Northern Arapaho Tribe

Wind River Indian Reservation and Surrounding Area Climate and Drought Summary

Fall Events & Winter Outlook 2016-2017

Eastern Shoshone Tribe

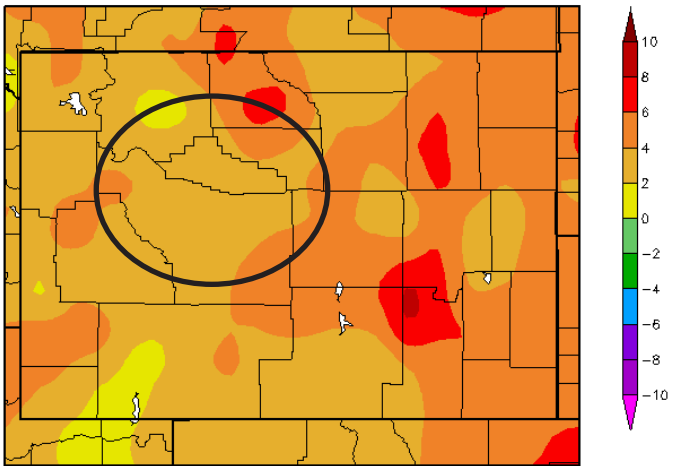
Warm And Wet Fall

The fall season was warm and very wet throughout the Wind River Region*. Average temperatures were generally 2-4°F above normal with isolated higher departures (see map below left). The Basin station was 7.8°F above normal and had its warmest fall on record, breaking the record just set last year. Perhaps the biggest story of the fall was the wet conditions. Most locations received 150-300 percent of normal precipitation (see map below right), and records were impressive. All stations with sufficient data to report a ranking had a top 10 wettest fall on record, and it was the wettest for Basin and Boysen Dam (see data table at the top of Page 2).

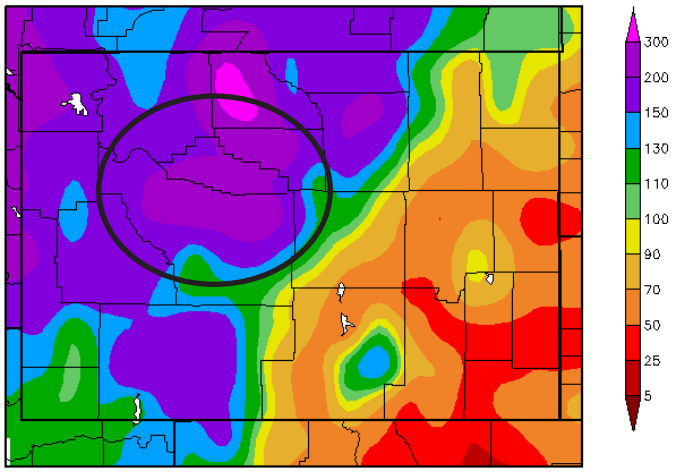
Each month of the fall was generally warmer and wetter than normal. September temperatures were closest to normal around the region, but it was very wet. Basin had its wettest September on record, while several other locations had a top 10 wettest September. October temperatures were slightly above normal, although not record-breaking, but it was again quite wet. None of the stations had a wettest October on record, but it was the 2nd wettest for Worland and 3rd wettest for Boysen Dam. The region experienced the greatest temperature departures in November, as much of the region was 4-8°F above normal. Several records for a top 5 warmest November were set: Basin and Worland (warmest), Thermopolis (2nd warmest), Boysen Dam (4th warmest), and Burris and Riverton (5th warmest). Like the other fall months, precipitation was above normal in November, but there were not as many top 10 records.

The wet fall was quite a change from the extremely dry summer, and it helped alleviate drought conditions in the northern part of the area. However, the warm temperatures late in the season caused most of the precipitation to fall as rain instead of snow, resulting in a below-normal snowpack for this time of year. (*Note: The Wind River Region refers to the Wind River and Upper Bighorn Basins.*)

Departure from Normal Temperature (°F)
September 1, 2016 - November 30, 2016



Percent of Normal Precipitation (%)
September 1, 2016 - November 30, 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 (September 2016-November 2016)

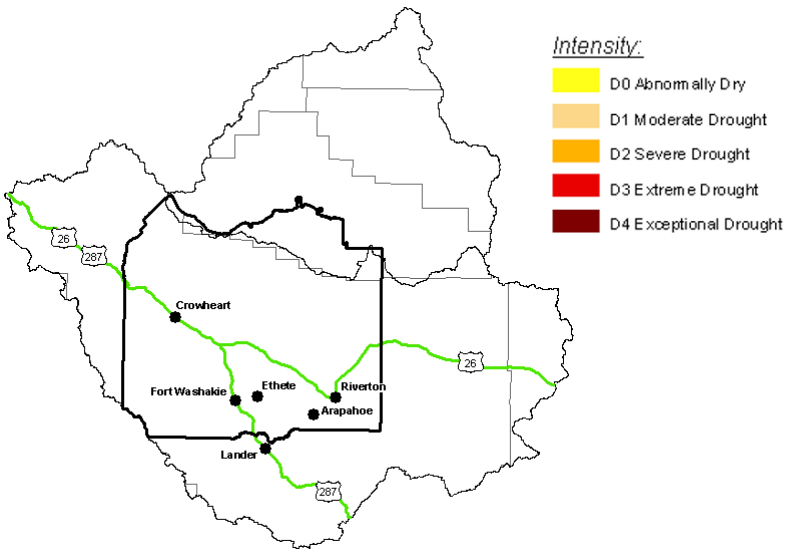
Station	Average Temp. (°F)	Dep. from Normal Temp. (°F)	Temp. Rank	Total Precip. (in.)	Dep. from Normal Precip. (in.)	Percent of Normal Precip.	Precip. Rank	Period of Record
Basin	53.4	7.8	WARMEST	5.63	3.90	325	WETTEST	1898-present
Black Mtn[1]	51.0	3.4	-	7.11	3.47	195	4th wettest	1963-present
Boysen Dam	50.6	3.8	-	5.43	3.15	238	WETTEST	1948-present
Burris	45.7	2.9	-	4.02	2.10	209	5th wettest	1963-present
Diversion Dam	-	-	-	4.03	1.88	187	9th wettest	1920-present
Dubois	44.8*	-	-	4.90	2.28	187	3rd wettest	1905-present
Lander 1N	46.3	3.6	-	3.61*	0.95	136	-	1999-present
Riverton	47.8	3.3	3rd warmest	4.05	1.96	194	10th wettest	1907-present
Thermopolis	52.2	2.6	-	6.59	3.30	200	3rd wettest	1899-present
Worland	51.7	6.2	-	5.47	3.43	268	2nd wettest	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
[1]The Black Mtn station is east of Thermopolis and does not refer to Black Mountain in the Owl Creek Mountains (northwest part of the reservation).

Summer Dryness Relieved By Wet Conditions This Fall

Above-normal precipitation during the fall months relieved drought that had crept into the Wind River Region over the summer. At the end of August, moderate drought (D1) and abnormal dryness (D0) were present along the northern tier of the region, according to the U.S. Drought Monitor. However, an extremely wet fall alleviated the dryness, and the entire area was drought-free by the end of November (see the most recent map and data below). At this time last year, the eastern half of the region was in D0. Temperatures during this fall remained above normal with most of the precipitation falling as rain rather than snow. However, during the latter half of November, the first significant snow and cold temperatures of the season arrived.

U.S. Drought Monitor of the Wind River Indian Reservation and Surrounding Area - November 29, 2016
Released December 1, 2016 Valid 7 a.m. EST



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	100.00	0.00	0.00	0.00	0.00	0.00
Last Week *11-22-2016*	100.00	0.00	0.00	0.00	0.00	0.00
3 Months Ago *08-30-2016*	77.20	22.80	6.70	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 *09-27-2016*	81.20	18.80	2.19	0.00	0.00	0.00
One Year Ago *12-01-2015*	53.84	46.16	0.00	0.00	0.00	0.00

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

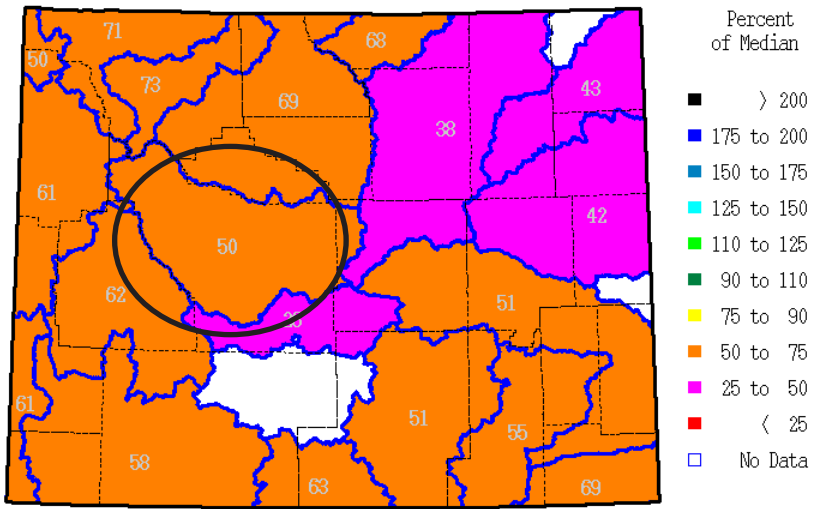
The U.S. Drought Monitor is jointly produced by the National Drought Mitigation Center at the University of Nebraska-Lincoln, the United States Department of Agriculture, and the National Oceanic and Atmospheric Administration. Map courtesy of NDMC-UNL. For more information on the U.S. Drought Monitor,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

Warm Fall Caused Mountain Snowpack To Get Off To A Slow Start

The mountain snowpack season got off to a considerably slow start compared to recent years. At the end of November, the average Snow Water Equivalent (SWE) for the Wind River Basin was a mere 50 percent of median (see SWE map of Wyoming and table of SNOTEL sites in the region below). In comparison to previous years on the same date (November 28th), SWE was 62 percent of median in 2015, 80 percent of median in 2014, and 117 percent of median in 2013. Compared to this time last year, SWE was higher for the Hobbs Park and St. Lawrence ALT SNOTEL sites but lower for the Cold Springs, Deer Park, and Owl Creek sites. The primary reason for the slow start was above-normal temperatures that caused much of the precipitation to fall as rain instead of snow. However, it is still very early and snowpack is continuing to trend higher as we get further into the season. (**Note: SWE is the amount of water contained within the snowpack. It can be thought of as the depth of water that would theoretically result if you melted the entire snowpack instantaneously. Median is a common descriptor used to express a "middle" value in a set of data. Median better represents SWE than does the "average." Source: Natural Resources Conservation Service.*)

As for surface water around the region, a thin layer of ice had formed on the lakes and reservoirs by the end of the season. Bull Lake was particularly low at 24.5 percent full compared to 46.4 percent full this time last year, but part of the reason is because construction on the dams and headgates of Bull Lake and Dinwoody Lake is about to begin.

Snow Water Equivalent (SWE) % of Median by Basin and SNOTEL Site (Wyoming) as of November 28, 2016



SNOTEL Site	SWE (% of median)
Cold Springs	57
Deer Park	26
Hobbs Park	72
Owl Creek	60
St. Lawrence ALT	40

On the map above, the percent of median value for the Wind River Basin is based on all reporting SNOTEL sites in the basin. The table above lists SWE by SNOTEL site in and around the Wind River Reservation. Reference period for average comparison is 1981-2010. Map provided by the Wyoming Water Resources Data System: http://www.wrds.uwyo.edu/wrds/nrcs/snowrept/snowrept.html. SNOTEL data provided by the Natural Resources Conservation Service: http://www.wcc.nrcs.usda.gov/snow/.

Reservoir Data as of November 30, 2016

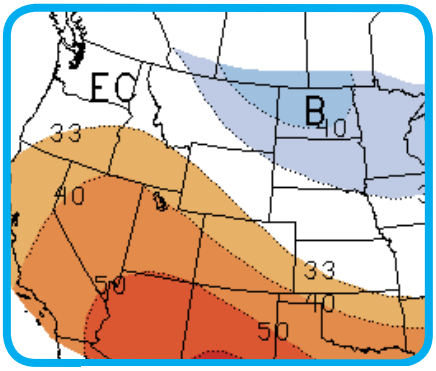
Reservoir Name	Reservoir Elevation (feet)	Reservoir Storage (acre-feet)	Reservoir % Full	Reservoir Name	Reservoir Elevation (feet)	Reservoir Storage (acre-feet)	Reservoir % Full
Anchor	6,369.0	849.2	4.9	Pilot Butte	5,455.2	29,504.0	87.5
Boysen	4,720.7	661,014	89.1	Ray Lake	5,522.27	no data	no data
Bull Lake	5,760.3	37,368.3	24.5	Washakie	6,348.08	no data	no data
Dinwoody	no data	no data	no data				

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

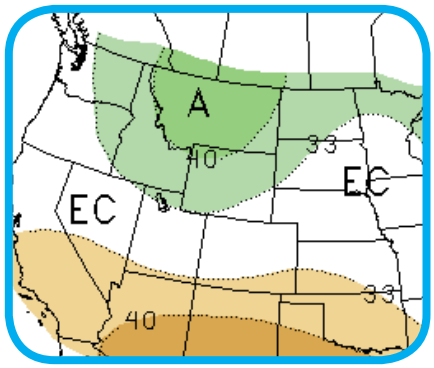
Wet Conditions And Near-Normal Temperatures Expected For Winter

La Niña is present in the Pacific. A transition to ENSO-neutral conditions is favored during January-March 2017. The Climate Prediction Center is calling for equal chances of above-, below-, or near-normal temperatures for central Wyoming this winter, which includes the Wind River Region (see map below left). However, above-normal temperatures are expected just to the south of the region. Above-normal precipitation is expected for the next three months (see map below center). Drought is not expected to develop through February in the region (see map below right). The National Weather Service long-range flood outlook calls for less than a 50 percent chance of flooding through February for the upper reaches of the Wind River. The National Interagency Fire Center predicts wildfire potential to be normal for the Wind River Region through March. CPC outlooks are available at: http://www.cpc.ncep.noaa.gov/

3-Month Temperature Outlook
Valid December 2016-February 2017



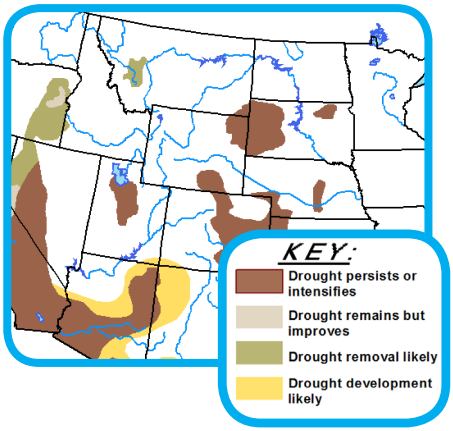
3-Month Precipitation Outlook
Valid December 2016-February 2017



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

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.

U.S. Seasonal Drought Outlook
Valid Nov. 17, 2016-Feb. 28, 2017



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. "Ongoing" 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.

Collaborators and Partners:

HPRCC

North Central Climate Science Center University Consortium

NIDIS

National Drought Mitigation Center

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

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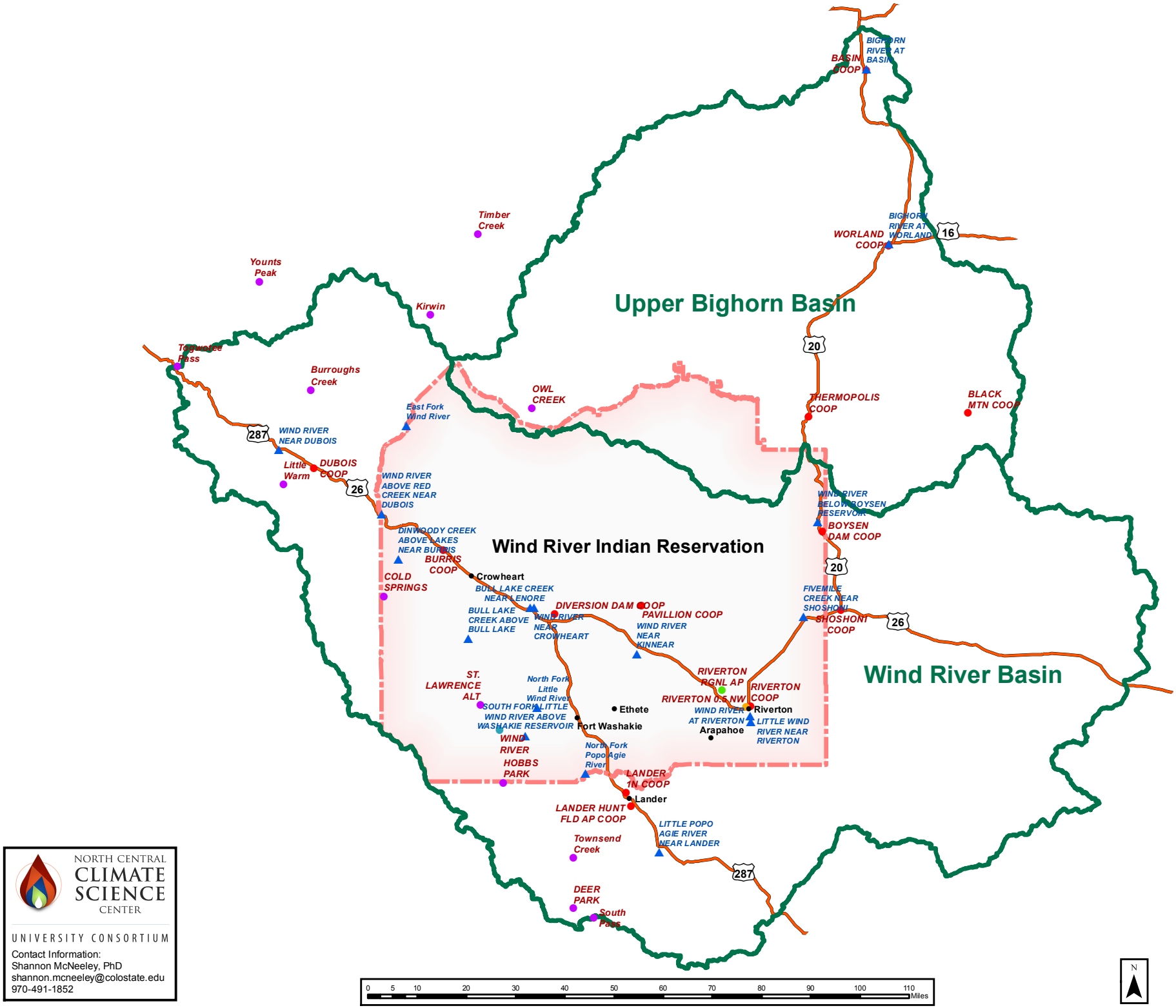

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