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Building Adaptive Capacity in Tribal Communities of the Missouri River Basin to Manage Drought and Climate Extremes: A Case Study from the Wind River Indian Reservation

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Cover Page Footnote

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Introduction and Background

The Missouri River Basin, located primarily within the Northern and Central Plains, is home to an array of landscapes and peoples, all of which are challenged by the inherent climatological variability of the region. Located in the interior of the continent, far from the moderating effects of the oceans, the Basin experiences extremes in both temperature and precipitation. A distinguishing feature of the region is its east to west precipitation gradient, with areas of the southeast receiving up to 40 inches of precipitation annually and areas of the west receiving less than 10 inches annually. Although the region is frequented by snowstorms in the winter months, the majority of this precipitation falls during the growing season, from about April through September. Historic trends indicate that, overall, the region is warming, with the largest increases in temperature in northern and western areas (Vose et al., 2017). Precipitation patterns have also changed, with eastern areas exhibiting wetter conditions over time, especially during the spring and fall (Easterling et al., 2017).

These changes in the climate have been observed by and are already impacting Native American communities. These impacts are quite complex, as their livelihoods and economies, in addition to their physical, mental, and indigenous values-based health, are all at risk (Jantarasami et al., 2018). For tribes in the Missouri River Basin, climate extremes, such as the back-to-back flooding and drought years of 2011 – 2012 (Fuchs et al., 2015; U.S. Department of Commerce, 2012), have sparked interest in increasing climate monitoring and promoting drought management on tribal lands (NIDIS, 2007). Although climate data are available throughout the Missouri River Basin, a lack of available data to monitor changing climatic conditions specifically on tribal lands impacts tribal decision-makers' abilities to manage their natural and cultural resources (NIDIS, 2008, 2010). Furthermore, varying resources among tribal nations and

unique climate conditions across tribal lands make it important for tribes to be able to access their own climate data and information for on-reservation decision-making in formats that are tailored to their needs. With these challenges in mind, tribes and federal partners have determined that a coordinated effort across political boundaries could strengthen relationships and foster the development of drought-related activities in the region (NIDIS, 2008).

One way in which this is accomplished in the Missouri River Basin is through the National Integrated Drought Information System (NIDIS) Missouri River Basin Drought Early Warning System (DEWS). NIDIS, housed within NOAA, leverages existing partnerships to support the creation of a national drought early warning information system, starting first at the regional level (NIDIS, 2020). NIDIS outlined two projects in the Missouri River Basin DEWS Strategic Plan that involved working with tribes to improve early warning of and resilience to drought (NIDIS, 2016). In particular, two areas where NIDIS has focused their efforts in the Basin are as follows:

Fostering collaborations between tribes, academic partners, and the federal government. Tribal environmental professionals and the scientific community recognize the need to establish partnerships to strengthen collaborations on climate and drought projects, as well as expand funding opportunities to work on such projects.

Building capacity through climate and drought education training and workshops. Tribal environmental professionals have identified a desire for additional education and training on basic climate processes; conveying uncertainty of climate variability and change projections; communicating and translating information on climate, drought, and water resources; identifying gaps in climate, drought, and water monitoring; building capacity for climate and drought planning efforts; and climate change adaptation.

In partnership with NIDIS, several agencies and organizations have been engaging with tribes throughout the Missouri River Basin. Through participation in tribally-focused meetings and other opportunities to interface with tribes, these long-term, incremental interactions have led to several ongoing projects between tribal communities and their partners. For instance, the High Plains Regional Climate Center (HPRCC), housed at the University of Nebraska-Lincoln, has partnered with tribes, focusing on building capacity with tribal communities to make management decisions based on climate information. Here, we offer a case study involving two co-located tribal communities in the Missouri River Basin that were seeking assistance in improving drought preparedness on tribal lands. This case study demonstrates the importance of frequent communication between tribal and scientific communities, as well as putting together a diverse and inclusive project team, to ensure that these capacity-building projects are successful, provide the greatest benefit to the tribe, and help reinforce tribal sovereignty.

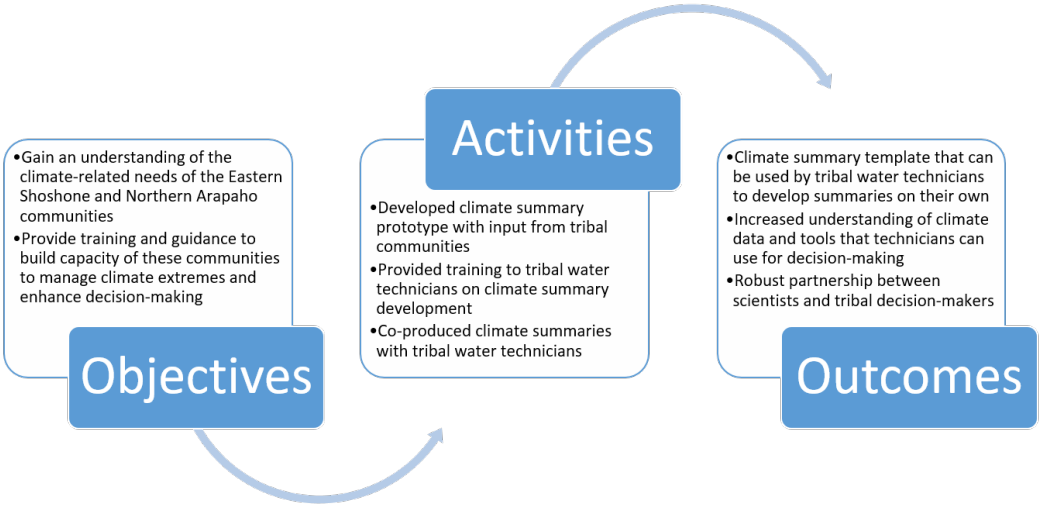
Building Capacity to Manage Climate Extremes on the Wind River Indian Reservation

In 2014, the Eastern Shoshone and Northern Arapaho tribes of the Wind River Indian Reservation (WRIR) in Wyoming partnered on a project with the HPRCC, NIDIS, the National Drought Mitigation Center (NDMC) at the University of Nebraska-Lincoln, and the U.S. Department of the Interior North Central Climate Adaptation Science Center (NCCASC) (formerly known as the North Central Climate Science Center) to conduct a drought vulnerability assessment on the reservation and further explore how to use climate information to enhance decision-making. The HPRCC's primary task for the project was to provide a quarterly climate and drought summary that assesses the local conditions and impacts in and around the reservation (Figure 1). Throughout the duration of the project, HPRCC staff engaged directly with staff from the Office of the Tribal Water Engineer (TWE) at WRIR via in-person

workshops, both on the reservation and at the University of Nebraska-Lincoln, as well as follow-up interactions through phone calls and email exchanges. Each of these modes of engagement was critical in determining their climate needs and understanding the tribes' water management timelines, such as when decisions have to be made regarding how much water will be allocated for irrigation.

Figure 1

HPRCC's Objectives, Activities, and Outcomes of the Wind River Project

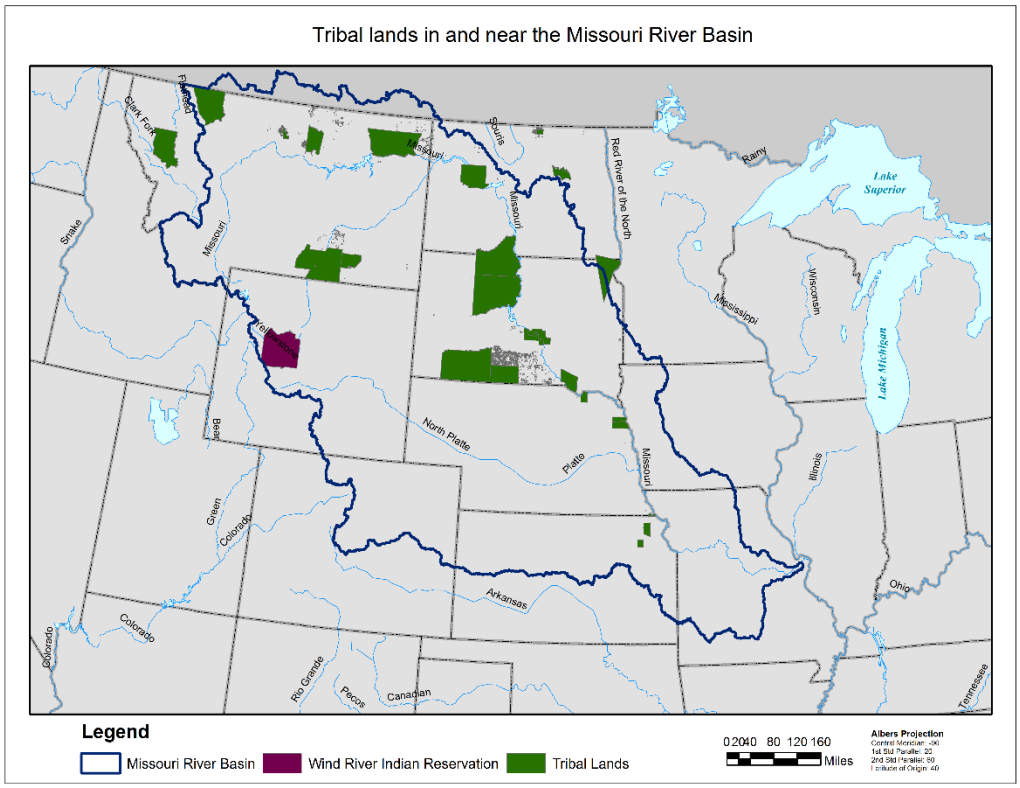


The WRIR is located just east of the Wind River Range in west-central Wyoming (Figure 2). Due to the region's semi-arid climate, the tribes almost entirely depend upon mountain snowpack for their water supply. The complex terrain and highly variable climate of the reservation and surrounding area produce climate extremes that present challenges for natural resource management. In particular, several droughts have impacted the reservation since the

early 2000s, causing major water shortages across the reservation. This issue prompted the Office of the TWE to begin exploring partnerships with the scientific community on how to reduce drought risk and increase drought preparedness on the reservation.

Figure 2

Tribal Lands in and near the Missouri River Basin



Beginning in 2014, staff from the Office of the TWE, HPRCC, NDMC, and NCCASC met to discuss the climate and water-related issues that have impacted WRIR as well as the capacity of the Centers to help address these issues. A primary outcome of this meeting was a request by the Office of the TWE for the development of a climate and drought summary to be periodically produced for the reservation and surrounding area, using examples of drought summaries produced by the Hopi Tribe (Sahmea et al., 2014) and the Navajo Nation (NNDWR,

2015). With extensive experience writing monthly and quarterly climate summaries, HPRCC staff agreed to take the lead on this endeavor.

Over the next few months, HPRCC staff produced several drafts of the climate and drought summary with input from the WRIR tribal communities and project partners. Through face-to-face interactions, as well as follow-up interactions through phone calls and email exchanges, several aspects of the summary were discussed and refined, including the regional scope, frequency of production, intended audience, format, and general content. Data and information incorporated into the summaries included temperature, precipitation, snowpack, streamflow, reservoir levels, drought updates, local impacts, and climate outlooks. After incorporating feedback, HPRCC staff began producing the summary for use by decision-makers and continued to refine the summary based on local input (Figure 3). For instance, local input included drawing the readers' attention to the reservation area on the maps shown by drawing a circle around it, as well as clarifying place names. And, input from dam operators and utilities regarding changing reservoir levels was incorporated into the summaries. The Office of the TWE expressed that the summaries have become a valuable tool in performing water management duties that are outlined by the Wind River Water Code. The summaries have been utilized by the Office of the TWE to communicate climate outlooks to irrigators in and around the reservation, as well as validate decisions to declare potential drought or water shortages within the reservation.

After the production of several climate and drought summaries by HPRCC staff, the Office of the TWE requested a training session to learn how to put the summaries together so that they could take over production. Subsequently, HPRCC and NDMC staff led a climate and drought summary training workshop for three technicians from the Office of the TWE. The

technicians learned how to put each section of the summary together, which included hands-on training on how to obtain and interpret the data used in the summary, as well as how to write about the data. Summary sections included an overview of climate conditions from the previous season, an update on drought conditions, seasonally-appropriate water supply information, and climate outlooks for the next season. Staff from both Centers demonstrated climate and drought tools from which the data in the summary originated, and they provided feedback on the narratives that the technicians produced to accompany the data. After the training workshop, HPRCC staff began transitioning the production of the summary to the Office of the TWE. Gradually, the Office of the TWE contributed more content to the summary while HPRCC staff contributed less. Contributions from the Office of the TWE were invaluable because of their local knowledge of the area, which allowed them to describe on-the-ground observations and impacts from recent weather and climate events.

Lessons Learned

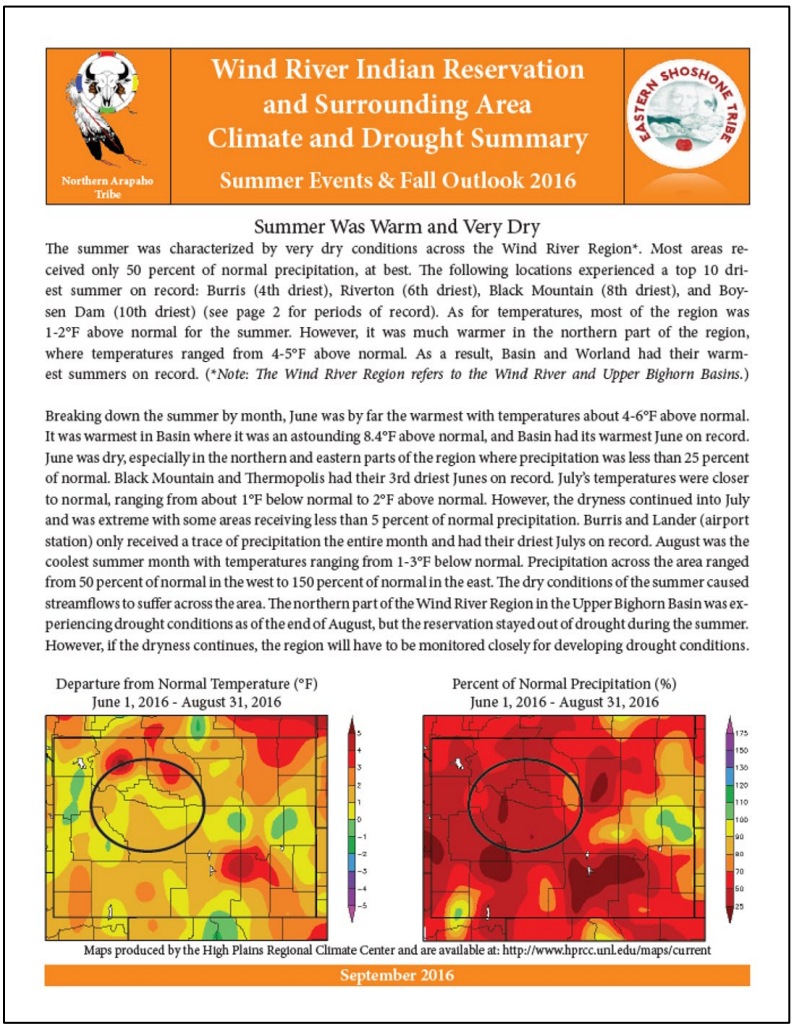
Ultimately, this project provided valuable insight on ways for tribal and scientific communities to engage with each other with the goal of building tribes' capacity to utilize climate information for decision-making. We found the following:

Frequent, face-to-face interactions between tribal and scientific communities builds relationships and trust between these two groups. The relationship between HPRCC staff and the tribes of WRIR has flourished over time due to frequent interactions throughout the course of this project. HPRCC staff visits to WRIR were highly beneficial, as they provided the opportunity for interaction between staff and the general tribal population rather than just professionals. Furthermore, by visiting the reservation, HPRCC staff learned more about the culture and day-to-day life of the tribes of WRIR, which helped determine how to best serve the

tribes' climate data and information needs. TWE staff also visited Lincoln, Nebraska, where HPRCC is located, on several occasions for meetings and trainings. This allowed for further personal interactions between TWE and HPRCC staff.

Figure 3

Example of First Page of a Finalized Wind River Indian Reservation and Surrounding Area Climate and Drought Summary



Note. The circled areas indicate the location of the reservation.

Climate capacity-building projects that include tribal members, as well as a diverse team of physical and social scientists, provide the greatest benefit to tribes. Climate data and information are not always conveyed in formats that are understandable by and usable to the general public, including tribal communities. The WRIR drought preparedness project consisted of physical and social scientists collaborating among themselves and with tribal community members to ensure that climate science was communicated accurately and effectively to the tribes. Additionally, including tribal members on the project team enhanced communication between the tribes and the scientific community, incorporated input from the tribes throughout every stage of the project, and ensured that tribally-sensitive issues were considered.

Climate capacity-building projects, like the one described here, can reinforce tribal sovereignty. Through its partnership with the HPRCC, NDMC, NIDIS, and NCCASC, the tribes of WRIR will be able to utilize the climate-related data to implement and support the Wind River Water Code (hereafter referred to as the Water Code) that was adopted by the Eastern Shoshone General Council and the Northern Arapaho General Council in March 1991. Through their participation in the drought vulnerability assessment on the reservation and the drought planning process they are currently undergoing, the tribes of WRIR are now in the position to use this information and knowledge to implement the water management processes outlined in the Water Code, based on scientific data. The water management process ensures that each of the "Beneficial Uses of Water" are protected in water-short years (Figure 4). The implementation and enforcement of the Water Code demonstrates the tribes' ability to assert its sovereignty over water management on the WRIR.

Figure 4

Excerpt from the Wind River Water Code, March 1991

Section 11-8-I(E) BENEFICIAL USES OF WATER

(1) The uses to which water on the Reservation may beneficially be applied include but are not limited to:
- (a) Domestic Use
- (b) Municipal Use
- (c) Agricultural Use
- (d) Stock Water Use
- (e) Industrial Use
- (f) Instream Flow Use, including instream flow for fisheries, wildlife, and pollution control, aesthetic and cultural purposes
- (g) Mineral Resource Development
- (h) Water Storage, Marketing and Transfer
- (i) Ground Water recharge and supply enhancement
- (j) Recreational Use
- (k) Cultural Use
- (l) Religious Use
- (m) Hydropower Generation
- (n) Pollution Control
- (o) Resource Development

No presumption of preference of use shall be given to the order in which beneficial uses are listed above.

Recent Activities and Next Steps

To aid in climate monitoring and climate summary production, HPRCC staff developed an online decision dashboard for the Office of the TWE at Wind River (https://hprcc.unl.edu/windriver.php). The dashboard serves as a "one-stop shop" for climate information, tailored to specific tribal lands, making tools and information easier to access. TWE staff gather information from the dashboard to provide an overview of climate conditions at the Water Board meetings. Also, with funding from the Bureau of Indian Affairs, a new project has begun in which the Wind River tribes are partnering with the HPRCC, NDMC, Colorado State

University, and the Wyoming Established Program to Stimulate Competitive Research (EPSCoR) to write a drought plan for the reservation. As part of this plan, TWE staff are identifying specific triggers, such as when mountain snowpack reaches a particular threshold, to help determine when drought declarations are made. Furthermore, HPRCC and TWE staff are working together to refine the dashboard so that it can be a more useful tool for drought monitoring in and around the reservation.

These activities helped to serve as a framework for other tribal communities in the Missouri River Basin region. Recently, four tribes in the Dakotas who are members of the Great Plains Tribal Water Alliance (GPTWA) collaborated on a project that was similar to the WRIR climate summary project in that it focused on capacity building through training workshops that introduced the participants to climate data and climate summary development. The online decision dashboard created for Wind River was popular among the GPTWA member tribes, leading to the development of a dashboard for the Rosebud Sioux Tribe (https://hprcc.unl.edu/rosebud.php). Similar capacity-building efforts have occurred among environmental professionals from four tribes in northeastern Kansas/southeastern Nebraska. Through a tribally-led effort, these professionals produced an inaugural climate summary focused on their tribal lands in March 2018 and have been producing them quarterly ever since. Here is their most recent summary: https://hprcc.unl.edu/pdf/Winter19ClimateSummary.pdf.

To further this work, HPRCC staff have planned to assess the effectiveness of the Center's training workshops and climate summary co-production process to determine potential modifications that should be made to improve these activities. The Center intends on expanding this work both within and beyond the Missouri River Basin based on the results of the evaluation

and is eager to partner with tribal communities that would like to use climate information for decision-making.

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