RECLAMATION

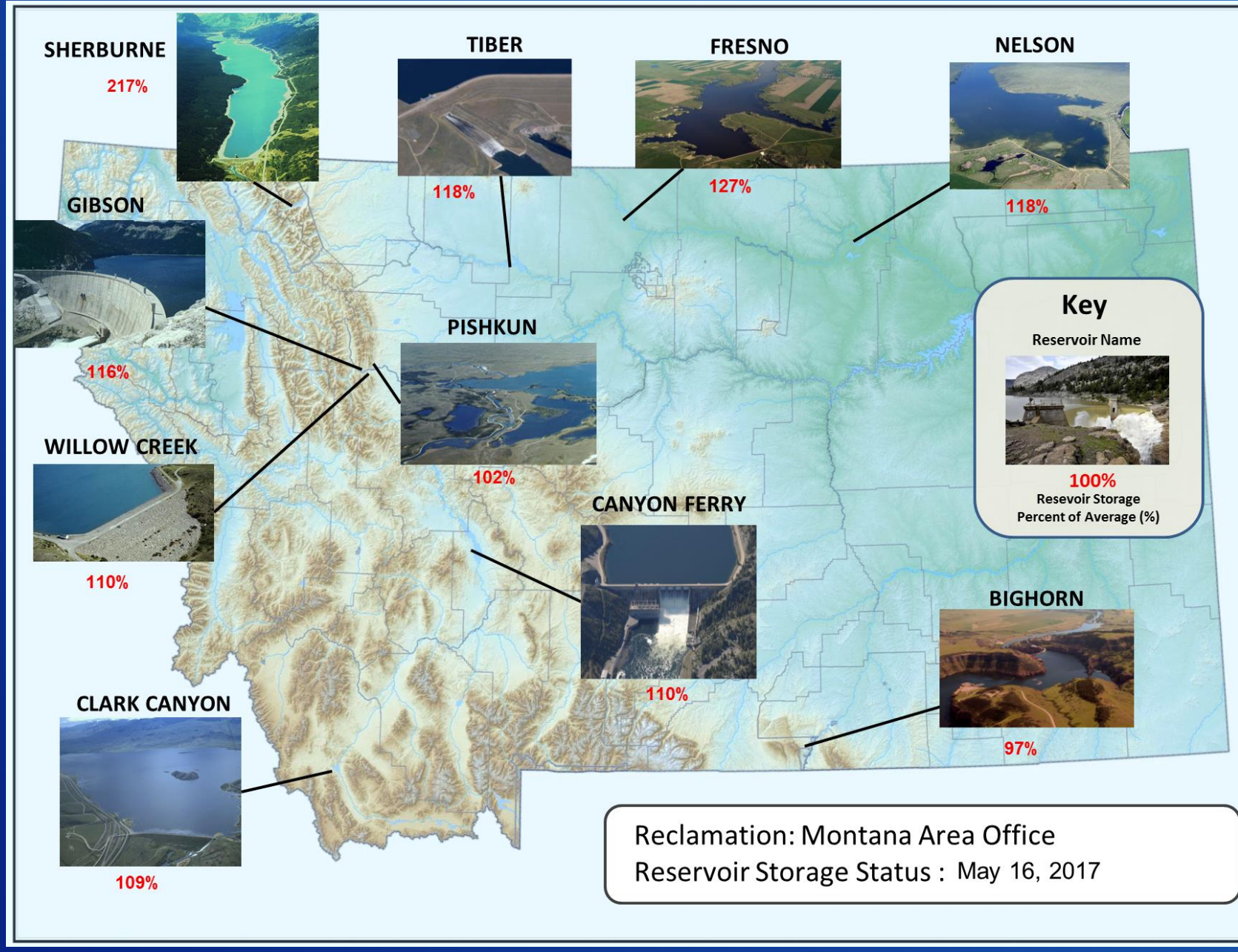
Managing Water in the West

River and Reservoir Status Briefing

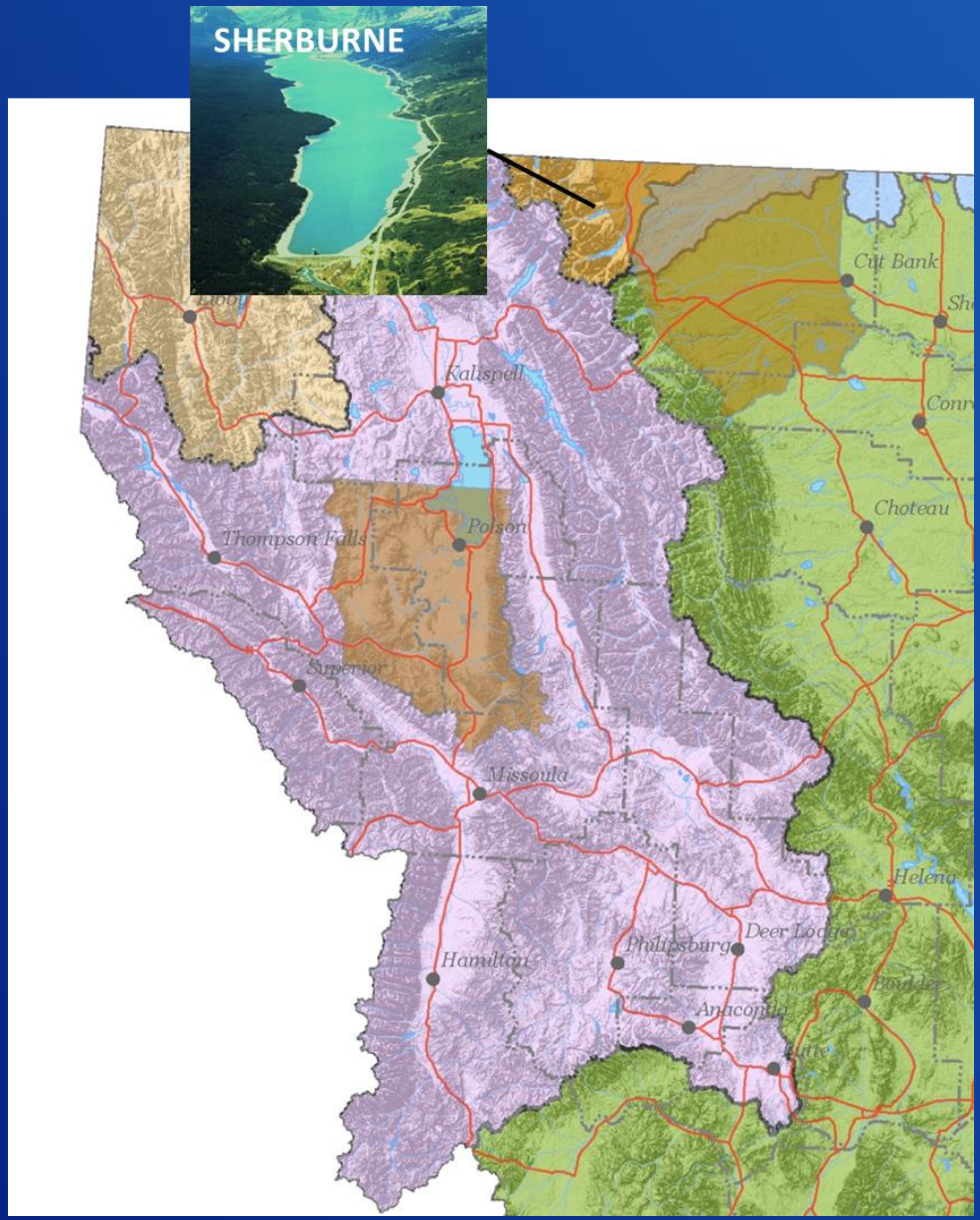
RESERVOIR AND RIVER OPERATIONS

Montana Area Office
Billings
May 18, 2017

U.S. Department of the Interior
Bureau of Reclamation



RECLAMATION



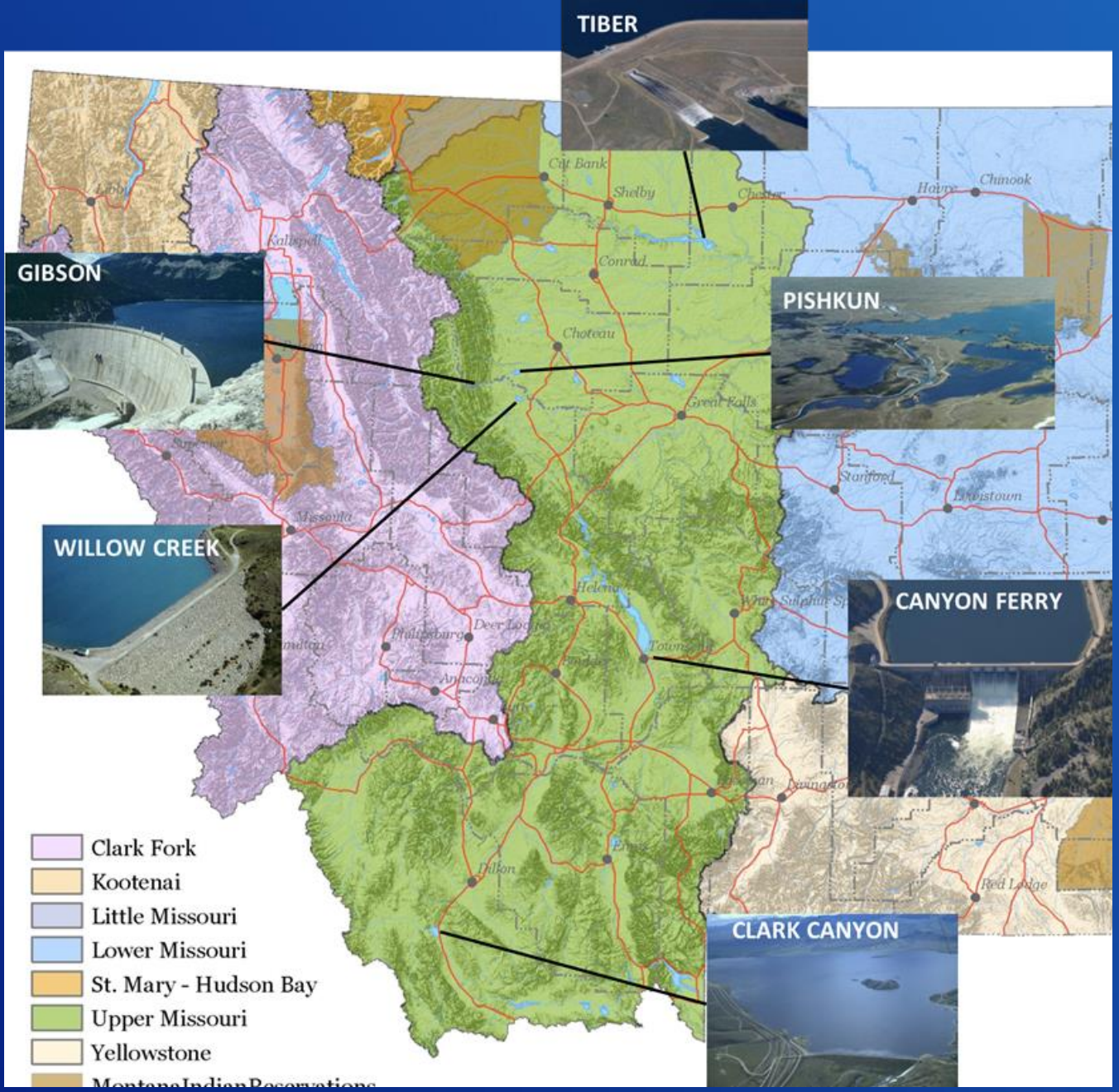
Clark Fork
Kootienai
St. Mary
Basins

RECLAMATION

Summary of Conditions

- **Reservoir Elevation – 218% of avg**
- **Reservoir Release – 720 cfs**

- **Continue drawing down reservoir elevation to store snowmelt runoff**



Upper Missouri Basin

RECLAMATION

Summary of Conditions

- **Full Irrigation Allotments**

  East Bench & Clark Canyon Company

  Greenfield Irrigation District

- **River Flows – above average releases**

  Sun River below Gibson – 2,200 cfs

  Missouri River below Canyon Ferry - 8,800 cfs

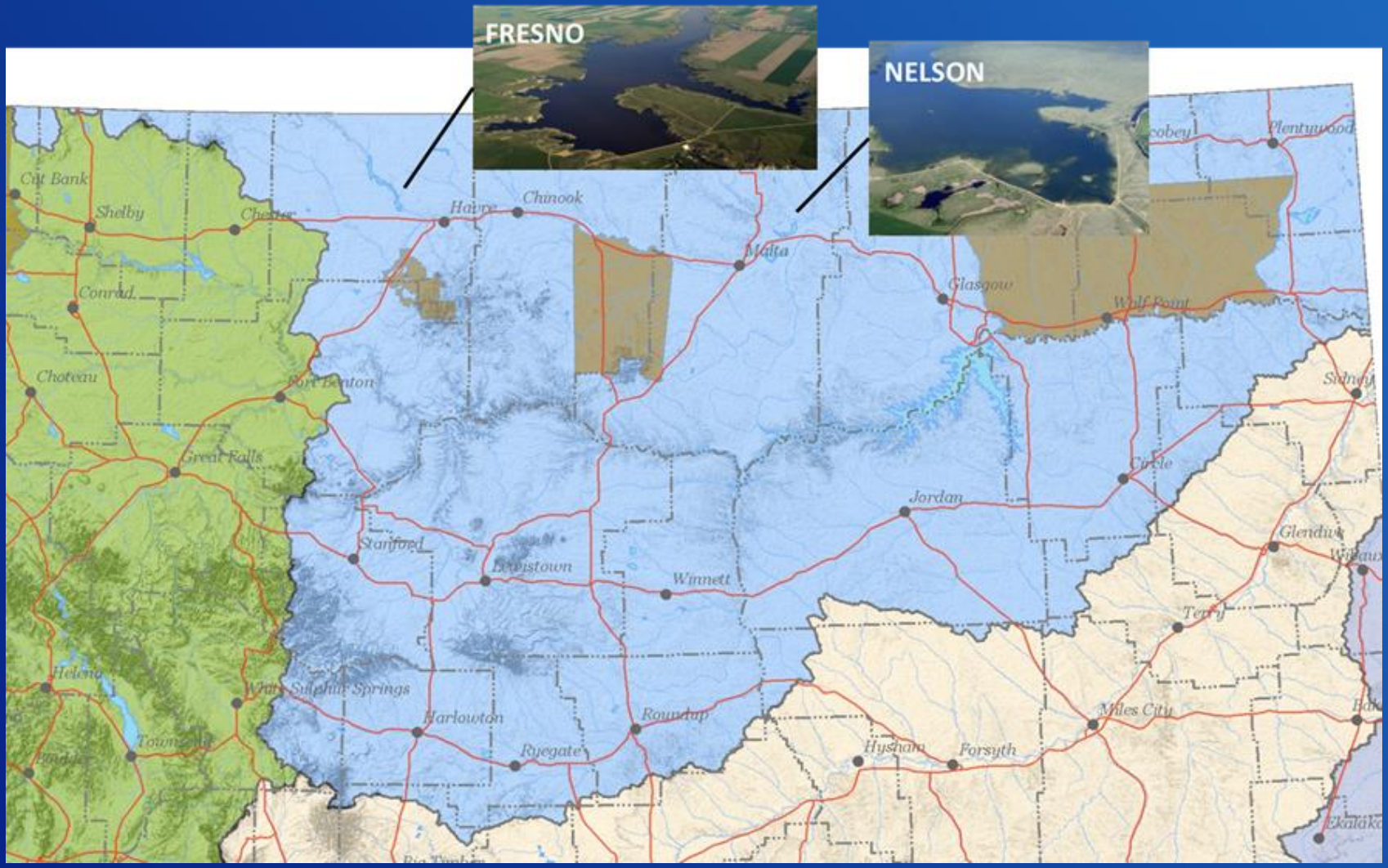
  Marias River below Tiber – 1,800 cfs

- **Reservoir Not Anticipated To Fill**

  Clark Canyon – 6 ft from full

RECLAMATION

Lower Missouri Basin



RECLAMATION

Summary of Conditions

- **Full Irrigation Allotments on Milk River**

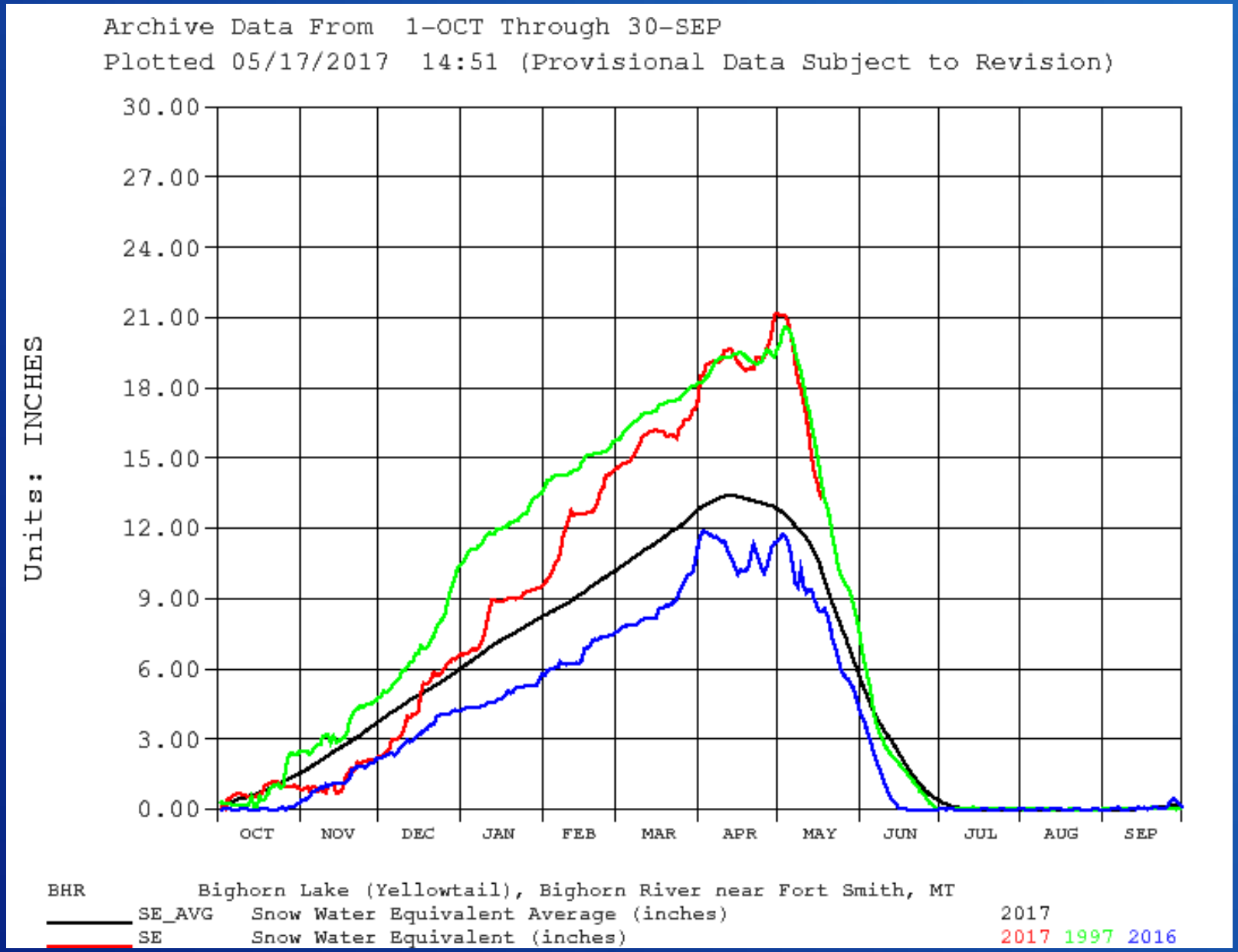
- **Reservoirs Anticipated To Fill**

  Nelson reservoir is full – construction completed

RECLAMATION

Yellowstone Basin

RECLAMATION



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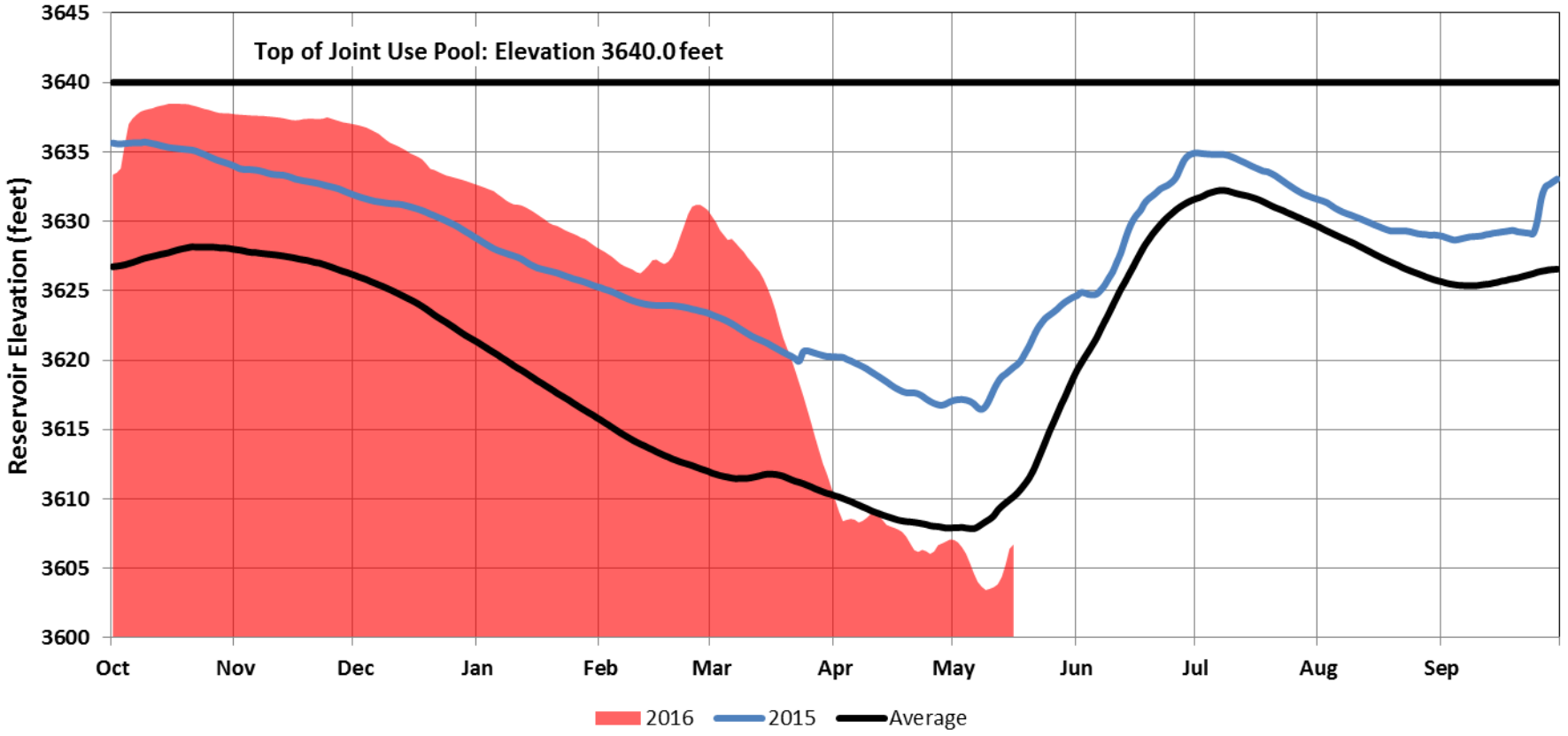
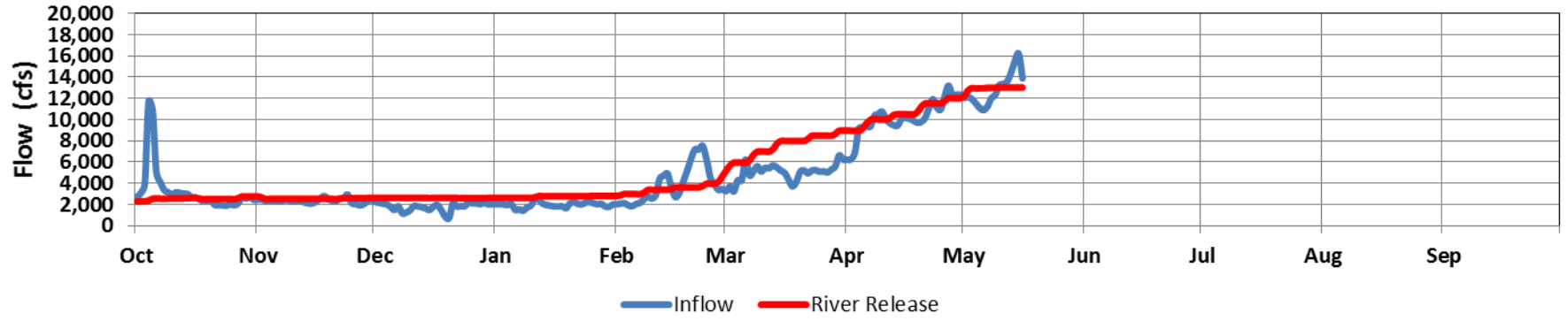
Bighorn Lake (Yellowtail Dam) Operations





Summary of Conditions

Yellowtail Dam

- **May-July Inflow Forecast – 278% avg**
- **April Inflows = 412 % avg**
- **May Inflows (1-15) = 382% avg**

Bighorn River Release – 13,000 cfs +

RECLAMATION

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

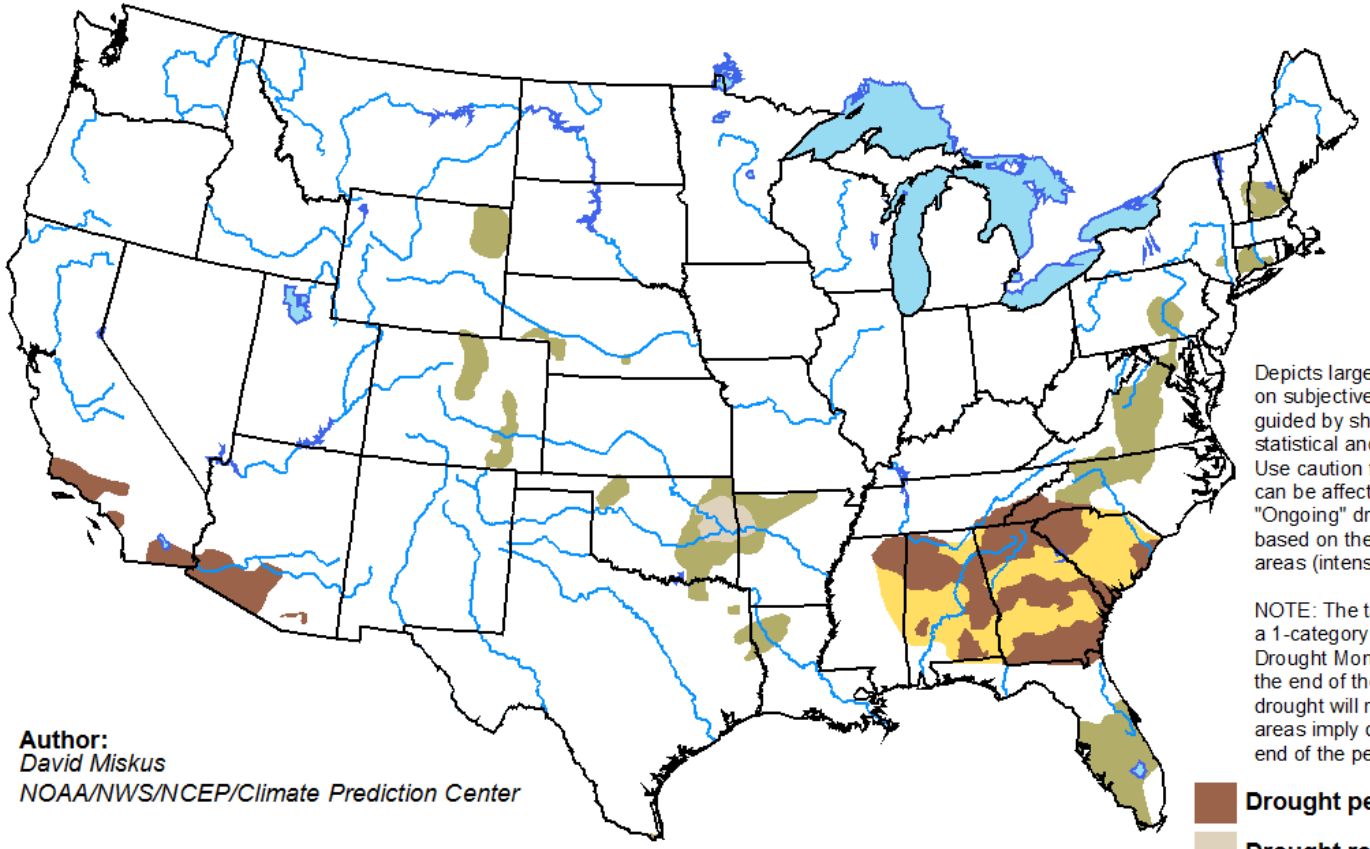
DROUGHT OUTLOOK: 2017

GOVERNOR'S DROUGHT AND WATER SUPPLY ADVISORY COMMITTEE

U.S. Seasonal Drought Outlook

Drought Tendency During the Valid Period

Valid for April 20 - July 31, 2017
Released April 20, 2017

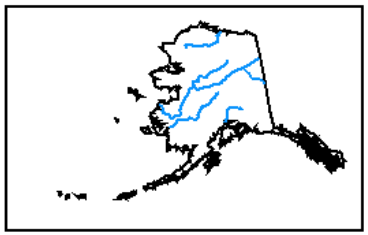


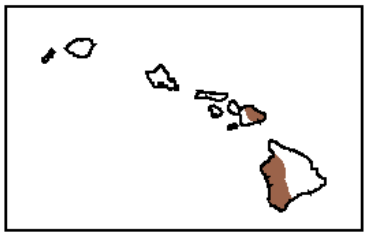
Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Use caution for applications that can be affected by short lived events. "Ongoing" drought areas are based on the U.S. Drought Monitor areas (intensities of D1 to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

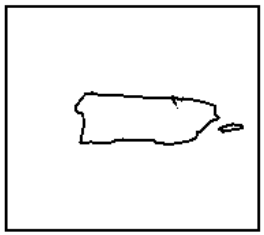
NOTE: The tan areas imply at least a 1-category improvement in the Drought Monitor intensity levels by the end of the period, although drought will remain. The green areas imply drought removal by the end of the period (D0 or none).

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

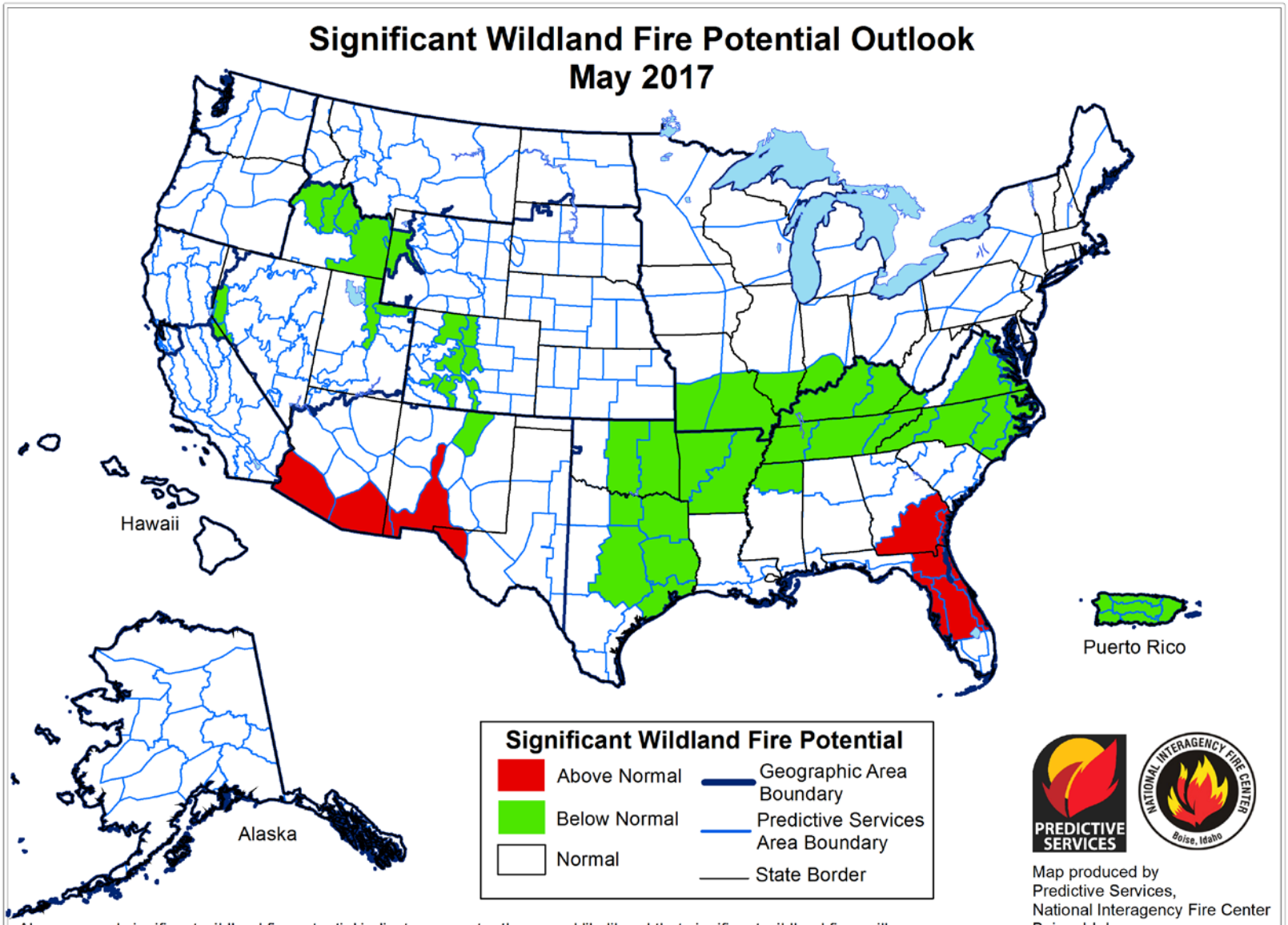
Author:
David Miskus
NOAA/NWS/NCEP/Climate Prediction Center







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

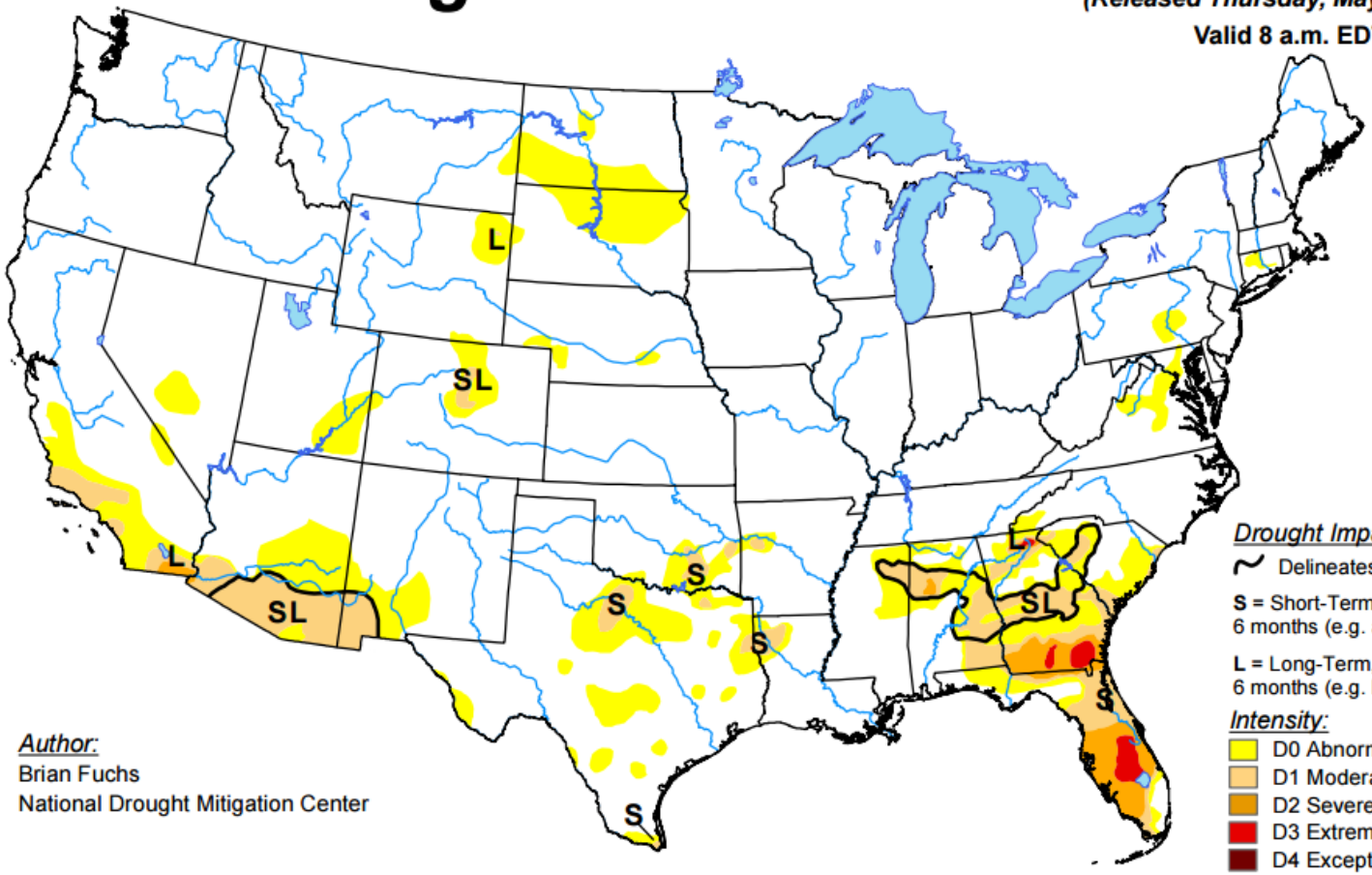

Significant Wildland Fire Potential Outlook
May 2017
Hawaii
Alaska
Puerto Rico
Significant Wildland Fire Potential
Above Normal
Below Normal
Normal
Geographic Area Boundary
Predictive Services Area Boundary
State Border
PREDICTIVE SERVICES
NATIONAL INTERAGENCY FIRE CENTER
Boise, Idaho
Above normal significant 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 May 1, 2017
Next issuance June 1, 2017

U.S. Drought Monitor

May 9, 2017

(Released Thursday, May. 11, 2017)

Valid 8 a.m. EDT



Author:
Brian Fuchs
National Drought Mitigation Center

Drought Impact Types:

~ Delineates dominant impacts

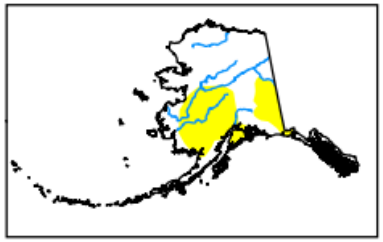
S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)

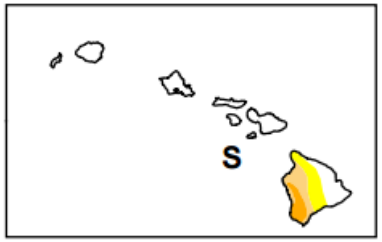
L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

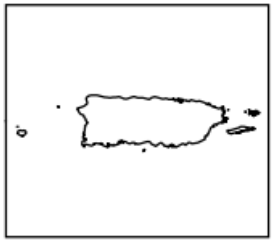
Intensity:

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

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

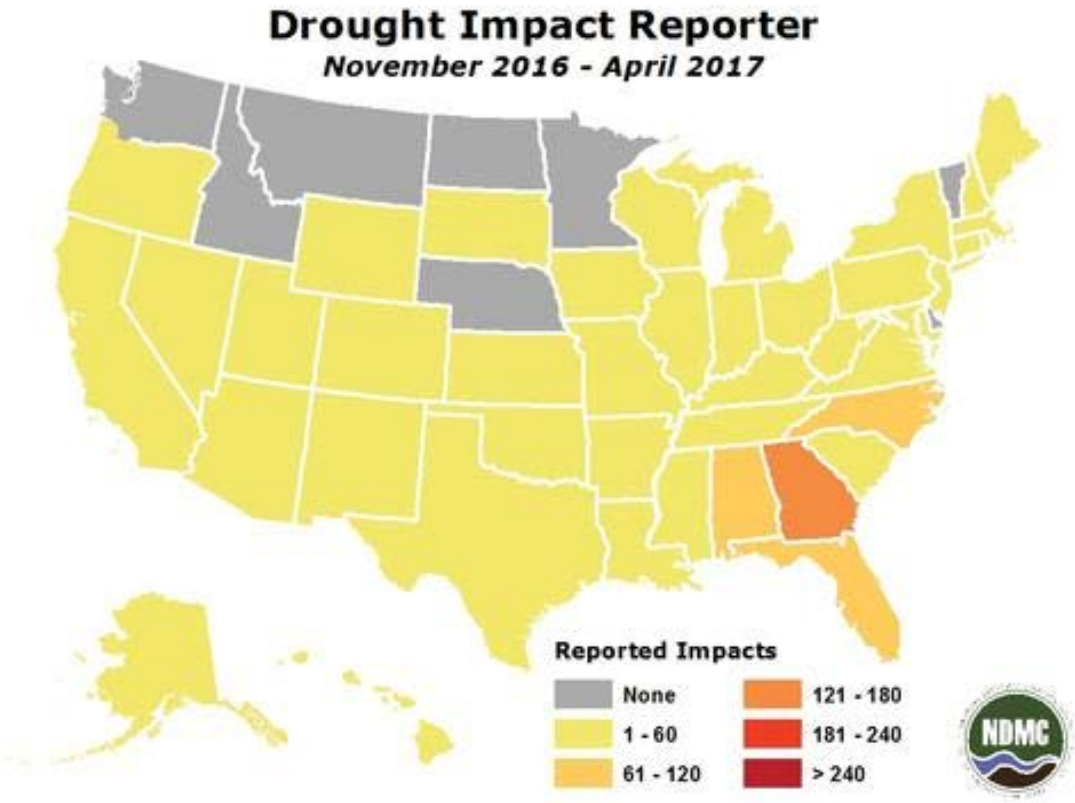




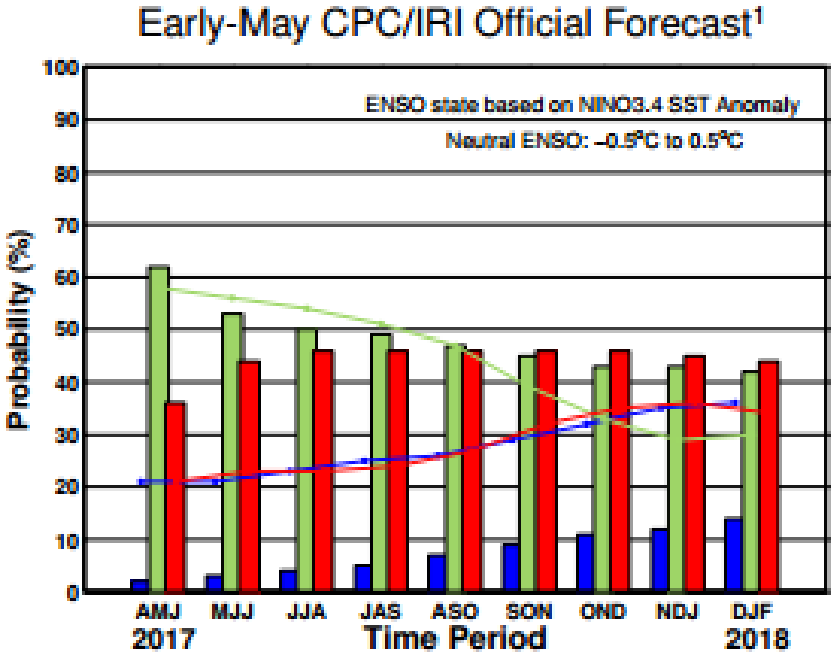


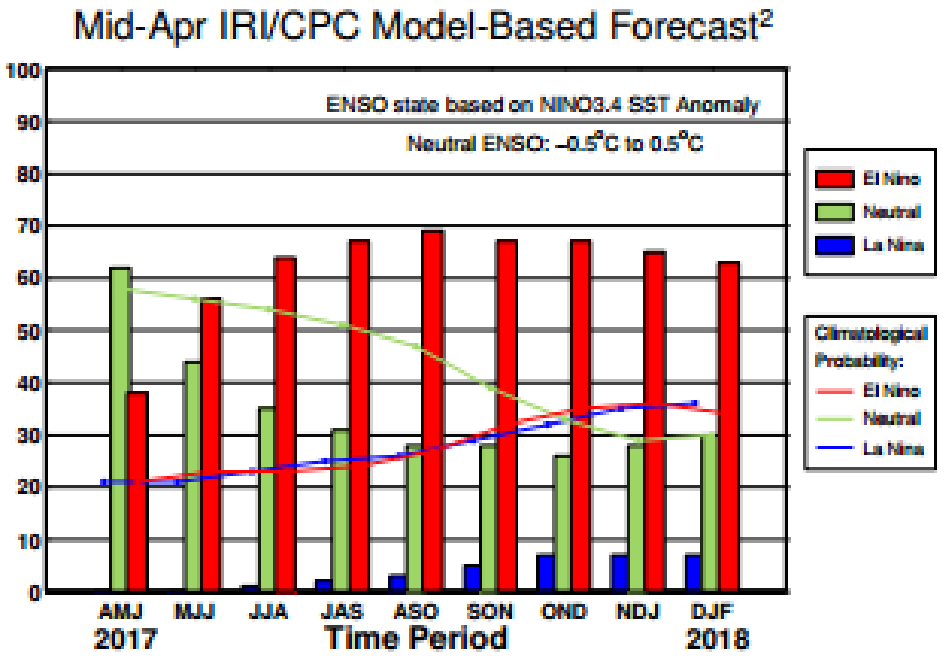
USDA NDMC

http://droughtmonitor.unl.edu/


Drought Impact Reporter
November 2016 - April 2017
Reported Impacts
None
1 - 60
61 - 120
121 - 180
181 - 240
> 240
NDMC

ENSO OUTLOOK: ENSO prediction models indicate increasing chances of El Nino into the summer and fall of 2017.





USGS
science for a changing world

Current Montana Streamflow Conditions

Yellowstone River near Livingston, May 12, 2017

Governor's Drought and Water Supply Advisory Committee May 18, 2017

U.S. Department of the Interior
U.S. Geological Survey

https://wy-mt.water.usgs.gov/

USGS science for a changing world

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Wyoming-Montana Water Science Center

home | information/data | projects | publications | floodwatch | droughtwatch | contact | *internal*

Using the window between ice out and high flows to make repairs on the Dinwoody Creek streamgage, April 26, 2017.

Connect with USGS science

In Montana
In Wyoming
In Montana
In Wyoming

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DATA CENTER

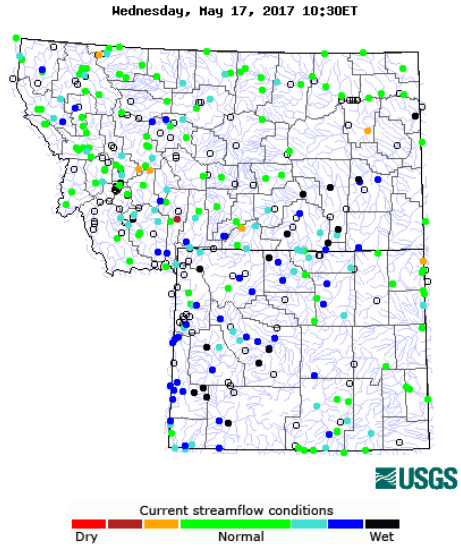
Current conditions

Water Resources of Wyoming and Montana

Welcome to the USGS Wyoming-Montana Water Science Center. These pages are your source for water-resource information collected and interpreted by the U.S. Geological Survey in Wyoming and Montana. Here you'll find information on Wyoming's and Montana's rivers and streams. You'll also find information about ground water, water quality, and many other topics. The USGS operates the most extensive satellite network of stream-gaging stations in the states, many of which form the backbone of flood-warning systems.

Wyoming and Montana Water Data and Information

Current Streamflow Conditions



News and Highlights

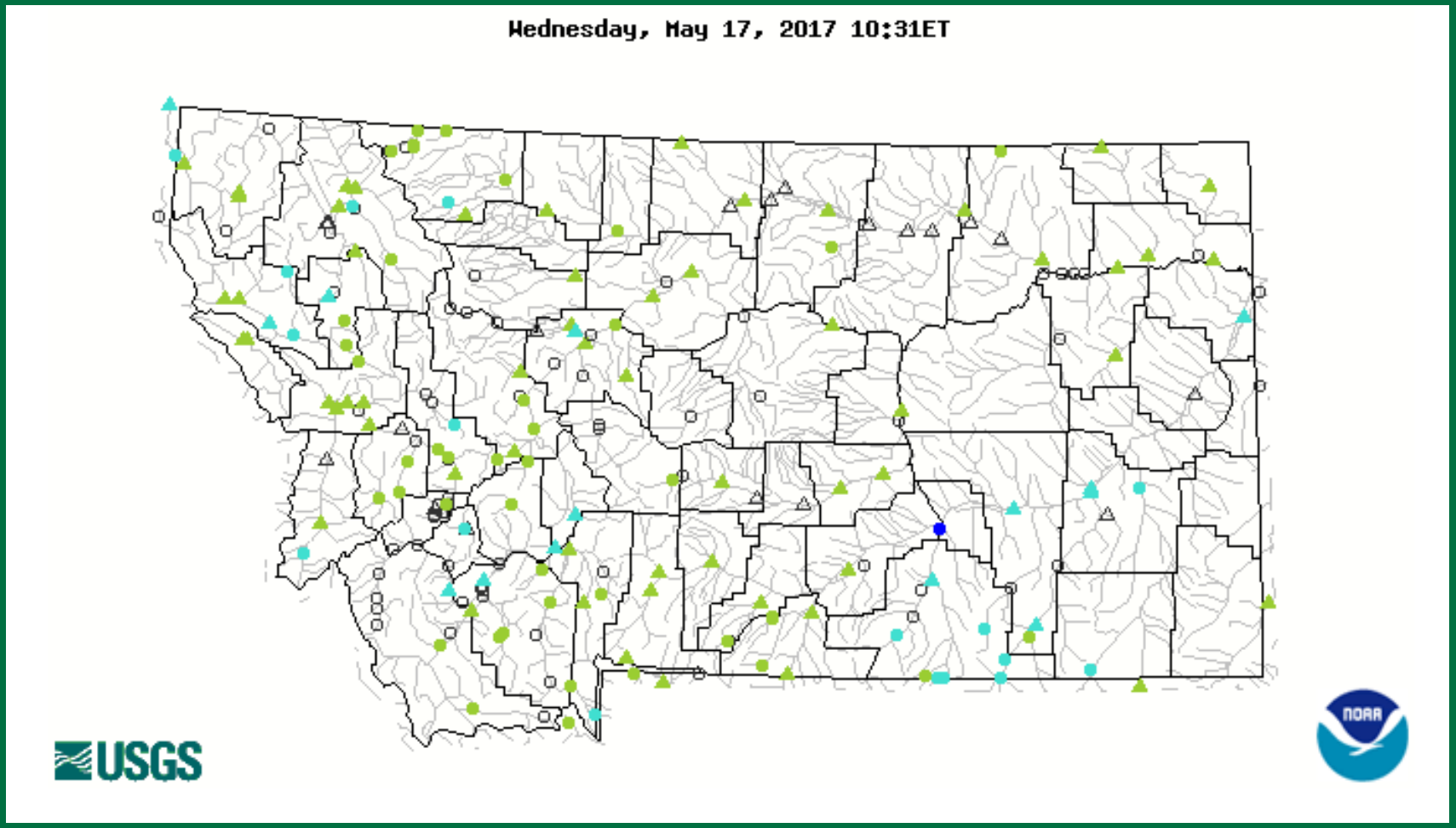
Historically, many floods have occurred in Wyoming and Montana during the month of May. In 1981, west-central Montana experienced record flooding due to extensive rainfall. Over 20 currently active streamgages keep track of the creeks and rivers in that area.

Recent Publications

USGS

Map of Flood and High Flow Conditions

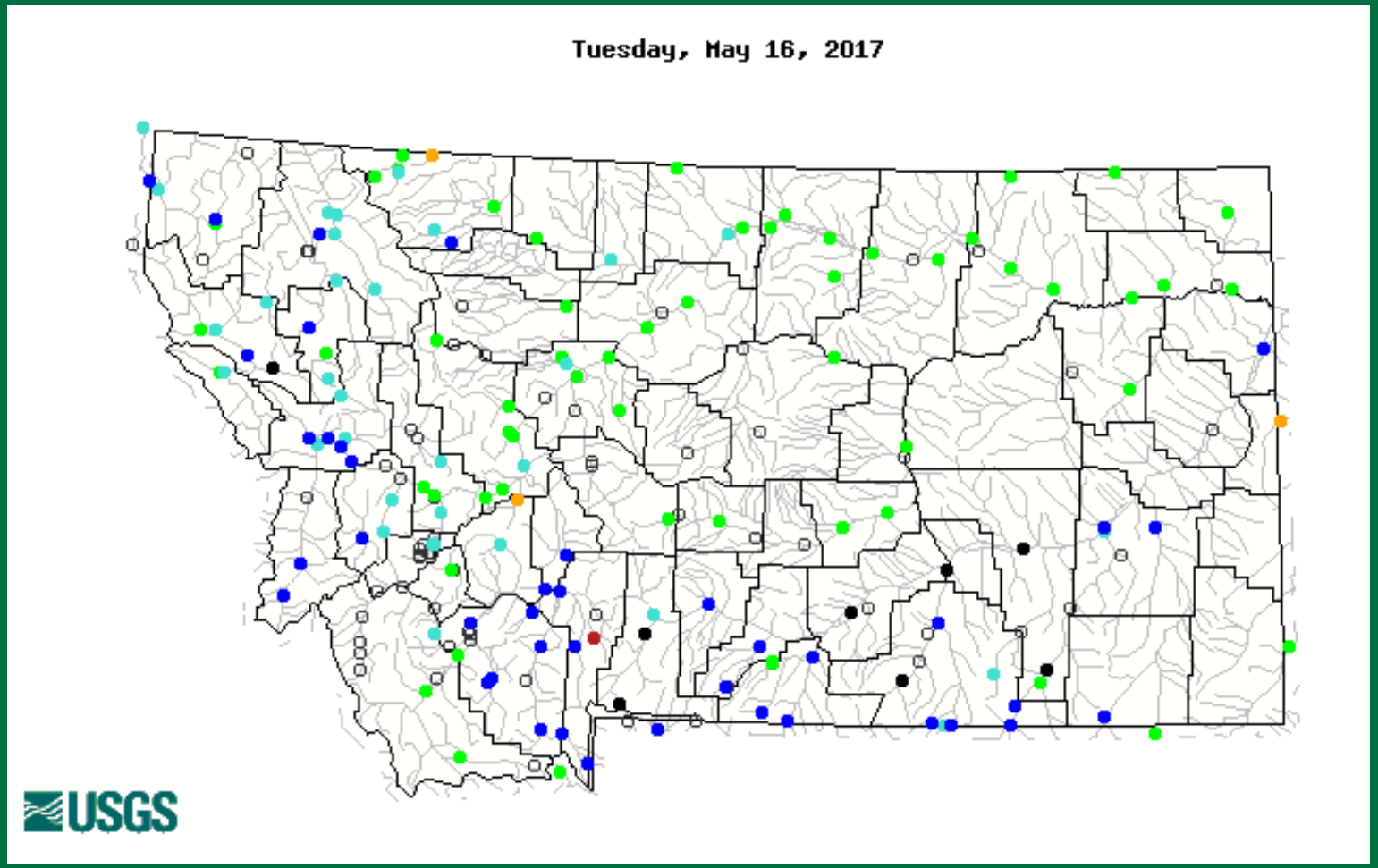
Explanation - Percentile classes				
<95	95-98	>= 99	River above flood stage	Not ranked
△ Streamgage with flood stage ○ Streamgage without flood stage				



USGS

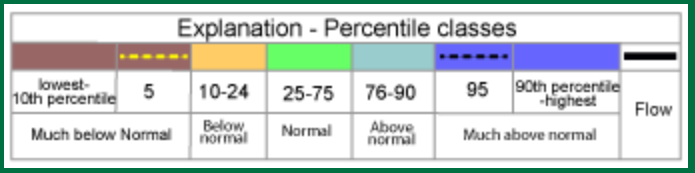
Map of 7-Day Average Streamflow Compared to Historical Streamflow for Day of Year

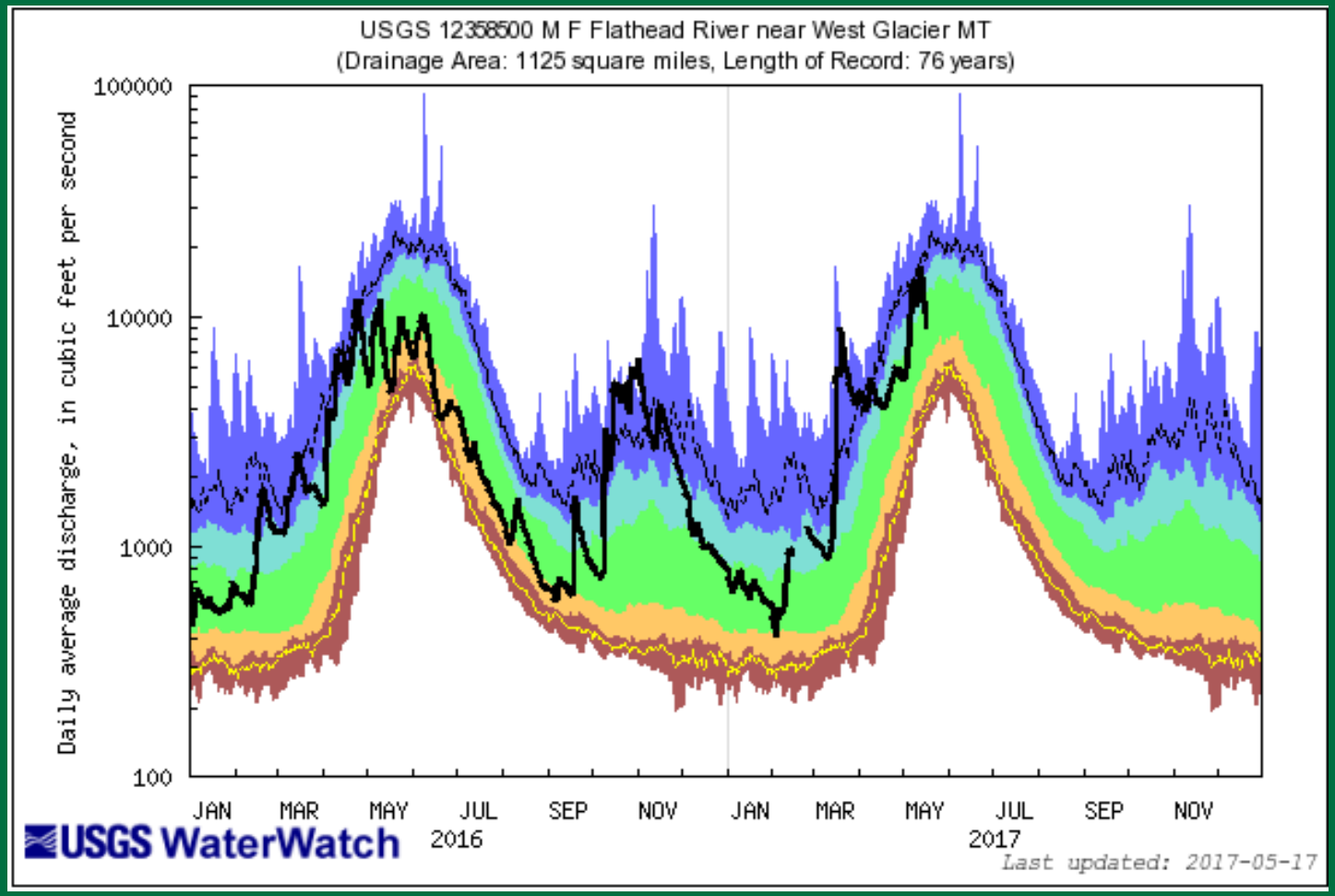
Explanation - Percentile classes							
Low	<10	10-24	25-75	76-90	>90	High	Not-ranked
	Much below normal	Below normal	Normal	Above normal	Much above normal		



USGS

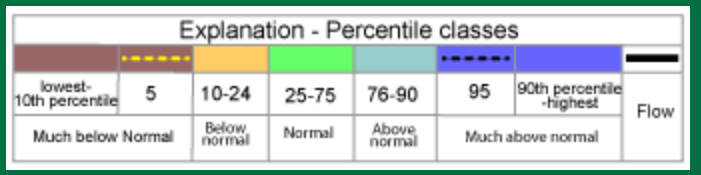
Streamflow Duration Hydrograph
Middle Fk Flathead R nr West Glacier

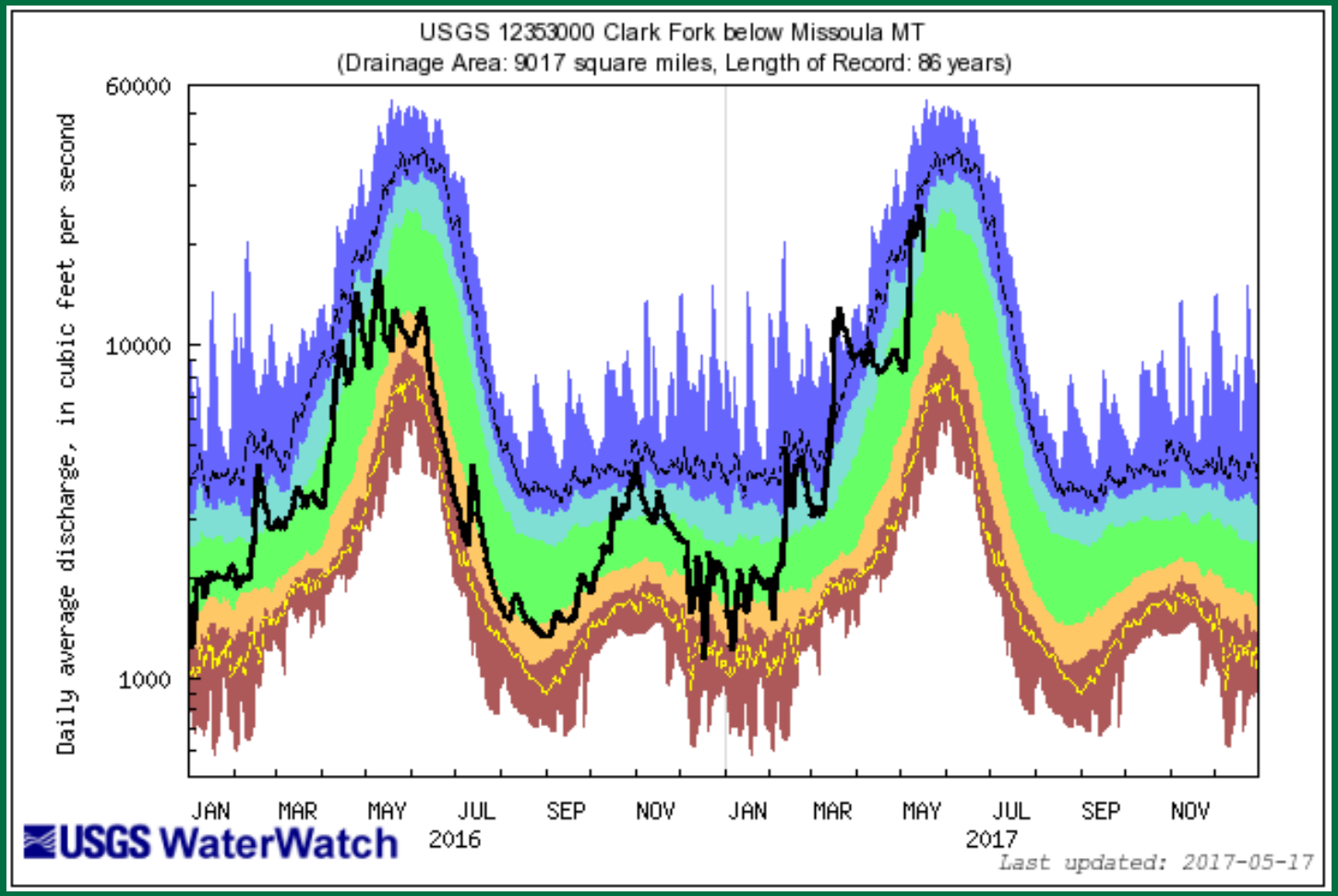




USGS

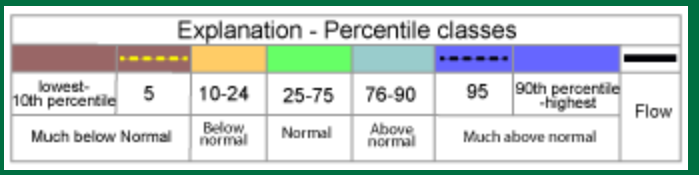
Streamflow Duration Hydrograph
Clark Fork below Missoula

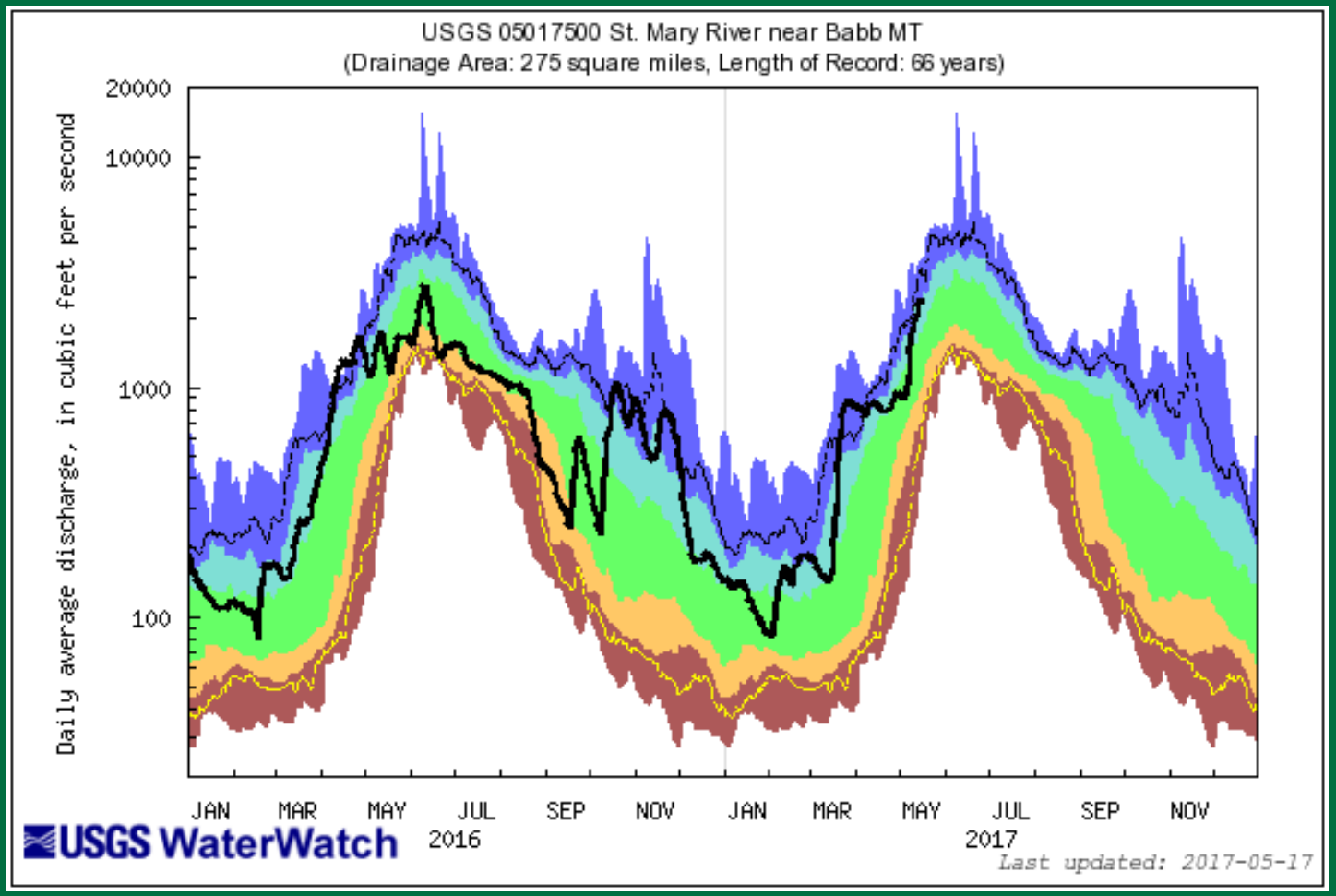




USGS

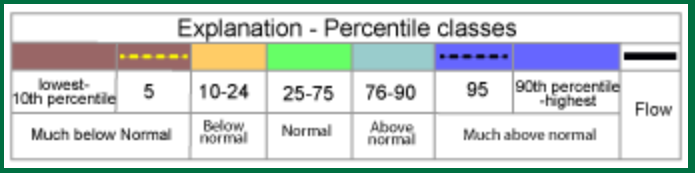
Streamflow Duration Hydrograph
St Mary R nr Babb

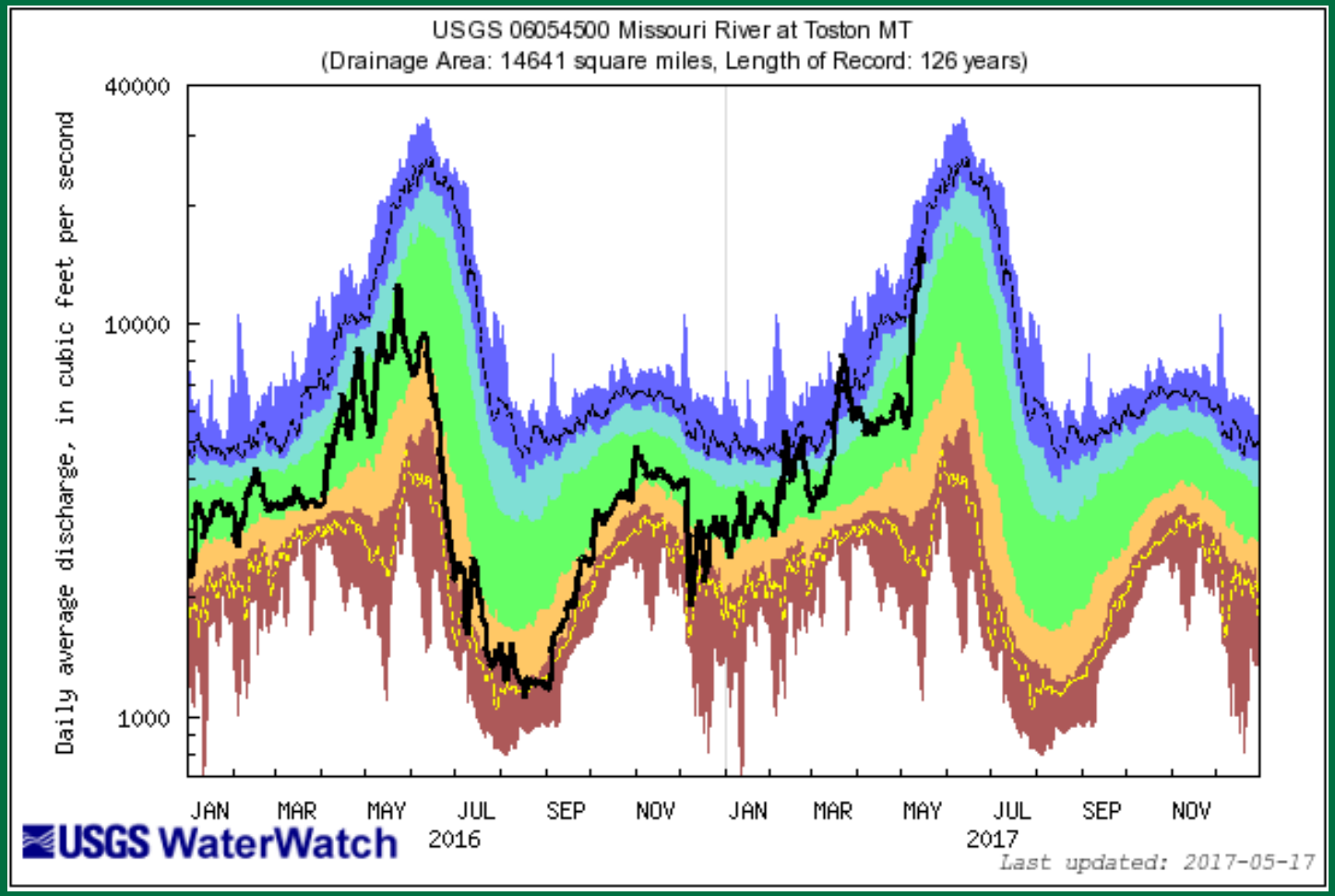




USGS

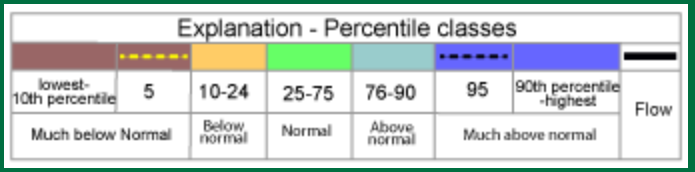
Streamflow Duration Hydrograph
Missouri R at Toston

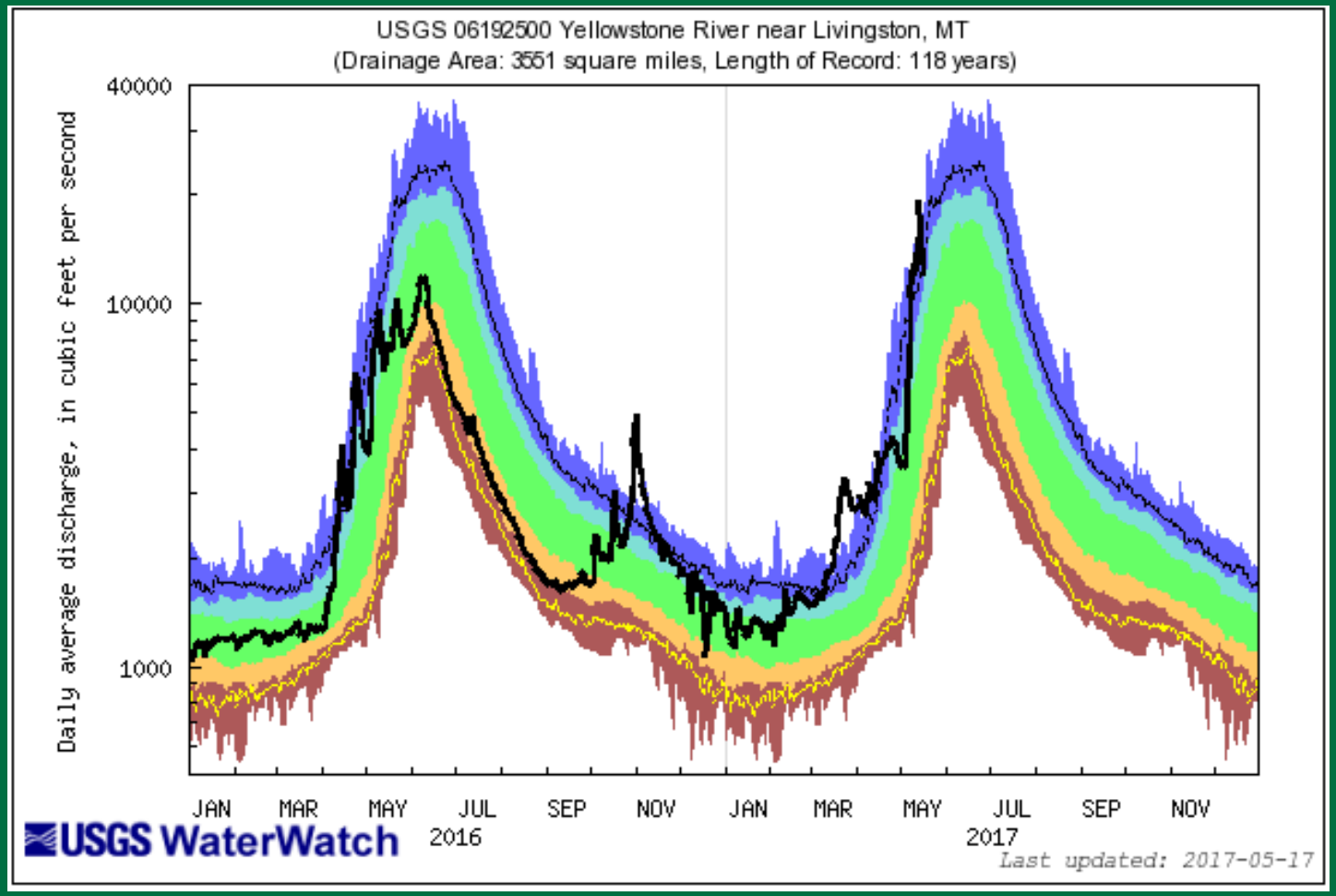




USGS

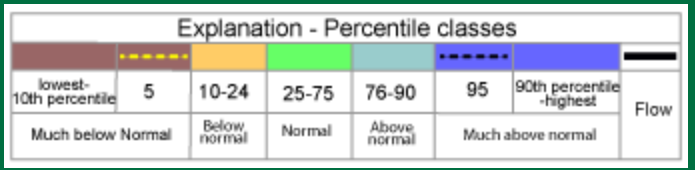
Streamflow Duration Hydrograph
Yellowstone R near Livingston

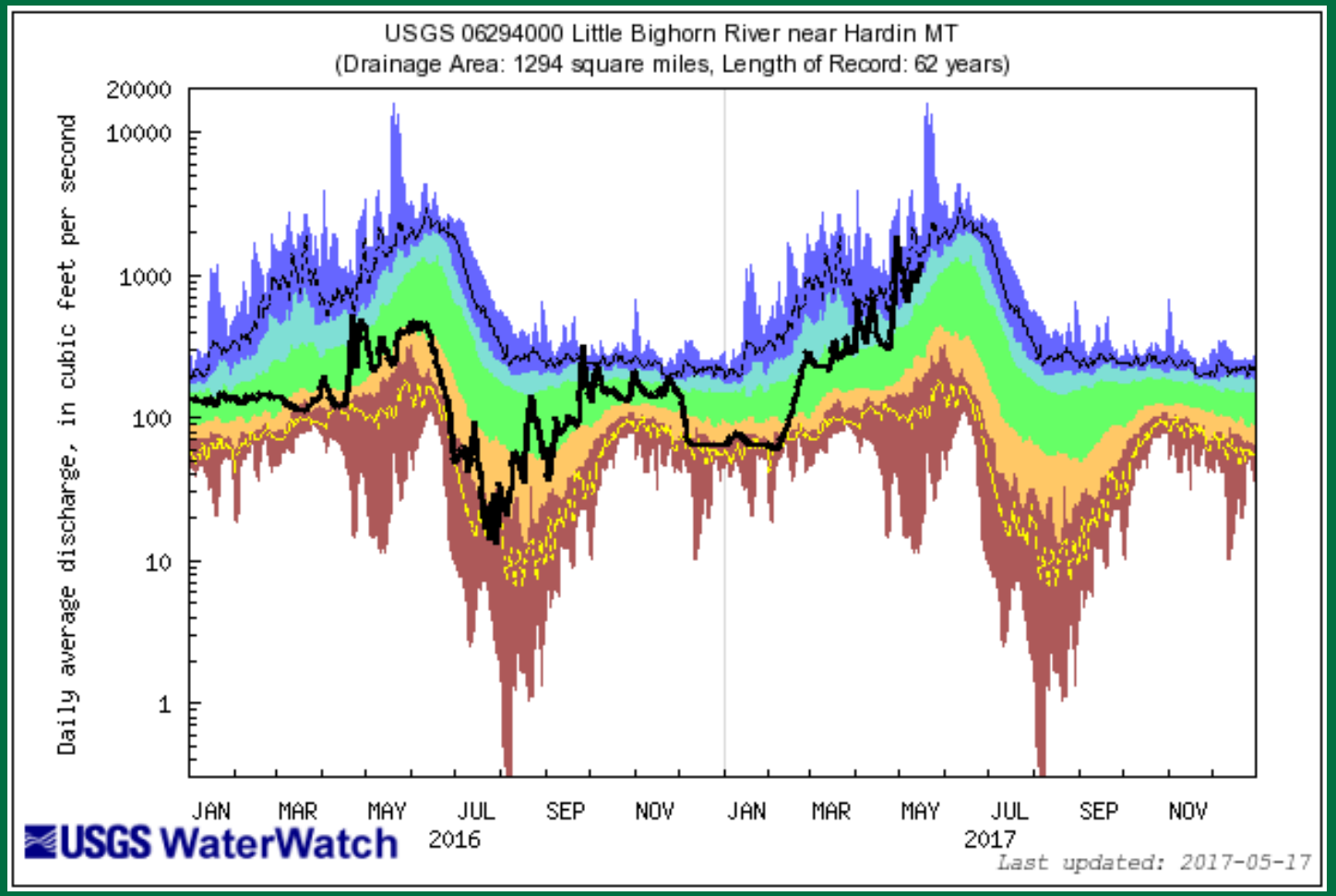




USGS

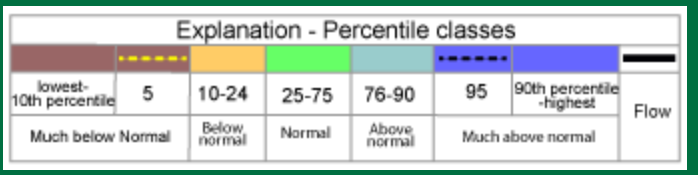
Streamflow Duration Hydrograph
Little Bighorn R near Hardin

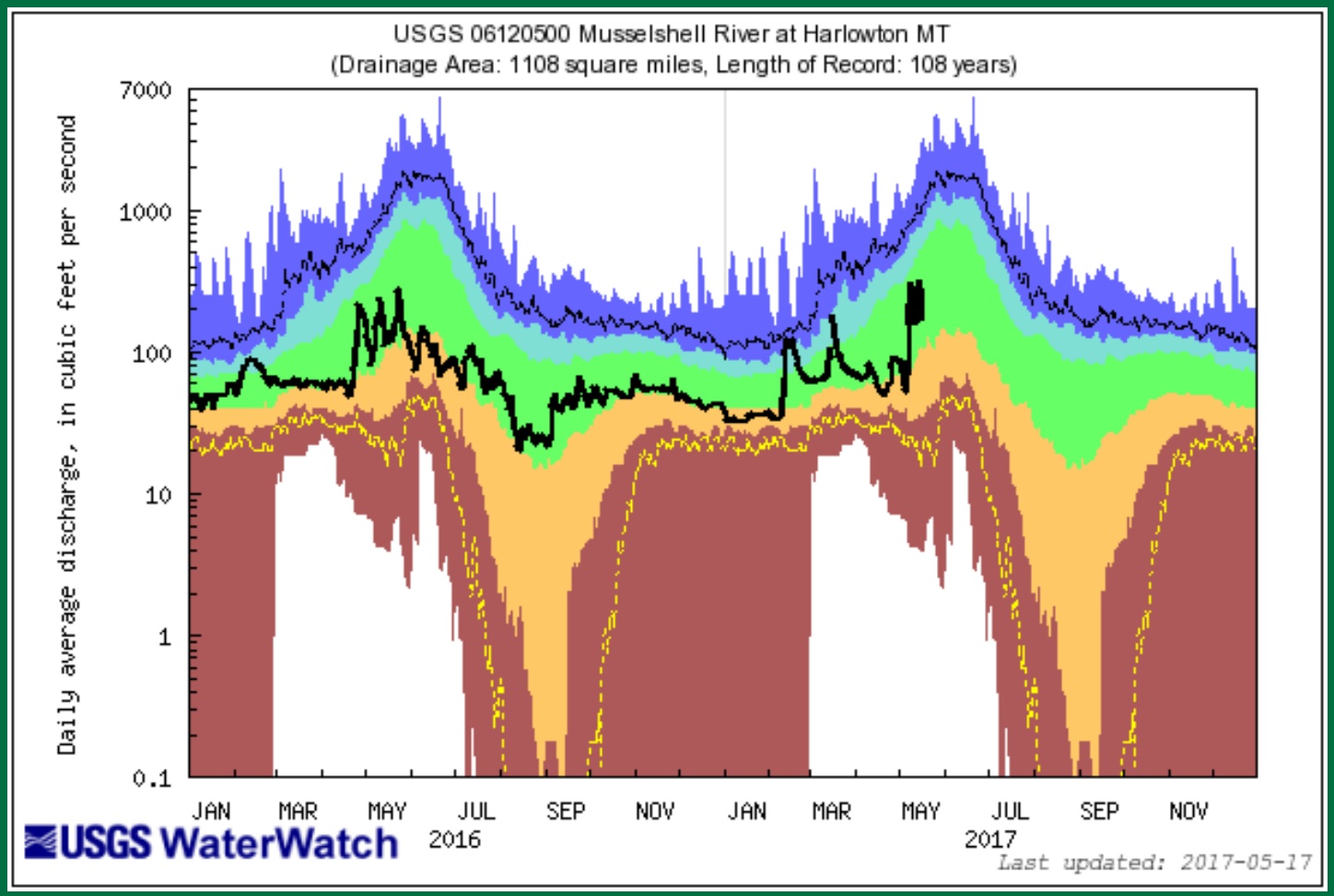




USGS

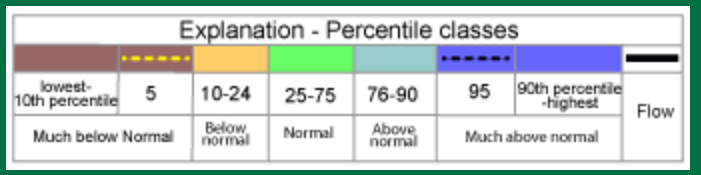
Streamflow Duration Hydrograph
Mussellshell R at Harlowton

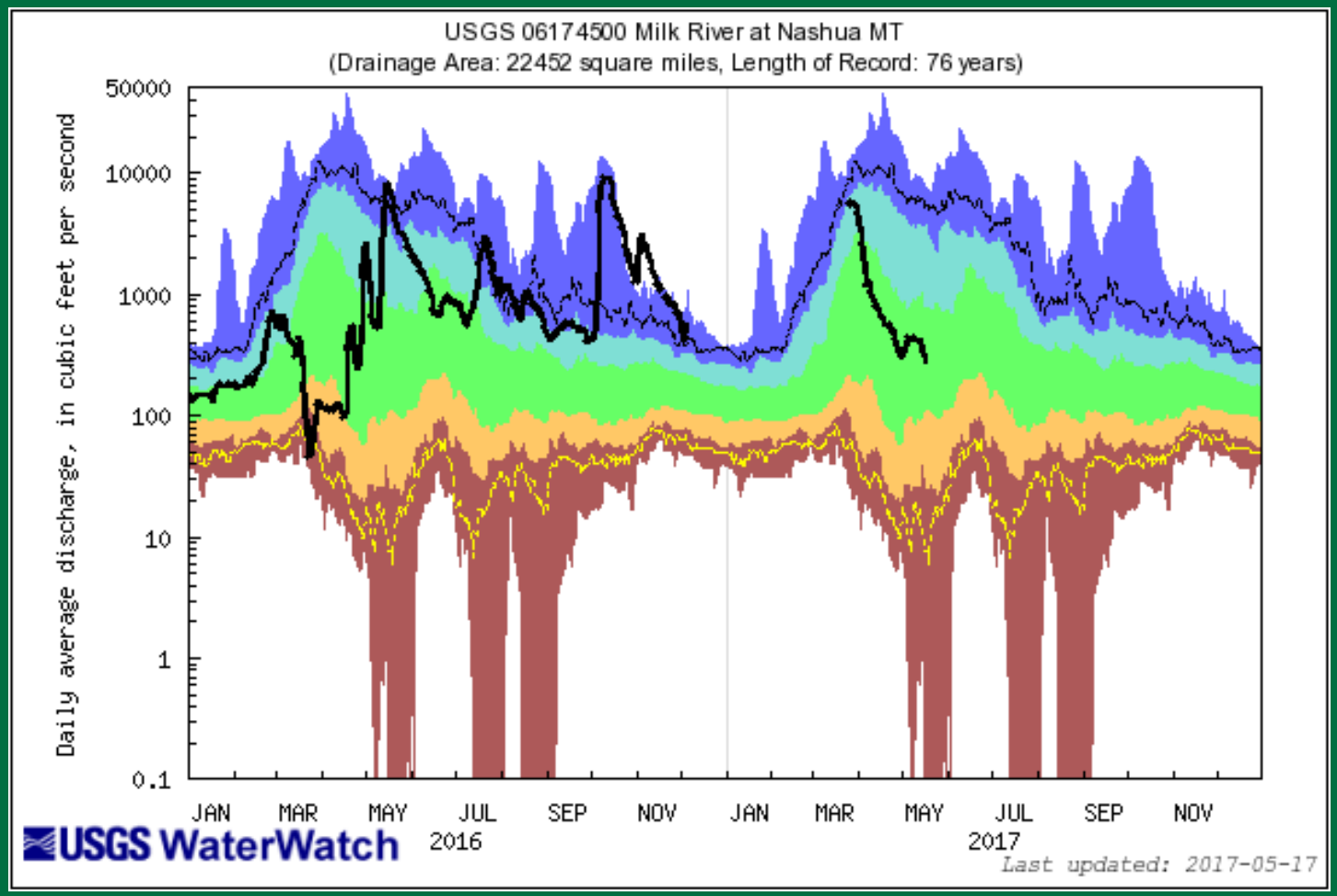




USGS

Streamflow Duration Hydrograph
Milk River at Nashua





USGS

Questions?

Helena Valley June 7, 2011

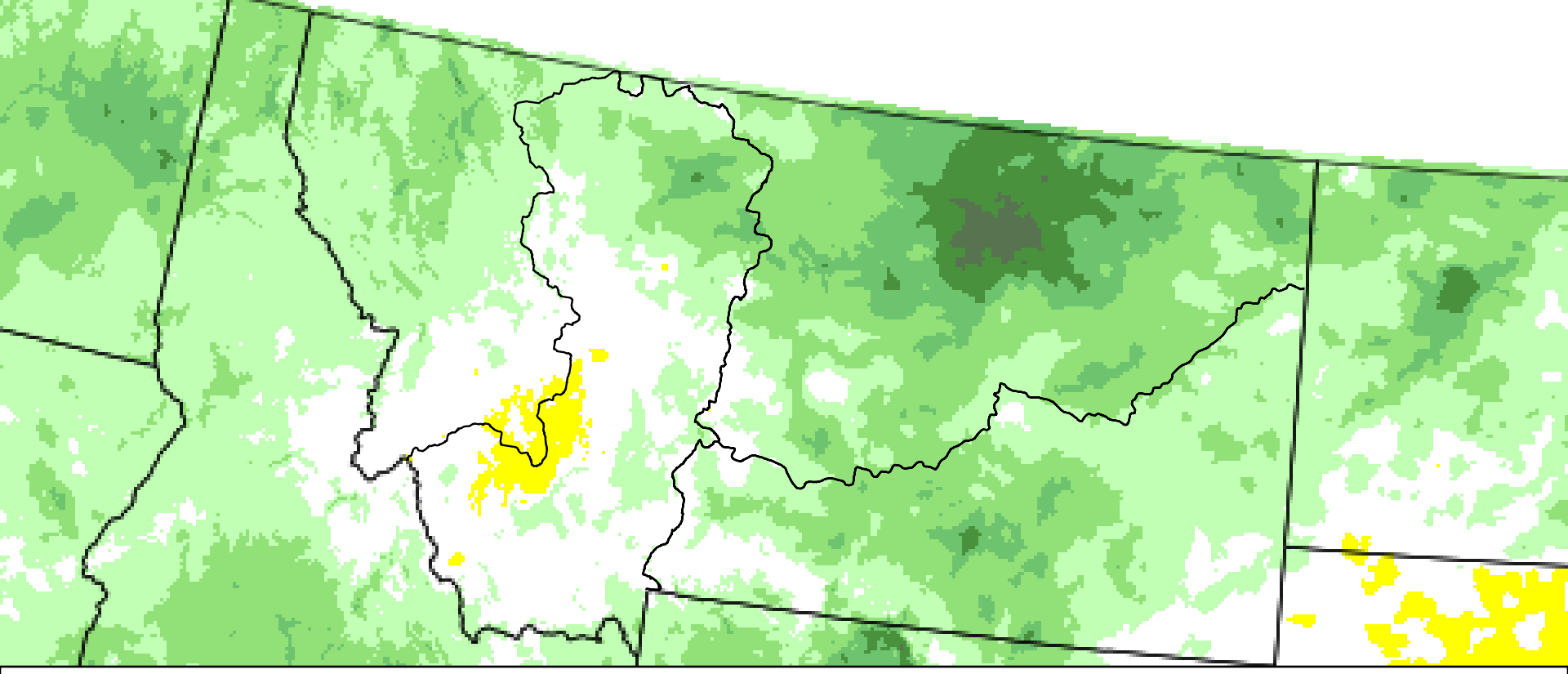
USGS

Montana DWSAC Briefing

May 18, 2017

Weather-Ready Nation

National Oceanic and Atmospheric Administration



May 16 – Apr 17 Precip Anomaly

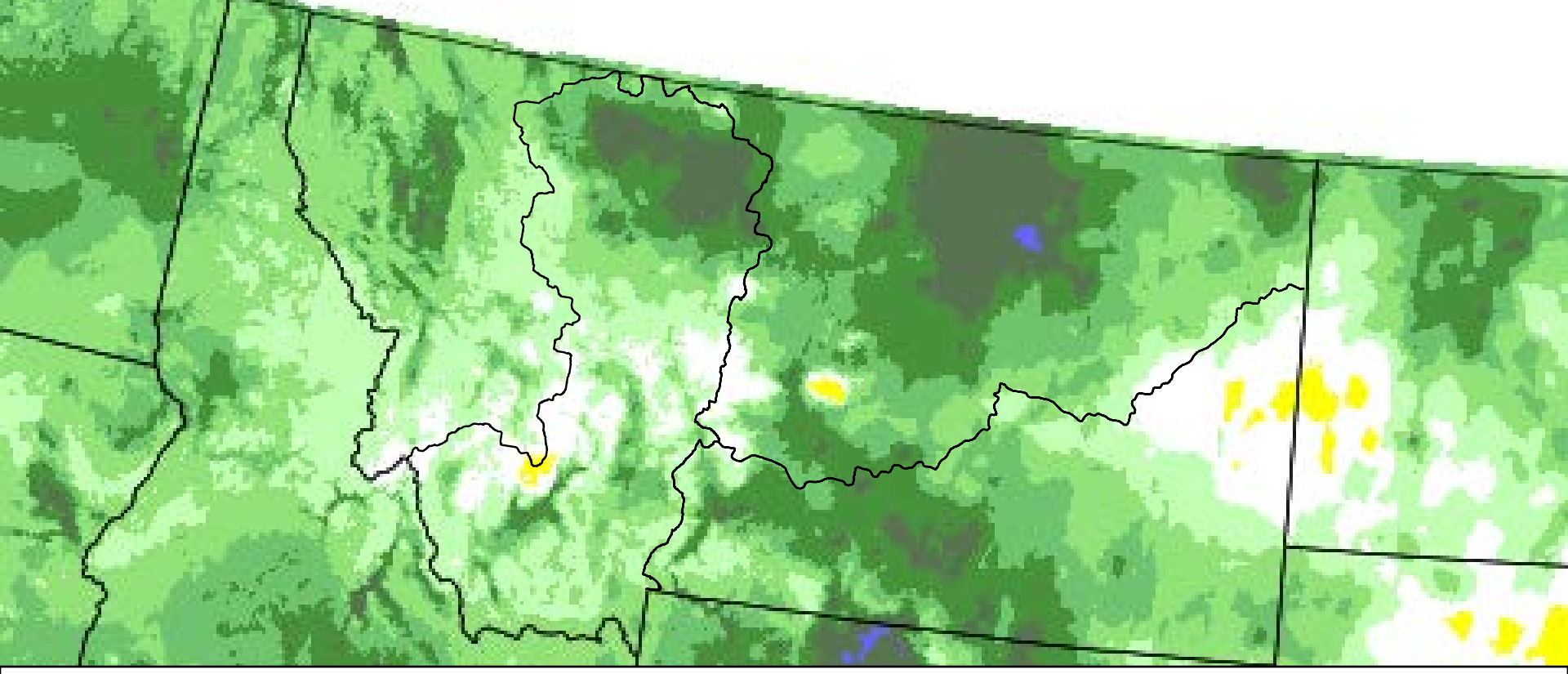
Montana: May 2016 – Apr 2017

22nd Warmest on Record

Avg Temp	20th Century Average	Departure
42.9°F	41.2°F	1.7°F

12th Wettest on Record

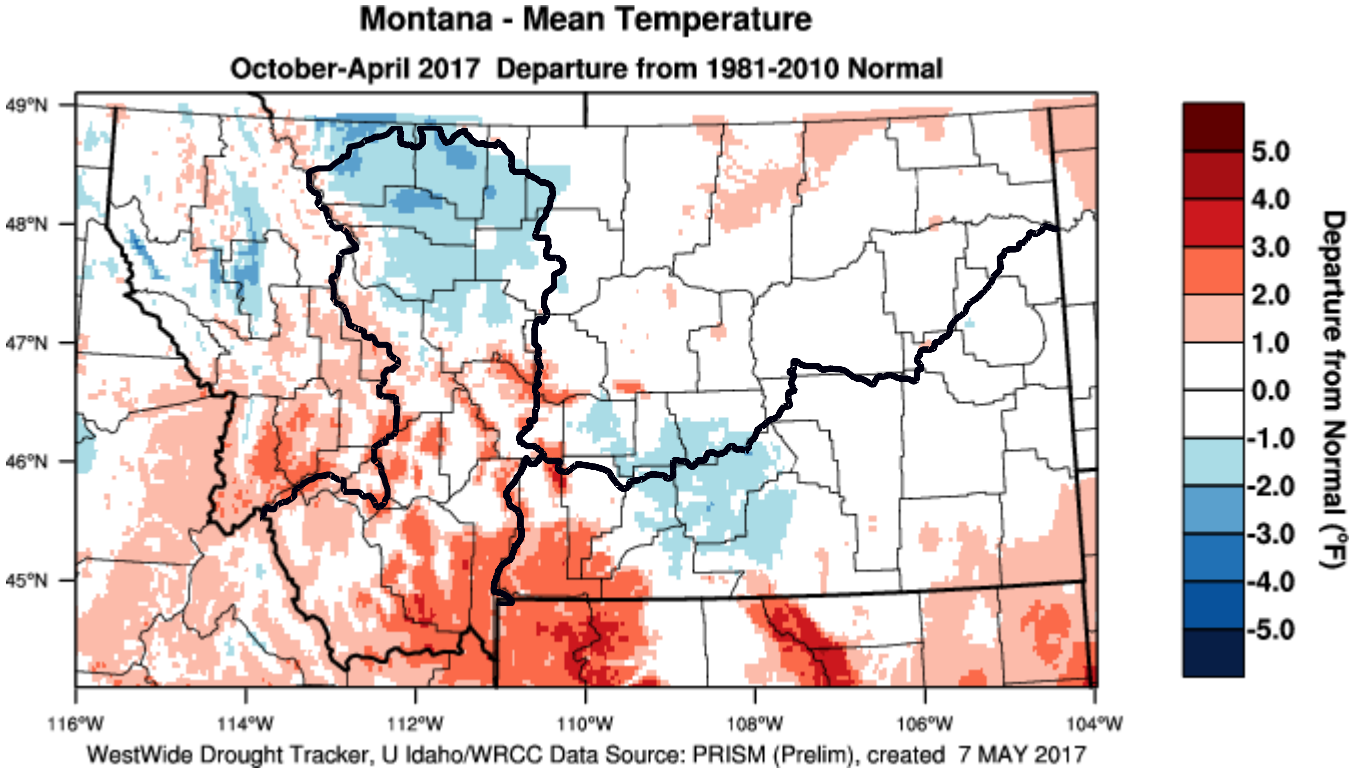
Precip	20th Century Average	Departure
22.27”	18.66”	3.61”



Water Year 2017 Precip Anomaly

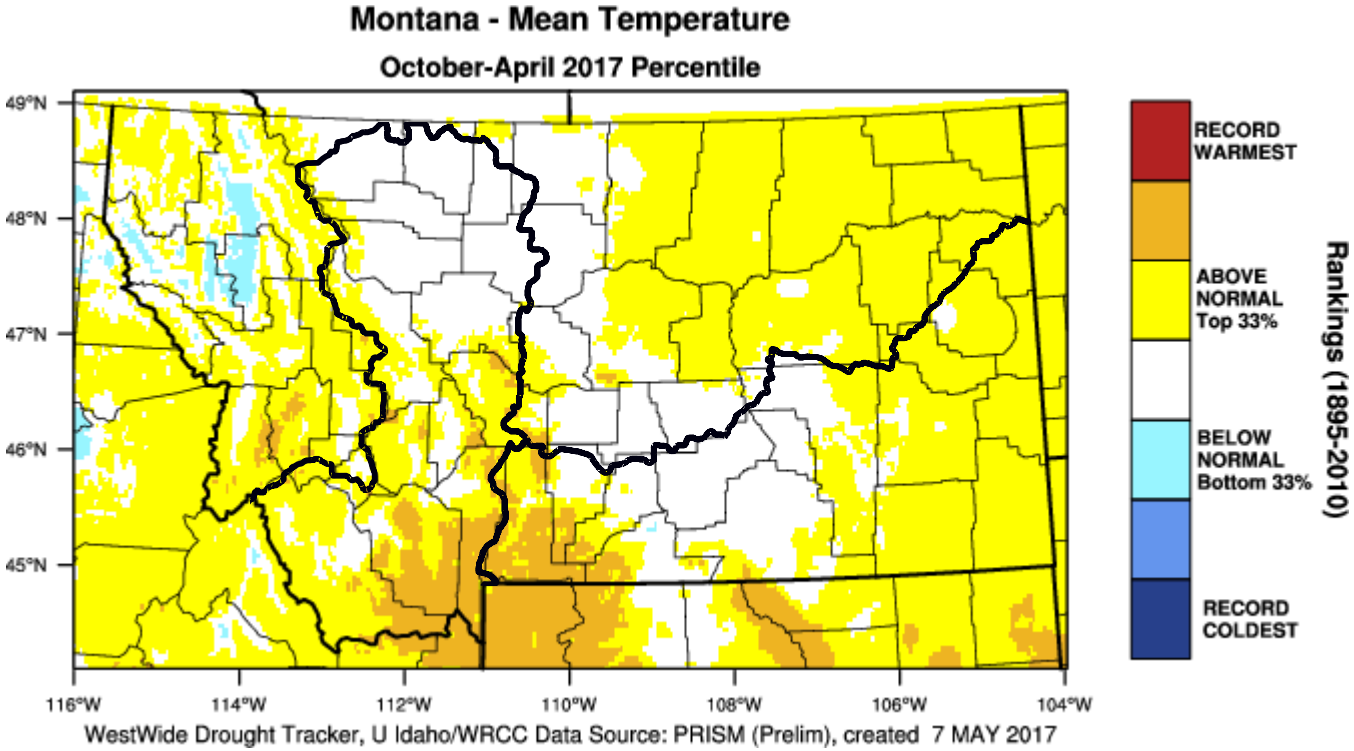
Mean Temperature Anomaly

Water Year 2017

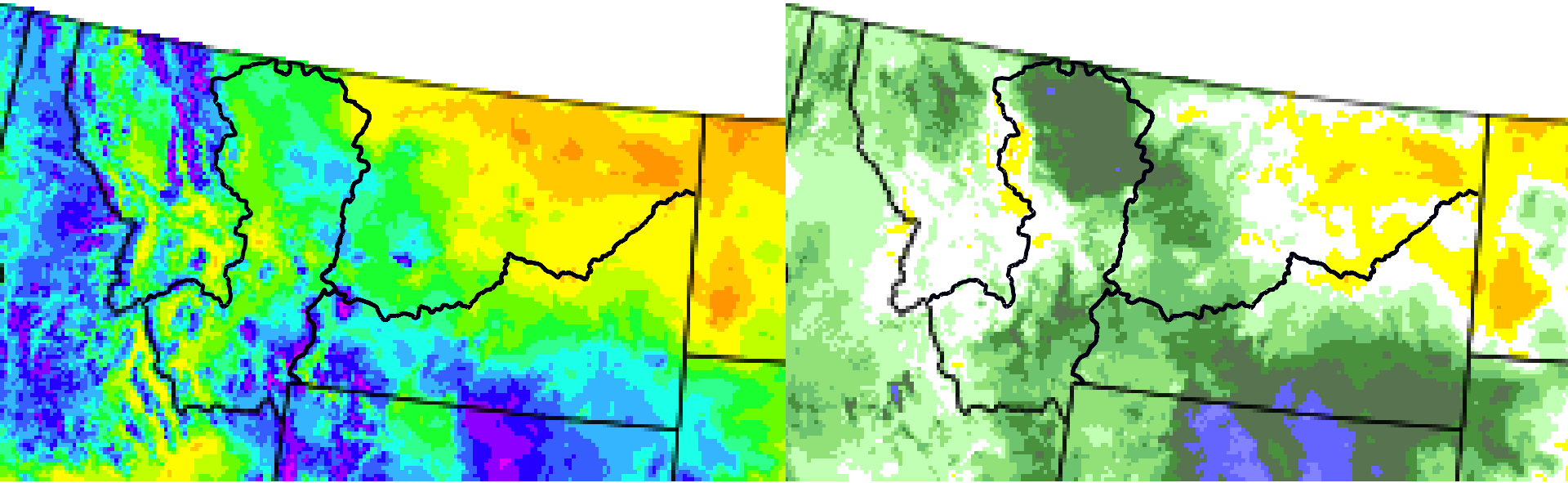


Mean Temperature Percentile

Water Year 2017



April 2017 Precip vs Anomaly



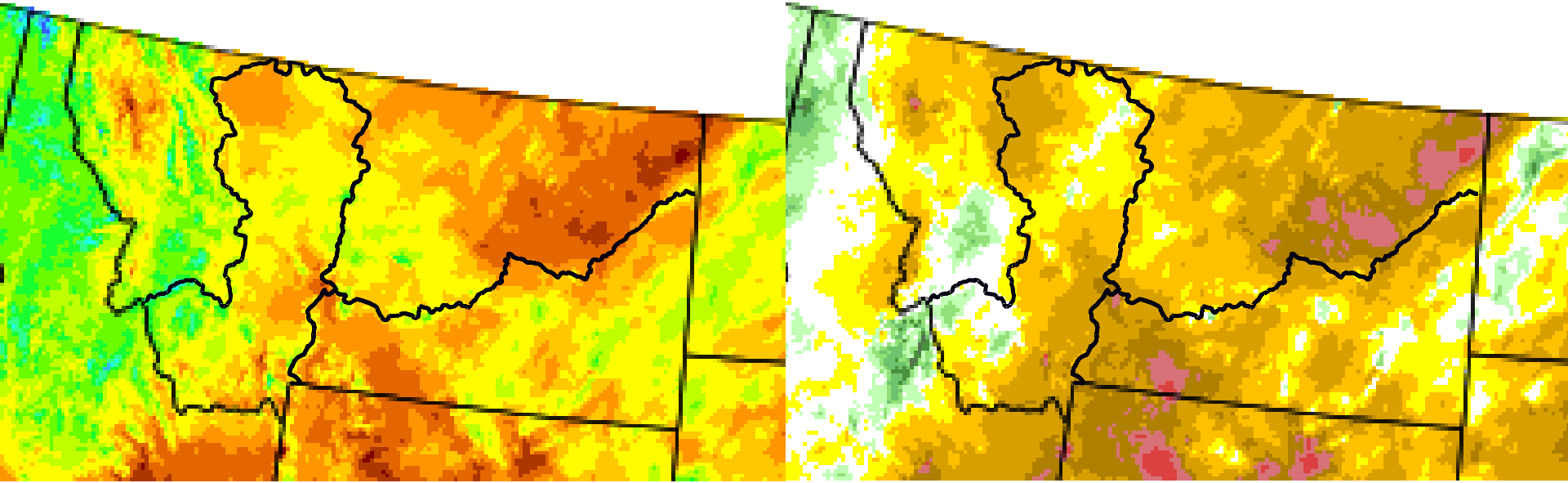
Monthly Precipitation (in.)

< 0.01	0.6 - 0.8	2.4 - 2.8	6 - 8
.01 - 0.1	0.8 - 1.2	2.8 - 3.2	8 - 12
0.1 - 0.2	1.2 - 1.6	3.2 - 4	12 - 16
0.2 - 0.4	1.6 - 2	4 - 5	16 - 20
0.4 - 0.6	2 - 2.4	5 - 6	> 20

% of Average Precipitation

0	50 - 70	150 - 170
1 - 10	70 - 90	170 - 200
11 - 20	90 - 110	200 - 300
20 - 30	110 - 130	300 - 400
30 - 50	130 - 150	> 400

May Precip vs Anomaly – So Far



Monthly Precipitation (in.)

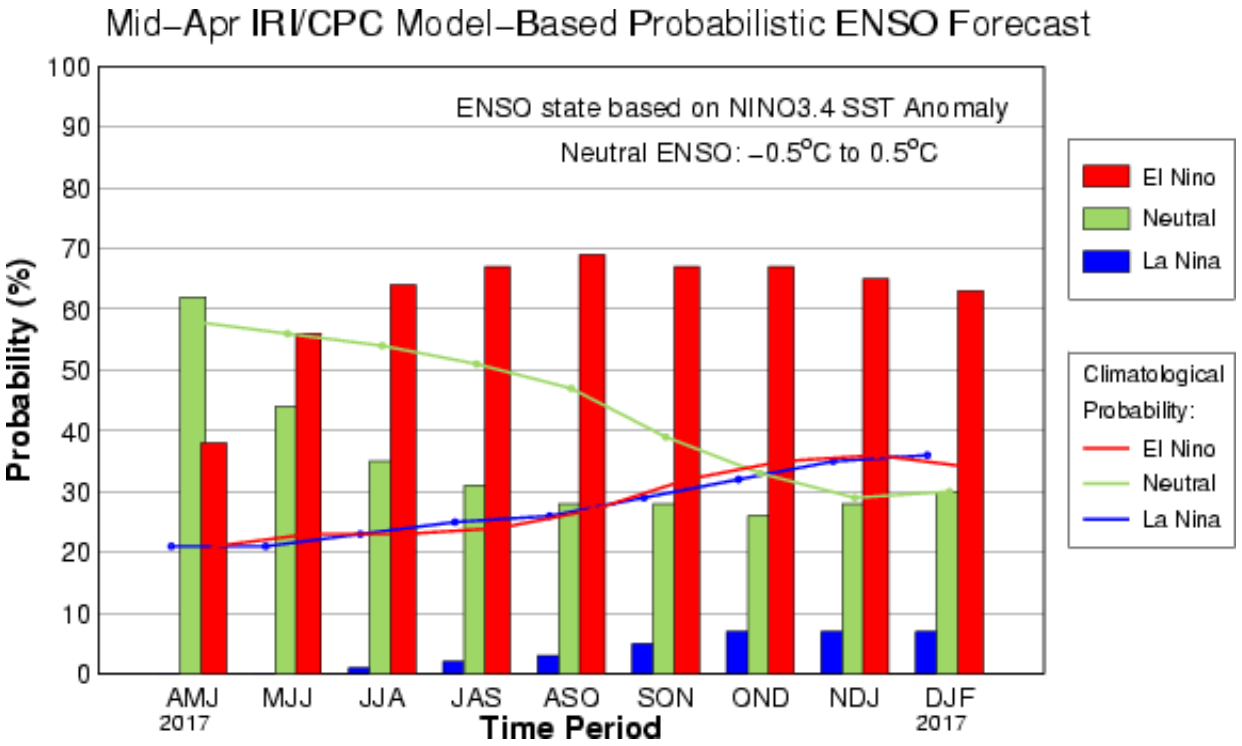
< 0.01	0.6 - 0.8	2.4 - 2.8	6 - 8
.01 - 0.1	0.8 - 1.2	2.8 - 3.2	8 - 12
0.1 - 0.2	1.2 - 1.6	3.2 - 4	12 - 16
0.2 - 0.4	1.6 - 2	4 - 5	16 - 20
0.4 - 0.6	2 - 2.4	5 - 6	> 20

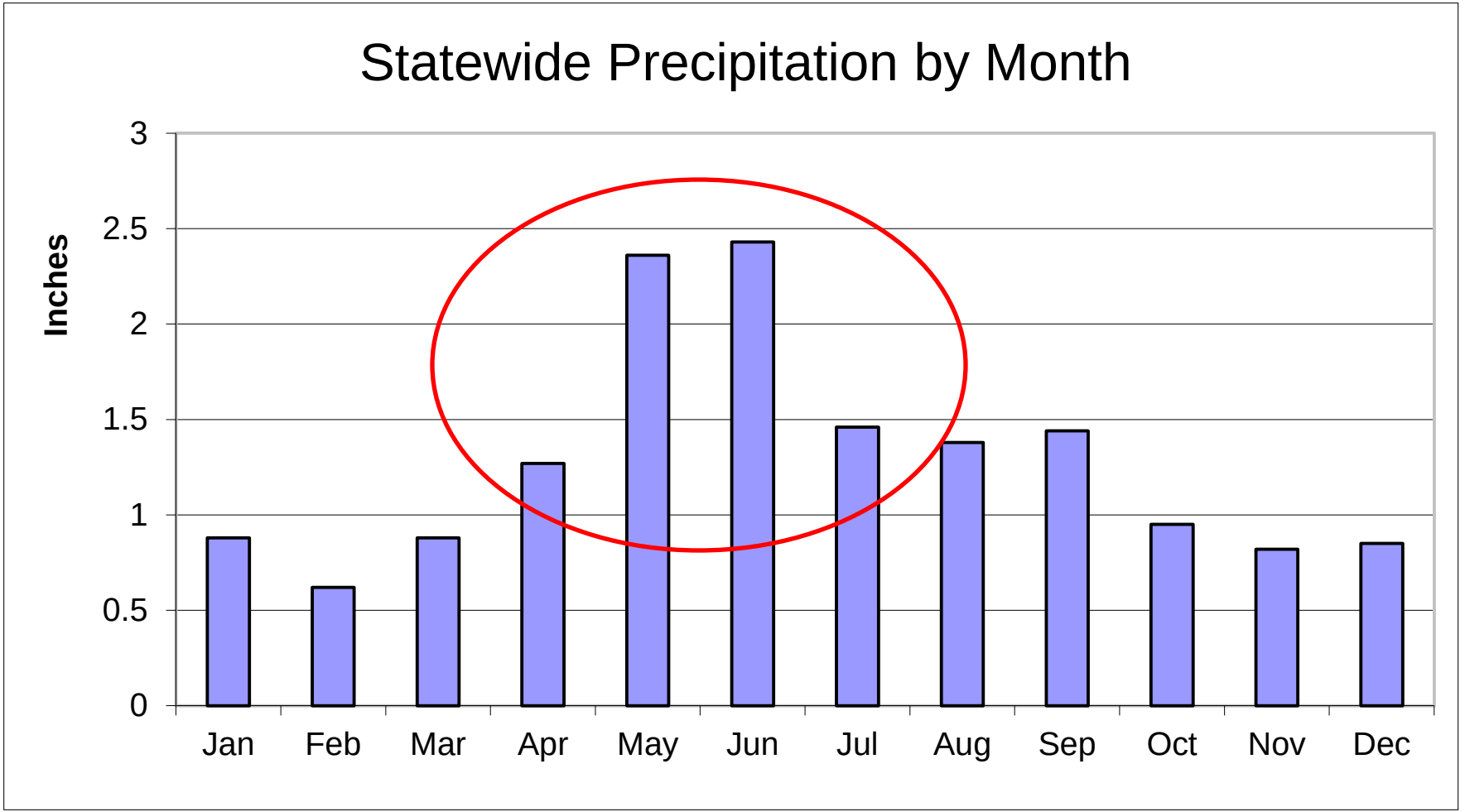
% of Average Precipitation

0	50 - 70	150 - 170
1 - 10	70 - 90	170 - 200
11 - 20	90 - 110	200 - 300
20 - 30	110 - 130	300 - 400
30 - 50	130 - 150	> 400

ENSO

Chance of El Niño Return this Summer

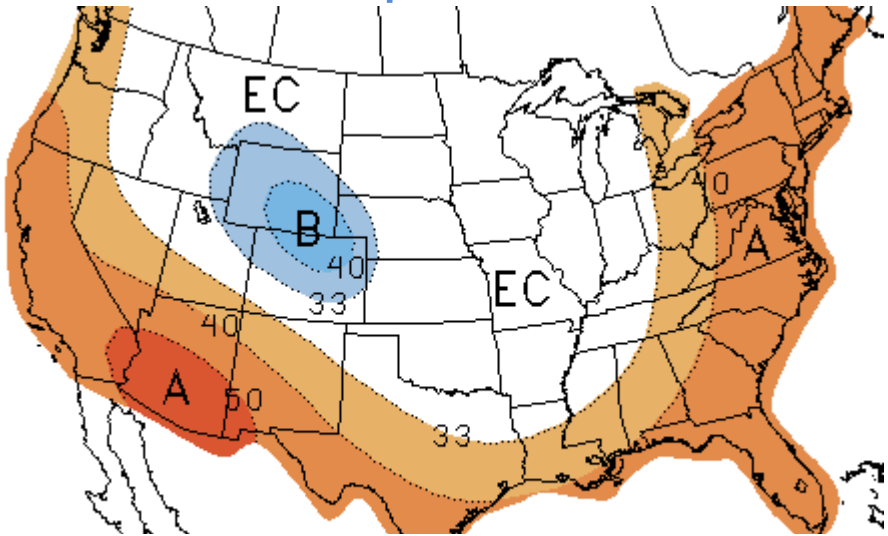



Statewide Precipitation by Month
Inches
3
2.5
2
1.5
1
0.5
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

June Outlook

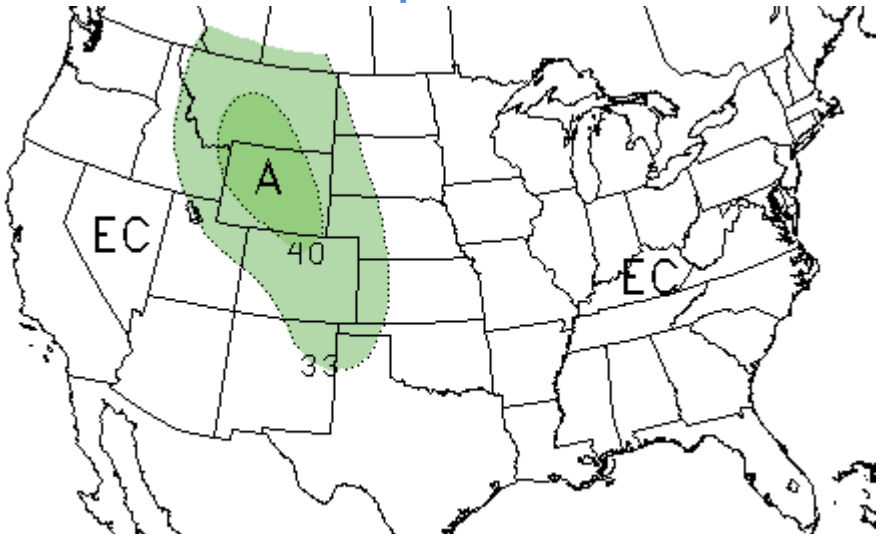
Created May18

Temperature



Equal chances for above normal or below temperatures over Montana, >33% chance of below normal temperatures over far southern Montana

Precipitation

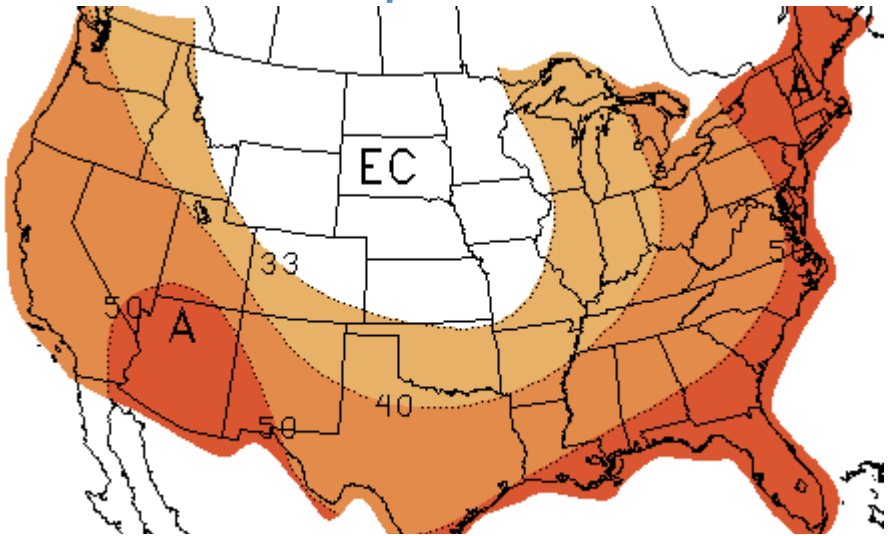


> 33% chance of above normal precipitation over Montana, but 40% chance of above precipitation extreme over central and southern Montana

June – August Outlook

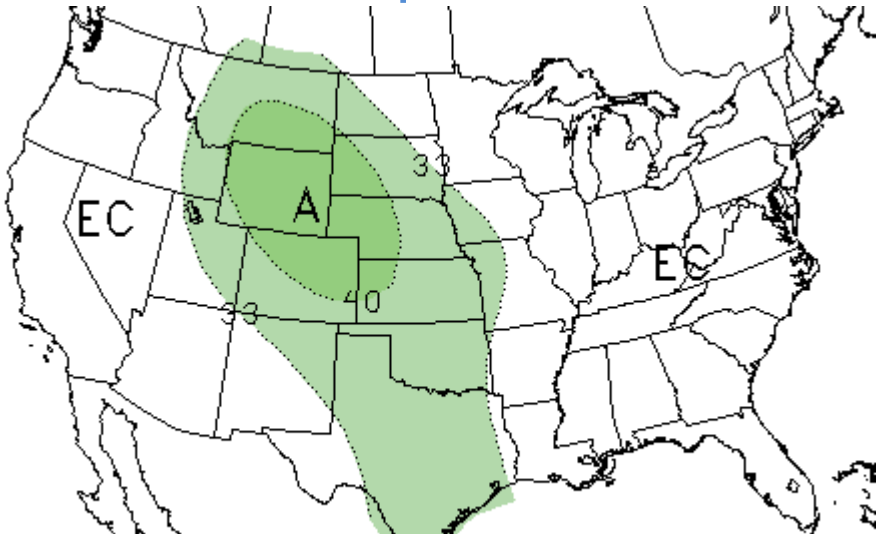
Created May 18

Temperature



Equal chances for above normal, normal or below normal temperatures over Montana

Precipitation

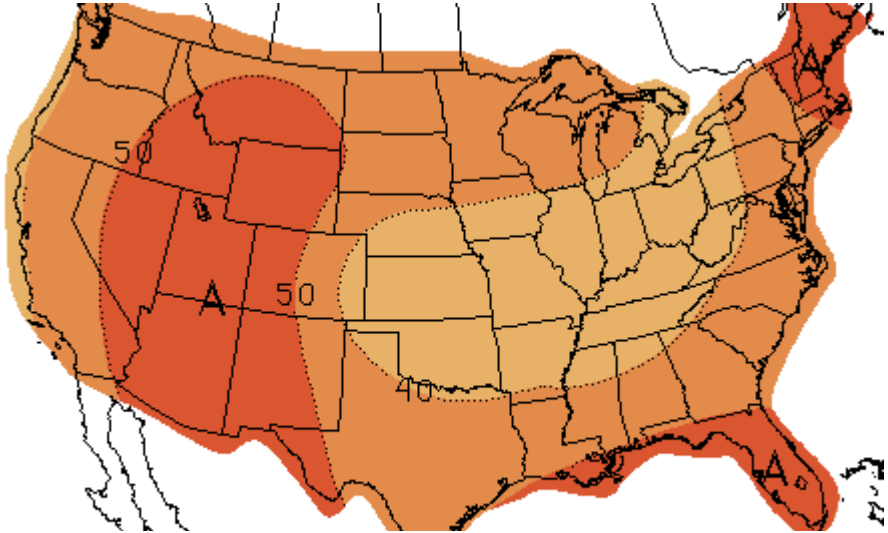


> 33% chance of above normal precipitation over Montana, but 40% chance of above precipitation over southeast Montana and equal chances for above normal, normal or below normal precipitation over northwest Montana

September – November Outlook

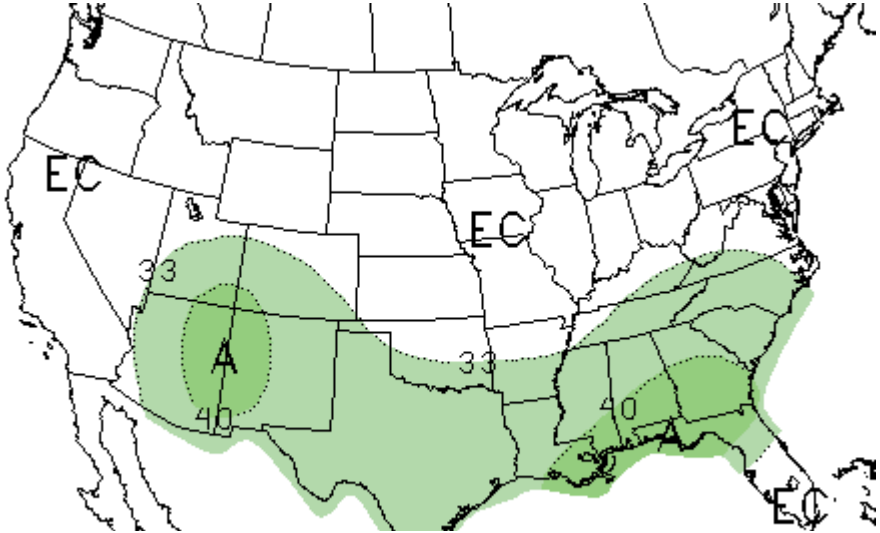
Created May 18

Temperature



>40% chance of above normal temperatures over northern Montana but >50% chance of above normal temperatures for rest of Montana

Precipitation

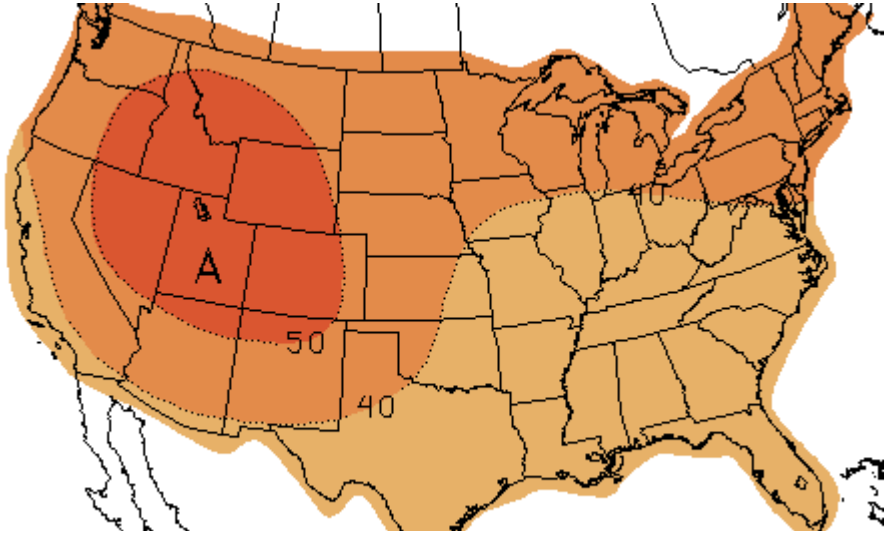


Equal chances for above normal, normal or below normal precipitation over Montana

December – February Outlook

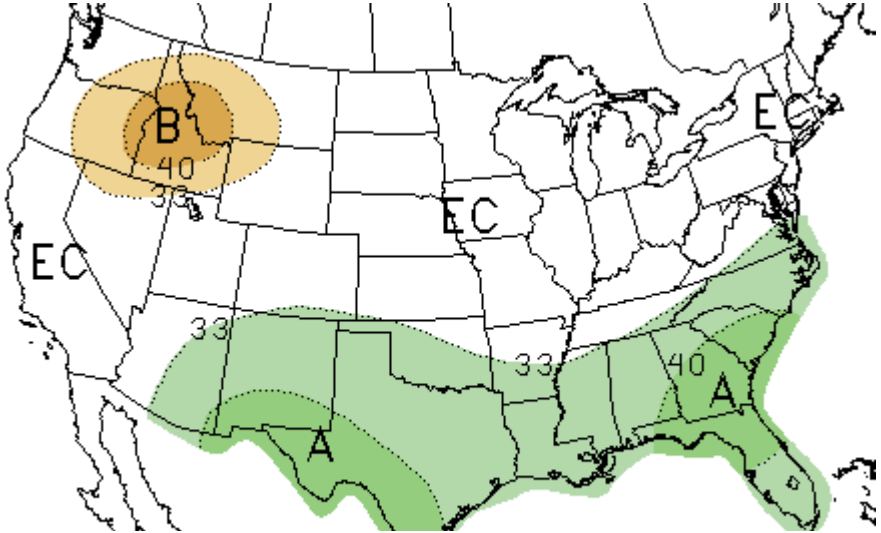
Created May 18

Temperature



>40% chance of above normal temperatures over northern and far eastern Montana but >50% chance of above normal temperatures for rest of Montana

Precipitation



> 33% chance of below normal precipitation over western and central Montana, but 40% chance of below normal precipitation over southwest Montana

weather.gov

weather.gov/billings
weather.gov/glasgow
weather.gov/missoula
weather.gov/greatfalls

Weather-Ready Nation
National Oceanic and Atmospheric Administration

Governor's Drought Advisory Committee
Snowpack and Streamflow Update
May 18th, 2017

Lucas Zukiewicz
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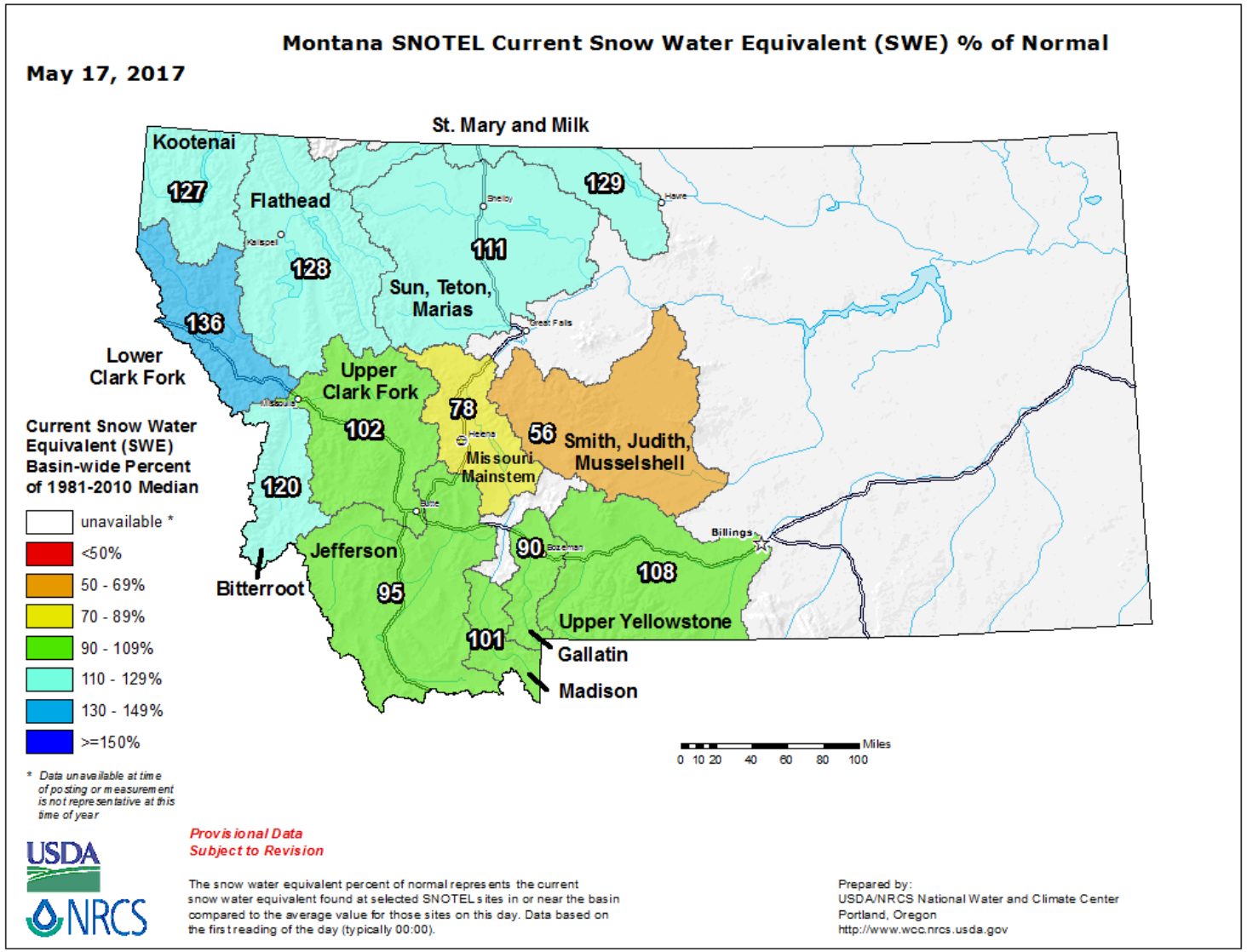
http://www.nrcs.usda.gov/wps/portal/nrcs/main/mt/snow/

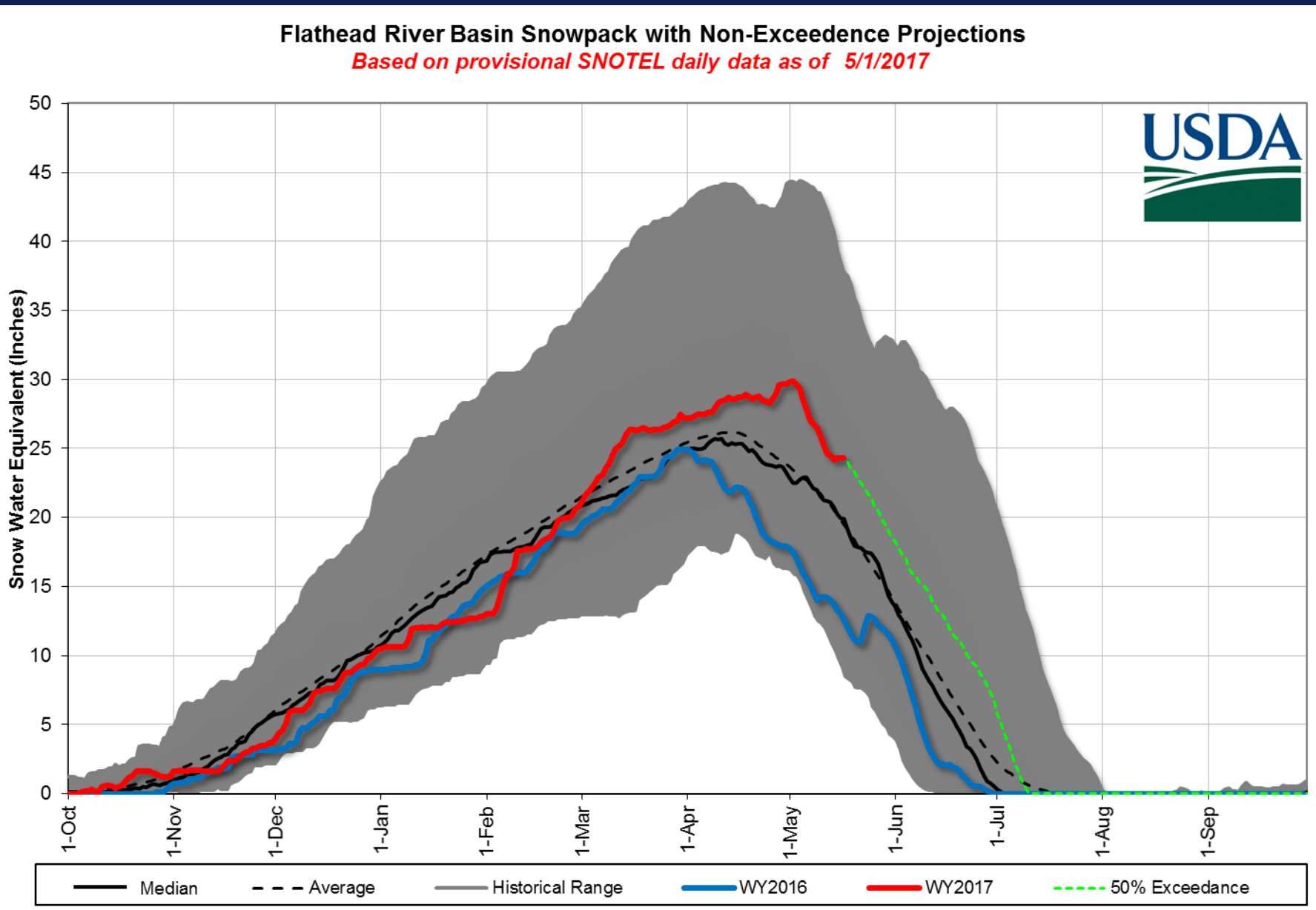
Snowpack

Montana Snow Survey

Snowpack Percentages May 17th, 2017



Montana Snow Survey



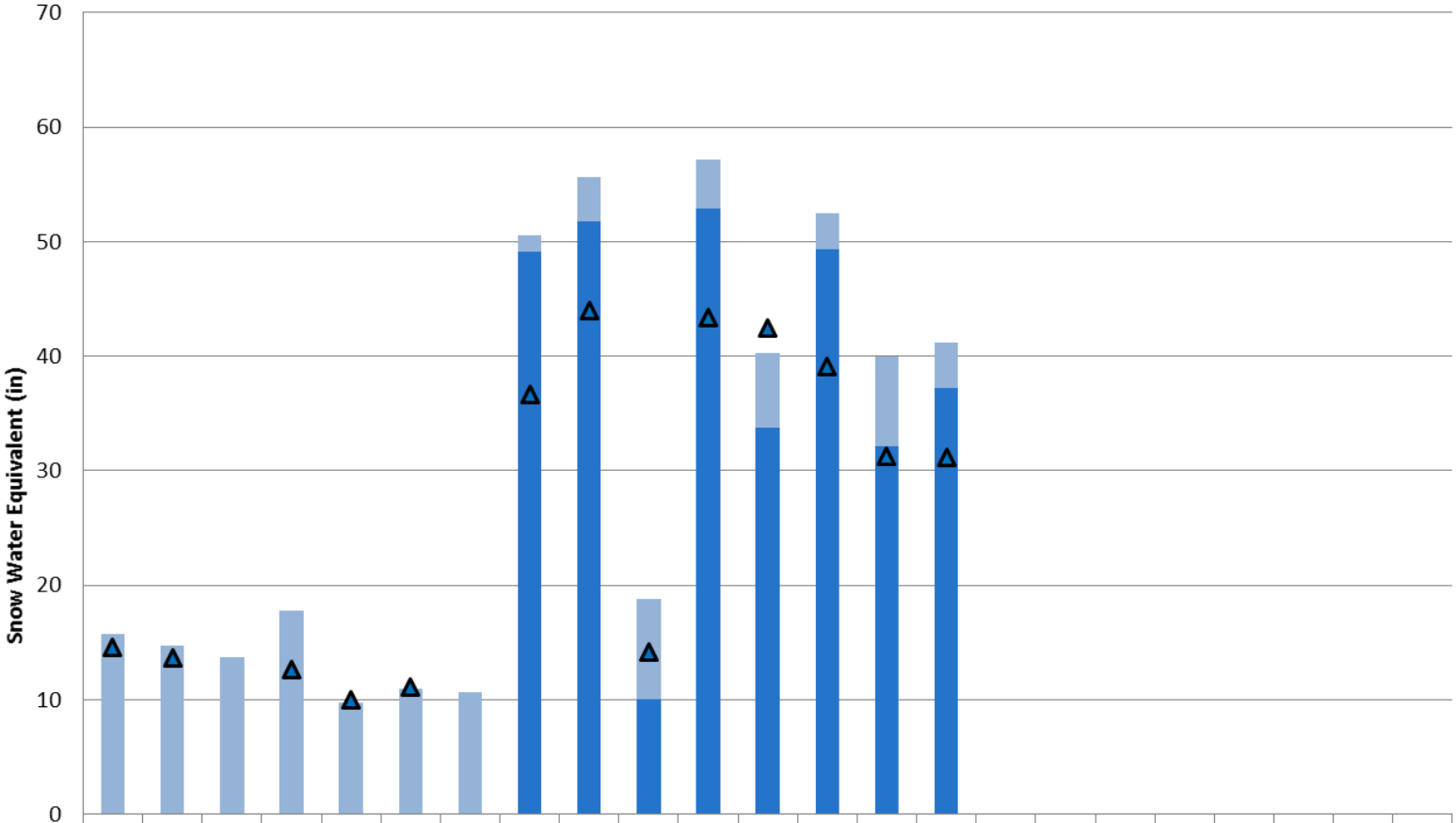
Montana Snow Survey

United States Department of Agriculture
NRCS Natural Resources Conservation Service

Flathead in Montana

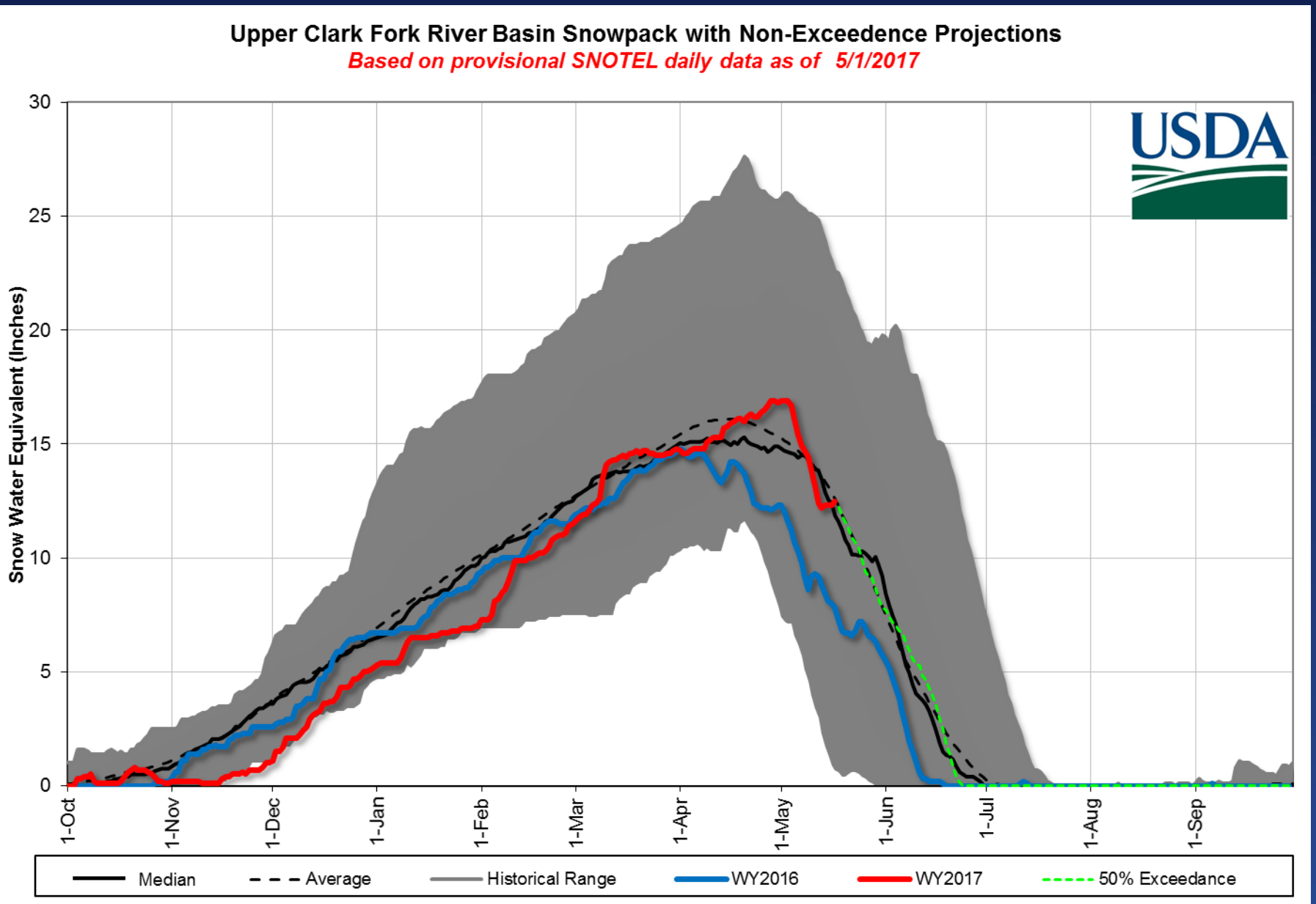
Percent Remaining Snowpack

5/17/2017



	4300	4350	4750	4900	4920	5035	5930	6030	6040	6150	6300	6330	6780	6900	7400
Peak SWE	15.7	14.7	13.7	17.8	9.7	11	10.7	50.6	55.6	18.8	57.2	40.3	52.5	40	41.2
Current SWE	0	0	0	0	0	0	0	49.1	51.8	10	52.9	33.8	49.3	32.1	37.2
Normal Peak	14.6	13.7		12.6	10.0	11.1		36.7	44.0	14.2	43.4	42.5	39.1	31.3	31.2
Percent Remaining	0%	0%	0%	0%	0%	0%	0%	97%	93%	53%	92%	84%	94%	80%	90%
Percent of Normal								138%	130%	222%	129%	98%	132%	118%	135%

Montana Snow Survey



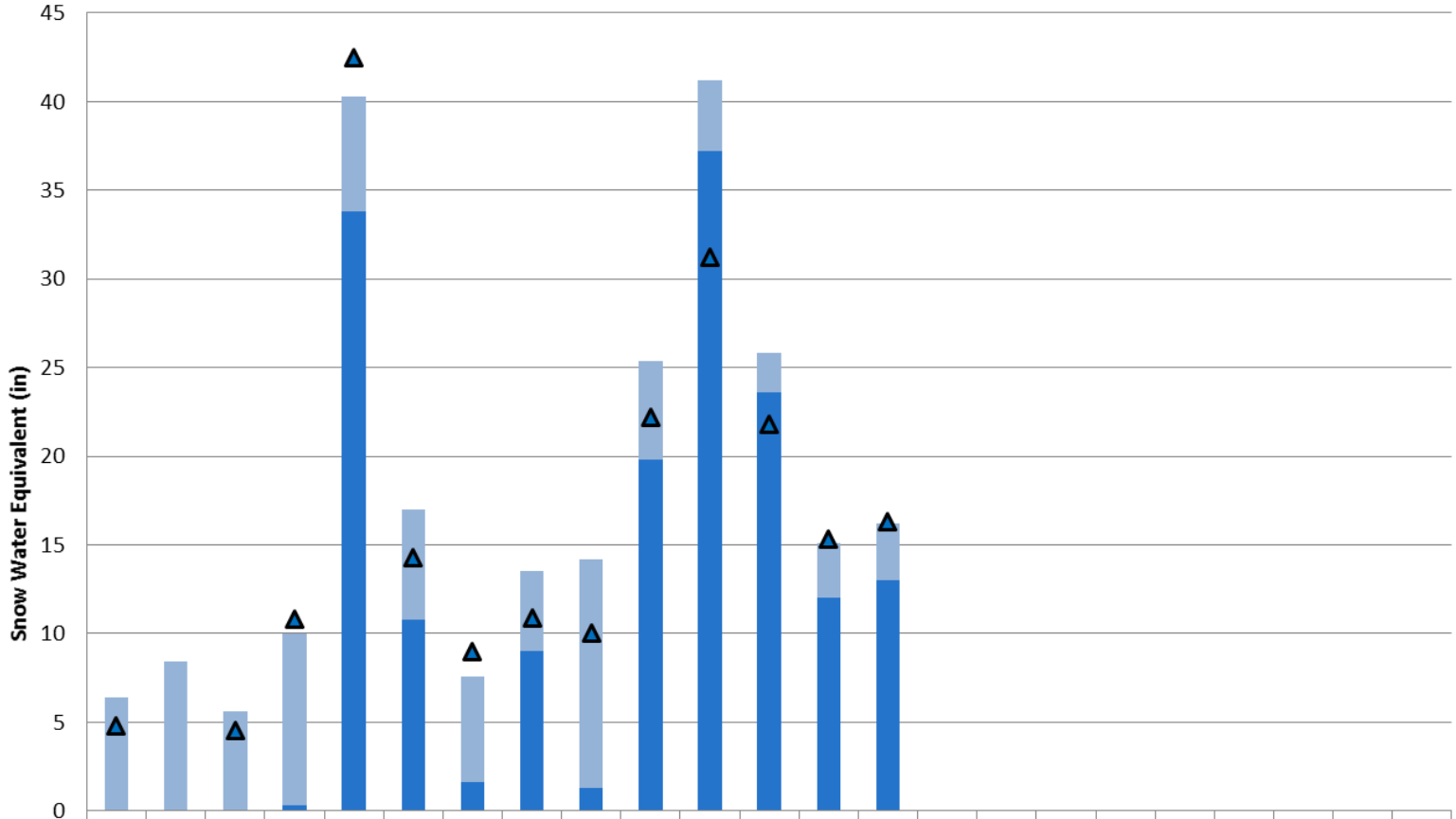
Montana Snow Survey

United States Department of Agriculture NRCS Natural Resources Conservation Service

Upper Clark Fork Basin

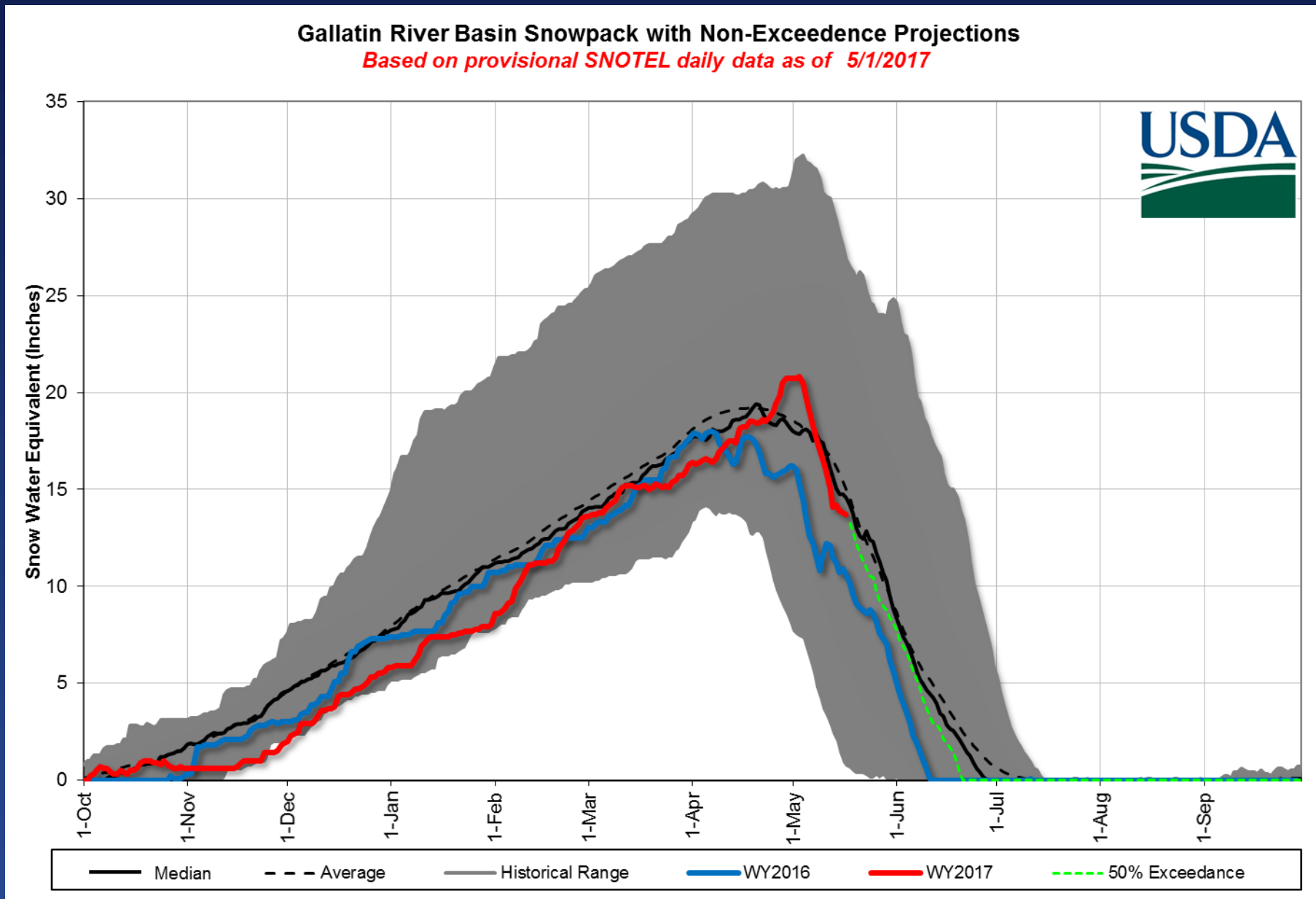
Percent Remaining Snowpack

5/17/2017

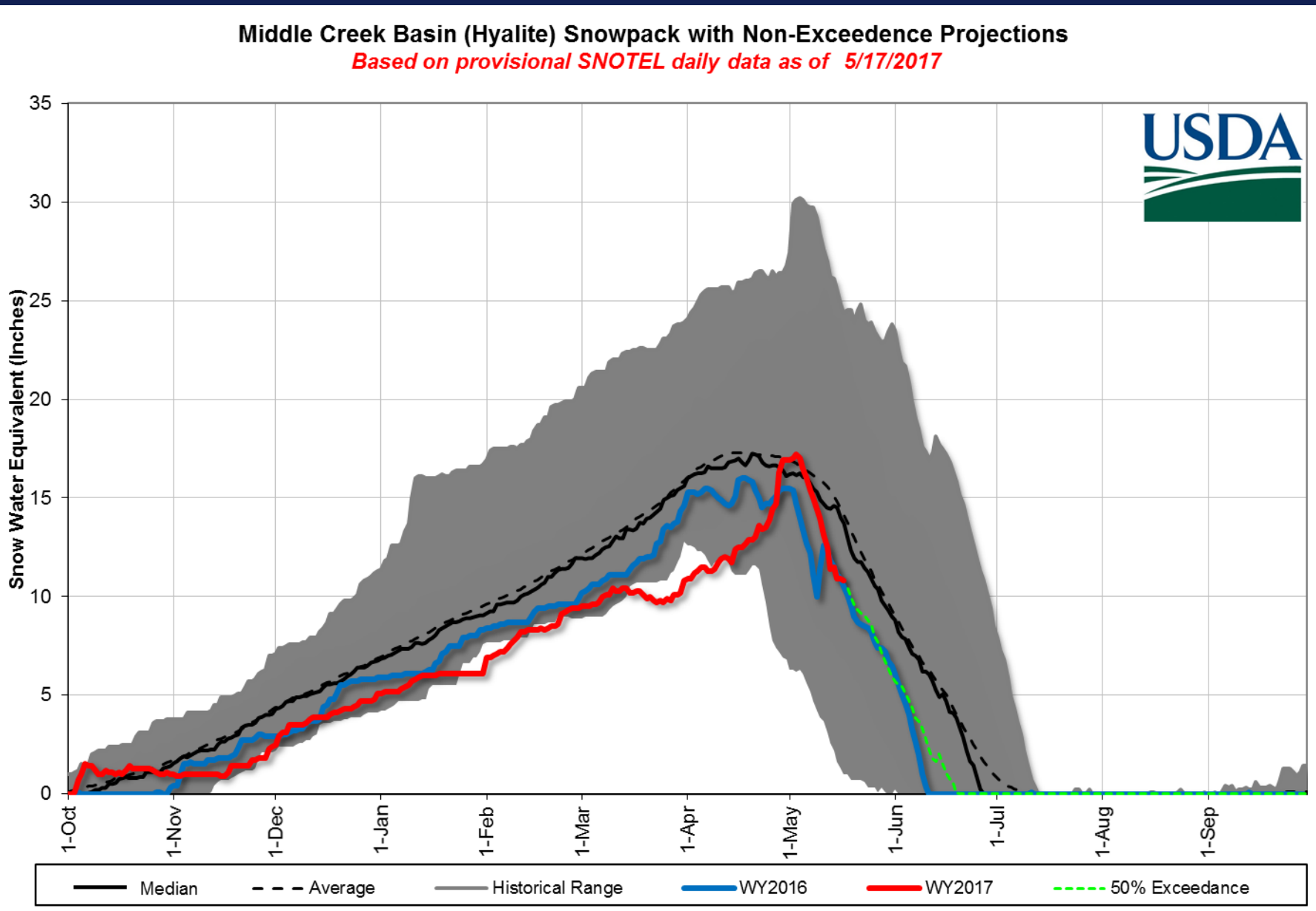


	4680	5200	5600	6250	6330	7020	7180	7200	7210	7250	7400	7800	8000	8250
Peak SWE	6.4	8.4	5.6	10	40.3	17	7.6	13.5	14.2	25.4	41.2	25.8	15.1	16.2
Current SWE	0	0	0	0.3	33.8	10.8	1.6	9	1.3	19.8	37.2	23.6	12	13
Normal Peak	4.8		4.5	10.8	42.5	14.3	9.0	10.9	10.0	22.2	31.2	21.8	15.3	16.3
Percent Remaining	0%	0%	0%	3%	84%	64%	21%	67%	9%	78%	90%	91%	79%	80%
Percent of Normal				75%	98%	121%	23%	110%	30%	106%	135%	112%	84%	89%

Montana Snow Survey



Montana Snow Survey



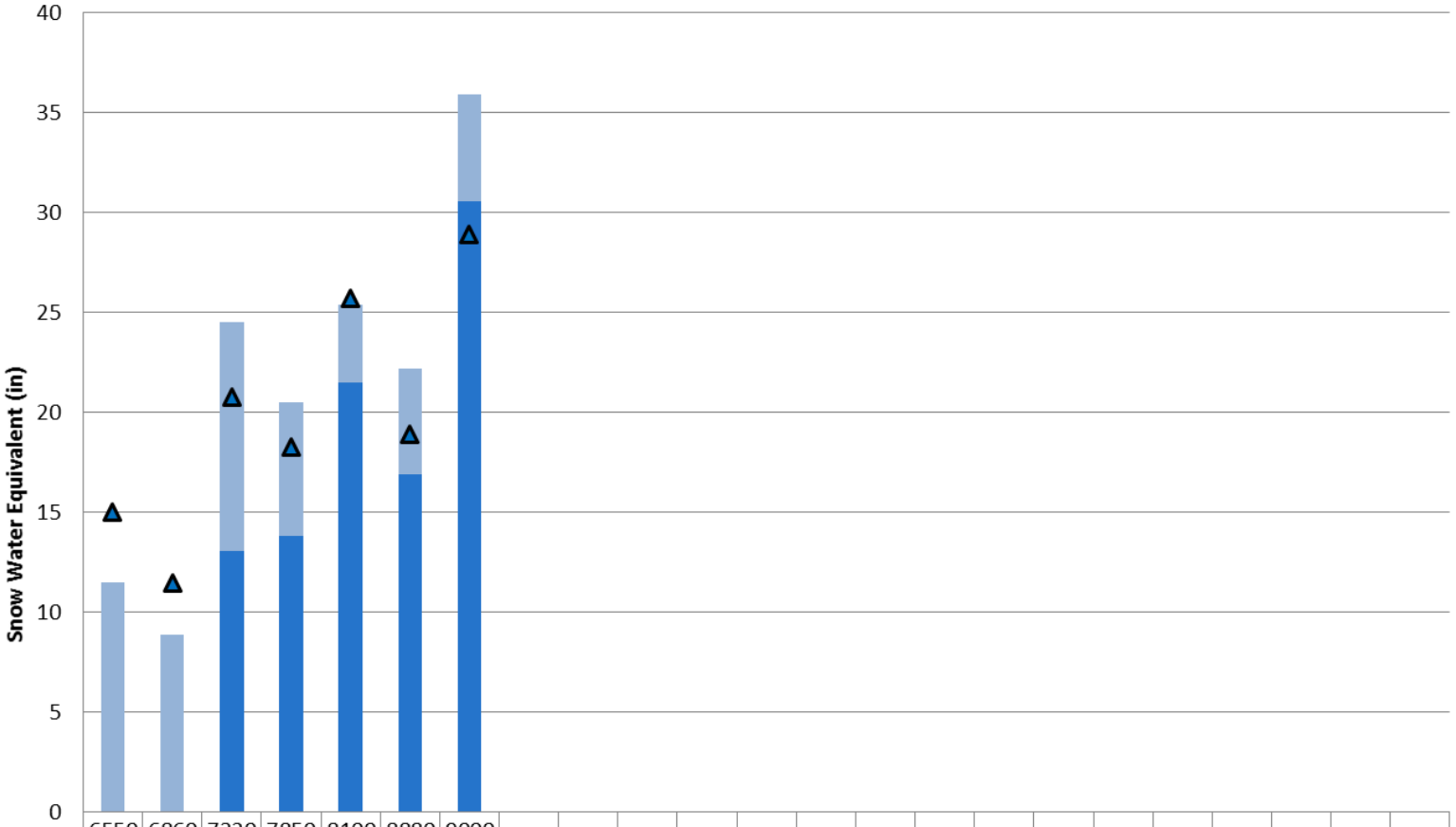
Montana Snow Survey

United States Department of Agriculture
NRCS Natural Resources Conservation Service

Gallatin River Basin

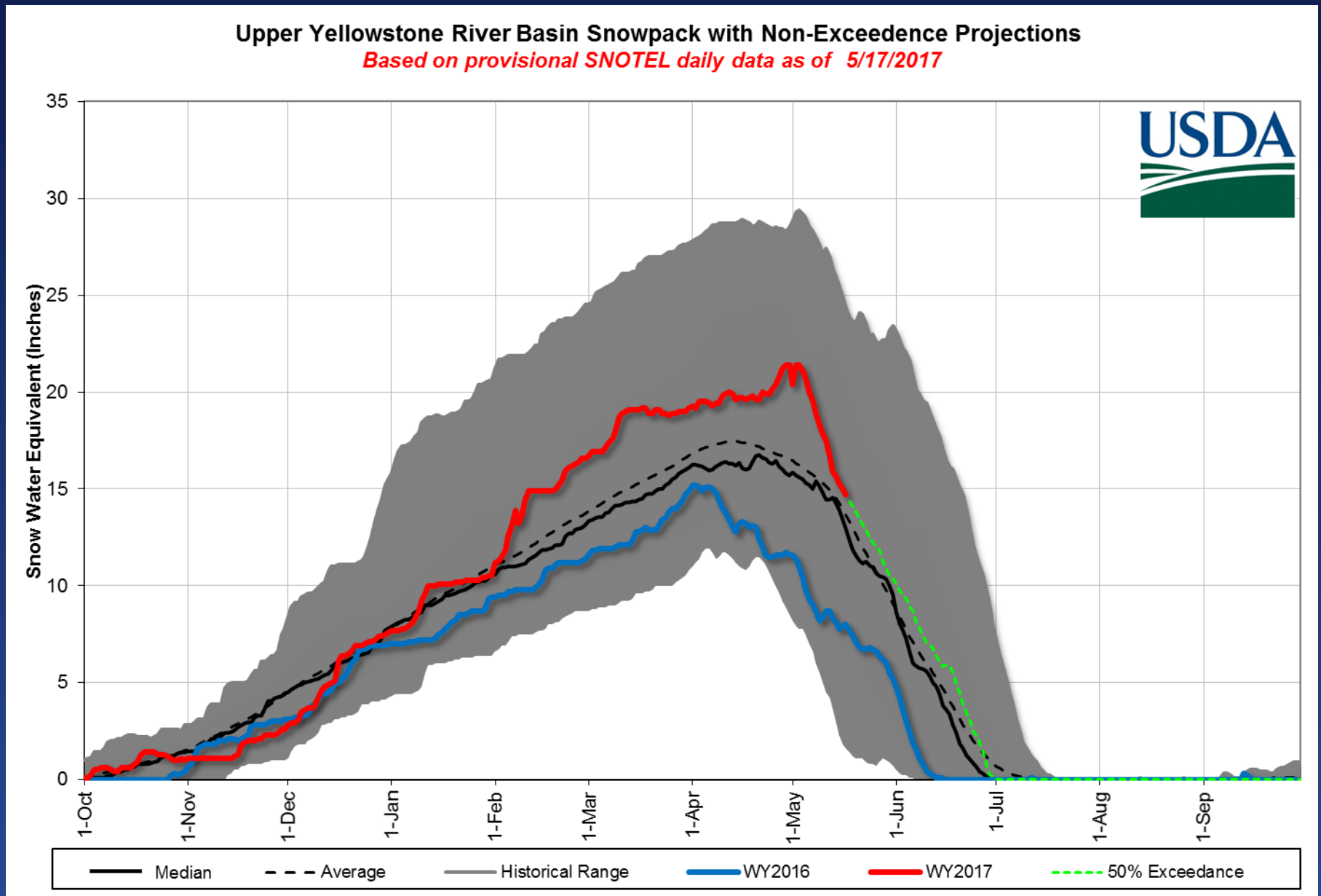
Percent Remaining Snowpack

5/17/2017

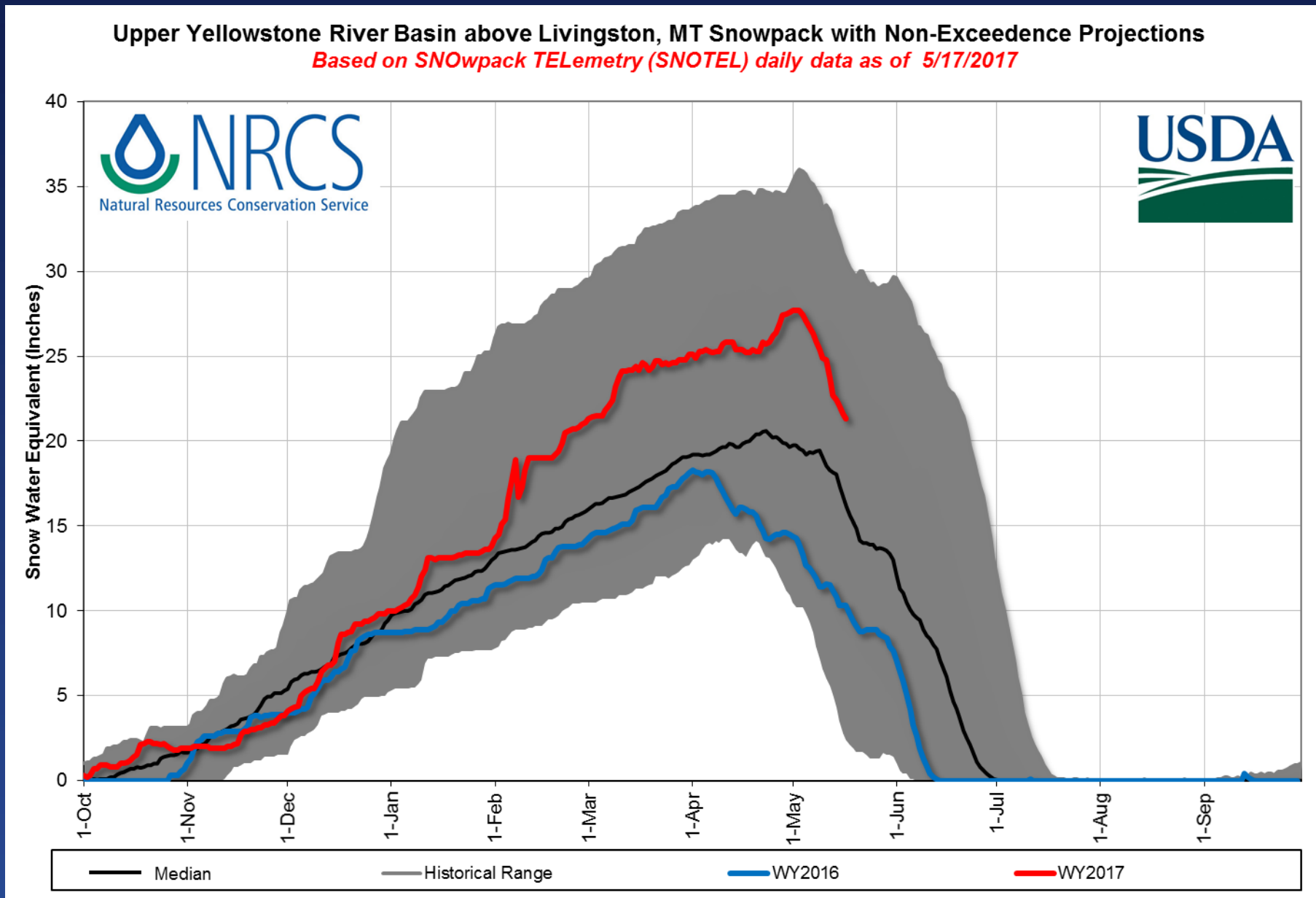


	6550	6860	7320	7850	8100	8880	9000
Peak SWE	11.5	8.9	24.5	20.5	25.4	22.2	35.9
Current SWE	0	0	13.1	13.8	21.5	16.9	30.6
Normal Peak	15.0	11.5	20.8	18.3	25.7	18.9	28.9
Percent Remaining	0%	0%	53%	67%	85%	76%	85%
Percent of Normal	0%	0%	74%	95%	84%	101%	114%

Montana Snow Survey



Montana Snow Survey



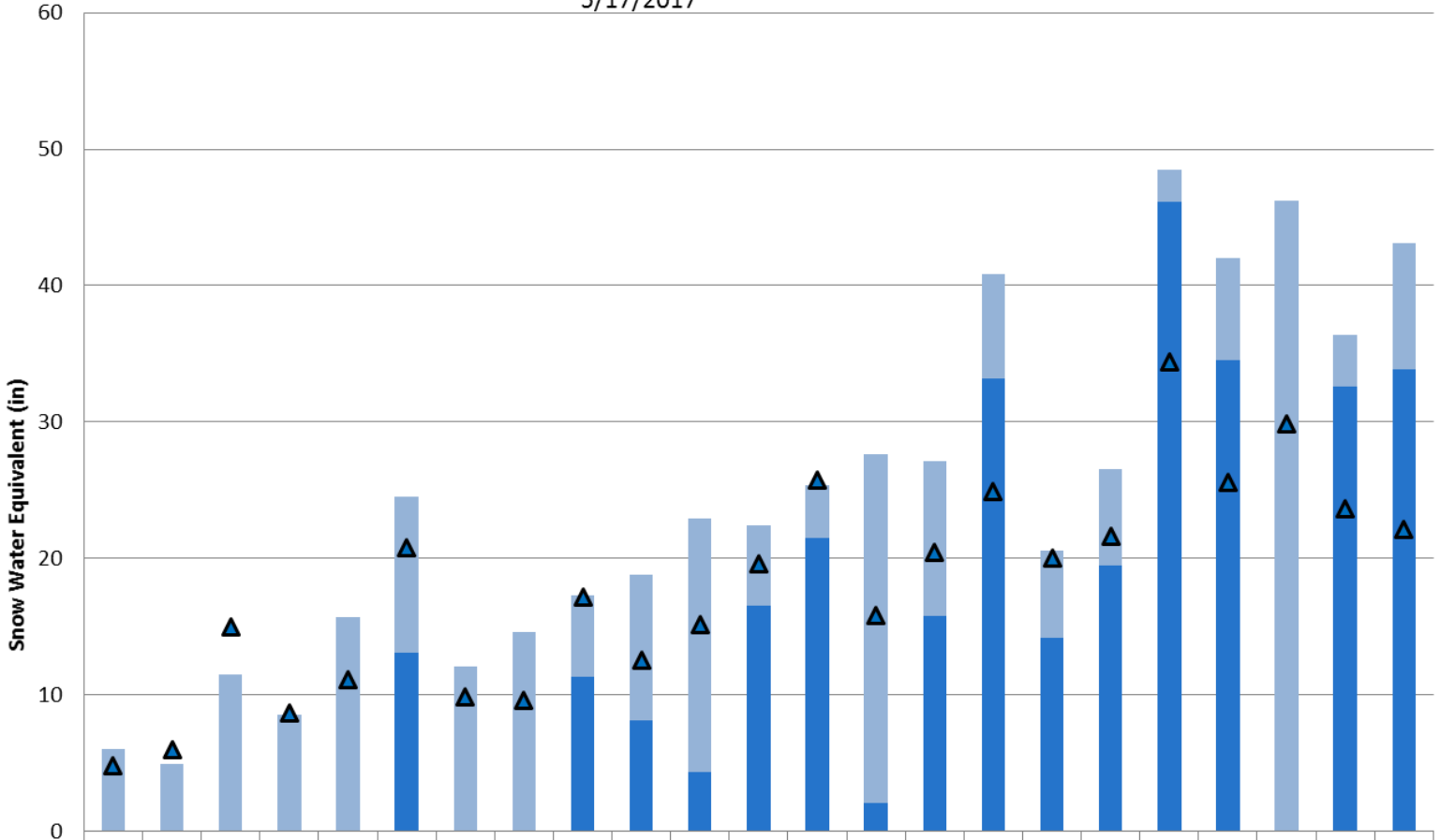
Montana Snow Survey

United States Department of Agriculture NRCS Natural Resources Conservation Service

Upper Yellowstone

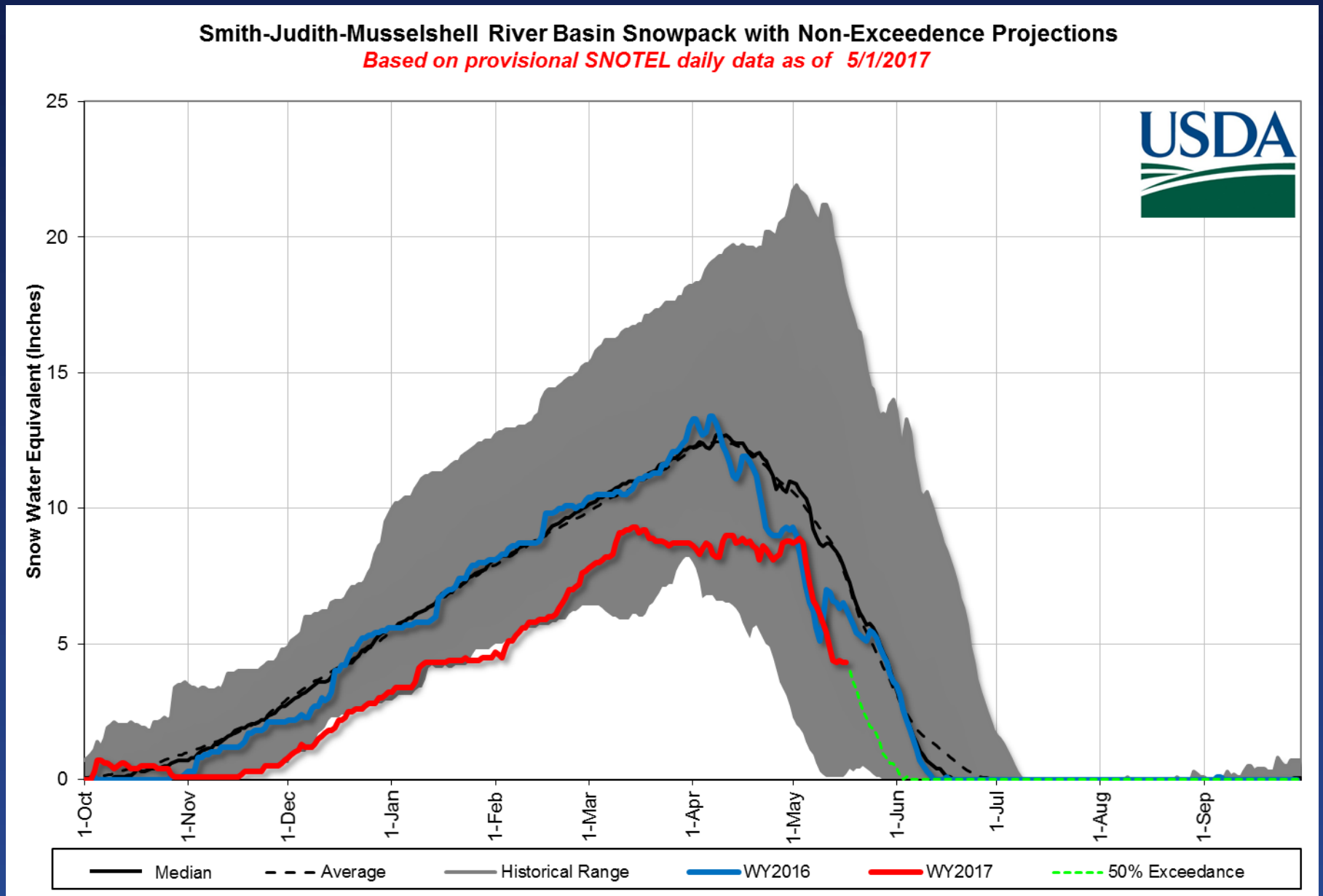
Percent Remaining Snowpack

5/17/2017



	5880	6500	6550	6670	7120	7320	7350	7650	7850	7870	7980	8100	8100	8350	8420	8700	8830	8850	9100	9200	9240	9360	9400
Peak SWE	6	4.9	11.5	8.5	15.7	24.5	12.1	14.6	17.3	18.8	22.9	22.4	25.4	27.6	27.1	40.8	20.6	26.5	48.5	42	46.2	36.4	43.1
Current SWE	0	0	0	0	0	13.1	0	0	11.3	8.1	4.3	16.5	21.5	2.1	15.8	33.2	14.2	19.5	46.1	34.5		32.6	33.9
Normal Peak	4.8	6.0	15.0	8.7	11.1	20.8	9.8	9.6	17.2	12.5	15.1	19.6	25.7	15.8	20.4	24.9	20.0	21.6	34.4	25.6	29.9	23.6	22.1
Percent Remaining	0%	0%	0%	0%	0%	53%	0%	0%	65%	43%	19%	74%	85%	8%	58%	81%	69%	74%	95%	82%		90%	79%
Percent of Normal			0%			74%			67%	193%	119%	88%	84%	16%	97%	140%	71%	98%	137%	139%		146%	162%

Montana Snow Survey



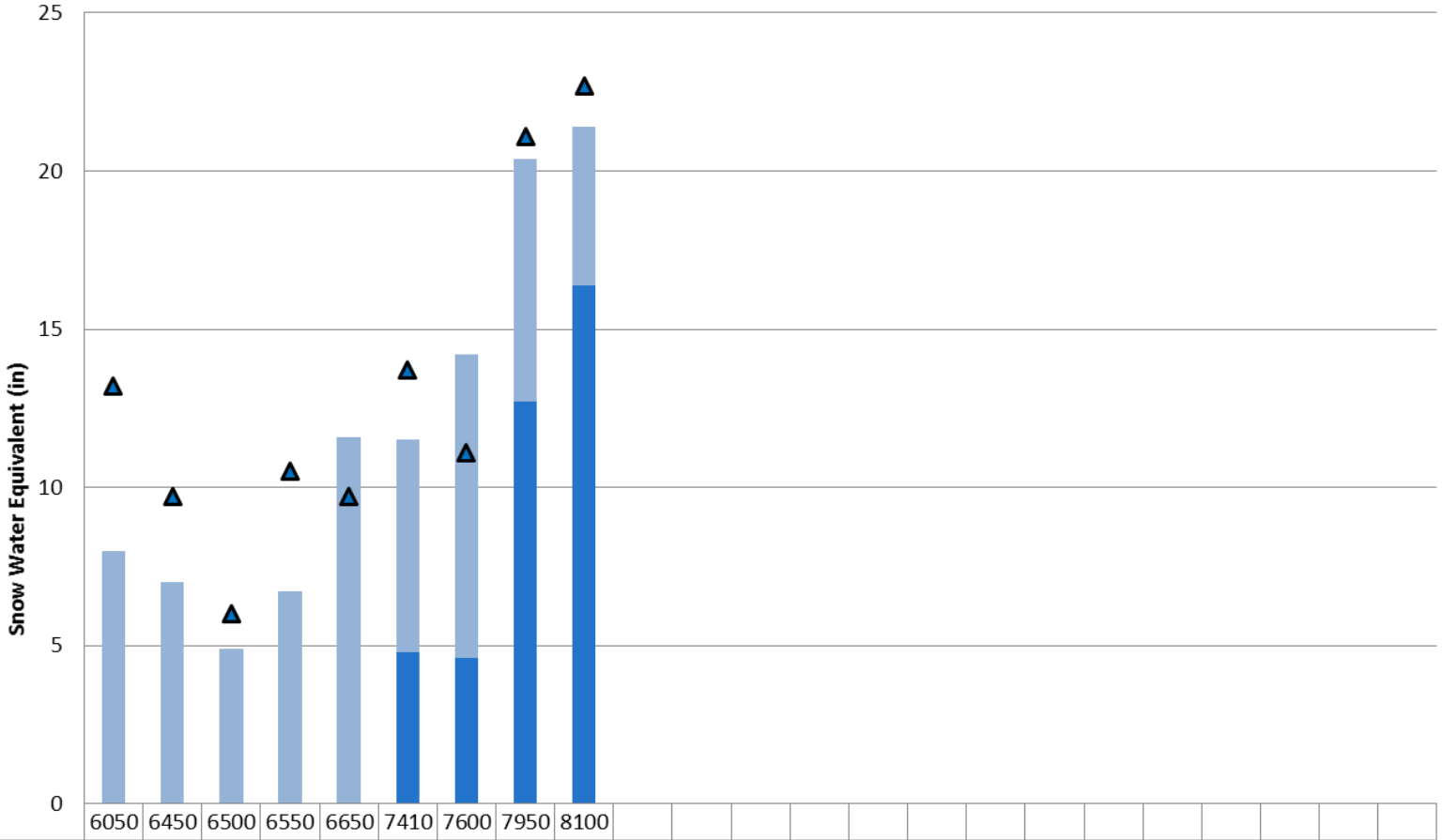
Montana Snow Survey

United States Department of Agriculture NRCS Natural Resources Conservation Service

Smith-Judith-Musselshell

Percent Remaining Snowpack

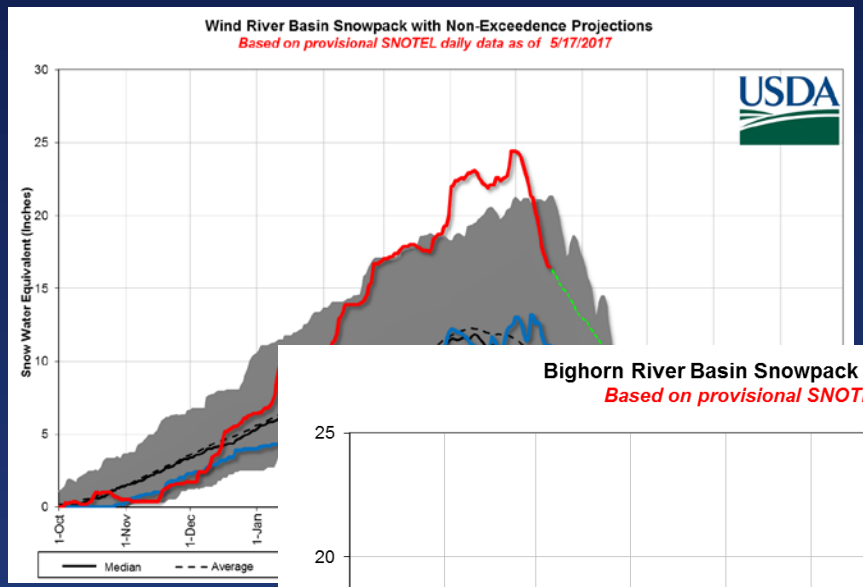
5/17/2017

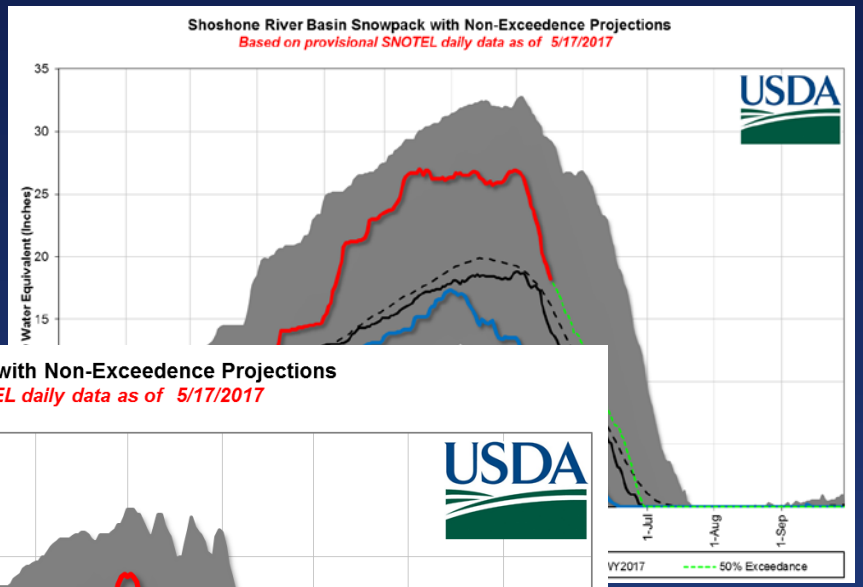


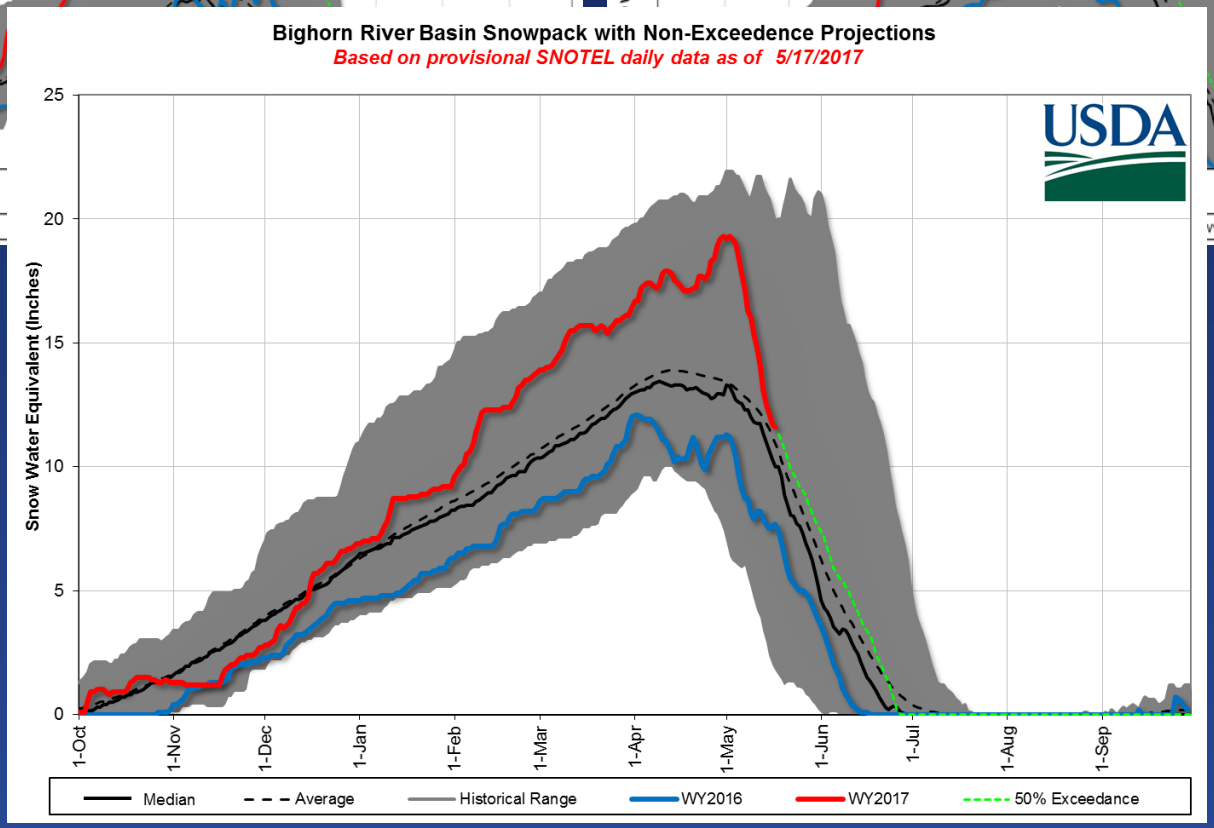
	6050	6450	6500	6550	6650	7410	7600	7950	8100
Peak SWE	8	7	4.9	6.7	11.6	11.5	14.2	20.4	21.4
Current SWE	0	0	0	0	0	4.8	4.6	12.7	16.4
Normal Peak	13.2	9.7	6.0	10.5	9.7	13.7	11.1	21.1	22.7
Percent Remaining	0%	0%	0%	0%	0%	42%	32%	62%	77%
Percent of Normal	0%			0%		41%	58%	63%	80%

Montana Snow Survey

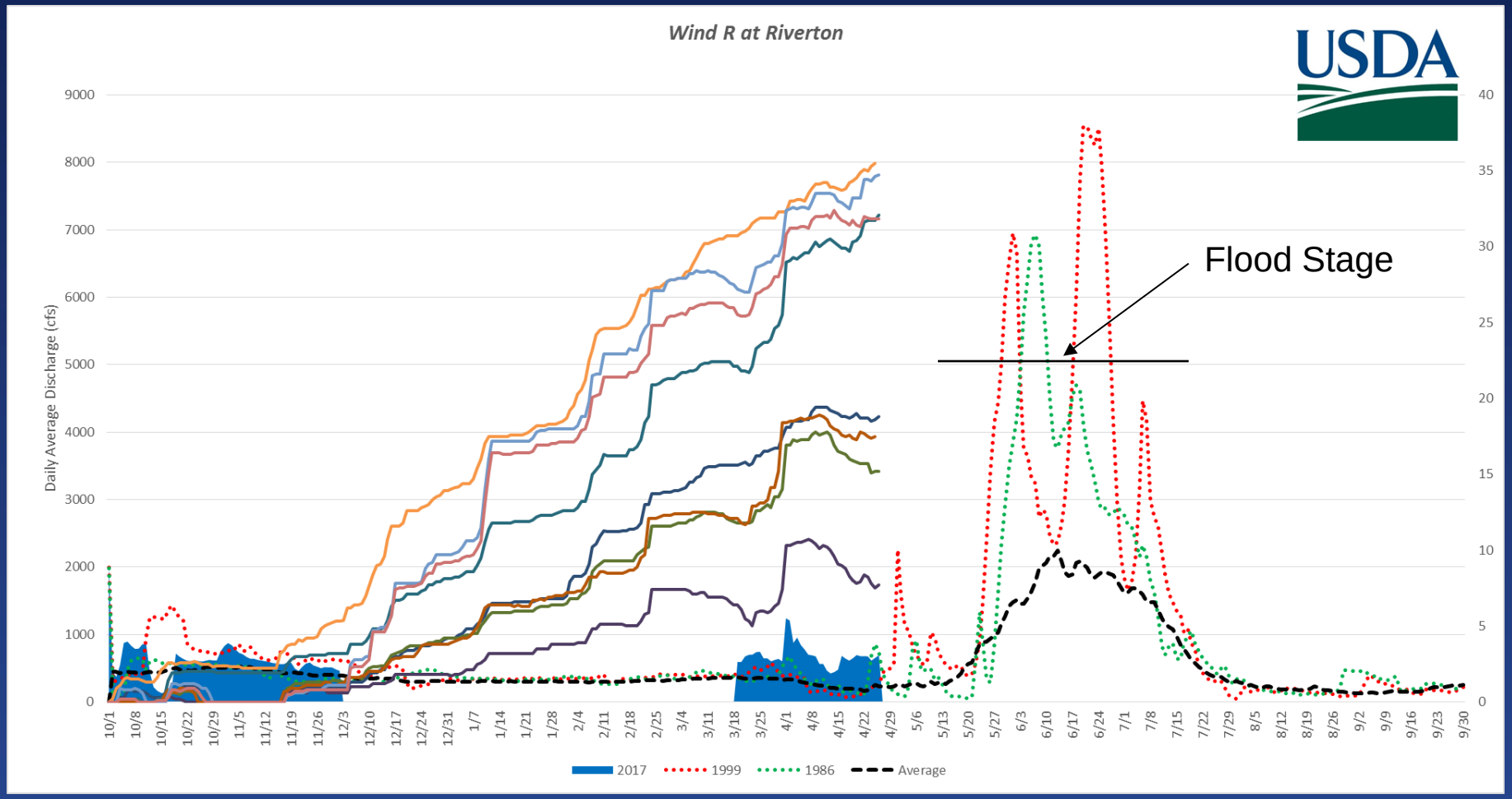
Lower Yellowstone: Remains above Normal





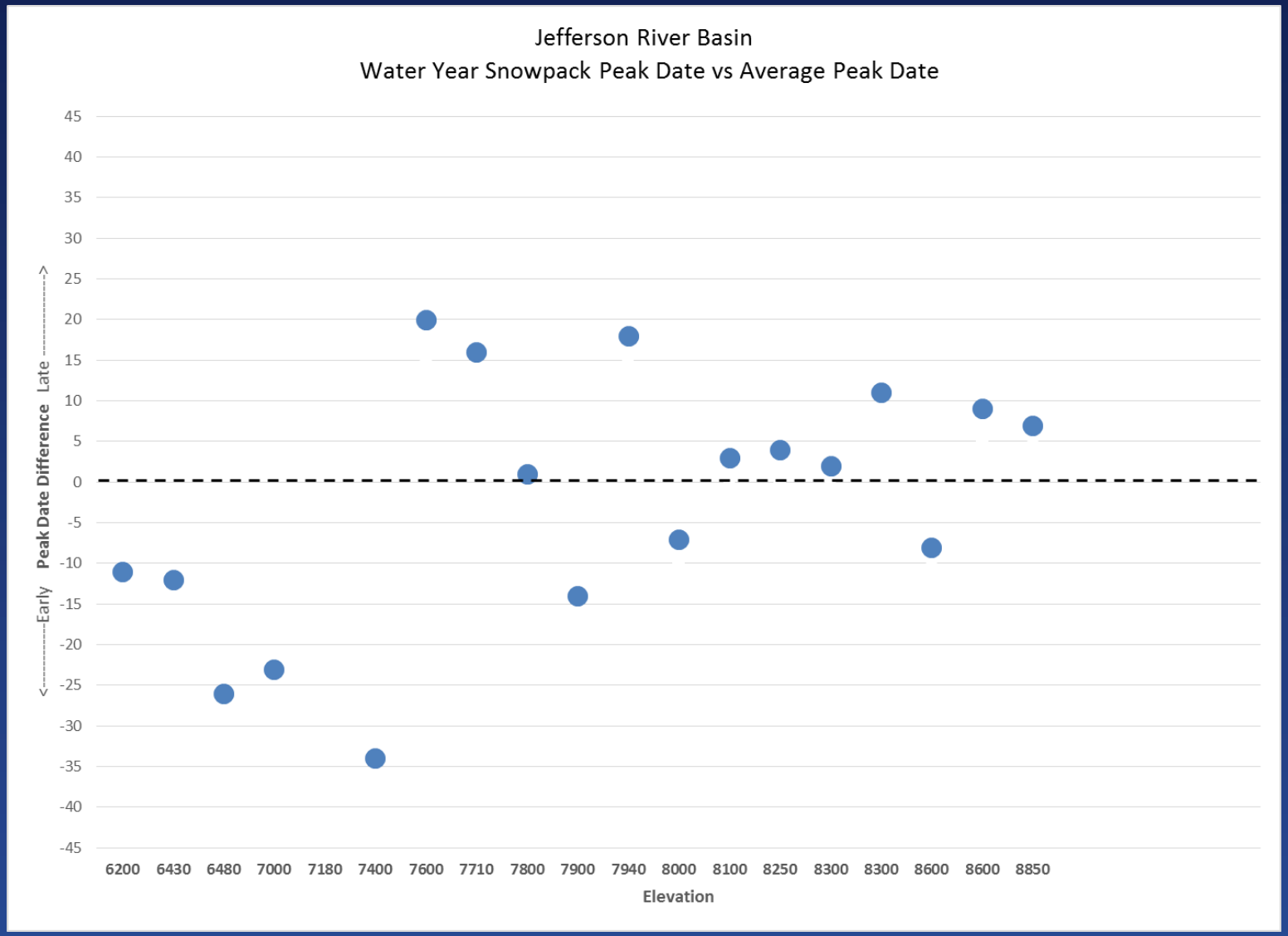


Wind River: Snowpack at Record Levels



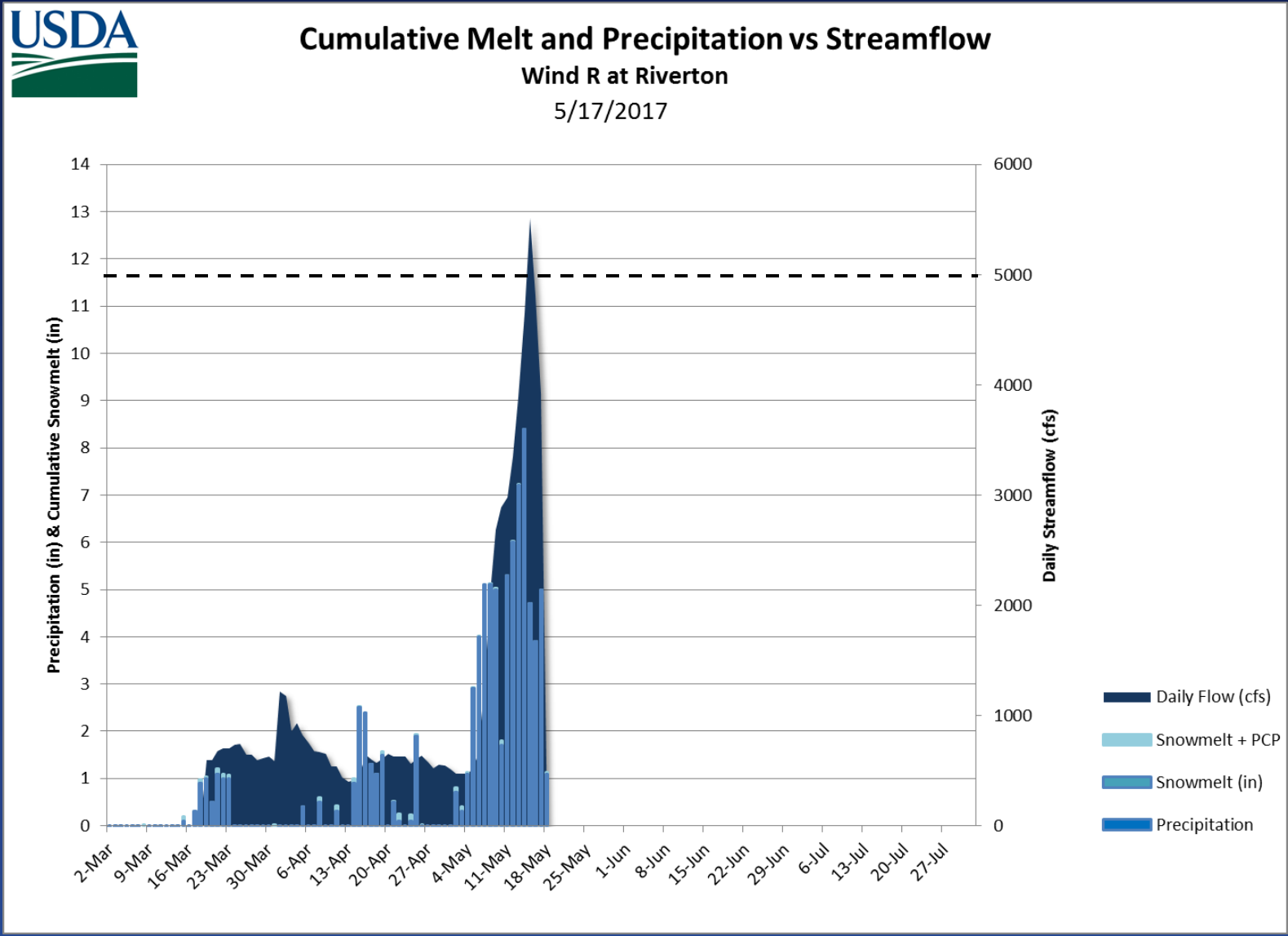
Montana Snow Survey

This year's Snowpack Peak



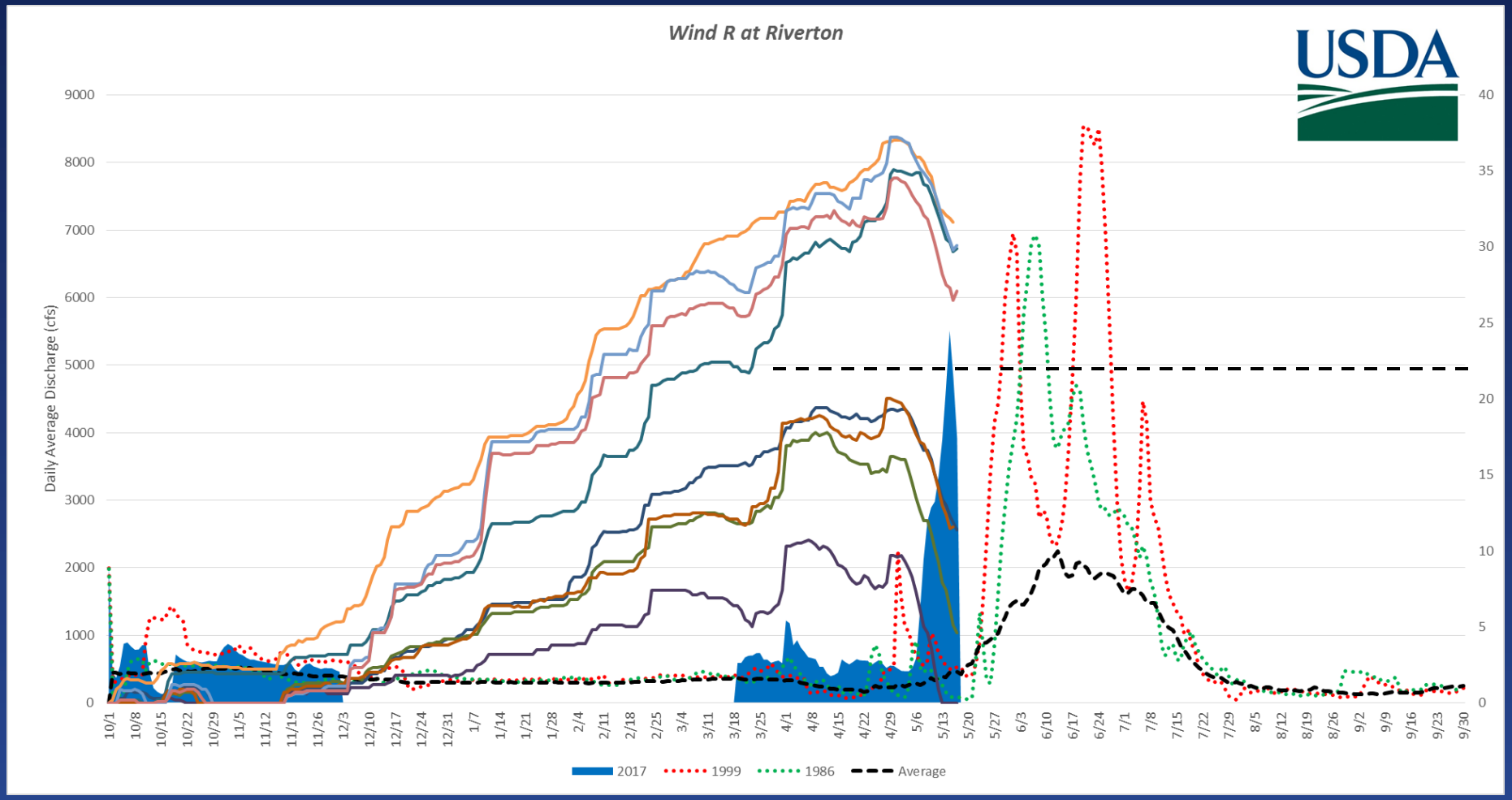
Montana Snow Survey

Last Week of Streamflows



Montana Snow Survey

Snowmelt and Streamflow Response



Water Supply

Montana Snow Survey

USDA NRCS

	MAY-JUL 50 % Exceedance Forecasts		
River Basin	**Highest Point Forecast***	**Lowest Point Forecast****	**Basin Avg Forecast*****
Columbia River Basin	152%	102%	**126%**
Kootenai River Basin	145%	124%	**131%**
Flathead River Basin	152%	117%	**135%**
Upper Clark Fork	136%	102%	**125%**
Bitterroot River Basin	117%	108%	**112%**
Lower Clark Fork	130%	119%	**125%**
Missouri River Basin	125%	78%	**109%**
Jefferson	125%	92%	**109%**
Madison	116%	111%	**114%**
Gallatin	108%	101%	**105%**
Headwaters Mainstem	113%	108%	**111%**
Smith Judith Musselshell	94%	78%	**86%**
Sun Teton Marias	119%	93%	**112%**
St Mary	125%	124%	**124%**
Yellowstone River Basin	244%	94%	**153%**
Upper Yellowstone	167%	94%	**134%**
Lower Yellowstone	244%	125%	**172%**

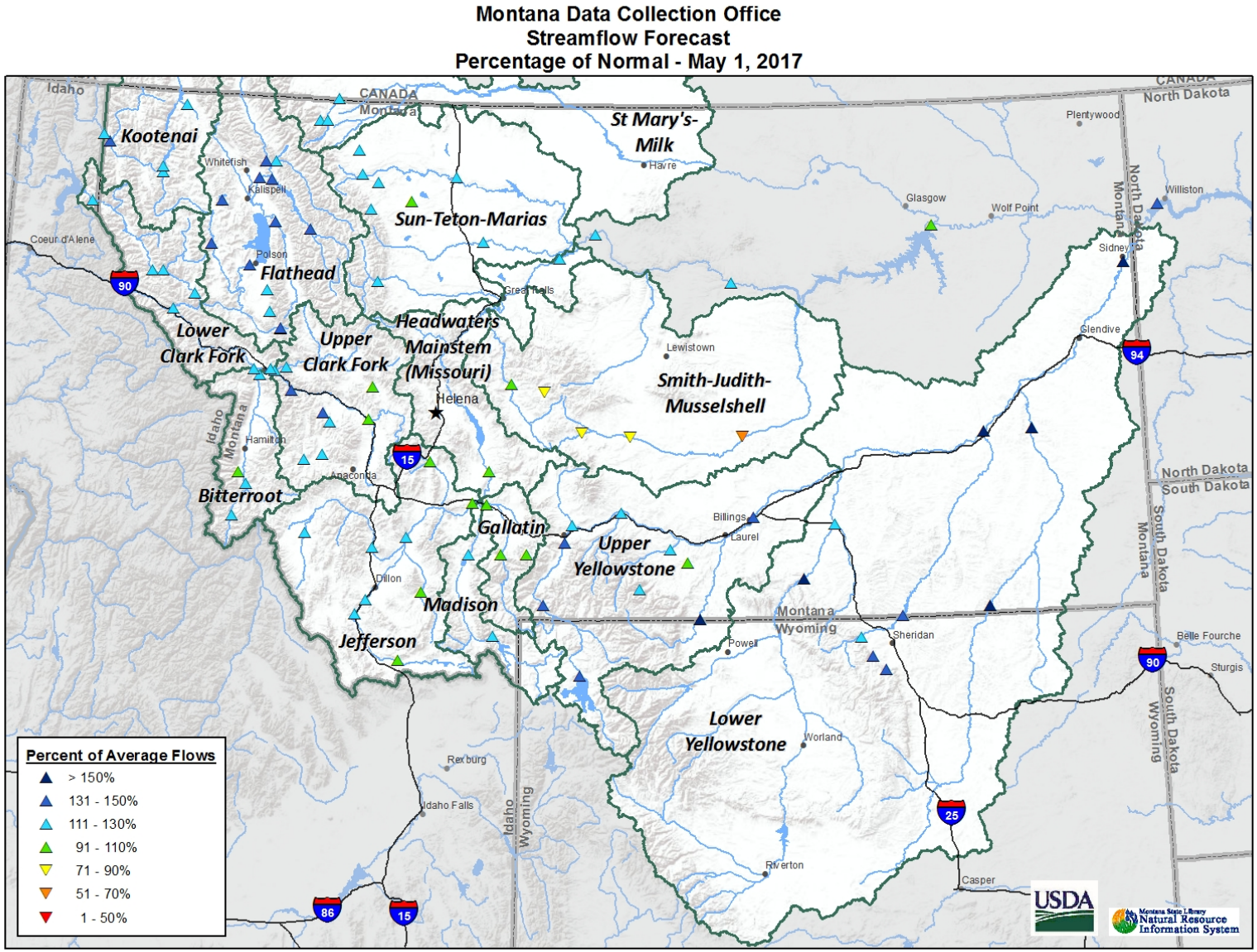
NOTE: Streamflow forecasts are issued for multiple points on rivers and streams within a major river basin and are given as a range of exceedance probabilities. Consult the individual river basin of interest to see the range of values for streams of interest.

*Highest point forecast is the highest 50% forecast of all forecast points within the basin

**Lowest point forecast is the lowest 50% forecast of all forecast points within the basin

***Basin Average Forecast is an average of all 50% forecasts within the basin

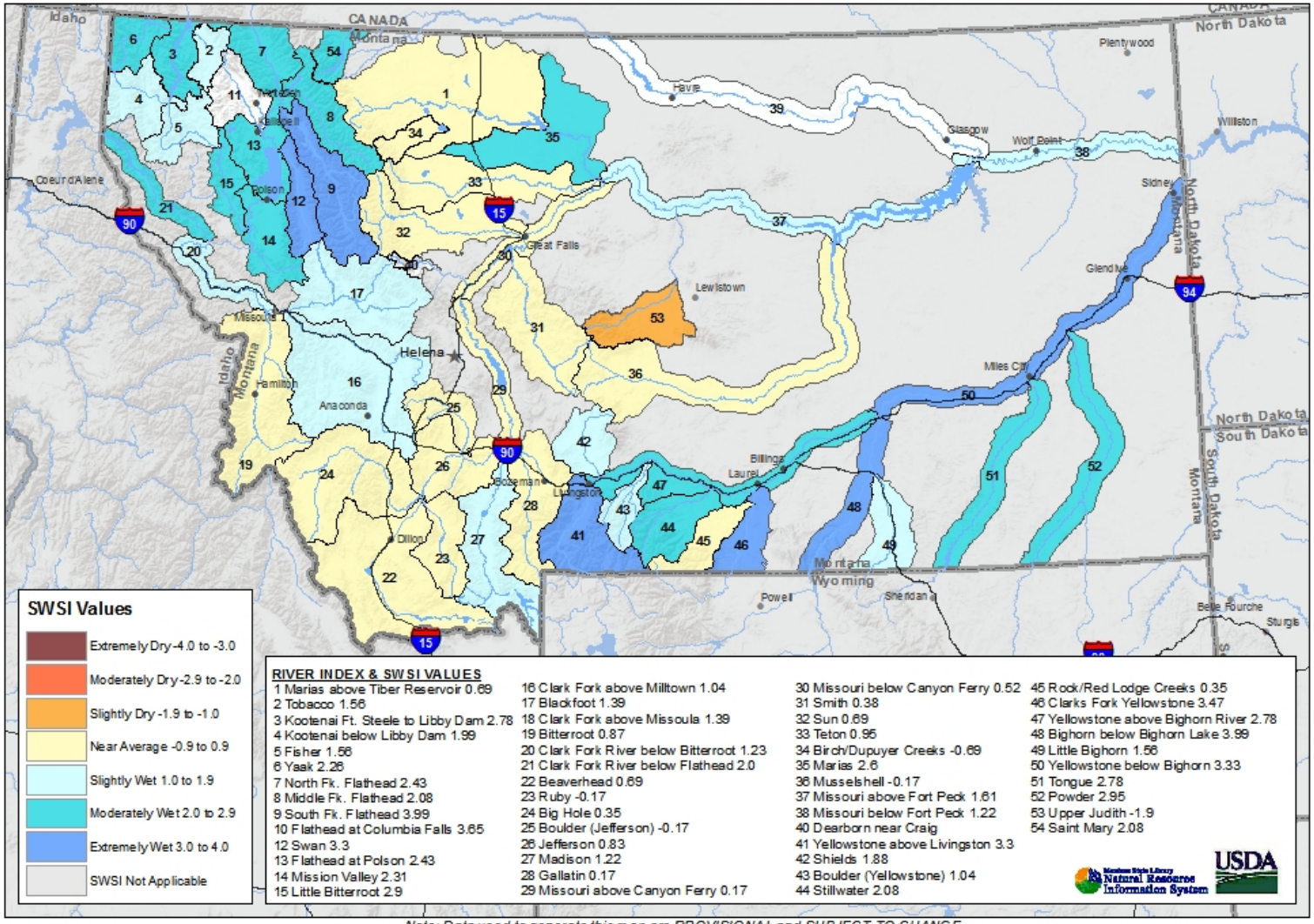
Montana Snow Survey



Montana Snow Survey

USDA NRCS

Montana Data Collection Office
Surface Water Supply Index (SWSI)
May 1, 2017



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

Governor's Drought Advisory Committee
Snowpack and Streamflow Update
May 18th, 2017

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

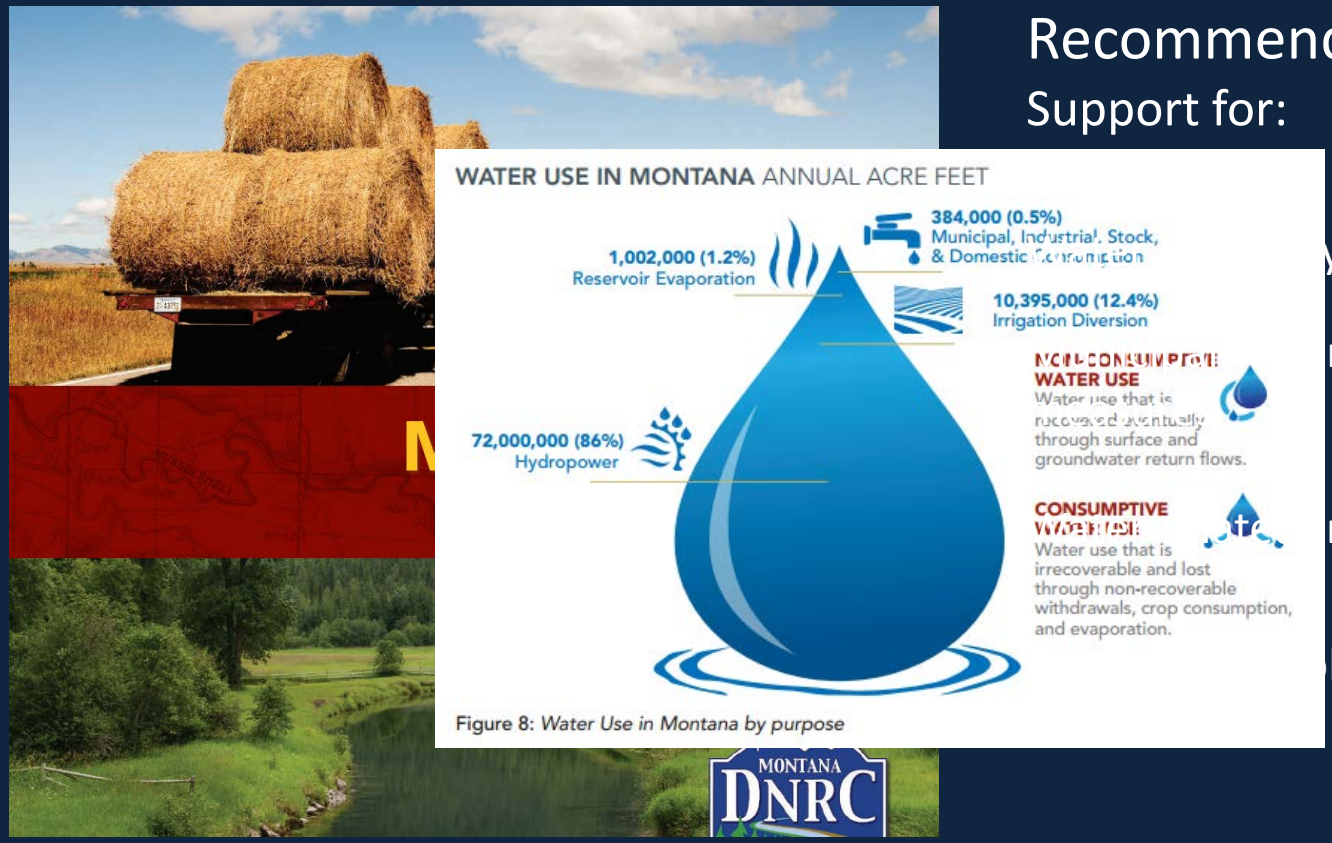
Beyond Supply

Integrated Water Resource (IWR) planning

for public water systems

Sara Meloy
Water Resource Planner
Water Resources Division

Why focus on public water supply?



Recommends

Support for:

y

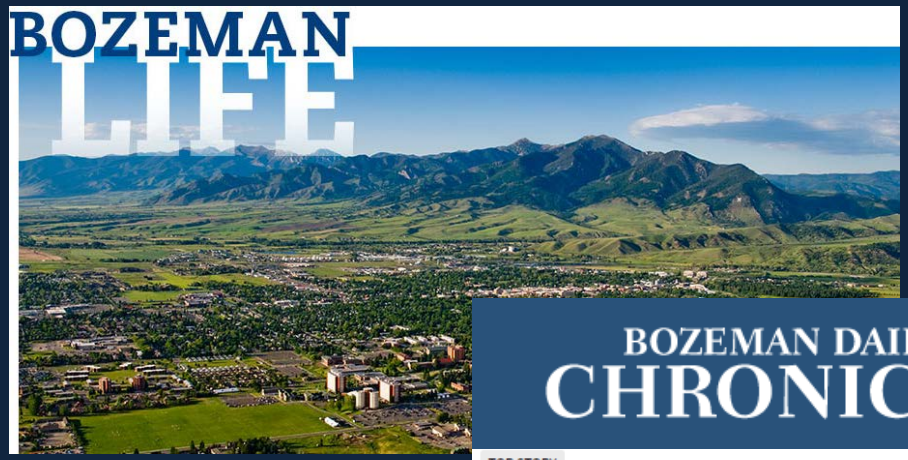
r conservation

raining and outreach

lanning

Why focus on public water supply?

1. Limited supply and increasing demand



BOZEMAN DAILY
CHRONICLE

TOP STORY

Bozeman's growth rate tops 4 percent, population likely past 45,000

By Eric Dietrich Chronicle Staff Writer Jul 21, 2016 0

Bozeman added 1,760 people to its population between 2014 and 2015, bringing the city to 43,400 residents, according to U.S. Census Bureau estimates.

The city-level statistics put the city's growth rate at a blistering 4.2 percent — well higher than comparable communities both in Montana and regionally.

Why focus on public water supply?

2. Issues of source water sustainability

BOZEMAN DAILY CHRONICLE

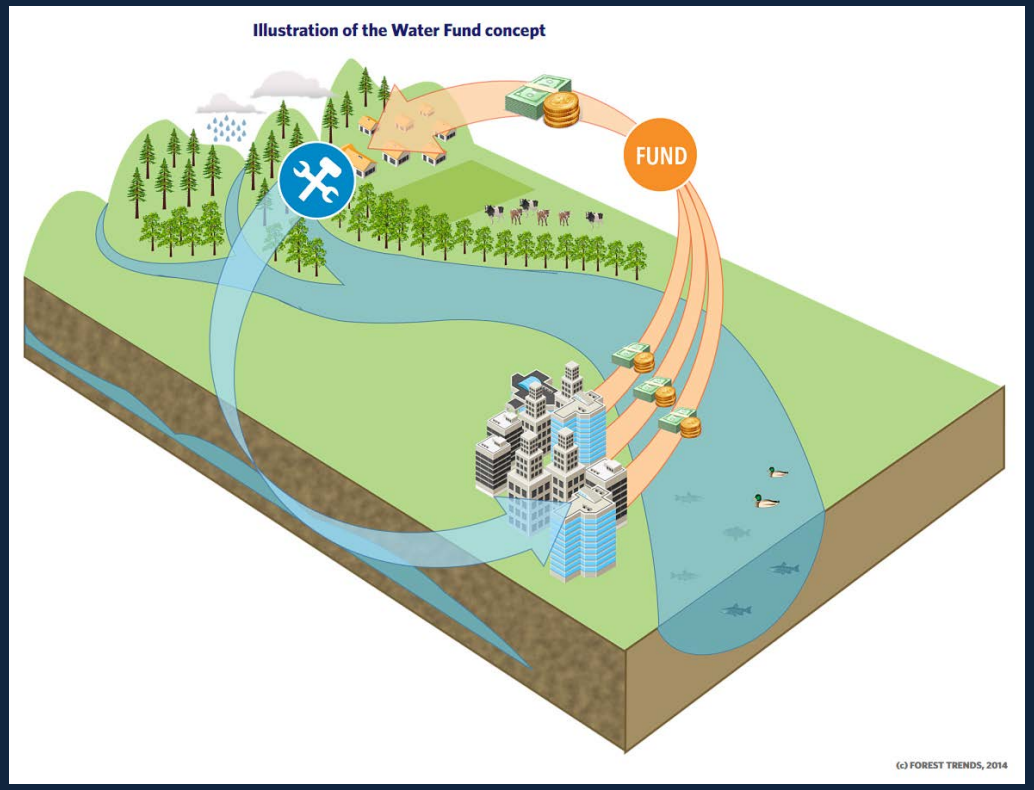
West Yellowstone places moratorium on new water connections

By JEREMY WEBER West Yellowstone News Jul 12, 2016 0

The resolution cites a substantial reduction in the current fresh water supply as the reason for the moratorium, which will be in place "until such time as the Town receives the necessary information to move forward in obtaining, repairing or replacing its water supply."

Why focus on public water supply?

3. Increasing interest in watershed and basin-level planning



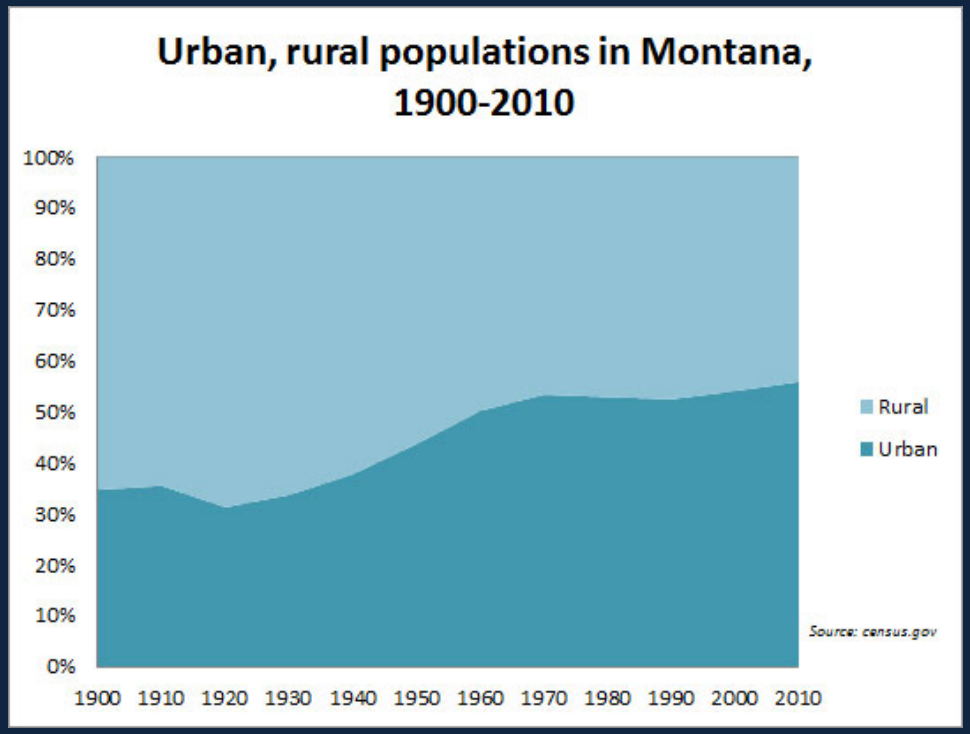
Water funds

Basin-level drought planning

Water marketing

Why focus on public water supply?

4. Approximately 75% of Montanans get their water from public water systems



Seven Cities Needs Assessment
2016

~~Water Conservation~~

Water Efficiency

Water Security

Integrated Water Resources (IWR) Planning

Planning for the **coordinated development and management of water, land and related resources** to:

- Maximize economic and social welfare
- Maintain ecosystem vitality and function

(Global Water Partnership)

What does your community's water supply picture look like in 50 years?

For public water systems,

IWR planning is a **customizable tool** to analyze:

Current and Future Water **Supply**

- Climate change
- Drought
- Changing snowpack
- Changing precipitation, etc.
- Water rights

Current and Future Water **Demand**

- Population growth rates
- Consumer demand
- Water uses (irrigation vs. indoor)

Yielding:

A range of **management options** that are:

- Publicly vetted
- Holistic
- Risk-averse
- Long-term
- Least-cost
- Adaptive

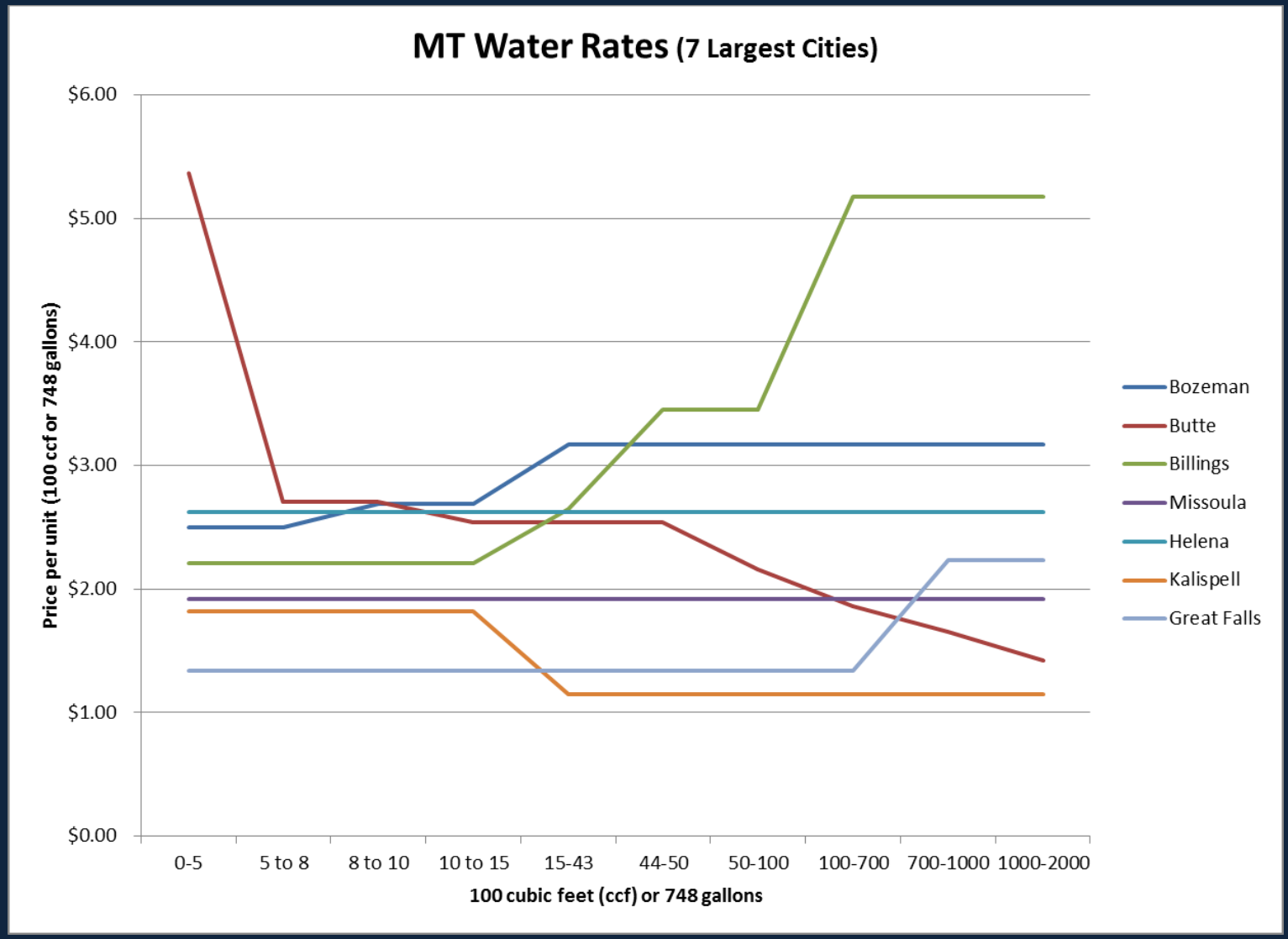
Integrated Water Resources (IWR) Planning
for Public Water Systems

If demand increases, do you:

Increase supply? or Manage Demand?

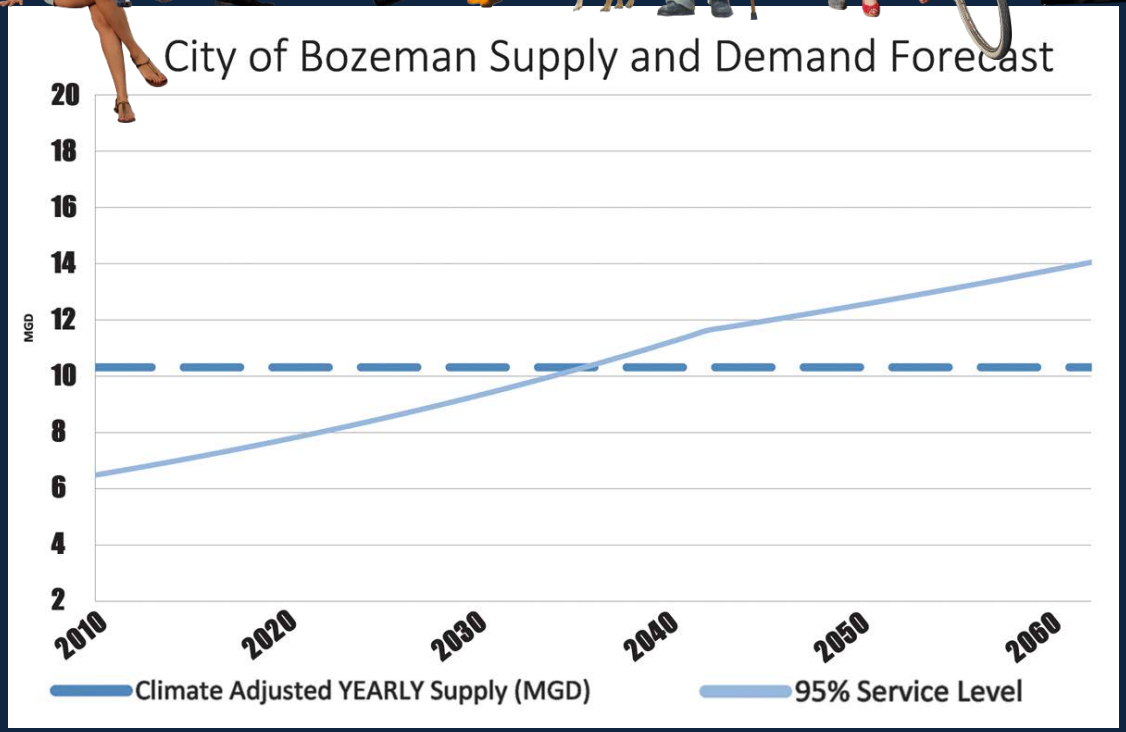
- Sink a new well
- Build a larger treatment plant

- Conduct a water audit
- Update water rates
- Develop a water conservation program


MT Water Rates (7 Largest Cities)
$6.00
$5.00
$4.00
$3.00
$2.00
$1.00
$0.00
Price per unit (100 ccf or 748 gallons)
0-5
5 to 8
8 to 10
10 to 15
15-43
44-50
50-100
100-700
700-1000
1000-2000
100 cubic feet (ccf) or 748 gallons
Bozeman
Butte
Billings
Missoula
Helena
Kalispell
Great Falls

Integrated Water Resources (IWR) Planning Example:

Bozeman



Focal issue:

Ensuring adequate water supply for population growth.

Integrated Water Resources (IWR) Planning Example:
Bozeman

Figure 3-1: Characterization of Total Water Demand by User Class

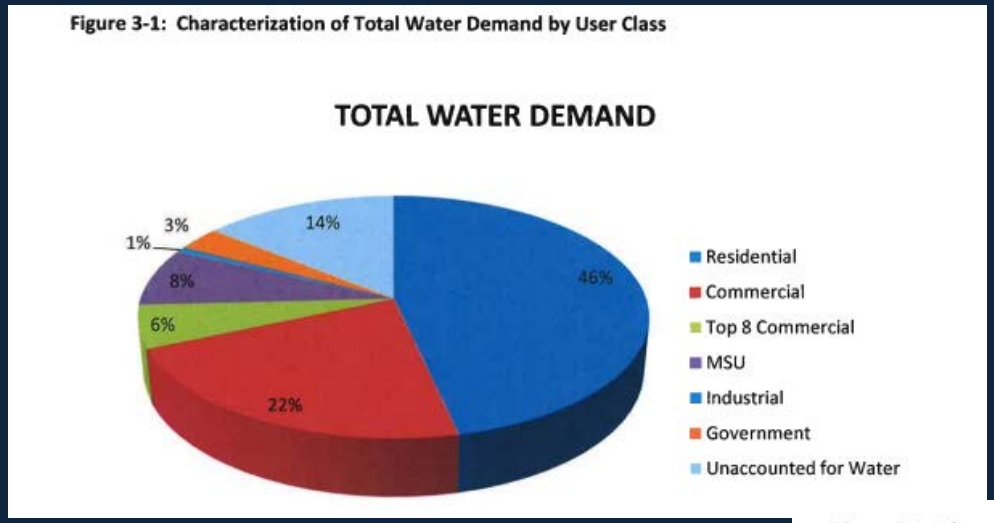
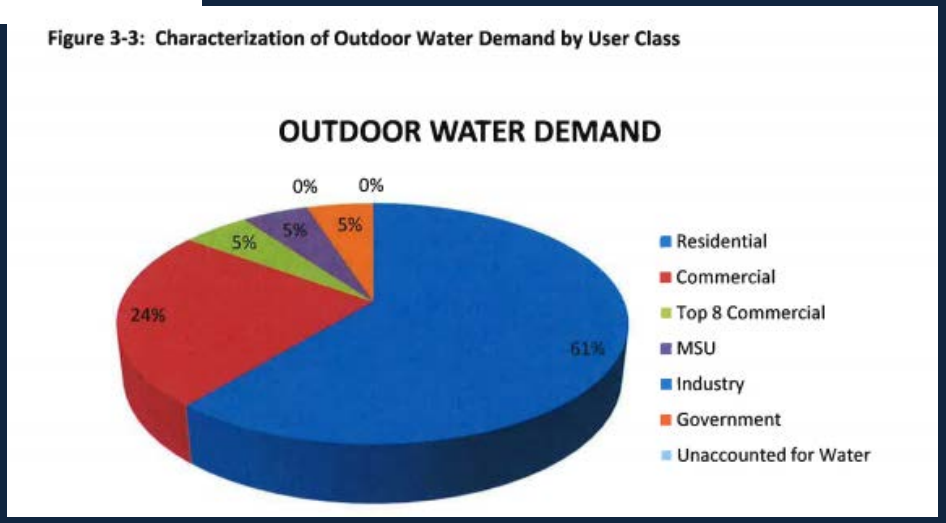


Figure 3-3: Characterization of Outdoor Water Demand by User Class



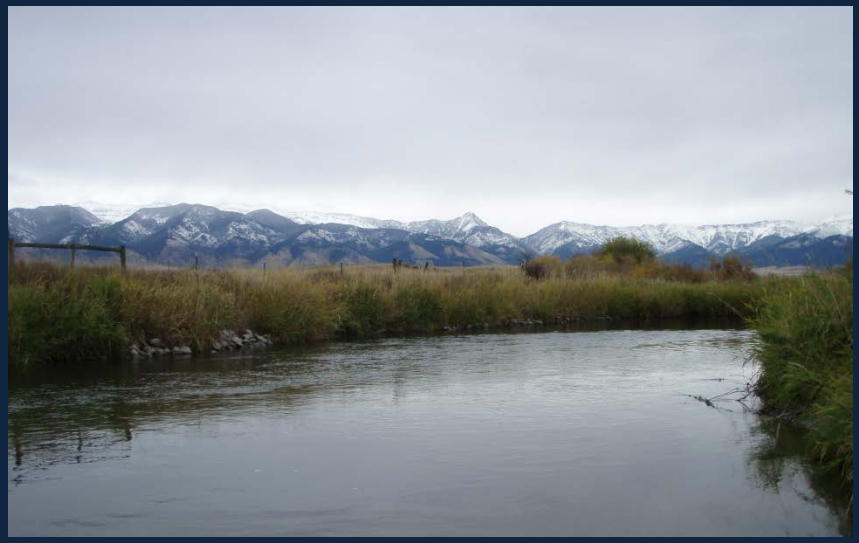
Integrated Water Resources (IWR) Planning Example:
Bozeman

Management Alternatives

- Develop a water conservation plan (2012) ✓
- Hire a water conservation specialist ✓
- Develop a drought plan (2016) ✓

- Reuse non-potable water
- Lease agricultural water rights
- Naturally store water (groundwater)
- Construct a new reservoir up Sourdough Creek
- Lease water from Canyon Ferry Reservoir

- Etc.



Integrated Water Resources (IWR) Planning Example:

Bozeman

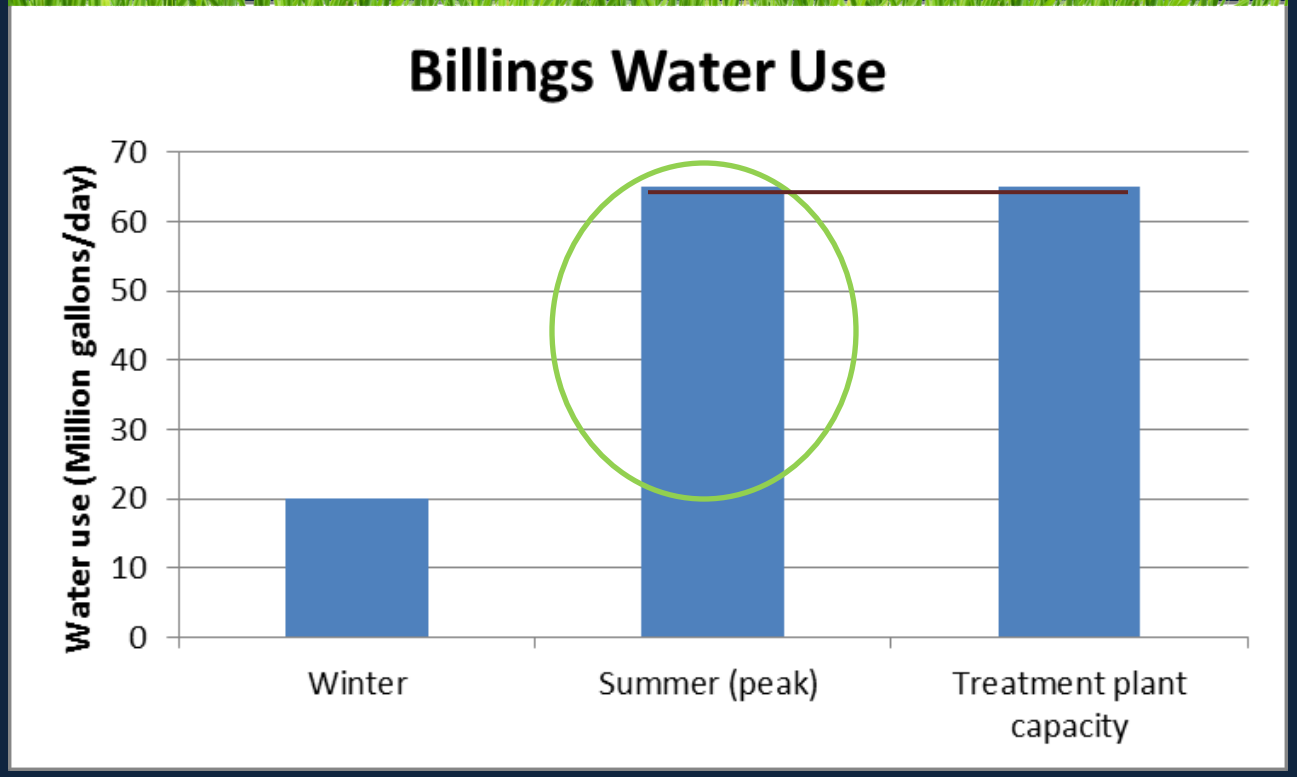
Sample ranking criteria for management alternatives:

Category	Criteria	Weight (%)	Score
Technical	Constructability	13	
Environmental	In-stream flow maintenance	21	
Social	Customer satisfaction	18	
Economic	Operation and maintenance costs	27	

Stakeholder input

Integrated Water Resources (IWR) Planning Example:

Billings



Solutions:

Manage demand

Re-use water

Increase storage

Moving Forward

Understand IWR planning in a rural context

Provide templates/tools for IWR planning, drought planning, and water conservation (demand management) programs

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Adaptation to Drought:

Rangeland Systems

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USDA Agricultural Research Service

USDA United States Department of Agriculture Climate Hubs
http://www.usda.gov/climatehubs

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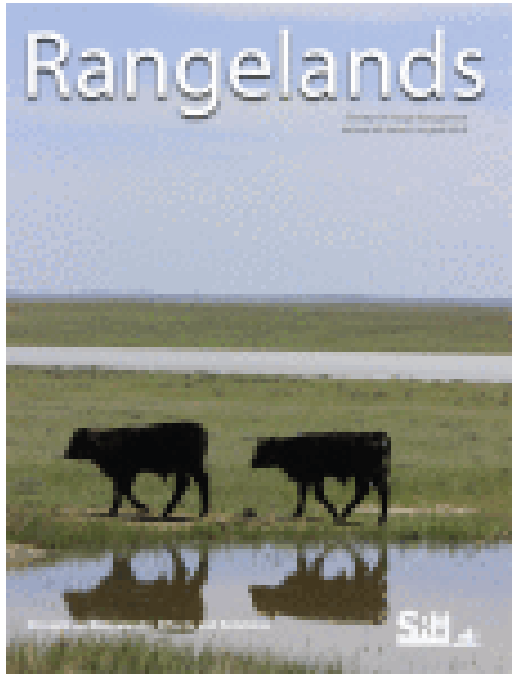
@USDAClimateHubs

Key resource:

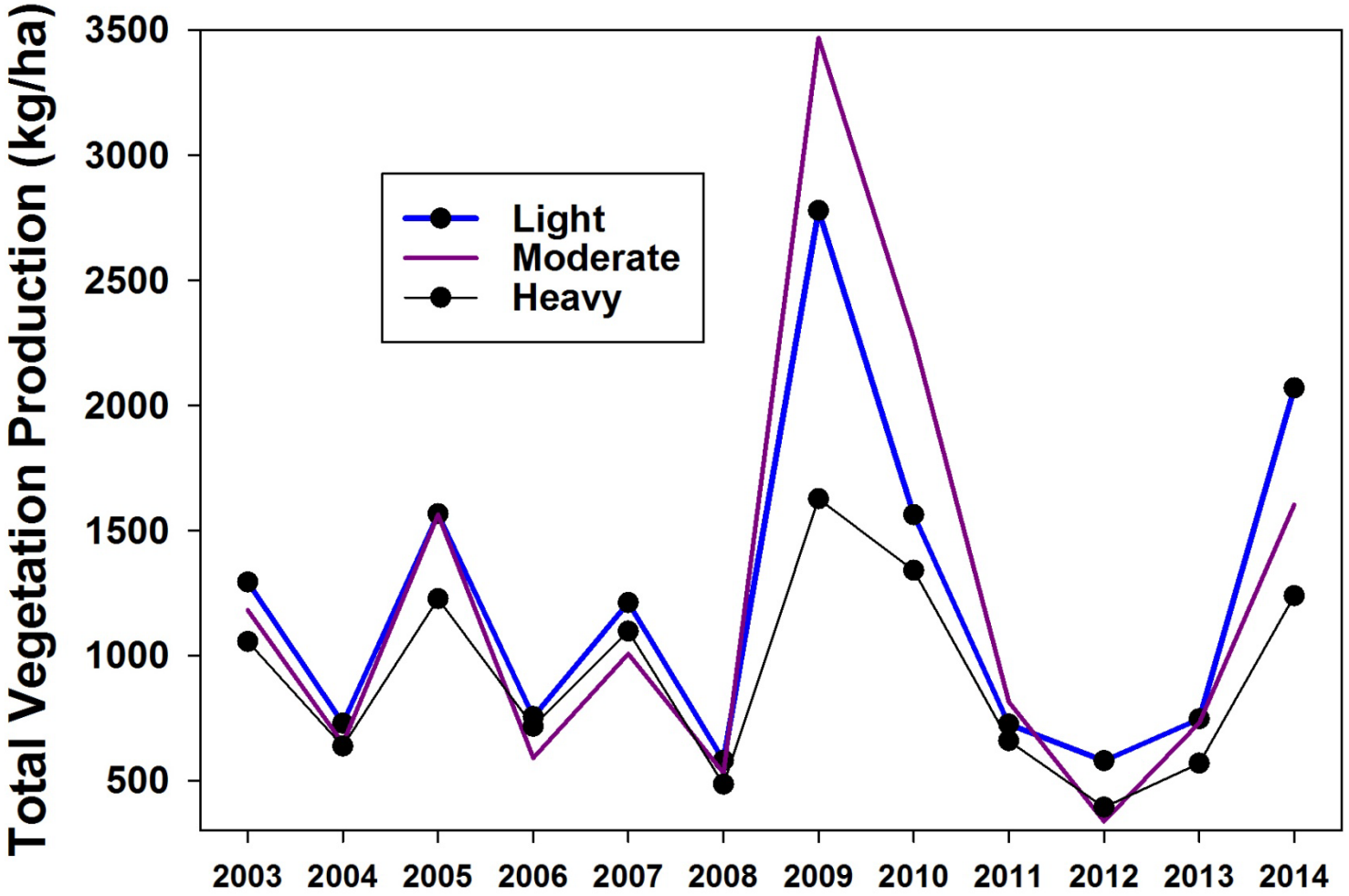
Rangelands

Society for Range Management
Volume 38, Issue 4,
August 2016
Open access



http://www.sciencedirect.com/science/journal/01900528/38/4

Precipitation and forage production are highly variable in the Great Plains.



2002

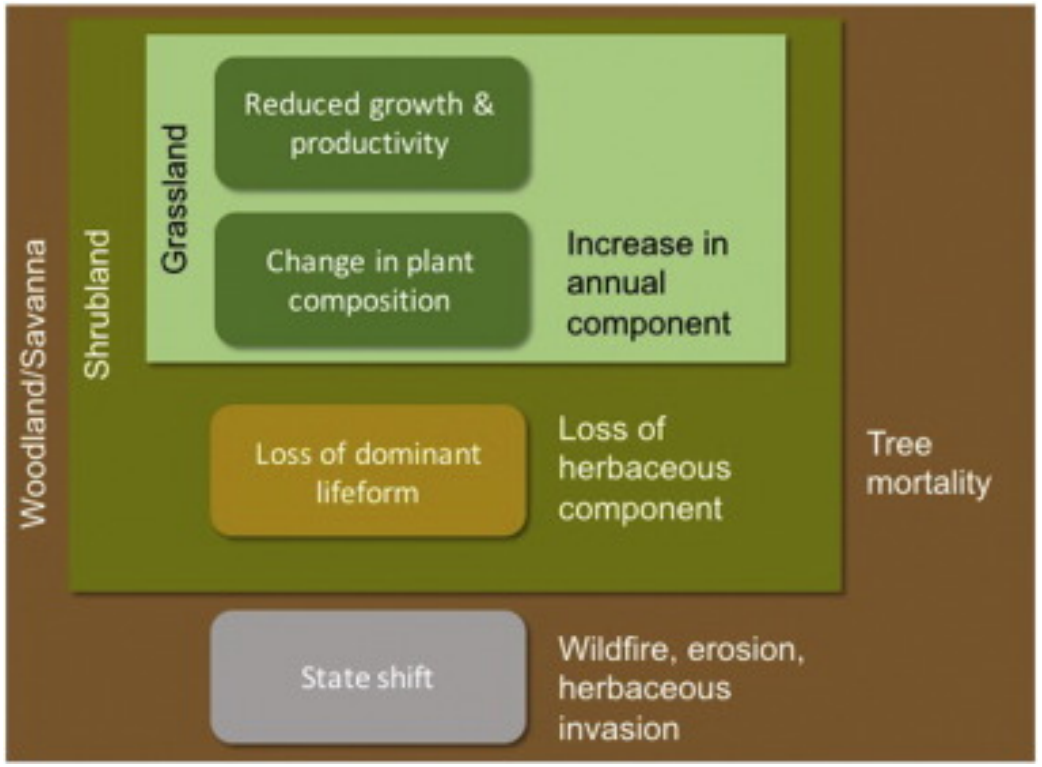
2003

2004

2005

This makes *Stocking rate decisions* **difficult.**

Drought: Management Challenges



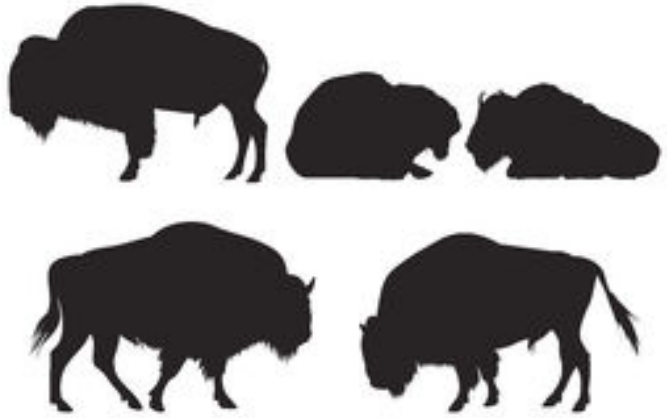
A proposed conceptual framework for considering how more extreme drought forecast with climate change may differentially impact rangeland types, based on life form types and their relative abundances.

(Breshears et al., 2016; Derner and Augustine, 2016; Crimmins and McClaran, 2016)

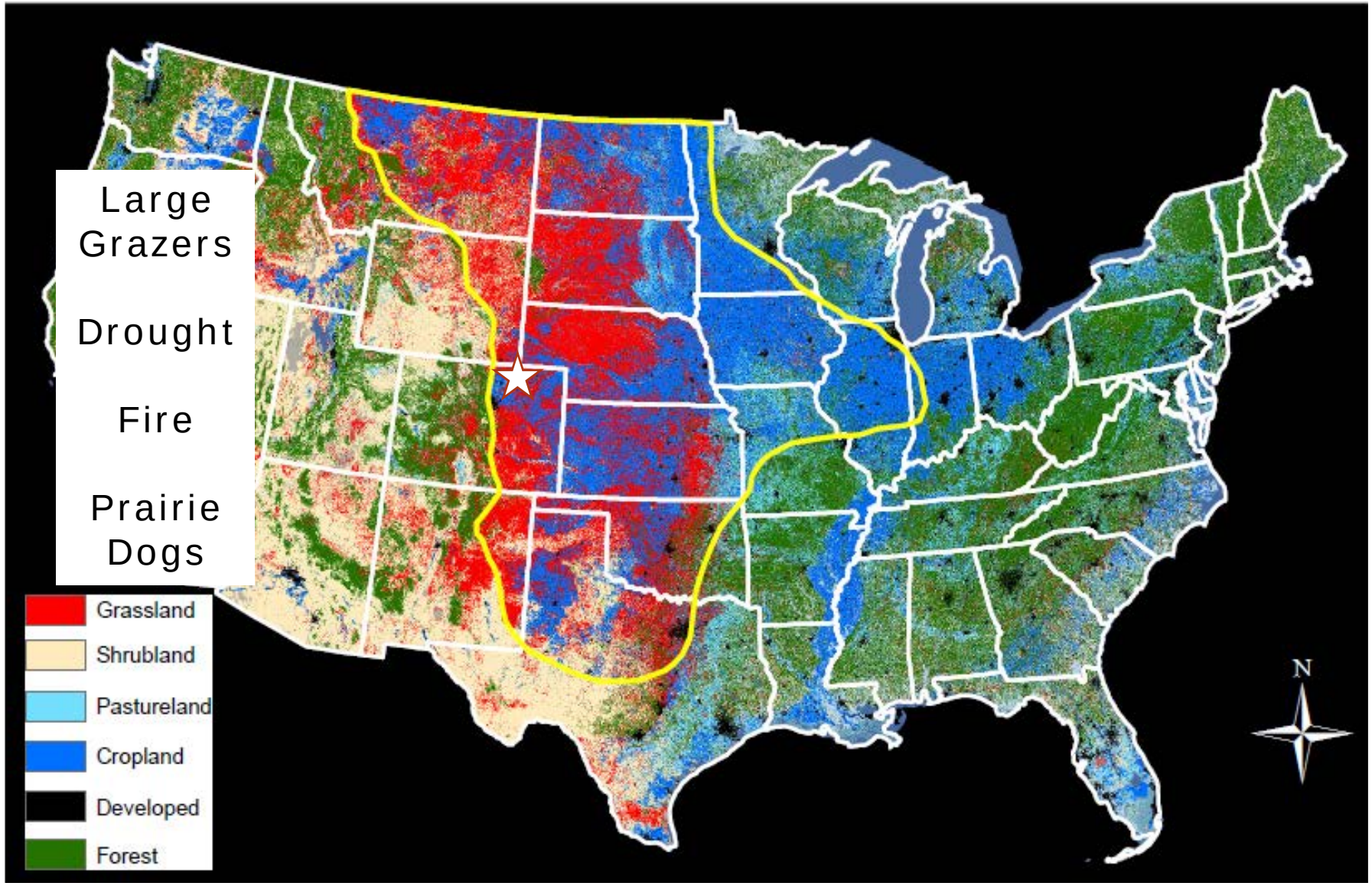
- No two droughts the same
- Limited ability of prediction and reliable seasonal forecasts
- Need for proactive planning
- Time scale:
  - Short term (fencing) vs. long term (plan for state shifts from grassland to woodland).
- Trees, shrubs, grasses differ in sensitivity to drought

Context *of the Great Plains*

Since the last ice age in the Great Plains, grasses co-existed with fire, bison and prairie dogs, and drought was often much drier than today.



National Land Cover Database, 2011



5 Steps to Ranch Scale Management of grazing in *highly variable systems*

Variability

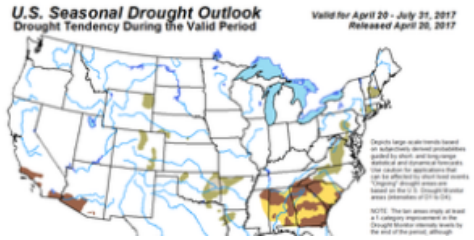
Anticipate
Predict
Track
Use
Create

Outlooks & Forecasts

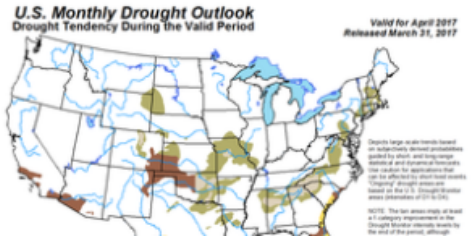
When will drought affect me? How long could it last? Choose a forecast product below to get information, forecasts, and outlooks on what could be ahead.

- Read an explanation of the causes and variables going into the prediction of drought, from the National Drought Mitigation Center.

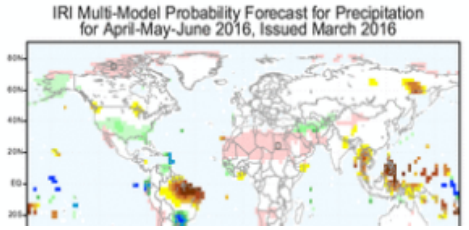
US Seasonal Drought Outlook



US Monthly Drought Outlook

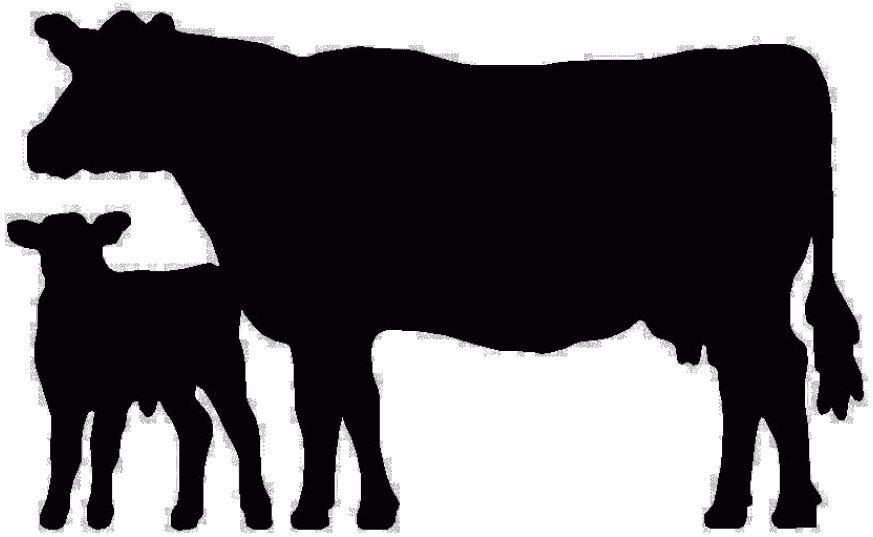


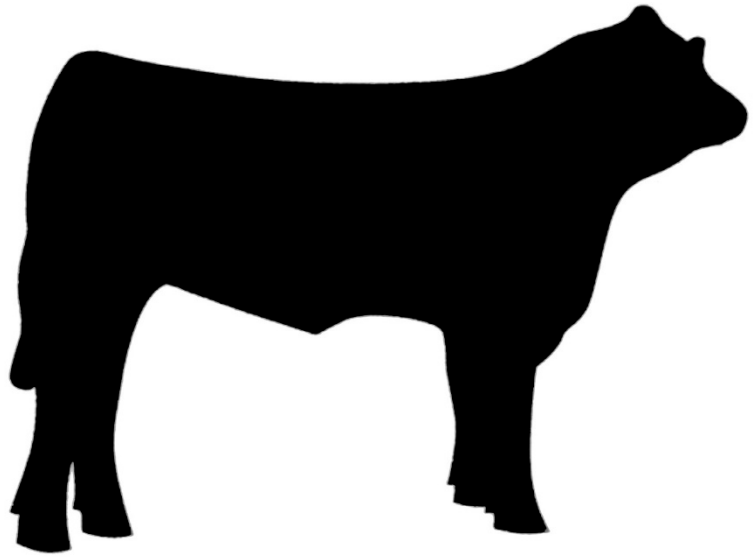
Seasonal Climate Forecasts



Yearlings?

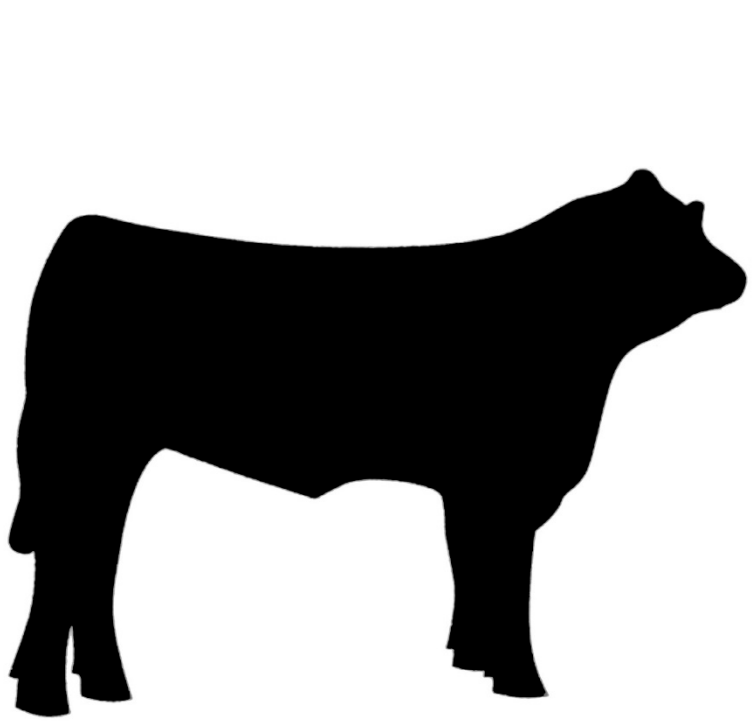
Track Variability





Use Spatial Variability

Create Variability



5 Steps to **Community Scale** Management of grazing in highly variable systems

Flexibility strategies

Mobility: **Move risk and resources across space. Examples: Secure forage/pastures in diverse landscape/topographic positions, or far from one another.**

Storage: **Move risk and resources across time. Examples: Hay/forage storage, grass-banking.**

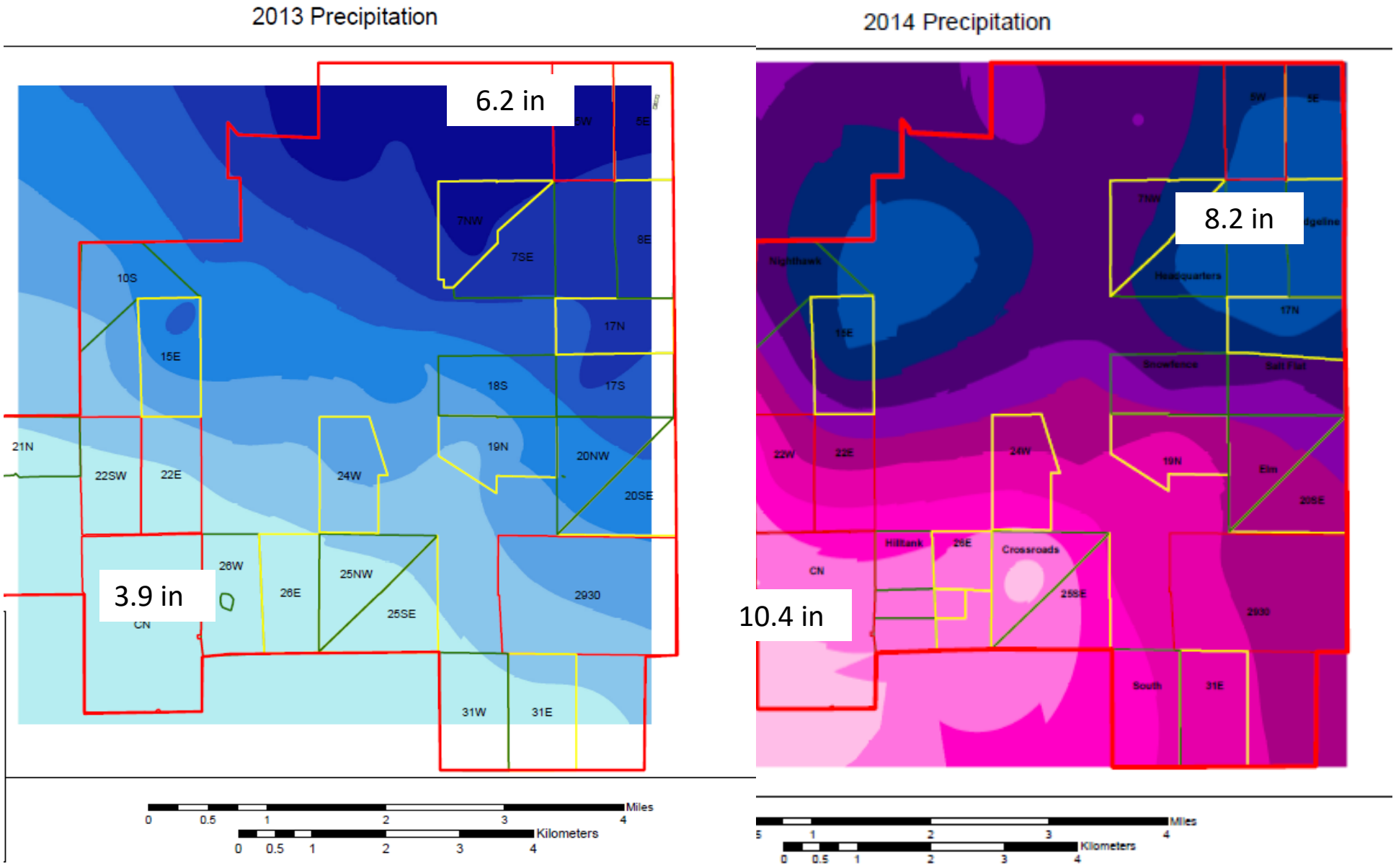
Diversification: **Move risk and resources across asset class. Examples: Diversified income and agricultural activities, diverse classes (e.g. yearling cattle and cow-calf) and species of livestock. Diversification of livestock class can enable flexible stocking rate decision-making.**

Pooling: **Move risk and resources across organizations/household. Examples: Broad social networks to exchange innovations, ideas, technology, labor, equipment, forage, etc.**

Market exchange: **Market-based adaptation strategies. Examples: Insurance-based risk management, non-traditional marketing strategies, and forage purchase.**

(Agrawal and Perrin, 2008)

Mobility: *Who do you know?*

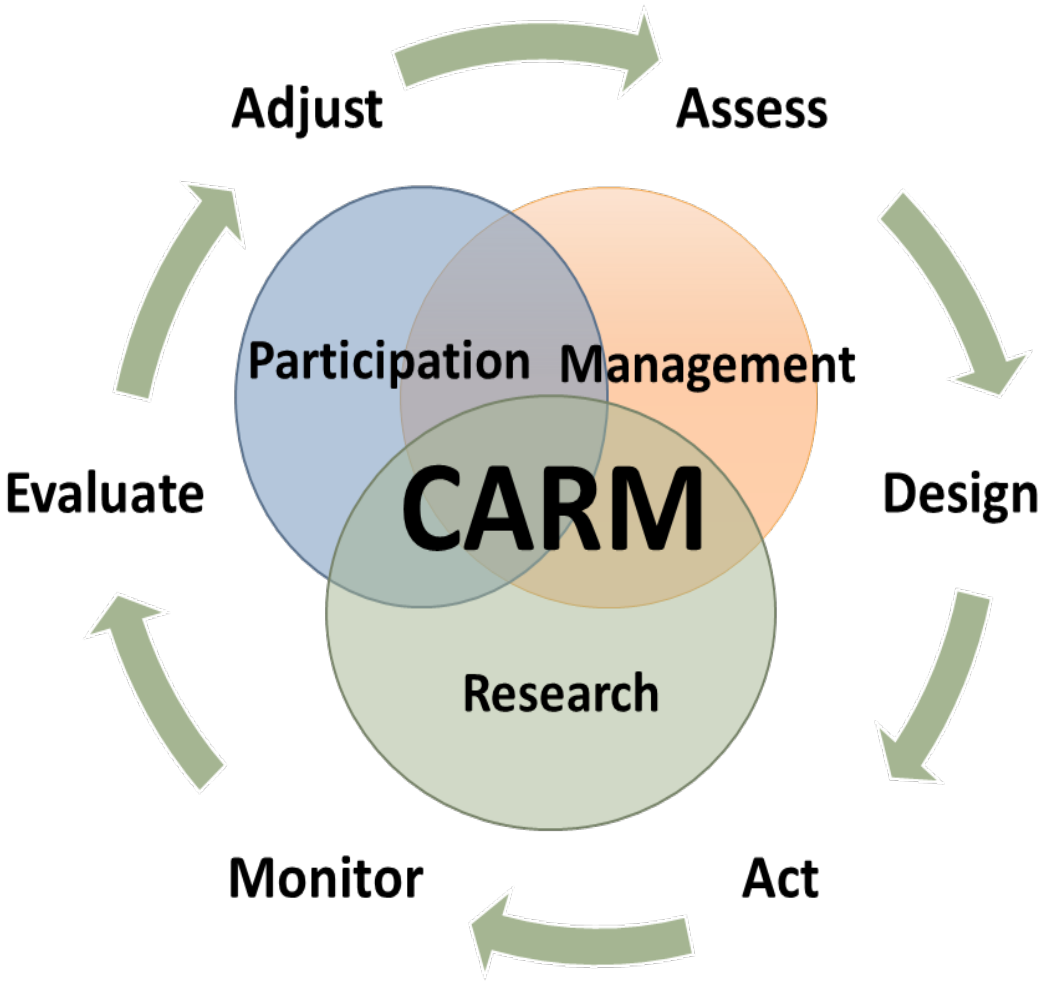


Flexibility strategies

Julie Kennedy

Keep Calm and CARM On:

Collaborative Adaptive Rangeland Management

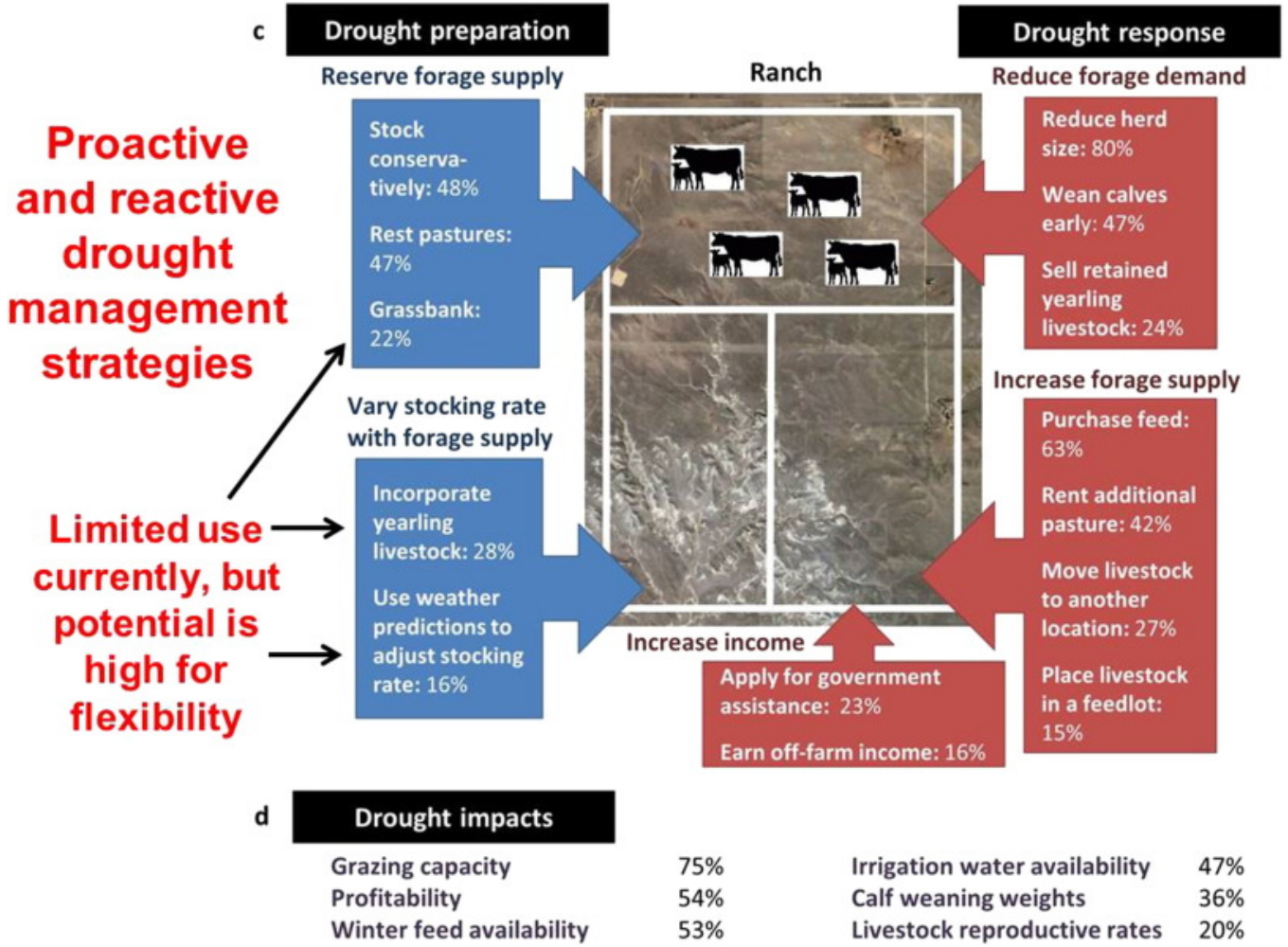


- Ongoing 10-year study at ARS research station in Nunn, CO
- Collaboration: Building trust and learning
  - Ranchers
  - Gov't Agencies
  - Conservation NGOs
  - Scientists
- Adaptive management
- Complexity promotes learning, builds trust

(Wilmer et al, In review, Fernandez-Gimenez et al, In prep)

Survey Says:

Drought management strategies Wyoming ranches use to balance forage demand with forage supply, reported as the percentage of respondents who use each practice. N=281 (Kachergis et al., 2014)



Survey Says:

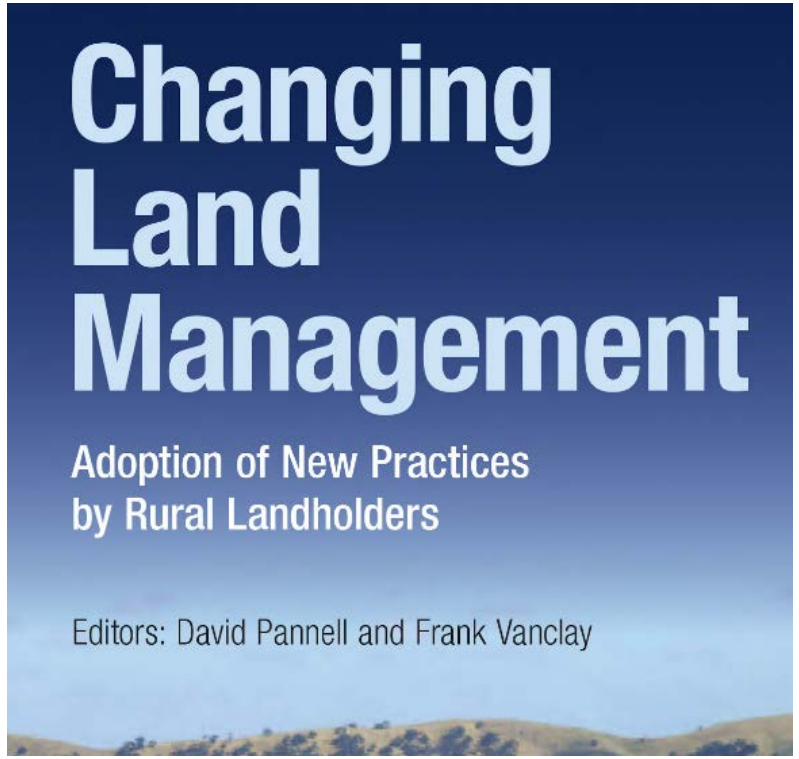
Proactive and reactive strategies for drought impact management from the 2011 California Rangeland Decision-Making Survey N=443 (Macon, et al., 2016)

	%
Proactive (Preparing for drought)	
Stock conservatively	34
Rest pastures	23
Incorporate yearling cattle	21
Grassbank/Stockpile forage	12
Use weather predictions to adjust stocking	11
Add other livestock types for flexibility	3

Reactive (Responding to drought)	%
Reduce herd size	70
Purchase feed	69
Apply for government assistance programs	39
Wean calves early	39
Rent additional pastures	26
Move livestock to another location	24
Earn additional off-ranch income	23
Sell retained yearlings	22
Place livestock in a feedlot	8
Maintain herd size; allow condition declines	7
Add alternative on-ranch enterprise	4

Transforming Decision-Making

- Manager success in drought depends **on knowing when to act** under high levels of uncertainty.
- **Managers are diverse** in their perceptions of risk, skills in planning, financial and emotional flexibility and interest in adapting. They come from different backgrounds. They need tailored adaptation approaches.
- **Facilitated collaborative learning** amongst managers/stakeholders may assist skill development, climate awareness and adoption of climate tools. Expect slow, incremental change.



(Marshall, 2010; Pannel and Vanclay, 2011;Marshall and Smajgly, 2013; Wilmer and Fernandez-Gimenez, 2015)

Projections

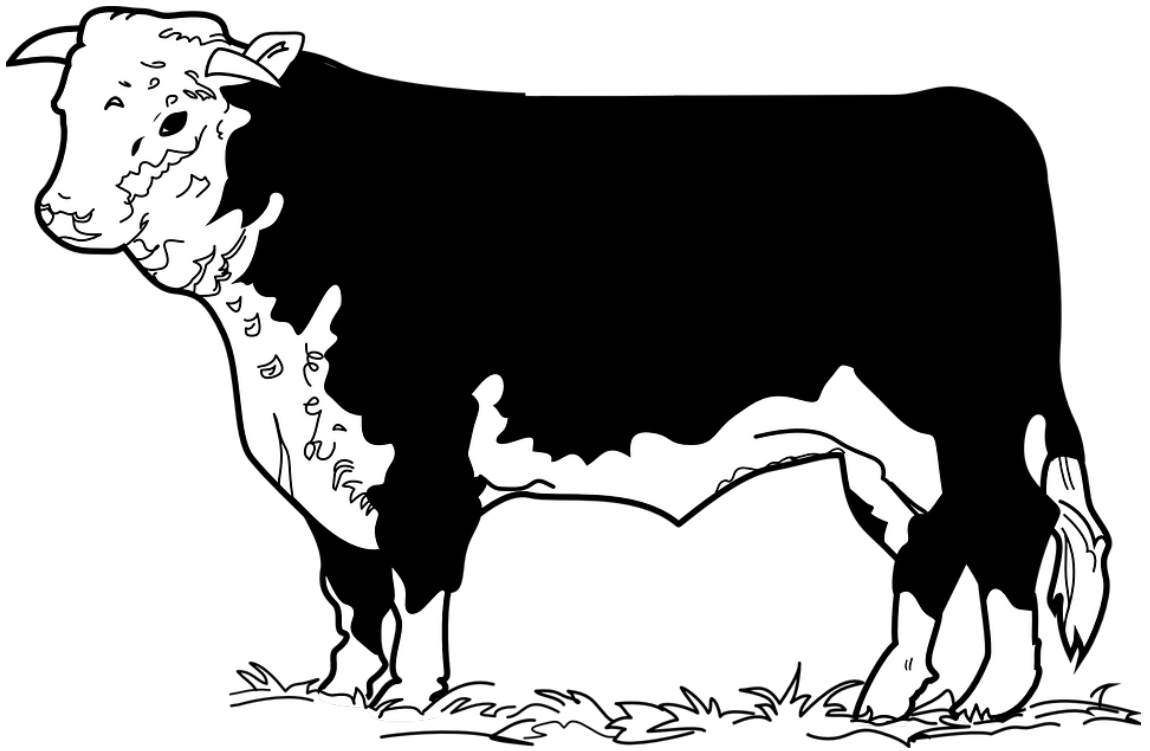
Existing	Potential
Grazing Livestock	
Adaptive grazing management	Collaborative adaptive management
Proactive flexible stocking	Robust contingency drought/deluge planning
Cattle breeds genetically predisposed to graze on uplands or slopes of rugged terrain	Breeds locally adapted to hot and fluctuating weather regimes, or shift in livestock species
Modification of livestock enterprise structure	Shift to new production enterprises emphasizing multiple ecosystem services
Confined Livestock	
Altered pen direction, orientation and slope	Altered design of containment facilities to handle increased frequency of extreme precipitation events
Increased insulation and ventilation in facilities	Genetic changes for greater heat stress tolerance
Shade, sprinkler cooling, high pressure misting, evaporative cooling pads	Geographic shift in primary areas of confined livestock facilities

(Derner et al., in review)

Conclusions

- Complexity requires adaptive management
  - Collaboration makes it happen!
- Drought poses management challenges but strategies already exist
  - Flexibility
  - Heterogeneity
  - Reactive vs. Proactive
- Projected changes require ongoing learning, adaptation

Questions?



For more information

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