



Henry's Fork Watershed Council

December 13th , 2016
Rexburg, Idaho

A comprehensive look at drought and drought planning in Idaho and the surrounding region.

How Does Idaho Define and Anticipate Drought?

- Recreational Impacts - Winter & Summer
- Surface Water Supply Index (SWSI) - Use in Dry & Wet Years
- US Drought Monitor - State Water Supply Meeting – Winter & Summer
- Use of SWSI & Palmer Drought Index to Monitor Crop Revenue
- Tools to Assist in Wet and Dry Years
 - NRCS Partnerships with BSU
- Snow Survey Program Status



Ron Abramovich
USDA NRCS
Water Supply Specialist
Snow Survey Boise, Idaho

Flying by helicopter
into Cool Creek
SNOTEL site after a
September snow
storm





Winter Snow Drought Impacts on Winter Recreation: skiing & snowmobiling

First signs of a winter snow drought - moving ski races to locations with better snow.

- Moving the race means loss of revenue for the ski club, ski area, and local economy.
- Winter of 2014/15 Jackson was running out volunteers to host ski races, they had best snow in the West
- **Receive positive thanks from local ski rentals shops for keeping it positive** during dry El Nino years.
- Brundage Mountain Ski Resort - magic number is 41 days to make money each season.
- Snow means money – competition between Grand Targhee & Jackson new snow fall & depth measurements.
- Bogus Basin – needs a snow storm on Presidents Day weekend during annul season pass sale.



Solder Mountain Downhill



Spring / Summer River Running Season

Interest to plan trips wisely after several deaths in the 1990s

Worked with Idaho Whitewater Association and Outfitter & Guides to educate public by providing same type of peak/low info that water managers use.

- Too much or too little water, know your limits & your skills.



Learn to provide positive, honest water supply information for river runners during high & low snowpack years.

- High snowpack years that have the potential for rivers to go big – outfitters have back-up plans A, B, C, or D for clients traveling from around the country or world to float Idaho famous rivers, the Selway, Middle Fork Salmon, Main Salmon or Hells Canyon.
- Lessons learned in 1987 low water year - keep it positive – there will always be a peak flow for river runners but may be short lived. This led to writing the Recreation section in our Water Supply Report as a collaboration with Idaho Department of Commerce.



Get the boats ready because the high flows wont last long...



Rivers Runners & Outfitters can change their plans because of dangerous high flows, and flying customers in for low flow conditions, but when it comes to fires, closing the rivers hurts their businesses.



Who uses info in dry/wet years:

- Power Boat Sales →
- Hunters
- Tire Sales
- Windshield Repair Business
- School Bus Drivers & Highway Departments - SNOW DAY!
- Teachers & School Children – Adopt-a-SNOTEL Program
- Ski Stores
- Homeowners
- Fire Weather Forecasters
- Range Management
- Pizza Sales
- Restaurant Owners
- Coal & Natural Gas Producers
- Federal Reserve Board
- Anheuser-Busch
- USDA – RMA crop insurance
- Roof Snowloads
- Federal Reserve Board & Natural Gas Companies to gauge growth

Take Me To the Water

Take me boating.
Because I'm growing up too fast.

Take me water skiing.
Because our boat's cooler than any video game.

Take me on the water.
Before I discover girls.

Take me fishing.
And I promise to clean my room.

Bayliner 185 \$19,895 ⁰⁰ 3 only	Sea Ray 200 Sundek \$38,980 ⁰⁰ 1 only	Lund WC-14 w/15hp Merc & Trailer \$5,746 ⁰⁰ 1 Red — 1 Blue
Bayliner 205 \$23,985 ⁰⁰ 3 only	Sea Ray 205 Sport \$30,533 ⁰⁰ 1 only	Lund 1775 Classic \$22,478 ⁰⁰ 2 only

CAPITAL SPORTS SALES

7 SEAS 10000 LAKES
1 LIFE TIME ?

Capital Sports Sales
9900 Fairview Ave.
Boise • 323-1500
www.capitalsportssales.com

Hours: Mon-Fri 9am-6pm • Saturday 9am-5pm • Sunday 12 noon-4pm

Who else?

- Navigation on the Columbia & Missouri Rivers
- Global Warming, Climatic Change Research
- Liz Claiborne – hired a Climatologist
- Target – has a “climate team”
- Blogs....
- Lake Water Quality Studies
- Leaky Sewer Lines
- Sizing Evaporation Ponds for Subdivisions
- Weekly Updates for:
 - US Drought Monitor
 - & Mt St. Helens activity
- Huckleberry / Mushroom pickers
- Bull Trout habitat
- Glacier Recession

Anheuser-Busch in St Louis uses the data to determine Barley and Hops outlook in many western US states & Canada.



Brewery Water Supply Update

April 28, 2006

CURRENT WATER SUPPLY

Brewery	Status*	Brewery	Status*
Baldwinsville	Green	Jacksonville	Yellow
Cartersville	Green	Los Angeles	Green
Columbus	Green	Merrimack	Green
Fairfield	Green	Newark	Yellow
Ft. Collins	Green	St. Louis	Yellow
Houston	Yellow	Williamsburg	Yellow
		Stag	Green

Green	> 90 % of normal
Yellow	50 – 90 % of normal
Red	< 50 % of normal

*Status is based on current precipitation, reservoir level and stream flow compared to 30-yr average.

Discussion of yellow and red status

- Precipitation is below normal in Houston, Jacksonville, Newark, St. Louis and Williamsburg. No impact to the brewery water supply is expected.

DROUGHT FORECAST



Agricultural Water Supply Update

April 28, 2006

CURRENT WATER SUPPLY

Barley	Status*	Rice	Status
Idaho	Green	Arkansas	Green
N. Montana	Green	California	Green
Wyoming/S. Montana	Green	Hops	Status
MonDak	Green	Washington	Green

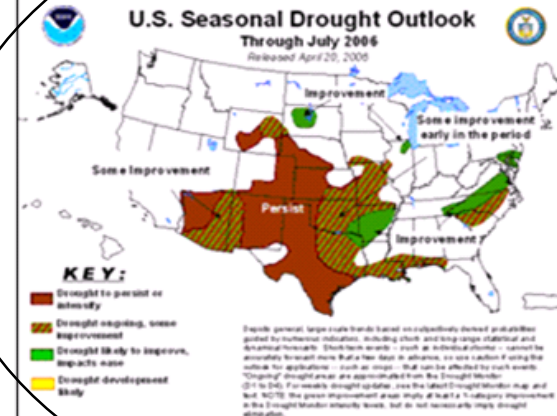
Green	> 90 % of normal
Yellow	50 – 90 % of normal
Red	< 50 % of normal

*Status is based on current precipitation, reservoir level and stream flow compared to 30-yr average.

Discussion of yellow and red status

- All locations are in the green status.

DROUGHT FORECAST



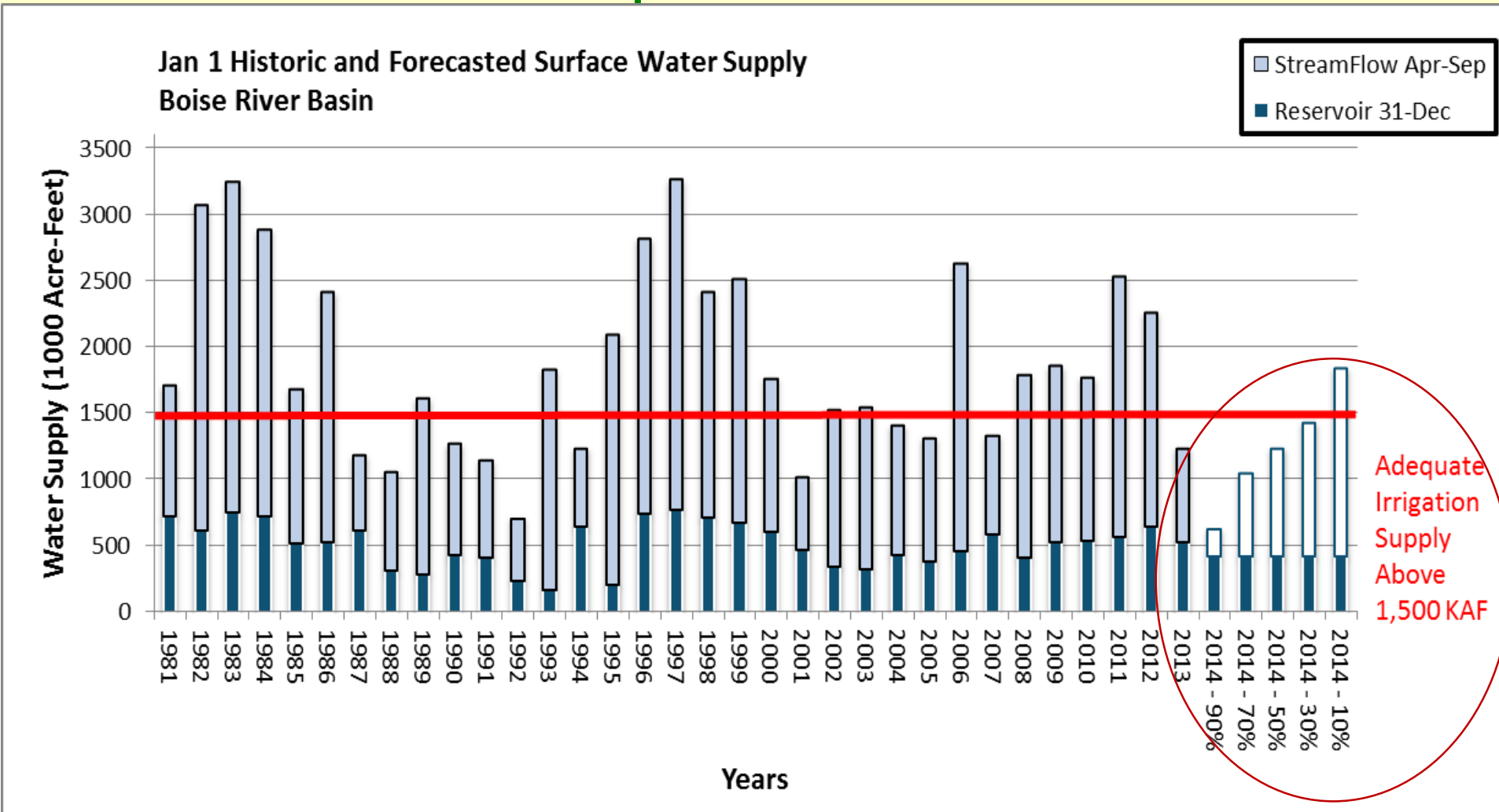
KEY NEWS HEADLINES

No key headlines to report.

Use of
US
Drought
Monitor

Uses of Surface Water Supply Index (SWSI)

- USDA Risk Management for Crop Insurance
- Bank Loan Officers
- Mint Contractors
- Water Banks – water rental price



Surface Water Supply Index (SWSI) Timeline

1990 USDA SCS (NRCS) developed criteria to produce SWSIs to better monitor western surface water supply as the Palmer Drought Index did not work well in western irrigated Ag basins.

**1993-94 Idaho NRCS formed a SWSI QAT to determine basins to produce SWSIs.
USBR, IWDR, IDofAg, NWS, IWUA, COE**

(7) Develop the following time series (basic SWSI formulation):

Computation Month	Reservoir Storage +	Streamflow Forecast
October	April 1 forecast +	April-September
November	April 1 forecast +	April-September
December	April 1 forecast +	April-September
January	April 1 forecast +	April-September
February	April 1 forecast +	April-September
March	April 1 forecast +	April-September
April	April 1 observed +	April-September
May	May 1 observed +	May-September
June	June 1 observed +	June-September
July	July 1 observed +	July-September
August	August 1 observed +	August - September
September	September 1 observed +	September

Table 1

**Keep in mind -
all SWSIs in the West
are not created equal**

(8) Generate SWSI historical time series.

Snake River nr Heise – upper Snake

4500 KAF threshold is still valid for surface irrigation

Henrys Fork

Only major shortages were in 1992, 2001 & 1977, puts threshold at 110 to 1300 KAF

Teton

Only years with major shortages were 1977 & 2001, which is ~70-80 KAF. In these types of years users switched to GW wells surface water supplies are short. Thus, this is reason for Utah Power & Light phone call about power surge when GW pumps were turned on in Aug. 2001; development of low flow forecast may benefit many. User notification may also help when supplies are short like this year.

Big Lost

180 KAF threshold is still valid. 2007 water users total volume on April 1 was 118 KAF. To receive GW credits require flow of 60 cfs at Arco gage.

Salmon Falls

110 KAF threshold is still valid. Improving irrigation delivery and on farm efficiency use. Any water saved is used in the same year to extend the irrigation season. Extend irrigation season by 7 or more days. The shortage level of 110 KAF was based primarily on just having enough water in 1977.

Oakley

50 KAF threshold is still valid. Improving irrigation delivery and on farm efficiency use is occurring.

2016 update:

48 KAF is full supply,

50 KAF is still valid for Ag shortage threshold

60 KAF is valid for Surplus amount

Little Lost

Use average streamflow flow – 39 KAF for 1971-2000, now 34 KAF for 1981-2010. Check when new averages are implemented.

Boise

1500 KAF is OK from Brian Sauer and Rex Barrie Dec 2011

Big Wood

275 KAF is still valid and used Lynn Harmon Dec 2011

Bear Lake

Real shortages occurred in 2003 & 2004 when Bear Lake Irrigation Total Acre-Feet (TAF) allotment fell below 200

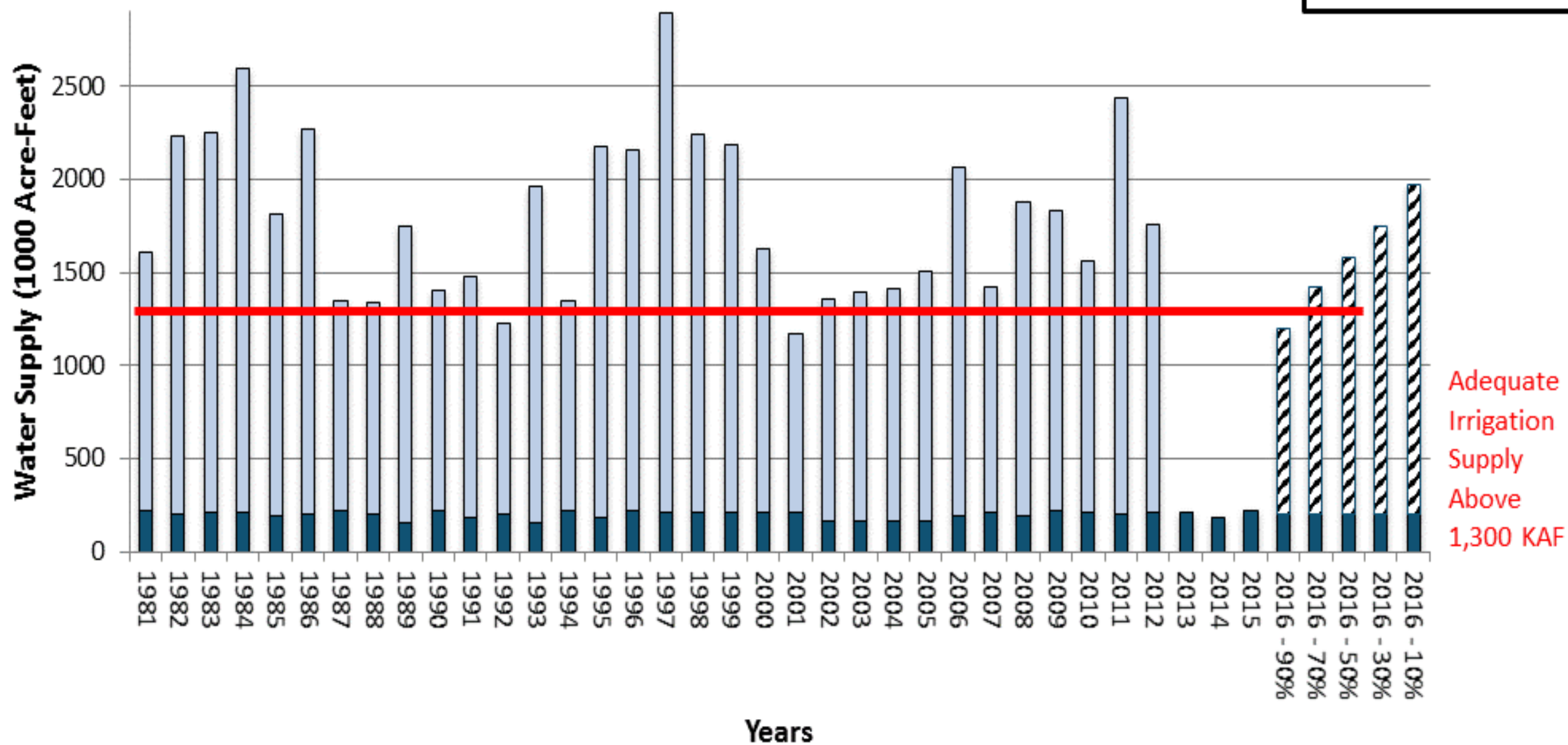
Credit goes to 1990s SWSI Committee and Bill Ondrechen for suggesting use of Ag Thresholds as targets.

Other states use triggers to determine drought actions.

And to Lynn Tominaga for promoting the use of SWSI to numerous users in the Ag industry to assist in their decision making process.

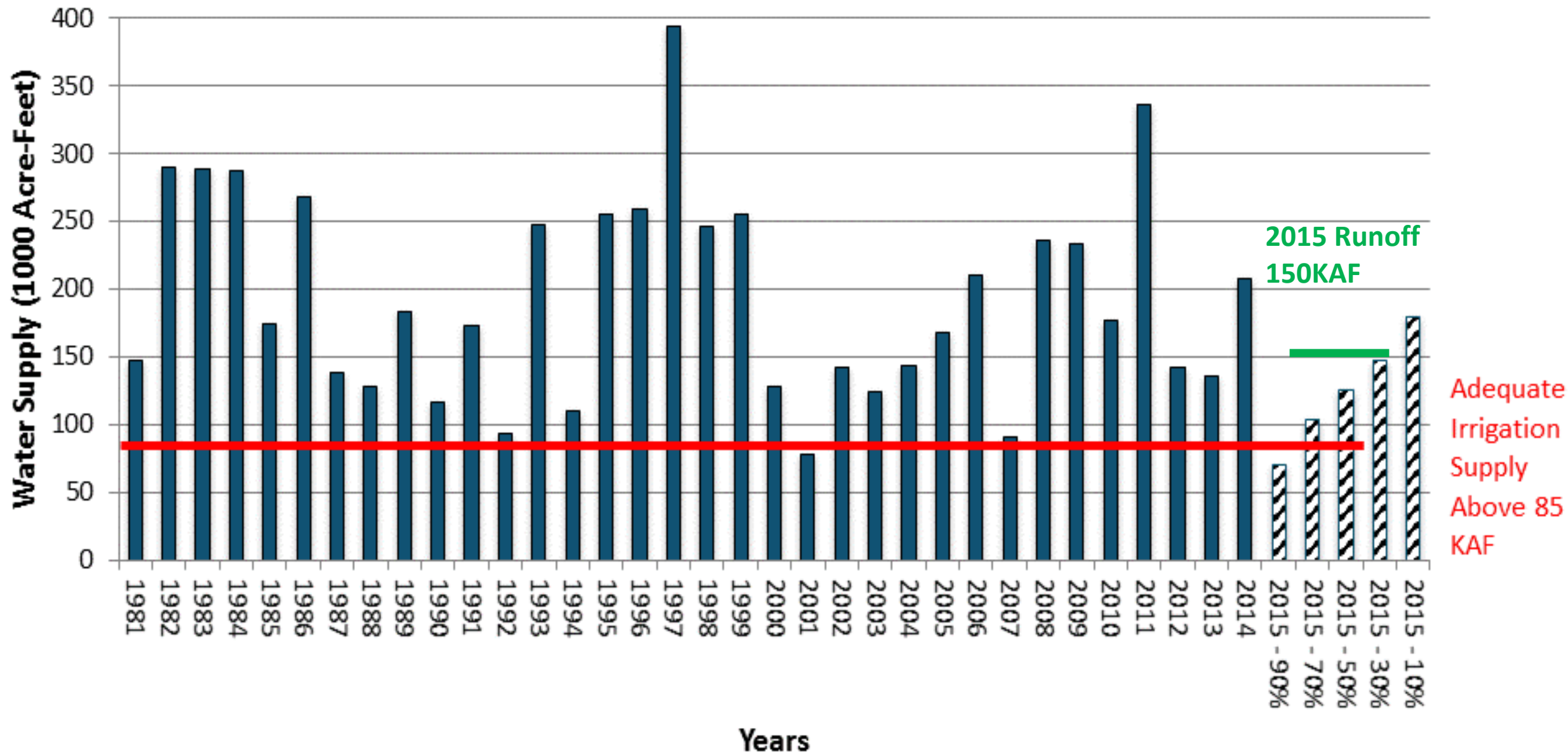
Mar 1 Historic and Forecasted Surface Water Supply Henrys Fork Basin

StreamFlow Apr-Sep
Reservoir 29-Feb



Apr 1 Historic and Forecasted Surface Water Supply Teton River Basin

Teton R nr Driggs



Station ID	Station Name	Period	Data Type	Years	# of Years		
13051300	Teton R nr Driggs	Apr-Sep	strm	1981-2015	35 Units KAF		
ENSO Classification							
SE Strong El Niño - EN Mild El Niño - N Neutral - LN Mild La Niña - SL Strong La Niña							
Rank	Year	Enso	Stream Flow Apr-Sep	Reservoir 31-Mar	Streamflow + Reservoir Sum	Non- Exceedance Probability	SWSI
1	1997	N	394	0	394	97%	3.9
2	2011	SL	356	0	356	94%	3.7
3	1982	N	390	0	390	92%	3.5
4	1983	SE	389	0	389	89%	3.2
5	1984	N	387	0	387	88%	3.0
6	1986	N	367	0	367	83%	2.8
7	1996	N	359	0	359	81%	2.5
8	1999	SL	356	0	356	78%	2.3
9	1995	SE	355	0	355	75%	2.1
10	1993	EN	347	0	347	72%	1.9
11	1998	SE	346	0	346	69%	1.6
12	2008	N	336	0	336	67%	1.4
13	2009	N	333	0	333	64%	1.2
2016 10% Chance Exceedance Forecast		SE	330	0	330	63%	1.0
14	2006	N	310	0	310	61%	0.9
15	2014	N	306	0	306	58%	0.7
2016 30% Chance Exceedance Forecast		SE	199	0	199	57%	0.6
16	1989	SL	183	0	183	56%	0.5
17	2010	EN	177	0	177	53%	0.2
2016 50% Chance Exceedance Forecast		SE	176	0	176	51%	0.1
18	1985	N	174	0	174	50%	0.0
19	1991	N	173	0	173	47%	-0.2
20	2005	EN	168	0	168	44%	-0.5
21	2015	EN	158	0	158	42%	-0.7
2016 70% Chance Exceedance Forecast		SE	154	0	154	40%	-0.8
22	1981	N	147	0	147	39%	-0.9
23	2004	N	144	0	144	36%	-1.2
24	2012	LN	143	0	143	33%	-1.4
25	2000	N	142	0	142	31%	-1.6
26	1987	N	138	0	138	28%	-1.9
27	2013	N	136	0	136	25%	-2.1
28	2000	N	128	0	128	22%	-2.3
29	1988	SE	128	0	128	19%	-2.5
30	2003	EN	124	0	124	17%	-2.8
2016 90% Chance Exceedance Forecast		SE	121	0	121	15%	-2.9
31	1990	N	117	0	117	14%	-3.0
32	1994	SE	110	0	110	11%	-3.2
33	1992	EN	93	0	93	8%	-3.5
34	2007	EN	91	0	91	6%	-3.7
35	2001	LN	78	0	78	3%	-3.9

2016 Runoff ~150KAF

Shortages < 85 KAF

March 1, 2014 Water Supply- Amount Needed, Shortages & Surplus

Based on All Five Chance of Exceedance Forecasts

Fore- cast Period Used	BASIN or REGION	Adequate Irrigation Water Supply (KAF)	Reservoir Storage (KAF)	Streamflow Volume Needed for Adequate Water Supply KAF (%)	90% Chance of Exceedance Streamflow Forecast (KAF)	70% Chance of Exceedance Streamflow Forecast (KAF)	50% Chance of Exceedance Streamflow Forecast (KAF)	30% Chance of Exceedance Streamflow Forecast (KAF)	10% Chance of Exceedance Streamflow Forecast (KAF)
Mar-Sep	Owyhee	450	127 Feb28	323 (55%)	49 (-274)	99 (-224)	144 (-179)	197 (-126)	290 (-33)
Mar-Sep	Salmon Falls	110	20 Feb28	90 (106%)	16 (-75)	26 (-64)	34 (-56)	44 (-46)	60 (-30)
Apr-Sep	Big Wood	275	60 Mar13 70 Mar31	205 (77%)	32 (-173)	82 (-123)	103 (-102)	155 (-50)	230 (+25)
Apr-Sep	Big Lost	180	30 Mar10 35 Mar31	145 (97%)	26 (-119)	55 (-90)	86 (-59)	117 (-28)	162 (+17)
Apr-Sep	Little Lost	40	N/A	40 (118%)	15 (-25)	22 (-18)	27 (-13)	33 (-7)	42 (+2)
Mar-Sep	Oakley	50	18.3 Feb28	31 (100%)	16 (-15)	26 (-5)	34 (+3)	44 (+13)	60 (+29)
Mar-Sep	Little Wood	60	15 Feb28	42 (46%)	14 (-28)	27 (-15)	39 (-3)	53 (+11)	77 (+35)
Apr-Sep	Boise	1500	522 Feb28 588 Mar13 640 Mar31	860 (63%)	675 (-185)	960 (+100)	1090 (+230)	1220 (+360)	1500 (+640)
Apr-Sep	Snake (Heise)	4400	760 Feb28 588 Mar13 860 Mar31	3540 (98%)	3950 (+410)	4320 (+780)	4570 (+1030)	4820 (+1280)	5190 (+1650)
Apr-Sep	Teton	85	N/A	85 (44%)	166 (+81)	200 (+115)	225 (+140)	250 (+165)	295 (+210)
Apr-Sep	Bear River	500	700 Mar31	minimal	4 (+184)	61 (+241)	115 (+295)	169 (+349)	248 (+428)
			Water Supply Outlook Key:		Shortages	Some Shortages	Marginal Supplies	Sufficient Supplies	Surplus

Most states only use the 50% Chance of Exceedance Forecast in their SWSI.

Idaho uses all 5 exceedance forecast for the end user to decide which one to use or as weather conditions change between 1st of month streamflow forecasts.

Summary Table: Amount of streamflow needed in 2017 for adequate surface irrigation supplies.

Created November 8, 2016

Fall reservoir carryover storage is used to project spring reservoir storage levels based on current conditions and recent trends. Then, by knowing the adequate irrigation water supply needed in your basin, the projected spring reservoir volumes are subtracted from the adequate irrigation supply to determine the volume of streamflow to marginally meet adequate surface irrigation supplies in 2017.

As of November 8, 2016: Projected change in reservoir storage from Fall 2016 to target levels in Spring 2017 which is when the runoff period starts for the streamflow forecasts.

	Oct 31 storage KAF	Nov 30 storage KAF	Dec 31 storage KAF	Projected Jan 31 Storage KAF	Projected Feb 28 storage KAF	Projected Mar 31 storage KAF	Estimated change in storage KAF
Boise Reservoir System	422.0	---	---	---	---	800	378
Magic Reservoir	65.0	---	---	---	---	105	40
Little Wood Reservoir	12.4	---	---	---	24	---	12
Mackay Reservoir	14.7	---	---	---	---	40	25
Jackson & Palisades Reservoir System	800.0	---	---	---	---	1300	500
Oakley Reservoir	11.5	---	---	---	22	---	11
Salmon Falls Reservoir	35.0	---	---	---	50	---	15
Lake Owyhee	179.0	---	---	260	---	---	81
Bear Lake	440.0	---	---	---	---	500	60

For reservoir projection, there may not be a right or wrong answer, but if there is a better projection, let me know.

Summary Table: Amount of streamflow needed in 2017 for adequate surface irrigation supplies.

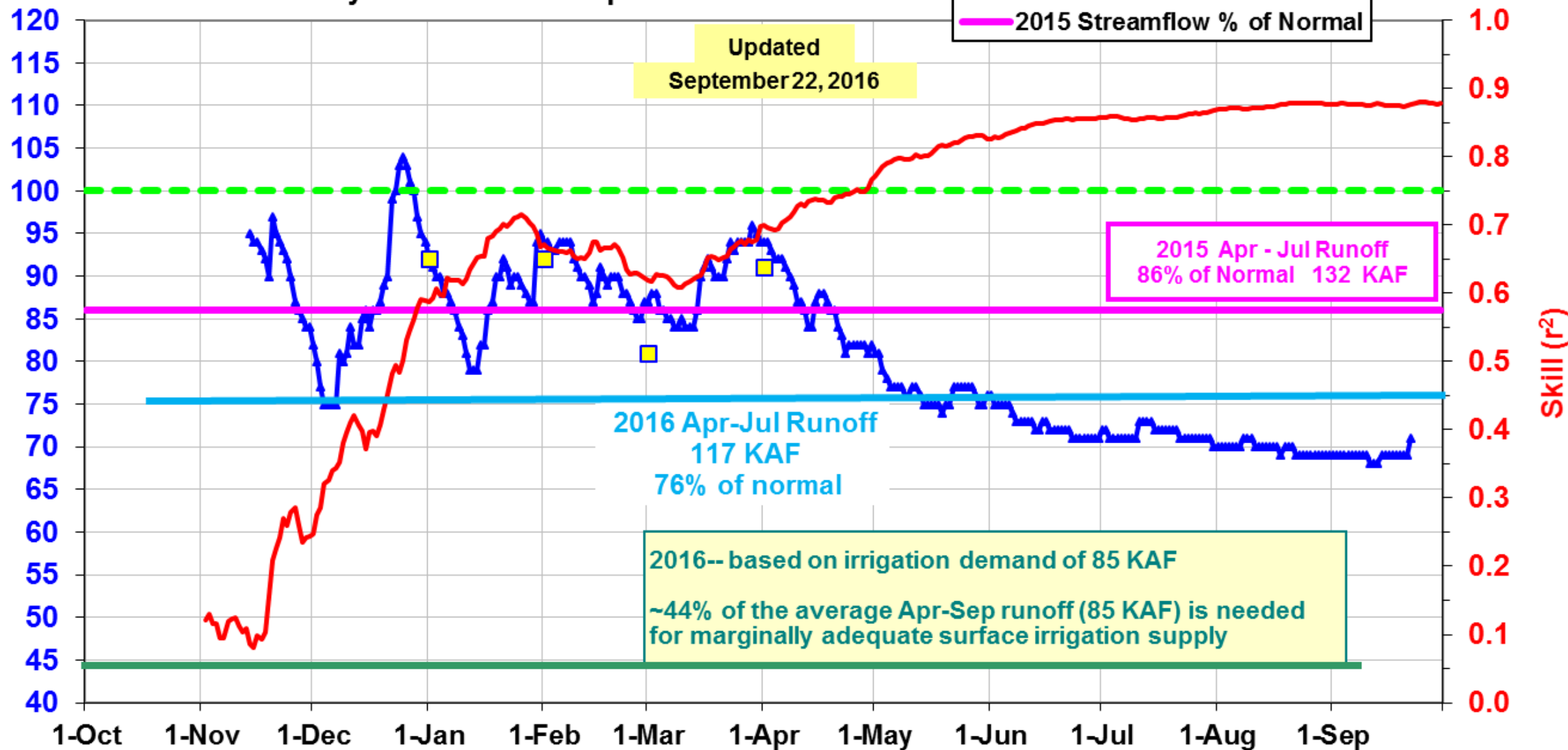
Created November 8, 2016

Fall reservoir carryover storage is used to project spring reservoir storage levels based on current conditions and recent trends. Then, by knowing the adequate irrigation water supply needed in your basin, the projected spring reservoir volumes are subtracted from the adequate irrigation supply to determine the volume of streamflow to marginally meet adequate surface irrigation supplies in 2017.

Column 2 - Column 3 = Column 4 Col4/Col6 X 100= Col 5								
Column 1 Basin	2 Amount needed for adequate irrigation water supply KAF	3 Projected end of month reservoir storage (Jan, Feb or Mar) KAF	4 2017 streamflow volume needed for adequate water supply KAF	5 % of average streamflow to meet adequate irrigation supply in 2017 KAF	6 1981-2010 average streamflow KAF	7 Streamflow runoff period used in the analysis	9 2016 Streamflow Runoff KAF / % of average	
Boise	1500	800	700	51%	1360	Apr-Sep	1255	92%
Big Wood	275	105	170	64%	265	Apr-Sep	186	70%
Little Wood	60	24	36	39%	92	Mar-Sep	66.4	72%
Big Lost	180	40	140	93%	150	Apr-Sep	119.4	80%
Little Lost	40	---	40	118%	34	Apr-Sep	26.9	79%
Teton	85	---	85	44%	193	Apr-Sep	140	73%
Snake (Heise)	4,400	1300	3100	82%	3,780	Apr-Sep	3000	79%
Oakley	50	22	28	90%	31	Mar-Sep	27.4	88%
Salmon Falls	110	50	60	71%	85	Mar-Sep	109	128%
Owyhee	575	260	315	47%	665	Feb-Sep	545	82%
Bear River	280	500	0	0%	205	Apr-Sep	145.5	71%

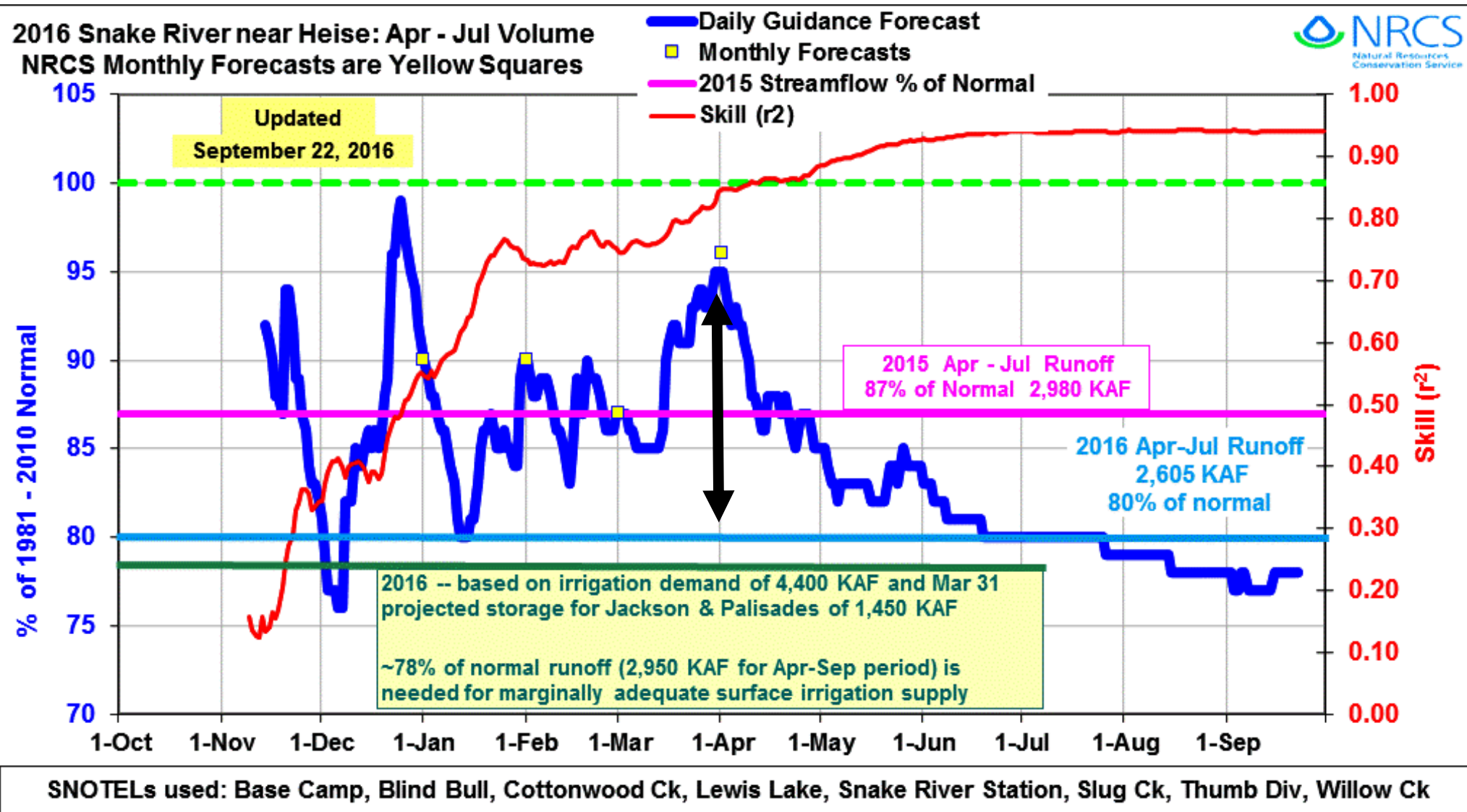
2016 Teton River nr Driggs: Apr-Jul Volume NRCS Monthly Forecasts are Squares

- Daily Guidance Forecast
- Monthly Forecasts
- 2015 Streamflow % of Normal



SNOTEL Sites Used: Pine Creek Pass, Phillips Bench Togwotee Pass, Lewis Lake Divide

- Ag irrigation supplies were marginal in Upper Snake with the runoff at 80% of average at Heise.
- Dec 2015 – estimated amount needed for adequate 2016 irrigation supplies
A volume greater than 78% of average was needed to provide marginally adequate supplies.

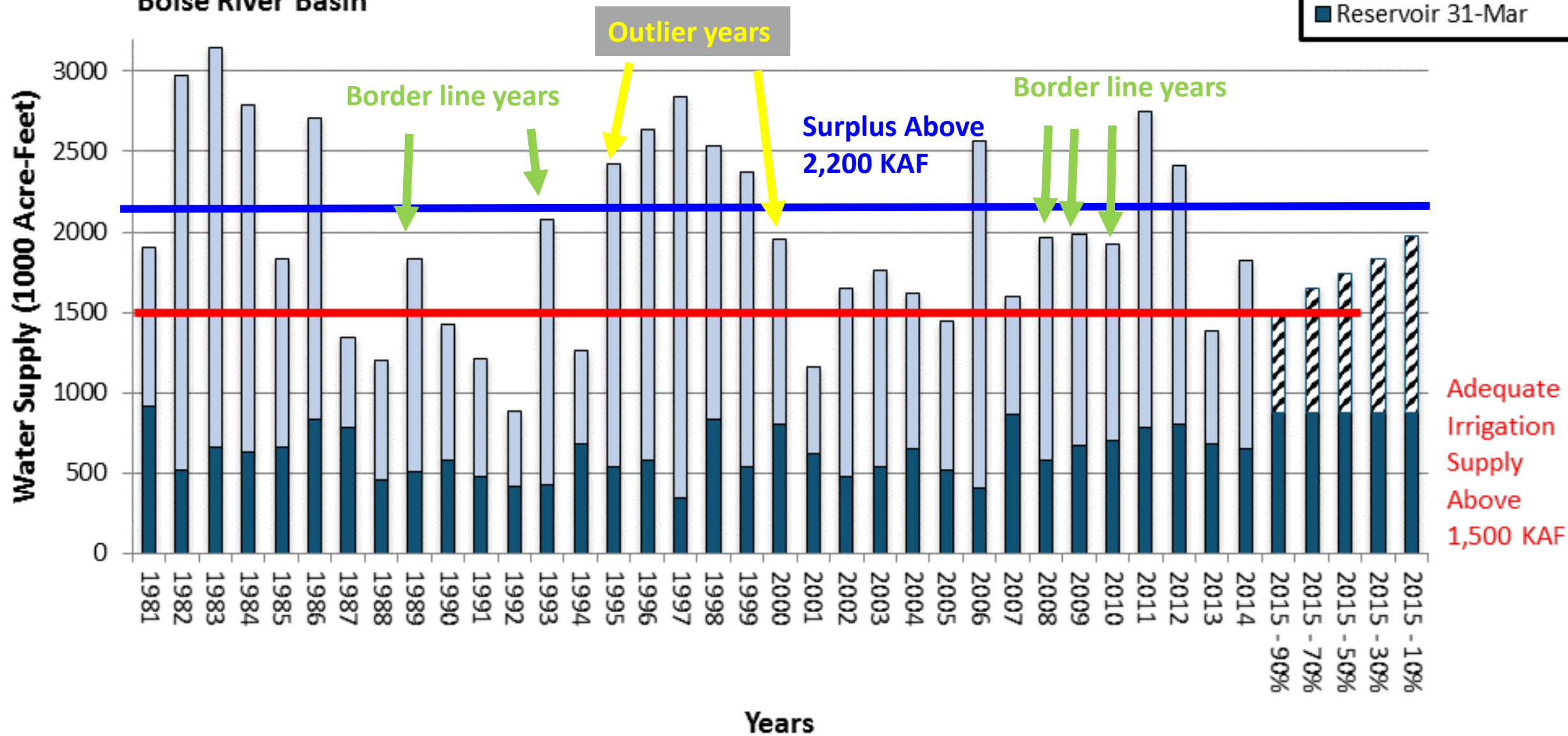
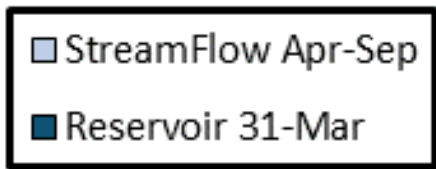


Idaho Surface Water Supply Index Ag Shortage & Surplus Thresholds

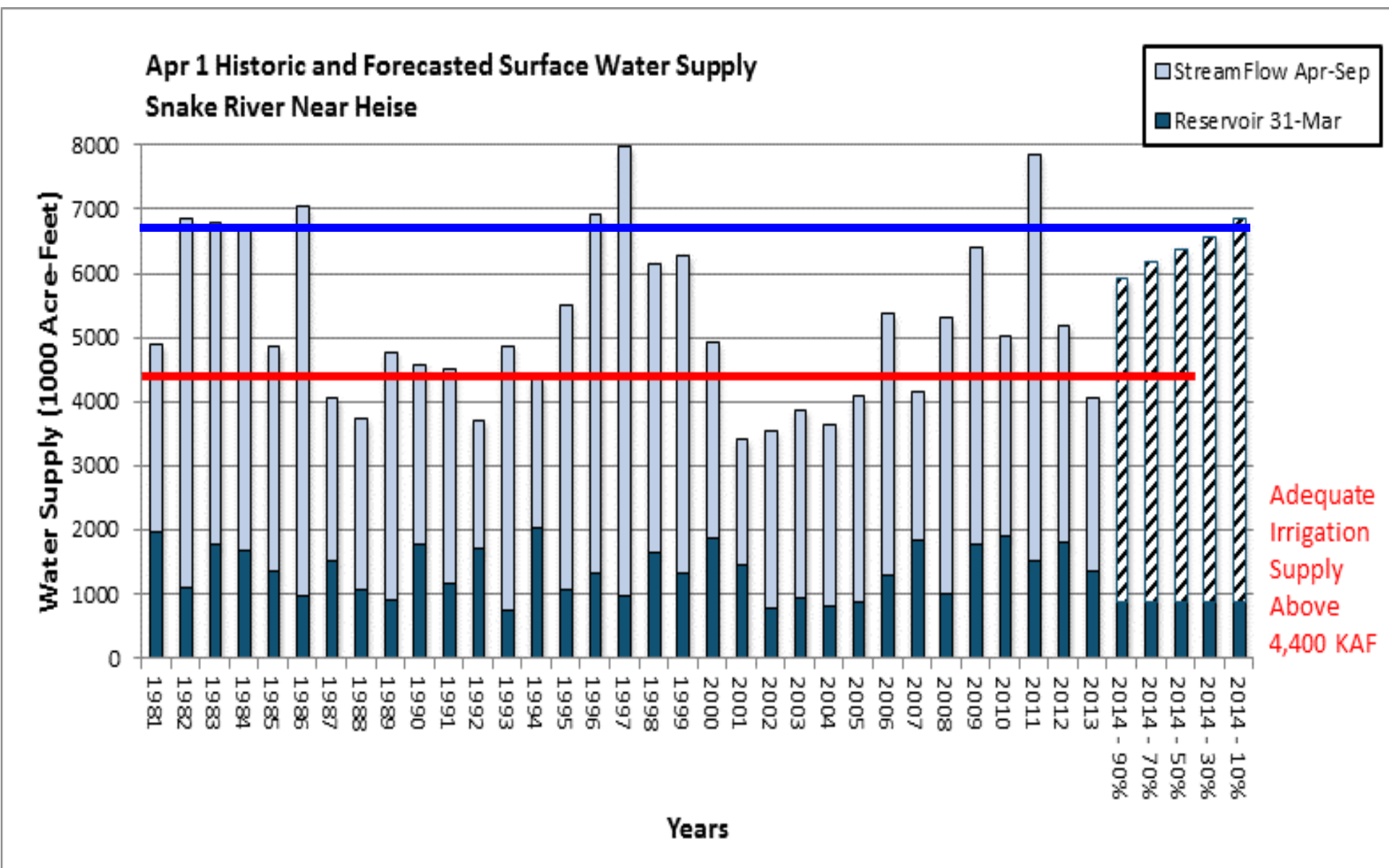
<u>Basin</u>	<u>Ag Shortage Threshold</u>	<u>Surplus Threshold</u>
Big Wood	275 KAF	350 KAF with 1,500 cfs release from the dam.
Boise Basin	1,500 KAF	2,200 KAF with a flow > 6,000 cfs passing the Glenwood gage for more than 5 days and approaching 25 days is considered the surplus threshold.
Little Wood	50-60 KAF	70 KAF was determined as the surplus volume based on the reservoir capacity of 30.0 KAF and potential to fill the reservoir.
Owyhee	575 KAF (updated value)	950 KAF with a flow greater than 1,800 cfs for 8 or more days meets the surplus threshold.
Oakley	50 KAF	60 KAF was determined as the surplus volume based primarily on the reservoir capacity of 76.6 KAF and the ability to rent water when volumes are above 60 KAF.
Salmon Falls	110 KAF	180 KAF was determined as the surplus volume based primarily on reservoir capacity of 182.65 KAF and potential to fill the reservoir.
Payette	Shortages not common	1,400 KAF based primarily on 2015 total water supply.

Not completed: Snake at Heise, Teton, Big Lost, Little Lost, Bear

Apr 1 Historic and Forecasted Surface Water Supply Boise River Basin



**DRAFT Analysis -- completed for cloud seeding suspension
in Upper Snake based on flow > 21,000 @ Blackfoot,
which resulted in volume about 6,800 KAF or +2.9 SWSI**



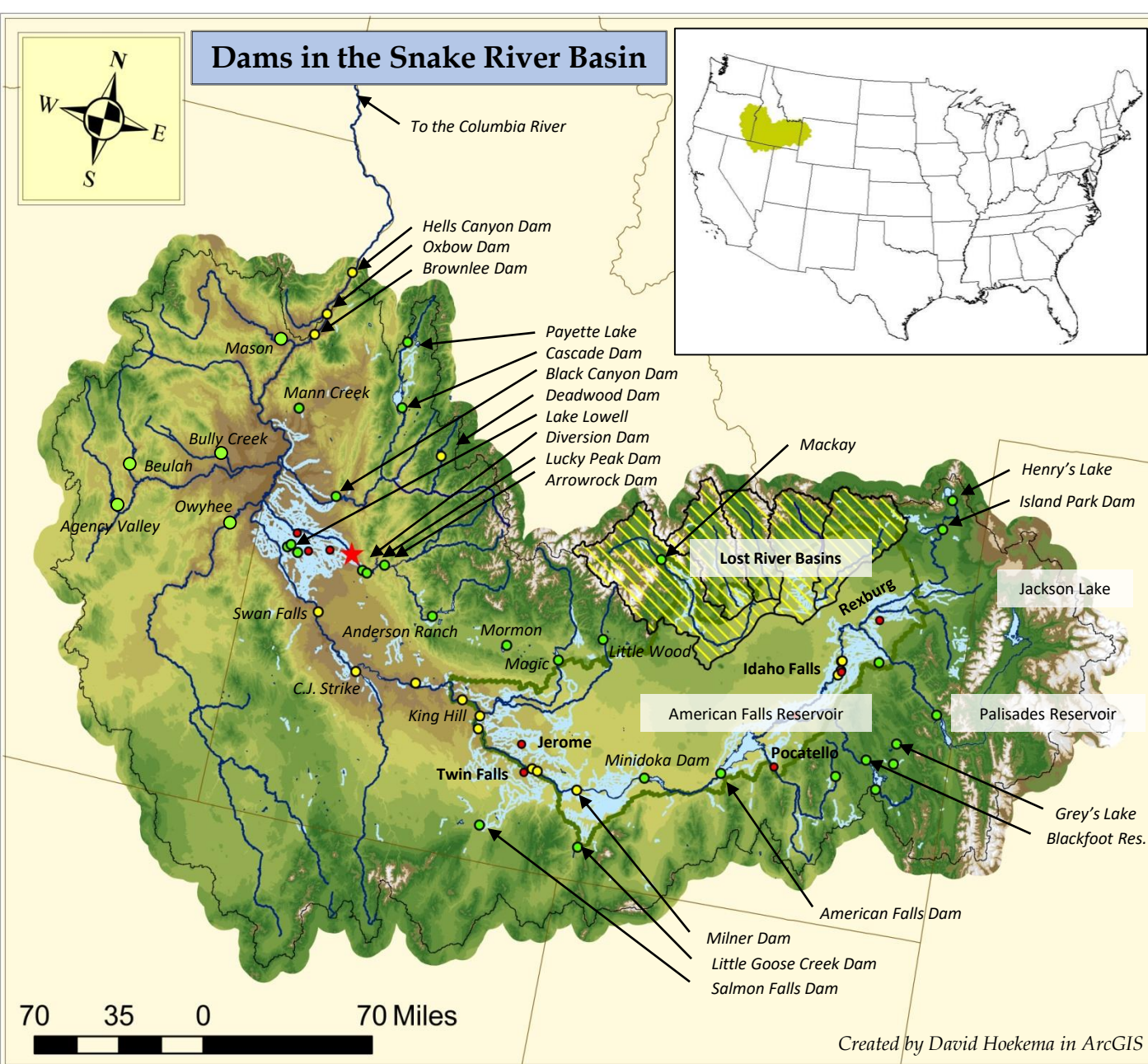


Figure 1.1 Study Area Map of the Snake River Basin Upstream of Hells Canyon Dam Showing Hydropower Dams and Irrigation Reservoirs.

Interest by to develop more SWSIs
to better monitor drought in
headwaters above reservoirs:
IDWR
Idaho Power
USDM

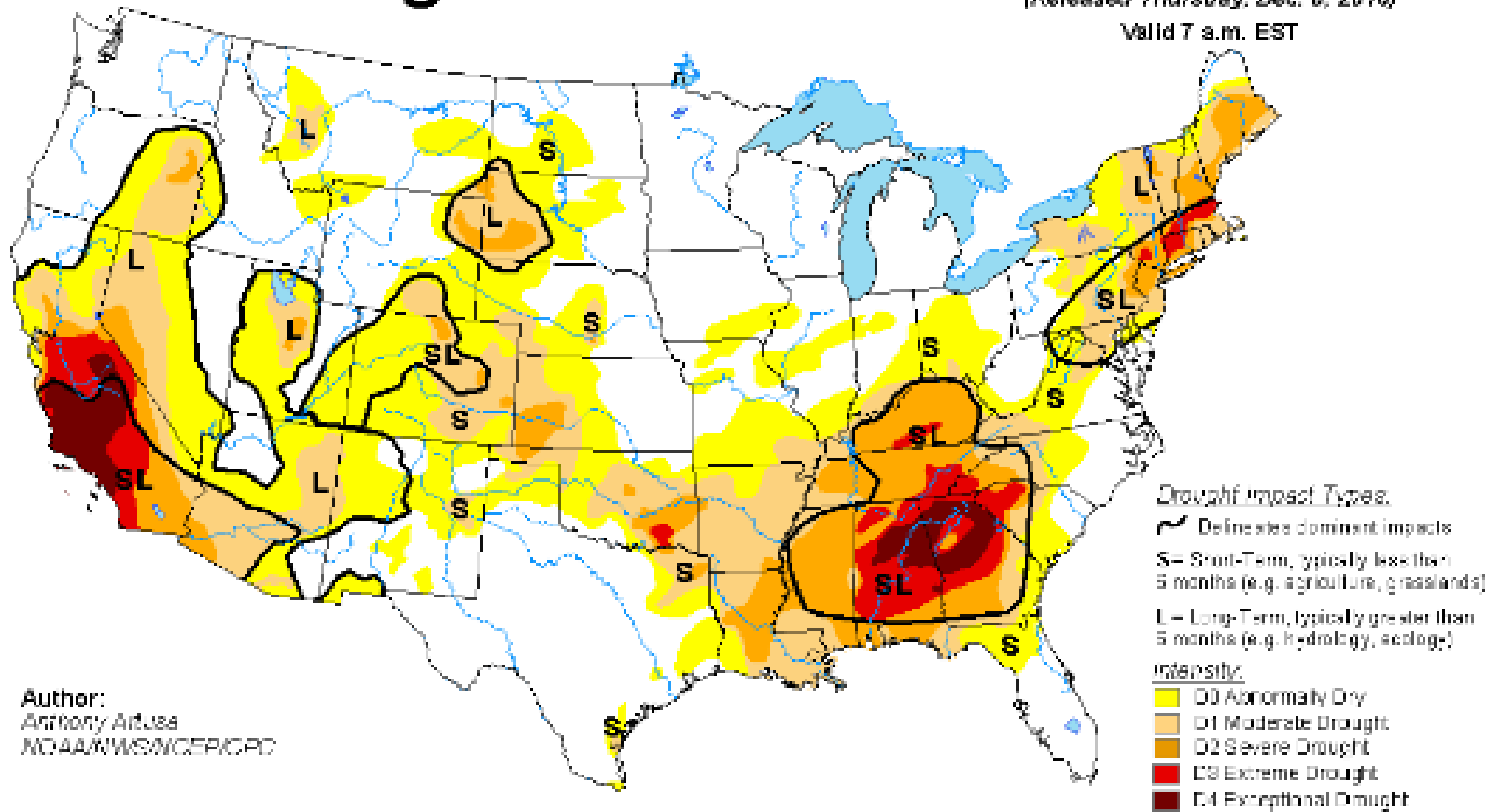
Potential basins:
Henrys above Ashton
Falls
Snake abv Flagg Ranch
Pacific
Buffalo
Greys
Salt
Ririe
Big Lost near Howell Ranch
Big Wood at Hailey
Boise headwater
Owyhee above Rome
Bronwlee, Others...

U.S. Drought Monitor

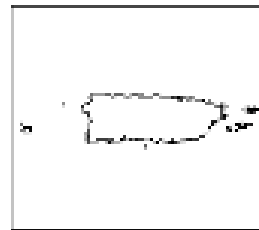
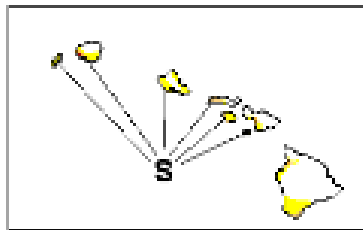
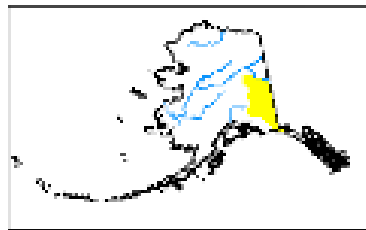
December 6, 2016

(Released Thursday, Dec. 8, 2016)

Valid 7 a.m. EST



Author:
Anthony Artusa
NOAA/NWS/NCEP/PCD



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

Drought driven by demand, timing and ability to meet demand.

US Drought Monitor Map responsible for \$1 billion / year in aid.

IRS uses USDM to monitor cattle sales in drought areas.

Idaho funds obligated under drought recovery:

2014 \$290,000

2015 \$690,000

2016 \$420,000

Critical to get maps correct for each state.

NOTE: To view regional drought conditions, click on map above. State maps can be accessed from regional maps.

The data cutoff for Drought Monitor maps is each Tuesday at 7 a.m. EST. The maps, which are based on analysis of the data, are released each Thursday at 8:30 a.m. Eastern Time.

Authorizes an Idaho Water Supply Committee (Section 2.1):

“If it becomes apparent that a problem could occur, IDWR will alert the Governor’s Office and will organize a Water Supply Committee to coordinate all drought related activities in Idaho.”

Idaho Drought Committee

contact: David Hoekema (208) 287-4830

Idaho Drought Plan created state water supply committee – meets once a month Jan-Apr.

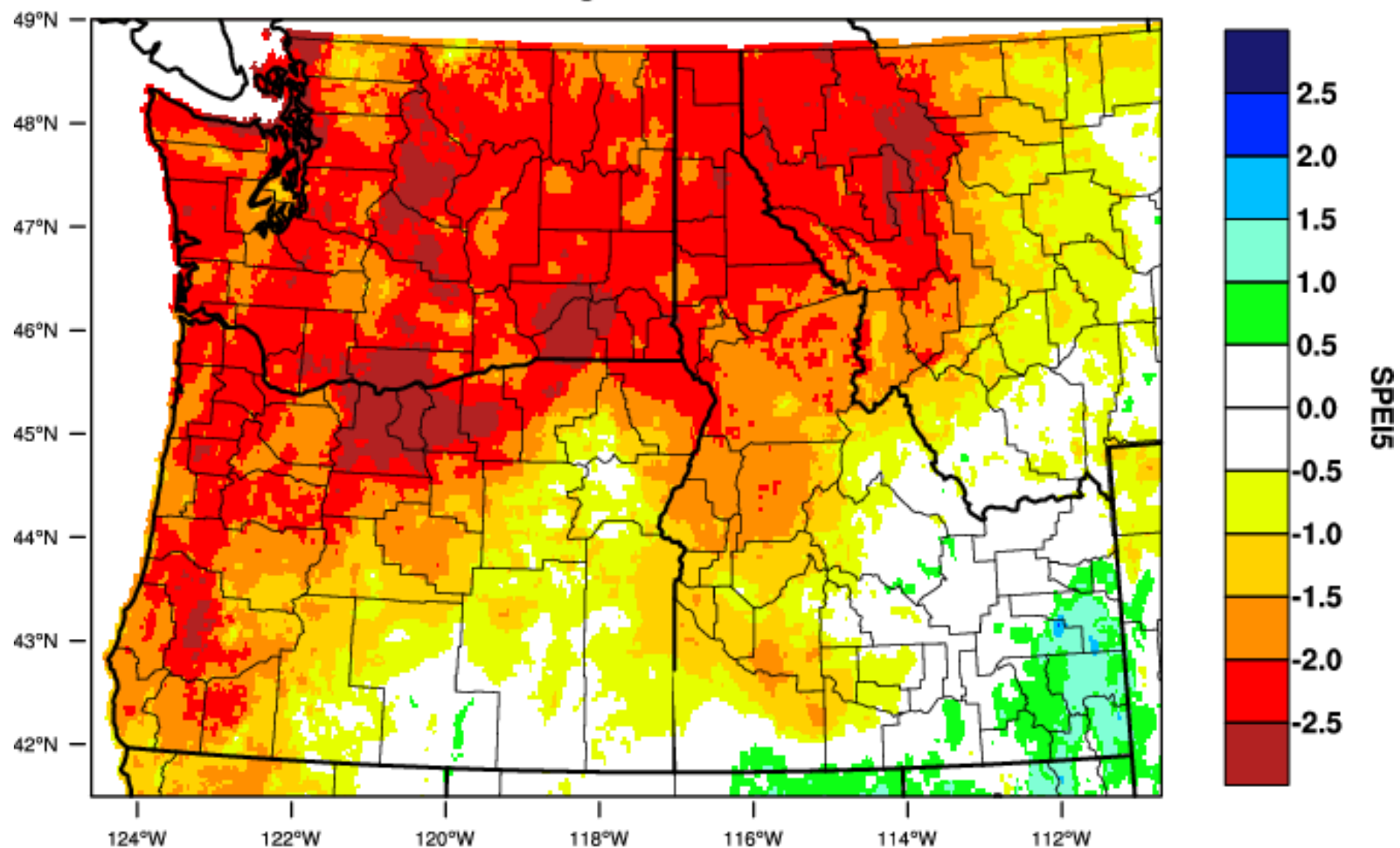
If severe drought coming on, allows committee to alter for Governor’s Office.

Smaller committee meets monthly rest of year to provide info to USDM authors

United States Drought Monitor (USDM): <http://droughtmonitor.unl.edu/Home.aspx>

Pacific Northwest - 5 month SPEI

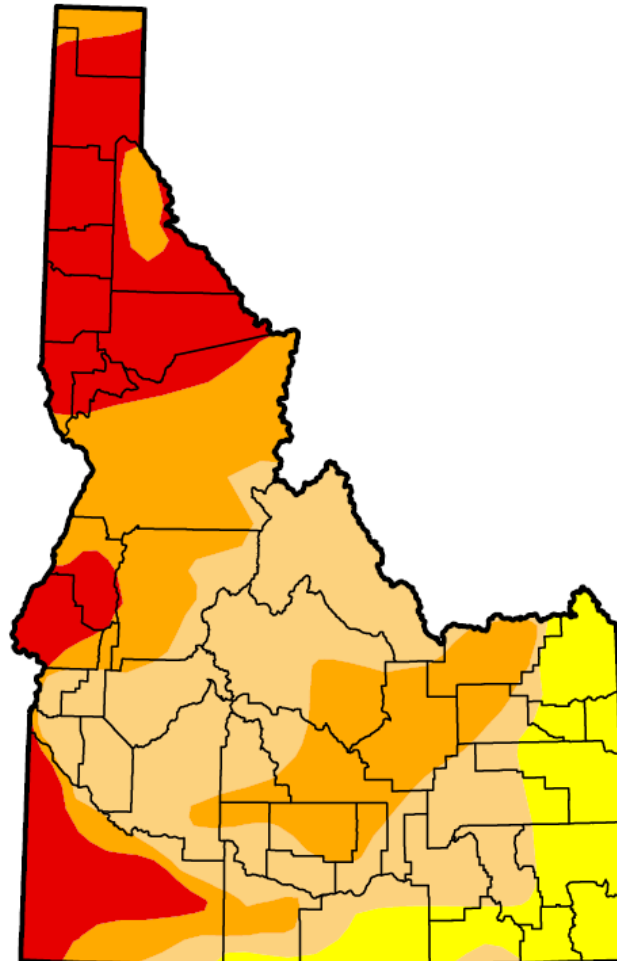
August 2015



WestWide Drought Tracker - U Idaho/WRCC Data Source - PRISM (Prelim), created 16 MAR 2016

U.S. Drought Monitor Idaho

August 4, 2015
(Released Thursday, Aug. 6, 2015)
Valid 8 a.m. EDT



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	86.63	51.71	22.20	0.00
Last Week <i>7/28/2015</i>	0.00	100.00	86.63	51.71	22.20	0.00
3 Months Ago <i>5/5/2015</i>	0.02	99.98	61.33	21.96	8.18	0.00
Start of Calendar Year <i>12/30/2014</i>	23.76	76.24	41.73	18.49	3.40	0.00
Start of Water Year <i>9/30/2014</i>	13.19	86.81	52.39	26.35	3.53	0.00
One Year Ago <i>8/5/2014</i>	15.80	84.20	43.76	28.95	2.09	0.00

Intensity:



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

Author:
Mark Svoboda
National Drought Mitigation Center



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

Mon 12/12/2016 2:10 PM

□ Hoekema, David <David.Hoekema@idwr.idaho.gov>

Idaho Suggestions to USDM author

To

Anthony,

After our meeting this morning, Idaho feels comfortable with the status quo.

- There is still some low snowpack in the Clark County region.**
- The Owyhee Mountains have improved, but any improvement there should be made in coordination with Oregon.**
- The Weiser basin is lagging a little in the indices, but any degradation there would need to be coordinated with Oregon.**

We are currently in a wet pattern across the state and may see some improvements in the coming weeks.

David Hoekema
Hydrologist, Technical
Hydrology Section
Idaho Department of Water Resources

**If interested, or to provide
input, contact David**

U.S. Drought Monitor Classification Scheme

What You See

D0-D4: The Drought Monitor summary map identifies general drought areas, labelling droughts by intensity, with D1 being the least intense and D4 being the most intense. D0, drought watch areas, are either drying out and possibly heading for drought, or are recovering from drought but not yet back to normal, suffering long-term impacts such as low reservoir levels.

S and L: Since "drought" means a moisture deficit bad enough to have social, environmental or economic effects, we generally include a description of what the primary physical effects are:

S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands) **L** = Long-Term, typically more than 6 months (e.g. hydrology, ecology)

The Thinking Behind the Map

Drought intensity categories are based on five key indicators, numerous supplementary indicators including drought impacts, and local reports from more than 350 expert observers around the country. The accompanying drought severity classification table shows the ranges for each indicator for each dryness level. Because the ranges of the various indicators often don't coincide, the final drought category tends to be based on what the majority of the indicators show and on local observations. The analysts producing the map also weigh the indices according to how well they perform in various parts of the country and at different times of the year. Additional indicators are often needed in the West, where winter snowfall in the mountains has a strong bearing on water supplies. It is this combination of the best available data, local observations and experts' best judgment that makes the U.S. Drought Monitor more versatile than other drought indicators.

Drought Severity Classification

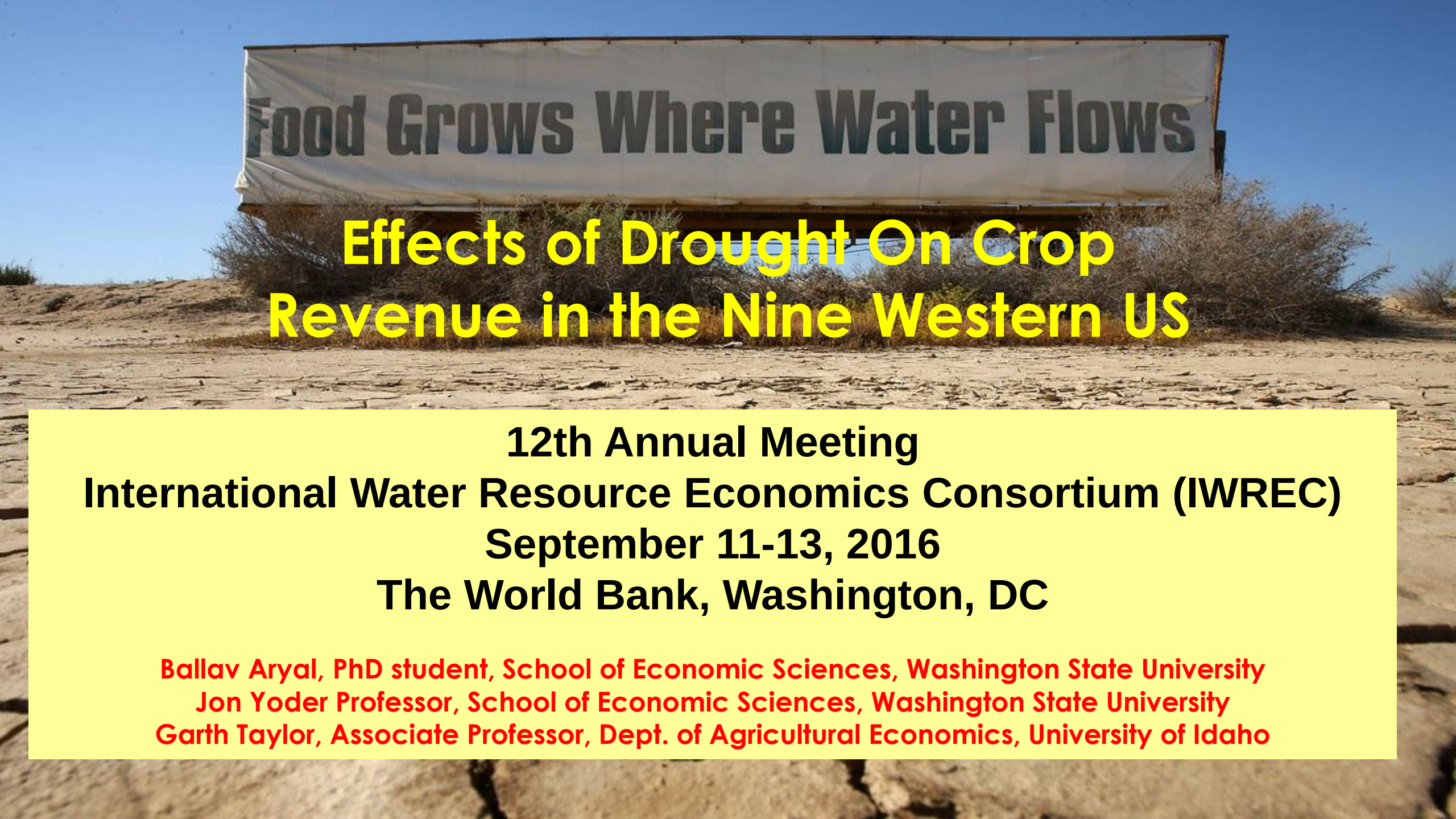
			Ranges				
Category	Description	Possible Impacts	Palmer Drought Severity Index (PDSI)	CPC Soil Moisture Model (Percentiles)	USGS Weekly Streamflow (Percentiles)	Standardized Precipitation Index (SPI)	Objective Drought Indicator Blends (Percentiles)

Drought Severity Classification

Category	Description	Possible Impacts	Ranges				
			Palmer Drought Severity Index (PDSI)	CPC Soil Moisture Model (Percentiles)	USGS Weekly Streamflow (Percentiles)	Standardized Precipitation Index (SPI)	Objective Drought Indicator Blends (Percentiles)
D0	Abnormally Dry	Going into drought: ▪ short-term dryness slowing planting, growth of crops or pastures Coming out of drought: ▪ some lingering water deficits ▪ pastures or crops not fully recovered	-1.0 to -1.9	21 to 30	21 to 30	-0.5 to -0.7	21 to 30
D1	Moderate Drought	▪ Some damage to crops, pastures ▪ Streams, reservoirs, or wells low, some water shortages developing or imminent ▪ Voluntary water-use restrictions requested	-2.0 to -2.9	11 to 20	11 to 20	-0.8 to -1.2	11 to 20
D2	Severe Drought	▪ Crop or pasture losses likely ▪ Water shortages common ▪ Water restrictions imposed	-3.0 to -3.9	6 to 10	6 to 10	-1.3 to -1.5	6 to 10
D3	Extreme Drought	▪ Major crop/pasture losses ▪ Widespread water shortages or restrictions	-4.0 to -4.9	3 to 5	3 to 5	-1.8 to -1.9	3 to 5
D4	Exceptional Drought	▪ Exceptional and widespread crop/pasture losses ▪ Shortages of water in reservoirs, streams, and wells creating water emergencies	-5.0 or less	0 to 2	0 to 2	-2.0 or less	0 to 2

Short-term drought indicator blends focus on 1-3 month precipitation. Long-term blends focus on 6-60 months. Additional indices used, mainly during the growing season, include the USDA/NASS Topsoil Moisture, Keetch-Byram Drought Index (KBDI), and NOAA/NESDIS satellite Vegetation Health Indices. Indices used primarily during the snow season and in the West include snow water content, river basin precipitation, and the Surface Water Supply Index (SWSI). Other indicators include groundwater levels, reservoir storage, and pasture/range conditions.

Caveats on use of the U.S. Drought Monitor



Food Grows Where Water Flows

Effects of Drought On Crop Revenue in the Nine Western US

**12th Annual Meeting
International Water Resource Economics Consortium (IWREC)
September 11-13, 2016
The World Bank, Washington, DC**

**Ballav Aryal, PhD student, School of Economic Sciences, Washington State University
Jon Yoder Professor, School of Economic Sciences, Washington State University
Garth Taylor, Associate Professor, Dept. of Agricultural Economics, University of Idaho**

Drought data

- ▶ We considered two drought indices – the Palmer Drought Severity Index (PDSI) and the Surface Water Supply Index (SWSI)
- ▶ PDSI is based on temperature, precipitation and soil moisture
- ▶ SWSI is based on the surface water available through streamflow and reservoir storage
- ▶ SWSI is more applicable in the western states since most of the agriculture is irrigated

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

Crop revenue data

- ▶ Each state starting 1928
- ▶ Cotton
- ▶ Feed crops (barley, corn, hay)
- ▶ Food grains (rice, wheat)
- ▶ Vegetables and melons (dry beans, potatoes, melons)
- ▶ Fruit and nuts
- ▶ Oil crops (Soybeans)
- ▶ All other crops (Sugar Beets, Hops, Mint, Flowers, Misc. crops)

Results

▶ Idaho examples

- ▶ Idaho potatoes SWSI coefficient is 0.8. If the SWSI index in Idaho changes from 0 to -4 (i.e from no drought to severe drought), potato revenue drops \$3.2 million.
- ▶ The dollar value of potatoes produced in Idaho in 2014 was close to a billion. Farmers are more likely to allocate all the available water to potatoes first during drought
- ▶ PDSI is negative (-0.4) and significant
- ▶ Idaho wheat SWSI coefficient is 0.12 and is not statistically significant

▶ Food grains (wheat)

- ▶ SWSI coefficient are not significant for most states and the magnitude of the coefficients are negligible when significant (AZ- 0.1, UT-0.03)
- ▶ Drought as measured by SWSI does not seem to effect food grains revenue since most wheat in the western states is not irrigated

Limitations

- ▶ The indices measure different aspects of drought. The coefficients for PDSI and the SWSI often have opposite signs when both are significant
- ▶ We have not been able to account for all the other factors that cause supply shifts (like groundwater) and demand shifts (global crop prices) to estimate our reduced form model
- ▶ Even when the coefficients are statistically significant, they are not economically significant. Ex- Potatoes in Idaho

**Other Tools to
Assist in Dry
or Wet Years**

Partnerships between NRCS & BSU



BOISE STATE UNIVERSITY

**1. Estimating timing of snowmelt peak streamflow using
snowmelt relationships at SNOTEL sites**

(Kara Ferguson & Dr. Jim McNamara)

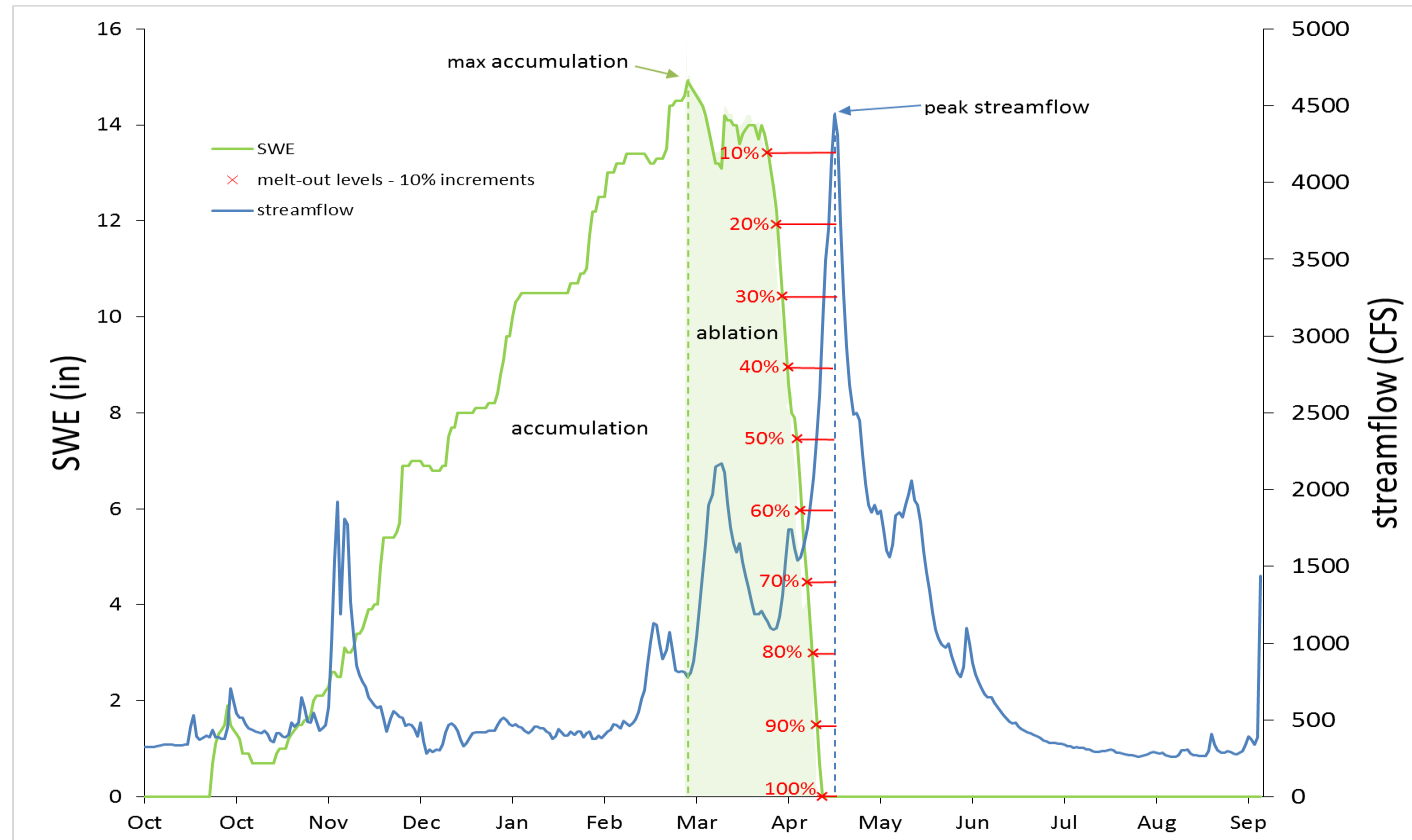
2. Estimating critical flow magnitudes using SNOTEL data

(Becca Garst & Dr. Jim McNamara)

Day of Allocation Prediction for the Boise, Payette & Upper Snake

From Snow to Flow:

Estimating the timing of peak streamflow using SNOTEL ablation curves



Upper Snake River Day of Allocation Prediction (without April Melt)

Time for Use	Inputs	Goodness of Fit	
Early Season	Maximum SWE Values	$R^2 = .72$ Adjusted $R^2 = .66$	
After April	Maximum SWE Values April Melt Ratios	$R^2 =$ Adjusted $R^2 = .63$	
After May	- Maximum SWE Values April and May Melt Ratios	$R^2 = .86$ Adjusted $R^2 = .79$	
After June	- Maximum SWE Values April, May, and June Melt Ratios	$R^2 = .92$ Adjusted $R^2 = .84$	

Increasing Confidence

You are Here: [Home](#) / [Snow Survey](#) / [Contact Idaho Snow Survey](#)

Stay Connected



Name	Position	Phone	Email
Shawn Nield	State Soil Scientist	208-378-5728	Shawn Nield

Office Staff

Office Staff			
Name	Position	Phone	Email
Ron Abramovich	Water Supply Specialist	208-378-5741	Ron Abramovich
Vacant	Hydrologist		
Phil Morrisey	Data Collection Officer	208-685-6983	Phil Morrisey
Daniel Tappa	Hydrologist	208-378-5740	Daniel Tappa

Retiring Dec 30

Field Staff			
Name	Position	Phone	Email
John Wilford	Electronics Technician	208-685-6943w	John Wilford
Vacant	Hydrologist	208-685-6942w	
Vacant	Hydrologic Technician	208-685-6942w	

Hydrologist position closed Nov 16

- **Questions**
- **Comments**
- **Corrections**
- **Discussions**



Monitoring & Predicting Drought is Critical for Idaho and to assist Water Users in Making Best Decisions Possible

SWSI is useful & powerful tool whether you are selling boats, monitoring restaurants sales, crop revenue, or looking at Ag shortages or Surplus volumes.

There is interest to expand SWSIs, to more basins, but we can not do this alone.

If interested in partnering, let us know.

85th Annual Western Snow Conference
April 17-20, 2017 Boise, Idaho
A Joint Meeting with the Weather Modification Association



WESTERN **S**NOW **C**ONFERENCE

Western Snow Conference Web Site: www.westernsnowconference.org

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scott.pattee@wa.usda.gov

October 25, 2016

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ron.abramovich@id.usda.gov

First Call for Papers
Joint Meeting of the
Western Snow Conference
and the
Weather Modification Association

**Secretary/Treasurer/
Documents Manager**

Jon Lea

P.O. Box 485

Brush Prairie, WA 98606

Phone: (503) 414-3267

westernsnowconference@gmail.com

Members and Friends of the Western Snow Conference:

Please join us on April 17 – 20, 2017 for a joint meeting of the 85th Annual Western Snow Conference and the Weather Modification Association in Boise, Idaho. The conference venue offers the opportunity to interact with other professionals while enjoying one of the most vibrant cities in the Intermountain West.

You are invited to submit an abstract of 150 – 300 words for either oral or poster presentation by January 31, 2017. Submit abstracts by filling out the online submission form at: