Building Drought Resilience in the Missouri River Headwaters in Montana

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EXECUTIVE SUMMARY

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Water has always been a scarce commodity in the western United States, and climate change may increase the frequency and duration of drought, impacted the timing of snowmelt runoff and changed water availability. Compounded with increased demands, Montana is facing serious water challenges, particularly in the historically dry and actively growing southwest corner of the state. We believe that successful drought planning must be locally-led to ensure that communities are invested in the approach, that the plan reflects the water management issues specific to that watershed and produces on-the-ground results. The National Drought Resilience Partnership (NDRP), along with the MT Department of Natural Resources and Conservation (DNRC) is working to leverage federal, state and local resources to strengthen local knowledge, awareness and capacity to develop local watershed drought plans and enhance community drought preparedness. In the recent Presidential memorandum, *Building National Capabilities for Long-term drought Resilience*, that institutionalizes the NDRP, President Obama emphasizes:

> *"Our Nation must sustain and expand efforts to reduce the vulnerability of communities to the impacts of drought…In responding to and recovering from past droughts, we have learned that focused collaboration across all levels of government and the private sector is critical to enable productive and workable solutions to build regional resilience to drought".*

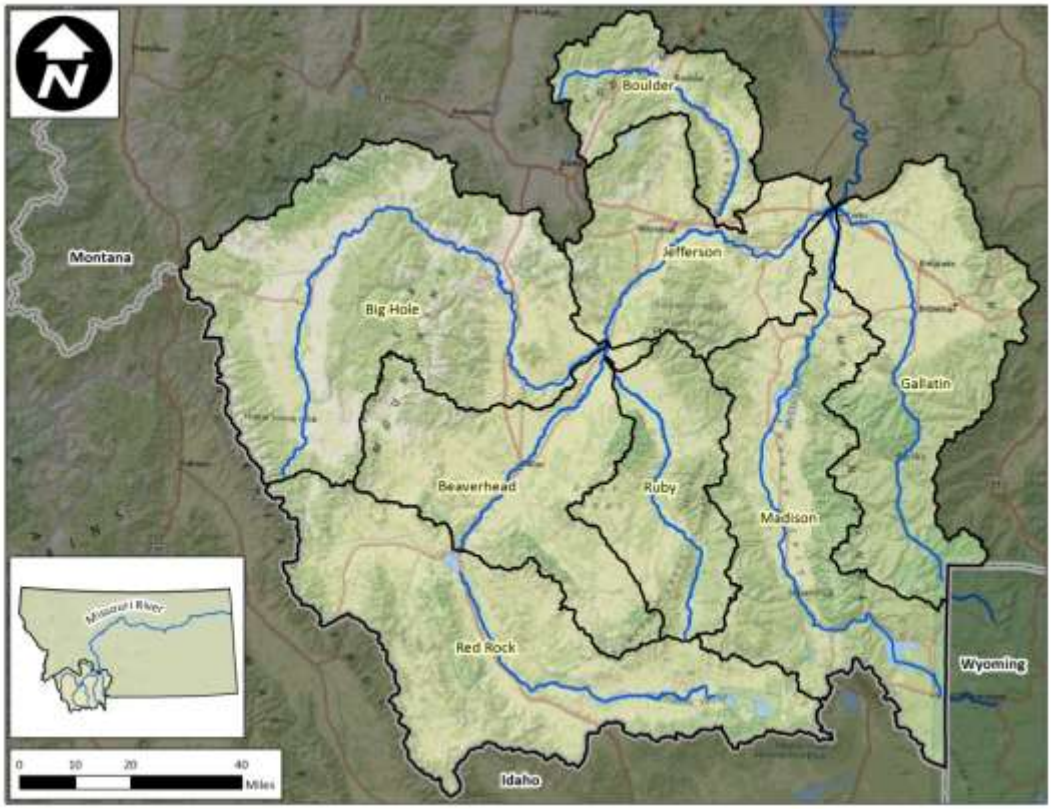
This proposal seeks to develop nine watershed drought resilience plans for each of the eight tributary (8-digit code, Beaverhead, Big Hole, Boulder, Jefferson, Lower Gallatin, Madison, Red Rock, Ruby, and Upper Gallatin) watersheds in the Missouri Headwaters Basin. The core elements and data of the individual watershed plans will then be incorporated into a regional Missouri Headwaters Basin Drought Resilience plan that considers downstream effects and evaluates impacts at the regional scale. The drought resilience plan for the Missouri Headwaters will provide a model for integrating drought preparedness across local watersheds to a regional scale, and better prepare communities for current and future droughts that are exacerbated by changing climate and land use in the West.

***Building Drought Resilience Planning Timeline*:**
August 2016-June 2018

***Reclamation Projects included in the Upper Missouri Basin*:**

Reclamation projects in the Basin include the following multi-purpose Pick-Sloan Missouri Basin Program (P-SMBP) Units: (1) *East Bench Unit* - Clark Canyon Dam and Reservoir (257,000 acre-feet capacity) on the Beaverhead River serves 56,000 irrigated acres; (2) *Crow Creek Pump Unit* – Crow Creek Pumping Plant near Toston on the Missouri River mainstem serves 23,400 irrigated acres; (3) *Canyon Ferry Unit* – Canyon Ferry Dam and Reservoir (2 million acre-feet capacity) and Powerplant (50 MW) on the Missouri River mainstem serves multi-purposes. While the project focuses on the tributary watersheds contributing to the headwaters of the Missouri, the downstream hydropower rights at Canyon Ferry are an important management factor.

Figure 1: Missouri River Headwaters Basin, Southwest Montana



BACKGROUND

BASIN AND WATERSHED CHARACTERISTICS:

Adjacent to Yellowstone National Park, this historically agricultural, but rapidly growing, 14,700 square mile Missouri Headwaters Basin in SW Montana is a mosaic of forested public and private agricultural lands. The Basin, which includes the area upstream of the confluence of the Madison, Gallatin and Jefferson Rivers and their tributaries at Three Forks, provides 4 million acre feet of water annually to sustain the Missouri River system. The area represents diverse conditions where one or more federal agencies, state and local partnerships are already working with community based organizations involved with watershed planning. The area is characteristically very dry and prone to frequent drought

and is experiencing rapid population growth, shifting demographics, and land and water use changes.

Most flow in the headwaters originates in the mountain ranges that rise to as high as 11,000 feet and receive substantial amounts of rain and snow. Valley bottoms, range in elevation from 4,000 to 6,000 feet and are typically much drier. Streamflow patterns in the headwaters area are snowmelt dominated, typically peaking during late May or early to mid-June, which coincides with peak mountain snowmelt and spring rains. Average annual precipitation ranges from about 10 inches in the drier valleys to about 80 inches at the highest elevations, with the average being about 19 inches for the Basin. Snow accumulation and snow water equivalents are tracked in near real time through the Natural Resources Conservation Service's SNOTEL monitoring network.

Water uses in the Basin include hydropower, industrial, mining, municipal, domestic, recreation and tourism, but almost 98 percent of water diverted in Montana is for agriculture, estimated to total almost 12 million acre-feet annually. About 11.5 million acre feet of that, or 98 percent, is diverted from surface water, and the small remainder from groundwater. There are an estimated 2 million acres of irrigated land in Montana, with 1.2 million in the Missouri Basin above Fort Peck Reservoir, or about half of the total farmed area in the basin. Irrigated lands in the Upper Missouri approximate 1 million acres, or 58 percent of the total upper basin agricultural land. Historically, most of the irrigation rights in Montana were used for flood irrigation to produce mostly grass and alfalfa hay. Now, over half the acres continue to be flood irrigated, but others have been converted to sprinklers, notably center pivot systems, especially for the potato crops. Recent warmer springs have resulted in water being turned on earlier, when base river flows may not be able to satisfy all of the irrigation needs.

Between 1990 and 2010, the Upper Missouri was the second fastest growing major basin in Montana with the population in the Gallatin watershed (84,847)[1] having increased by 79 percent between 1990 and 2010. The Madison and Jefferson sub-basins experienced significant population growth, increasing by 49 percent and 41 percent, respectively, during the period. The Missouri Basin Study that DNRC and BOR is developing will provide a more complete understanding of the current and projected water needs in the Basin.

SUB BASIN WATERSHEDS:

Gallatin River-The Gallatin River originates in Yellowstone National Park, and is further supplemented by streams from the Madison, Gallatin, and Bridger mountain ranges. The main stem is unregulated, although Middle Creek Dam on Hyalite Creeks captures and stores about 10,200 acre-feet of water. During the peak flow months, the East Gallatin River adds water to the stream, which increases the flow at Gallatin Gateway. During mid-to-late summer, diversions and depletions for about 110,000 acres of irrigation reduce streamflow.

[1] Population estimates from the 1990, 2000, and 2010 censuses for cities and towns.

Madison River-The Madison River also originates in Yellowstone National Park, with important flow contributions from tributary streams in the Madison, Gravelly, and Tobacco Root mountain ranges. The Madison is regulated by Hebgen Reservoir just downstream of Yellowstone Park, with a capacity of about 386,000 acre-feet, and Ennis Lake with 27,200 acre-feet of storage. The Madison Valley is characterized by alluvial terraces with a limited amount of river-bottom land that was historically easier to irrigate. For this reason, there is not as much irrigation development (about 37,000 acres) relative to other headwater tributaries, and irrigation depletions relative to the total flow are less.

Ruby River-The Ruby River originates in the Snowcrest, Gravelly, and Greenhorn mountain ranges, with flow contributed to the lower Ruby River from tributaries in the Ruby and Tobacco Root mountains. About 36,000 acres of land are irrigated in the Ruby River watershed. Ruby Reservoir, a state-owned project, stores 36,600 acre-feet, has a major effect on the distribution of flow downstream, and is representative of the operations of other mid-sized reservoirs in the basin.

Beaverhead-Red Rock Rivers-The Red Rock River originates in the Centennial Valley in the southwestern corner of Montana. Lima Dam and Reservoir regulate the flow of the river, where it leaves the Centennial Valley. The Red Rock then merges with several tributary streams in the vicinity of Clark Canyon Reservoir. Below Clark Canyon Dam, it is referred to as the Beaverhead River. There is substantial irrigation and storage development in the Beaverhead-Red Rocks drainage, which has had a considerable effect on streamflow. Approximately 135,000 acres are irrigated overall, and the two major reservoirs can store a combined volume of 338,400 acre-feet: Lima Reservoir on the Red Rock River stores 85,000 acre-feet, and Clark Canyon Reservoir stores 253,400 acre-feet.

Big Hole River-The Big Hole River originates in the Beaverhead, Pioneer, and Pintler mountain ranges. The river passes through an upper and lower valley. The upper valley, which includes the communities of Jackson and Wisdom, is relatively high with typical elevations from 6,000 to 6,500 feet. The river then passes through a more confined canyon before flowing into a lower valley centered near the town of Melrose. About 170,000 acres are irrigated from the Big Hole River, and most of this is flood irrigated hay or pasture.

Jefferson and Boulder Rivers-The Jefferson River is formed by the confluences of the Ruby, Beaverhead, and Big Hole Rivers near the town of Twin Bridges, Montana. The Boulder River and Willow Creek are major tributaries to the Jefferson River. Other tributaries that originate in the Tobacco Root and Highwood Mountains also add flow to the Jefferson. About 52,000 acres are irrigated from the Jefferson River and smaller tributaries, with another 12,000 acres irrigated from the Boulder River. Flows are also regulated on the Willow Creek tributary by Willow Creek Reservoir, with a capacity of 17,700 acre-feet.

Table 1: Tributary flow contributions to the Missouri Headwaters

Watershed	Drainage Area (square miles)	Approximate Median Annual Volume of Water Produced (acre-feet)
Gallatin River	1,800	946,000
Madison River	2,510	1,310,000

Ruby River	965	216,000
Beaverhead-Red Rock Rivers	3,620	592,000
Big Hole River	2,500	817,000
Jefferson River*	2,445*	120,000*
Missouri Headwater Total (to Toston)	**14,700**	**4,000,000**

*For the Jefferson River, the drainage areas and flow volumes listed are only for that portion contributed from the confluence of the Beaverhead and Jefferson Rivers near Twin Bridges.

National drought resilience partnership demonstration project

As part of President Obama's Climate Action Plan, the National Drought Resilience Partnership (NDRP) was launched in November 2013. One objective of this national initiative was to select an area that experiences frequent drought to demonstrate how the federal partners could go "all-in" to support proactive drought resilience efforts. The Missouri Headwaters Basin (Basin) in southwest Montana was selected by the NDR Partners as the pilot area. The goal of the NDRP's MT Demonstration Project is to focus federal and state resources such as drought mitigation tools and technical and financial resources to the local decision makers to demonstrate successful collaborative planning to build community resilience. The MT DRP demonstration project provides the framework for catalyzing partnerships across agencies to enhance existing efforts, build local capacity, connect and support critical water use sectors, and coordinate/integrate resources to effectively build long term resilience. As the only pilot project in the nation, the State of Montana is demonstrating our ability to work collaboratively with multiple partnerships, stakeholders, and jurisdictions to wisely manage our resources in the individual watersheds and across a larger basin region. Working together assures efficient water use and drought mitigation measures to prepare the people and the landscape for a drier future.

There are several actively engaged soil and water conservation districts, watershed and water user groups as well as non-governmental organizations (NGOs) in the Basin. These groups represent a broad range of stakeholders, are embedded in their communities, have local knowledge and respect and are engaging key water users in their watersheds. These local coordinators provide a hub for convening stakeholders for collaborative planning efforts and develop consensus driven conservation goals. Although the area is divided into 8 geographic watersheds, we have divided the Gallatin River drainage into upper and lower sections as they are distinctly different areas with unique drought planning challenges. A few of the watersheds have drought response plans, but their plans need to be updated or include additional areas, while others do not yet have a plan. Thus, the NDRP MT Partners identified the need to build community based watershed drought plans. We believe that providing a common framework for each of the plans will provide us the foundation for building a cumulative drought resilience plan for the entire headwaters basin. To initiate the planning process and engage the community based drought coordinators, the Training Committee has developed an online webinar course, *Building Drought Resilient Communities* (See Appendix). The online training course is based on a blend of the NDMC *Drought Ready Communities Course* as well as the six required elements of the Bureau of

Reclamation *Drought Contingency Planning criteria*. This course is being led by experts from the National Integrated Drought Information System and the National Drought Mitigation Center with assistance from the other Training Committee members, (MT Climate Office, MT EPA and DNRC). The webinars are intended to provide the common core elements and basis for each of the in-depth plans that the drought coordinators will develop for their watersheds, as well as the outline for the Missouri Headwaters Basin Plan. The 6 series online webinar course, which began in February and will conclude in May, is a combination of lesson and constructive discussion among the trainers and small group of participating coordinators. The concept of the online course is to deliver the technical tools and resources to provide an outline for the coordinators to guide the further development of their individual plans. The community-based drought coordinators are creating the individual watershed drought resilience outlines that will be completed by June 2016. The coordinators will then work with their community leaders to fully develop comprehensive plans and lay out their strategies for responding and mitigating the impacts of drought.

Providing a common framework to the individual plans will set the stage for a Missouri Headwaters Basin plan to build resilience across the broader landscape, demonstrating collective planning over a much larger area. MT DNRC will coordinate the efforts and work with BOR, state and federal agency partners, regional water users and conservation organizations, and the individual watershed drought coordinators to roll up the information developed in the watershed plans into a Basin-wide plan that will guide response and mitigation strategies for water use in the headwaters region. In this way, we are building from the ground up, but creating a drought contingency planning model that can demonstrate the power of engaged local community planning as the basis for landscape level impacts.

TECHNICAL PROJECT DESCRIPTION

This (**Task A**) project proposal seeks to support the development of Drought Resilience plans for each of the eight individual watersheds in the Missouri Headwaters Basin, as well as a comprehensive plan for the entire Basin area. MT DNRC proposes to leverage the technical knowledge and assistance of the MT DRP Training Committee partners to work with the community-based drought coordinators to develop robust drought contingency plans for each of the watersheds. The Training Committee developed an online *Drought Resilient Communities Course* (Appendix B) and has launched the first few series of webinars to the identified drought coordinators in each of the geographic watersheds.

Montana NDRP Drought Resilient Communities Plans

As described above, the Drought Resilient Communities Course webinars will conclude in May, with the expectation that each drought coordinator will produce a drought planning outline for their watershed. Following the online course we expect the coordinators to work with the key stakeholders and fully develop a comprehensive Drought Resilience Plan. Unfortunately since most of the coordinators are staff of small, underfunded Conservation Districts or non-profit organizations, they do not have the financial capacity to dedicate the time to coordinate the planning efforts. This proposal would provide the foundational support for the coordinators to dedicate their time to complete their

community drought planning activities. The funding from this proposal would be distributed through DNRC directly to the nine local organizations that are already engaged and participating in the *Drought Resilient Communities* course to continue their important work. Each comprehensive watershed drought plan will include all of the following elements as required by a Bureau of Reclamation Drought Contingency plan.

SURVEY EXISTING DROUGHT INFORMATION AND TOOLS:

Through the online course, we have already introduced the existing tools and resources that the coordinators will use to further evaluate and assess the current conditions and help inform the plan development. As part of the planning process the local drought coordinators will build from their drought planning outline developed through the online course and expand the outline to include a more thorough review of the history of drought in the region, the resulting impacts, and the responses. We believe that in order for the plans to really build resilience, they need to be well connected to all of the other community planning efforts. These additional plans to consider may include; Pre-disaster Mitigation Plans, Water Quality Restoration Plans, City and County Growth Plans, as well as Federal land use plans and watershed assessments that the U.S. Forest Service (USFS) and Bureau of Land Management (BLM) might have. They will also review and summarize other water and land use planning documents to determine the nexus between water/land use planning and drought. As mentioned above, the basic framework for the plans is already established, but the plans will be individualized by each of the coordinators to meet the specific needs of their communities. The Training Committee experts will be available to further assist the coordinators as they are actively building and refining their plans during this process.

DROUGHT MONITORING:

It is critical to drought planning in Montana to have a clear understanding and analysis of climate, snowpack, precipitation, streamflows, water demands and community needs. There are many state and national resources and websites that provide critical information for monitoring the status of drought conditions. The data needs may be specific to the individual watersheds, but will most likely include: streamflow, snowpack, precipitation, soil moisture, temperature, reservoir stages and vegetation health. The MT DRP project is also coordinating a Drought Monitoring Committee with representatives from all of the agencies that participate in collecting and monitoring water availability, drought, climate, and soil moisture conditions. The Monitoring Committee is developing methods for compiling, integrating and disseminating the information to improve the accessibility and delivery of the information to the community coordinators, planners and water users. The drought coordinators rely on drought indicators and indices to assess current conditions, forecast near term issues, and develop specific triggers to implement drought response actions. There is an abundance of information available for drought planning, and each coordinator may develop his or her plan-specific suite of data to aid in monitoring, but gathering and assessing the information takes dedicated time to review. With funds provided through this proposal, financial support will be provided to each watershed drought coordinator to better identify drought impacts, establish triggers and synthesize the relevant drought indicator data. There are many flavors of drought and each plan will

integrate critical data (indicators, indices and triggers) into their resilience plans that addresses both short term response and long term mitigation actions across all affected water use sectors.

VULNERABILITY ASSESSMENT:

Each watershed within the Missouri Headwaters Basin has a range of critical resources and values that are important to local communities during times of drought. These critical resource values likely include economic livelihoods (e.g., ranching, farming, tourism, etc.) and human health and safety, but also those related to traditional use and enjoyment of the region's fish, wildlife, forests, and other natural resources. As part of this project, we will provide technical assistance and support the work of the local coordinators to engage communities to identify the critical water resources and risks that are the highest priority to address within their drought resilience plan. This information will help focus the drought vulnerability assessment. To assess the vulnerability of the critical resources of concern to residents, it is important to synthesize known and expected impacts of drought from a variety of resources, including: local knowledge among community members from past experiences with drought; documented drought impacts from state and federal agencies; the National Drought Mitigation Center's Drought Impact Reporter (http://droughtreporter.unl.edu); and peer-reviewed and grey literature publications from the region. The vulnerability assessment will consider the effects of drought on surface water availability and agricultural crop production (e.g., hay), as well as the effects on forest health, wildfire, wildlife and the function of natural systems that currently provide valuable services to local communities in the Basin (e.g., water purification and water storage in shallow aquifers). Aggregating this information at the Basin scale will support the planning efforts of the Montana Governor's Drought and Waters Supply Committee and will ensure the needs of downstream users are considered. This facilitates efforts to build drought resilience in areas outside of the basin that will be supported by proactive drought planning occurring upstream in the individual watersheds.

Additionally, it is essential to consider how droughts of the future – those driven not only by natural variability but exacerbated by increased warming due to climate change—may shape and affect the Basin. While the Basin is projected to experience slight increases (roughly +10%) in annual precipitation, increased evaporative losses due to warmer air temperatures and changes in the frequency of precipitation events is projected to increase the number of consecutive dry days experienced each year by roughly 10%. To characterize how climate change might affect drought frequency and severity in the Basin, and related changes in water availability, we will examine results from the forthcoming BOR climate risk assessment for the Upper Missouri River; information from the 2014 U.S. National Climate Assessment; and consult with experts at BOR, NIDIS, NOAA, and the Department of Interior's North Central Climate Science Center. Information gathered on drought impacts will be shared with local communities in the Basin, to help them develop robust vulnerability and risk assessments to inform their drought resilience plans. Our assessment of vulnerabilities and risks will follow the guidance laid out in the Bureau of Reclamation's Drought Response ramework, and draw upon recent guidance on climate change vulnerability assessments. Assessments of vulnerabilities will explicitly include

consideration of the exposure, sensitivity and adaptive capacity of critical resources in the Basin and assessments of risks will consider both the magnitude of effects and level of importance of drought impacts on critical resources.

MITIGATION ACTIONS:

Having assessed the drought risks and vulnerabilities of greatest concern to residents in the basin, the drought coordinators will work with community members to develop mitigation and response strategies for preparing for and coping with the effects of drought. This will include actions that can be taken ahead of the onset of a large drought that can proactively reduce the negative effects of drought, or increase the ability of human and natural systems to bounce back after the drought (i.e., "mitigation actions"). Drawing upon guidance on planning for the effects of climate change, they will ensure that drought mitigation and response actions are designed to be effective under plausible drought conditions of the future. Proactively identifying and implementing mitigation actions strengthens community and resilience through reducing the frequency and impacts of reduced water supply and availability.

There are many actions already underway in the Basin that will serve to increase the resilience of local communities and natural ecosystems from the effects of drought. These actions were identified in the MT DRP workplan as key implementation activities that will support building drought resilience. These include efforts to increase the efficiency of water use for agriculture and ranching operations (e.g., improvements to irrigation efficiency, seeding pastures with more drought tolerant grass species); reverse the degradation of stream channels and riparian vegetation (e.g., fencing cattle out of riparian areas, providing off-steam water resources for cattle, restoring sedimentation process that build up incised stream beds); and boost the natural recharge of shallow aquifers (e.g., restoring stream meanders, raising stream bed elevations, reducing stream velocities, allowing water to spread across natural floodplains, restoring wetlands). Some of these actions are being implemented directly in response to drought concerns, but many have been designed to address other ecological and economic concerns (e.g., to prevent the endangered species listing of the Arctic graying). Regardless of the motivation for their implementation, there has been an increasing focus on how these efforts can be more closely coordinated and integrated across the Basin. A working group of state and federal agencies, NGOs and University researchers has recently formed to look more closely at strategies for restoring naturally-functioning streams and ecosystems in ways that increase the recharge of shallow aquifers. By convening constituents both within and across watersheds in the Basin, we also expect to see an exchange of ideas that stimulate creative brainstorming about new and innovative strategies for drought preparedness that are not currently being implemented. We will seed these brainstorming sessions with examples of drought mitigation and response actions that are being implemented in other states and river basins, which we will extract from a database of drought plans made available from the National Drought Mitigation Center. The MT NDR partners are also actively seeking funds to support the implementation of potential mitigation projects as they are identified.

RESPONSE ACTIONS:

In addition to developing mitigation actions that can be taken in advance of a drought, it is critical that the drought resilience plans include actions that can be taken during a drought to buffer critical resources from the immediate impacts. Fortunately, the Basin is home to an excellent model of a voluntary drought management plan in the Big Hole River watershed, which lays out a detailed plan of action for reducing irrigation withdrawals when particular stream flow and temperature triggers have been reached. Additional drought response plans in Montana (e.g., on the Blackfoot River to the north of the Basin) provide further examples of measures users can take to reduce their water use during times of drought, to help buffer any individual or smaller group from shouldering the full effects of the drought. These local models of shared sacrifice offer valuable examples for response actions.

As with the mitigation actions, the Basin drought resilience plan will provide an opportunity for communities to come together to discuss current efforts to manage the effects of drought while they are underway, communicate lessons learned from existing shared sacrifice plans, and tailor actions to meet the collective needs across watersheds within the Basin. In addition to learning from examples of drought responses being implemented in Montana, we will also collate examples from other states and basins in the US to see if there are new ideas that might be appropriate for adoption in the Basin plan. We will also look closely at whether and how drought response actions might need to be adjusted to be effective under increasingly frequent and severe droughts exacerbated by climate change. This might involve adjusting triggers for drought response actions, and the amount of shared sacrifice that is needed to balance water deficiencies.

OPERATIONAL AND ADMINISTRATIVE FRAMEWORK:

The MT NDRP Demonstration project provides the overarching framework, with direct connections to national and regional priorities and resources. These partners and resources are also connected to state agencies, academia and regional/national NGOs working on climate research and conservation and are critical to the development and implementation of drought resilience plans. Many partners are actively engaged in providing guidance, training, delivering tools and coordinating the efforts, but ultimately the individual watershed plans must be locally led by community based leaders. The nine watershed drought coordinators act as the liaisons between federal/state efforts and the communities they represent, connecting the human and technical resources. National partners can provide assistance, but the local coordinators will convene their invested community stakeholders, develop the plans, and be responsible for implementation and updates of the nine individual plans. Through the local planning process key representatives for the different water use sectors will be directly engaged in the planning process.

Development of the Missouri Headwaters Drought Resilience Plan will be led by the MT DNRC, with assistance from the other key federal and state agency partners, as well as local representatives. The large scale plan will be cooperatively developed based on the nine individual plans but with an eye on meeting the needs of the many impacted water users both up and downstream of the basin. Lessons learned from developing the plan and the model will be used to develop replicable models for MT DNRC drought planning across the

other basins in Montana. DNRC recently updated the MT State Water Plan, which is a cumulative plan of the four large Basin plans (Upper Missouri, Lower Missouri, Yellowstone and Clark Fork Basins). The Missouri Headwaters Drought Resilience Plan will link directly into the Upper Missouri plan and will aid in the implementation of the previously identified drought sections of that plan.

PLAN UPDATE PROCESS:

It is vital that after expending great effort to develop the nine individual plans, and the Missouri Headwaters plans, that they are living, adaptable working documents that provide relevant guidance for both response and mitigation actions. Given the level of commitment from all of the partners, this planning process is only the beginning. As water demands increase and a changing climate creates uncertainty we will need to constantly review, modify and update the individual plans and the Basin plan as we learn from experience. MT DNRC Water Management Bureau has planning staff and hydrologists dedicated to working with local communities to build resilience and ensure that planning is always in process. The funding from this proposal will guarantee that the local drought coordinators have the funds to support their critical roles in maintaining the momentum that the MT NDRP project has garnered, and that the plans remain current and appropriate.

EVALUATION CRITERIA:

DROUGHT IN THE BASIN/NEED

EXISTING AND POTENTIAL DROUGHT CONDITIONS

The Missouri Headwaters Basin relies primarily on snowpack, with only a small amount arriving as rain. With changing climate, snowpack that is melting earlier in the spring, and a shift to precipitation coming in the form of rain, the region needs to rethink how water is managed in the basin. Compared to many areas of the country this semi-arid basin is extremely susceptible to even minor changes in the timing and availability of the limited water supply. Drought in the Upper Missouri River Basin is unique. The Missouri Headwaters is the source of the Missouri River, where tiny ribbons of tributary streams make their way across the semi-arid Montana landscape to eventually form the "Mighty Mo." Along their way, these tributary rivers and streams traverse a wide open landscape that consists mostly of gravelly loam soils with slopes ranging from roughly 45% to 4%. The water carried by these rivers and streams is used for wildlife and fisheries, cattle grazing, wheat, alfalfa, storage, hydropower, recreation and some municipal uses. Every drop available is claimed under the Montana prior appropriation doctrine and the Basin is now legislatively closed to any new appropriations of water. As a result, the area and its wildlife, people and economy is especially hard hit by cyclical drought or what some regions may consider a minimal change in precipitation creating near drought conditions.

The US Drought Monitor for Montana, as a result of Decadal Climate Variation (DCV) for the Missouri Headwaters, does not always register this Basin as a drought prone area. For

example, the US Drought Monitor for April 5, 2016 does not show the Missouri Headwaters Basin in danger of drought (Figure 1 in Appendix). However, only a year ago the area was listed as abnormally dry for this time of year and ten years ago the area was in a severe drought (See Figures 2 & 3). As a result of this decadal fluctuation and the deleterious effects on all water users, an early warning system is needed to manage drought long-term. Furthermore, demonstrating the importance of proactively planning for drought may provide a model for other communities to emulate. Early warning systems across the Midwest and Great Plains have become a focus of the National Integrated Drought Information System. The focus of this effort is to improve "quarterly and extreme summaries" as well as partnerships with the U.S. Department of Agriculture, DOI Climate Science Center & Landscape Conservation Cooperatives, and the U.S. Army Corps of Engineers to better respond to improving soil moisture and snow monitoring.

In addition to the decadal variations in the Missouri Headwaters, within each given water year (typically April – November), when water flows are supplied by high-mountain snowpack, the amount of surface water available can fluctuate greatly. When this uncertainty in supply is coupled with the legal demands on the corpus of available water, the result is not only conflict among water users, but further reduced amount of flows in general. Tracking the surface water available led to the creation of a Surface Water Supply Index (SWSI) that accounts for snowpack, mountain precipitation, streamflow, reservoir storage, and soil moisture conditions. The SWSI is used by irrigators, fisheries specialists, recreationalists, and others to evaluate current and seasonal surface water supplies. The SWSI for Montana for March of 2016 paints a slightly different picture than the US Drought Monitor maps and provides an indication of why the Missouri Headwaters is an area in need of early-onset drought monitoring in order to effect planning decisions that can provide the necessary insulation from negative impacts to water users (See Figure 4). Furthermore, these maps provide an indication of the yearly seasonal drought-like signals that occur in the later part of the water year (August – October) when water supplies are their most diminished (Figure 5).

In understanding the type of drought faced by water users in the Missouri Headwaters Basin, soil moisture is also important to appreciate. Soil moisture provides insight not only on drought, but also agricultural productivity and resilience to drought. The Montana State Library stores Montana Water Supply and Moisture status maps by county that offer an almanac view of soil moisture depletion on a monthly basis in a given year. In 2015, for example, in the later part of the season the Missouri Headwaters Basin was identified as moderately dry and listed for a drought alert (Figure 6).

Given recent trends in climate for the area, the frequency, severity and duration of drought are predicted to increase (Appendix). Montana is influenced by the El Nino-Southern Oscillation (ENSO), a climate pattern created by anomalies in sea surface temperatures in the Pacific Ocean that create warming (El Nino) and cooling (La Nina) phases. The Montana Climate Assessment (MCA) predicts that, "Montana temperatures will continue to increase through the 21st century."

RISKS TO WATER SUPPLIES TO BE ADDRESSED IN DROUGHT CONTINGENCY PLANNING

As a result of the unique decadal and persistent yearly seasonal drought concerns for the Missouri Headwaters, particularly in the face of climate change, Drought Contingency Planning is critical to address a variety of risks associated with water supplies; from public health concerns regarding increased wildfire, to environmental concerns regarding threatened species, and from potential economic losses to the potential for growing conflict over shared water resources.

Public Health and Wildfire

Wildfire risk is amplified by increased temperatures and decreased precipitation. In June of 2015, Montana was ranked as much above average in temperature based on the historical record (1895-2015), with precipitation below average. Western Montana, and particularly the Missouri Headwaters were characterized by abnormally dry to moderate drought conditions, leading to the hot and dry environment in which wildfires flourish. The total 44,906 wildfires that burned in Montana in 2015 led the State's governor to declare a state of fire emergency. Air quality ratings were posted and the State issued warnings about wildfire smoke and limiting exposure. In order to meet public health standards and keep air quality ratings at acceptable levels, drought management planning is critically needed.

Environment and Threatened Species

In addition to migrating Trumpeter Swans, grizzly bears, wolves and the Greater Sage-grouse, the Missouri Headwaters also is home to several local salmonid populations, such as cutthroat trout and Arctic Grayling, a species of concern. Cold water fisheries are left particularly vulnerable to increased water temperatures as well as increased water scarcity. Fish species in the intermountain west are most at risk in the Missouri River Basin, where the distribution of west-slope cutthroat trout has already contracted significantly and 85 percent of the remaining populations do not meet persistence criteria. Furthermore, as stated by Climate change stressors commonly are synergistic with existing ecosystem stressors. That is, the existing integrity of stream channels, riparian habitats, and floodplains may moderate or exacerbate negative effects of climate.

The last remaining population of fluvial Arctic Grayling in the lower 48 states is found in the Big Hole watershed. They were identified as a species of concern and a candidate species for an endangered listing. The Big Hole Watershed Committee and the Arctic grayling recovery team (MT FWP, DNRC, USFWS, and NRCS) worked to build relationships with the local communities and landowners, ranchers, irrigators and recreationalists, to implement several initiatives to create strong drought management policies at the grassroots level to meet needs and maintain targeted minimum flows. In the summer of 2014, US Fish and Wildlife Service announced that due to these efforts, the grayling did not warrant a listing. Recently MT FWP has expanded habitat protection and reintroduction efforts in the Red Rock, Ruby and Madison watersheds to increase the populations and improve landscape connectivity for the Grayling. However, continued drought conditions create new challenges in voluntary water reduction. Drought planning in the Missouri

Headwaters will prevent conflict over shared use of water to enhance habitat and environmental quality, and will develop the long-term view of resource husbandry needed to maintain fish and wildlife populations.

Potential Economic Losses

The Missouri Headwaters serves as the life source for the entire Missouri River System, along its length from Montana to St. Louis, MO. where it forms the Mississippi. In addition, the Missouri Headwaters supplies local drinking water, irrigation and industrial needs, hydroelectricity, recreation, and fish and wildlife habitat. Almost 90% of the entire Missouri River system is dependent on precipitation, making the area in total highly vulnerable to climate variability and change. Decreased water flow impacts water storage facilities by reducing hydropower production, increasing demand for irrigation water and limiting the amount of water available for recreation, including the utility of recreation infrastructure, such as boat ramps and docks. Urban water impacts may include water restrictions, adding water treatment plants, modifying intakes for lower water levels, increased effluent monitoring and modification, and installation of temporary wells. Municipalities may experience difficulty meeting National Pollutant Discharge Elimination System (NPDES) permit requirements because of reduced stream flows. In addition, while precipitation is less, storms are more severe, which may overwhelm storm sewers and water treatment facilities. Agricultural impacts include drought-induced reductions in crop and grass production and related increased selloff of livestock and hay. If severe, drought may lead to an increase in farm consolidations that could be prevented by early response style drought planning as opposed to ad hoc disaster relief programs. Water shortages will also lead to the curtailment for junior water right holders all together and force them to seek other sources of water or cease operation. Uncertainty about water availability causes direct economic uncertainty that can be mitigated through early drought management.

Conflict over Shared Water Use

Population increase and water right adjudication is forcing the issue of conflicts over water to come to the forefront for individuals and communities alike. With growing pressure on the already over-appropriated Missouri Headwaters basin, whether they are wildlife, habitat, human, or economic in nature, conflict is sure to remain an aspect of drought management planning. "Many competing interests wish to participate in governance of the West's valuable water resources. Sorting out these diverse demands through enforcement of legal rights alone results in winners and losers, often costing a good deal of money and leaving many unsatisfied. Increasingly, westerners are discovering new means of dialogue and cooperation, often outside the strict boundaries of legal regimes, resulting in more creative and mutually satisfying outcomes that make better use of limited water resources and resolve problems creatively."[2] Using drought contingency planning as a means to initiate collaborative processes will likely reduce the potential for water-related crisis and conflict.

STATUS OF DROUGHT CONTINGENCY PLANNING

[2] "Water in the U.S. West: 150 Years of Adaptive Strategies," Policy Report for the 6th World Water Forum (March 2012) 28.

As stated above, several of the local organizations have some type of drought response plan or are trying to initiate water planning within their watersheds. These groups or areas include: The upper Big Hole River (not the lower), the Jefferson River, the Beaverhead (as part of their agreement with management of Clark Canyon), portions of the Ruby and the City of Bozeman. This effort would build on the MT Drought Resilient Communities course and connect the plans into the Missouri Headwaters Drought Resilience Plan. This comprehensive project will dovetail with several of the recommendations in the recently updated Montana State Water Plan, specifically "Support and Expand Existing Drought Preparedness and Planning Efforts". This will also build upon the data generated during the BOR/DNRC Impact Assessment and will provide a framework for continuing to engage partners on a variety of levels involved in water management and proactive drought planning.

Diversity of Stakeholders

A variety of federal, state and local partners are actively engaged in the Montana NDRP Demonstration project and will continue to participate in the drought resilience planning supported through this funding request (See Appendix B, Workplan).

Federal NDRP partners include: USDA, Department of Commerce/NOAA, DOI/BLM, USFS; FWS, BOR, BIA, EPA, DOE, FEMA, NRCS, ACOE, Great Northern Landscape Conservation Cooperative; and others.

State partners include: DNRC, Department of Environmental Quality; Fish Wildlife and Parks; Montana Association of Conservation Districts; Big Sky Watershed Corps; Montana Watershed Coordination Council; and others.

Statewide or regional Non-governmental organizations (NGOs) include: Center for Large Landscape Conservation; Wildlife Conservation Society; One Montana, Future West, Wilburforce Foundation and The Nature Conservancy.

Local partners within the watersheds include: Missouri Headwaters Partnership; **Beaverhead Watershed Committee**; Beaverhead Conservation District; High Divide Collaborative; Beaverhead County Commissioners; State Representatives; Ruby Valley Conservation District; **Ruby Valley Watershed Council**; Ruby Habitat Foundation, Gravelly Landscape Collaborative, Ruby Water Users Association; **Broadwater Conservation District**; Jack Creek Preserve Foundation; **Big Hole Watershed Committee**; **Jefferson River Watershed Council**; Trout Unlimited; Jefferson County Commissioners, Lower Jefferson Watershed Council; **Madison Valley Conservation District**; Madison River Foundation; Madison Valley Ranchlands Group; Wildlife Conservation Society Community Partners Program; **Gallatin River Task Force**; **Greater Gallatin Watershed Council;** City of Bozeman; Gallatin local WQ District; Gallatin Conservation District; and the Gallatin Valley Land Trust. (**Bolded groups** are leading their watershed planning process)

The local, or community based groups pride themselves on bringing diverse viewpoints to the table. Southwest Montana has a very traditional agricultural ranching base, a burgeoning fly fishing industry and many new people moving into the area for the recreational and scenic amenities. The community based groups work hard to be inclusive and believe that long term solutions require broad involvement, local engagement and are committed to being involved in drought planning. The organizations in bold above have dedicated time and resources for a drought coordinator in their watershed. See the budget narrative for details on financial obligations from project partners to date.

Project Implementation

The MT NDR partners have been working together since November 2014 to develop the framework that outlines objectives and strategies to build a coordinated plan for drought resilience in the Basin. The recently developed MT NDRP workplan (Appendix A: *A Workplan for Drought Resilience in the Missouri Headwaters Basin, A National Demonstration Project)* focuses on three overarching goals and their associated objectives.

Figure 2

A Workplan for Drought Resilience in the Missouri Headwaters Basin

1. Provide Tools for Drought Monitoring, Assessing and Forecasting

2. **Develop Local and Regional Capacity to Plan for Drought**
   - **Build and Engage local capacity for drought planning**
   - **Increase Local Community Awareness** of Drought & Supply Planning, Forecasting & Mitigation
   - **Provide the Tools and Technical Assistance** to help local groups strategize and develop drought plans
   - **Connect local drought plans** at the regional scale
     Develop a regional network to create a streamlined structure to share learning, coordinate and pursue funding opportunities and deliver resources across the Basin

3. Implement Local Projects to Build Regional Drought Resilience.

The MT DNRC proposes to focus this request to accomplish the objectives under Goal 2 (above) by leveraging State and Federal resources to build local capacity for targeted drought planning. This proposal seeks funding to provide direct financial support for the local drought coordinators to build on the initial work with the MT NDRP Training Committee to further develop, refine and implement their individual watershed drought plans. In addition to building the individual watershed drought resilience plans, we will compile and incorporate the plans into a Missouri Headwaters Basin Drought Resilience plan to guide regional drought and water planning. Our hope is that this model project will demonstrate how to build locally and connect regionally to create comprehensive plans for a much larger and significant headwaters landscape. And then use the demonstration

project model to transfer and apply to other watersheds in Montana and perhaps the regions.

Nexus to the Bureau of Reclamation

Reclamation is currently conducting a Missouri Headwaters Impact Assessment to determine projected changes in water supply and demand associated with climate change. This information will provide the basis for the Missouri Basin Study, which is a partnership project with MT DNRC and BOR. The Impact Assessment and Basin Study are being carried out under Reclamation's WaterSMART Program pursuant to the authority and mandates of the Secure Water Act (SWA), Subtitle F (P.L. 111-11). Under the SWA, Reclamation can partner with entities in the 17 Western U.S. to: (I) evaluate projections of water supply and demand within a basin, including an assessment of the risks associated with climate change. During the Impact Assessment, Reclamation will take the lead in assessing projected changes in water supply and demand associated with climate change and in analyzing how the existing water and power infrastructure will perform under future conditions. The lead will then shift to DNRC during the Basin Study, which will incorporate evaluations of the effects of future growth and develop options for supplying adequate water in the future.

Reclamation and Montana DNRC have a long history of partnering and working together. Reclamation has been a very strong supporter of the Big Sky Watershed Corps members currently placed with the Ruby Valley, Broadwater and Beaverhead Conservation Districts working to build drought capacity for their organizations as part of the MT NDRP Demonstration project. Managing water supplies, demands and flood control in the basin requires continual communication and coordination among the agencies with water delivery authority or regulation.

LETTERS OF PROJECT SUPPORT (ATTACHED IN APPENDIX)

Big Hole Watershed Committee
Center for Large Landscape Conservation
Great Northern Landscape Conservation Cooperative
Gallatin River Task Force
Jefferson River Watershed Council
National Drought Mitigation Center
National Integrated Drought Information System/NOAA Affiliate
Ruby Valley Conservation District/ Ruby Watershed Council
Wildlife Conservation Society

OFFICIAL RESOLUTION

See Appendix A

APPENDICES

DROUGHT MAPS:

Figure 1: US Drought Monitor, Montana: April 5, 2016

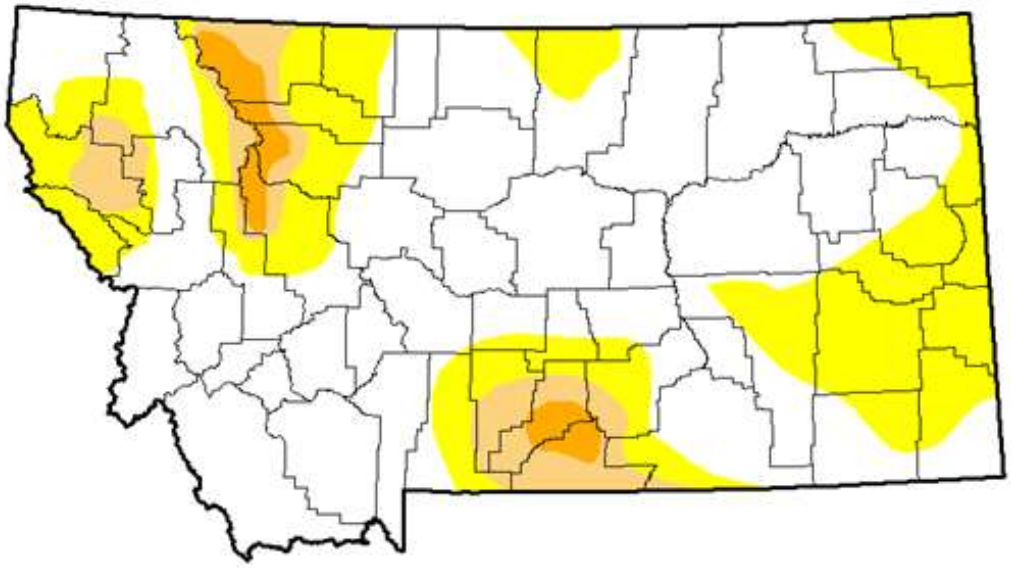


Figure 2: US Drought Monitor, Montana: April 7, 2015

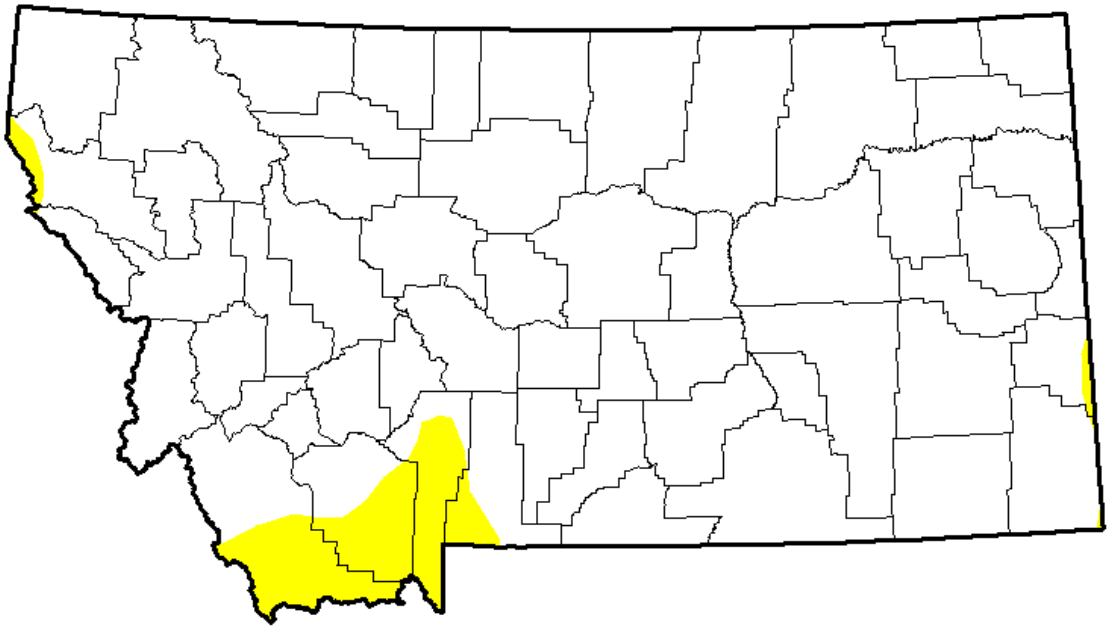
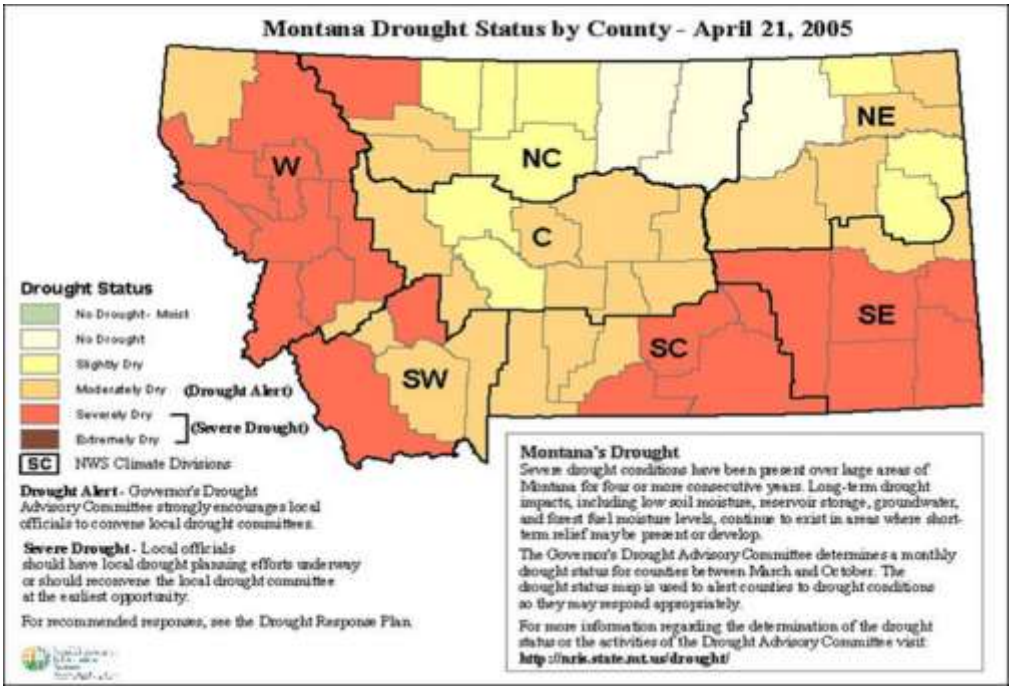


Figure 3: Montana State Library County Drought Status Maps: April 21, 2005



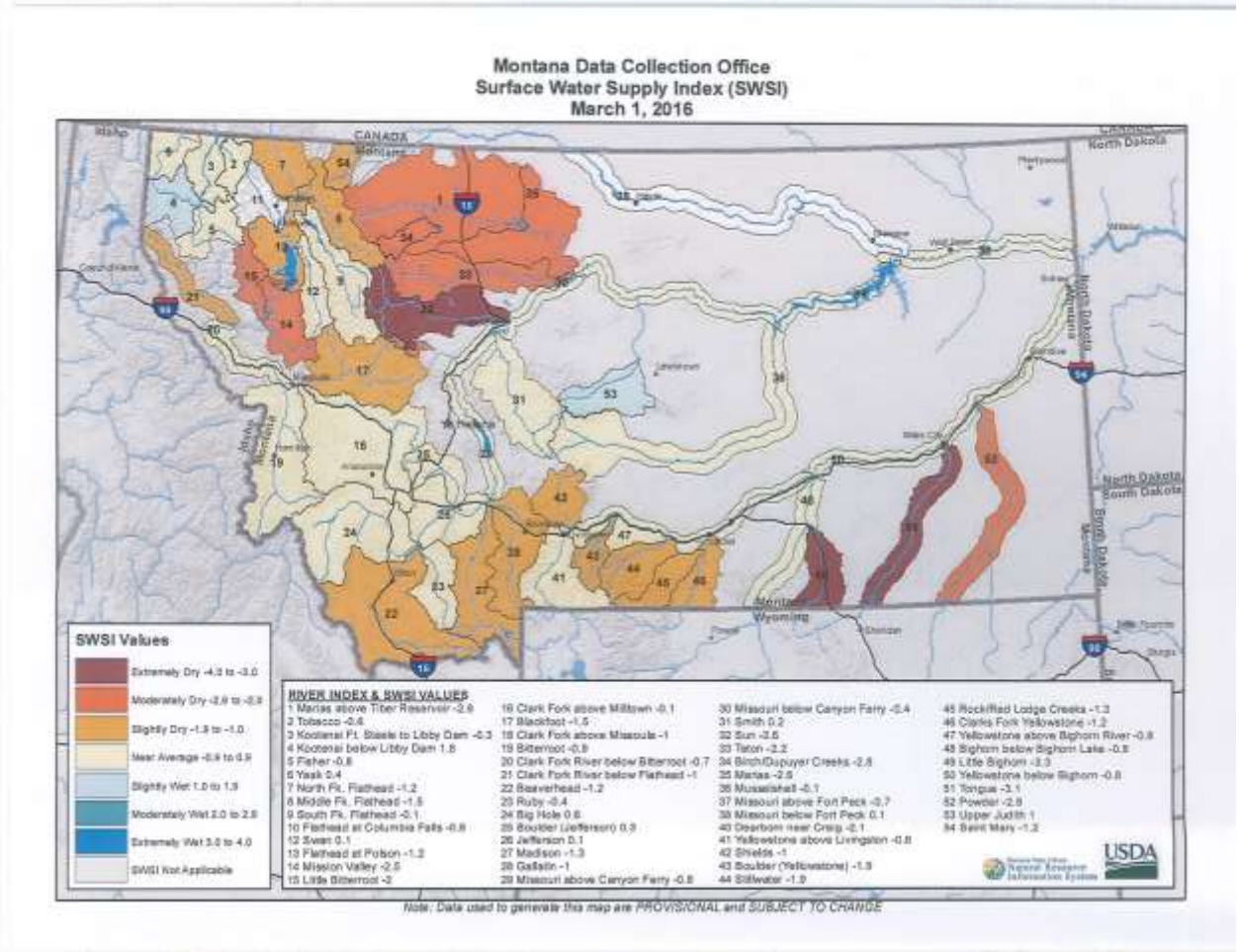


Figure 5: SWSI: August 1, 2015

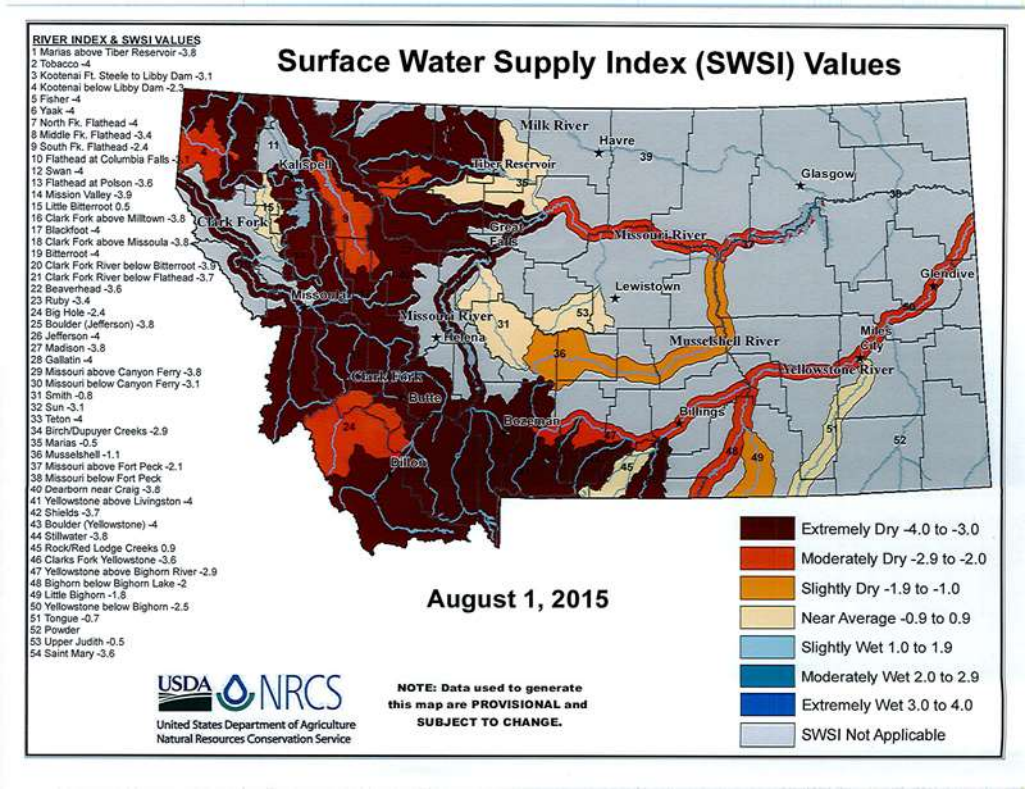
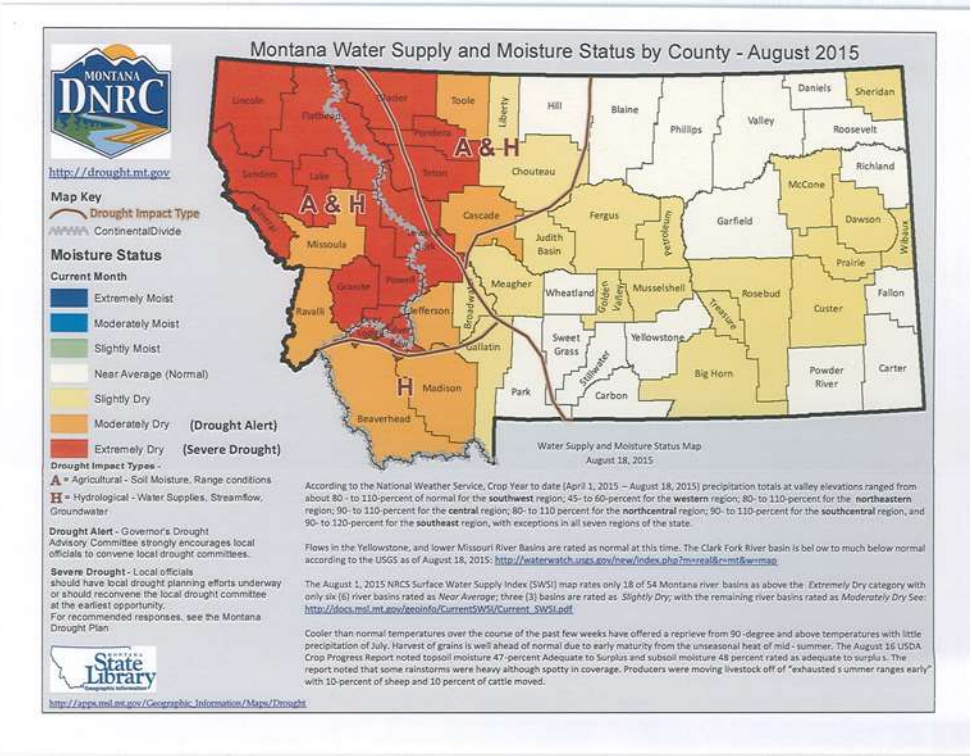


Figure 6: Montana Water Supply and Moisture Status by County: August 2015



RESOLUTION

LETTERS OF SUPPORT

DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION

STEVE BULLOCK
GOVERNOR

DIRECTOR'S OFFICE (406) 444-2074
TELEFAX NUMBER (406) 444-2684

STATE OF MONTANA

WATER RESOURCES DIVISION (406) 444-6601
TELEFAX NUMBERS (406) 444-0533 / (406) 444-5918
http://www.dnrc.mt.gov

1424 9TH AVENUE
PO BOX 201601
HELENA, MONTANA 59620-1601

April 11, 2016

Michael Dieterich
PO Box 25007
Denver, CO 80225

Re: WaterSmart Drought Contingency Planning Grant
MT DNRC *Building Drought Resilience in the Missouri Headwaters Basin of Montana*

Dear Mr. Dietrich:

The Montana Department of Natural Resources and Conservation (DNRC) has reviewed and approved the WaterSMART Drought Contingency Planning Grant Application titled *Building Drought Resilience in the Missouri Headwaters Basin of Montana.* As Administrator of the Water Resources Division (WRD) within the DNRC, I have the legal authority to enter into a cooperative financial assistance agreement with the U.S. Bureau of Reclamation. As the unit of State Government charged with coordinating the development and utilization of the state's water resources, WRD had the capability to meet the funding and/or in-kind contributions specified in the funding plan. WRD will work with Reclamation to meet all cooperative financial assistance agreement deadlines.

Sincerely,

Tim Davis, Administrator
Water Resources Division

DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION

STEVE BULLOCK
GOVERNOR

DIRECTOR'S OFFICE (406) 444-2074
TELEFAX NUMBER (406) 444-2684

STATE OF MONTANA

WATER RESOURCES DIVISION (406) 444-6601
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April 11, 2016

Michael Dieterich
PO Box 25007
Denver, CO 80225

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MT DNRC *Building Drought Resilience in the Missouri Headwaters Basin of Montana*

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The Montana Department of Natural Resources and Conservation (DNRC) has reviewed and approved the WaterSMART Drought Contingency Planning Grant Application titled *Building Drought Resilience in the Missouri Headwaters Basin of Montana.* As Administrator of the Water Resources Division (WRD) within the DNRC, I have the legal authority to enter into a cooperative financial assistance agreement with the U.S. Bureau of Reclamation. As the unit of State Government charged with coordinating the development and utilization of the state's water resources, WRD had the capability to meet the funding and/or in-kind contributions specified in the funding plan. WRD will work with Reclamation to meet all cooperative financial assistance agreement deadlines.

Sincerely,

Tim Davis, Administrator
Water Resources Division

THE CENTER FOR
LARGE LANDSCAPE
CONSERVATION

April 11, 2016

To: Whom It May Concern

Re: **Missouri Headwaters Basin Drought Resilience Project (Montana DNRC)**

The Center for Large Landscape Conservation (CLLC) is a "hub" for large landscape conservation, connecting people, organizations and resources to foster solutions that integrate diverse stakeholders. The Montana DNRC proposal submitted to the Bureau of Reclamation requesting support for the Missouri Headwaters Basin Drought Resilience Project is a perfect example of supporting stakeholders to work together to achieve a large landscape vision that surpasses the sum of the partners. It is a project chosen by the National Drought Resilience Partnership (NDRP) as a demonstration project of national recognition that reaches all the way to local landowners to support a common goal and vision.

As the lead agency for the NDRP demonstration project, the Montana DNRC has been a great champion of making sure this national project integrates critical on-the-ground participation. Finding support for the work of watershed groups to build their capacity and engage local landowners has been the most challenging aspect of the project. At CLLC we are also supporting local project work where possible and recognize the need for further funding at this level. We feel local stakeholders and landowners are critical to the long term success of a project such as this.

The Center for Large Landscape Conservation strongly supports this proposal to fund partners on the ground working towards a collective landscape vision. We encourage the Bureau of Reclamation to support work that has both local and national significance,

Yours Sincerely,

Melly Reuling
Senior Project Manager
Center for Large Landscape Conservation

ATTACHMENTS FORM

Instructions: On this form, you will attach the various files that make up your grant application. Please consult with the appropriate Agency Guidelines for more information about each needed file. Please remember that any files you attach must be in the document format and named as specified in the Guidelines.

Important: Please attach your files in the proper sequence. See the appropriate Agency Guidelines for details.

1) Please attach Attachment 1	Building Drought Resilience i	Add Attachment	Delete Attachment	View Attachment
2) Please attach Attachment 2	MHB-Authorization.pdf	Add Attachment	Delete Attachment	View Attachment
3) Please attach Attachment 3	NDRP Workplan summary.pdf	Add Attachment	Delete Attachment	View Attachment
4) Please attach Attachment 4	EN-MB-Sep2015.pdf	Add Attachment	Delete Attachment	View Attachment
5) Please attach Attachment 5	1617 Ind Cost Neg Agrmt-Signe	Add Attachment	Delete Attachment	View Attachment
6) Please attach Attachment 6	BCD_LOS_DNRC DroughtR.pdf	Add Attachment	Delete Attachment	View Attachment
7) Please attach Attachment 7	BHWC_BOR Drought Contingency	Add Attachment	Delete Attachment	View Attachment
8) Please attach Attachment 8	CLLC letter for BOR.pdf	Add Attachment	Delete Attachment	View Attachment
9) Please attach Attachment 9	GRTF LOS 2016 BOR Drought Pla	Add Attachment	Delete Attachment	View Attachment
10) Please attach Attachment 10	Montana NDMC LOS April 2016.p	Add Attachment	Delete Attachment	View Attachment
11) Please attach Attachment 11	NIDIS.MT_NDRP_LOS_4-16 (1).pd	Add Attachment	Delete Attachment	View Attachment
12) Please attach Attachment 12	RVCD LOS.2016.pdf	Add Attachment	Delete Attachment	View Attachment
13) Please attach Attachment 13	WCS_LOS_MTDNRC.pdf	Add Attachment	Delete Attachment	View Attachment
14) Please attach Attachment 14		Add Attachment	Delete Attachment	View Attachment
15) Please attach Attachment 15		Add Attachment	Delete Attachment	View Attachment

Wildlife Conservation Society
212 S. Wallace Avenue, Suite 101
Bozeman, MT 59715 USA
406-209-4060

TO: Bureau of Reclamation Financial Assistance Services
Attn: Mr. Michael Dieterich
PO Box 25007
Denver, CO 80225

11 April, 2016

Re: WaterSmart Drought Contingency Planning Grant
MT DNRC *Building Drought Resilience in the Missouri Headwaters Basin of Montana*

Please accept this letter of support for the "*Building Drought Resilience in the Missouri Headwaters Basin of Montana"* proposal submitted by the Montana Department of Natural Resources and Conservation (DNRC). The Wildlife Conservation Society is pleased to support the DNRC's efforts to proactively plan and prepare for the effects of drought in the Missouri Headwaters Basin. Now is the time for water users and managers in the region to get ahead of the curve in preparing for drought, before we find ourselves in the thick of a crisis like that facing California and other parts of western US. It is also important for drought planning to look ahead to the future, so that we are adequately prepared for droughts whose frequency and severity are exacerbated by the effects of climate change.

Montana DNRC's proposed project takes on these challenges by proactively planning for both current and future droughts, in order to bolster the near- and long-term resilience of local communities and the region's valued natural resources. By developing the local and regional capacity needed to create a coordinated drought contingency plan for the Missouri Headwaters Basin ("the Basin") that considers both drought mitigation and response actions, the proposed project will catalyze the implementation of actions needed to reduce the vulnerability of critical resources before droughts occur, while simultaneously laying out a plan of action to minimize negative impacts during a drought event. By engaging local communities throughout the Basin in watershed-scale and basin-wide drought planning, the proposed project will ensure a seamless consideration of drought vulnerabilities and proactive drought preparedness actions across scales.

The Wildlife Conservation Society is prepared to invest our time, expertise and resources to help support the DNRC's drought planning efforts in the Basin. Drawing upon our 15+ years of experience in proactively understanding and preparing for the effects of climate change, we will help advise drought planners in the Basin on climate change science and planning resources. Our involvement will also leverage a $400,000 investment by the US Geological Survey in a national "Science for Nature and People Partnership" (www.snap.is) working group led by

USGS, the Wildlife Conservation Society and the Nature Conservancy, that aims to increase the consideration of ecological impacts of drought and climate change in community-based drought planning. Using those leveraged resources, we will synthesize and share information about the effects of drought on forests, wetlands, streams and other ecosystems that provide valuable services (e.g., water purification, aquifer recharge, recreation-based economic opportunities) to human communities in the Basin. Lastly, we will share with drought planners in the Basin our experiences implementing and monitoring drought mitigation actions in riparian and wetland systems across the region. In these and other ways, we look forward to participating in and supporting the drought resiliency building efforts proposed by Montana DNRC.

Sincerely,

Molly S. Cross, Ph.D.
Climate Change Adaptation Coordinator
Wildlife Conservation Society

Ruby Valley Conservation District

P. O. BOX 295
402 SO. MAIN ST.
SHERIDAN, MT 59749
(406) 842-5741

*** PROTECT THE LAND AND PRESERVE OUR HERITAGE ***

April 12, 2014

Bureau of Reclamation Financial Assistance Services
Attn: Mr. Michael Dieterich
PO Box 25007
Denver, CO 80225

Re: WaterSmart Drought Contingency Planning Grant
MT DNRC *Building Drought Resilience in the Missouri Headwaters Basin of Montana*

Dear Mr. Dieterich,

The Ruby Valley Conservation District (RVCD) and Ruby Watershed Council (RWC) are currently engaged in planning efforts to increase drought resilience in the Ruby River watershed through the National Drought Resilience Partnership (NDRP) pilot project. These efforts have led directly to the development of a watershed stewardship program that promises to implement conservation and watershed restoration projects that are aimed at building resilience throughout our watershed, and by extension the Missouri River headwaters region. These efforts simply would not be possible without our participation in the NDRP. While we have been successful in partnering with several state and federal agencies, non-profit groups, and local stakeholders to begin these drought planning and implementation efforts, groups of our size and capacity are in constant need of funds to support the staff time and expenses necessary to realize the tasks at hand. Without capacity funding many groups, including our own, have difficulty accomplishing the long-term, locally driven planning that is necessary to comprehensively deal with phenomena such as drought. The RVCD and RWC have committed to developing a community drought resilience plan, implementing projects to build resilience in our watershed, and supporting the efforts of other groups in the headwaters region. We fully support the MT DNRC's request for funding which will in turn support the following types of projects in the Ruby River watershed:

- Joint ground water and surface water hydrologic monitoring
- Irrigation-surface water monitoring and drought trigger development
- Watershed restoration to reconnect flooplain surfaces, develop shallow aquifer storage, and supplement base-flows
- Conifer encroachment and fuel-load reduction projects to restore function and safeguard rangelands and riparian areas from drought exacerbated wildfire

Sincerely,

David Stout
Drought and Restoration Projects Coordinator
Ruby Valley Conservation District/Ruby Watershed Council

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Office of Oceanic and Atmospheric Research
Earth System Research Laboratory
325 Broadway – David Skaggs Research Center
Boulder, Colorado 80305-3337

April 10, 2016

Bureau of Reclamation Financial Assistance Services
Attn: Mr. Michael Dieterich
PO Box 25007
Denver, CO 80225

Re: WaterSmart Drought Contingency Planning Grant
MT DNRC *Building Drought Resilience in the Missouri Headwaters Basin of Montana*

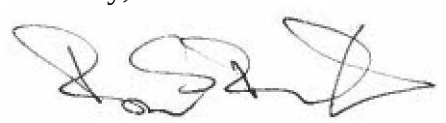
It is with great pleasure that I write this letter of support for the proposal, *Building Drought Resilience in the Missouri Headwaters Basin of Montana*, developed by the Montana Department of Natural Resources and Conservation (DNRC). The proposal builds on the National Drought Resilience Partnership (NDRP) and its Montana Demonstration Project workplan goal: *Develop Local and Regional Capacity to Plan for Drought*.

The National Integrated Drought Information System (NIDIS) has a Congressional mandate to help support and improve our nation's ability to anticipate drought. As the Director of NIDIS and a leader within the NDRP effort, I realize drought early warning is only effective when drought contingency plans are in place so that mitigation and response actions can be taken to reduce the potential impacts. Developing a series of locally-led drought contingency plans at the scale of individual watersheds and integrating those into a Missouri Headwaters plan is an excellent opportunity for NIDIS to leverage our work on early warning and create early warning data and tools that could be incorporated into these plans.

As part of the NDRP process, and NIDIS' development of a Drought Early Warning System in the Missouri River Basin, we have worked closely with the DNRC to develop a series of drought planning webinars specifically targeted to the eight watersheds that form the Missouri Headwaters. The webinars are structured using the Bureau of Reclamation's (BoR) six core elements for a drought plan and the Drought Ready Communities process created by the National Drought Mitigation Center at the University of Nebraska-Lincoln. This proposal extends the concepts covered by the webinars to on-the ground actions that will have a real impact in preparing these communities to anticipate and prepare for drought.

As NIDIS continues its work to develop drought early warning systems we view BoR's Drought Response Program as an exceptionally important program that is complimentary to NIDIS' efforts in that it is one of the few programs that provides resources for communities, states, tribes, and others to plan for drought. I hope this proposal will be given all due consideration as it is an excellent example of NIDIS and BoR leveraging expertise and resources and is reflective of the goals articulated by the NDRP. I strongly endorse this proposal and if there is anything I can do to assist this process please let me know.

Sincerely,



Roger S. Pulwarty
Director, National Integrated Drought Information System

University of Nebraska Lincoln

SCHOOL OF NATURAL RESOURCES
National Drought Mitigation Center

April 9, 2016

Bureau of Reclamation Financial Assistance Services
Attn: Mr. Michael Dieterich
PO Box 25007
Denver, CO 80225

Re: WaterSmart Drought Contingency Planning Grant
MT DNRC *Building Drought Resilience in the Missouri Headwaters Basin of Montana*

I am writing this letter of support to enthusiastically endorse the proposal the Montana Department of Natural Resources and Conservation (DNRC) is submitting to the Bureau of Reclamation as part of the WaterSmart Drought Contingency Planning program. The DNRC request builds upon a series of webinars that local drought coordinators in the Missouri Headwaters have been participating in during 2016, and the request meets the goal to "develop local and regional capacity to plan for drought."

As the Director of the National Drought Mitigation Center (NDMC) located at the University of Nebraska-Lincoln, I have been able to both participate in and observe these activities led by the DNRC. Drought planning has been a core theme of the NDMC's mission and, for this reason, it is exciting to experience the interest that the 8 tributary watersheds have had in the webinar series, and to support the opportunity to maintain and enhance that drought planning momentum! The funding this grant provides will assist the watersheds to continue making progress and allow them to convene stakeholders at the local, watershed, regional, and state scales vital to build drought resiliency across the Missouri Headwaters Basin. If the NDMC has the expertise to contribute with any of these activities going forward, we are certainly willing to assist the DNRC when possible. We are eager to see the progress continue!

Finally, the interest generated by the DNRC webinars this spring highlights the need for coordinated efforts to build local and regional drought planning capacity. I believe that continued support of these activities will create an excellent model for drought managers across the entire country who are always looking for relevant examples of successful drought risk management strategies. Please let me know if you have any questions for me during any stage of this process.

Sincerely,

Michael J. Hayes, Ph.D.
Professor, School of Natural Resources
Director, National Drought Mitigation Center

3310 Holdrege Street / 823 Hardin Hall / P.O. Box 830988 / Lincoln, NE 68583-0988
(402) 472-4271 / FAX (402) 472-2946 / E-mail: mhayes2@unl.edu / http://drought.unl.edu

PO Box 160513
Big Sky, MT 59716

Bureau of Reclamation Financial Assistance Services
Attn: Mr. Michael Dieterich
PO Box 25007
Denver, CO 80225

Re: WaterSmart Drought Contingency Planning Grant
MT DNRC *Building Drought Resilience in the Missouri Headwaters Basin of Montana*

Dear Mr. Dietrich,

On behalf of the Gallatin River Task Force (Task Force), a nonprofit watershed group dedicated to health of the Upper Gallatin Watershed, I would like to express our enthusiastic support for the Montana DNRC *Building Drought Resilience in the Missouri Headwater Basin of Montana* grant application.

The Task Force is a non profit based in Big Sky, MT whose mission is to partner with our community to inspire stewardship of the Gallatin River Watershed. Our organization has been involved with the Missouri Headwaters Drought Resiliency project over the past year and have begun initial discussions to develop a drought plan for our community. The Upper Gallatin Watershed community lacks a drought plan and with a rapidly growing community and predictions of future drought by climate scientists, the Task Force recognizes the immediate need to develop a plan.

Like many nonprofit watersheds, we lack the organizational capacity required to fully develop and implement the activities to develop a drought plan. These activities include gathering critical information from community and governmental agencies, convening and coordinating major watershed stakeholders, leading planning discussions, and creating the plan.

Contributing funds from the WaterSmart Drought Contingency Planning program would be instrumental in ensuring success of the drought planning efforts in the Upper Missouri basin. For this reason, the Gallatin River Task Force offers its enthusiastic support for the Montana DNRC *Building Drought Resilience in the Missouri Headwater Basin of Montana* grant application and urges you to approve this proposal for funding. Thank you for your consideration of this proposal.

Sincerely,

Kristin Gardner
Executive Director
Gallatin River Task Force

THE CENTER FOR
LARGE LANDSCAPE
CONSERVATION

April 11, 2016

To: Whom It May Concern

Re: **Missouri Headwaters Basin Drought Resilience Project (Montana DNRC)**

The Center for Large Landscape Conservation (CLLC) is a "hub" for large landscape conservation, connecting people, organizations and resources to foster solutions that integrate diverse stakeholders. The Montana DNRC proposal submitted to the Bureau of Reclamation requesting support for the Missouri Headwaters Basin Drought Resilience Project is a perfect example of supporting stakeholders to work together to achieve a large landscape vision that surpasses the sum of the partners. It is a project chosen by the National Drought Resilience Partnership (NDRP) as a demonstration project of national recognition that reaches all the way to local landowners to support a common goal and vision.

As the lead agency for the NDRP demonstration project, the Montana DNRC has been a great champion of making sure this national project integrates critical on-the-ground participation. Finding support for the work of watershed groups to build their capacity and engage local landowners has been the most challenging aspect of the project. At CLLC we are also supporting local project work where possible and recognize the need for further funding at this level. We feel local stakeholders and landowners are critical to the long term success of a project such as this.

The Center for Large Landscape Conservation strongly supports this proposal to fund partners on the ground working towards a collective landscape vision. We encourage the Bureau of Reclamation to support work that has both local and national significance,

Yours Sincerely,

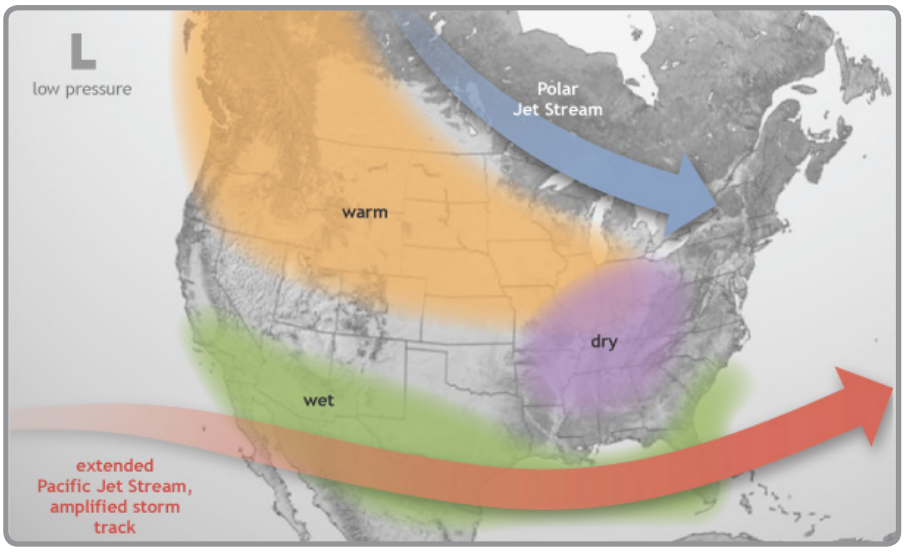
Melly Reuling
Senior Project Manager
Center for Large Landscape Conservation

El Niño Impacts and Outlook

Missouri Basin Region

August 2015

Typical El Niño Winter Pattern



The image above shows the typical pattern in the winter during El Niño events. The polar jet stream tends to stay to the north of the Missouri Basin region, while the Pacific jet stream remains across the southern U.S. With the Missouri Basin isolated between the storm tracks, warmer and possibly drier conditions can develop during El Niño events.

Image courtesy of the National Oceanic and Atmospheric Administration.
For more information please visit: https://www.climate.gov/news-features/department/enso-blog

El Niño in Winter

An El Niño develops when sea surface temperatures are warmer than average in the equatorial Pacific for an extended period of time. This is important to North America because El Niño has an impact on our weather patterns, most predominantly in the winter.

Although each El Niño is different, there are some general patterns that are predictable. For instance, the polar jet stream is typically farther north than usual, while the Pacific jet stream remains across the southern United States (see figure to left).

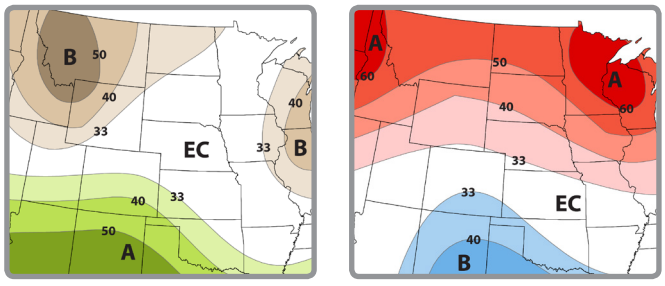
This pattern brings above-normal temperatures to much of the Missouri River Basin region, particularly across the northern tier of the basin. Keep in mind that this does not mean that cold weather will not happen this winter. Extreme cold weather may be milder and less frequent, however.

Snowpack can also be impacted by the typical El Niño winter pattern as well. Snowpack in the northern Rockies and Plains can be reduced and heavy snow events may be less frequent.

El Niño Outlook

Winter Temperature and Precipitation Outlooks

Valid for December 2015 - February 2016



Precipitation Temperature

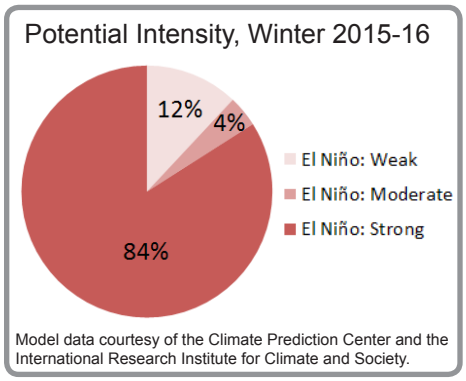
EC: Equal chances of above, near or below normal, **A:** Above normal, **B:** Below normal

As of August, the winter outlooks for the region show that below-normal precipitation is favored for the headwaters of the Missouri River, while above-normal precipitation is favored for areas of the southern Rockies. This could have implications for many sectors, in both positive ways (increased snowpack to the south could be welcomed by ski resorts) and negative ways (reduced snowpack to the north could impact spring runoff). Meanwhile, the temperature outlook indicates that central and northern areas of the region could have above-normal temperatures, while some southern areas could have below-normal temperatures.

The seasonal outlooks above combine many factors including dynamical models, the effects of long-term trends, soil moisture, and the El Niño Southern Oscillation cycle (ENSO). Because these outlooks combine many inputs, they do not match the typical El Niño conditions exactly. To learn more about these outlooks, or to retrieve the latest temperature, precipitation, and drought outlooks, please visit the Climate Prediction Center at: http://www.cpc.ncep.noaa.gov

El Niño Strength

Winter 2015-16



Model data courtesy of the Climate Prediction Center and the International Research Institute for Climate and Society.

El Niño conditions have continued this summer and forecasts indicate that this El Niño will strengthen, peaking as a strong event in late fall or early winter. According to the Climate Prediction Center, there is a greater than 90% chance that these conditions will last through the winter and about an 85% chance that El Niño will continue into the early spring. Research has shown that strong El Niños are often followed by La Niñas, so conditions should continue to be monitored closely, especially if the El Niño weakens next spring, as predicted.

Contacts: Doug Kluck (doug.kluck@noaa.gov)
Natalie Umphlett (numphlett2@unl.edu)
Dennis Todey (dennis.todey@sdstate.edu)

Potential Winter and Spring Impacts

Missouri River

The Missouri River at Gavins Point, South Dakota. Image courtesy of Natalie Umphlett.

The wet spring resulted in higher than normal river levels in the lower Basin, but with weather conditions in the upper Basin switching from wet to dry to wet again, 2015 runoff above Sioux City, Iowa is expected to be near average at about 25 million acre feet. The Missouri River Mainstem Reservoir System will begin the 2016 runoff season at the base of the Annual Flood Control and Multiple Use Zone, which means that all flood control storage will be available. Some indicators suggest a tilt toward lower than normal mountain snowpack in the upper Basin during a moderate to strong El Niño. Mountain and Plains snowpack will be closely monitored.

Agriculture

Wheat damaged by cold weather in Kansas - 2014. Image courtesy of Mary Knapp.

El Niño has worldwide impacts to the agricultural sector, and in the Missouri Basin region, there could be mixed impacts. Because El Niño winters typically result in a reduced snowpack in the northern Plains, this could expose winter wheat to harsh temperatures and wind, and also lead to soil moisture concerns. In southern areas, however, good soil moisture conditions could be expected where above-normal precipitation may occur. Additionally, warmer conditions in the northern tier of the basin could be beneficial for livestock producers both in terms of greater gains due to less severe cold weather and for calving in the later winter and spring.

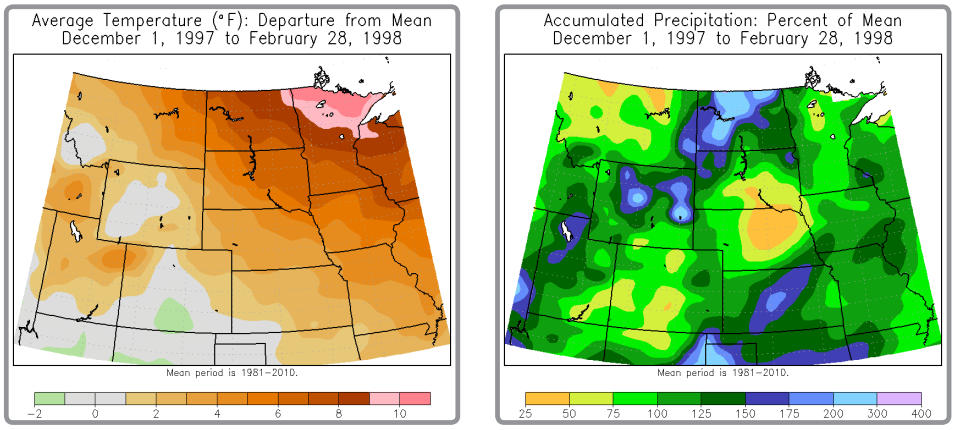
Ecosystems

An iconic animal of the Great Plains - the bison. Image courtesy of Natalie Umphlett.

For northern areas of the Missouri Basin region, higher temperatures combined with a lower snowpack could be a recipe for increased fire danger this winter and spring. These conditions could also result in earlier peak stream flows; reduced runoff into wetlands, streams, and rivers in the spring; reduced spring vegetation growth (depending on spring precipitation); and generally warmer stream temperatures. Any reduction to spring runoff or vegetation growth could have negative impacts to wildlife, however these impacts may not be apparent until later in the spring or summer and will be dependent on springtime precipitation.

Comparisons and Limitations

Winter Conditions During Past El Niños



Departure from mean temperature (left) and percent of mean precipitation (right) during the El Niño winter of 1997-98. Maps courtesy of the Midwestern Regional Climate Center.

The maps above illustrate the winter conditions of the record breaking El Niño of 1997-98. Much of the basin was warmer than average. Precipitation signals varied across the basin, but the mountain snowpack peaked near normal. While the current El Niño is on track to be one of the strongest on record, please note that each El Niño is different. Other factors can be considered such as antecedent conditions or the Arctic Oscillation, which trumped the El Niño during the winter of 2009-10. Right now, there is a warm pool of water off the Pacific Northwest coast that should be monitored, although it does not seem likely to affect the current El Niño at this time.

While past El Niño events can help inform forecasters about certain conditions, there are some limitations. For instance, in the Missouri Basin region, El Niño is *not* known to impact:

- Potential for ice storms or blizzards.
- Track or intensity of any single weather system.
- First freeze in the fall (early or late).
- Last freeze in the spring (early or late).

Missouri Basin Partners

High Plains Regional Climate Center
www.hprcc.unl.edu
International Research Institute for Climate and Society
http://iri.columbia.edu
National Drought Mitigation Center
www.drought.unl.edu
National Integrated Drought Information System
www.drought.gov
National Oceanic and Atmospheric Administration
National Weather Service - Central Region
www.crh.noaa.gov/crh
National Centers for Environmental Information
www.ncdc.noaa.gov
Missouri River Basin Forecast Center
www.crh.noaa.gov/mbrfc
Climate Prediction Center
www.cpc.ncep.noaa.gov
Plains & Prairie Potholes Landscape Conservation Cooperative
www.plainsandprairiepotholeslcc.org
State Climatologists
www.stateclimate.org
U.S. Army Corps of Engineers - Missouri River Basin Water Management Division
www.usace.army.mil
U.S. Department of Agriculture
Natural Resources Conservation Service
www.nrcs.usda.gov
NRCS National Water & Climate Center
www.wcc.nrcs.usda.gov
Regional Climate Hubs
www.usda.gov/oce/climate_change/regional_hubs.htm
U.S. Department of Interior
Bureau of Reclamation
www.usbr.gov
North Central Climate Science Center
www.doi.gov/csc/northcentral/index.cfm
U.S. Geological Survey, Water Mission Area
www.usgs.gov/water

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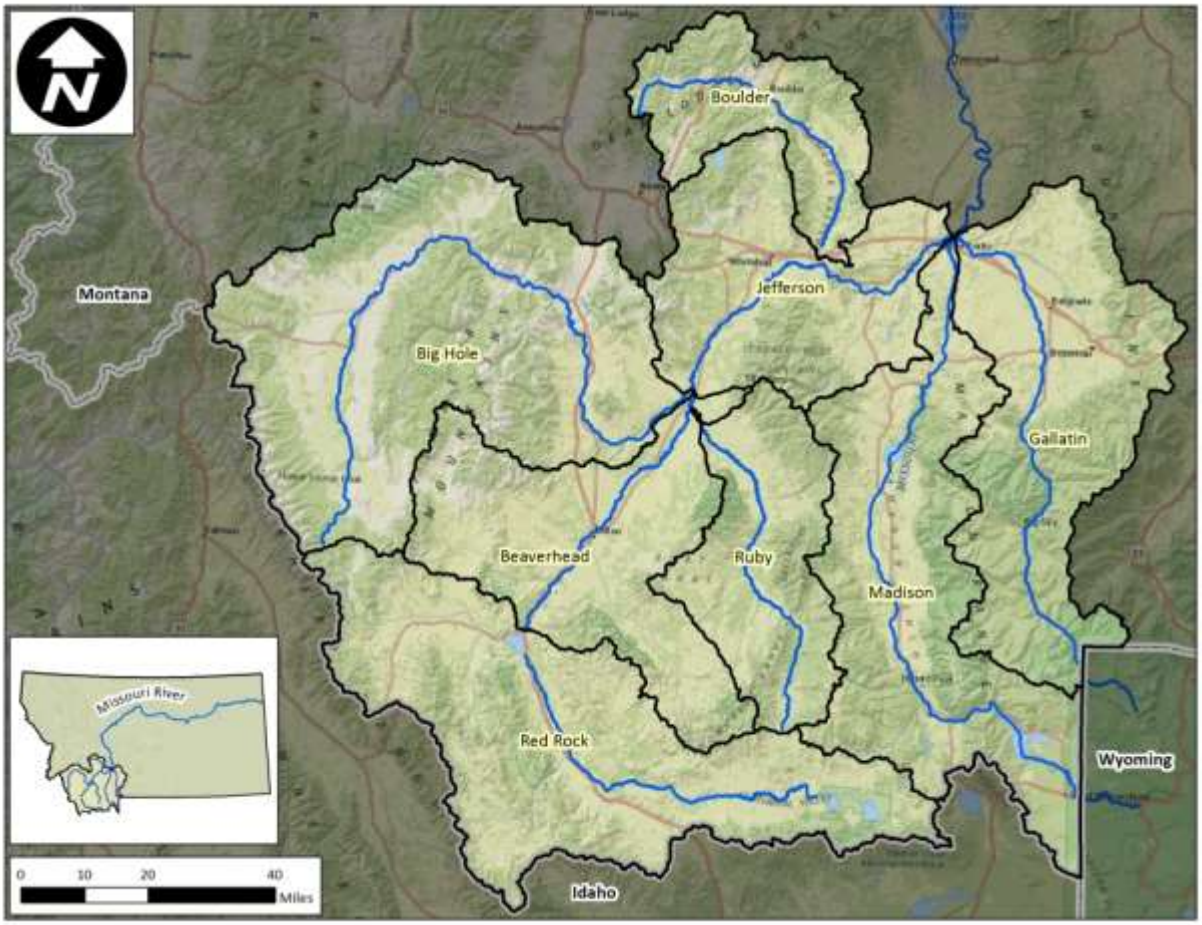
Dennis Todey (dennis.todey@sdstate.edu)

A WORKPLAN FOR DROUGHT RESILIENCE
in the
MISSOURI HEADWATERS BASIN

A National Demonstration Project



Montana Drought Demonstration Partners
November, 2015

EXECUTIVE SUMMARY

The urgency for drought resilience planning has never been greater. With rapid changes in land use and increasing impacts from climate change, communities need to determine ways to meet their drought planning goals. Montana is forging new ground to join agencies, resource managers and communities to plan for drought impacts and build drought resilience. The State of Montana and the National Drought Resilience Partnership (NDRP)--a collaborative of federal and state agencies, non-governmental organizations (NGOs), and watershed stakeholders--are working together to leverage and deliver technical, human and financial resources to help address drought in the arid West.

The Missouri Headwaters Basin in southwest Montana was selected as one of two national Drought Resilience pilots by the NDRP to demonstrate collaborative efforts to build resilience.. The Basin plays an important role in landscape connectivity in the northern Rockies, experiences frequent drought, and faces rapidly changing population and land use. Although local groups in the area recognize the need to prepare for drought, they lack the human and financial capacity to fully utilize planning tools and implement solutions. Federal and State resources can assist greatly with drought monitoring, forecasts, and early warning systems, but the information isn't always readily accessible to local planners and decision makers.

The goal of the Missouri Headwaters Drought Resilience Demonstration Project is a two-way proposition -- to deliver government drought mitigation tools and resources to watershed stakeholders who need them, and to build information from local groups in direct contact with the landscape. This project will produce a model for information sharing, efficient water use and storage, and community collaboration. It will also prepare people to mitigate for drought while preserving cultural and ecological values in the face of a drier future. In September 2015, Montana's NDRP members and local watershed representatives met in Dillon, Montana, in the heart of the Missouri Headwaters Basin, to identify shared goals for developing drought preparedness plans and mitigation strategies. From this meeting and two previous meetings, the group drafted a workplan that identifies objectives and implementation tasks required to assure drought resiliency basinwide. The workplan is organized in three overarching goals that are equally important to the success of the Missouri Headwaters Drought Resilience Demonstration Project:

1. **Provide Tools for Drought Monitoring, Assessing and Forecasting**
2. **Develop Local and Regional Capacity to Plan for Drought**
3. **Implement Local Projects to Build Regional Drought Resilience**

Within each of these broad goals, the workplan highlights objectives and implementation tasks all of which will be refined as the project grows. The Montana NDRP is dedicated to empowering communities to prepare for and mitigate the impacts of drought on livelihoods and the economy. This workplan grew from participation of partners living and working in the Missouri Headwaters Basin, and defines a wide assortment of tasks that can be undertaken to reach the overarching goal of coordinated landscape-wide drought resilience.

KEY GOALS, OBJECTIVES, AND IMPLEMENTATION TASKS
GOAL 1: PROVIDE TOOLS FOR DROUGHT MONITORING, ASSESSING, AND FORECASTING
A. Develop a Drought Monitoring Network
• Coordinate a monitoring network to support local and regional needs
• Expand soil moisture monitoring
• Expand streamflow monitoring to address data gaps
• Expand precipitation monitoring (CoCORaHS)
B. Develop a Portal to Share Monitoring, Assessment and Forecasting Information Across the Network
• Explore and compile existing data to create a central information portal on Basin specific data accessible to all water users
GOAL 2: DEVELOP LOCAL AND REGIONAL CAPACITY TO PLAN FOR DROUGHT
A. Build and Engage Local Capacity for Drought Planning
• Assure adequate staffing and operational needs
• Provide consistent drought mitigation trainings and technical assistance
B. Increase Local Community Awareness of Drought and Supply Planning, Forecasting, and Mitigation
• Inventory and assemble local community member lists and conduct awareness workshops
• Develop creative communication and outreach tools to engage local leaders in the planning process
• Develop a marketing or branding strategy for drought and the demonstration project
C. Provide the Tools and Technical Assistance to Help Local Groups Strategize and Develop Drought Plans
• Monitor and identify risks, vulnerabilities and supply/demand triggers
• Set systems in place to manage voluntary agreements
D. Connect Local Drought Plans at the Regional Scale
• Review local plans and merge into a regional drought preparedness plan for the entire Basin
• Explore agency drought plans
E. Develop a Regional Network to create a Streamlined Structure to Share Learning, Coordinate and Pursue funding opportunities and Deliver Resources across the Basin
• Build a network/framework that unifies, coordinates and simplifies the delivery and sharing of resources.
GOAL 3: IMPLEMENT LOCAL PROJECTS TO BUILD REGIONAL DROUGHT RESILIENCE
A. Increase Water Conservation Measures
• Work with municipalities in the Basin to develop water conservation campaigns and measures
• Work with the farmers/ranchers in the Basin to implement water conservation and irrigation efficiency and delivery measures.
B. Ensure Riparian, Floodplain and Water Management Measures Are in Place
• Inform the public of the value of riparian areas and floodplains for improved water holding capacities
• Assess and improve natural storage capacity
• Install off-stream stock water tanks to reduce impacts to riparian areas and facilitate upland grazing management
• Consolidate and maintain points of diversion to improve efficiencies
• Implement hybrid sprinkler/flood systems that transition as flows change
C. Ensure Upland Management Measures are in Place
• Demonstrate integrated management on public lands, and collaborate to implement projects to protect water quantity and quality in the headwaters
• Develop a suite of soil and upland health demonstration projects in the Missouri Headwaters
• Explore the impacts of conifer expansion on water yield
• Study, understand, and implement practices that improve soil health and moisture holding capacities.

Last	First	Affiliation	Title
Aber	Jesse	MT DNRC	MT Gov. Drought & Water Supply Advisory Committee Coordinator
Anevski	John	BIA Water Program	Branch Chief for Biological Resources and Conservation
Barndt	Scott	USFS, Custer & Gallatin NF	Ecosystems Staff Officer
Bathke	Deborah	National Drought Mitigation Center	Assistant Professor of Practice, Dept. of Earth & Atmospheric Sciences
Benavides	Ada	Army Corps of Engineers	Western Regional Manager
Benock	Gerald	Bureau of Reclamation	Manager of Planning and Project Develop Division
Bilbo	Keri	USDA NRCS	Assistant State Conservationist for Field Operations
Bogan	Kathy	NIDIS	Web and communication specialist
Bostrom	Mark	DNRC CARRD	Division Administrator
Boyk	Katherine	Greater Gallatin Watershed Council/ Gallatin Valley Land Trust	BSWC member
Brammer	Jim	USFS Beaverhead Deer Lodge Forest	Forest Aquatics Program Manager
Brown	Peter	Gallatin Valley Land Trust	Stewardship Manager
Brown	Zach	One Montana	Water Program Manager
Buckley	Alice	Future West	Program Manager/ Outreach Specialist
Burbach	Thor	USFS	Regional Hydrologist
Byorth	Pat	MT Trout Unlimited Water Project	Staff Attorney/ Water Rights Specialist
Card	Joan	EPA	Senior Policy Advisor
Carparelli	Chris	Beaverhead Conservation District	BSWC member
Cayer	Emma	MT Fish Wildlife and Parks	Arctic Grayling biologist
Chase	Kathy	USGS	Hydrologist
Coverdale	Lisa	USDA NRCS	State Conservationist
Colosimo	Robyn	DoD	Asst. for Water Resources Policy
Combs	David	Army Corps of Engineers	NWD Chief
Converse	Yvette	Great Northern Landscape Conservation Cooperative/ USFWS	Coordinator
Cottam	Steve	East Bench Irrigation District	Chair, Certified Seed Potato farmer
Cross	Molly	Wildlife Conservation Society	Climate Change Specialist
Cross	Wyatt	Montana State University Water Center	Ecology Professor/Director
Darling	Jim	MT FWP	Habitat Bureau Chief
Davis	Liz	Madison River Foundation	Executive Director
Davis	Tim	DNRC Water Resources	Divison Administrator
Deheza	Veva	Associate, Physical Science Division	NOAA
Dodge	Ted	Jefferson River Watershed Council	Coordinator
Dolan	Larry	MT DNRC	UpMo Hydrologist
Downing	Jen	Big Hole Watershed Committee	Executive Director
Downey	Michael	MT DNRC	Water Planner
Durham	Dan	USDA NRCS	District Conservationist
Econopouly	Thomas	USFWS	Hydrologist
Eiring	Katie	MT DEQ	Missouri Watershed Planner
Esplin	Brent	Bureau Of Reclamation	Area Manager

Evans	Elena	MT Association of Conservation Districts	Executive Director
Farris-Olsen	Erin	Montana Watershed Coordination Council	Executive Director
Gardner	Kristin	Gallatin River Task Force	ED
Gelston	Tim	Federal Emergency Mgmt Agency	Recovery Planning Coordinator
Glosso	Melany	USFS Beaverhead Deer Lodge Forest	District Ranger
Gullett	Kale	USDA NRCS	State Resource Conservationist
Hagenbarth	Jim	Big Hole Watershed Committee	Rancher/irrigator
Hardy	Meredith	Jack Creek Preserve Foundation	BSWC member
Harris	Sierra	TNC/Missouri Headwaters	Freshwater Specialist
Hayes	Mike	U of Nebraska, National Drought Mitigation Center	Director
Heaston	Brian	City of Bozeman	Water Engineer
Heikes-Knapton	Sunni	Madison Conservation District	WS Coordinator
Heinrich	Drew	Jack Creek Preserve Foundation	Programs Coordinator
Higgins	Susan	Center for Large Landscape Conservation	Coordinator
Horton	Travis	MT FWP	Endangered Species Coordinator
Inman	Kris	WCS Community Partners Program	Coordinator
Jaeger	Matt	MT FWP	Biologist
Jensen	Amy	USDA USFS	Region 1 Hydrologist
Johnston	Eric	USDA USFS	Region 1
Kelley	Windy	USDA Climate Center	Regional Extension Program Coordinator
Kilpatrick	John	USGS	MT/ Wyoming Science Center Director
Kluck	Doug	Dept Of Commerce	
Korb	Nathan	The Nature Conservancy	SW Lands Coordinator
Kountz	Jodi	Jefferson River Watershed Council	Drought Coordinator
Kountz	John	Jefferson River Watershed Council	Water user
Kreiner	Holly	Broadwater Conservation District	BSWC member
Kunard	Ethan	Madison Conservation District	Water Programs Manager/BSWC 2014
Laidlaw	Tina	EPA	Environmental Specialist
Leoniak	Lain	City of Bozeman	Water Conservation Specialist
Lucas	Natalie	One Montana	Intern
Lynn	Stephanie	Blue Water Task Force	BSWC member
Mangold	Jane	Montana State University	Invasive Species Specialist
Maplethorpe	Kara	Centennial Valley Association	Former BSWC member/coordinator
Marrs	Alicia	NIDIS	Regional Drought Information Coordinator
McEvoy	Jamie	Montana State University	Professor of Earth Sciences
McGinnis	Stephanie	MT Watercourse/ MT Water Center	Assistant Director
McGrath	Shaun	EPA	Region 8 Director
McNutt	Chad	NOAA/NIDIS	Program Affiliate
Meissner	Justin	USDA NRCS	District Conservationist
Micek	Stephanie	Bureau of Reclamation	Reservoir Operations
Miotke	Dennis	East Bench Irrigation District	Manager
Moore	Sara	WCS Community Partners Program	BSWC member
Myers	Josh	Cascade CD / Sun River Watershed Group	BSWC member
Nulph	Tana	Big Hole Watershed Committee	Conservation Programs Coordinator

Oliff	Tom	Great Northern Landscape Conservation Cooperative/ NPS	Coordinator
Philbin	Mike	BLM/ Montana Dakota field offices	Branch Chief for Bio Resources & Conserv.
Pipp	Michael	MT DEQ	Water Quality Standards
Prill	Kim	Bureau of Reclamation	Outdoor Recreation Planner
Ramsey	Rebecca	Ruby Valley CD/ Ruby Watershed Council	Watershed Coordinator
Reuling	Melly	Center for Large Landscape Conservation	Coordinator
Rice	Tom	Beaverhead Co/ Joint Board of Control	County Commissioner, Chair
Roberts	Mike	MT DNRC	Hydrologist
Sandve	Nikki	Montana Watercourse	Director
Sawatzke	Tom	Bureau of Reclamation	Deputy Area Manager
Savage	Kelly	Bureau of Land Management	Rangeland Mgmt Specialist
Schoonen	Jennifer	Blackfoot Challenge	Water Steward
Schwend	Ann	MT DNRC	Water Planner
Spoon	Ron	MT FWP	Fisheries Biologist
Stout	David	Ruby Valley CD/ Ruby Watershed Council	BSWC member
Strasheim	Kerri	MT DNRC	Regional Office WR specialist
Svoboda	Mark	U of Nebraska/ NDMC	Climatologist, Monitoring Program leader
Sweet	Mike	Montana Climate Office	Research and Information Specialist
Tackett	Katie	Beaverhead CD/ Watershed Committee	Coordinator
Tackett	Kyle	USDA NRCS	District Conservationist
Tubbs	John	DNRC	Agency Director
Velasco	Ryan	CEQ	Whitehouse Council on Env. Quality
Washko	Sarah	Big Hole Watershed Committee	BSWC member
Webster	Meredith	USDA USFS	Region 1
West	Bill	Red Rocks Lakes Wildlife Refuge/USFWS	Project Leader
Zimbric	Joe	One Montana	BSWC member
Zimmer	Bob	Greater Yellowstone Coalition	Water resources

WATERSHED	LOCALLY BASED GROUPS	GEOGRAPHY	NEEDS	ACTIVITIES & CHALLENGES	ECONOMY
Beaverhead and Red Rock Rivers	**Beaverhead CD, Beaverhead WS Committee, Centennial Valley Association**	**Watershed Drainage:** 3,620 **Acre Feet of water produced (annually):** 592,000	Funding for a BSWC member; Community engagement on drought; Develop drought plan; Better understanding of drought forecasting; Increased soil moisture and streamflow monitoring; Triggers for water conservation and to maintain instream flows; Management of wells for water quality; Plan for future supply and demand. Assess opportunities for natural storage.	Land use change and management; persistent drought over the past decade; insufficient overwinter releases for fisheries out of Clark Canyon dam; assessing relationship between soil health and drought resilience; protection of arctic grayling and sage grouse.	Mostly focused on agriculture and recreation interests. ~55% of the land area is federally or state owned. Beaverhead County is the #1 cattle producing and #3 sheep producing county in Montana. Primary crops: alfalfa, hay, potatoes, spring wheat. Angling and tourism are also vital to the local economy.
Ruby River	**Ruby Valley Conservation District, Ruby Watershed Council, Gravelly Landscape Collaborative**	**Watershed Drainage:** 965 sq. mi. **Acre Feet of water produced (annually):** 216,000	Funds to support capacity (e.g., attend meetings; trainings); Community engagement on drought; Better understanding of drought forecasting; Increased soil moisture, streamflow, snowpack and precipitation monitoring; Identification of instream flow triggers; Assessment of drought impacts.	Dewatering of tributaries, irrigation conveyance; competing needs between agriculture and fishing sectors. Previous droughts caused wildfire, reduced stream flows, and reduced water quality and soil health	Livestock production primarily on public land in the upper watershed for summer pasture; recreational fishing, with several fishing lodges and two fly rod manufacturers in Twin Bridges. Approximately 1200 residents.
Big Hole River	**Big Hole Watershed Committee, Big Hole River Foundation, Beaverhead, Mile High & Ruby Valley CDs**	**Watershed Drainage:** 2,500 sq. mi. **Acre Feet of water produced (annually):** 817,000	Funds to support capacity (e.g., attend meetings; trainings); Funding for a BSWC member; Better understanding of drought forecasting; Increased soil moisture monitoring; Identification of drought conservation measures (e.g., irrigation scheduling); Assessment of drought impacts.	In 1997 the BHWC developed the Big Hole Drought Management Plan to mitigate the effects of low water quality for fisheries (particularly the Arctic grayling) through a voluntary effort among agricultural operations, municipalities, businesses	Cattle production; 70% public ownership and 30% private; fishing (blue ribbon trout stream). Fewer than 2,000 year-round residents

Jefferson and Boulder Rivers	**Jefferson River Watershed Council, Lower Jefferson Watershed Council, Jefferson & Ruby CDs**	**Watershed Drainage:** 2,445 sq. mi. **Acre Feet of water produced (annually):** 120,000	**Upper:** Funds to support capacity (e.g., trainings; visit projects); Better understanding of drought planning tools and drought forecasting; Explore need for soil moisture monitoring; Improve ability to monitor, assess and document drought conditions; Increased snowpack and precipitation monitoring; Forest management for water supply. **Lower:** Training support; Community engagement on drought; work to preserve community priorities; educate community on the benefits of soil health; Develop drought plan; Increased soil moisture and precipitation monitoring; Improve ability to monitor, assess and document drought conditions.	Maintaining flow to support the ecosystem, and the fishery in particular; changes in land and water uses; aquatic invasive species; coordinating information among the tributaries	Agriculture and fishing. More than 57% of the land is private; the rest administered by USFS, BLM, and DNRC Trust lands
Madison River	**Madison CD, Madison River Foundation, Madison Valley Ranchlands Group, Wildlife Conservation Society Community Partners Program**	**Watershed Drainage:** 2,510 sq. mi **Acre Feet of water produced (annually):** 1,310,000	Funds to support capacity (e.g., attend meetings; trainings); Better understanding of drought planning tools and drought forecasting; Community engagement on drought; Develop drought plan; Increased soil moisture and precipitation monitoring; Identification of water conservation and instream flow triggers; Assessment of drought impacts; Management of wells for water quality. Plan for future supply/demand issues. Assess opportunities for natural storage.	Development; changing land and water use; chronic dewatering; nutrient overload; irrigation conveyance and infrastructure; ice jams; high percentage of absentee landowners	Agriculture; tourism, abundant wildlife and trout fishing.
Gallatin River	**Upper: Gallatin River Task Force & Jack Creek Preserve Lower: Greater Gallatin WS Council, Gallatin Valley Land Trust, Association of Gallatin Irrigators, Gallatin CD, & City of Bozeman**	**1,800 sq. mi.**	**Upper:** Develop drought plan; Better understanding of drought forecasting; Increased soil moisture and precipitation monitoring; Identification of instream flow triggers; Assessment of drought impacts; Fire preparedness. **Lower:** Funds to support capacity (e.g., attend meetings; trainings); Better understanding of drought forecasting; Increased soil moisture and precipitation monitoring; Identification of water conservation and instream flow triggers; Improve ability to monitor, assess and document drought conditions and assess impacts; forest management for water supply and improved fire preparedness. Assess opportunities for natural storage.	**Upper Gallatin**: Big Sky Resort Development, many absentee landowners **Lower Gallatin**: City of Bozeman is working on drought plan for its municipal water supply; the West Gallatin agricultural users have established a sub-watershed plan to ensure the West Gallatin is not dewatered.	Tourism, fly fishing destination (portions of the upper river have been designated as a blue ribbon trout streams); agriculture; unprecedented growth in Bozeman and the region