

Wind River Indian Reservation and Surrounding Area Climate and Drought Summary Summer Events & Fall Outlook 2016

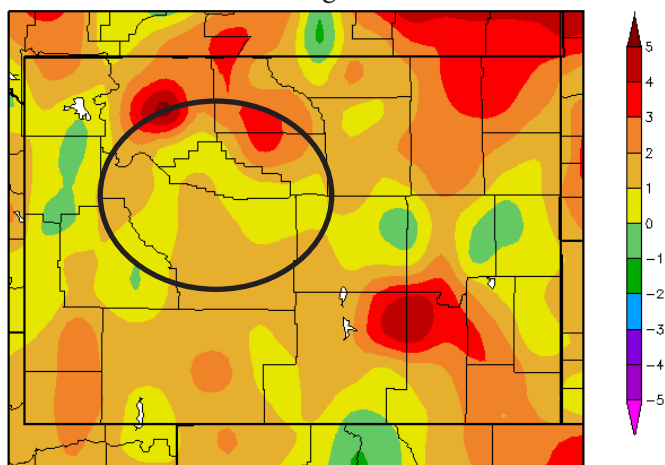


Summer Was Warm and Very Dry

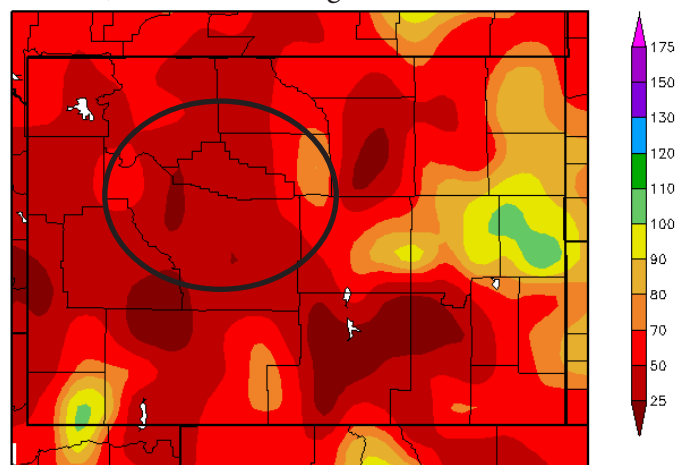
The summer was characterized by very dry conditions across the Wind River Region*. Most areas received only 50 percent of normal precipitation, at best. The following locations experienced a top 10 driest summer on record: Burris (4th driest), Riverton (6th driest), Black Mountain (8th driest), and Boysen Dam (10th driest) (see page 2 for periods of record). As for temperatures, most of the region was 1-2°F above normal for the summer. However, it was much warmer in the northern part of the region, where temperatures ranged from 4-5°F above normal. As a result, Basin and Worland had their warmest summers on record. (*Note: The Wind River Region refers to the Wind River and Upper Bighorn Basins.)

Breaking down the summer by month, June was by far the warmest with temperatures about 4-6°F above normal. It was warmest in Basin where it was an astounding 8.4°F above normal, and Basin had its warmest June on record. June was dry, especially in the northern and eastern parts of the region where precipitation was less than 25 percent of normal. Black Mountain and Thermopolis had their 3rd driest Junes on record. July's temperatures were closer to normal, ranging from about 1°F below normal to 2°F above normal. However, the dryness continued into July and was extreme with some areas receiving less than 5 percent of normal precipitation. Burris and Lander (airport station) only received a trace of precipitation the entire month and had their driest Julys on record. August was the coolest summer month with temperatures ranging from 1-3°F below normal. Precipitation across the area ranged from 50 percent of normal in the west to 150 percent of normal in the east. The dry conditions of the summer caused streamflows to suffer across the area. The northern part of the Wind River Region in the Upper Bighorn Basin was experiencing drought conditions as of the end of August, but the reservation stayed out of drought during the summer. However, if the dryness continues, the region will have to be monitored closely for developing drought conditions.

Departure from Normal Temperature (°F)
June 1, 2016 - August 31, 2016



Percent of Normal Precipitation (%)
June 1, 2016 - August 31, 2016



Maps produced by the High Plains Regional Climate Center and are available at: <http://www.hprcc.unl.edu/maps/current>

Summary of Station Data (June 2016-August 2016)

Station	Average Temp. (°F)	Dep. from Normal Temp. (°F)	Temp. Rank	Total Precip. (in.)	Dep. from Normal Precip. (in.)	Percent of Normal Precip.	Precip. Rank	Period of Record
Basin	74.7	4.5	WARMEST	0.90	-0.99	48	16th driest	1898-present
Black Mtn ¹	71.3	1.1	-	1.36	-2.11	39	8th driest	1963-present
Boysen Dam	72.6	1.5	-	1.30	-1.18	52	10th driest	1948-present
Burris	62.3*	0.6	-	0.69	-2.11	25	4th driest	1963-present
Diversion Dam	-	-	-	-	-	-	-	1920-present
Dubois	60.1*	1.5	-	1.74	-1.51	54	15th driest	1905-present
Lander 1N	-	-	-	-	-	-	-	1999-present
Riverton	69.4	1.4	3rd warmest	0.47	-2.02	19	6th driest	1907-present
Thermopolis	72.4*	0.5	-	-	-	-	-	1899-present
Worland	74.2	4.1	WARMEST	1.24	-1.09	53	17th driest	1907-present

A dash (-) indicates insufficient data for calculation. An asterisk (*) indicates some missing data for this period.

All data are preliminary and subject to change.

Data were retrieved from the Applied Climate Information System (ACIS): rcc-acis.org

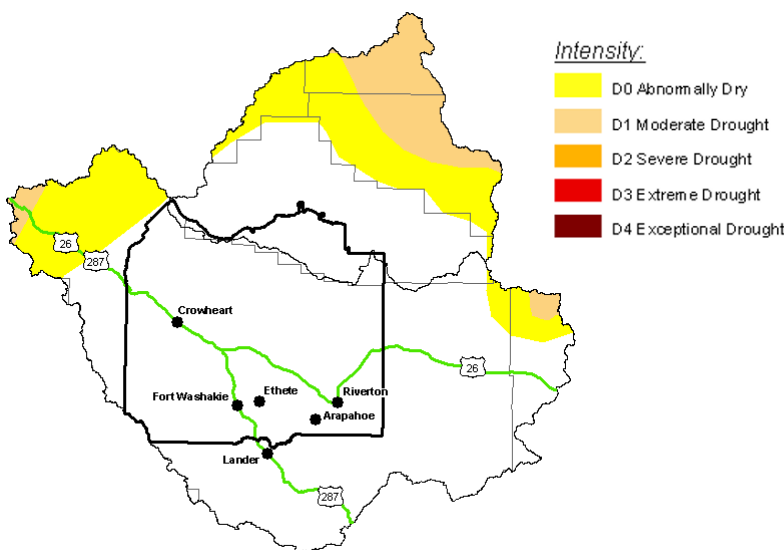
¹The Black Mtn station is east of Thermopolis and does not refer to Black Mountain in the Owl Creek Mountains (northwest part of the reservation).

Dry Conditions Caused Drought Development To The North

The U.S. Drought Monitor showed moderate drought (D1) developing in the northern part of the Wind River Region, but the reservation remained drought-free throughout the months of June, July, and August. Conditions remained mostly constant throughout these three months. The only drastic change was the reservoirs and rivers began to recede as we neared August due to the lack of precipitation across the area. Water levels started to drop off, affecting fish habitat, municipal uses, irrigation, and farming. However, light precipitation and thunderstorms have been occurring regularly, alleviating dryness in the area. Conditions will be monitored closely during the fall if the dryness continues.

U.S. Drought Monitor of the Wind River Indian Reservation and Surrounding Area - August 30, 2016

Released September 1, 2016 Valid 8 a.m. EDT



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	77.20	22.80	6.70	0.00	0.00	0.00
Last Week 08-23-2016	77.20	22.80	6.10	0.00	0.00	0.00
3 Months Ago 05-31-2016	96.91	3.09	0.42	0.00	0.00	0.00
Start of Calendar Year 12-29-2015	53.84	46.16	0.00	0.00	0.00	0.00
Start of Water Year 09-29-2015	74.90	25.10	0.00	0.00	0.00	0.00
One Year Ago 09-01-2015	99.55	0.45	0.00	0.00	0.00	0.00

(Note: Statistics are for reservation and surrounding area.)

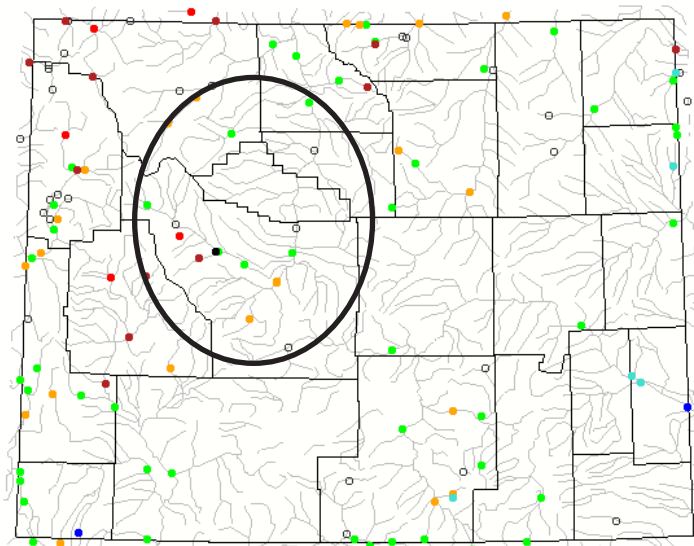
The U.S. Drought Monitor is jointly produced by the National Drought Mitigation Center at the University of Nebraska-Lincoln, the United States Department of Agriculture, and the National Oceanic and Atmospheric Administration. Map courtesy of NDMC-UNL. For more information on the U.S. Drought Monitor, go to: <http://droughtmonitor.unl.edu>

Dry Summer Causing Low Streamflow And Impacts Around The Region

Snowpack in the Wind River Basin peaked later than normal in 2016 but it melted and ran off earlier than normal. Snowpack in the basin normally peaks in April, but late-season storms caused snowpack to peak in May. However, warm temperatures in late spring and early summer caused a rapid melting of the snowpack, and the snowpack had completely melted and run off by mid-June, while this usually does not happen until toward the end of June. Additionally, the summer was very dry, so precipitation did not greatly contribute to streamflow or reservoir supplies. As a result, the majority of the streamflows across the Wind River Basin were near normal or below normal, specifically within the reservation, as of the end of August. Dinwoody Creek above the lakes near Burris and Bull Lake Creek above Bull Lake were especially low, reporting 28-day average streamflows in the 2nd and 3rd percentiles, respectively.

Due to the snowpack being completely depleted earlier than normal, along with minimal precipitation during the summer, the lakes, reservoirs, and the Wind River and its tributaries were low. During this time of year, these conditions negatively impact local farmers and instream municipal uses of the Little Wind Drainage System.

28-Day Average Streamflow Compared To Historical Streamflow For August 31 (Wyoming)



Stream Gauge	Percentile
Wind River near Dubois	26th
Wind River above Red Creek, near Dubois	21st (NR')
Dinwoody Creek above lakes, near Burris	2nd
Bull Lake Creek above Bull Lake	3rd
Bull Lake Creek near Lenore	98th
Wind River near Crowheart	28th
Wind River near Kinnear	34th
Wind River at Riverton	11th
South Fork Little Wind ab Washakie Reservoir	13th**
Little Wind River near Riverton	12th
Little Popo Agie River near Lander	12th
Fivemile Creek near Shoshoni	55th
Wind River below Boysen Reservoir	N/A
Bighorn River at Worland	40th (NR')
Bighorn River at Basin	50th

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		

'NR=Not Ranked. **Data are real-time. A percentile is a value on a scale of one hundred that indicates the percent of a distribution that is equal to or below it. The streamflow data and map shown represent 28-day average streamflow compared to historical streamflow for the day of the year (August 31). Streamflow data and map provided by the U.S. Geological Survey: <http://waterwatch.usgs.gov>

Reservoir Data as of August 31, 2016

Reservoir Name	Reservoir Elevation (feet)	Reservoir Storage (acre-feet)	Reservoir % Full	Reservoir Name	Reservoir Elevation (feet)	Reservoir Storage (acre-feet)	Reservoir % Full
Anchor	6,360.6	438.7	2.5	Pilot Butte	5,426.8	10,155.0	30.1
Boysen	4,719.1	633,484	85.4	Ray Lake	no data	no data	no data
Bull Lake	5,771.6	61,271.9	40.2	Washakie	no data	no data	no data
Dinwoody	no data	no data	no data				

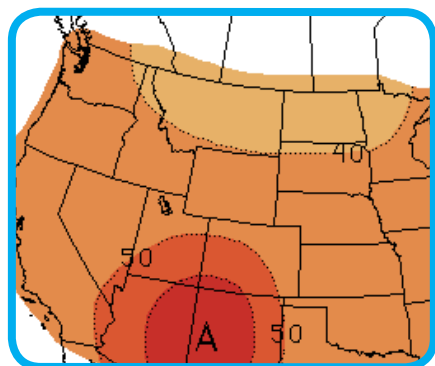
*Reservoir elevation is estimated.

Data sources: Bureau of Indian Affairs (not available online), Bureau of Reclamation (http://www.usbr.gov/gp/lakes_reservoirs/wyoming_lakes.htm)

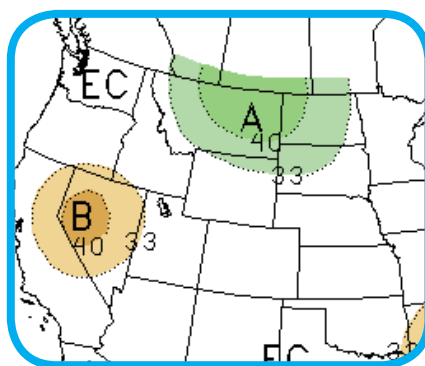
A Warm Fall Is Likely

The El Niño ended in May and ENSO-neutral conditions are present. La Niña may develop during August-October 2016, with about a 55-60% chance of La Niña being present during the fall and winter. The Climate Prediction Center is calling for an increased chance of above normal temperatures for all of Wyoming this fall, including the Wind River Region (see map below left). Equal chances for above, near, or below normal precipitation are expected for the next three months, with above normal precipitation possible to the north of the area (see map below center). Drought in northern Wyoming is expected to improve or be removed by the end of November (see map below right). The National Inter-agency Fire Center predicts wildfire potential to return to normal in the Wind River Region in September, and normal conditions are expected in October and November. CPC outlooks are available at: <http://www.cpc.ncep.noaa.gov/>

3-Month Temperature Outlook
Valid September-November 2016

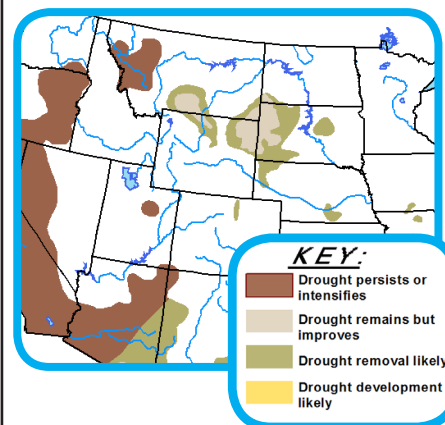


3-Month Precipitation Outlook
Valid September-November 2016



EC: Equal chances of above, near, or below normal
A: Above normal B: Below normal

U.S. Seasonal Drought Outlook
Valid August 18-November 30, 2016



Drought Outlook explanation:

The Climate Prediction Center issues a seasonal drought outlook for the U.S. that is based on probabilities for drought development, persistence and intensification, improvement, and removal at a large scale. Local-scale changes in drought conditions may not be captured by this outlook. “On-going” drought areas are based on the U.S. Drought Monitor areas (intensities of D1 to D4). The tan areas on the map 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). The white areas imply no drought present.

Three-Month Temperature and Precipitation Outlook explanation:

Each month, the Climate Prediction Center issues a new three-month outlook for temperatures and precipitation for the lower 48 states and Alaska. These outlooks indicate the probability of temperatures and precipitation being above, near, or below normal. (“Normal” is what is expected based on average temperatures and precipitation during the period of 1981-2010.) In general, the colors on the map will indicate warmer/cooler or wetter/drier conditions. In the temperature outlook, the oranges signify above normal temperatures, while the blues signify below normal temperatures. In the precipitation outlook, the greens indicate above normal precipitation, while the browns indicate below normal precipitation. You will also see probabilities on the map (e.g. 33, 40, 50, 60, 70, and 80). For a location and season, forecasters divide the 30 observations from 1981-2010 into thirds: 1/3 is the coldest or driest, 1/3 is the warmest or wettest, and 1/3 is in between. When forecasters indicate that an area will have above normal precipitation, for example, they are saying that the probability is greater than 33 percent. The outlooks are for the 3-month period as a whole and do not indicate when certain conditions would occur or the duration and intensity of any particular event. Areas of white are marked by “EC,” which means equal chances of above, near, or below normal temperatures/precipitation. EC does not mean near normal.

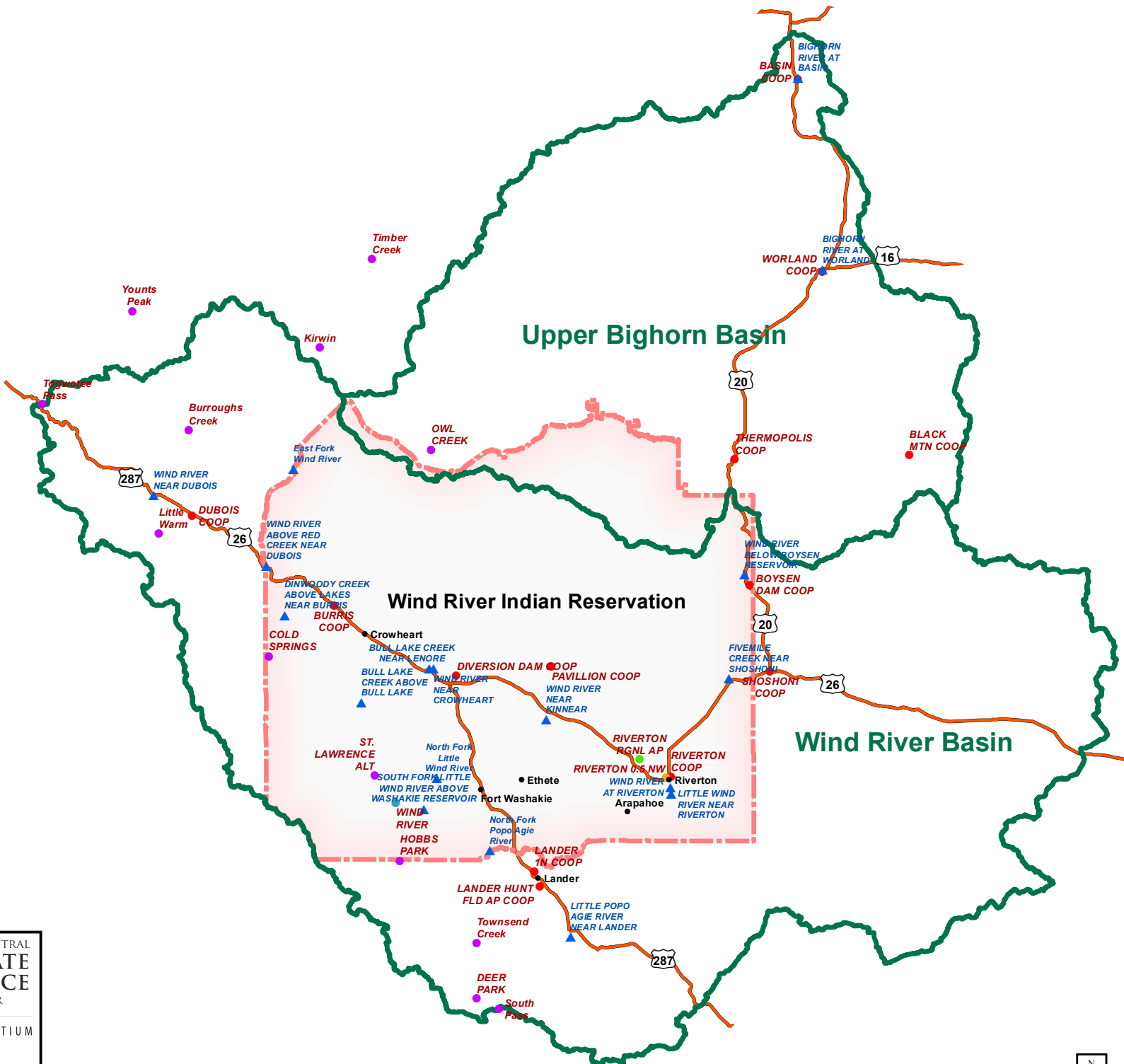
Collaborators and Partners:



Contact Information: Please direct questions and feedback on this climate summary to Al C’Bearing, Office of the Tribal Water Engineer, 307-332-6464.

Wind River Indian Reservation and Surrounding Area

Revised 6/18/2015



Legend

- WR Stream Gauges
 - ▲ RAWS
- WR Weather Stations
 - COOP
 - CoCoRaHS
 - SNOTEL
 - WBAN
- Basin Boundary

NORTH CENTRAL CLIMATE SCIENCE CENTER
UNIVERSITY CONSORTIUM

Contact Information:
Shannon McNeeley, PhD
shannon.mcneeley@colostate.edu
970-491-1852