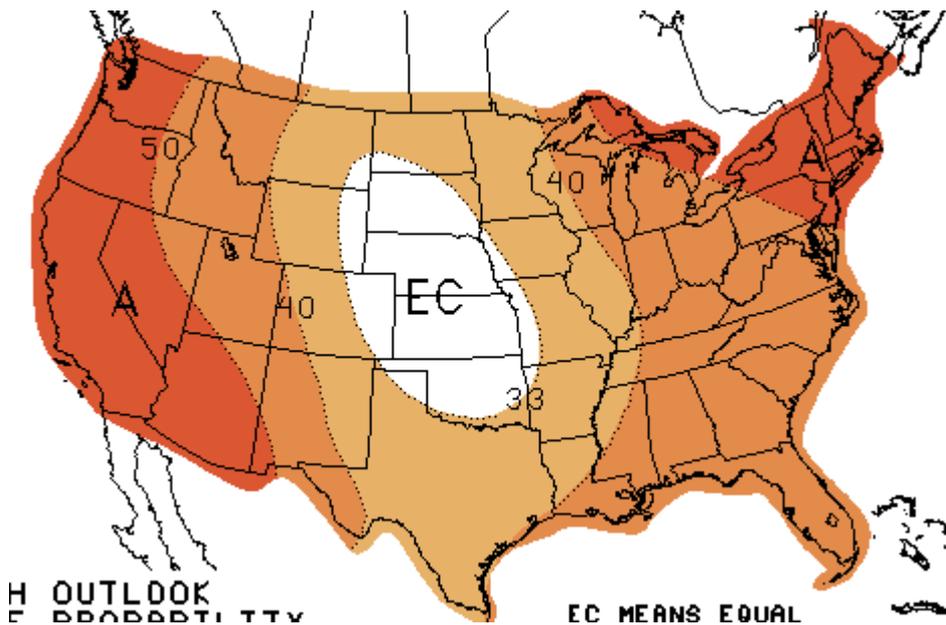
# FORECAST...



# July – September Outlook

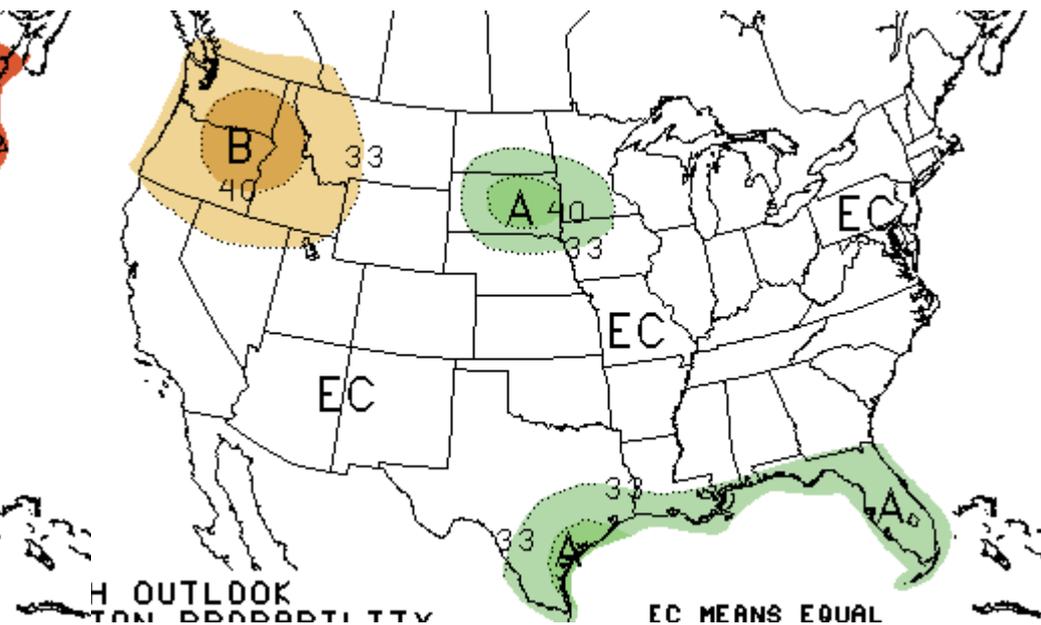
Created June 16

## Temperature



Generally 50% chance of above normal temperatures in the west, and 44% elsewhere

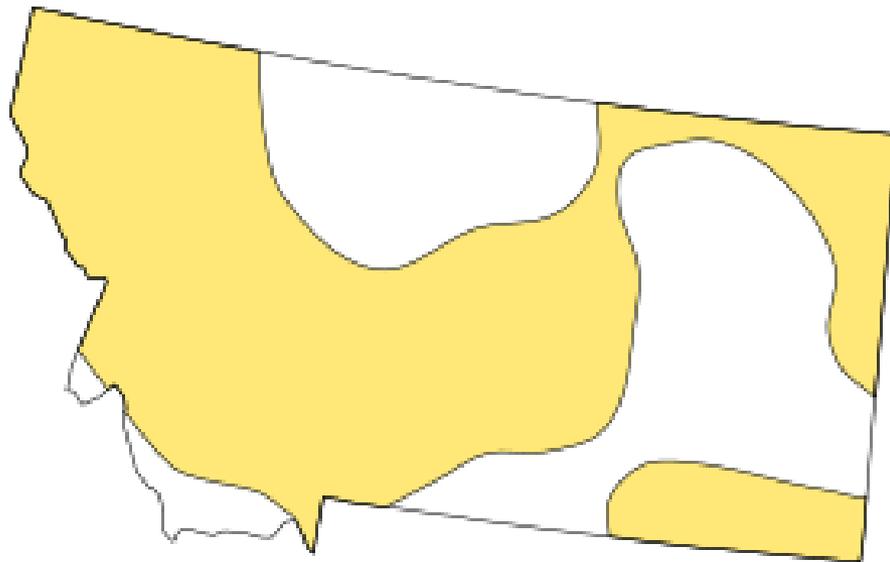
## Precipitation



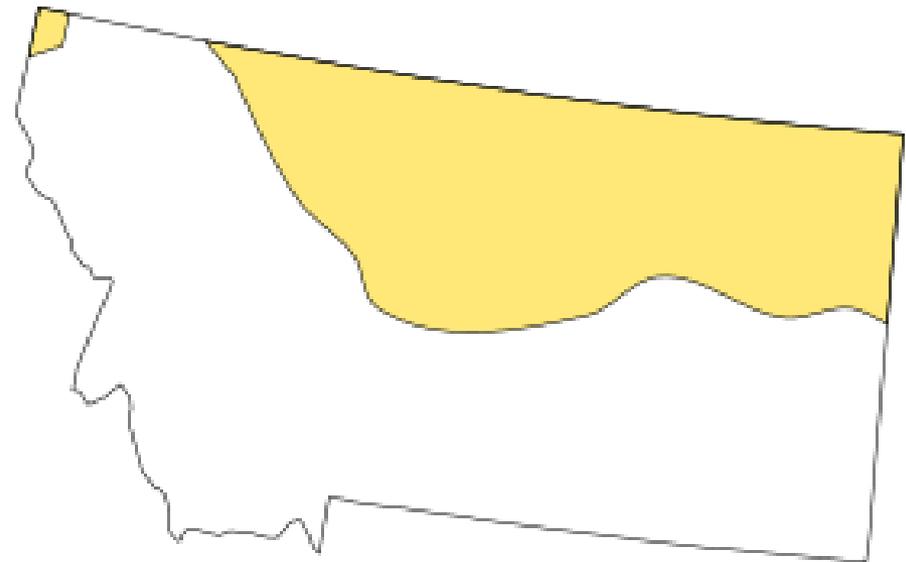
33% chance of above normal precipitation west, otherwise equal chances for above, below, or near average precipitation



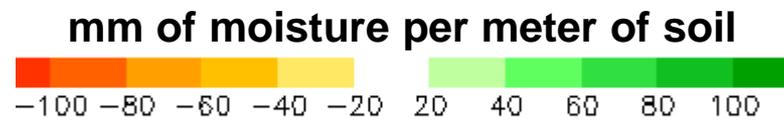
# Soil Moisture Anomaly Forecast



Jul 31, 2016



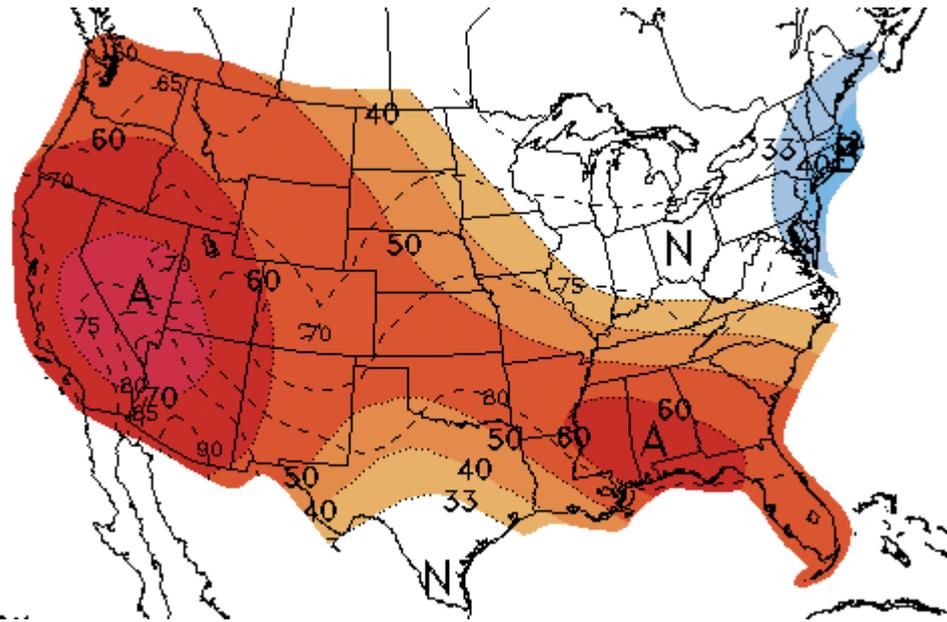
Sep 30, 2016



# 8 – 14 Day Outlook

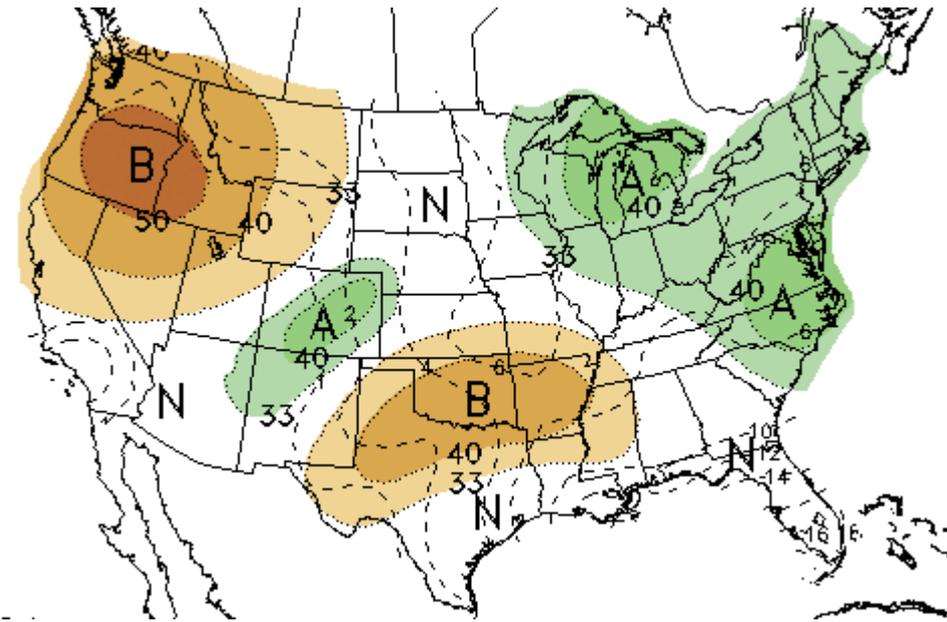
Created June 16

## Temperature



40% to >50% chance of above normal temperatures statewide

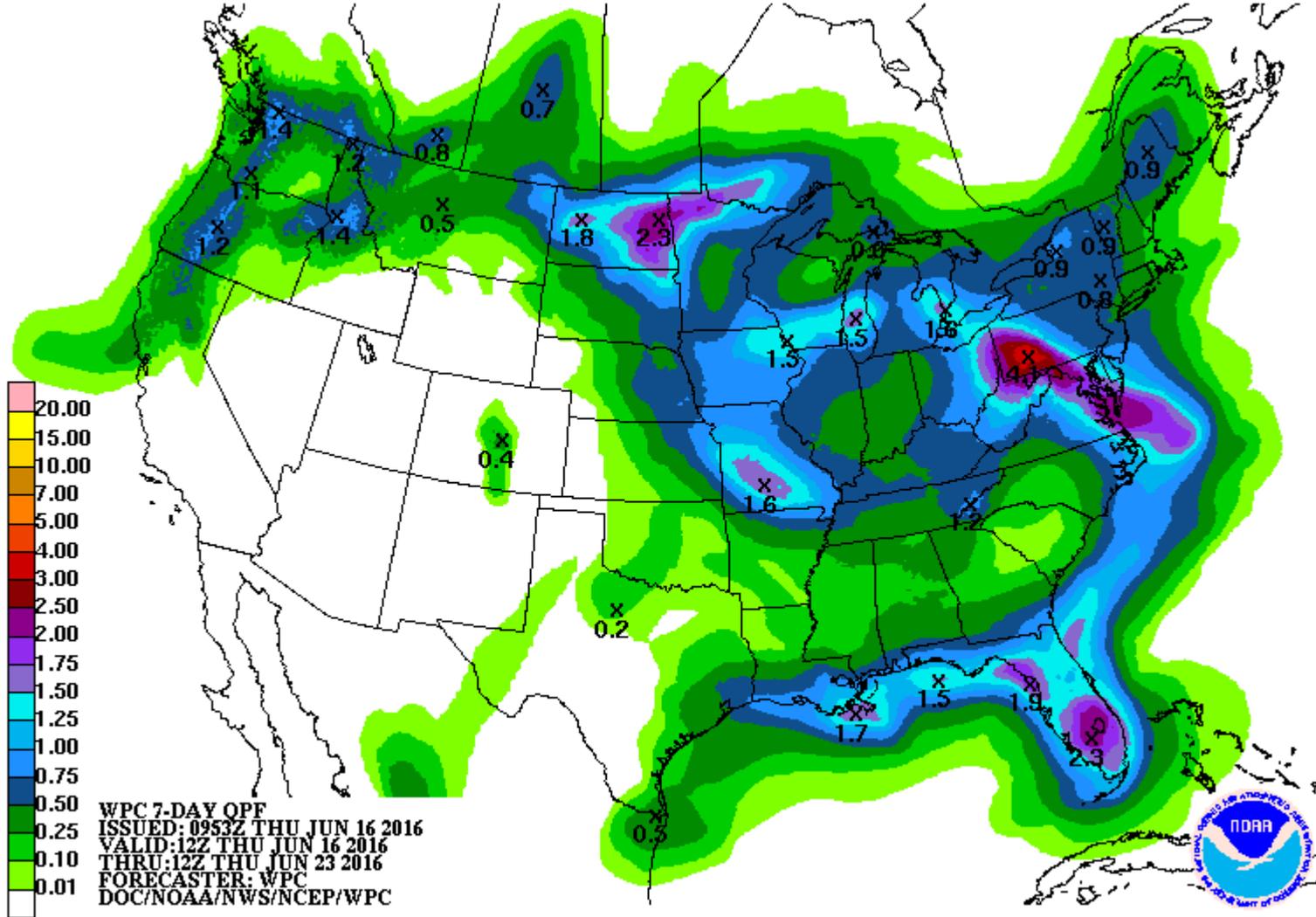
## Precipitation



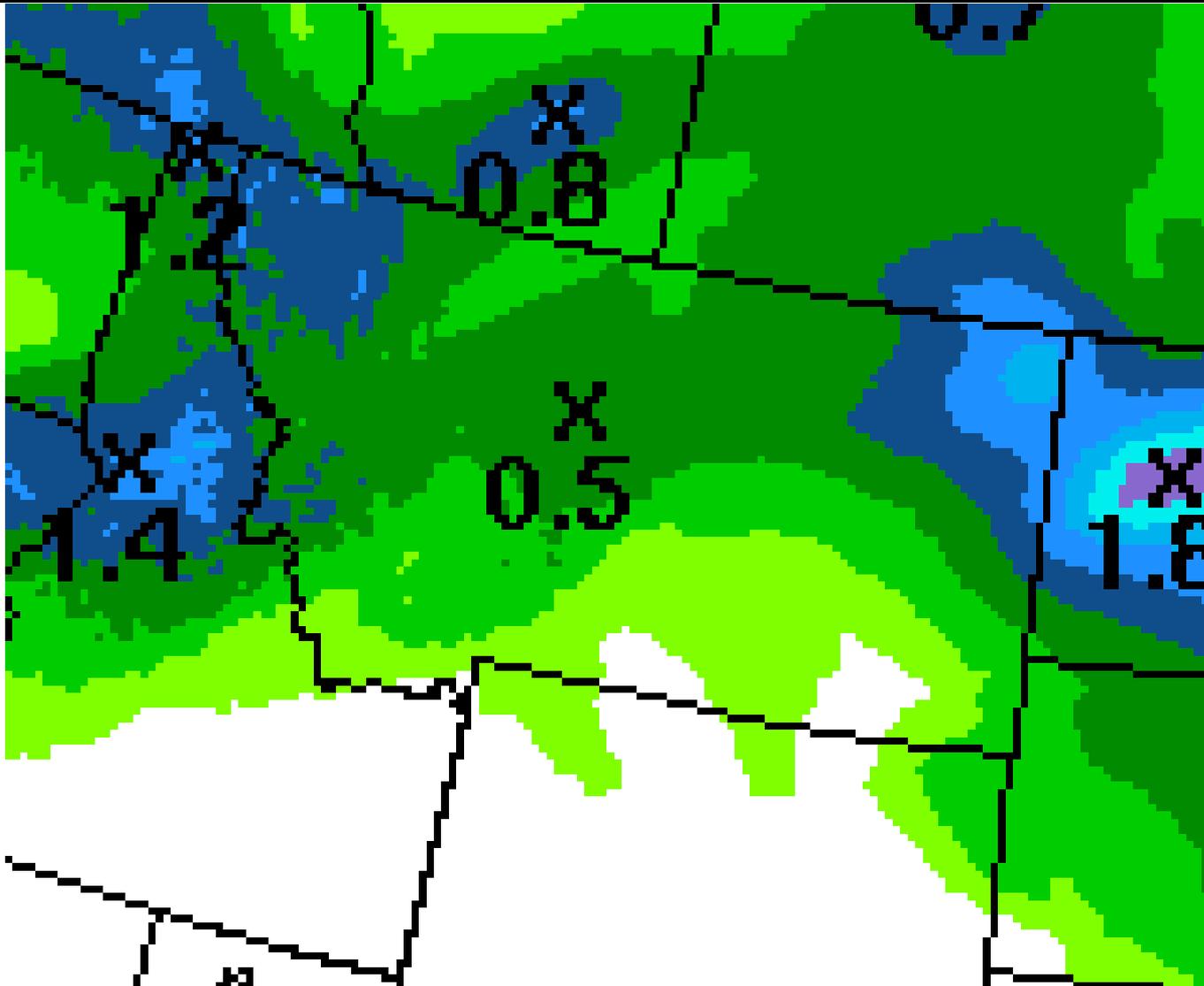
33% to >40% chance of below normal precipitation



# 7-Day WPC Precipitation Forecast



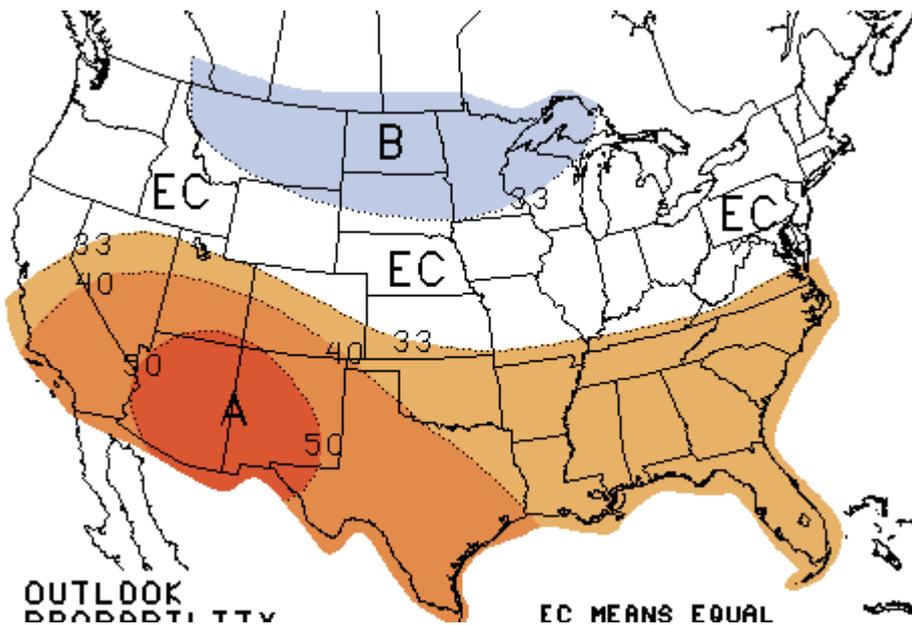
# 7-Day WPC Precipitation Forecast



# December – February Outlook

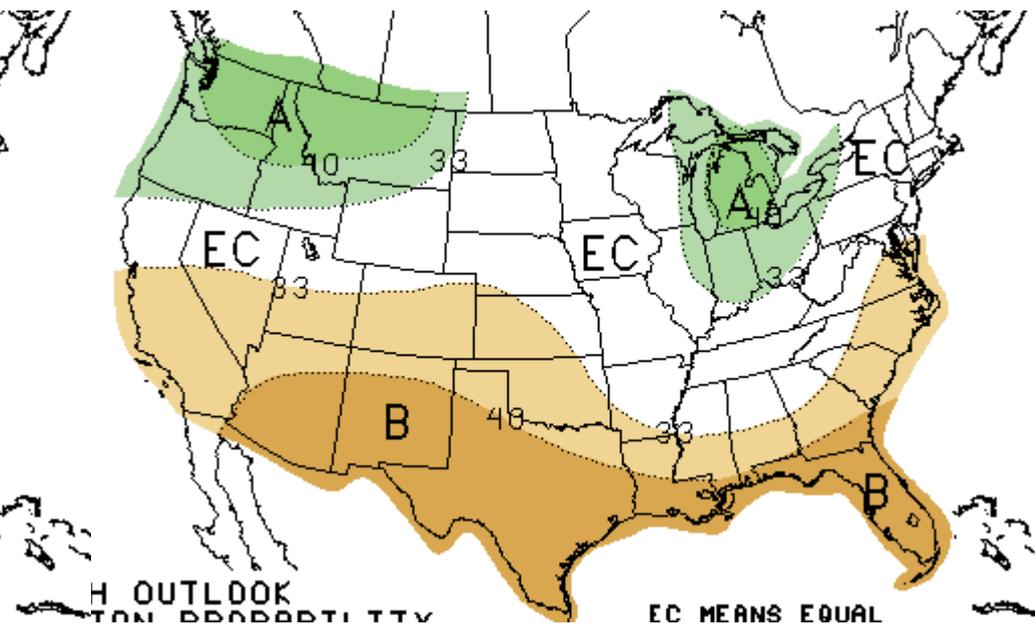
Created June 16

## Temperature



- 33% chance of below normal temperatures statewide

## Precipitation



- 33% to 40% chance of above normal precipitation statewide...particularly NW Montana



# In Summary...

- Moisture conditions have been deteriorating across southern and western Montana prompting a response in National Drought Monitor and Montana Drought and Water Supply Conditions
- After June, seasonal precipitation begins to decrease
- Current long-range forecasts indicate above normal temperatures from summer into mid-autumn
- El Niño has weakened, giving way to ENSO neutral conditions until late summer when La Niña becomes predominant through winter





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

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

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

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

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

# MONTANA DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION

WATER RESOURCES DIVISION - STATE WATER PROJECTS BUREAU

**June 2, 2016**

All Contents in Acre-Feet

RESERVOIR	TOTAL CAPACITY (includes dead storage)*	CONTENTS					% CAPACITY	%AVERAGE	READING DATE	COMMENTS
		Full Pool	AVERAGE	Last Year	Last Month	PRESENT				
		Contents	1960 - 2014	5/30/2015	4/31/2016	5/31/2016				
<b>Clark Fork Basin</b>										
E.F. ROCK CREEK	16,040	9,666	10,813	11,140	<b>15,979</b>	100	165	6/15/2016	elev.=6055.3	
NEVADA CREEK	11,207	10,018	9,924	9,802	<b>8,920</b>	80	89	6/15/2016	elev.=46109.47	
W.F. BITTERROOT	32,362	20,328	33,334	32,362	<b>32,362</b>	100	159	5/30/2016	spilling	
<b>Lower Missouri Basin</b>										
ACKLEY	6,722	3,678	6,572	4,472	<b>6,472</b>	96	176	6/2/2016	elev. =4317.1	
BAIR	7,300	5,289	7,537	5,445	<b>6,519</b>	89	123	6/2/2016	elev.=5322.08	
DEADMAN'S BASIN	75,968	53,666	75,315	66,664	<b>67,010</b>	88	125	5/31/2016	elev.=3916.5 (63,260 AF)	
FRENCHMAN	2,777	2,431	2,777	2,777	<b>2,777</b>	100	114	5/24/2016	spilling	
MARTINSDALE	23,348	12,124	23,168	18,176	<b>18,170</b>	78	150	6/15/2016	elev.=4773.6	
N.FK. SMITH RIVER	11,406	8,783	11,553	8,473	<b>11,418</b>	100	130	6/2/2016	elev.=5488.37	
YELLOWATER	3,842	1,356	3,252	3,268	<b>3,431</b>	89	253	5/29/2016	elev.=3117.5	
<b>Upper Missouri Basin</b>										
MIDDLE CREEK	10,184	6,523	10,142	9,164	<b>10,159</b>	100	156	6/15/2016	elev.=6720.9	
NILAN	10,992	7,138	10,980	9,300	<b>7,848</b>	71	110	5/18/2016	elev.=4437.98	
RUBY RIVER	37,612	36,156	37,642	38,505	<b>37,923</b>	101	105	6/15/2016	spilling	
WILLOW CREEK	18,000	17,271	18,809	18,000	<b>18,111</b>	101	105	5/31/2016	spilling	
<b>Yellowstone Basin</b>										
COONEY	28,230	22,403	28,499	25,985	<b>27,790</b>	98	124	5/20/2016	elev.=4250.45 (27,700 AF)	
COTTONWOOD	1,900	1,518	1,940	1,835	<b>1,980</b>	104	130	5/27/2016	spilling	
TONGUE RIVER	79,071	51,121	83,412	80,301	<b>80,856</b>	102	158	6/15/2016	spilling	

\* Note: Reservoir contents include dead storage at the following:

Ackley	1001 AF	**	** O&M slope storage table does not include dead storage (so dead storage has to be added into the storage from the table)	
Cooney	90 AF	**	Tongue River	711 AF (O&M storage table includes dead storage)
Deadman's	3750 AF	**	W. F. Bitterroot	656 AF (O&M storage table includes dead storage)
Nilan	900 AF	**	Willow Creek	269 AF (O&M storage table includes dead storage)

\* Note: Cooney capacity reflects capacity after 1982 dam rehabilitation; prior capacity was 24,195 A.F.. Average storage shown is for post rehabilitation data.

\* Note: Middle Creek capacity reflects capacity after 1993 dam rehabilitation; prior capacity was 8,027 A.F.. Average storage shown is for post rehabilitation data.

\* Note: Nevada Creek Reservoir Capacity reflects live storage capacity survey conducted in year 2000. Prior live storage capacity documented as 12,723 AF.

\* Note: Tongue River capacity reflects capacity after 1999 dam rehabilitation; prior capacity was 68,040 A.F.. Average storage is post rehabilitation data.

\* Note: Frenchman Reservoir capacity tables updated based on aerial survey; prior capacity was 3752 A.F. Average shown is pre aerial survey

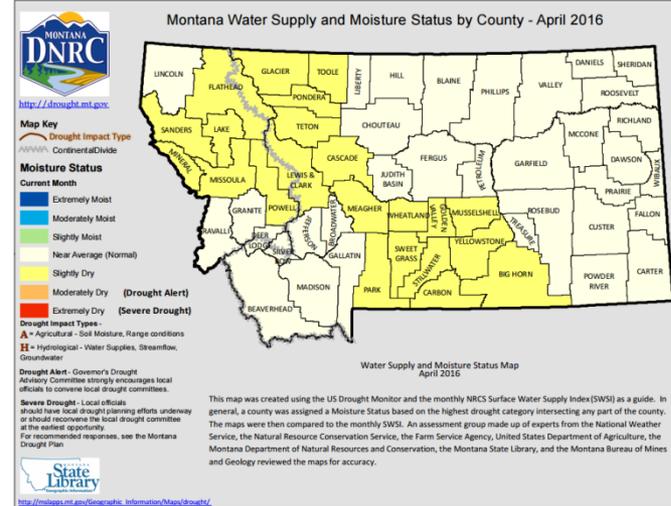
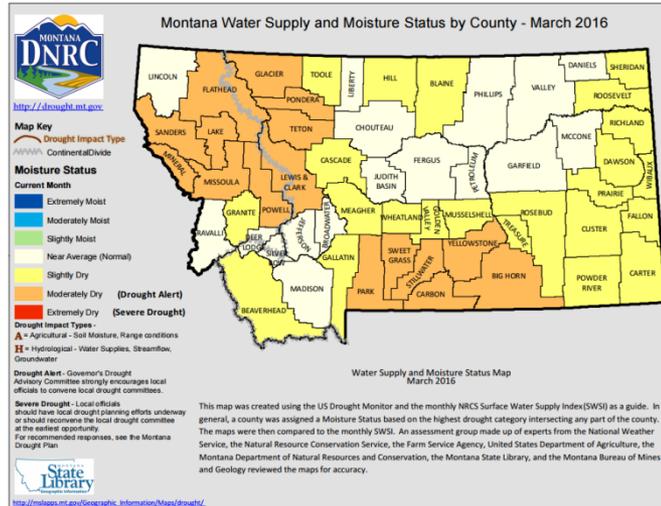
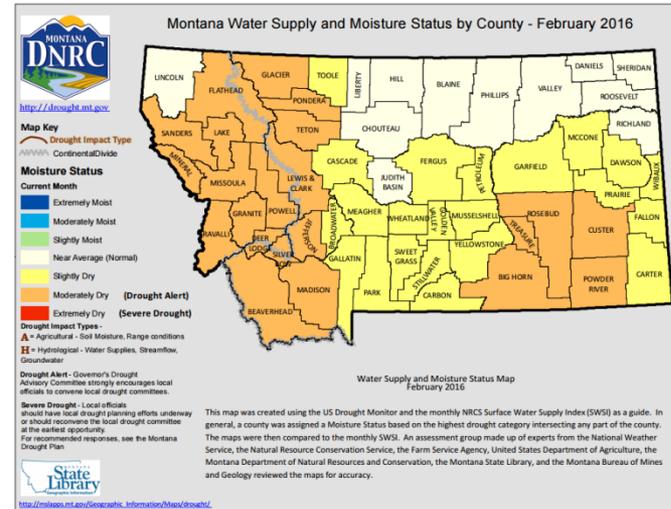
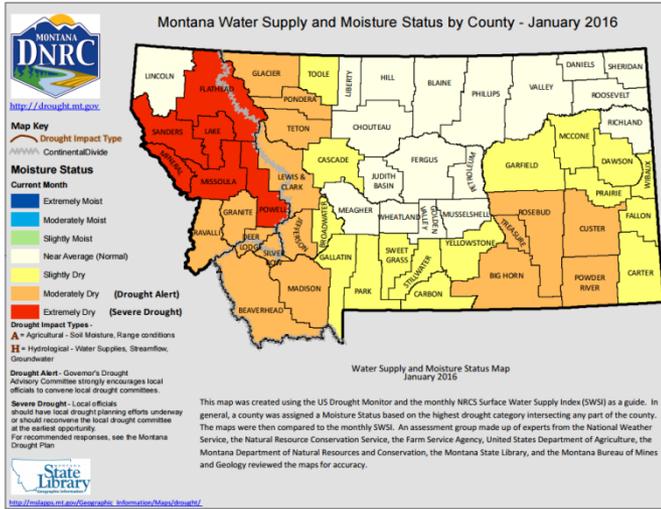


The Montana Department of  
Natural Resources  
& Conservation

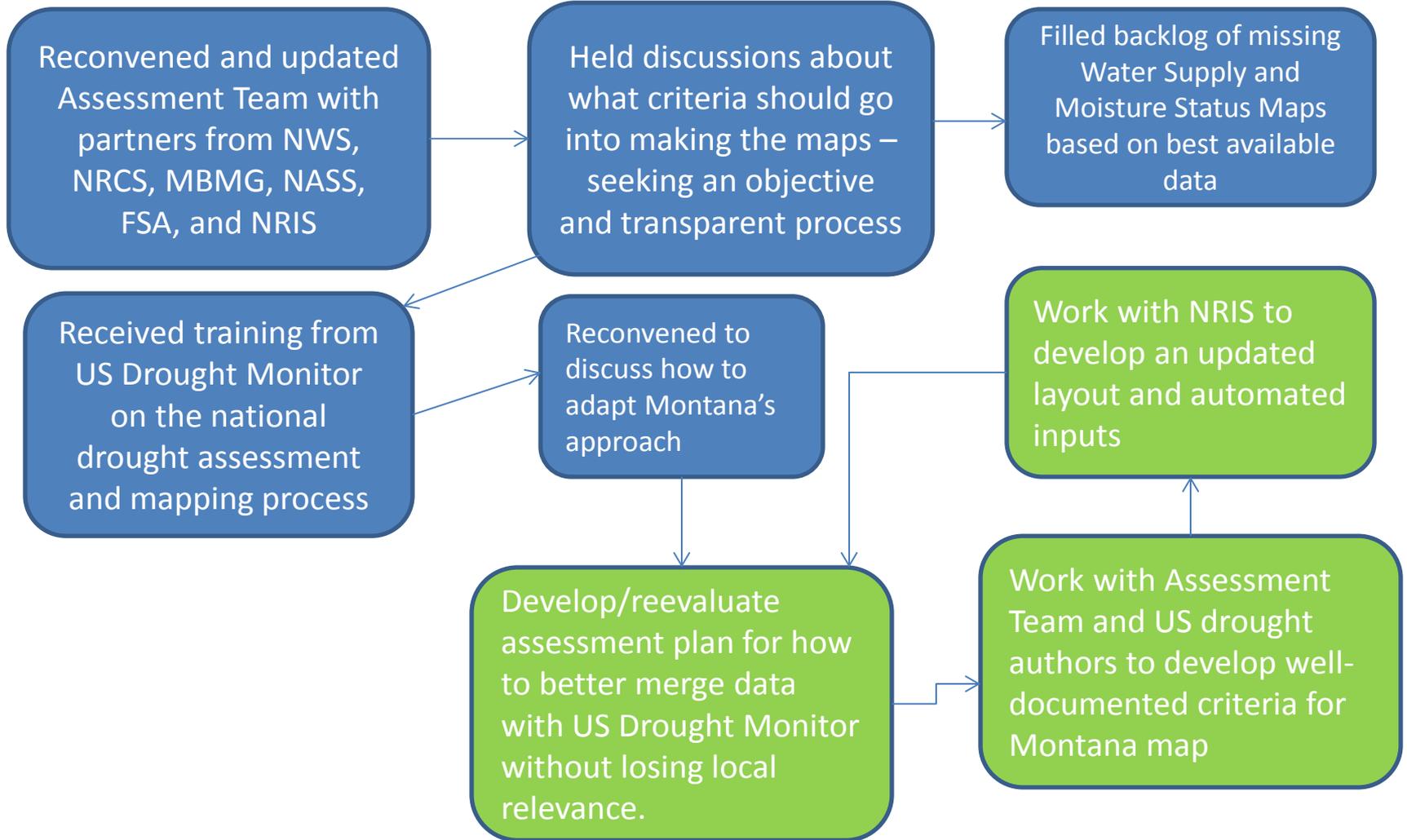
# Montana Water Supply and Moisture Status by County Update

Ada Montague, Water Planner  
DNRC Water Management Bureau

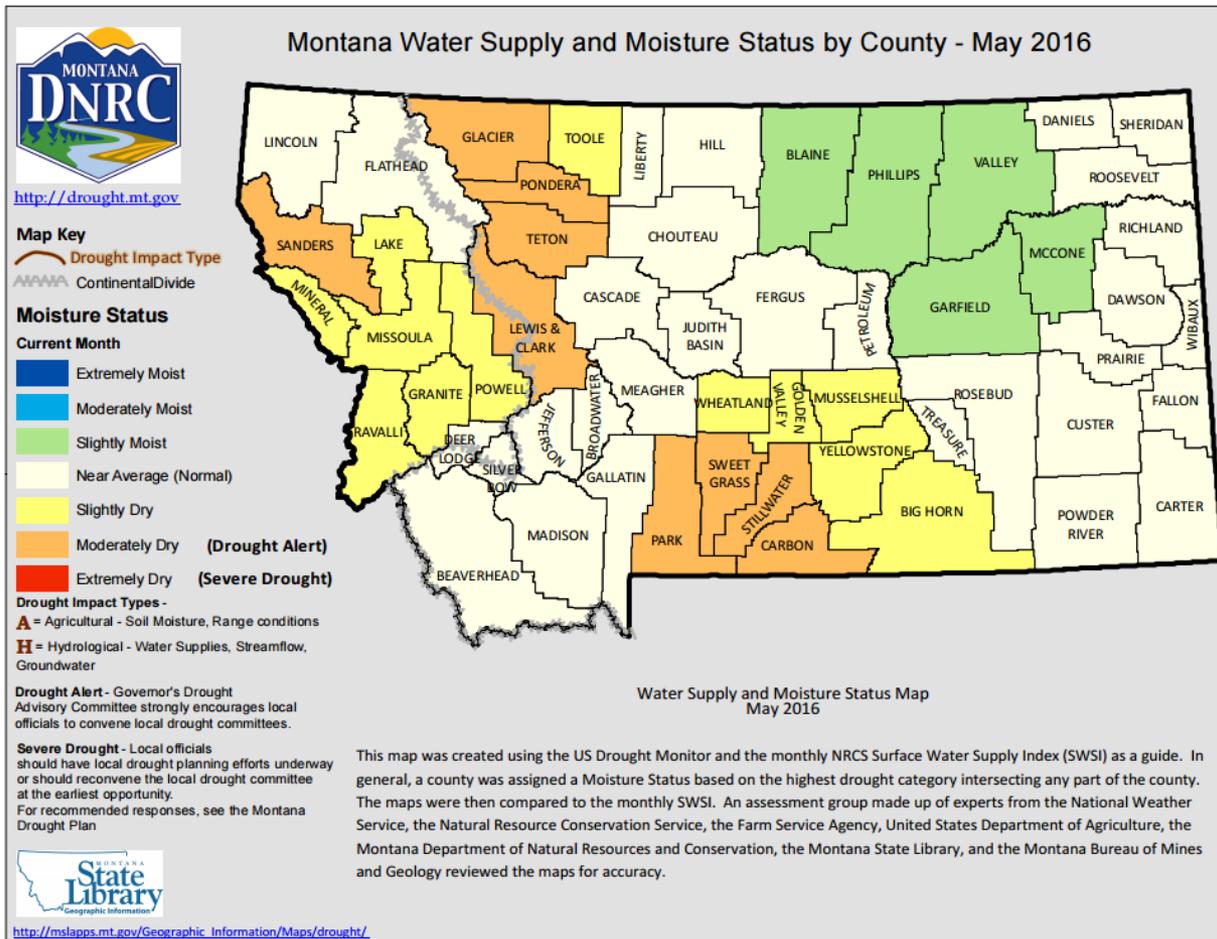
# January – April 2016



# Process to Date



# May 2016





# Montana Drought Response Plan and Updates

Ada Montague, Water Planner  
DNRC Water Management Bureau

# Montana's Drought Response Planning History



1988 Yellowstone National Park Fire  
Photo courtesy of YNP Photo Collection  
<https://www.nps.gov/features/yell/slidefile/fire/wildfire88/misc/Images/12325.jpg>

1970-1980: Dry years prompt Montana Legislature to direct DNRC to employ the State Water Plan process to study how to cope with drought.

1991: Legislature creates the Governor's Drought Advisory Committee

1995: First Montana Drought Response Plan written and adopted by the governor.

2007: Montana Drought Plan updated by Drought Advisory Committee, but not finalized for approval by the governor.

2015: Montana Drought Plan update revisited by Drought Advisory Committee, but not finalized for approval by the governor.

# Recent Attention

- Glacier National Park
- Changes in snowpack
- Increased river temperatures
- California drought

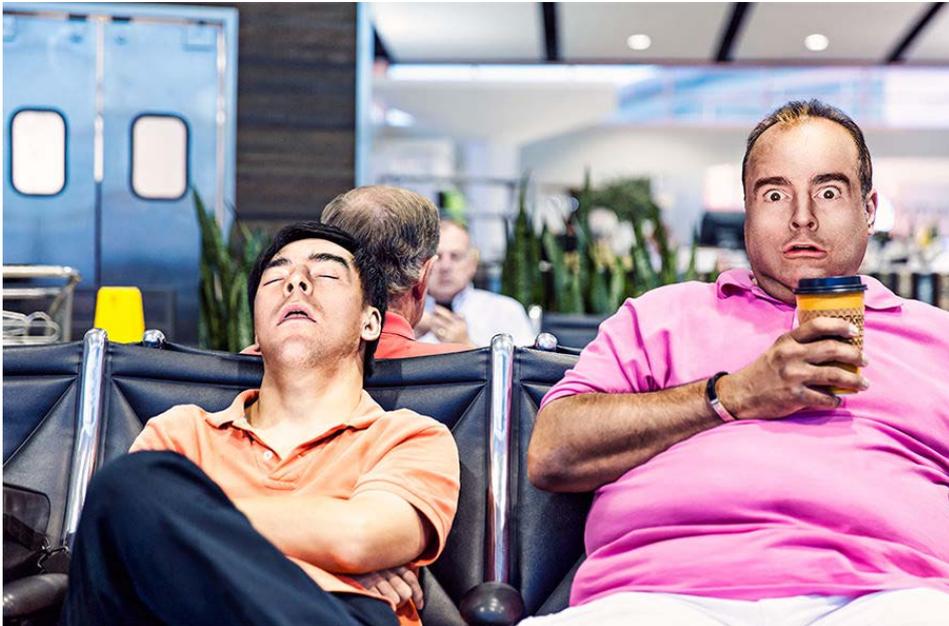


Grinnell Glacier 1920 and 2010

Photo Courtesy of NPS Public Domain Photo Collection

<https://www.nps.gov/media/photo/view.htm?id=FBD434CA-C4ED-B49F-80D0061B4BBCF6D8>

# Components of Montana Drought Response Plan



- Summary
- Background
- Structure and Function
- Drought Monitoring
- Drought Assessment
- Drought Response
- State, Federal and Local Response Actions

# Structure and Function

- Montana Drought and Water Supply Advisory Committee (DWSAC)
  - Procedure
  - Reporting
- Local Drought Advisory Committees
  - Structure
  - Function
- Data Support
- Funding



# DWSAC Structure and Function

## Procedure

MCA § 2-15-3308: Drought advisory committee –

- ✓ Chaired by a representative of the governor
- ✓ Has representatives from DNRC, Dept. Ag, Dept. Livestock, Dept. Commerce, FWP, Military Affairs, and DEQ.
- ✓ DNRC responsible for staff support.
- ✓ DNRC to provide a yearly report describing the potential for drought in the coming year to the governor by mid-April.
- ✓ Required to meet in February and October, with additional meetings as necessary
- ? Additional non-voting members who represent federal and local government agencies and public and private interests appointed by the governor.
- ? A water supply meeting of the agencies that monitor conditions or technical subcommittee may be called in lieu of full committee meeting



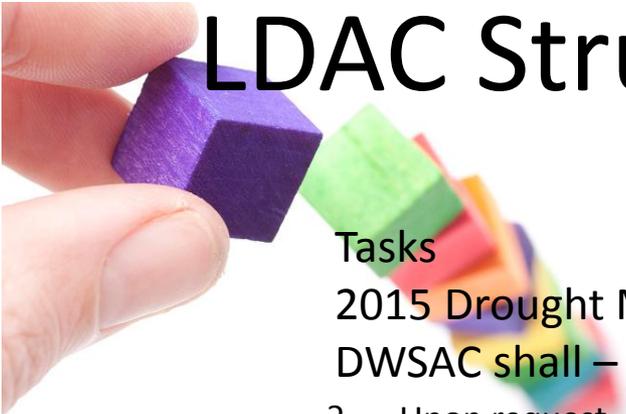
# DWSAC Structure and Function

## Reporting

MCA § 2-15-3308: Drought advisory shall –



- ? With the approval of the governor, develop and implement a state drought plan.
- ✓ Review and report drought monitoring information to the public.
- ✓ Coordinate timely drought impact assessments.
- ✓ Identify areas of the state with a high probability of drought and target reporting and assistance efforts to those areas.
- ? Upon request, assist in organizing local drought advisory committees for the areas identified as drought prone.
- ? Request state agency staff to provide technical assistance to local drought advisory committees.
- ✓ Promote ideas and activities for groups and individuals to consider that may reduce drought vulnerability.



# LDAC Structure and Function

## Tasks

### 2015 Drought Management Plan:

#### DWSAC shall –

- ? Upon request, provide assistance to local governments for drought mitigation.
- ? After May 15, DWSAC will identify areas of the state for which the creation of LDAC's is advisable.
- ? An LDAC should include participants from a wide variety of backgrounds and professions.
- ? Topics for LDACs to consider include domestic and municipal water supply, fire suppression, agricultural water use, limitations on sewage discharge, and impacts to fish and wildlife, recreation, tourism, and energy use.
- ? LDACs serve to exchange of information between the DWSAC and counties.
- ? They are encouraged to submit regular reports.
- ? LDACs can request assistance from state or federal entities.
- ? A local drought operations manual is referenced in 2015 Montana Drought Response plan.

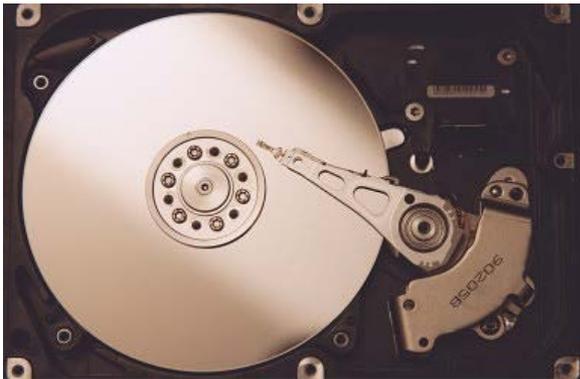
# Structure and Function: Data Support

- Federal and State Agency Partners



collect assessment data and report to the DWSAC.

- ✓ National Weather Service – soil moisture, precipitation, soil moisture, forecasts
- ✓ NRCS – mountain snowpack, precipitation, soil moisture, forecasts
- ✓ USGS – streamflow
- ✓ Reclamation – Reservoir levels (federal)
- ✓ DNRC – Reservoir levels (state), Fire conditions, County drought map
- ✓ NASS – weather, soil moisture, crop information
- ? MSU Extension – soil moisture, crop condition



# Structure and Function: Funding

- DNRC → ? Staff is responsible for procuring additional funding for state drought management as needed or as it becomes available.
  - ? Staff applies for grant funding from federal sources, such as the Reclamation States Drought Emergency Relief Act of 1991, administered by the U.S. Bureau of Reclamation.



# Drought Monitoring: Primary Indicators

SWSI

Precipitation Received

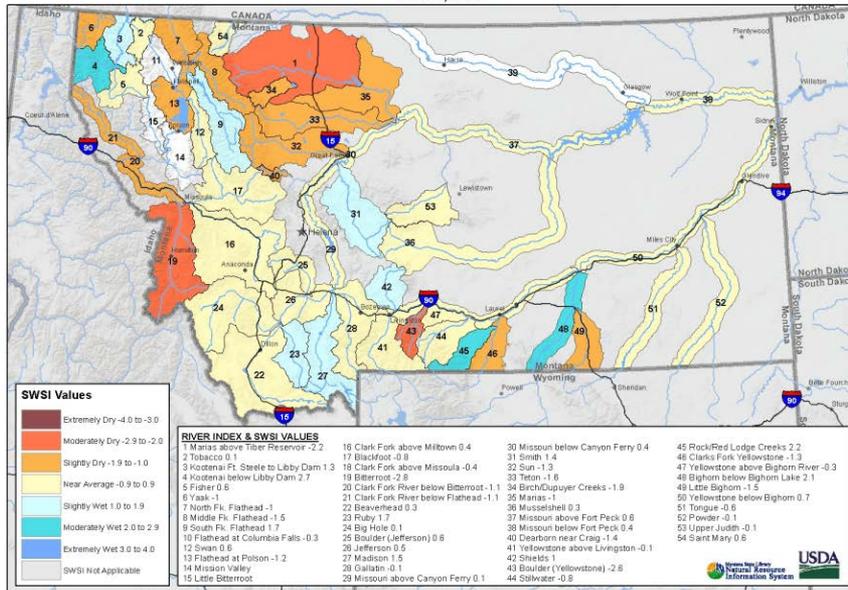
PHDI

projects surface water supply, including reservoir inflows and streamflow within individual basins.

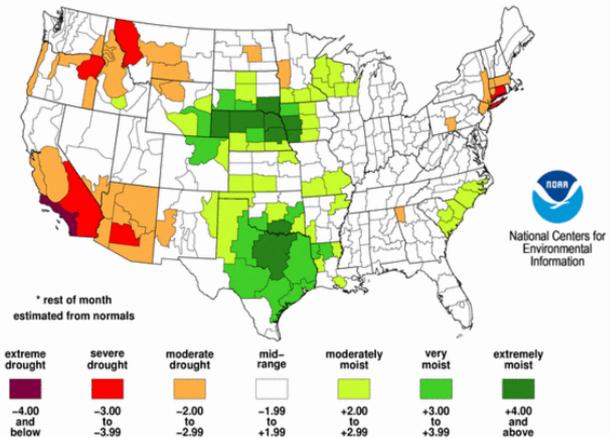
used as a surrogate for soil moisture and is expressed in percentage of average and in inches received. Assessed in terms of Water Year (Oct. 1 – Sept. 30), Crop Year (April 1 to date), Calendar Year, and by month.

measure of average soil moisture content

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



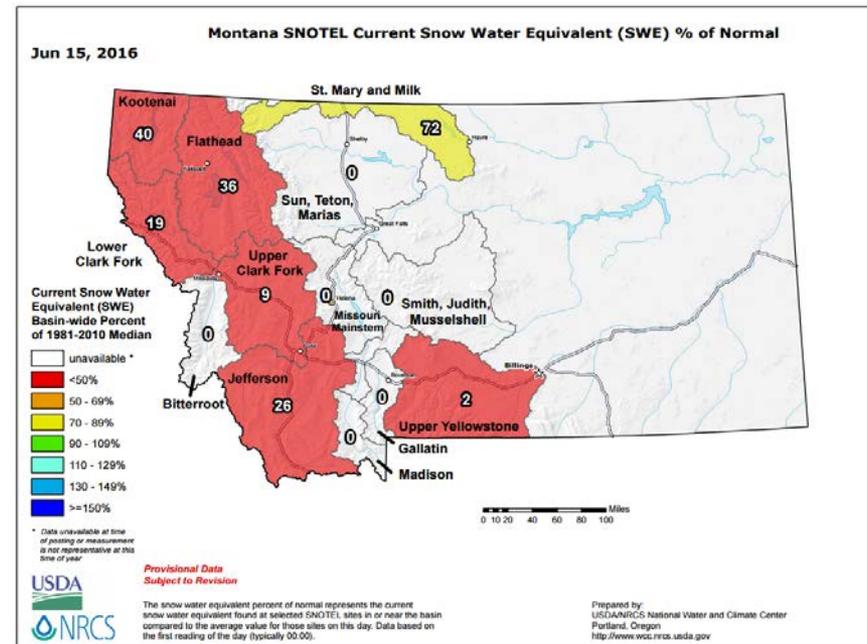
Palmer Hydrological Drought Index  
Long-Term (Hydrological) Conditions  
June 2016: through June 4, 2016\*



Note: Data used to generate this map are PROVISIONAL and SUBJECT TO CHANGE

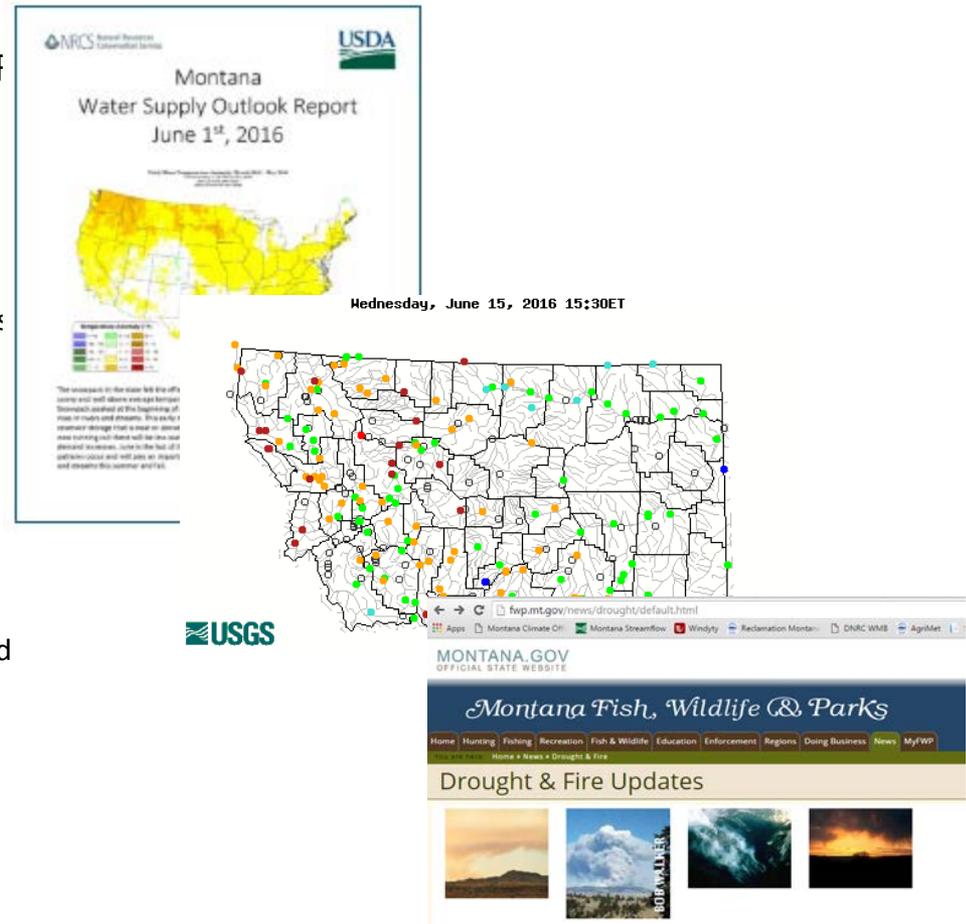
# Drought Monitoring: Other Indicators

- SWE – snow water equivalent of mountain snow pack
- Current and projected reservoir storage levels
- Current streamflows
- Groundwater levels
- Current and projected soil moisture levels
- Short- and long-term weather and climate forecasts
- Fuel moisture levels of forests
- Rate and nature of change in any of the foregoing factors
- Reports of livestock producers hauling water
- Field observations and reports



# Drought Reporting

- Partner agency reports – NRCS, USGS, BOI, NWS, USACE, FWP
- Governor’s Report on the Potential for Drought (DNRC)
  - Snowpack and year-to-date precipitation
  - Monthly average streamflows
  - Status of stored water – federal and state projects
  - Soil moisture conditions
  - Palmer Drought Severity Index
  - Surface Water Supply Index
  - Temperature
- News Media
  - Made aware of all DWSAC meetings
- Press
  - Press releases with any pertinent drought or flood information as needed
- Public Service Announcements
  - Inform public of worsening conditions, water shortages, conservation efforts, closures and restrictions.
- Television and Radio
  - Staff will mail agendas to local television studios prior to each DWSAC meeting.



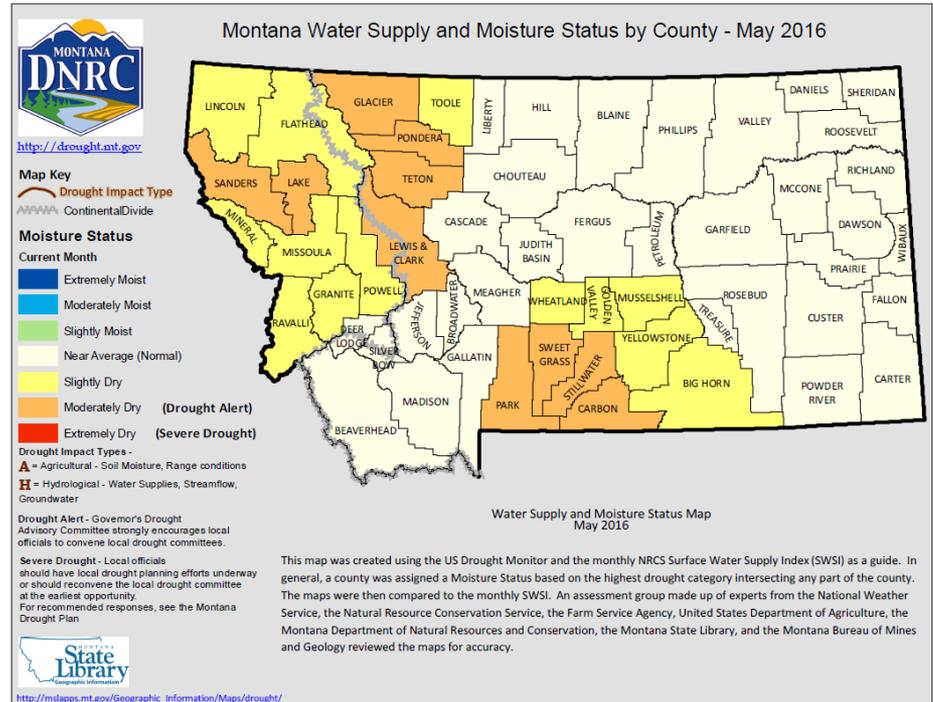
# Drought Assessment

## Assessment of Conditions:

### 1. Drought Assessment by County

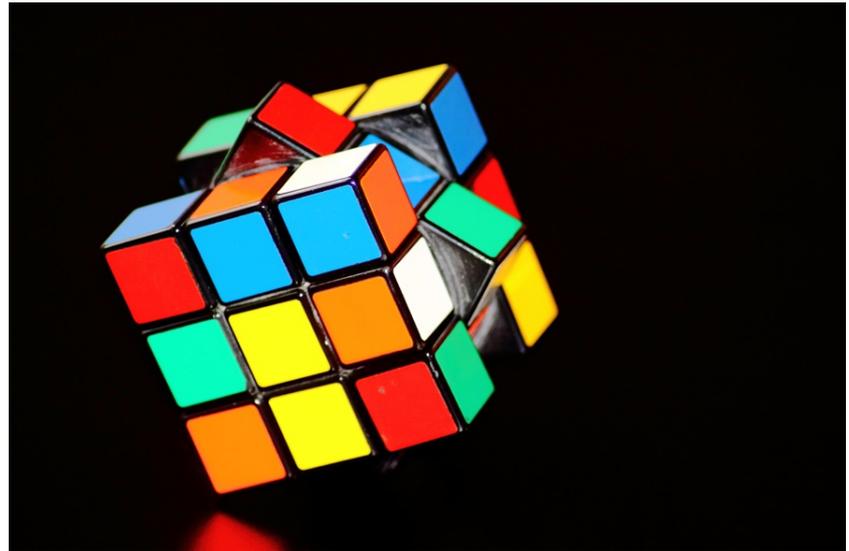
### 2. Assessment During Course of Recovery:

- Reconcile precipitation shortfalls with precipitation averages.
- Look at temperature, wind, soil-type, topography, and duration of drought.
- Offers a snapshot of the “water balance” and can provide an idea of the amount of precipitation needed to ameliorate or end a drought.



# Drought Assessment by Subject Area

- Dryland Farming
- Livestock Operations
- Irrigation Water Supplies
- Municipal and Domestic Water Supplies
- Fish and Wildlife
- Wildfire
- Public Lands
- Energy Production
- Tourism
- Recreation
- Secondary Commerce



# Drought Response: Triggering Mechanisms

- Drought Indices:
  - SWSI – by May 15 is at -3.5 or less
  - PDHI – by May 15 is at -4.0 or less
- Other Factors:
  - Precipitation since prior month's end
  - Snow water equivalent of remaining snow pack
  - Current and projected reservoir storage levels
  - Current streamflows
  - Current soil moisture levels
  - Short-range weather forecasts
  - Rate and nature of change
  - Agency personnel field observations
  - Reports from the public



# Drought Response

- Emergency Meetings of the DWSAC
- County response through LDACs
- Governor can set an alert status or declare a “Severe Drought” when triggered



# State, Federal and Local Response Under Severe Drought

## State:

Governor's office  
DNRC  
FWP  
DEQ  
Military Affairs  
Montana State  
Library/NRIS  
MBMG  
MSU Cooperative  
Extension Service



## Federal:

Bureau of Reclamation (BOR)  
US Geological Society (USGS)  
Bureau of Land Management  
(BLM)  
National Weather Service  
(NWS)  
Natural Resources  
Conservation Service (NRCS)  
Farm Service Agency (FSA)  
Federal Crop Insurance  
Corporation  
US Army Corps of Engineers  
(USACE)  
Federal Emergency  
Management Agency (FEMA)  
Small Business  
Administration (SBA)

## Local:

MSU Extension Agents  
County Disaster and  
Emergency Services (DES)  
Montana Association of  
Counties (MACO)  
County Food and Agricultural  
Committee  
Montana Association of  
Conservation Districts  
LDACs

## Annexes:

A more in-depth overview of what each state agency is responsible for in times of drought.

# Needs Going Forward

- A plan approved by the governor
- An established system for local response

## How do we get there?

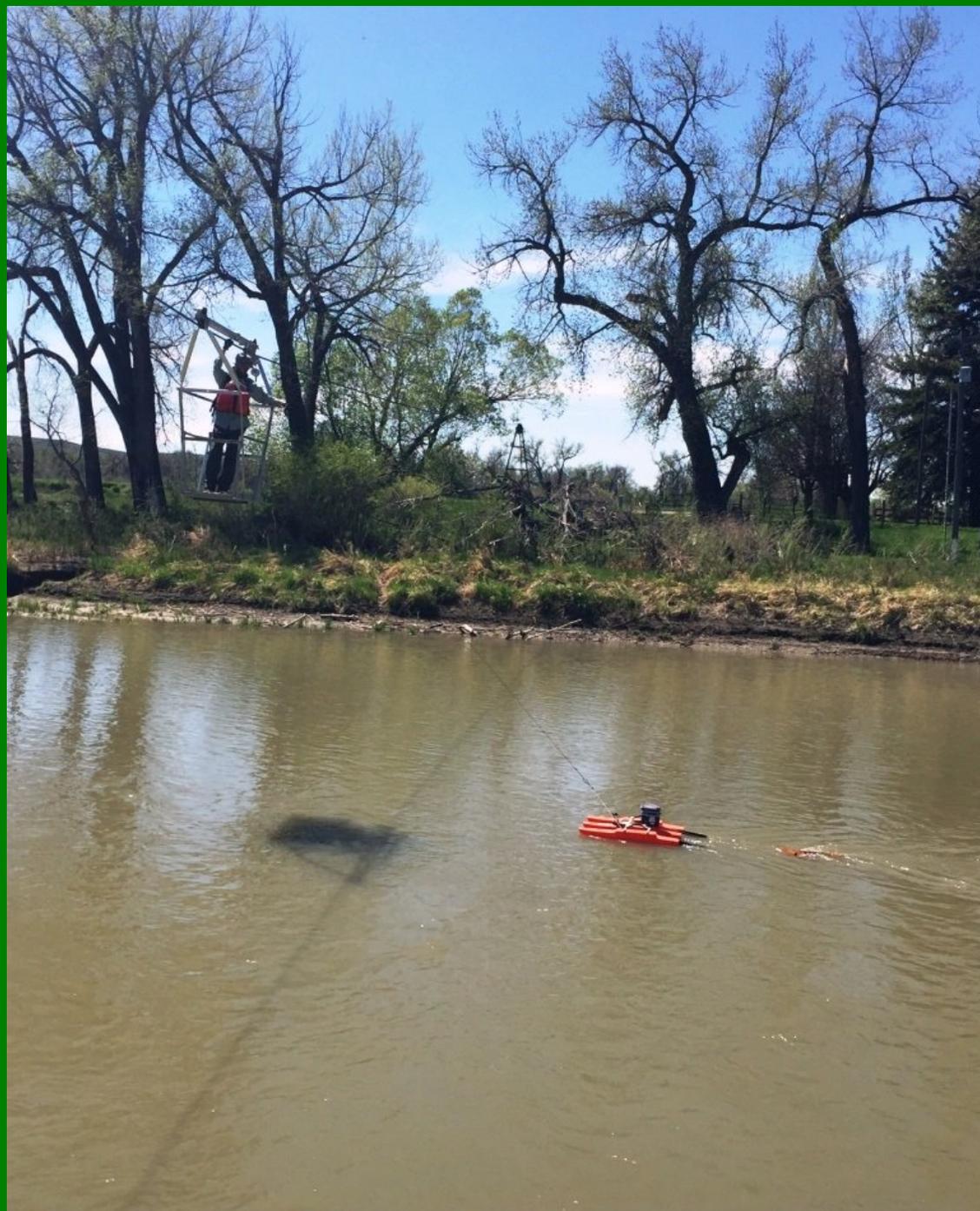


# Options

- DWSAC reviews and approves existing plan to send to governor for approval.
- DWSAC undertakes an update to existing draft Drought Management Plan.
- DWSAC seeks staff input on updated and/or new drought management planning options.



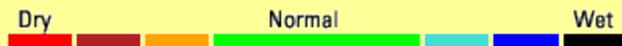
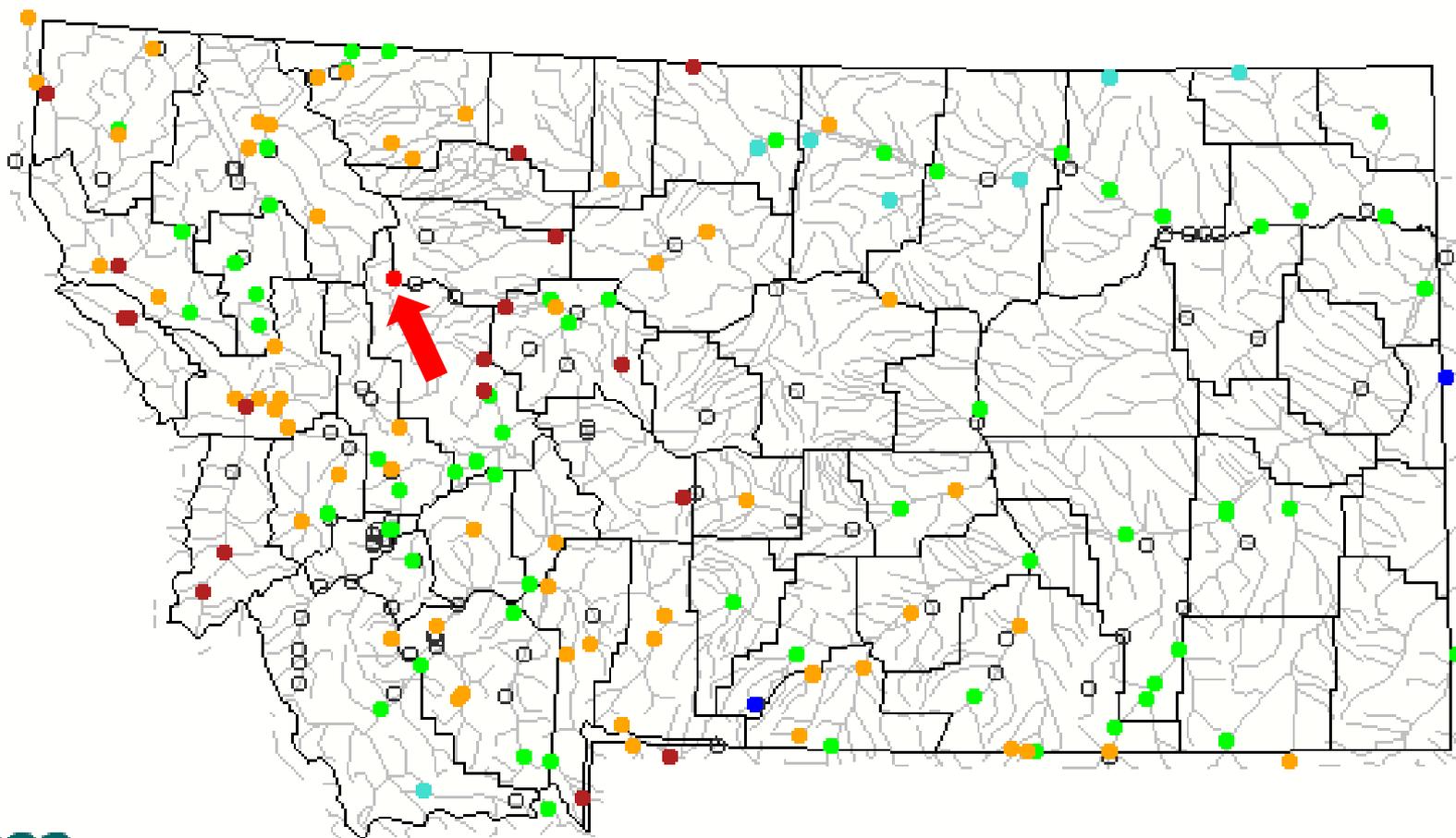
# USGS Streamflows, June 2016



Clarks Fork Yellowstone River at  
Edgar, May 4, 2016.

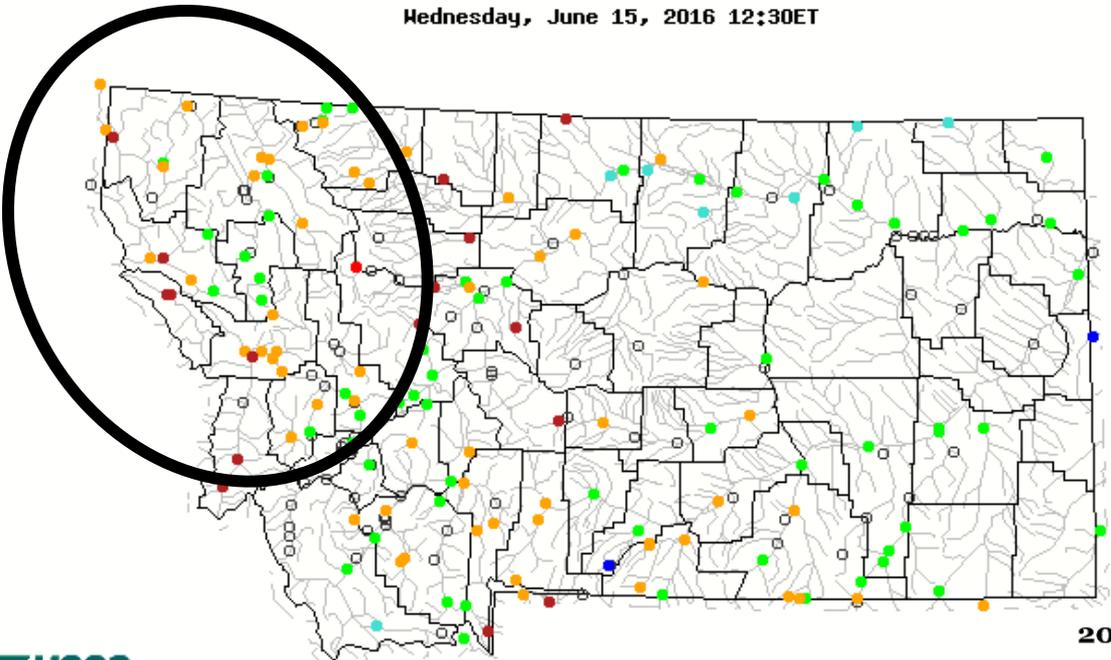
# DAILY STREAMFLOW CONDITIONS

Wednesday, June 15, 2016 12:30ET

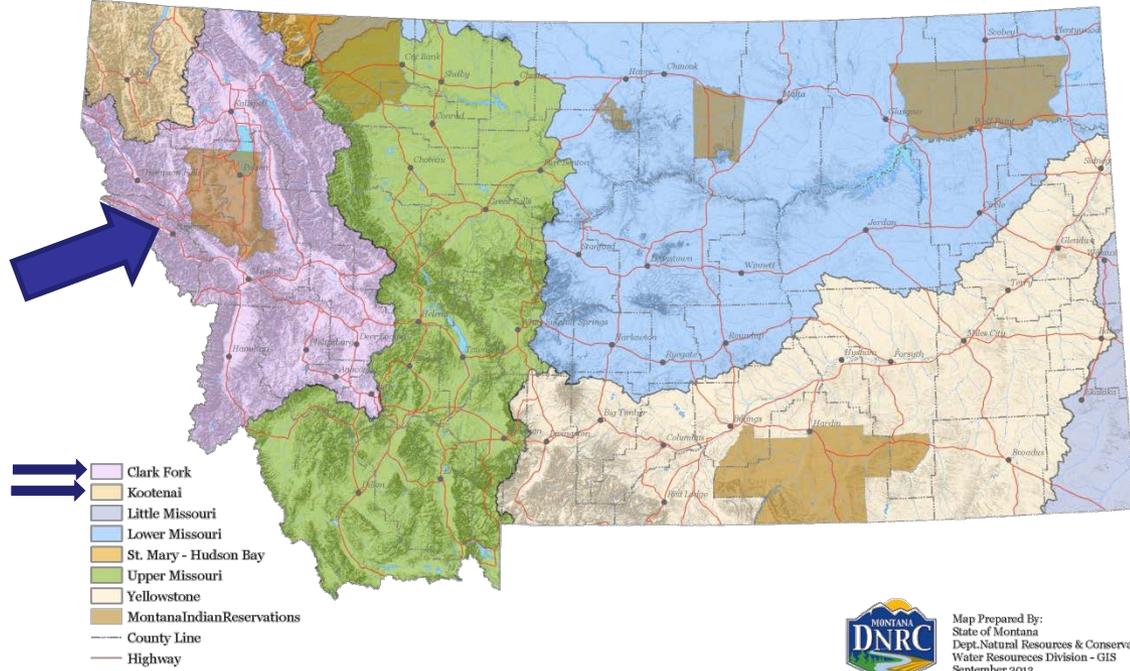


# New Minimum Discharge for June 14

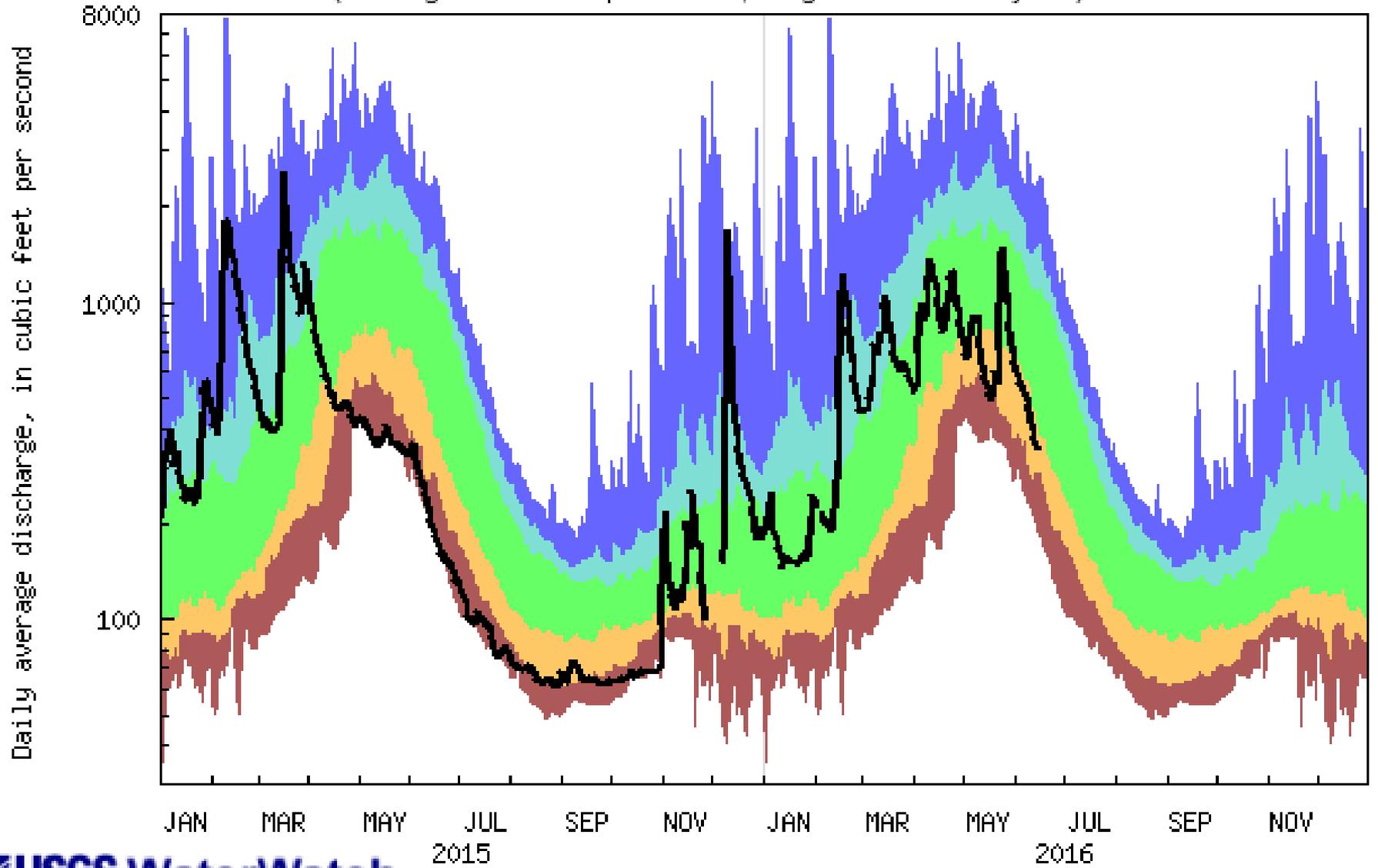
06078500 – North Fork Sun River near Augusta



### 2015 Montana Water Supply Initiative Major Water Planning Basins

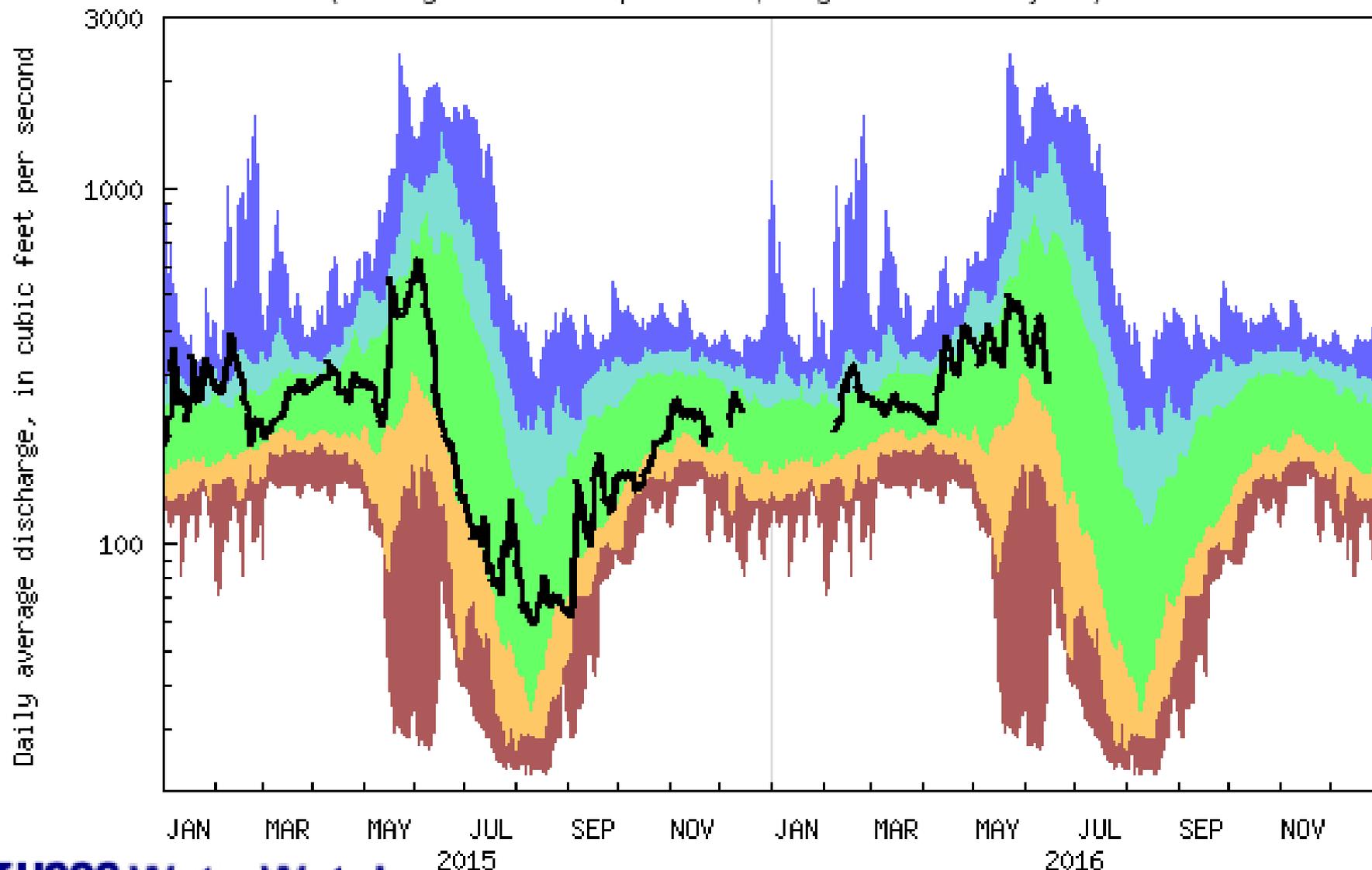


USGS 12302055 Fisher River near Libby MT  
 (Drainage Area: 842 square miles, Length of Record: 48 years)



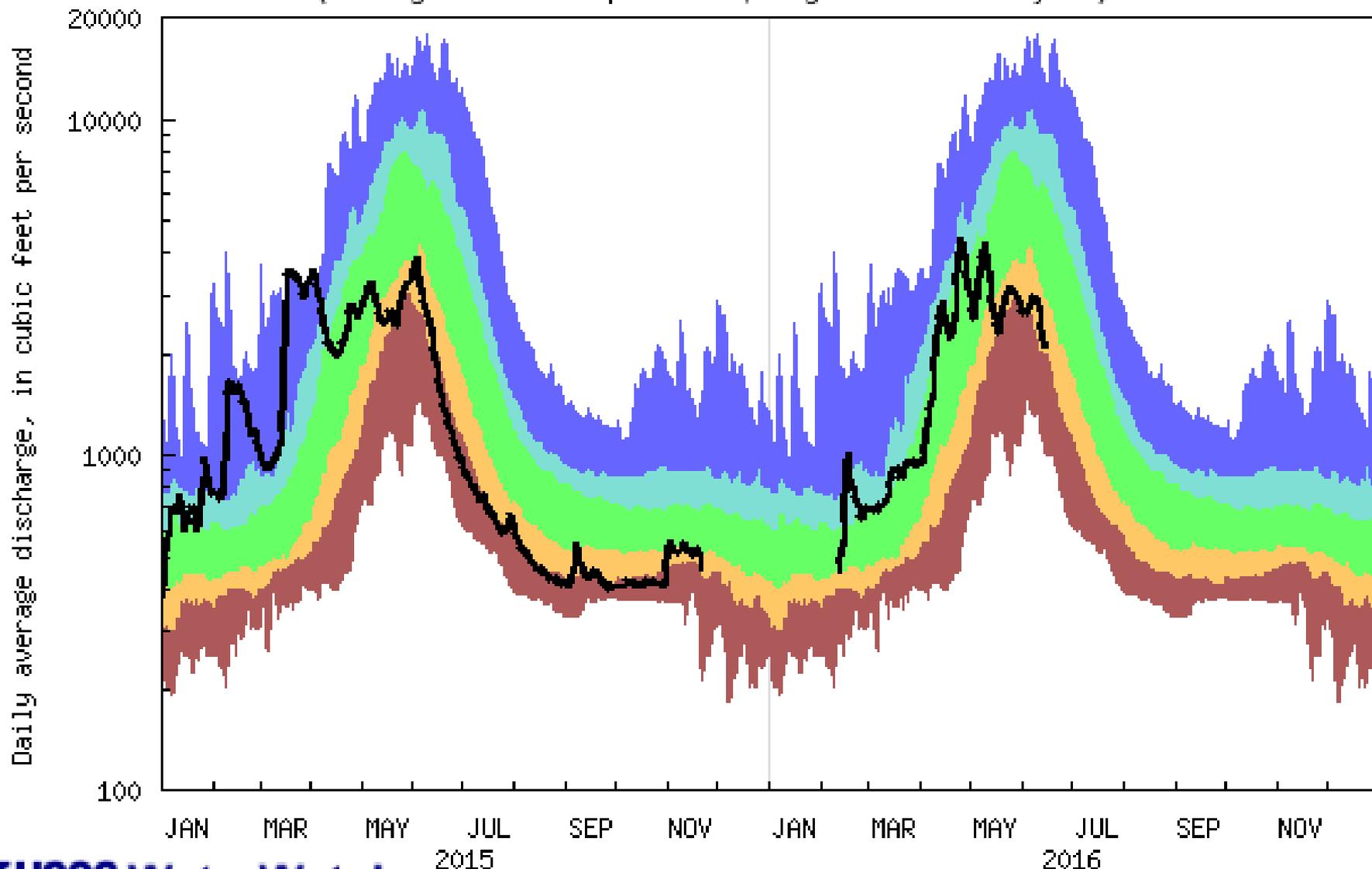
Explanation - Percentile classes				
lowest-10th percentile	10-24	25-75	76-90	90th percentile-highest
Much below normal	Below normal	Normal	Above normal	Much above normal

USGS 12324200 Clark Fork at Deer Lodge MT  
 (Drainage Area: 1001 square miles, Length of Record: 37 years)



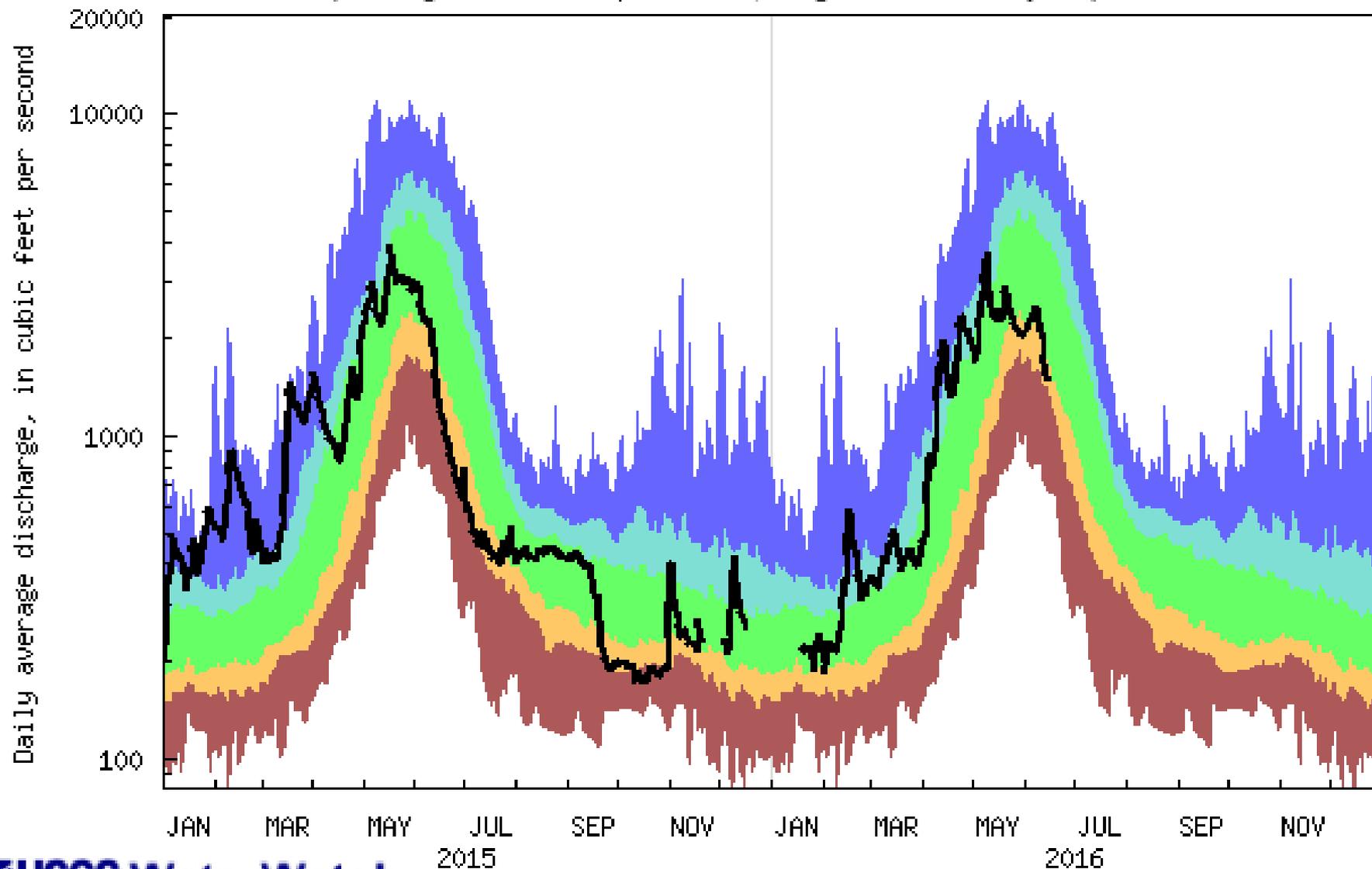
Explanation - Percentile classes					
lowest-10th percentile	10-24	25-75	76-90	90th percentile-highest	Flow
Much below normal	Below normal	Normal	Above normal	Much above normal	

USGS 12340000 Blackfoot River near Bonner MT  
 (Drainage Area: 2287 square miles, Length of Record: 117 years)

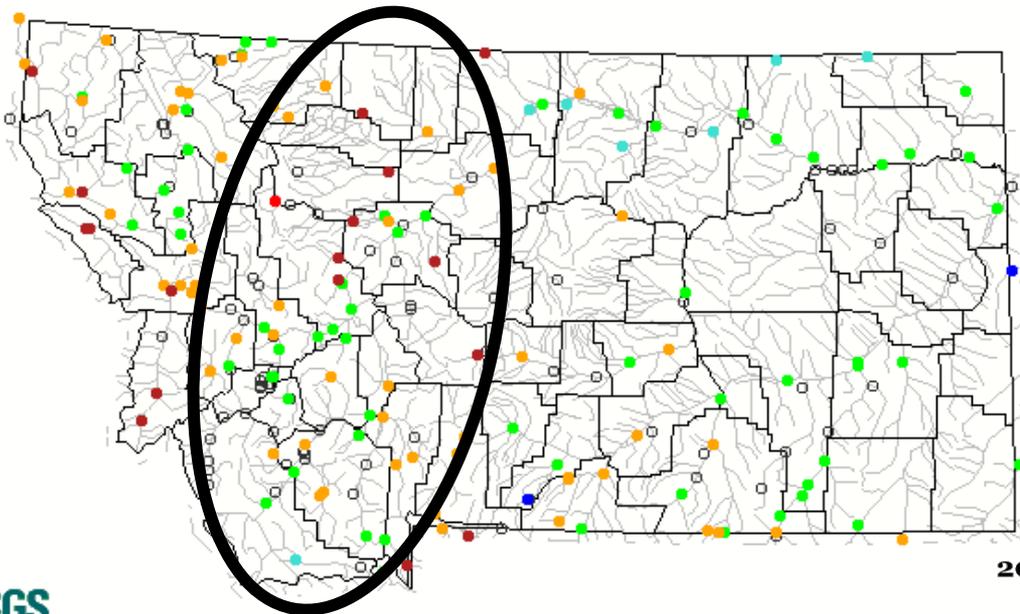


Explanation - Percentile classes					
lowest-10th percentile	10-24	25-75	76-90	90th percentile-highest	Flow
Much below normal	Below normal	Normal	Above normal	Much above normal	

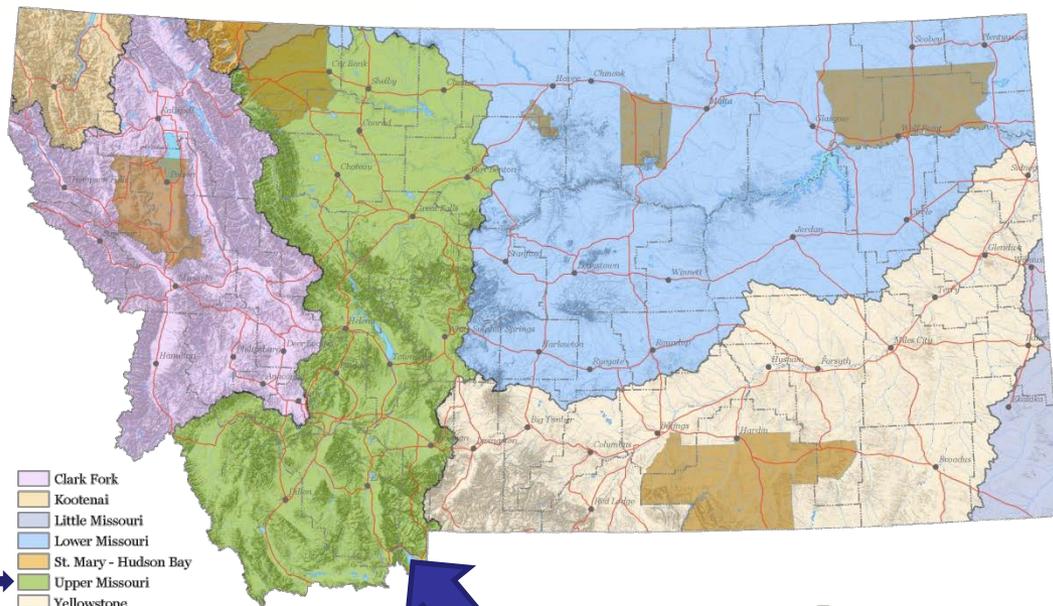
USGS 12344000 Bitterroot River near Darby MT  
 (Drainage Area: 1050 square miles, Length of Record: 78 years)



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				



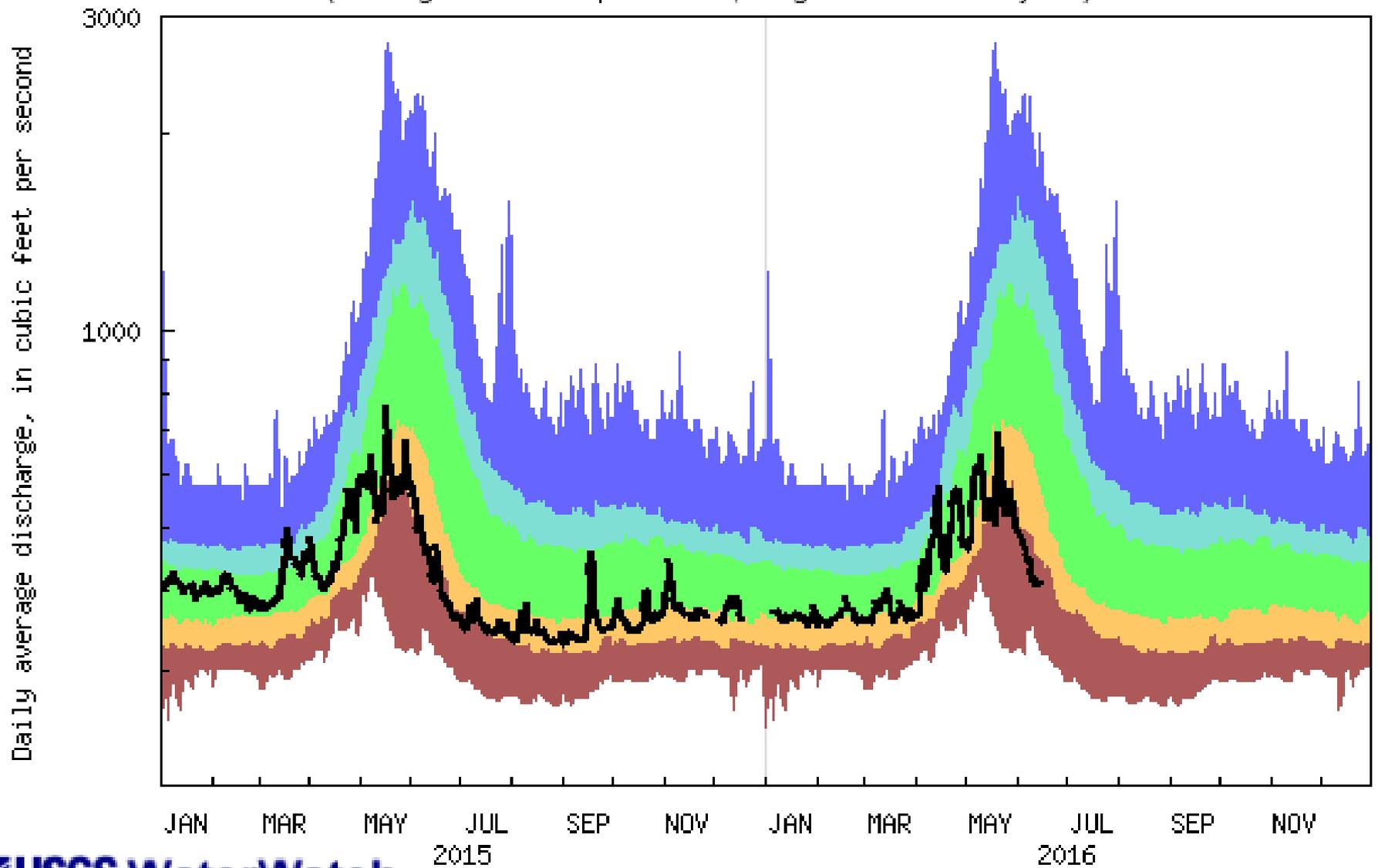
2015 Montana Water Supply Initiative  
Major Water Planning Basins



- Clark Fork
- Kootenai
- Little Missouri
- Lower Missouri
- St. Mary - Hudson Bay
- Upper Missouri
- Yellowstone
- Montana Indian Reservations
- County Line
- Highway

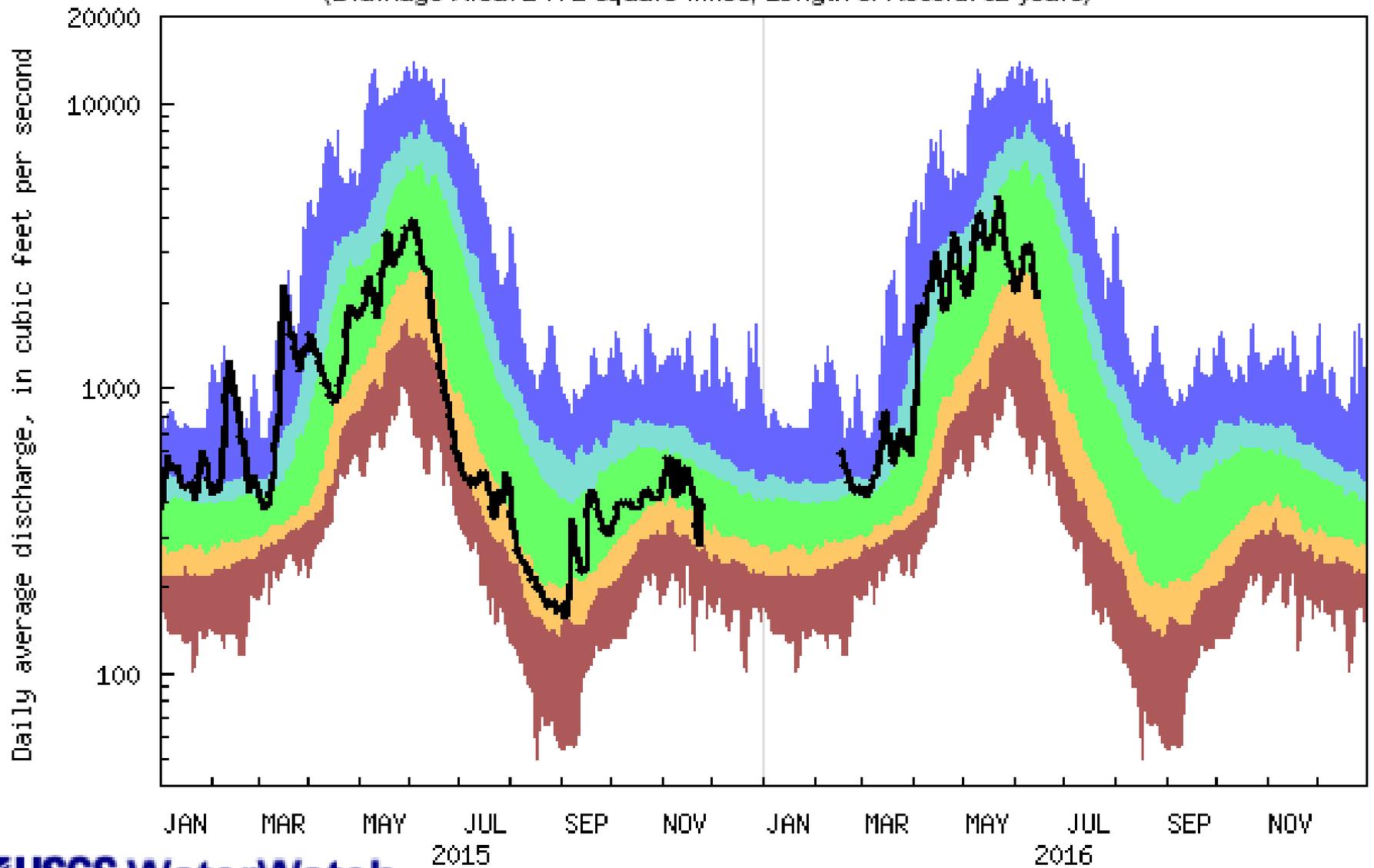


USGS 06037500 Madison River near West Yellowstone, MT  
 (Drainage Area: 435 square miles, Length of Record: 102 years)



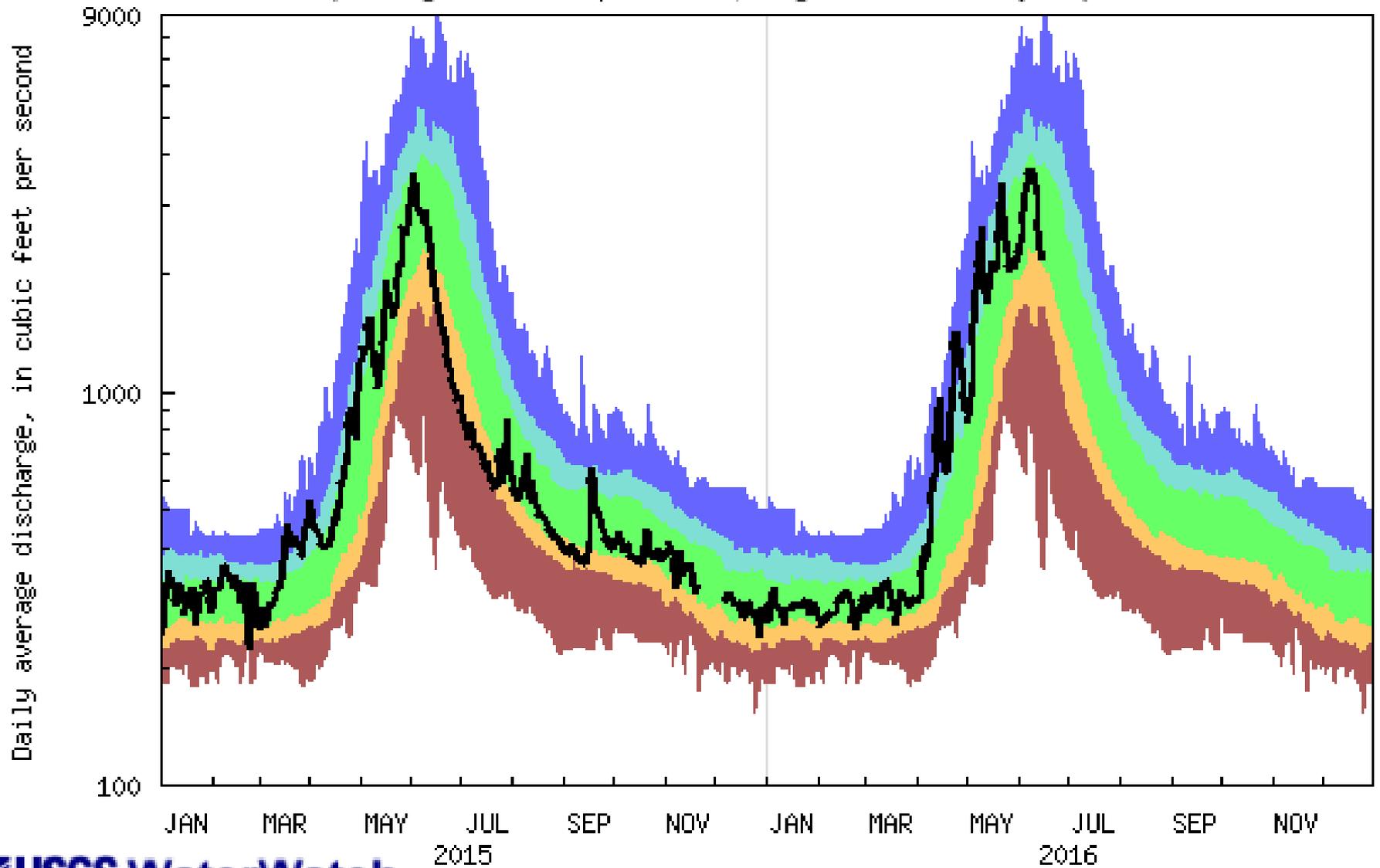
Explanation - Percentile classes					
lowest-10th percentile	10-24	25-75	76-90	90th percentile-highest	Flow
Much below normal	Below normal	Normal	Above normal	Much above normal	

USGS 06025600 Big Hole River near Melrose MT  
 (Drainage Area: 2472 square miles, Length of Record: 92 years)



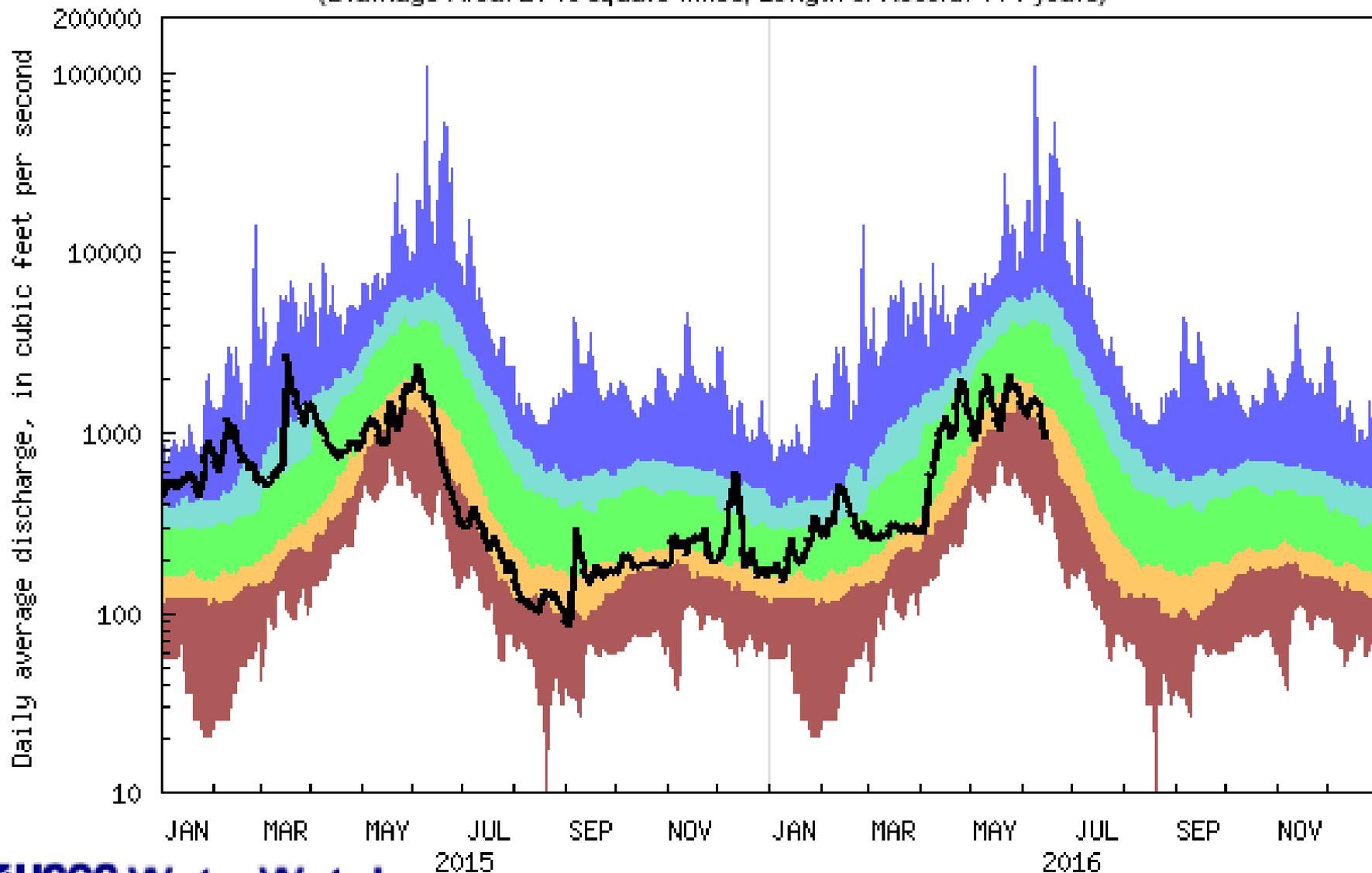
Explanation - Percentile classes					
lowest-10th percentile	10-24	25-75	76-90	90th percentile-highest	Flow
Much below normal	Below normal	Normal	Above normal	Much above normal	

USGS 06043500 Gallatin River near Gallatin Gateway, MT  
 (Drainage Area: 819 square miles, Length of Record: 126 years)



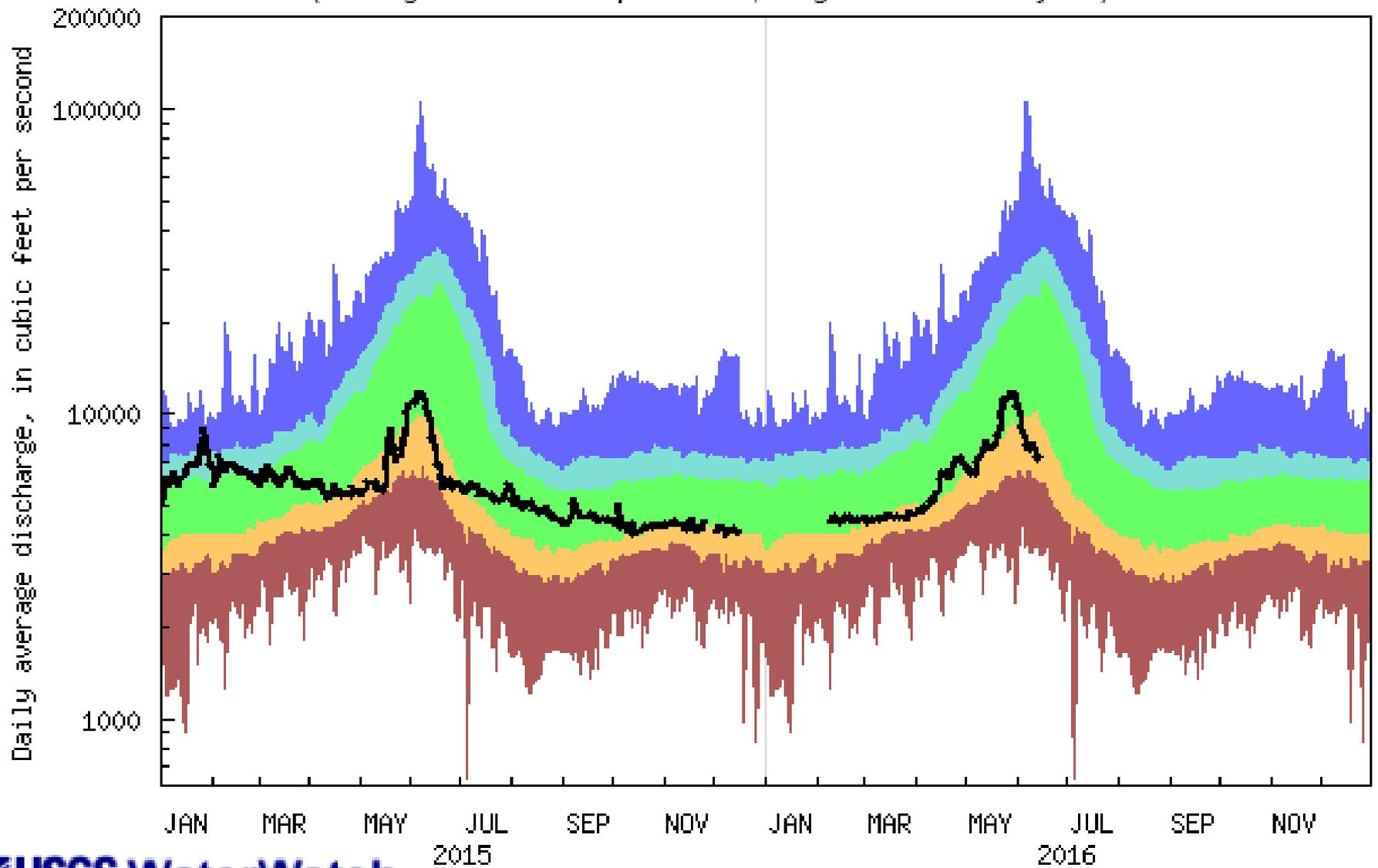
Explanation - Percentile classes				
lowest-10th percentile	10-24	25-75	76-90	90th percentile-highest
Much below normal	Below normal	Normal	Above normal	Much above normal
— Flow				

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

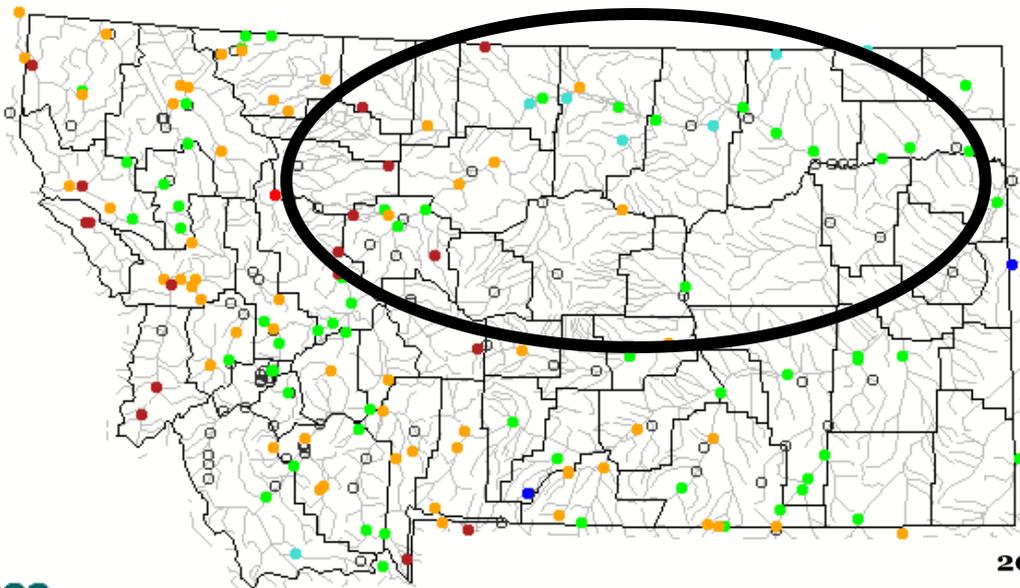


Explanation - Percentile classes					
lowest-10th percentile	10-24	25-75	76-90	90th percentile-highest	Flow
Much below normal	Below normal	Normal	Above normal	Much above normal	

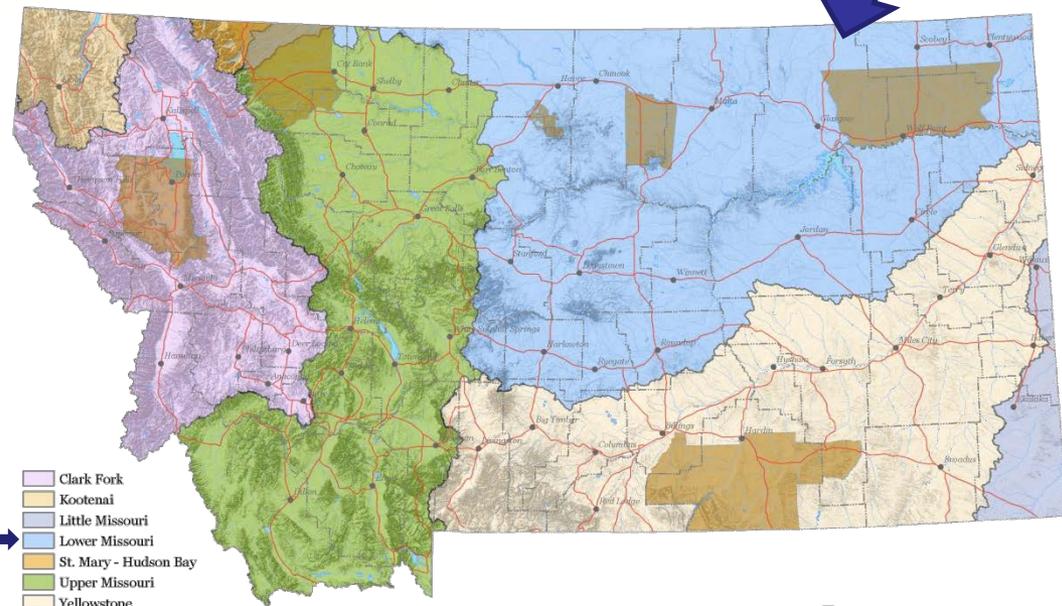
USGS 06090800 Missouri River at Fort Benton MT  
 (Drainage Area: 24297 square miles, Length of Record: 125 years)



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	

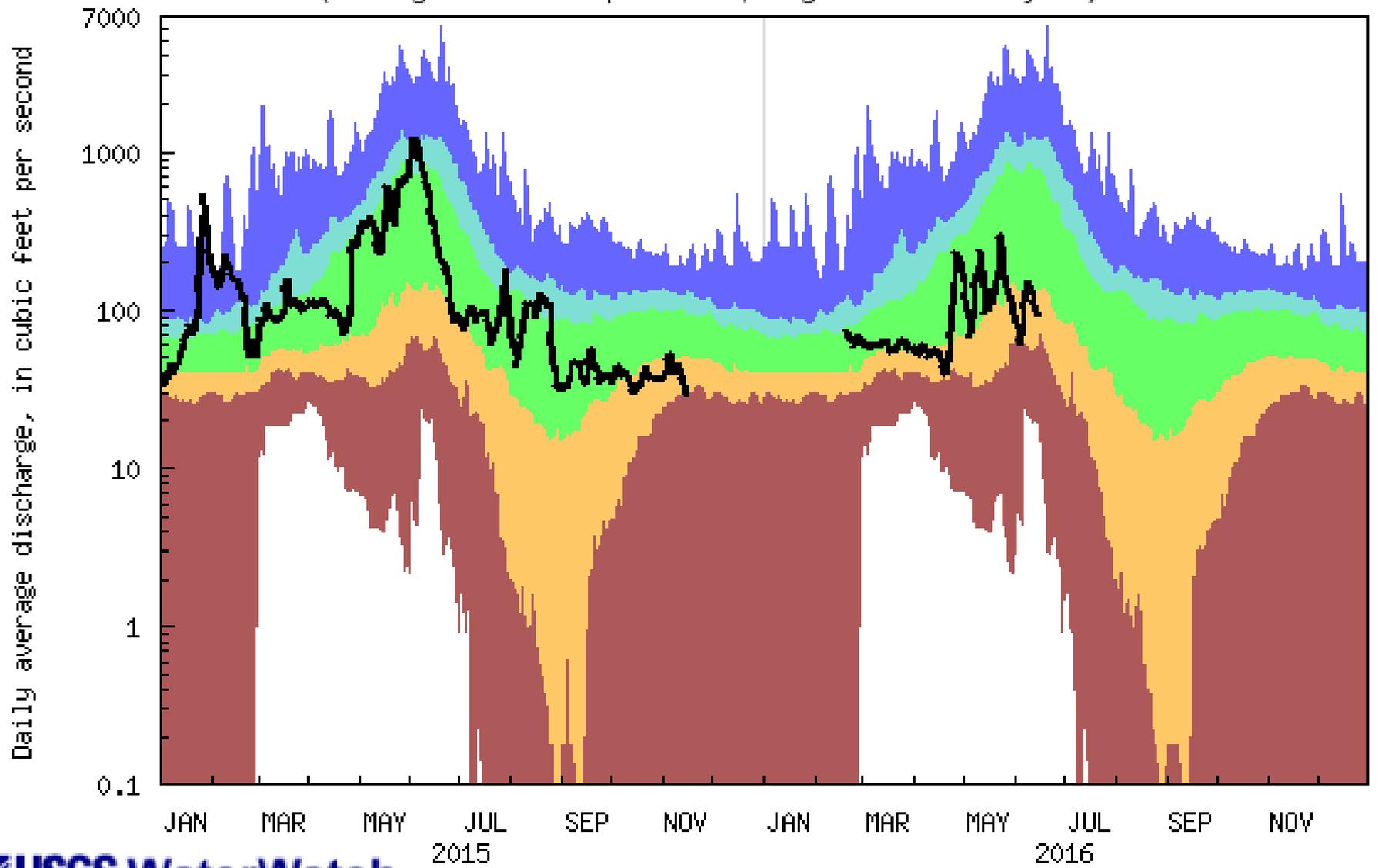


**2015 Montana Water Supply Initiative  
Major Water Planning Basins**



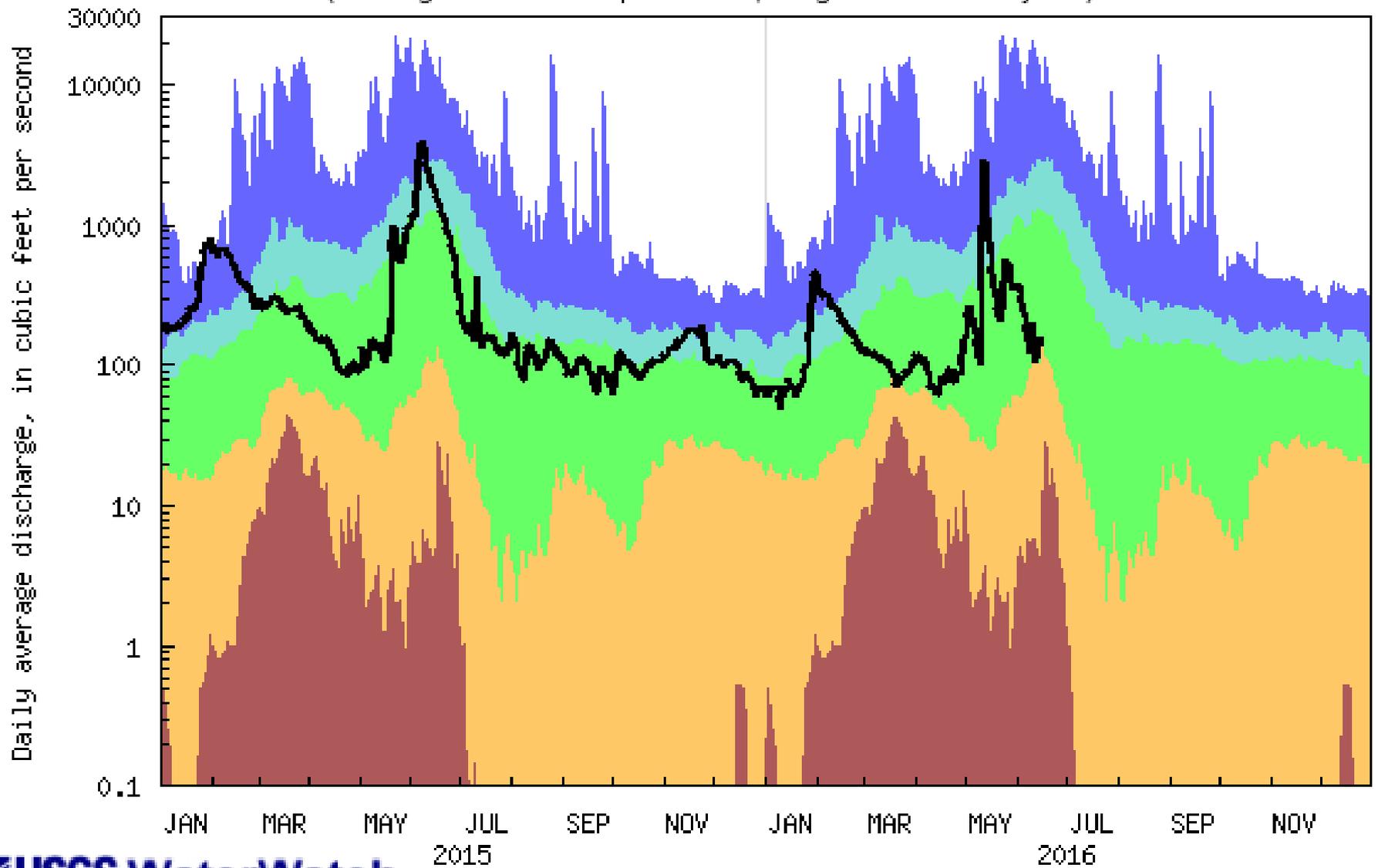
- Clark Fork
- Kootenai
- Little Missouri
- Lower Missouri
- St. Mary - Hudson Bay
- Upper Missouri
- Yellowstone
- Montana Indian Reservations
- County Line
- Highway

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



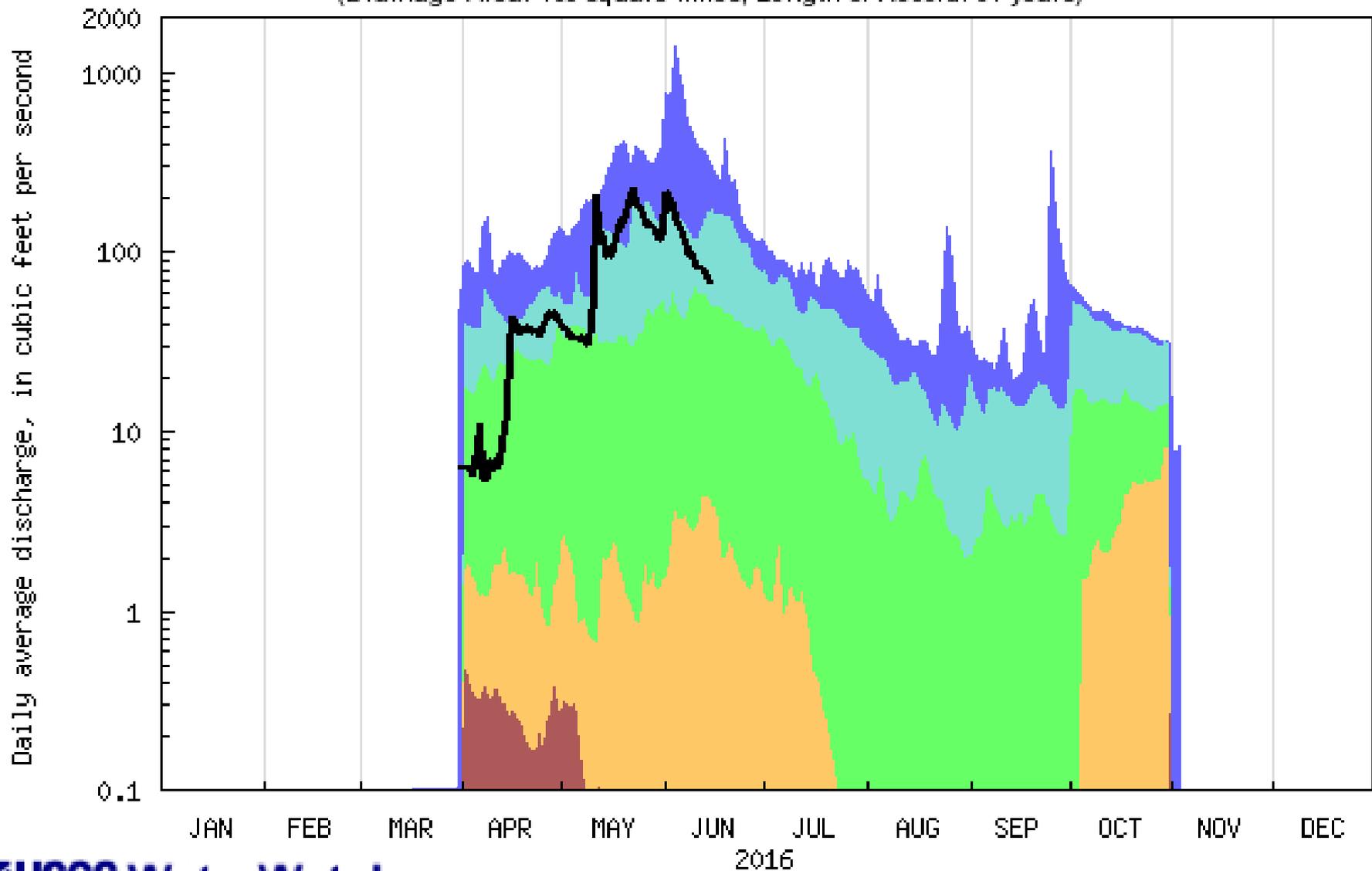
Explanation - Percentile classes					
lowest-10th percentile	10-24	25-75	76-90	90th percentile-highest	Flow
Much below normal	Below normal	Normal	Above normal	Much above normal	

USGS 06130500 Musselshell River at Mosby MT  
 (Drainage Area: 7784 square miles, Length of Record: 86 years)



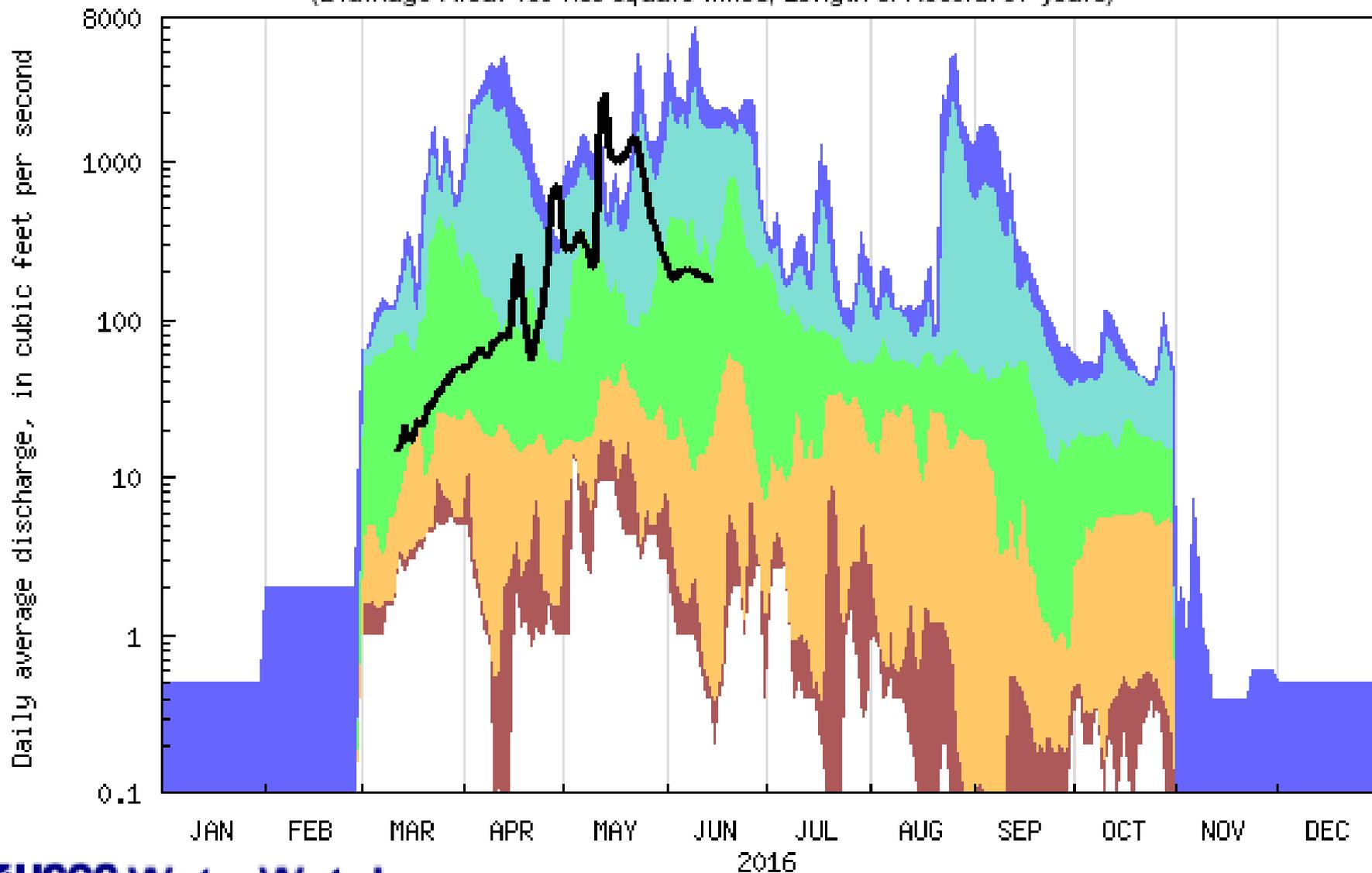
Explanation - Percentile classes					
lowest-10th percentile	10-24	25-75	76-90	90th percentile-highest	Flow
Much below normal	Below normal	Normal	Above normal	Much above normal	

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



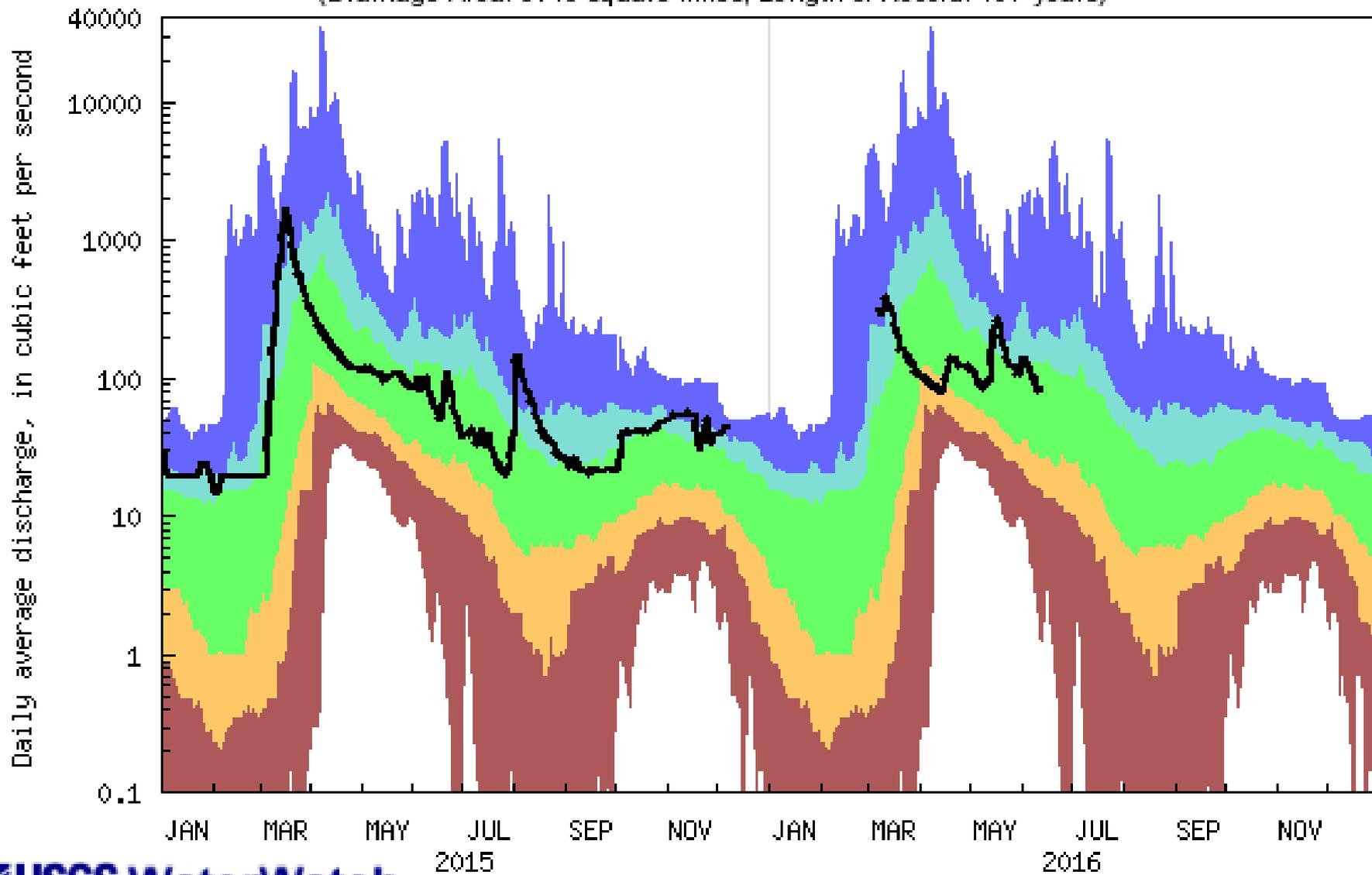
Explanation - Percentile classes					
lowest-10th percentile	10-24	25-75	76-90	90th percentile-highest	Flow
Much below normal	Below normal	Normal	Above normal	Much above normal	

USGS 06167500 Beaver Creek near Hinsdale MT  
 (Drainage Area: 1804.89 square miles, Length of Record: 97 years)

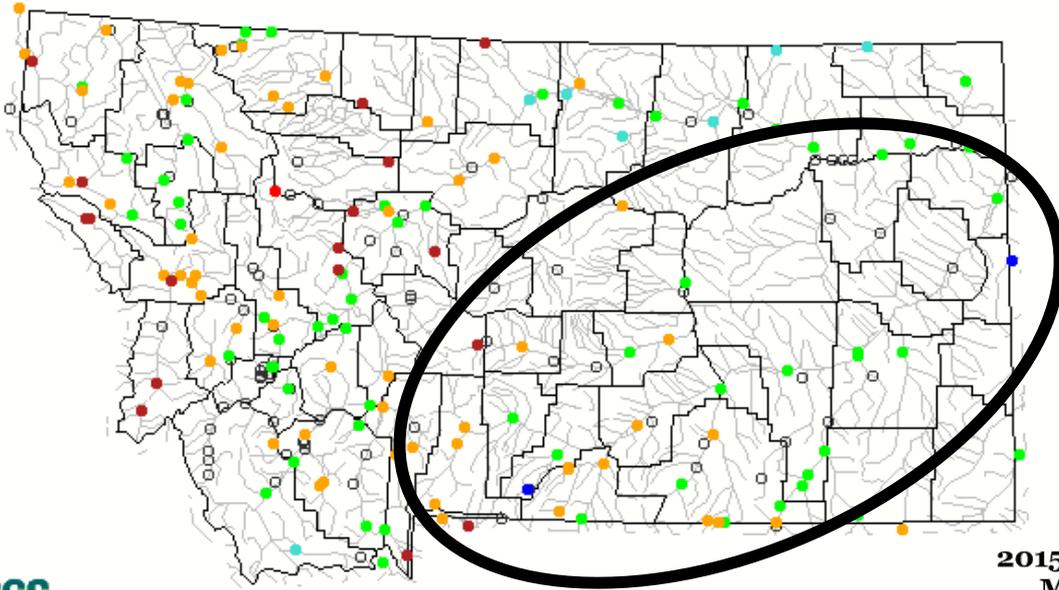


Explanation - Percentile classes					
lowest-10th percentile	10-24	25-75	76-90	90th percentile-highest	Flow
Much below normal	Below normal	Normal	Above normal	Much above normal	

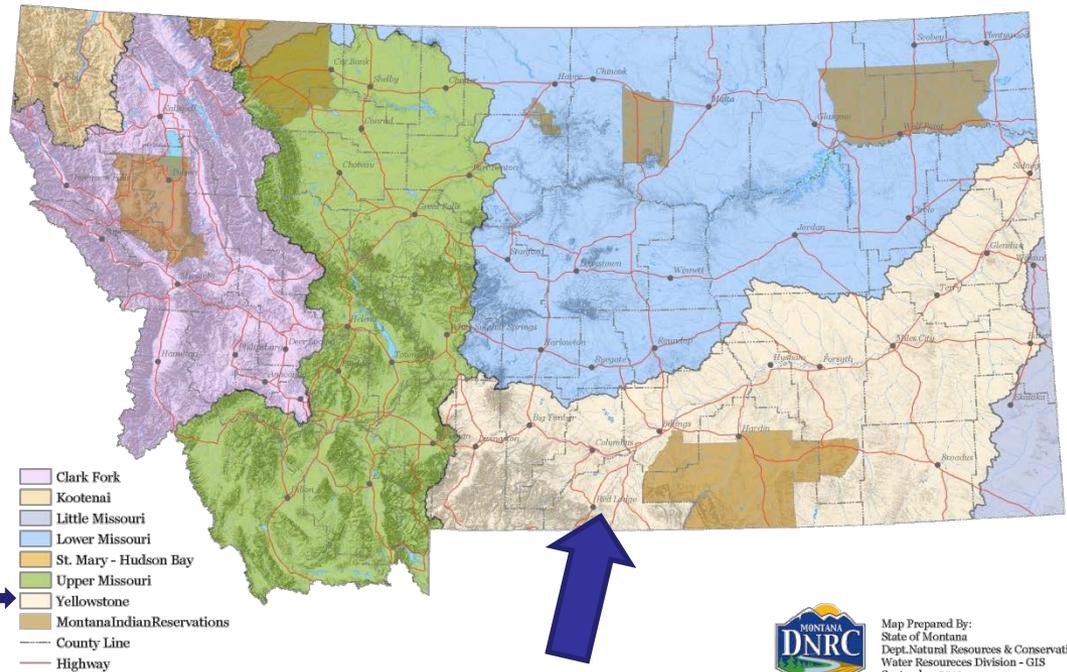
USGS 06181000 Poplar River near Poplar MT  
 (Drainage Area: 3140 square miles, Length of Record: 107 years)



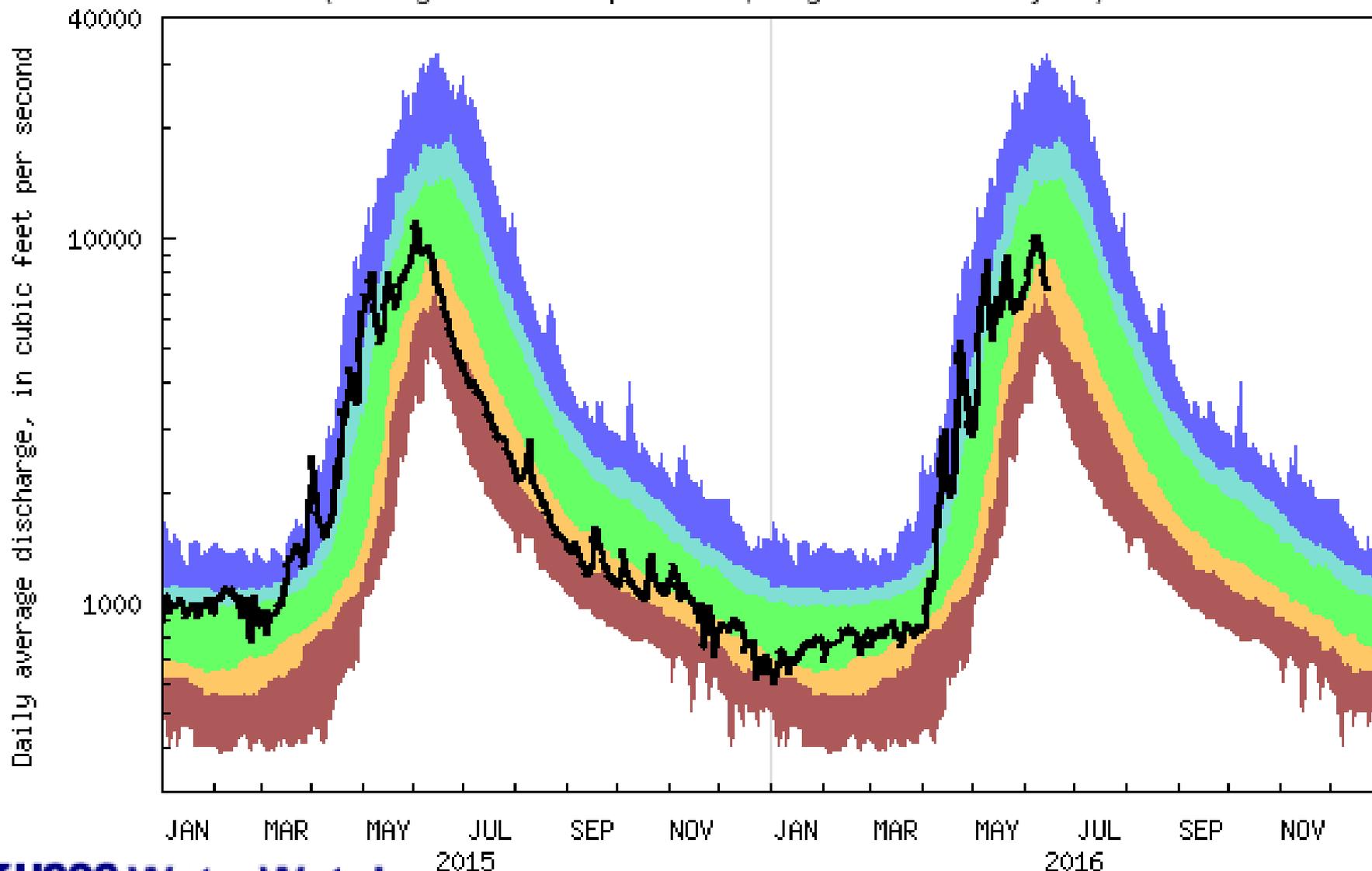
Explanation - Percentile classes					
lowest-10th percentile	10-24	25-75	76-90	90th percentile-highest	Flow
Much below normal	Below normal	Normal	Above normal	Much above normal	



**2015 Montana Water Supply Initiative  
Major Water Planning Basins**

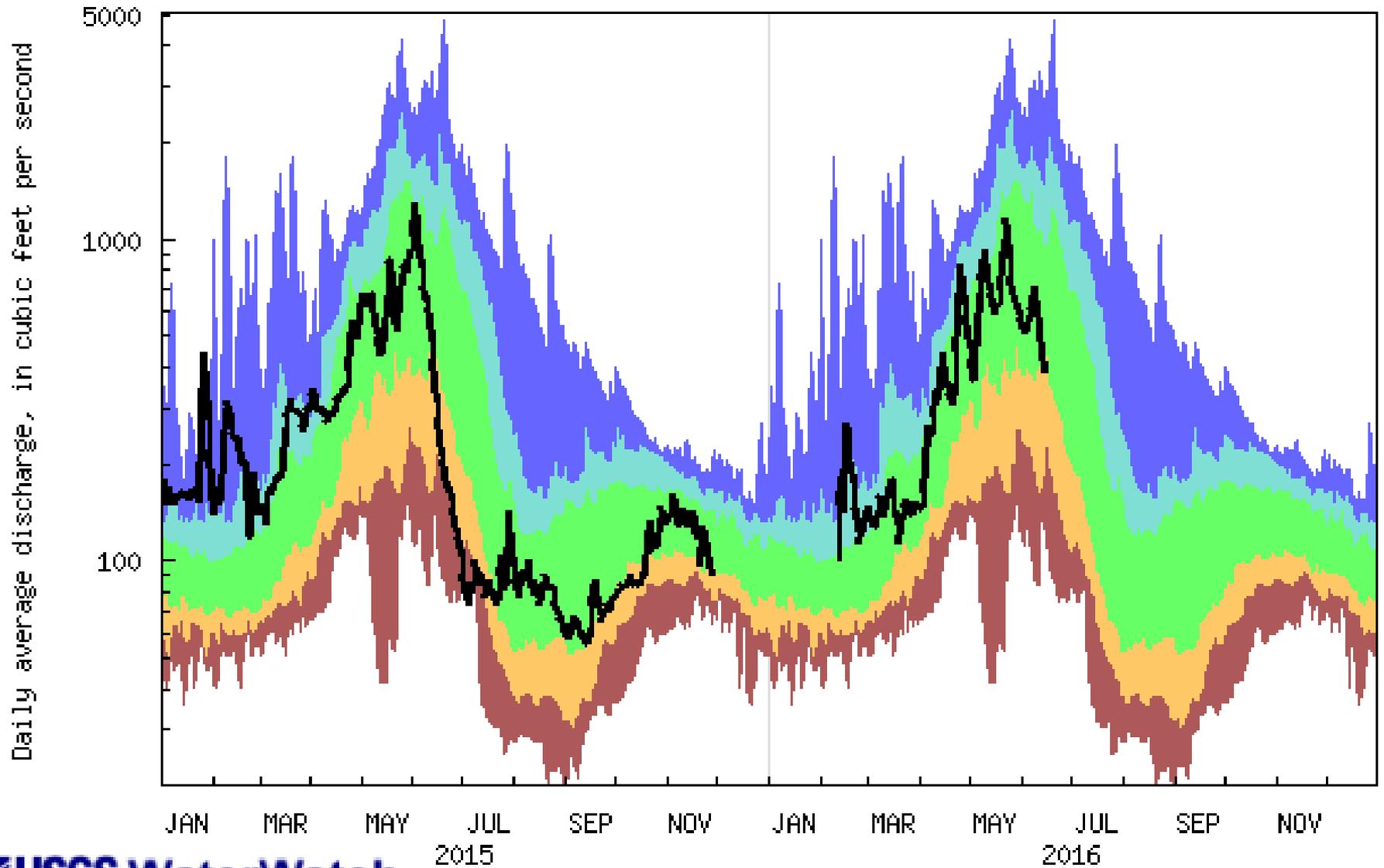


USGS 06191500 Yellowstone River at Corwin Springs MT  
 (Drainage Area: 2616 square miles, Length of Record: 126 years)



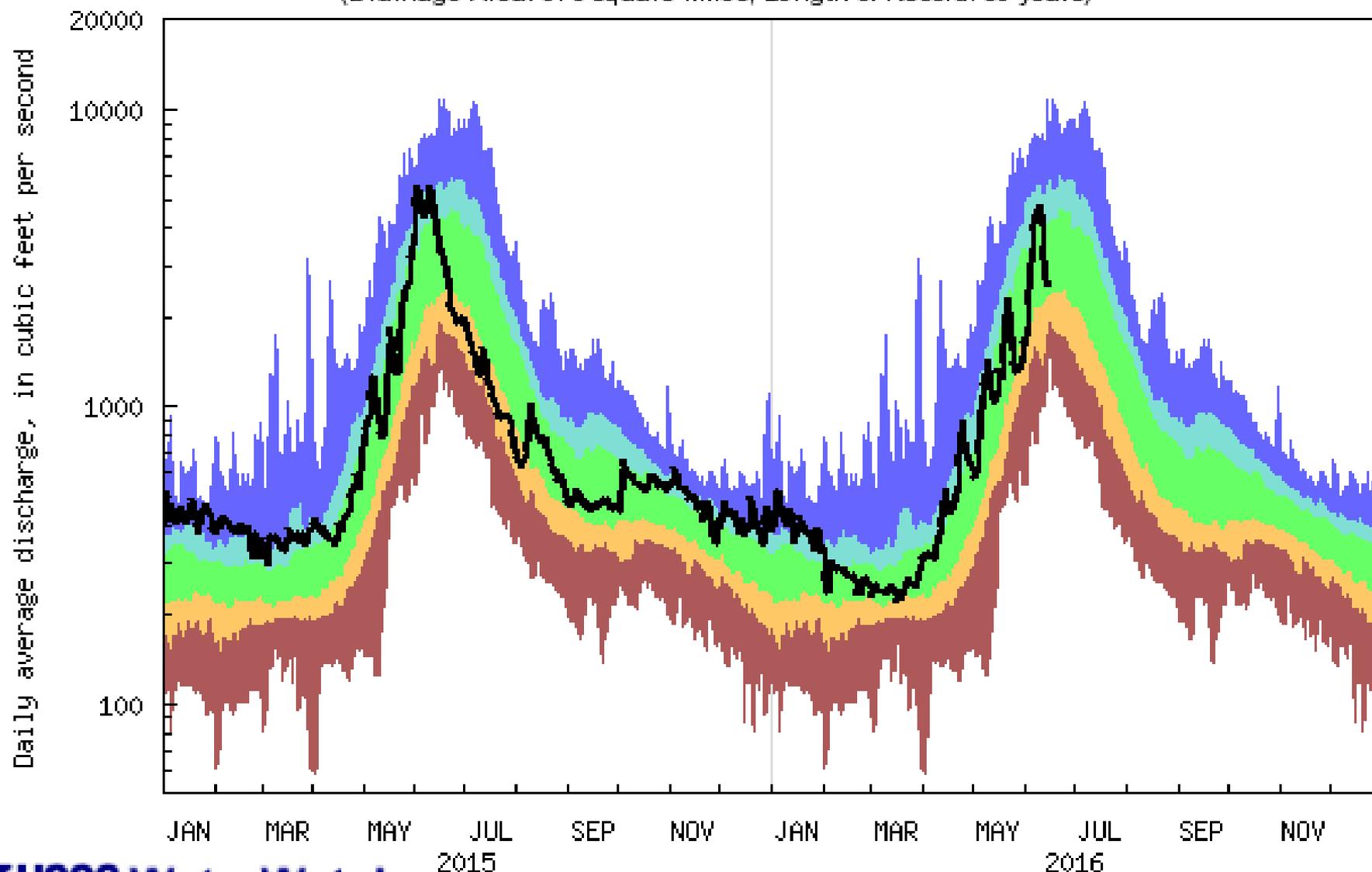
Explanation - Percentile classes				
lowest-10th percentile	10-24	25-75	76-90	90th percentile-highest
Much below normal	Below normal	Normal	Above normal	Much above normal
— Flow				

USGS 06196600 Shields River nr Livingston MT  
 (Drainage Area: 846 square miles, Length of Record: 37 years)



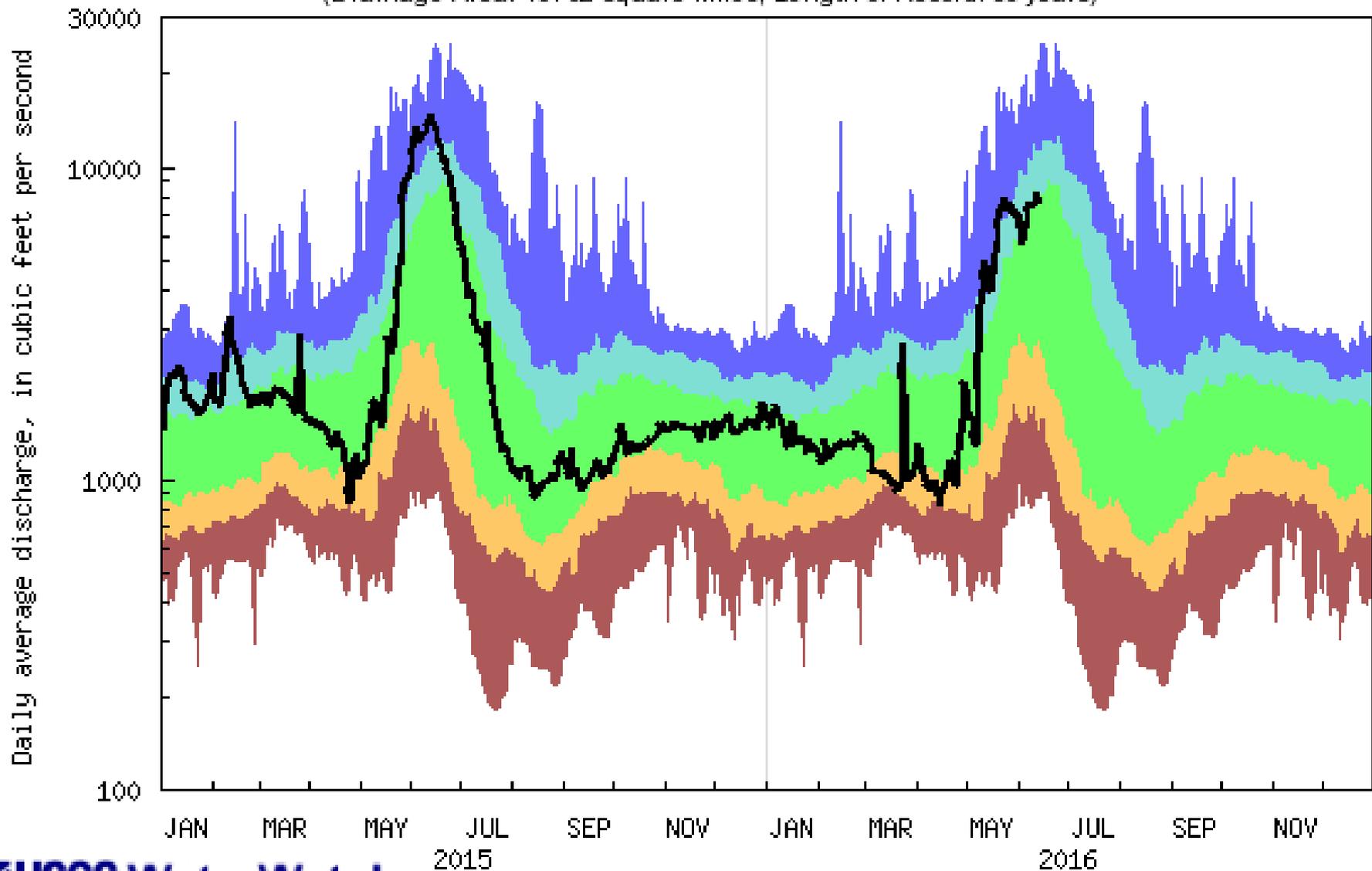
Explanation - Percentile classes				
lowest-10th percentile	10-24	25-75	76-90	90th percentile-highest
Much below normal	Below normal	Normal	Above normal	Much above normal
— Flow				

USGS 06205000 Stillwater River near Absarokee MT  
 (Drainage Area: 976 square miles, Length of Record: 80 years)



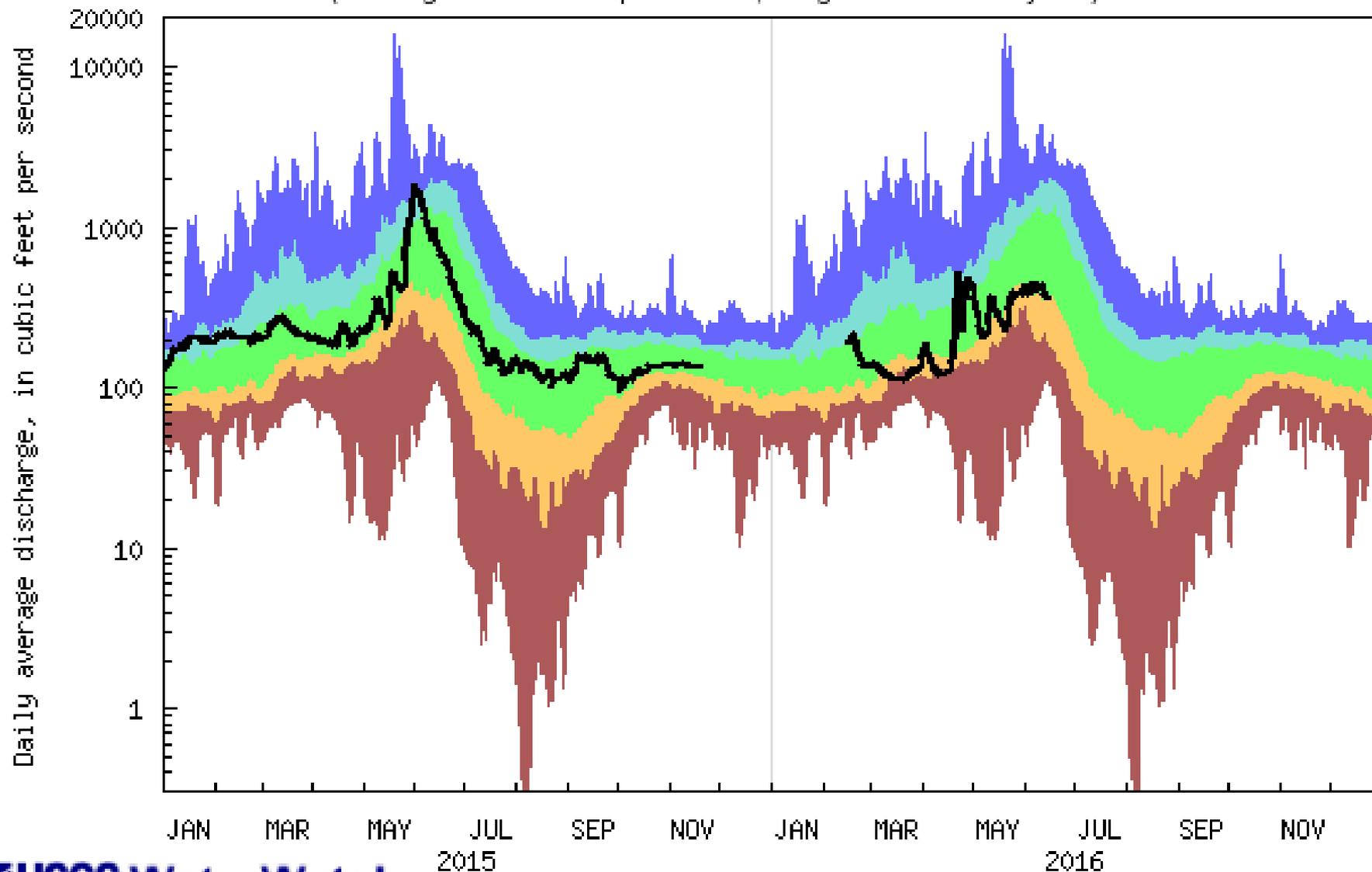
Explanation - Percentile classes					
lowest-10th percentile	10-24	25-75	76-90	90th percentile-highest	Flow
Much below normal	Below normal	Normal	Above normal	Much above normal	

USGS 06279500 BIGHORN RIVER AT KANE, WY  
 (Drainage Area: 15762 square miles, Length of Record: 86 years)



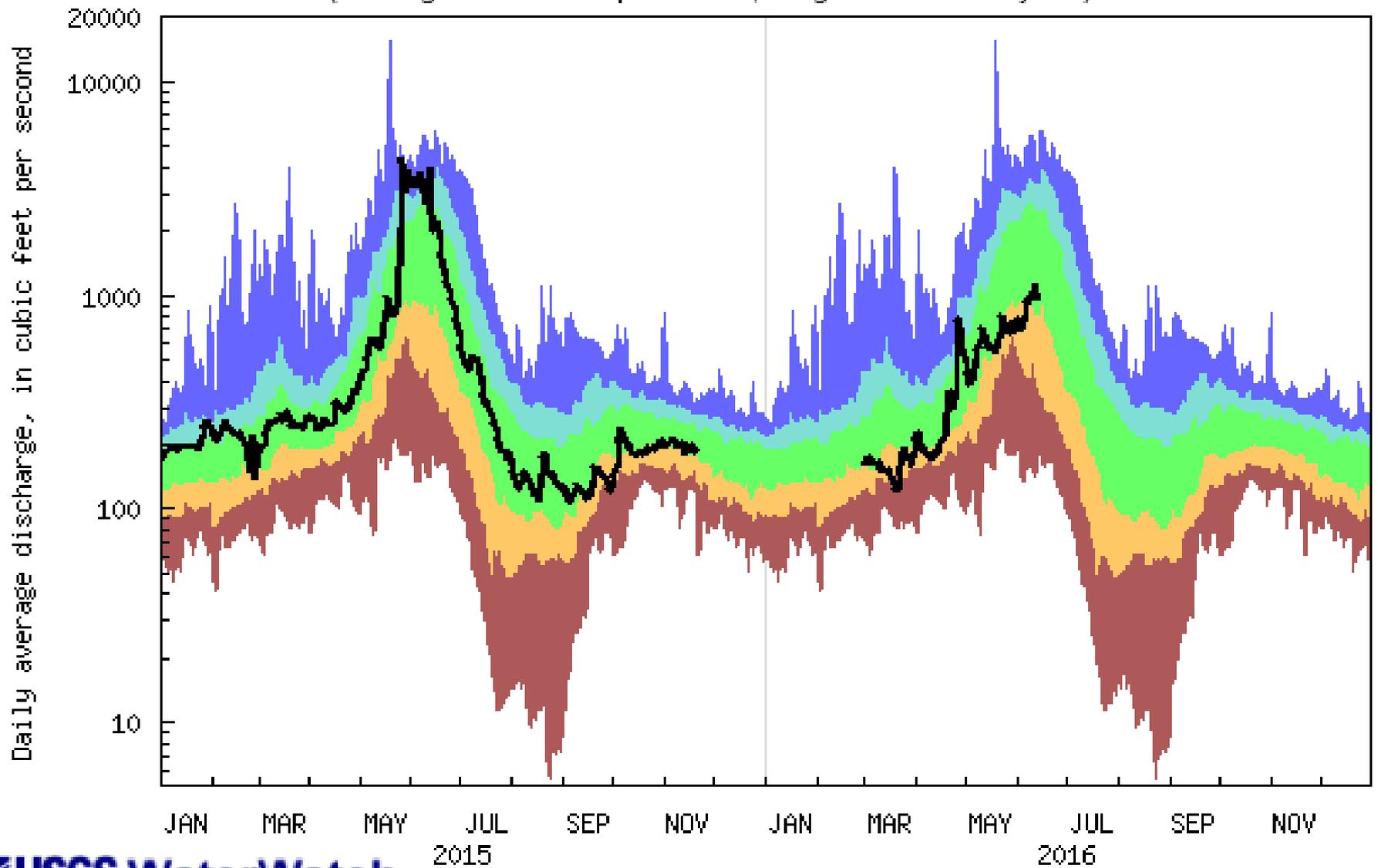
Explanation - Percentile classes					
lowest-10th percentile	10-24	25-75	76-90	90th percentile-highest	Flow
Much below normal	Below normal	Normal	Above normal	Much above normal	

USGS 06294000 Little Bighorn River near Hardin MT  
 (Drainage Area: 1294 square miles, Length of Record: 62 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	

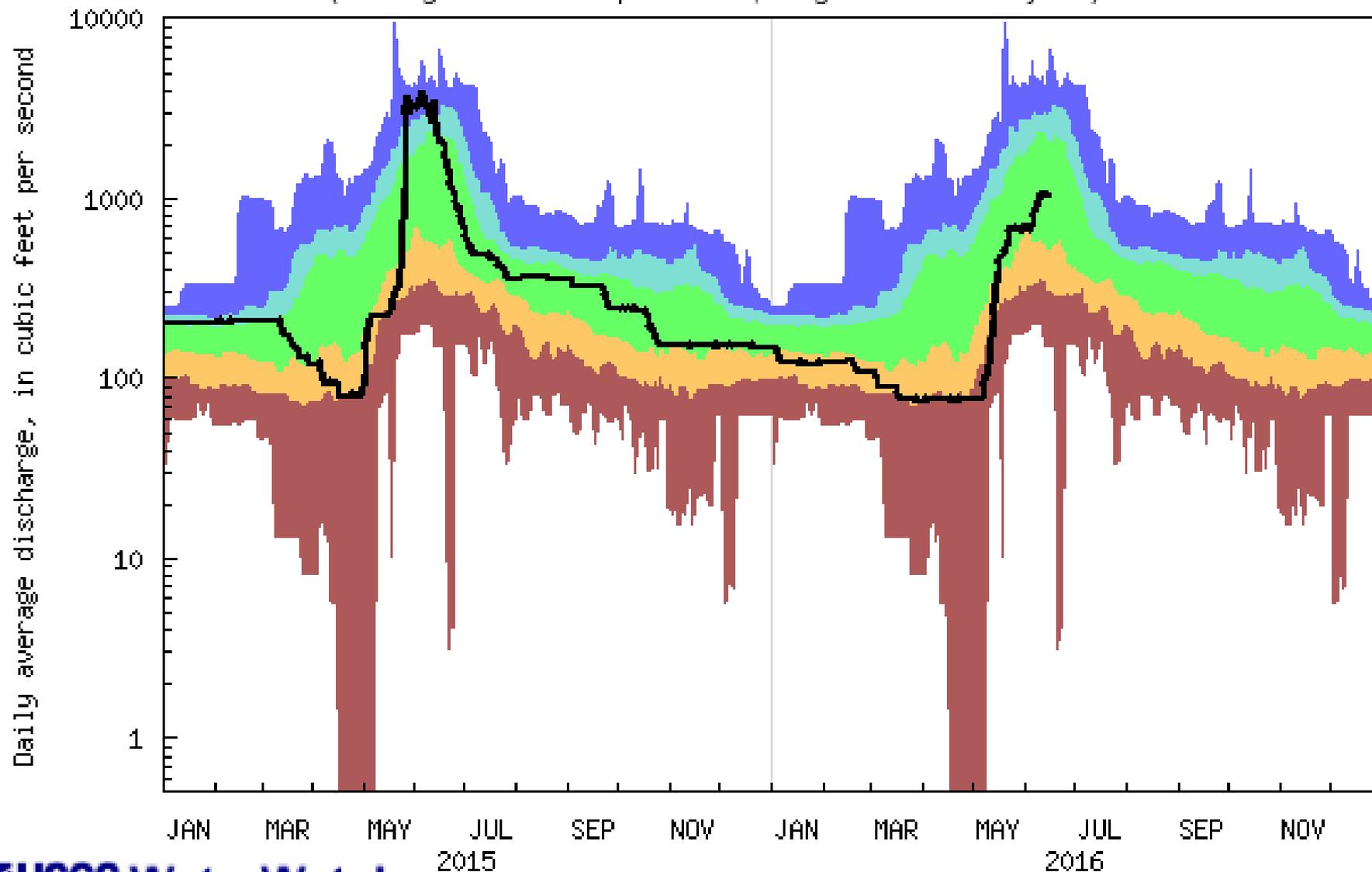
USGS 06306300 Tongue River at State Line nr Decker MT  
 (Drainage Area: 1451 square miles, Length of Record: 55 years)



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

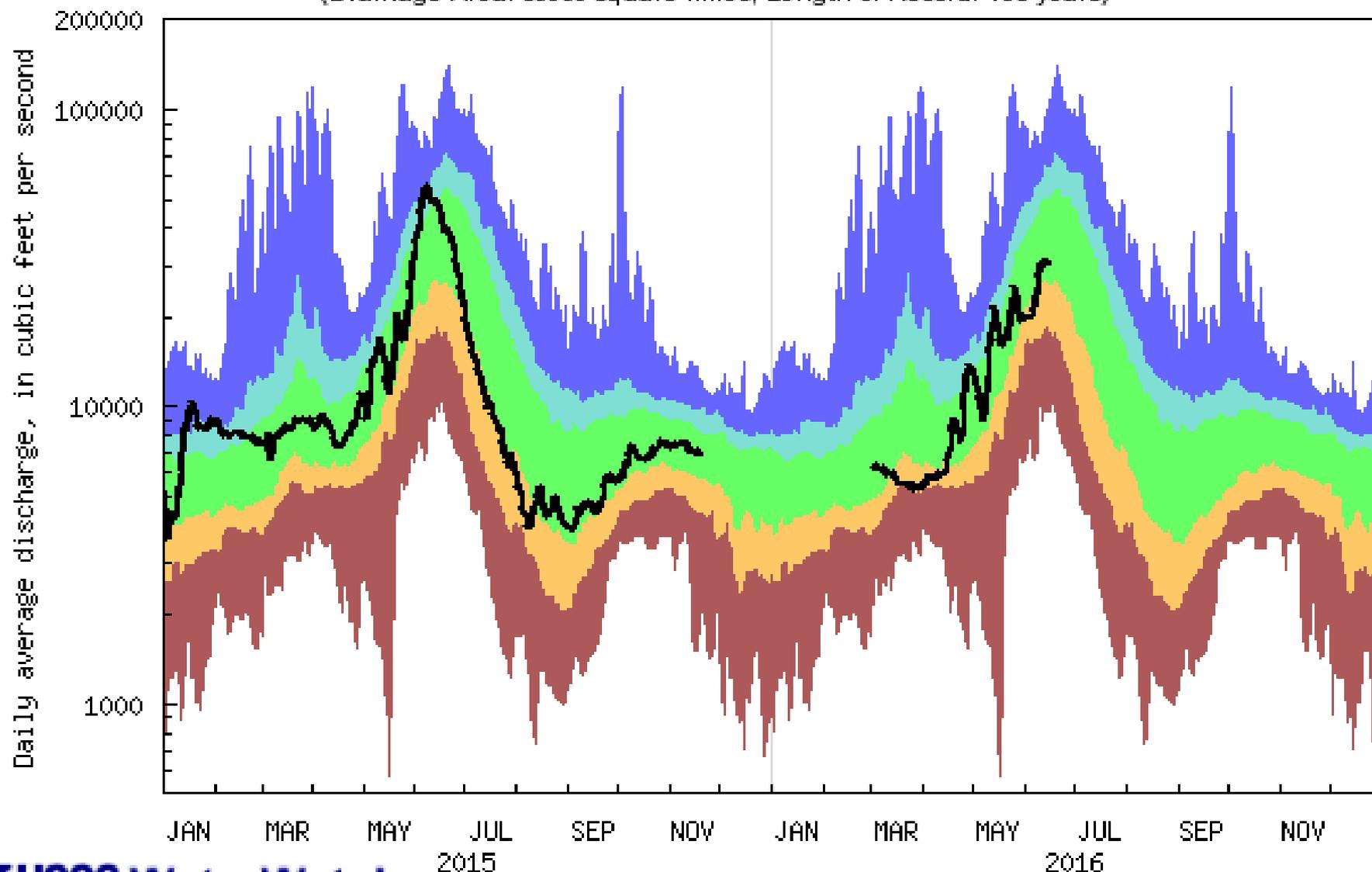
— Flow

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)



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 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/>

# RECLAMATION

*Managing Water in the West*

## 2016 Operations for Hungry Horse and Como

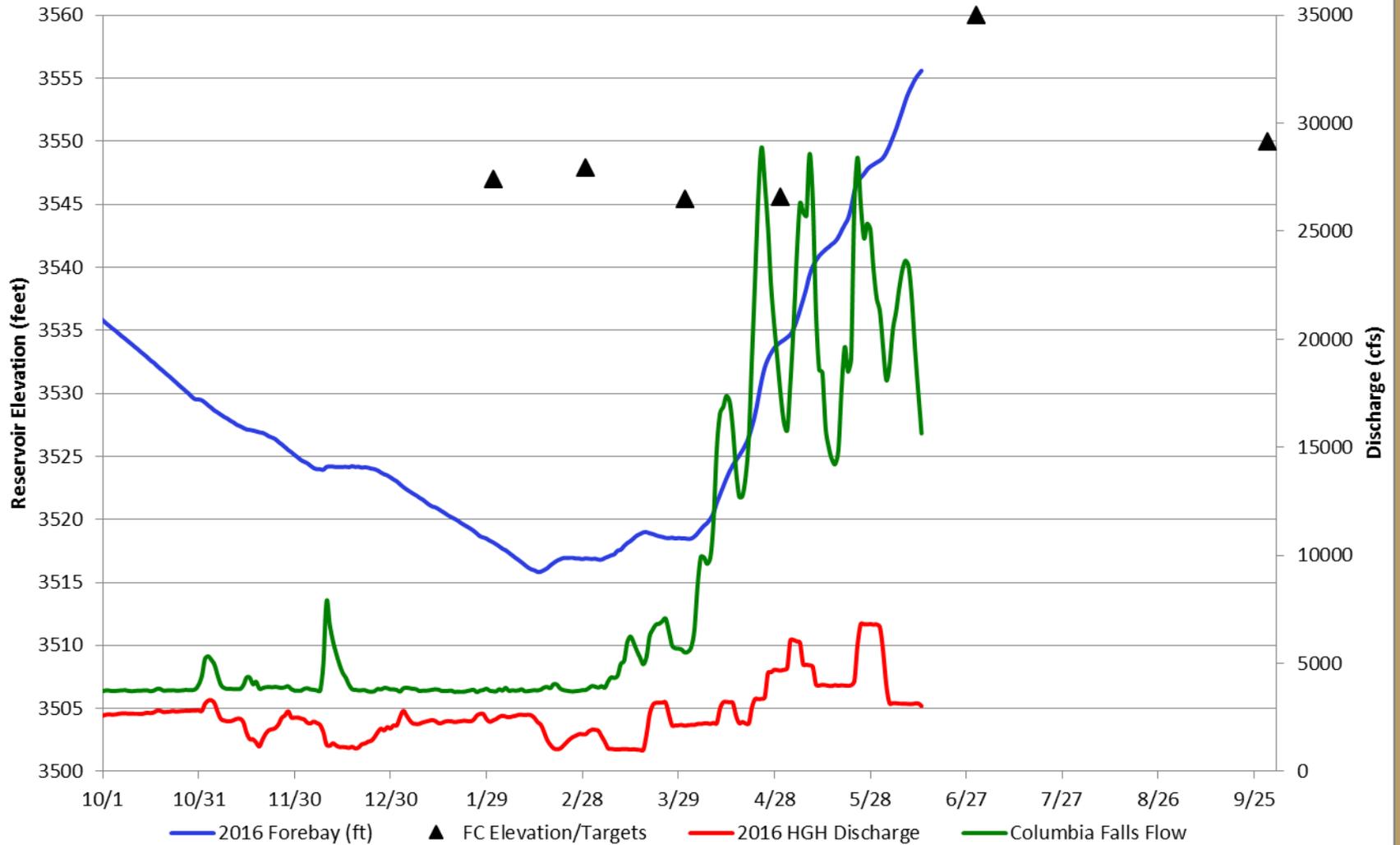


U.S. Department of the Interior  
Bureau of Reclamation

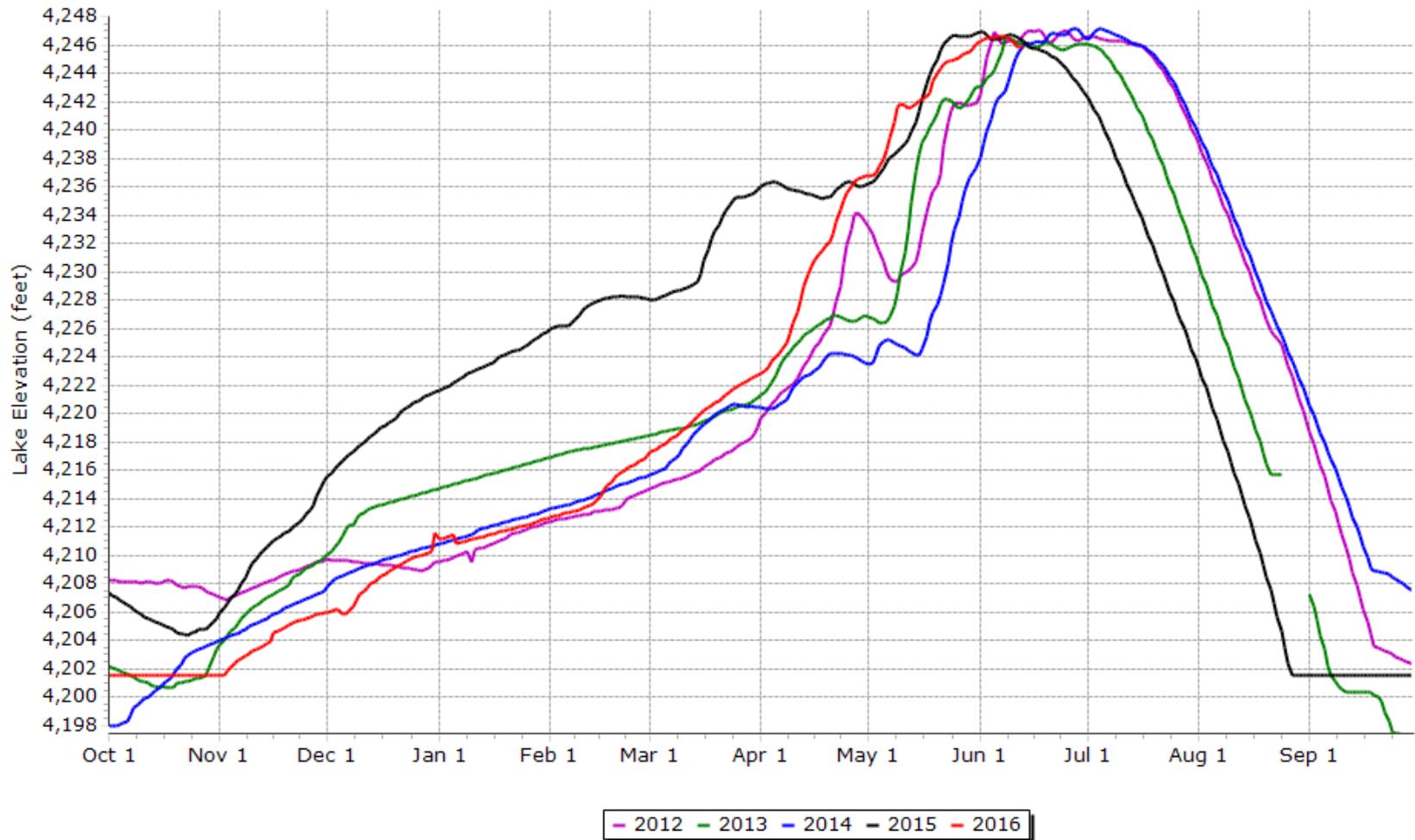
# 2016 Conditions

- Hungry Horse Reservoir – Current volume forecast for April - August is 1,695,000 acre-feet which is 88 percent of average.
- Runoff was early, April and May runoff was 111 percent of average. Currently inflows are very low.
- Reservoir elevation was below flood control this spring due to dry conditions in 2015.
- Dam is currently discharging 2500 cfs and reservoir will come close to filling in early July.

# Hungry Horse Operations (WY 2016)



## Lake Como Elevations 2012-2016



# Como Operations

- Lake Como filled this spring.
- Elevation drafted to below full elevation on June 11.

## Governor's Drought Advisory Committee Snowpack and Streamflow Update June 16<sup>th</sup>, 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/>

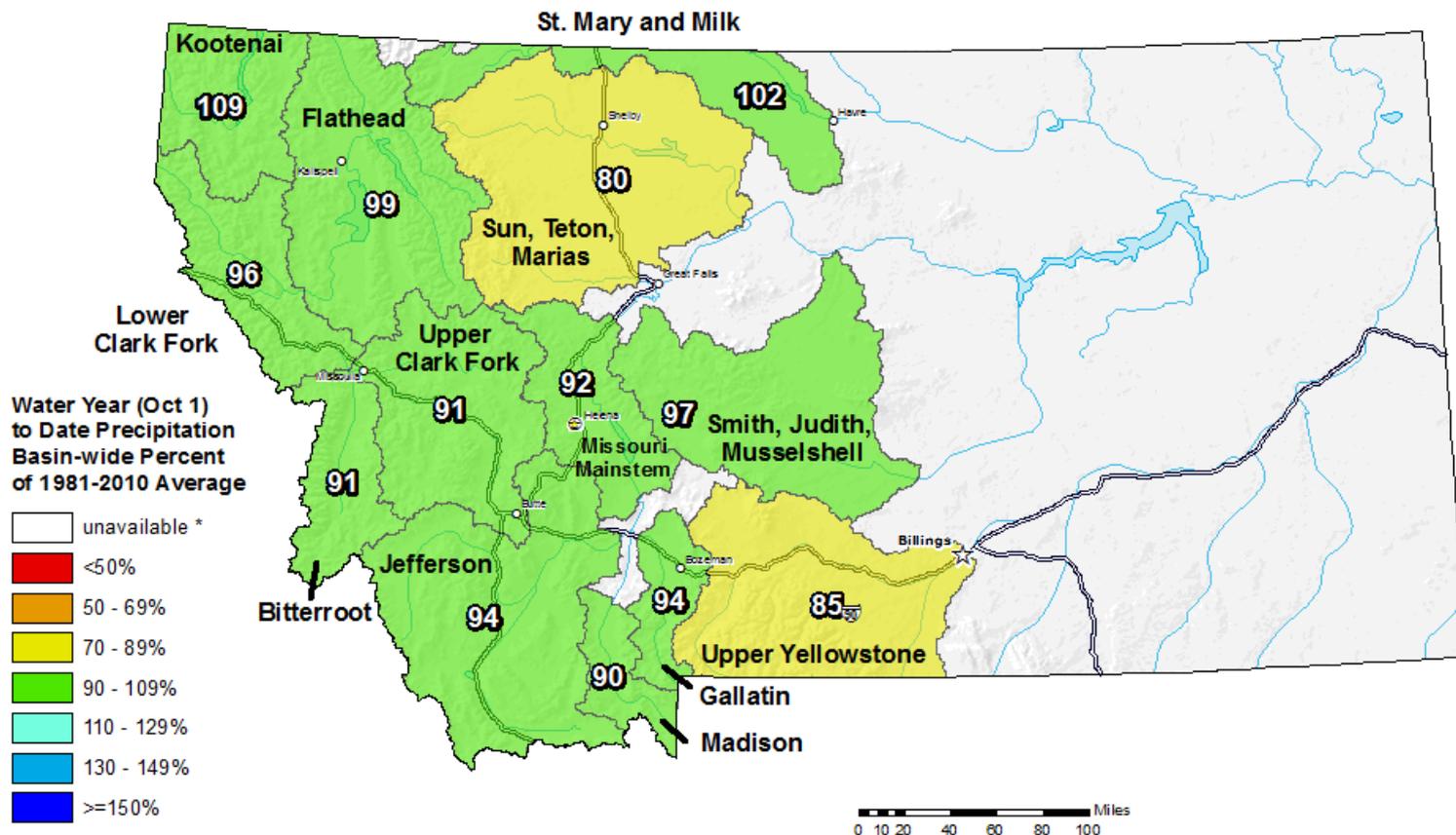
Snow in June!!!!

Big Mountain Summit on June 14<sup>th</sup>, 2016

## Mountain Precipitation

## Montana SNOTEL Water Year (Oct 1) to Date Precipitation % of Normal

Jun 14, 2016



Water Year (Oct 1) to Date Precipitation Basin-wide Percent of 1981-2010 Average

- unavailable \*
- <50%
- 50 - 69%
- 70 - 89%
- 90 - 109%
- 110 - 129%
- 130 - 149%
- >=150%

\* Data unavailable at time of posting or measurement is not representative at this time of year

*Provisional Data  
Subject to Revision*



The water year (oct 1) to date precipitation percent of normal represents the accumulated precipitation found at selected SNOTEL sites in or near the basin compared to the average value for those sites on this day. Data based on the first reading of the day (typically 00:00).

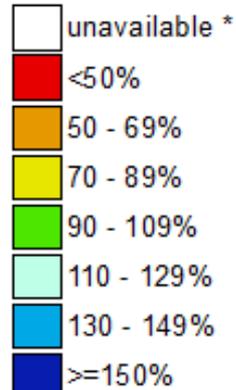
Prepared by:  
USDA/NRCS National Water and Climate Center  
Portland, Oregon  
<http://www.wcc.nrcs.usda.gov>

## Month-to-date Mountain SNOTEL Precipitation (June<sup>st</sup> – June 14<sup>th</sup>)

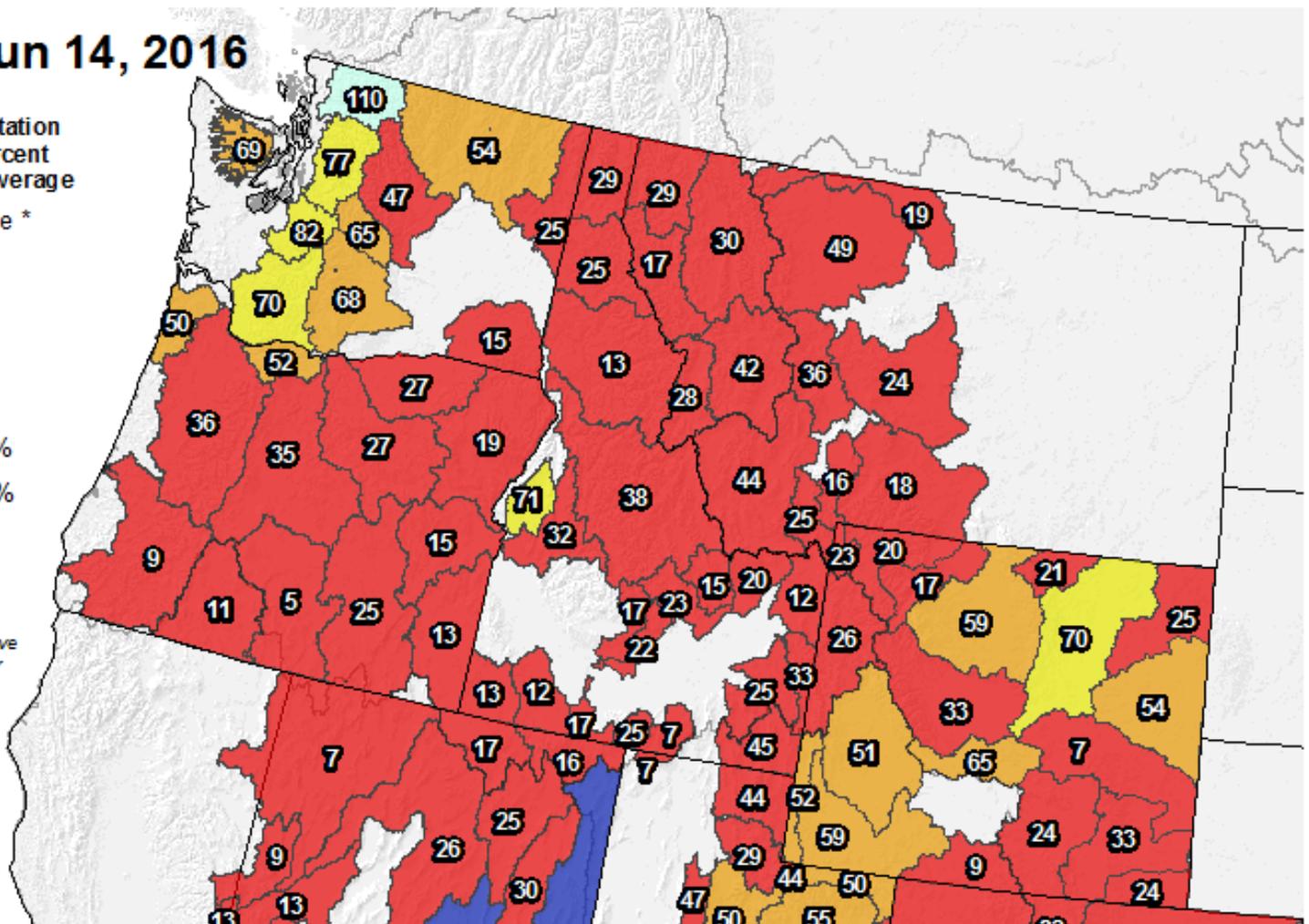
### Westwide SNOTEL Current Month to Date Precipitation % of Normal

Jun 14, 2016

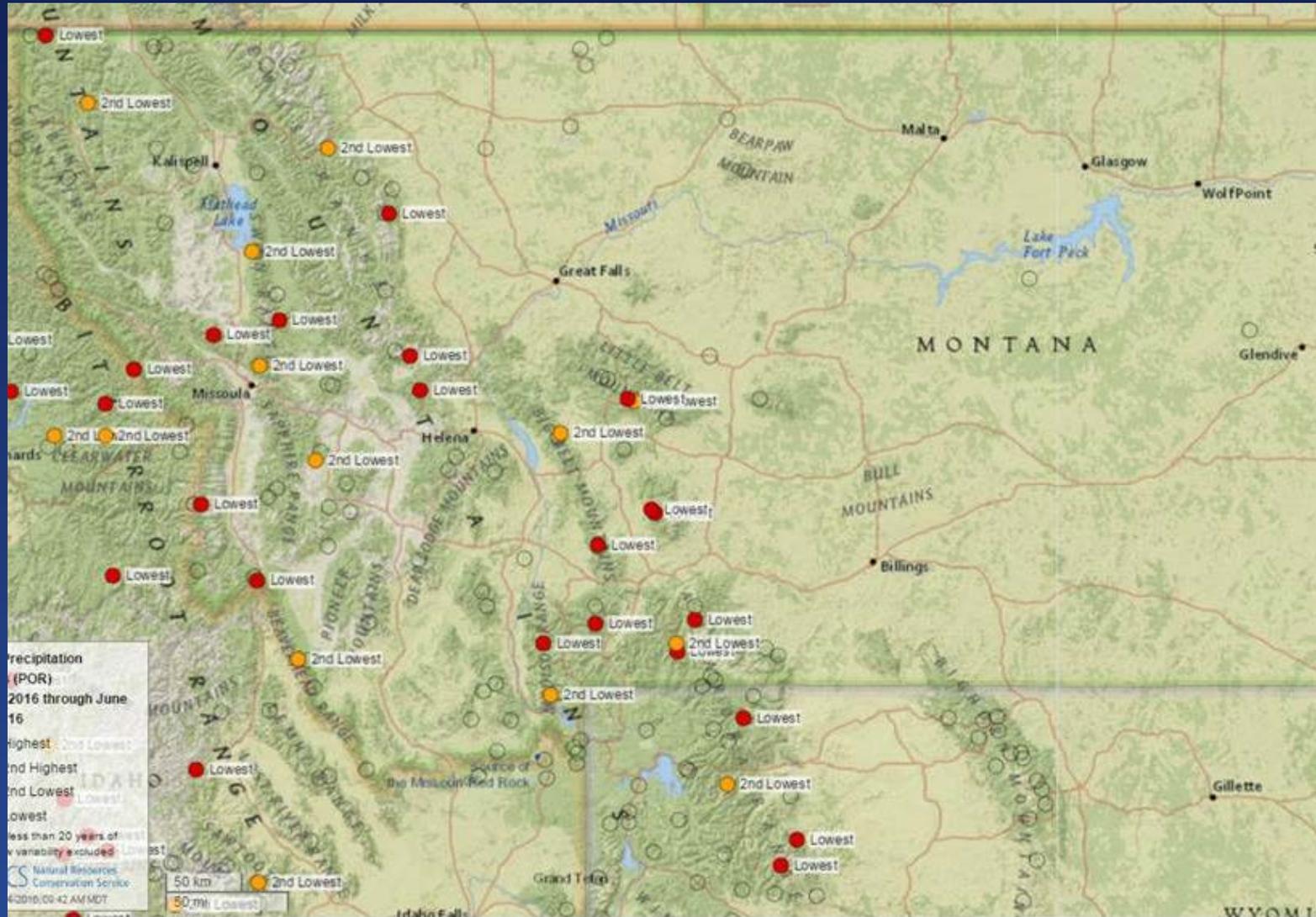
Current Month to Date Precipitation Basin-wide Percent of 1981-2010 Average



\* Data unavailable at time of posting or measurement is not representative at this time of year



## 21 Day Mountain SNOTEL Precipitation (May 24<sup>th</sup> – June 14<sup>th</sup>)



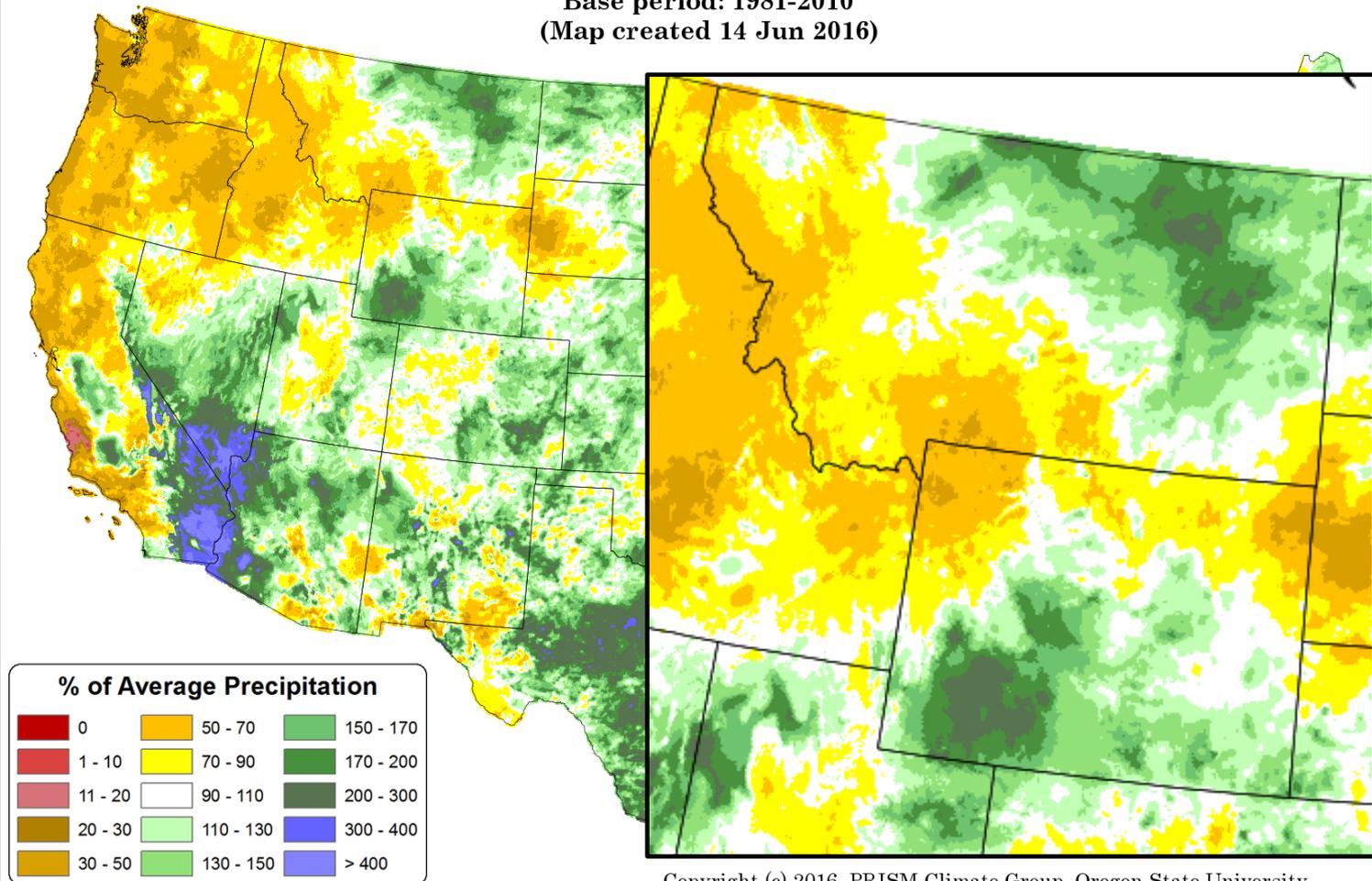
April 1<sup>st</sup> – June 14<sup>th</sup>  
Precipitation Percentage

**Total Precipitation Anomaly: April 2016 - 13 June 2016**

Period ending 7 AM EST 13 Jun 2016

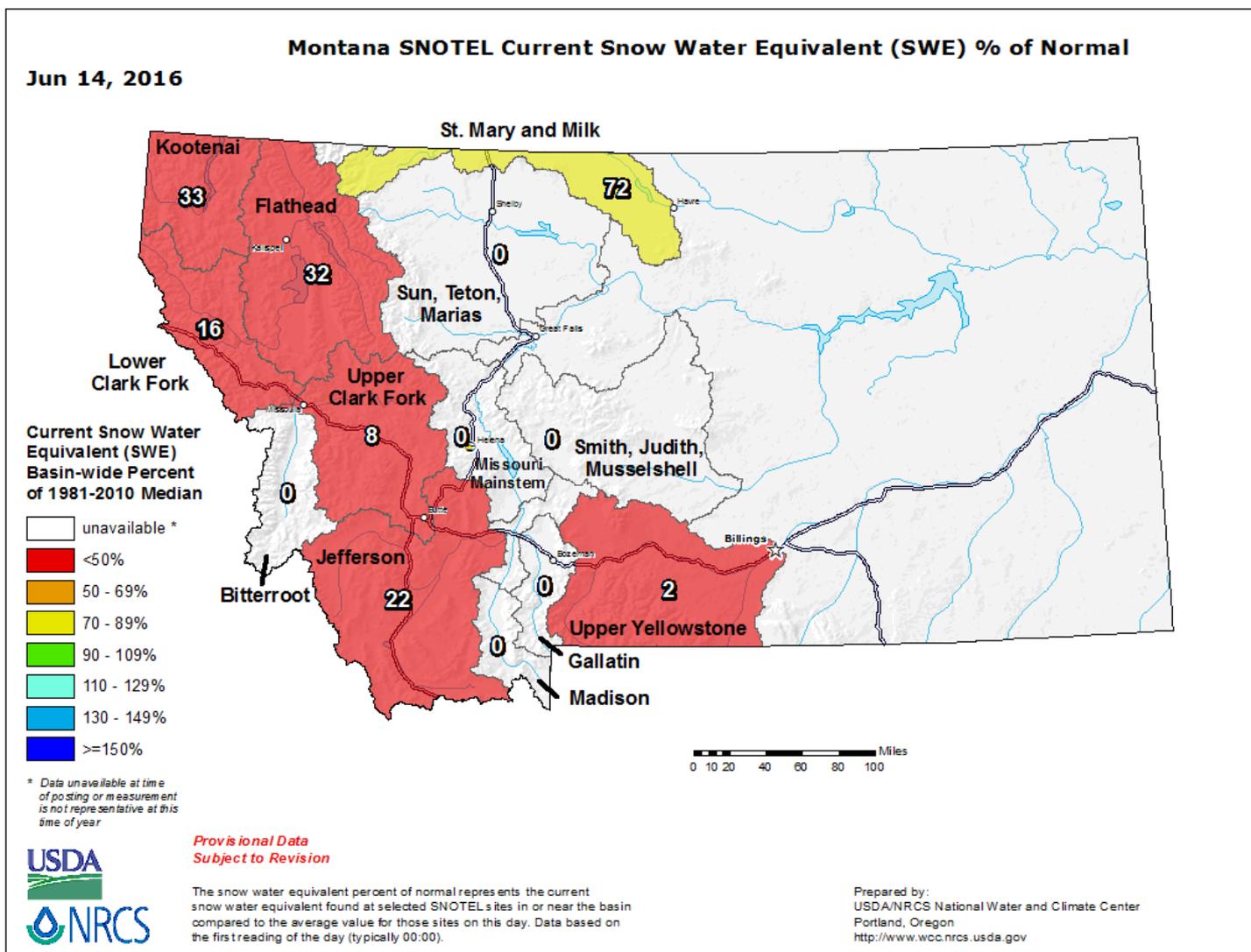
Base period: 1981-2010

(Map created 14 Jun 2016)



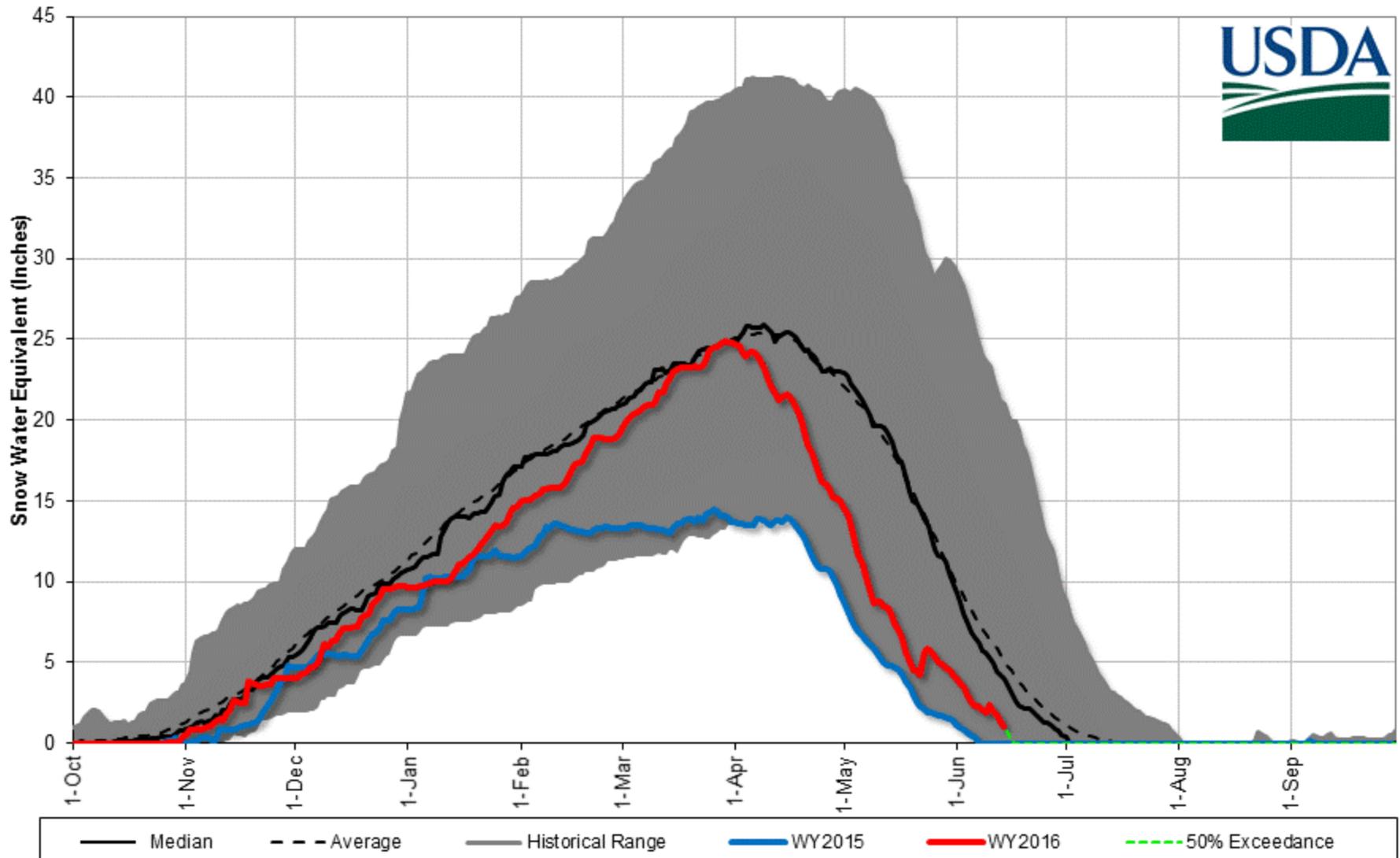
# Snowpack

## Snowpack Percentages June 14<sup>th</sup>, 2016



## Kootenai River Basin Snowpack with Non-Exceedence Projections

*Based on provisional SNOTEL daily data as of 6/14/2016*

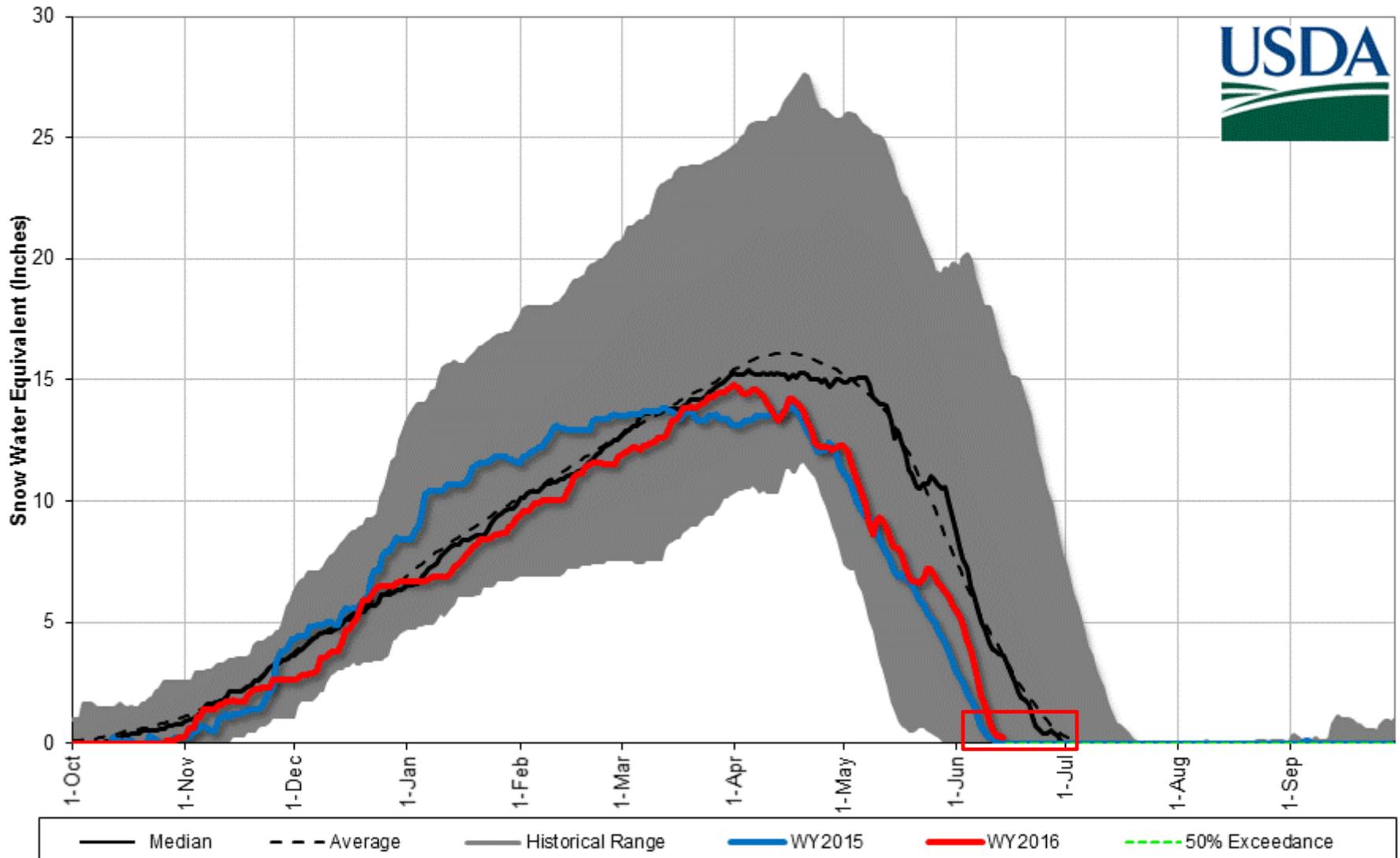


# Montana Snow Survey



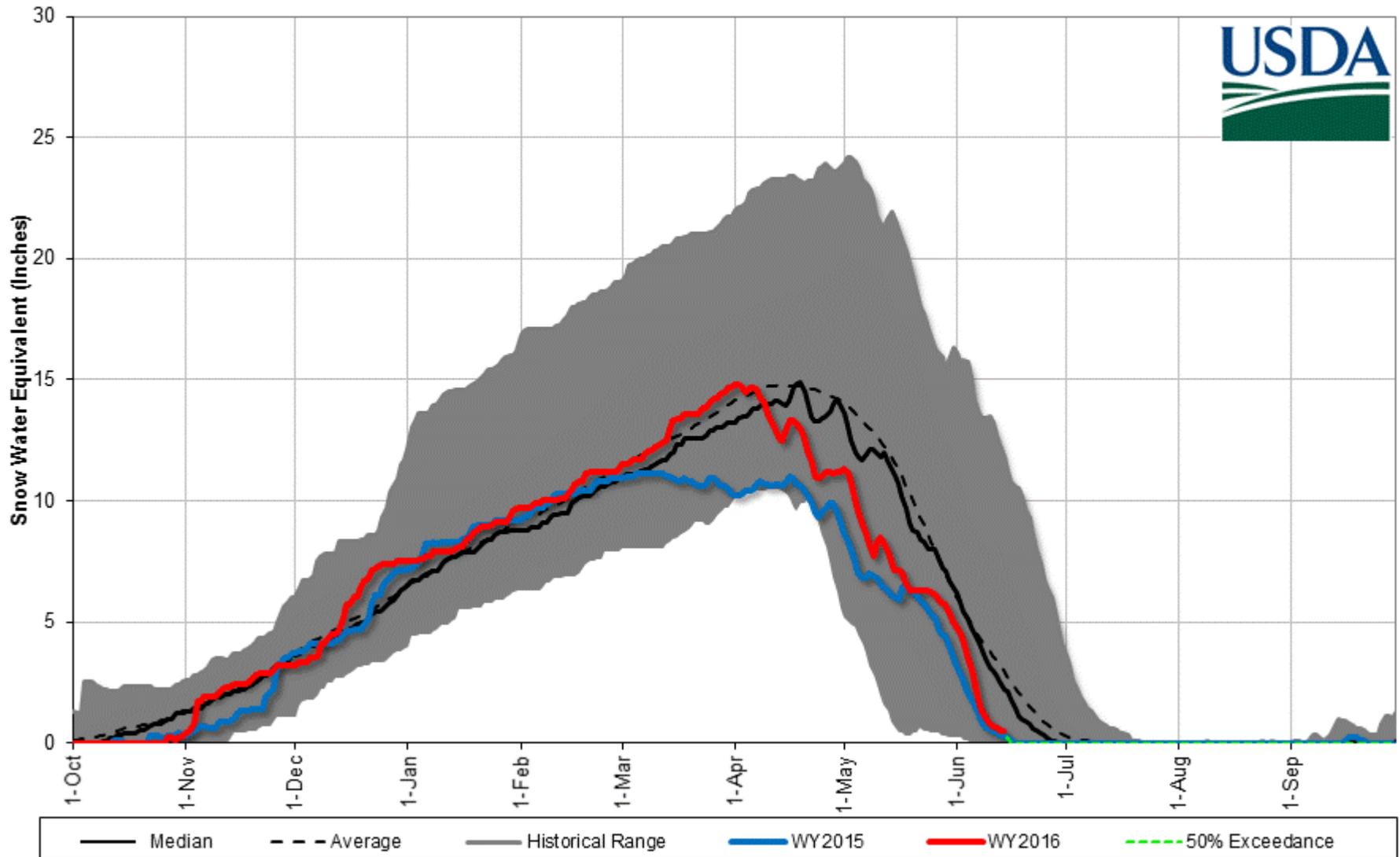
## Upper Clark Fork River Basin Snowpack with Non-Exceedence Projections

*Based on provisional SNOTEL daily data as of 6/14/2016*



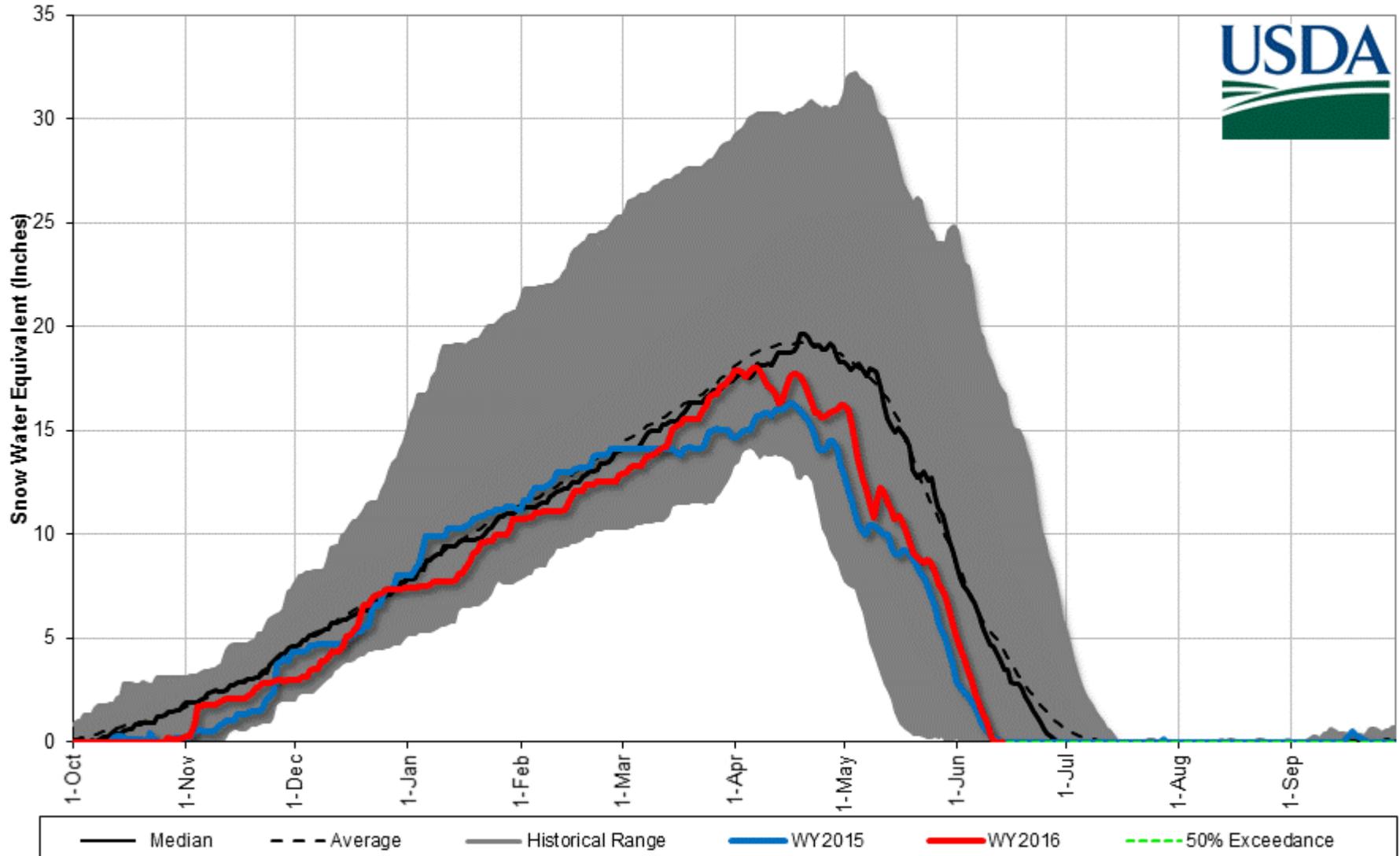
## Jefferson River Basin Snowpack with Non-Exceedence Projections

*Based on provisional SNOTEL daily data as of 6/14/2016*



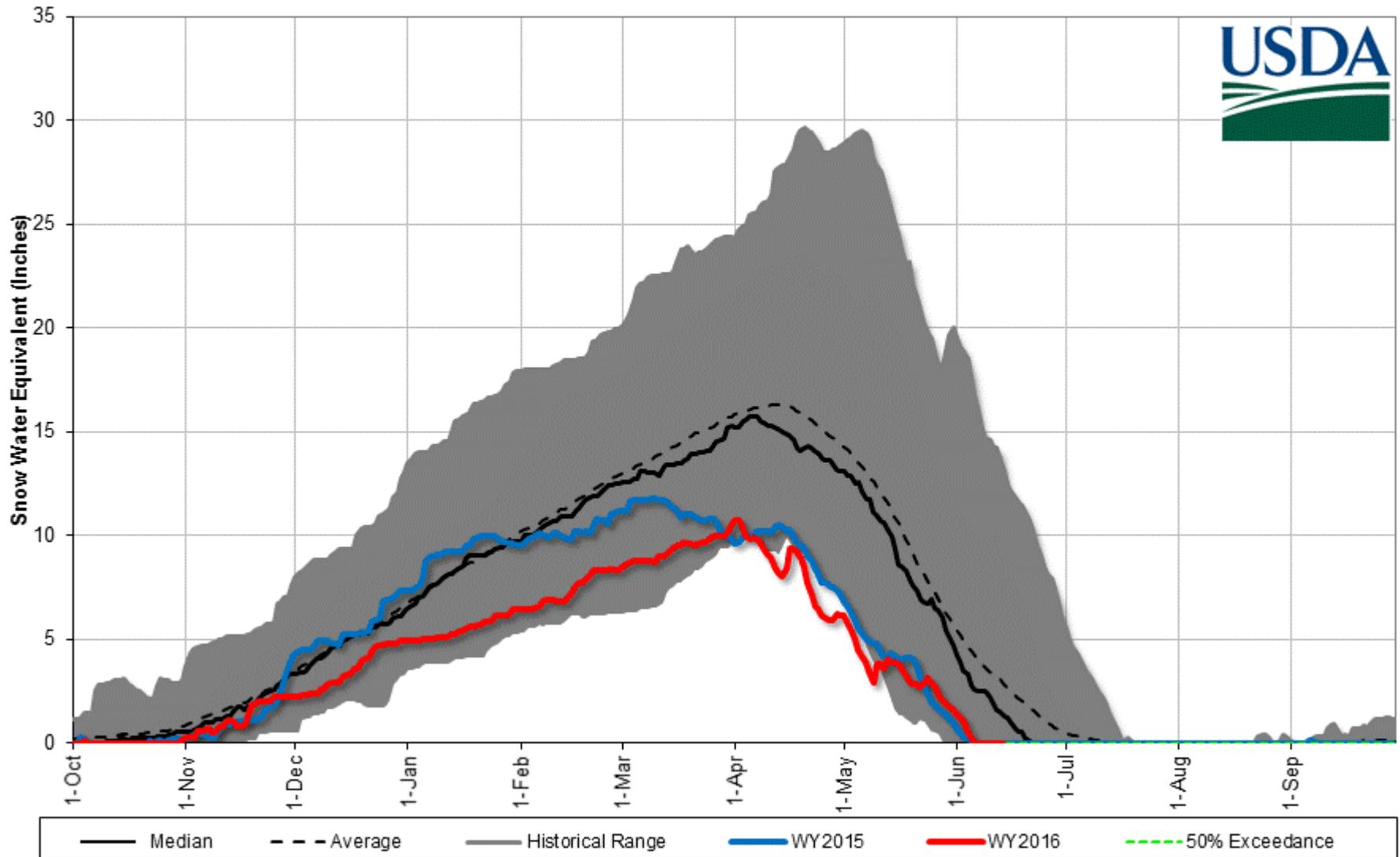
## Gallatin River Basin Snowpack with Non-Exceedence Projections

*Based on provisional SNOTEL daily data as of 6/14/2016*



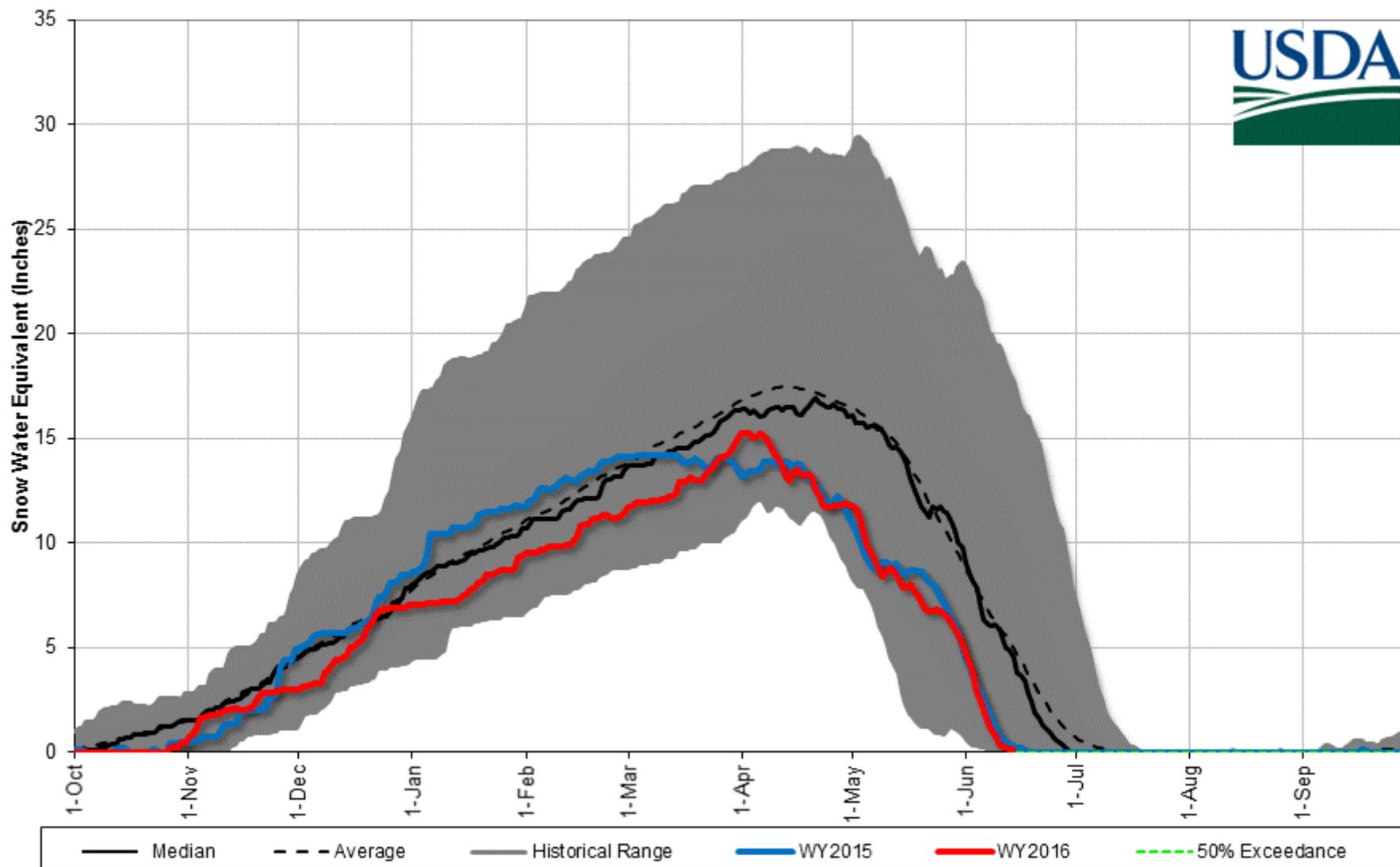
## Sun-Teton-Marias River Basin Snowpack with Non-Exceedence Projections

*Based on provisional SNOTEL daily data as of 6/14/2016*

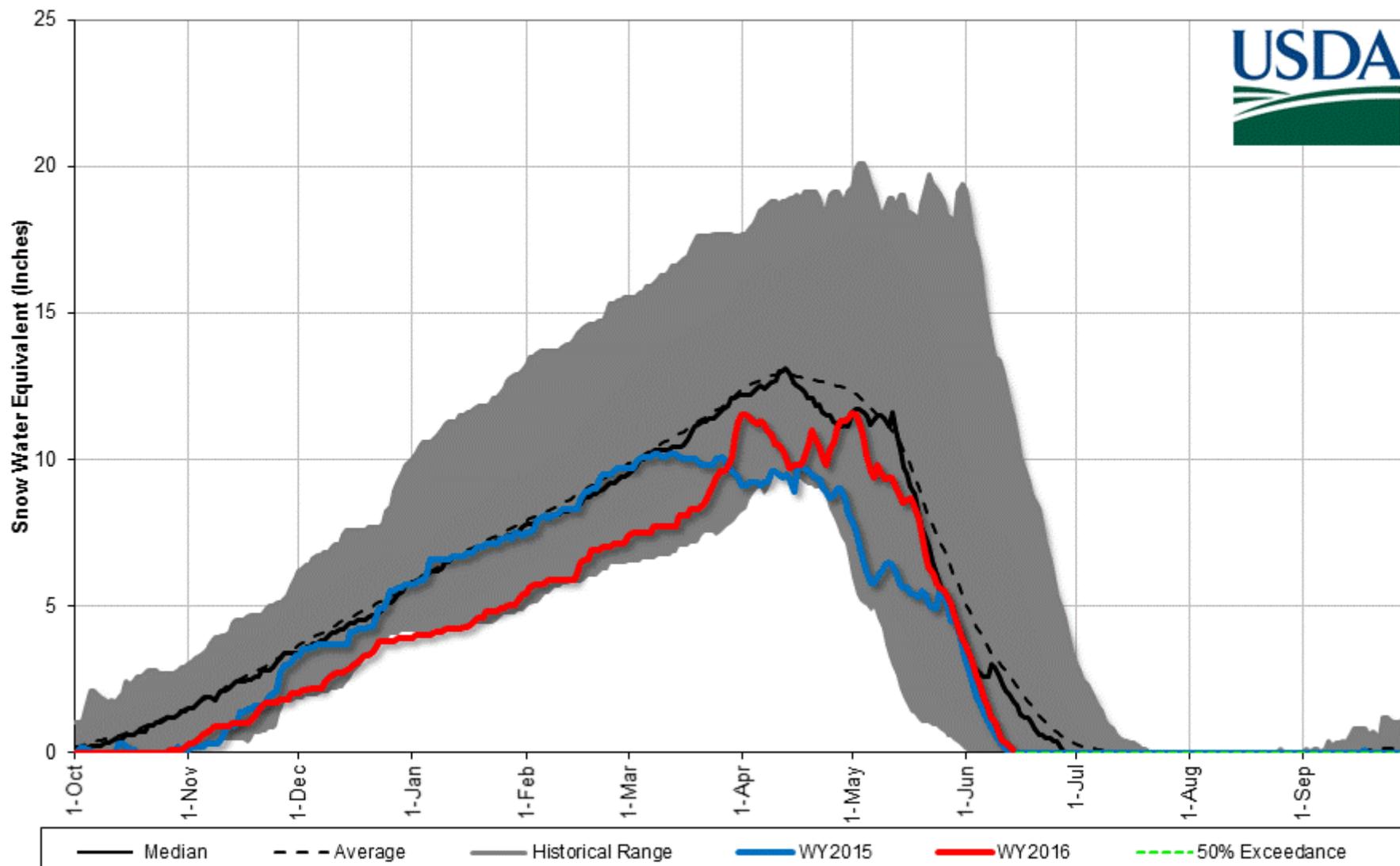


## Upper Yellowstone River Basin Snowpack with Non-Exceedence Projections

*Based on provisional SNOTEL daily data as of 6/14/2016*



**Lower Yellowstone River Basin Snowpack with Non-Exceedence Projections**  
*Based on provisional SNOTEL daily data as of 6/14/2016*



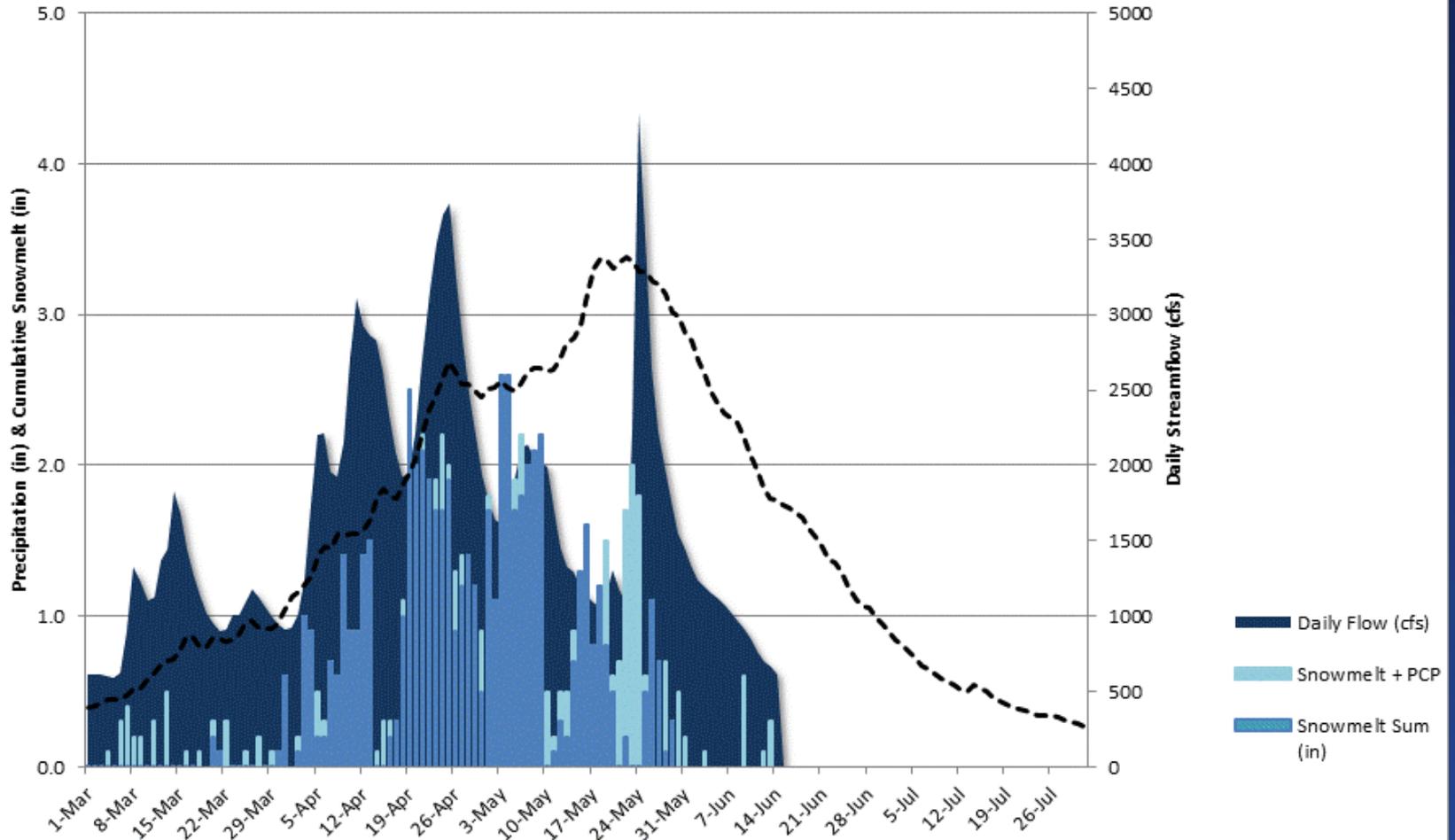
## Streamflows & Snowmelt



## Cumulative Melt and Precipitation

Yaak R nr Troy

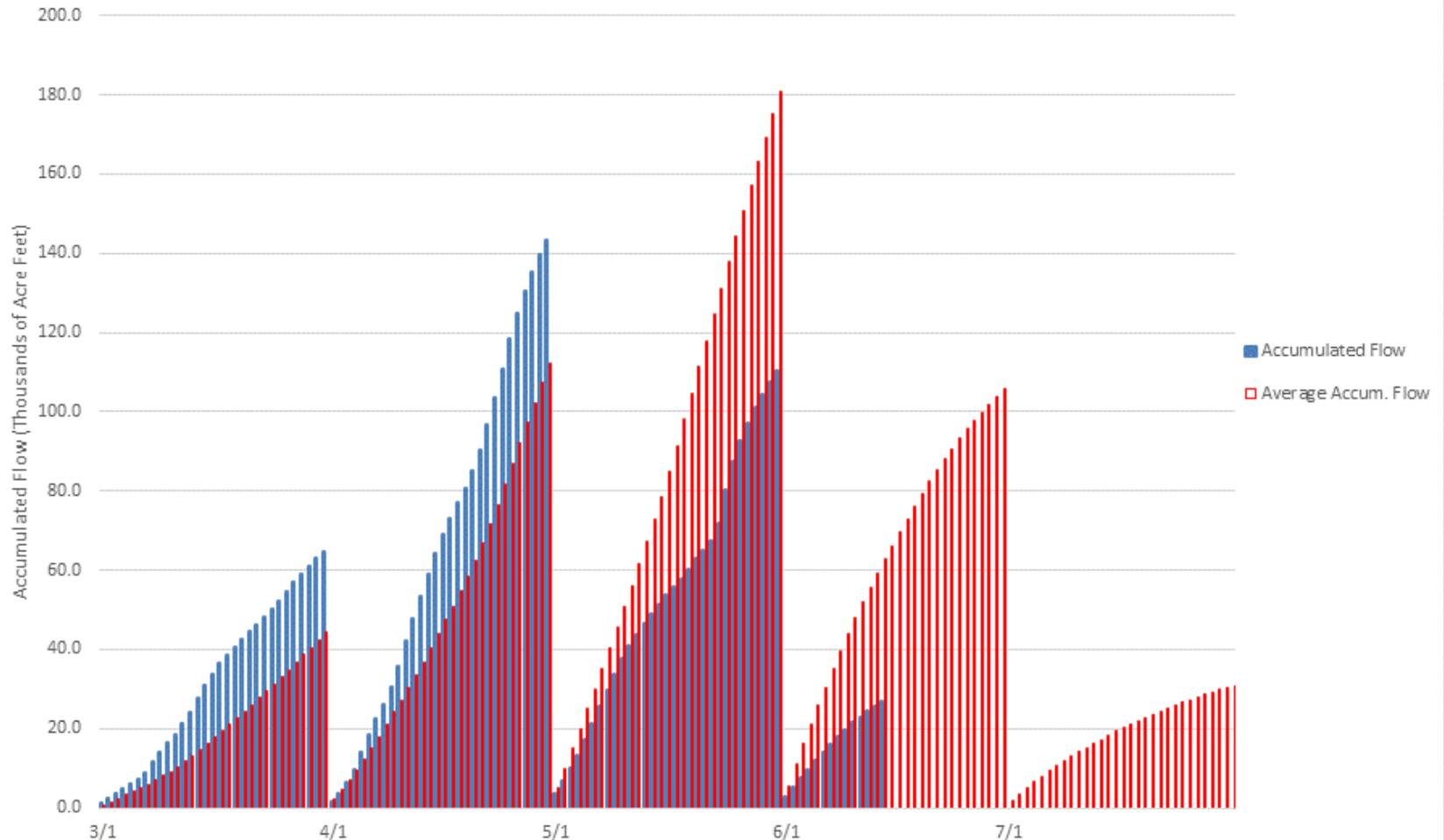
6/14/2016





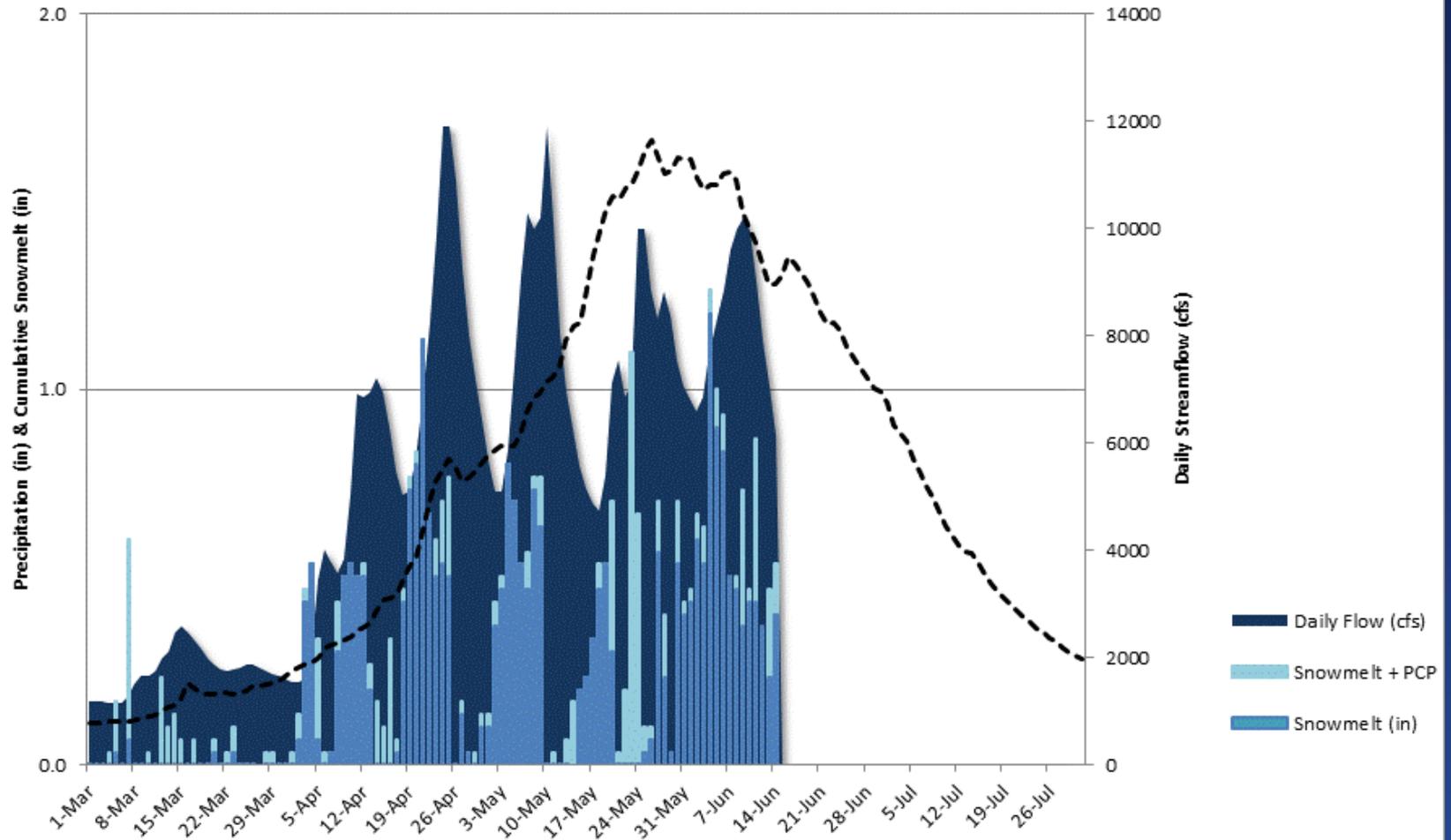
## Yaak R nr Troy

Monthly Accumulated Flows (Thousands of Acre Feet) vs Average  
6/14/2016



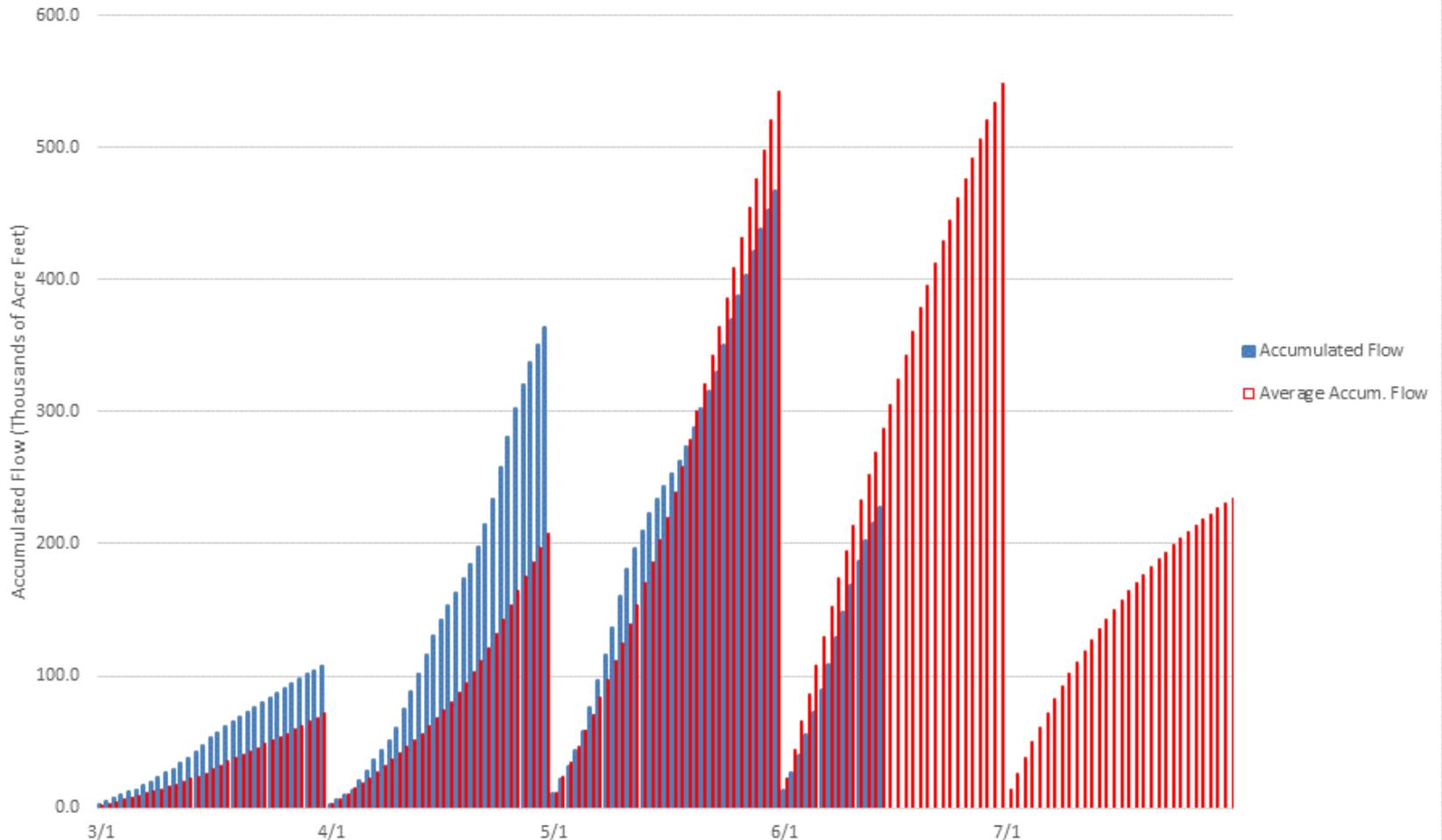


## Cumulative Melt and Precipitation MF Flathead R nr West Glacier 6/14/2016



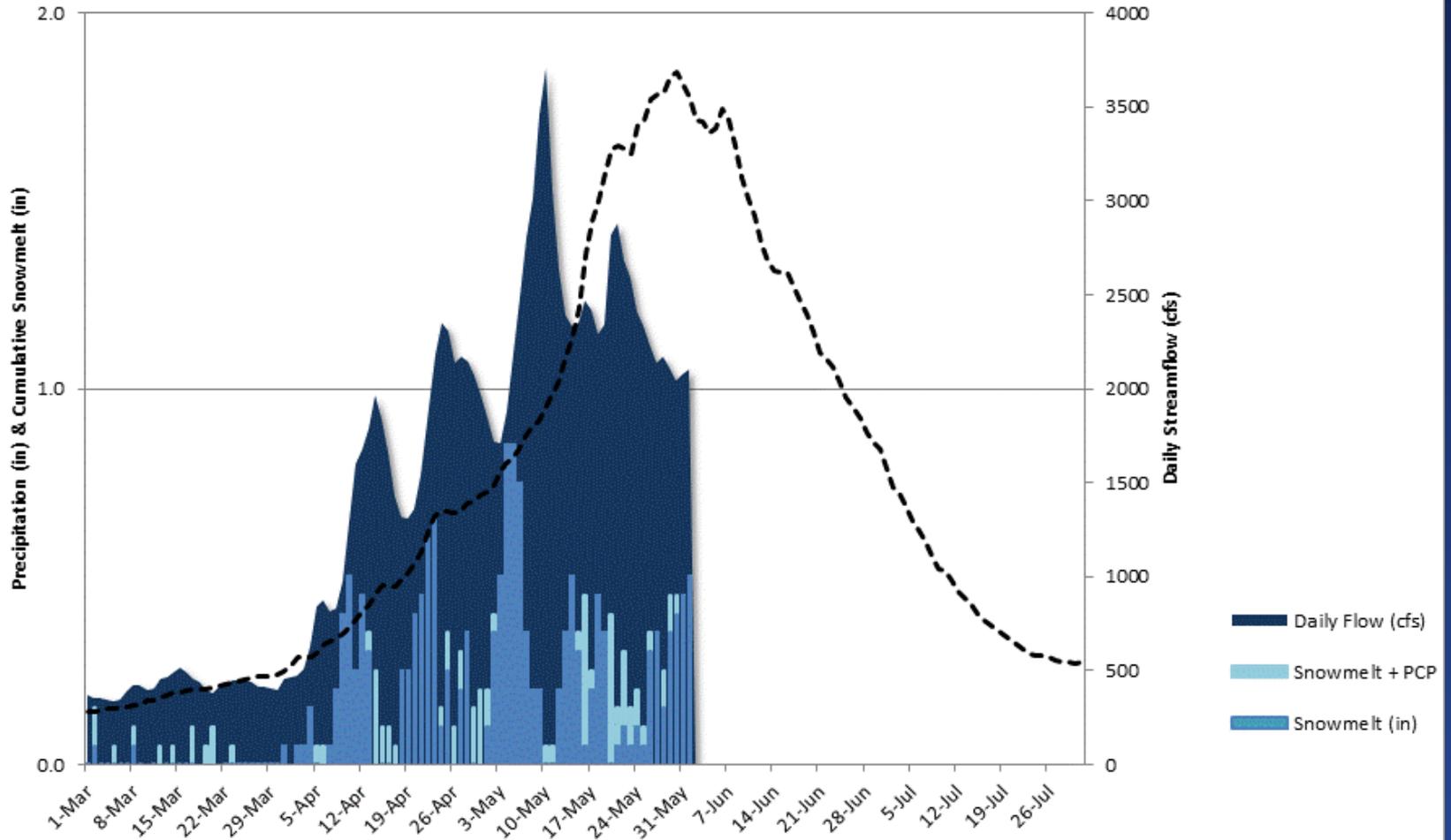


**MF Flathead R nr West Glacier**  
Monthly Accumulated Flows (Thousands of Acre Feet) vs Average  
6/14/2016



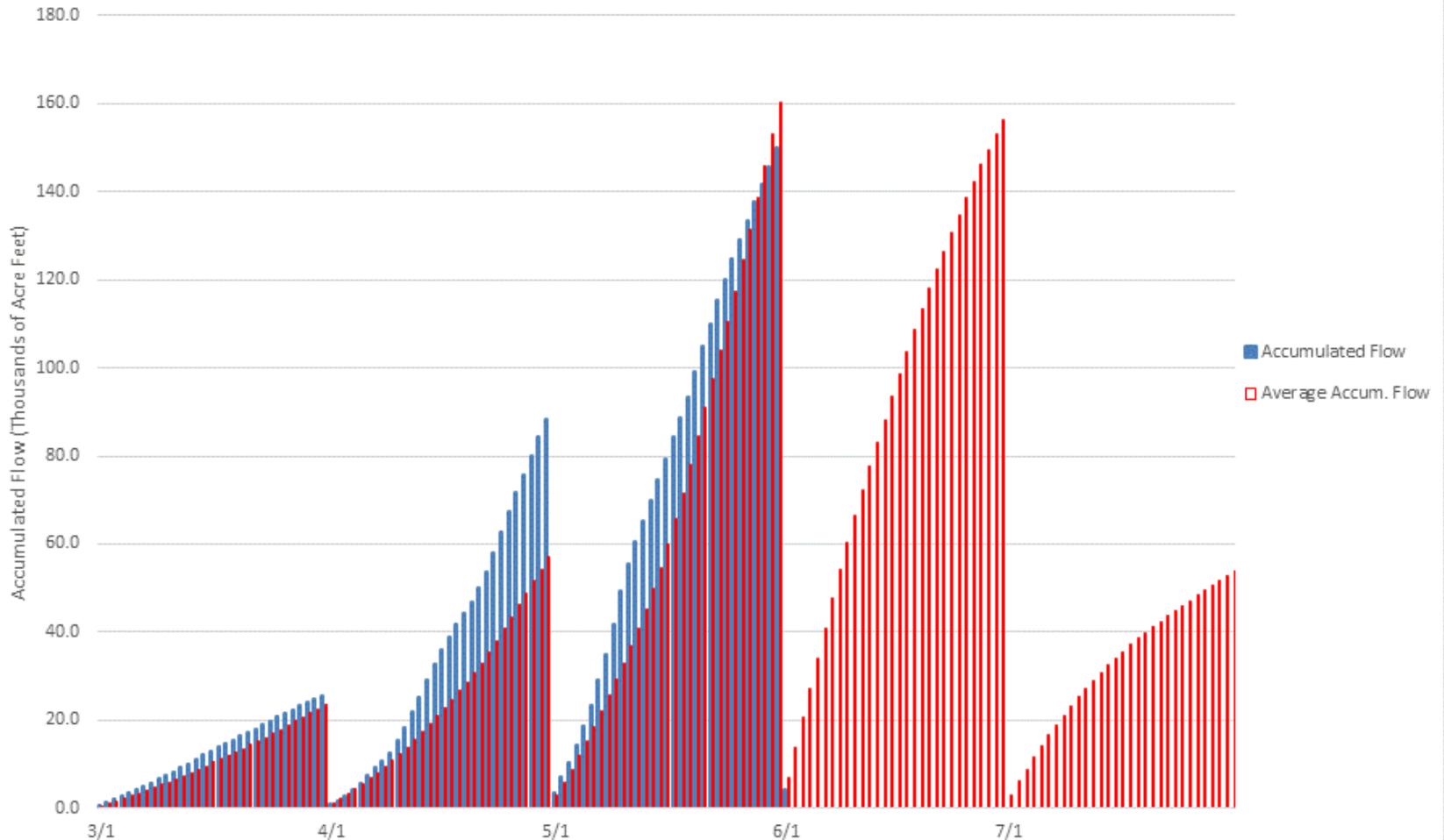


## Cumulative Melt and Precipitation Bitterroot R Nr Darby 6/1/2016





**Bitterroot R Nr Darby**  
Monthly Accumulated Flows (Thousands of Acre Feet) vs Average  
6/1/2016

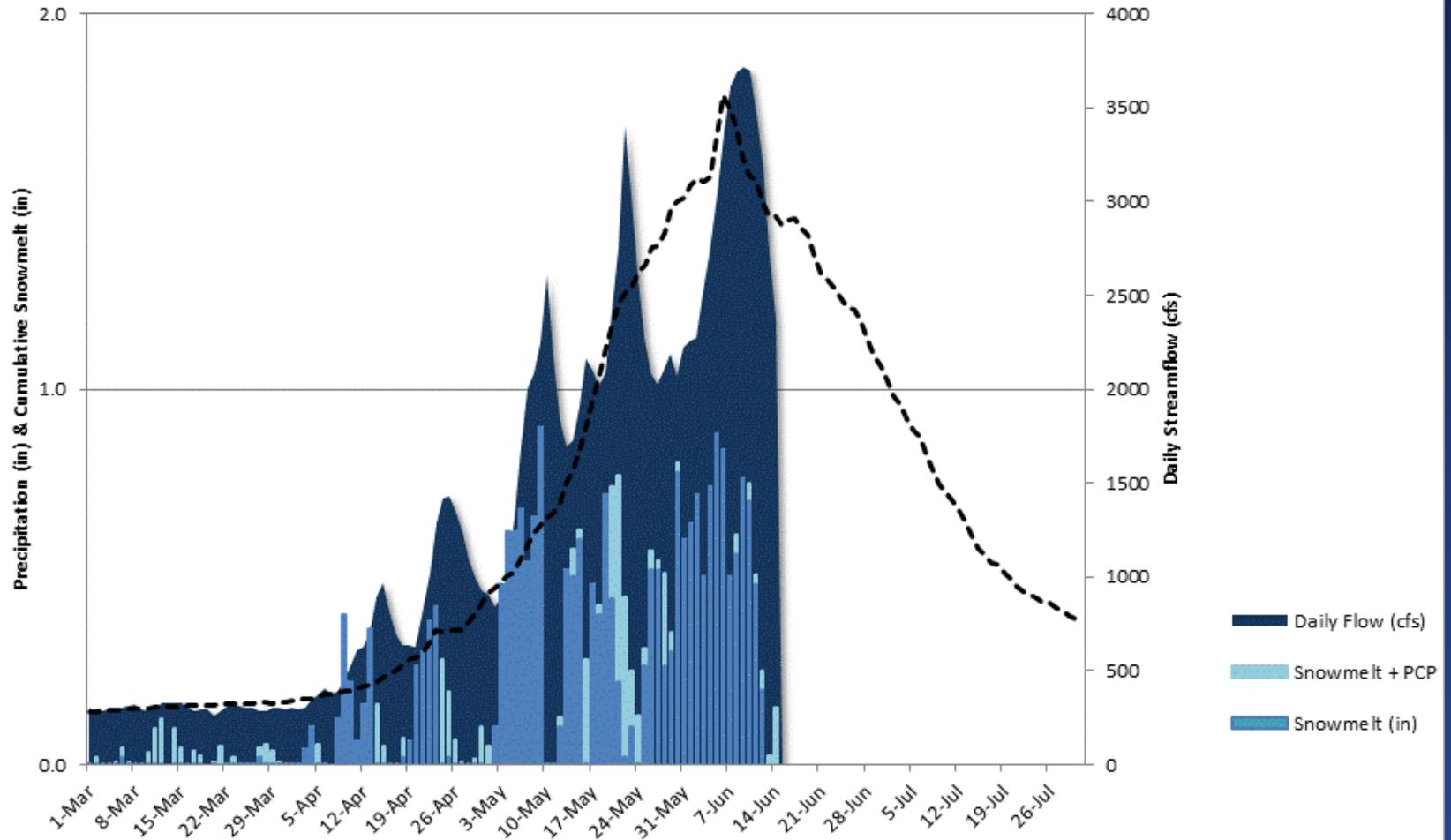




## Cumulative Melt and Precipitation

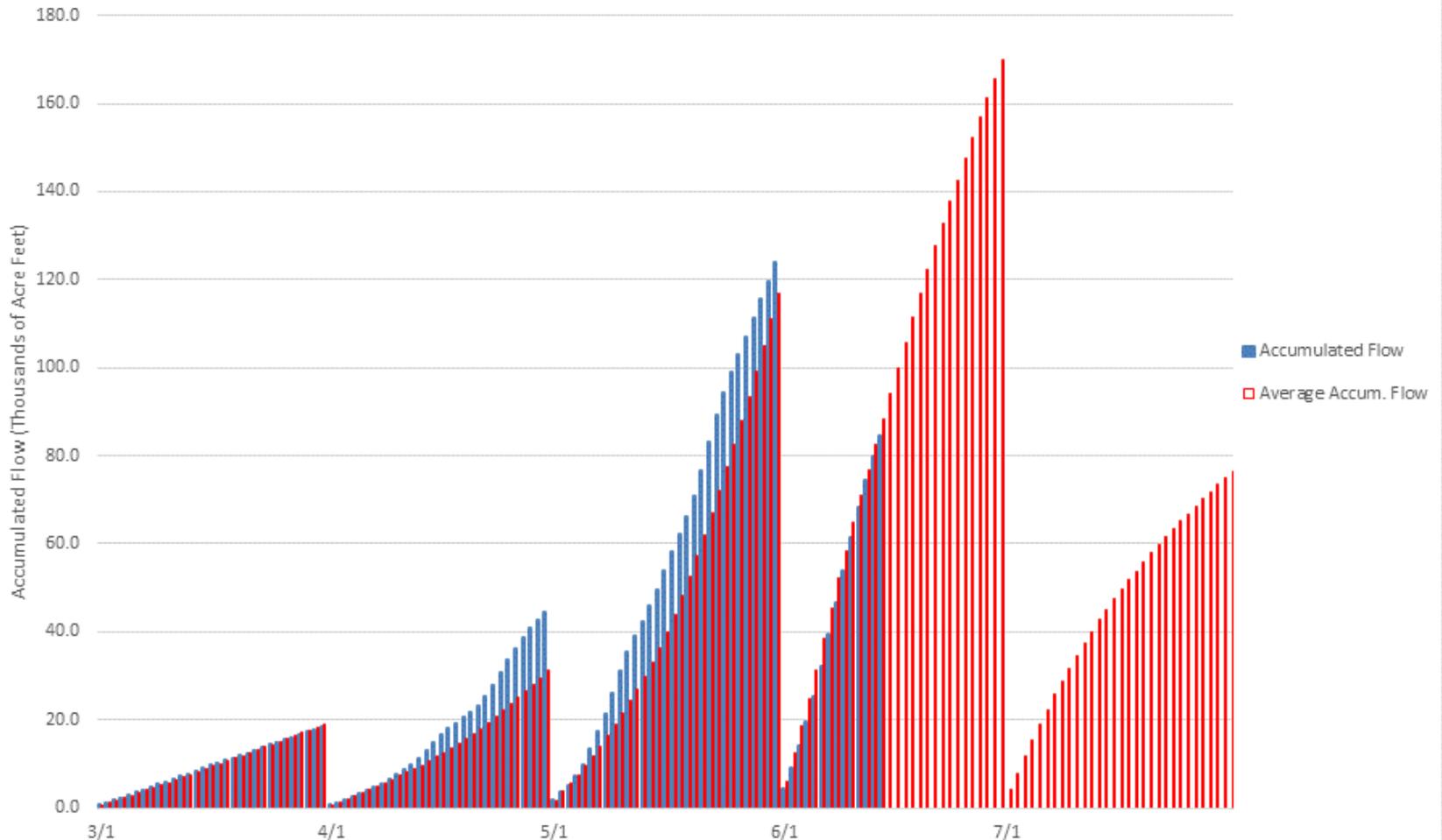
Gallatin R nr Gateway

6/14/2016





**Gallatin R nr Gateway**  
Monthly Accumulated Flows (Thousands of Acre Feet) vs Average  
6/14/2016

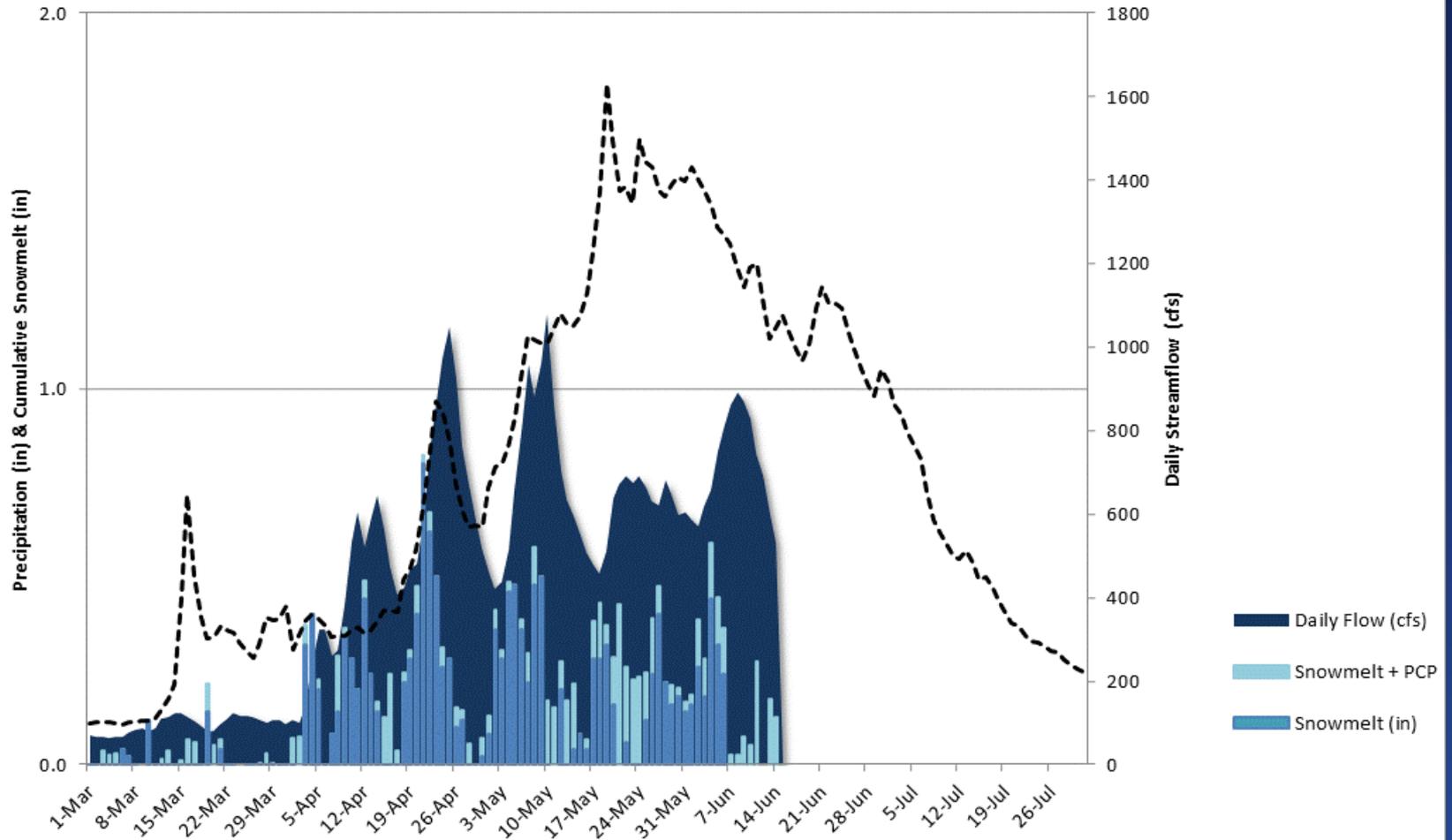




## Cumulative Melt and Precipitation

NF SUN R NR AUGUSTA

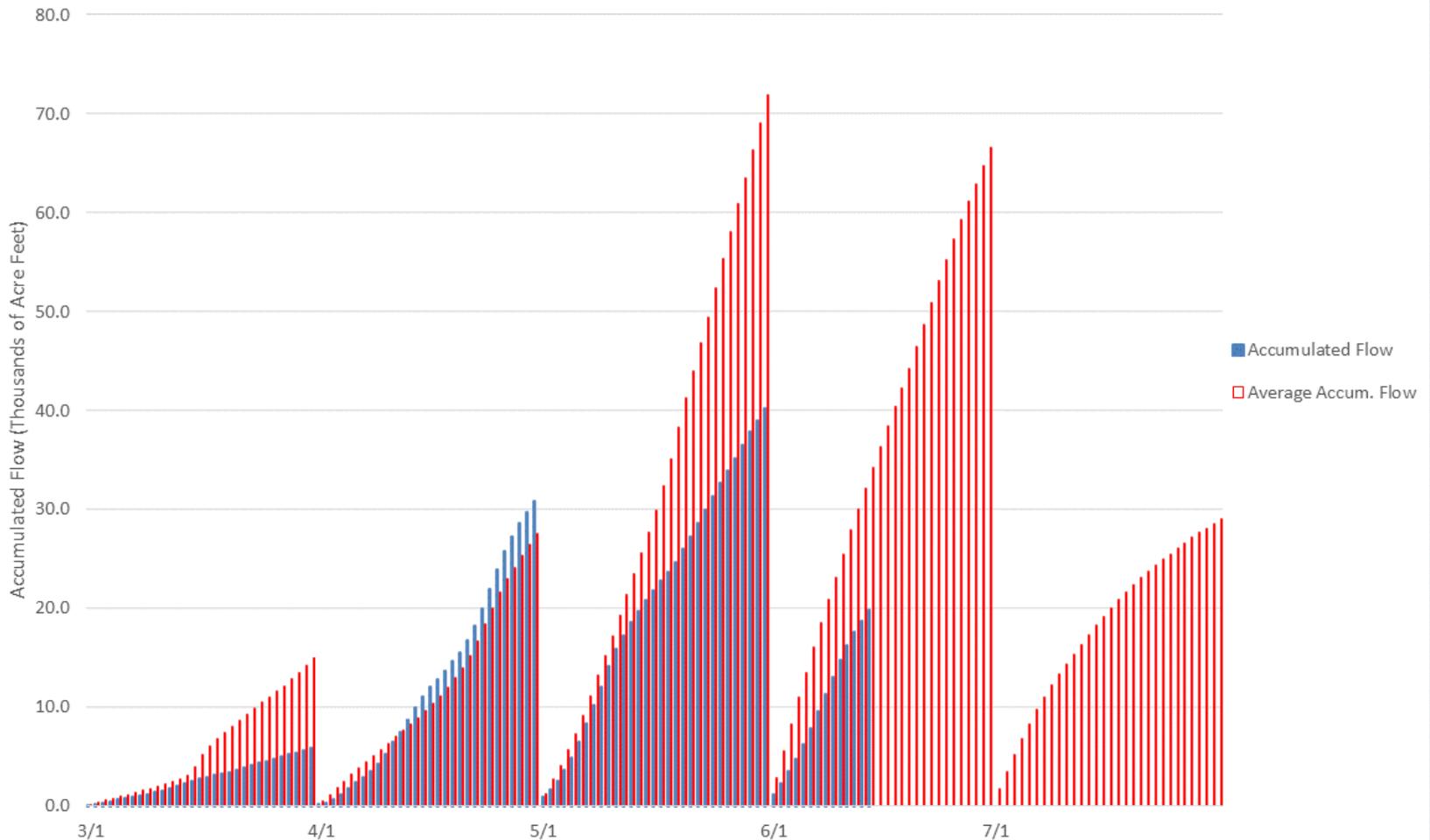
6/14/2016



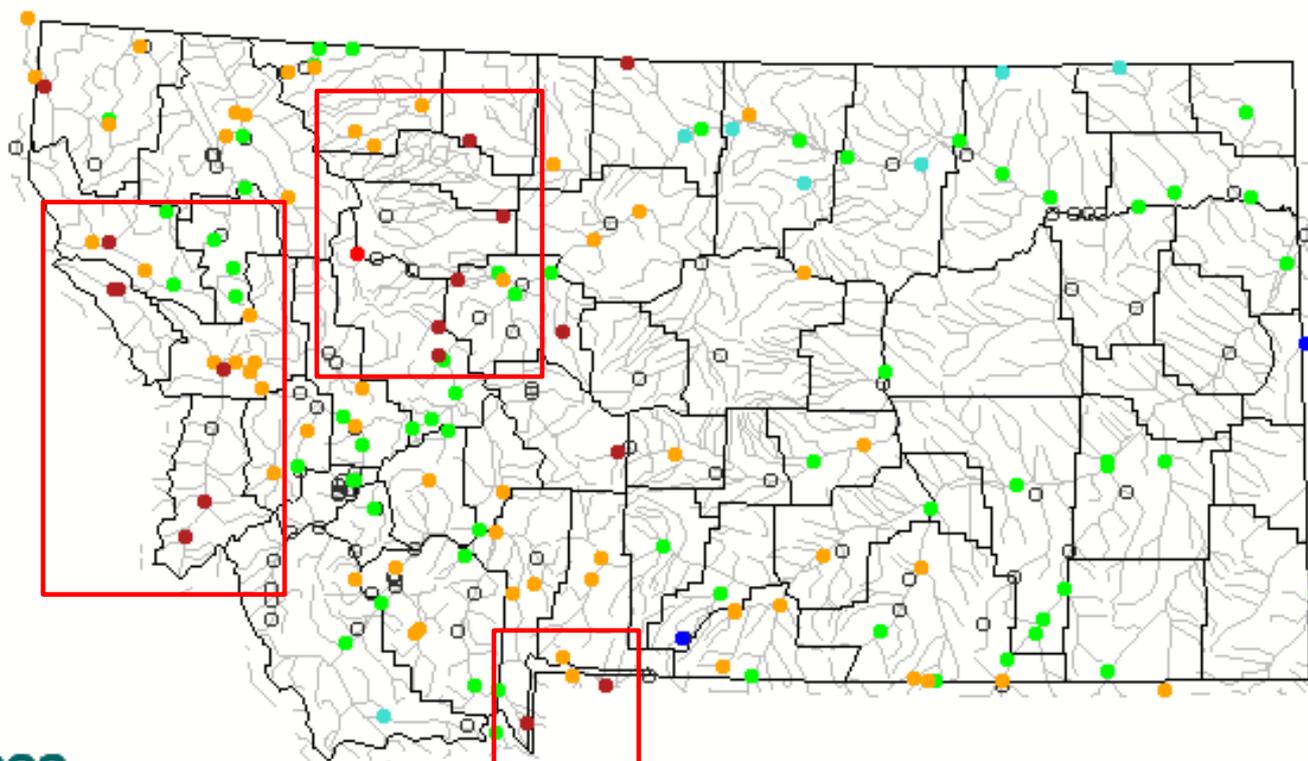


## NF SUN R NR AUGUSTA

Monthly Accumulated Flows (Thousands of Acre Feet) vs Average  
6/14/2016



Wednesday, June 15, 2016 12:30ET



Explanation - Percentile classes

Low	<10	10-24	25-75	76-90	>90	High	Not-ranked
	Much below normal	Below normal	Normal	Above normal	Much above normal		

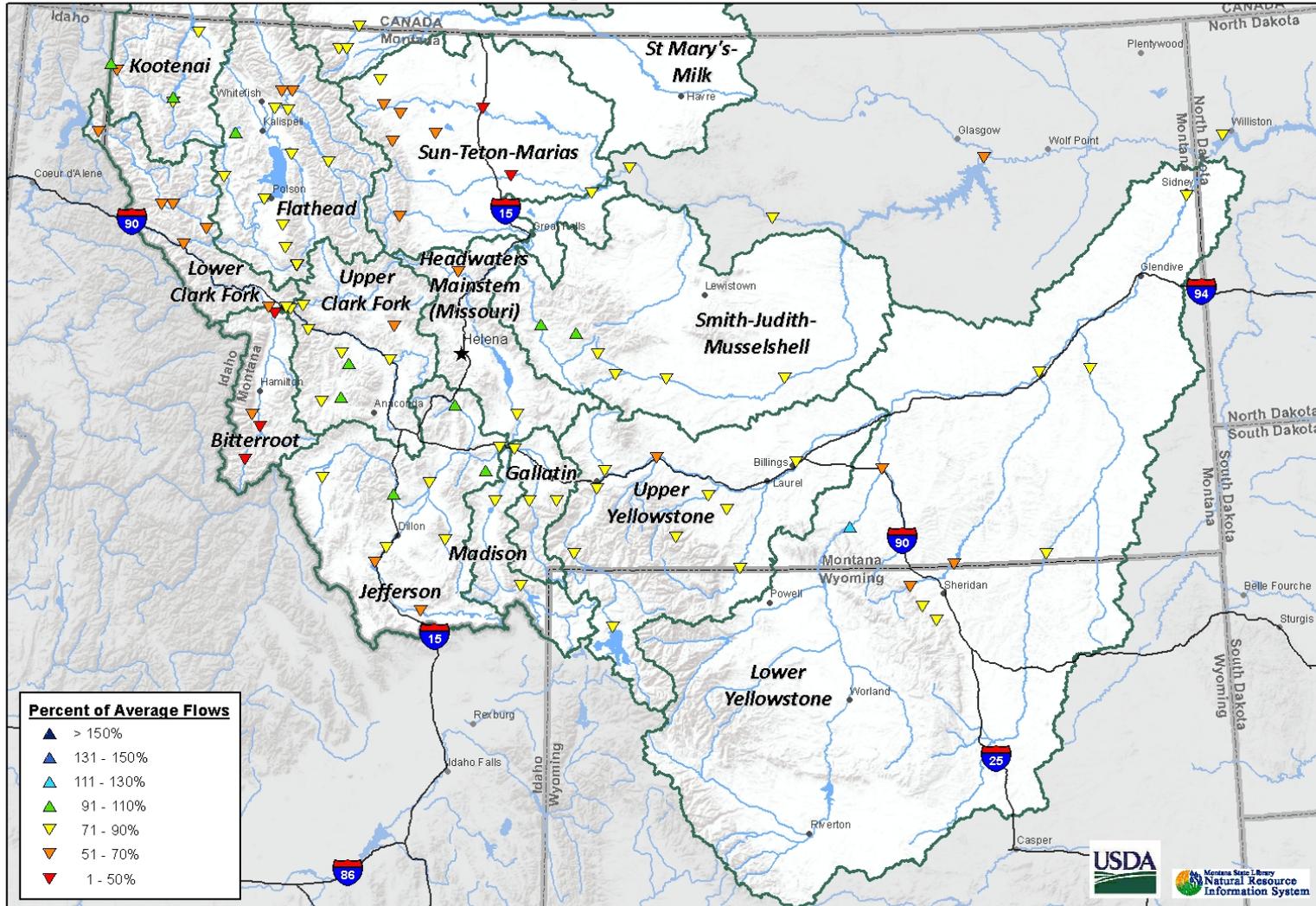
## Water Supply

## *JUN-JUL Streamflow Forecasts*

<b>6/1/2016</b>	<i>% Average</i>	<i>% Last Year</i>
<b>Columbia River Basin</b>	<b>70</b>	<b>143</b>
Kootenai in Montana	71	151
Flathead in Montana	70	141
Upper Clark Fork	79	154
Bitterroot	50	96
Lower Clark Fork	68	139
<b>Missouri River Basin</b>	<b>73</b>	<b>116</b>
Jefferson	84	323
Madison	76	128
Gallatin	78	134
Headwaters Mainstem	73	106
Smith-Judith-Musselshell	86	105
Sun-Teton-Marias	54	122
St. Mary-Milk	82	122
<b>Yellowstone River Basin</b>	<b>83</b>	<b>90</b>
Upper Yellowstone	76	103
Lower Yellowstone	88	84
<b>West of Divide</b>	<b>70</b>	<b>143</b>
<b>East of Divide</b>	<b>78</b>	<b>101</b>
<b>Montana State-Wide</b>	<b>74</b>	<b>117</b>

Forecasted values above are basin-wide averages for the 50% exceedance level. For individual forecast points, or forecasts at the 10%,30%,70%,90% levels consult the Water Supply Outlook Report

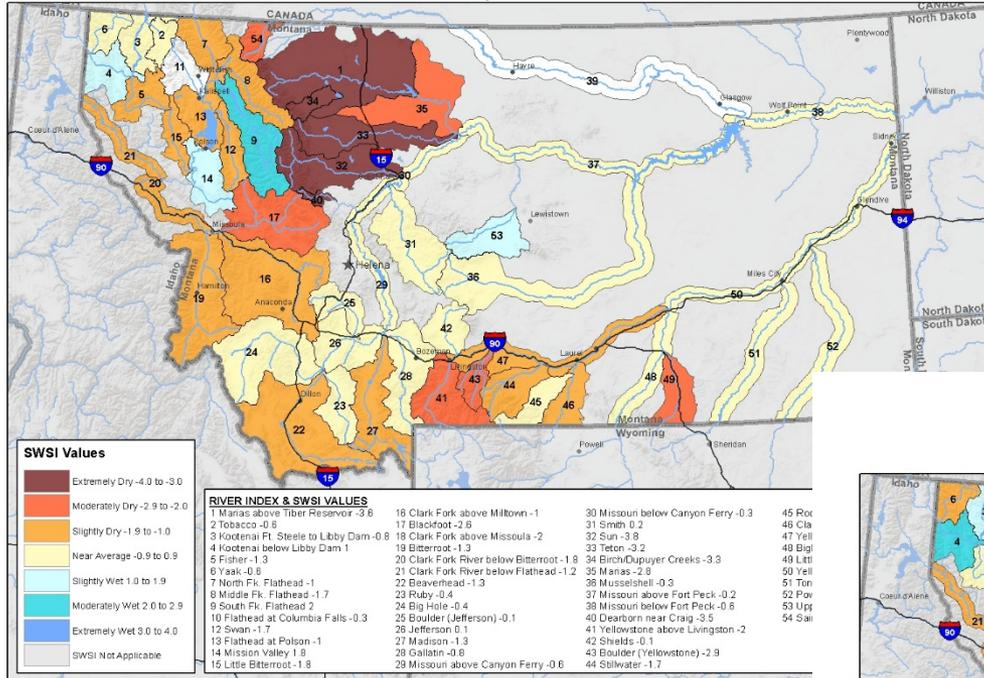
Montana Data Collection Office  
Streamflow Forecast  
Percentage of Normal - June 1, 2016



# Montana Snow Survey



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

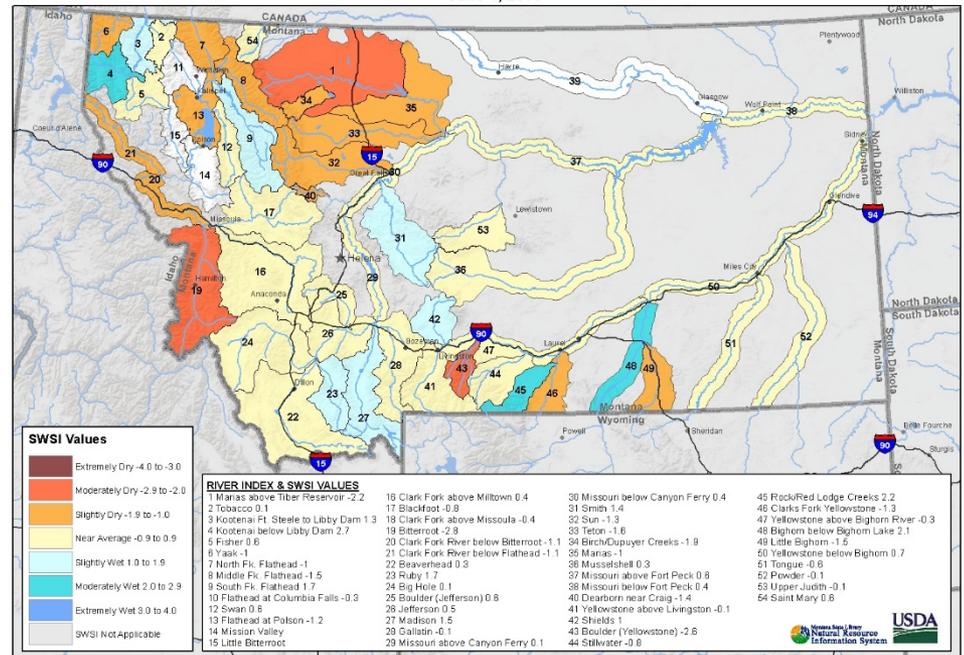


Note: Data used to generate this map are PROVISIONAL and SUBJECT TO CHANGE

May 2016

June 2016

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



Note: Data used to generate this map are PROVISIONAL and SUBJECT TO CHANGE



## Summary

- Water year mountain precipitation continues to be near average in most basins across the state. Since the end of May, precipitation has been well below average. Crop year (April 1<sup>st</sup>- Current) precipitation reflects this lack of precipitation.
- Most water yielding elevations have no snow remaining on June 15<sup>th</sup>. Snowpack melt out dates at SNOTEL sites were 2 to 4 weeks earlier than normal
- River and streams have seen their seasonal snowmelt driven peaks as of June 15<sup>th</sup>. High elevation driven streams in southern MT peaked during the first week of June, other basins peaked during the first or second week of May.
- A substantial portion of this year's snow water moved through the rivers and streams early. This will reduce the volumes from this point forward and likely result in advanced stream recession rates.
- As a result, streamflow forecasts have dropped state-wide for the June 1<sup>st</sup> – September 30<sup>th</sup> time period.

# RECLAMATION

*Managing Water in the West*

## River and Reservoir

## Status Briefing

### RESERVOIR AND RIVER OPERATIONS

Montana Area Office

Billings

June 16, 2016



U.S. Department of the Interior  
Bureau of Reclamation

# Color Code Criteria

## Green

- Full irrigation water supply
  - Near or at full pool
  - River flows at or above desired levels
- 

## Yellow

- Minor irrigation shortages
  - Between 60% - 90% full pool
  - River flows just below desired levels
- 

## Red

- Severe irrigation shortages
- Lower than 60% of full pool present
- River flows at minimums and/or flooding occurring

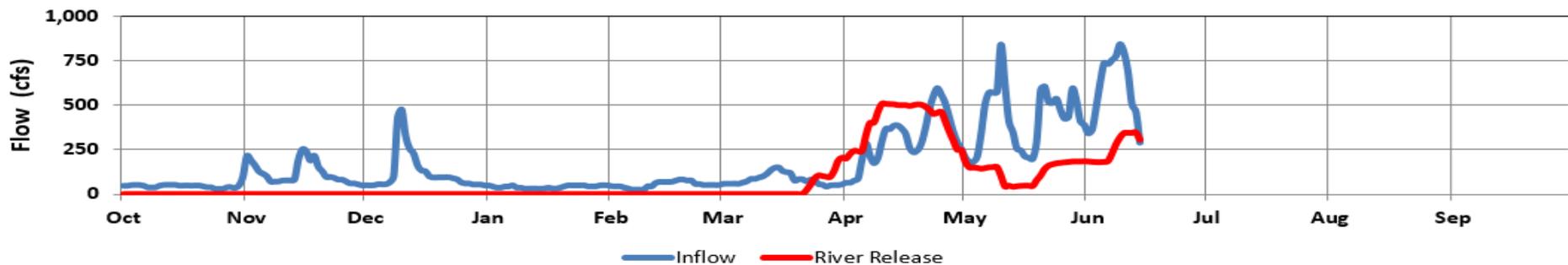
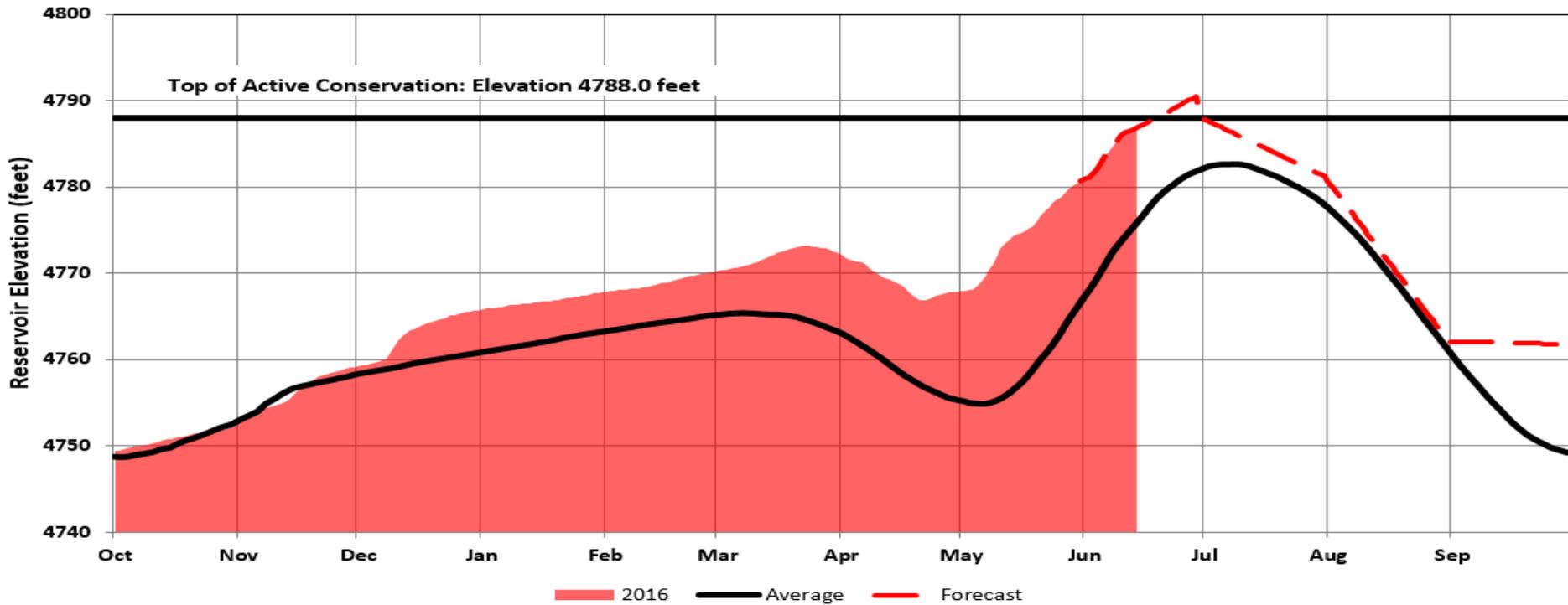


Reclamation: Montana Area Office  
Reservoir Storage Status : June 12, 2016



Map Prepared By:  
State of Montana  
Dept. Natural Resources & Conservation  
Water Resources Division - GIS  
September 2013

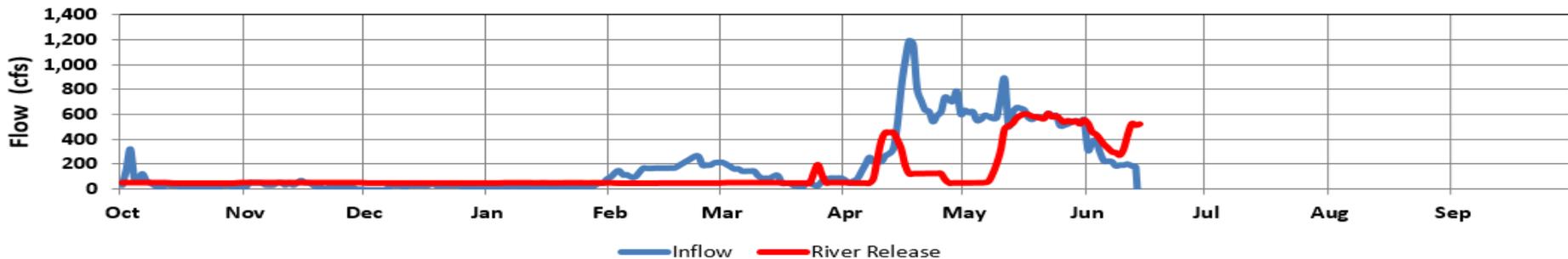
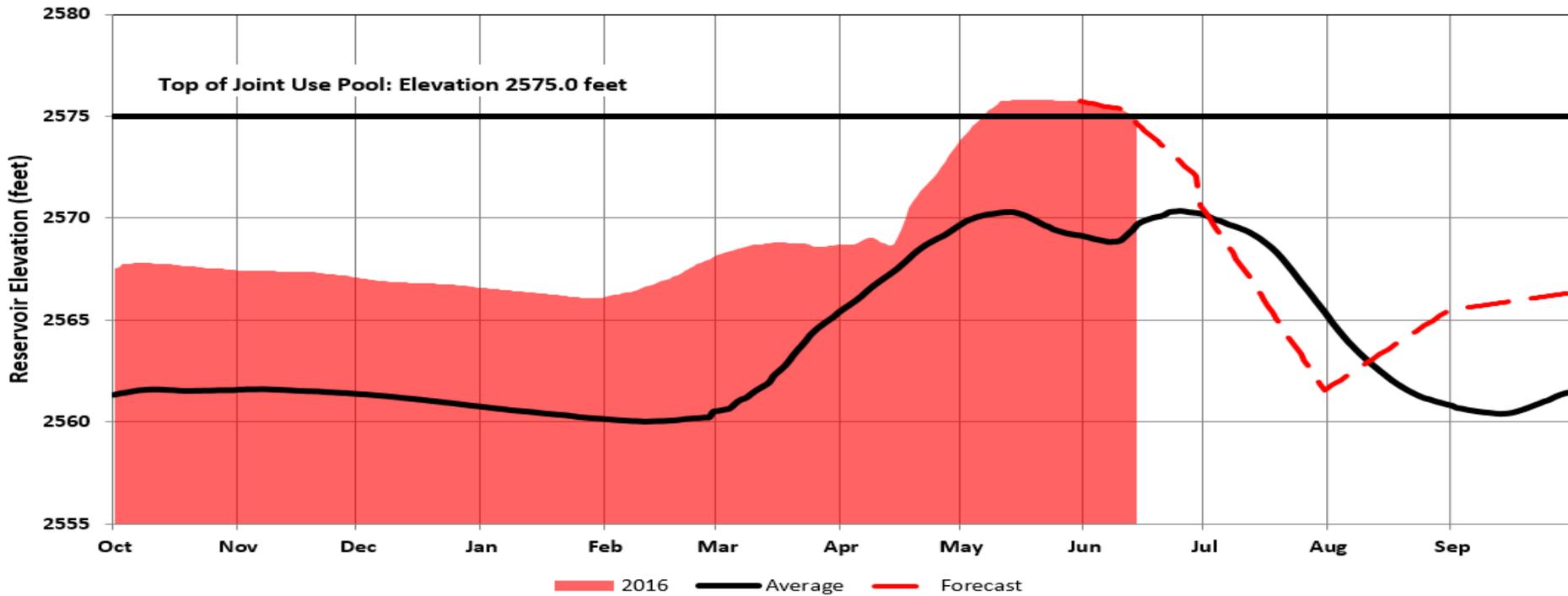
# Lake Sherburne Operations



96% of full pool  
Majority of snow melt gone  
Nelson safety of dams modification project

RECLAMATION

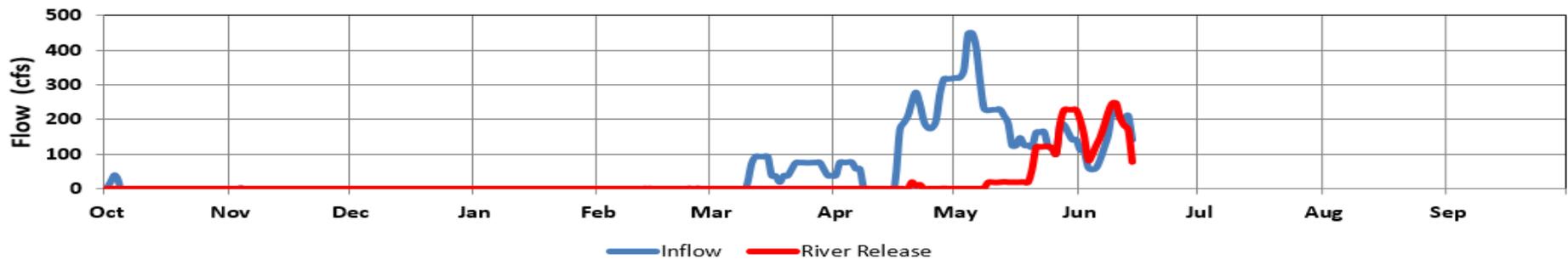
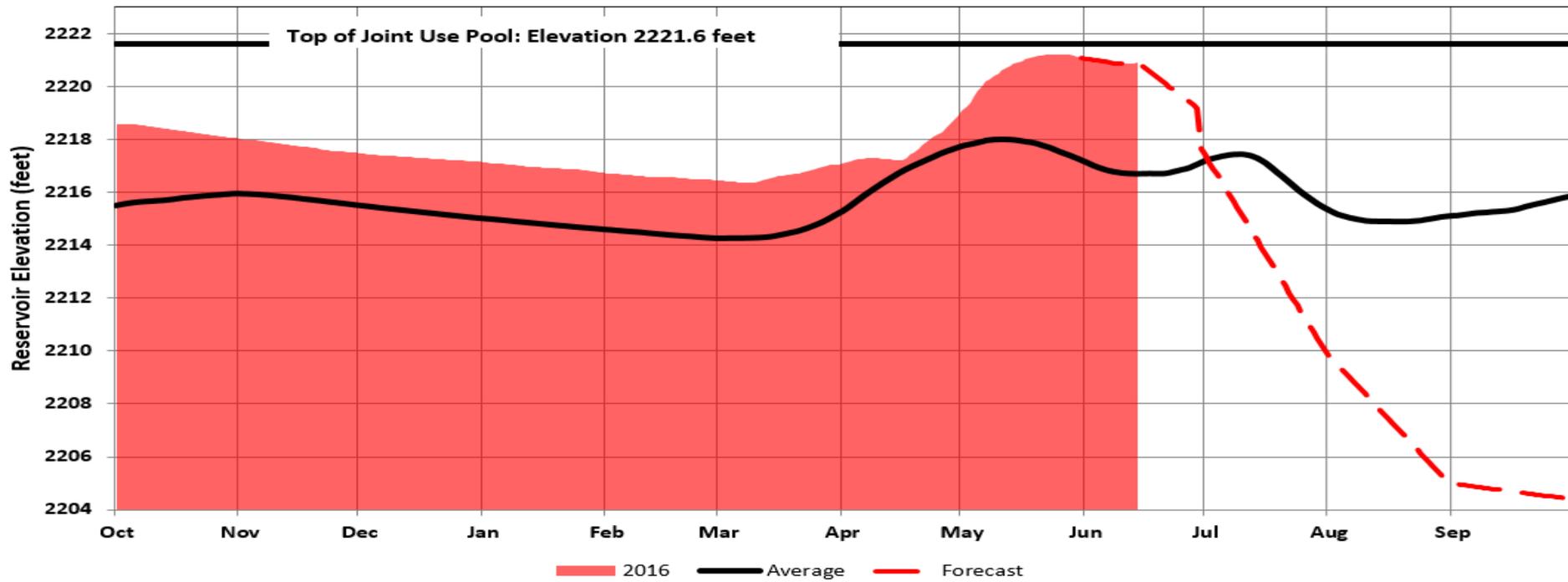
# Fresno Reservoir Operations



100% of full pool  
Majority of snow melt gone  
Nelson safety of dams modification project

RECLAMATION

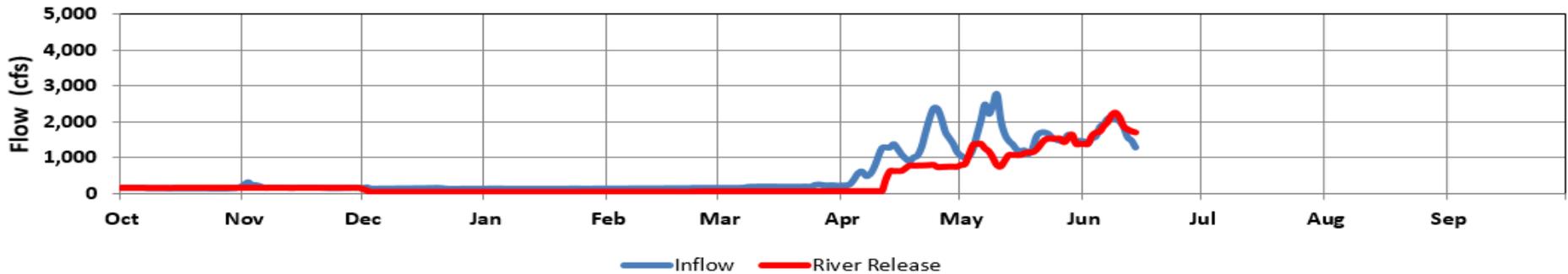
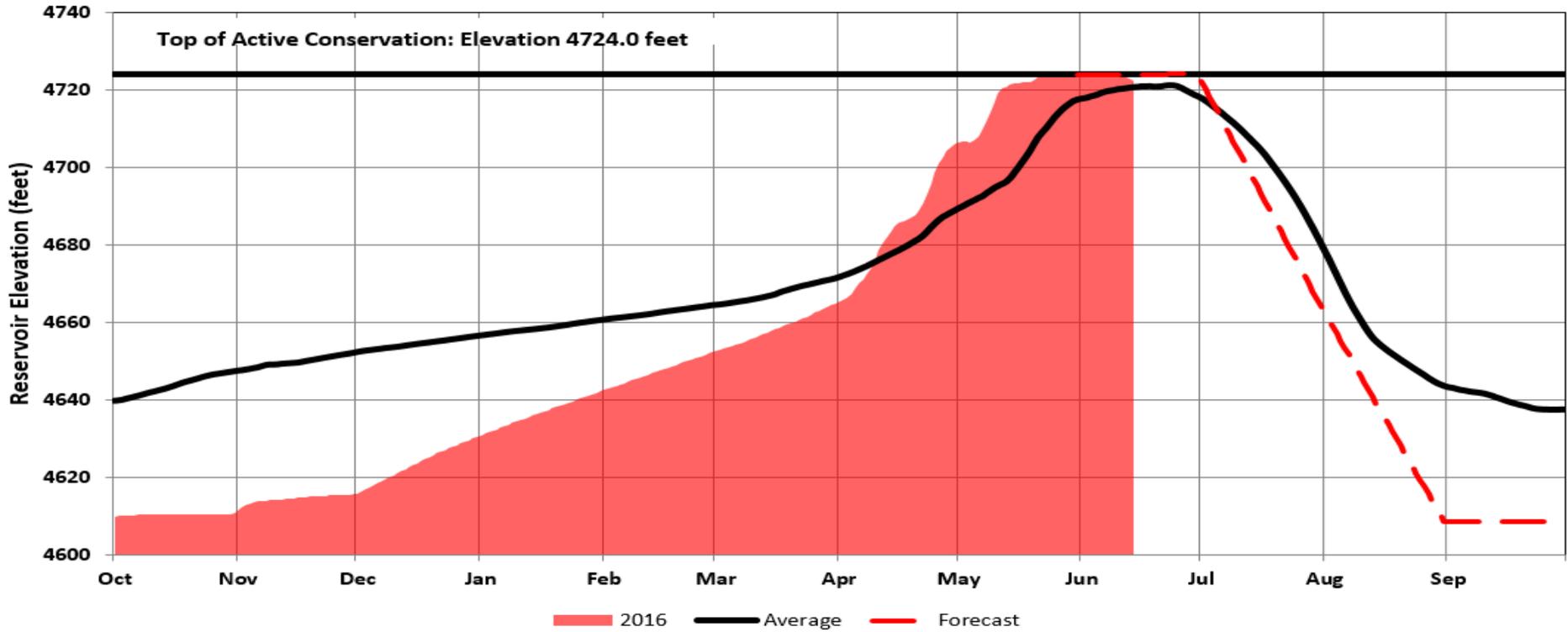
# Nelson Reservoir Operations



96% of full pool  
Majority of snow melt gone  
Shortage of irrigation water supply  
Construction in the fall

RECLAMATION

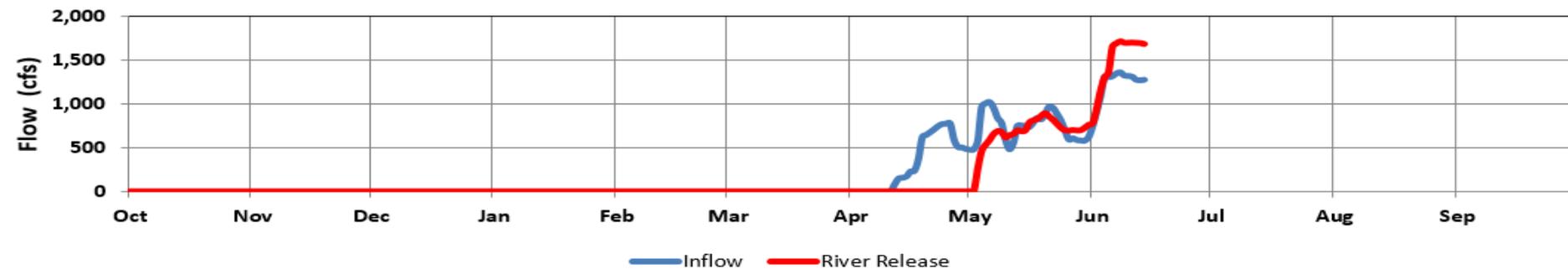
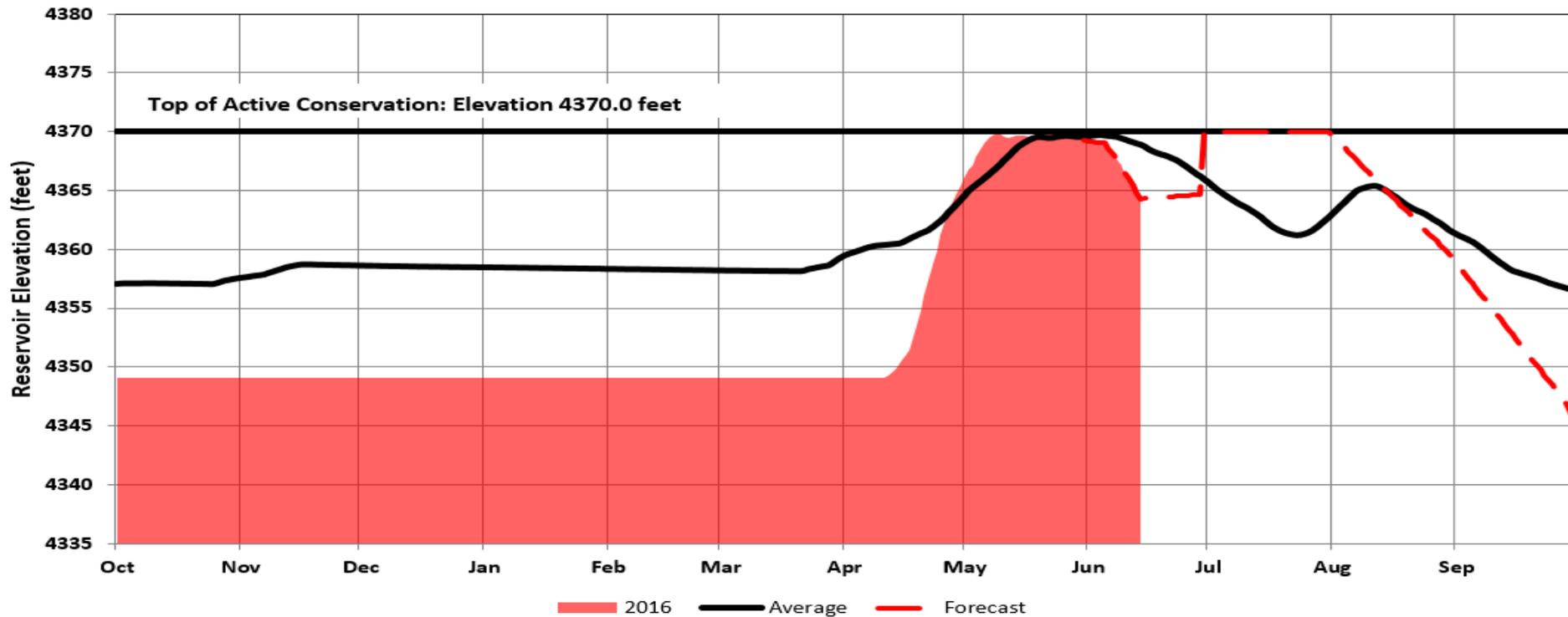
# Gibson Reservoir Operations



98% of full pool  
Possible shortage of irrigation water supply

# RECLAMATION

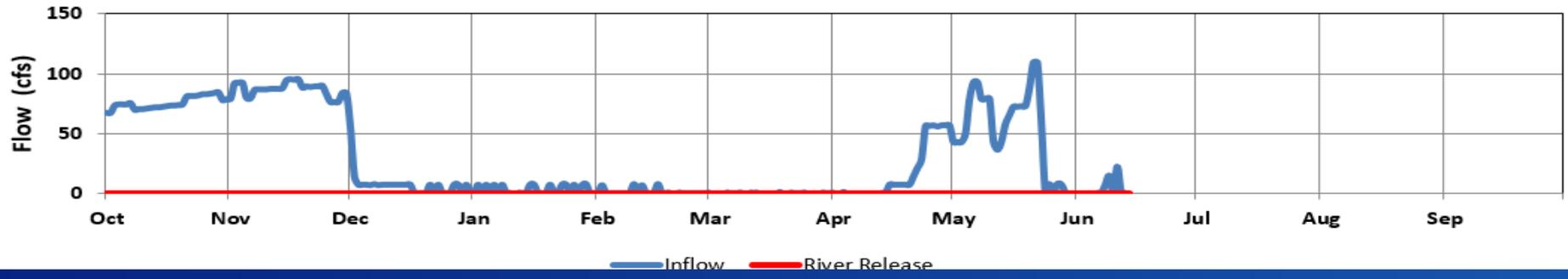
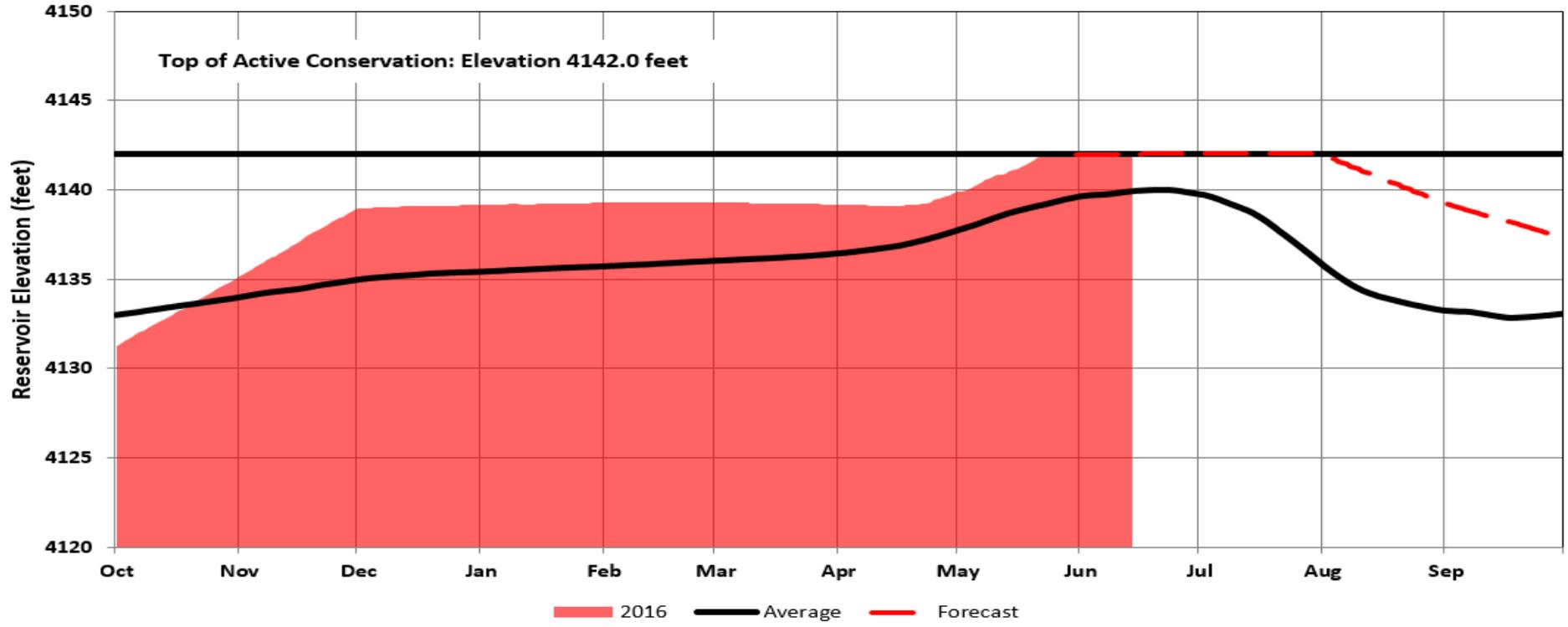
# Pishkun Reservoir Operations



82% of full pool  
Shortage of irrigation water supply

# RECLAMATION

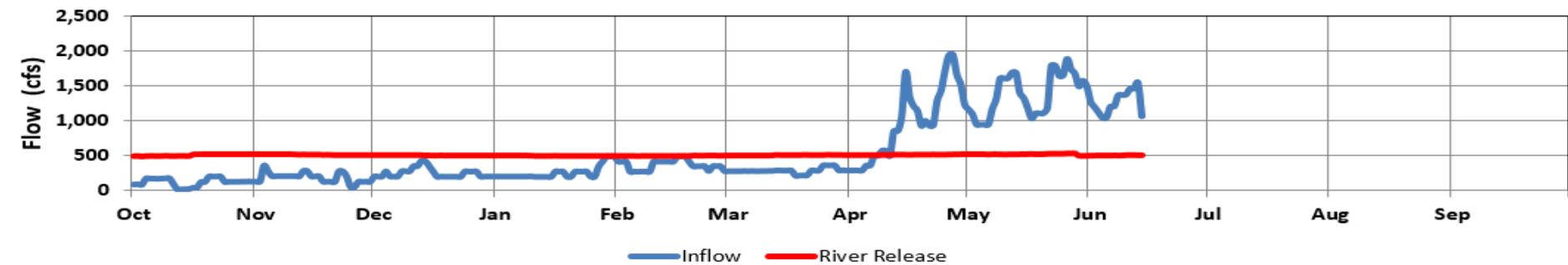
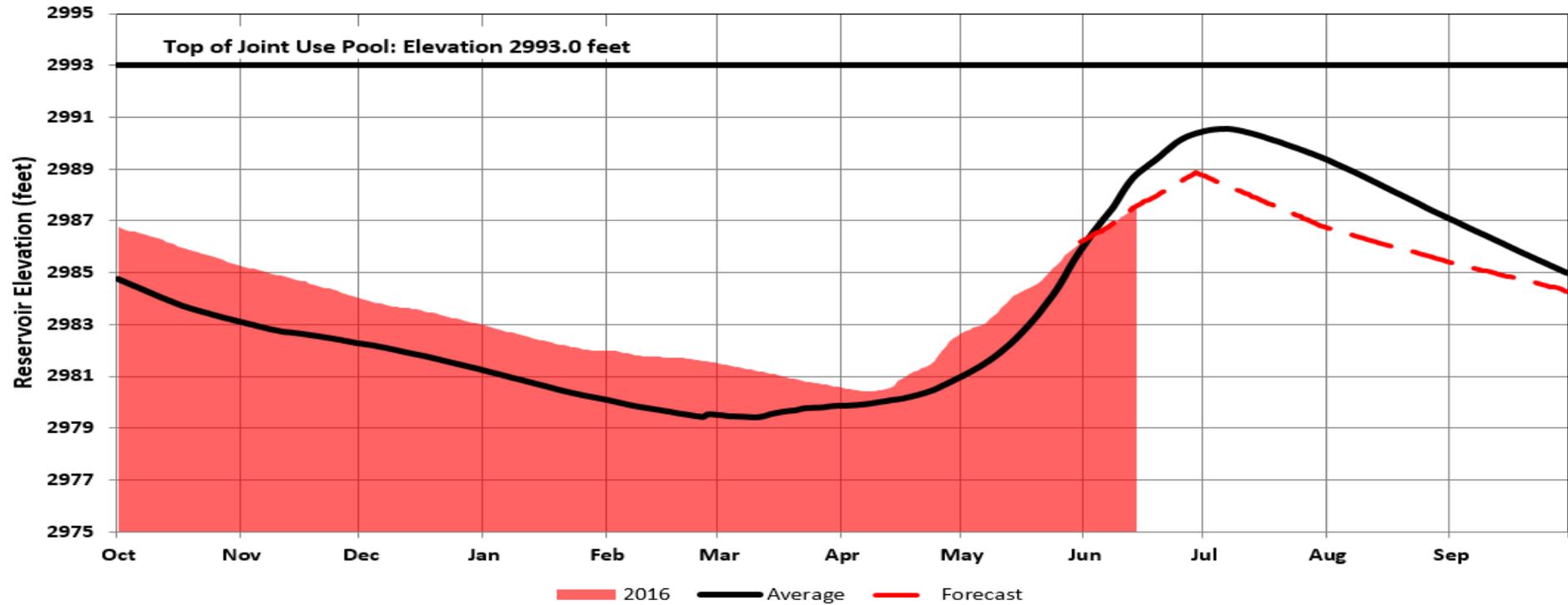
# Willow Creek Reservoir Operations



100% of full pool  
Shortage of irrigation water supply

RECLAMATION

# Lake Elwell (Tiber Dam) Operations



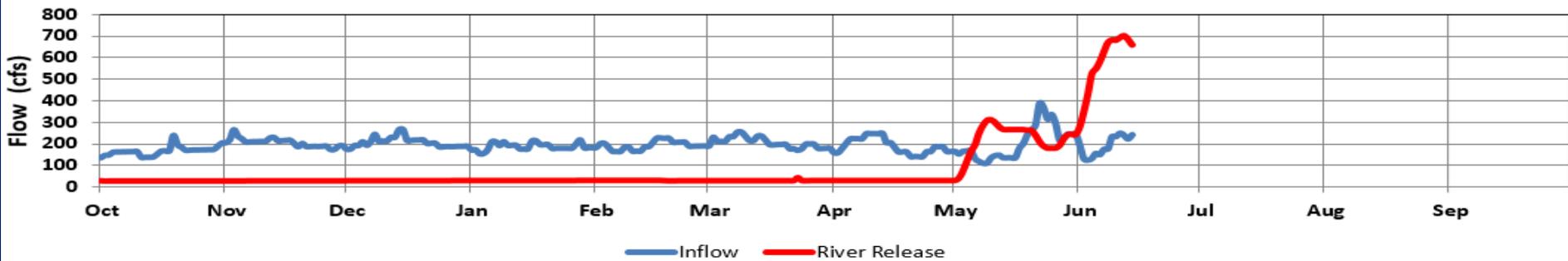
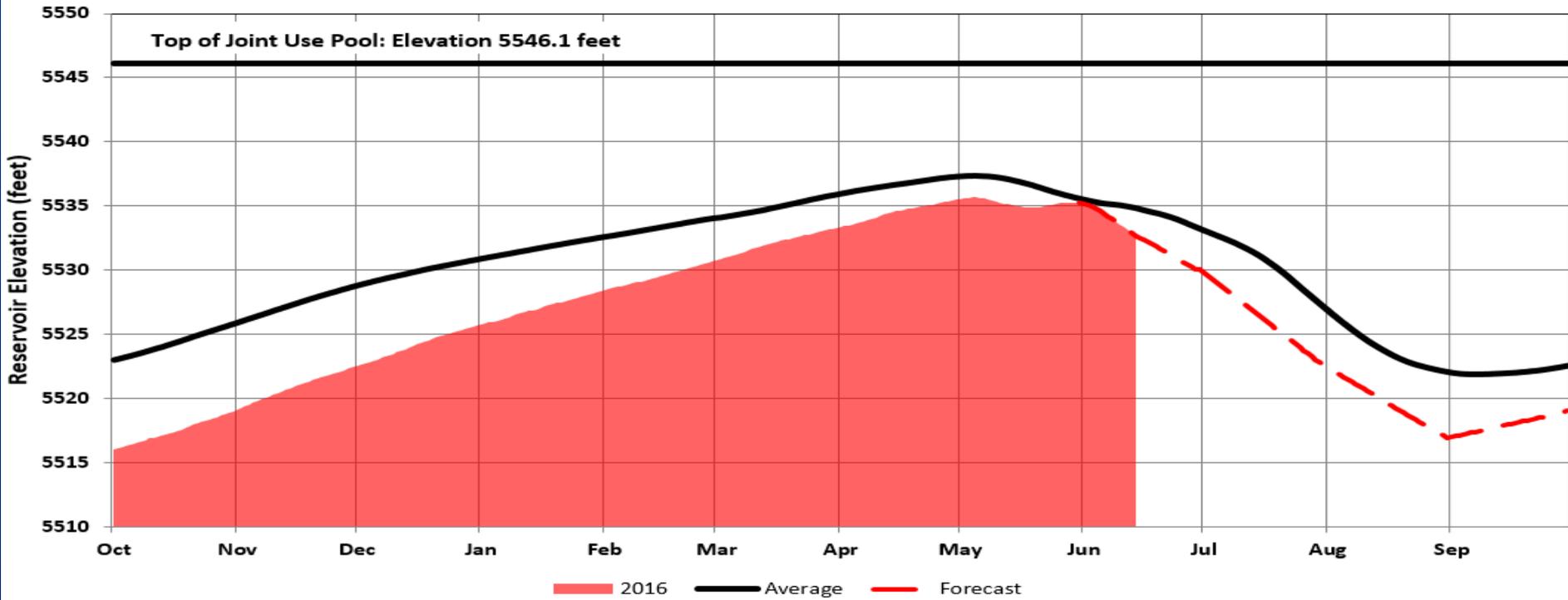
90% of full pool

Releases are at minimum fishery flow

Minimum irrigation requirements

# RECLAMATION

# Clark Canyon Reservoir Operations

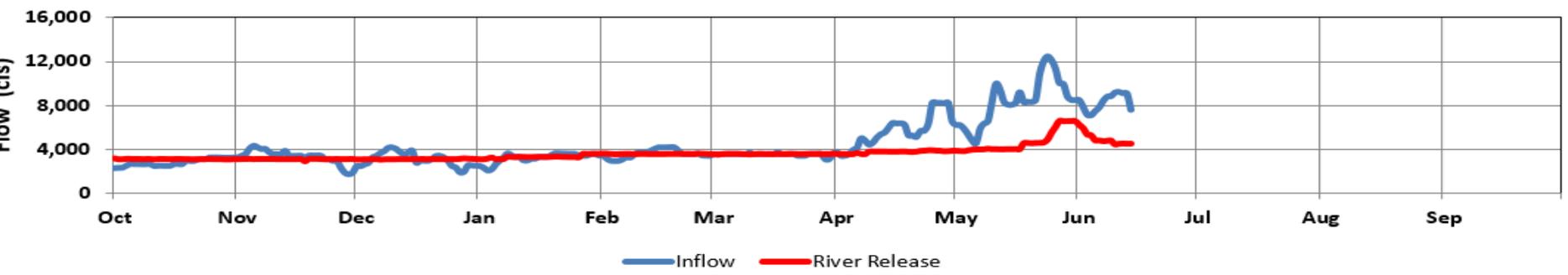
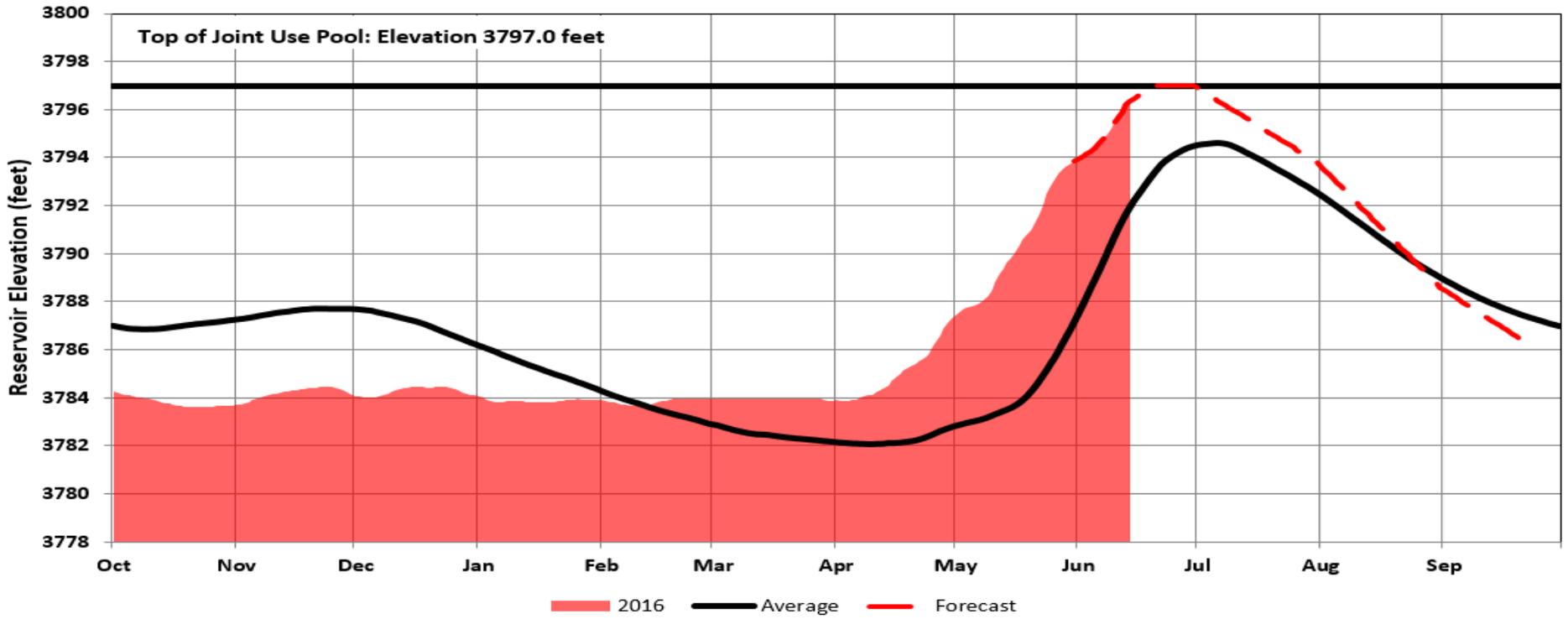


64% of full pool

Shortage of irrigation water supply

RECLAMATION

# Canyon Ferry Reservoir Operations

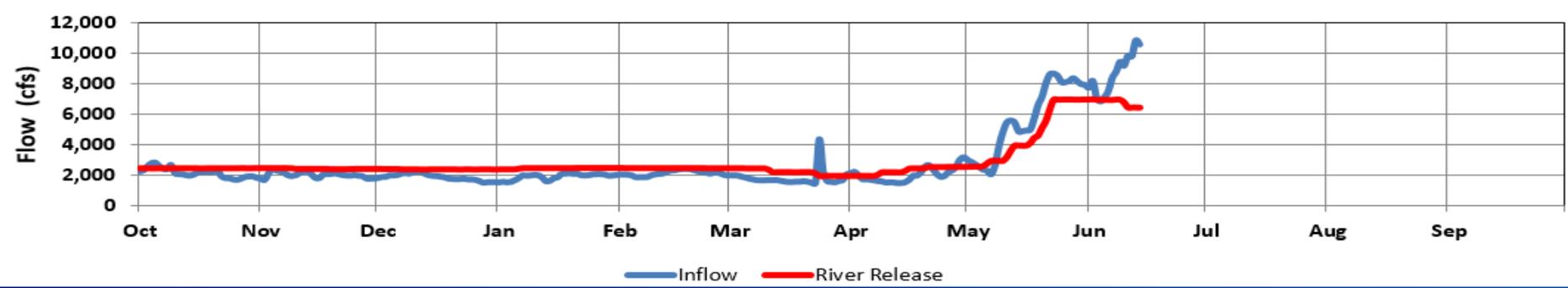
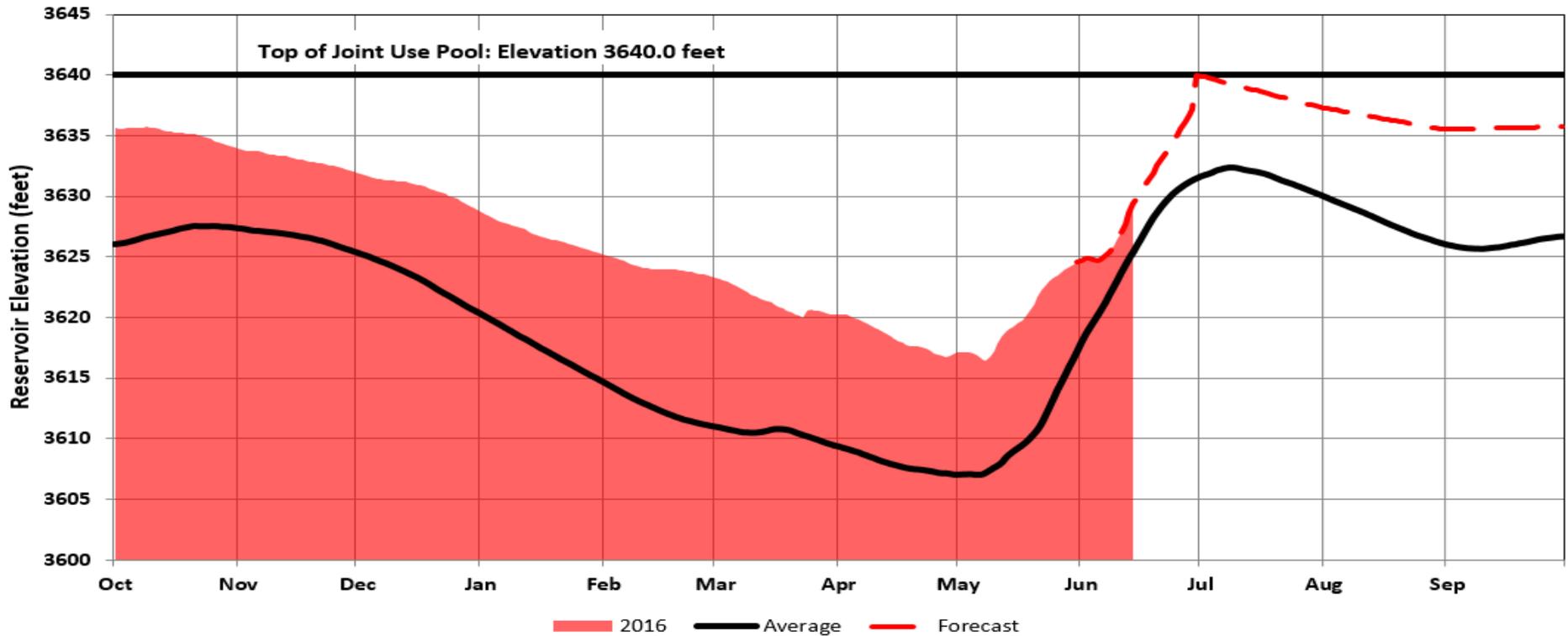


99% of full pool

Desirable river release levels

# RECLAMATION

# Bighorn Lake (Yellowtail Dam) Operations



89% of full pool  
Desirable river release levels

RECLAMATION

# Summary of Conditions

- **Reduced Irrigation Allotments**

  - East Bench & Clark Canyon Company

  - Greenfield Irrigation District

  - Milk River Project (Board may raise allotments)

- **Fishery Flows – At or Above Targets**

  - Bighorn River

  - Missouri River below Canyon Ferry

- **Reservoirs Not Anticipated To Fill**

  - Tiber

  - Clark Canyon

# Reclamation's Internet Website

<http://www.usbr.gov/gp/hydromet/>

- near real-time data available through the HYDROMET data system
- summaries and plots of historical data
- annual reservoir operating plan publication
- monthly water supply reports
- project data
- snow plots
- links to related internet sites

RECLAMATION