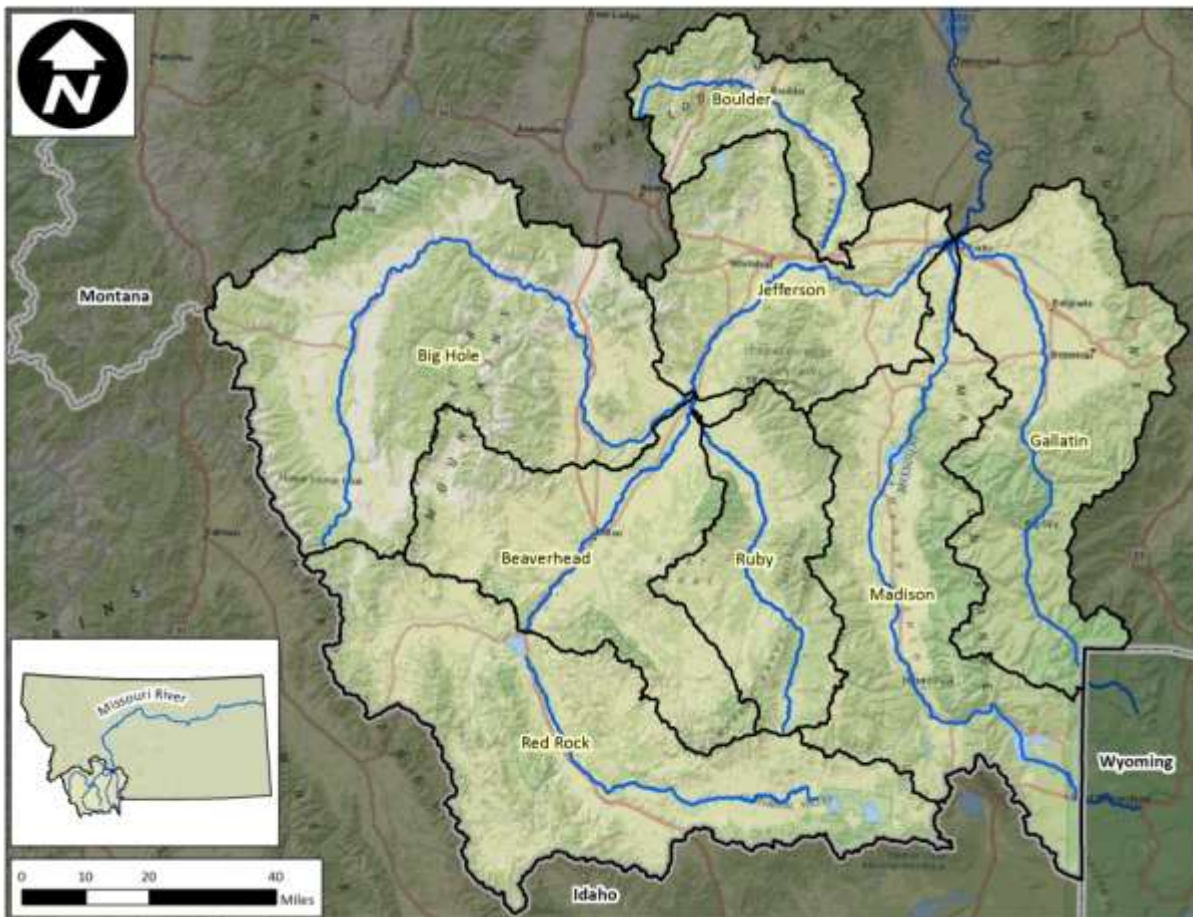


**A WORKPLAN FOR DROUGHT RESILIENCE
in the
MISSOURI HEADWATERS BASIN**

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
<ul style="list-style-type: none"> • 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
<ul style="list-style-type: none"> • 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
<ul style="list-style-type: none"> • 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
<ul style="list-style-type: none"> • 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
<ul style="list-style-type: none"> • 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
<ul style="list-style-type: none"> • 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
<ul style="list-style-type: none"> • 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
<ul style="list-style-type: none"> • 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
<ul style="list-style-type: none"> • 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
<ul style="list-style-type: none"> • 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.

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I. VISION

The need to strengthen drought resilience has never been greater. With rapid changes in land use and increasing impacts from climate change, communities need to identify projects that build long-term drought resilience. The Montana National Drought Resilience Partnership (Montana NDRP) is dedicated to empowering communities to prepare for and mitigate the impacts of drought on ecosystems, livelihoods and the economy.

The overarching goal of the Montana NDRP is to leverage multiple resources to engage communities in drought preparedness planning, and put forward implementation projects that build resiliency in the Missouri Headwaters Basin. Successful drought preparation hinges on local leadership to ensure communities are aware of and invested in the approach, but also coordinated regionally across the broader landscape for greater impact. Local planning gets down to specific issues in sub-watersheds, produces on-the-ground results, and connects watersheds and resources to create greater resiliency throughout the basin.

Traditionally, Federal partners operate from a top-down regulatory framework while local watershed groups tend to work from a bottom-up, community-focused approach. State agencies and organizations often serve as the “go-between” for the two. Montana’s NDRP is the framework for catalyzing across agencies and sub-basins to build local capacity, connect and support water users, and integrate resources. State and Federal partners will coordinate efforts to help meet the technical, financial and capacity needs of the local organizations, while also coordinating the project across the basin. The ultimate challenge lies in finding ways to efficiently deliver resources to communities in a manner that supports rather than directs them, invests in local capacity, and creates locally led, long-term resiliency and sustainability. In building this network, this project will provide a template for drought resiliency applications nationally.

II. DEFINITIONS

Drought: Drought is a deficiency in precipitation over an extended period, usually a season or more, resulting in a water shortage causing adverse impacts on vegetation, animals, and/or people. Human factors, such as water demand and water management, can exacerbate the impact that drought has within a watershed or across a region. Because of the interplay between a natural drought event and various human factors (e.g., growth), drought means different things to different people and can be defined as meteorological, hydrological, or agricultural drought.

- **Meteorological Drought:** Meteorological drought is based on the degree of dryness (in comparison to some “normal” or average) and the duration of the dry period. Drought onset generally occurs with a meteorological drought.
- **Hydrological Drought:** Hydrological drought usually occurs after periods of extended precipitation shortfalls that impact water supply (i.e., streamflow, reservoir and lake levels, ground water), potentially resulting in significant societal impacts.
- **Agricultural Drought:** Agricultural drought links characteristics of meteorological or hydrological drought to agricultural impacts, focusing on precipitation shortages, soil water deficits, reduced ground water or reservoir levels needed for irrigation, etc.

Resilience: Resilience is an ability by people or systems to adapt to stress and adversity. Drought resilience responds to the stress of drought in both communities and in ecosystems. In ecology, resilience is the capacity of an ecosystem to respond to a disturbance by resisting damage and recovering quickly. Community resilience is the ability to anticipate risk, limit impact, and utilize resources to bounce back from change or stress. The phrase, “building drought resiliency”, is used to describe the goals of national drought-related efforts and the Montana demonstration project. Ensuring a common understanding of what drought and resilience mean is critical to identifying measures of success for this project.

III. BACKGROUND

Project History

As part of President Obama’s Climate Action Plan, in November 2013 the Administration launched a multi-agency National Drought Resilience Partnership (NDRP) to provide federal support to communities and resource managers to improve drought preparedness and information transfer. Federal NDRP partners include USDA, DOC/NOAA, DOI/BLM, FWS, BOR, BIA, EPA, DOE, FEMA, and others. NDRP also leverages the work of Federal and State investments such as the National Integrated Drought Information System (NIDIS) and the National Drought Mitigation Center (NDMC).

Under the leadership of Governor Steve Bullock of Montana, the State and NDRP announced a drought demonstration project for Montana’s Missouri Headwaters Basin in July 2014. The Montana NDRP demonstration project is a collaborative effort of the Federal and State agencies, NGOs, and local watershed stakeholders. The project pursues a “proof of concept” around long-term drought resilience by demonstrating how improved drought mitigation can be achieved with better coordination of Federal agency resources to support efforts in the Missouri Headwaters Basin (Basin). This project also builds on drought mitigation recommendations in Montana’s recently updated State Water Plan.

The Basin, which includes the area upstream of the confluence of the Madison, Gallatin and Jefferson Rivers and their tributaries at Three Forks in southwest Montana, was selected by the Montana NDRP because of its diverse conditions and existing partnerships with community watershed organizations. Adjacent to Yellowstone National Park, the Basin sustains valuable natural resources in a river system that is critical to many downstream water interests. The area is also prone to frequent drought, and is marked by rapid population growth, shifting demographics, and land and water uses.

Montana NDRP partners believe that successful drought preparedness is rooted first in communities and guided by invested leaders in the approach. Accordingly, the plan will recognize water management issues of the watershed and produce on-the-ground results. The Montana Department of Natural Resources and Conservation (DNRC) proposes to accomplish this goal by leveraging State and Federal resources to build local capacity. The Basin has several actively engaged soil and water conservation districts (CDs), watershed and water user groups, and non-governmental organizations (NGOs) (see Appendix A). These groups represent a broad range of stakeholders; have local knowledge, leadership and respect; and actively engage water users in their watershed communities. They also address many natural resource topics, including water quality and quantity, weeds, environmental education and land use planning.

Right now, the level of drought planning varies greatly across the Basin from actively engaged to the very early stages of awareness. Many seek guidance, technical assistance and tools on how to best plan in the absence of financial or human resources to dedicate solely to proactive drought planning and soil health. Montana's natural resource agencies provide technical assistance, but have limited staffing resources and a very large and geographically diverse landscape to cover.

Process

The Federal and State partners met in November 2014 and outlined a framework for implementing the demonstration project. In March 2015, NOAA, NIDIS and NDMC hosted a Building Drought Resiliency workshop in Bozeman for all of the Basin watershed groups/CDs and their Big Sky Watershed Corps AmeriCorps (BSWC) members (50 participants). The workshop outlined the national tools and resources available to assist in drought response. At the workshop, many groups realized the need for in-depth follow-up and one-on-one assistance to better utilize the resources and implement the tools. Thus, the planning team focused on direct support to local organizations to develop their local plans. In September 2015, the Federal, State and local partners met in Dillon (80+ participants) to share the status of activities, needs and goals of the local watershed organizations. The group used this information to identify strategies to meet the Missouri Headwaters Drought Resilience Demonstration Project objectives. This document is the outcome of the September workshop and serves as a tool for guiding drought resiliency planning in the Basin moving forward.

Landscape and Watershed Group Descriptions

The Basin includes the three forks of the Missouri River—the Jefferson, Madison, and Gallatin Rivers—and tributaries to these. The headwater streams originate in mountain ranges that rise up to 11,000 feet and receive substantial rain and snow. Valley bottoms are drier and range in elevation from 4,000 to 6,000 feet. Streamflows in the headwaters are snowmelt dominated, typically peaking in late May or early-to mid-June, coincident with peak mountain snowmelt and spring rains. Average annual precipitation ranges from about 10 inches in the drier valleys and prairies, to about 80 inches at the highest elevations, with an average of about 19 inches across the Basin. Water uses include hydropower, industrial, mining, municipal, domestic, recreation and tourism, but almost 98 percent of water diverted in Montana is for agricultural use, estimated at almost 12 million acre-feet annually. The area is also a nationally renowned fly fishing destination. Land ownership in the basin is a combination of private (3,750,826 acres), State (654,013 acres) and Federal (4,563,529 acres). Most of the valley bottoms are privately owned, while the USFS and BLM administer most of the higher elevations.

There are many community-based conservation organizations working within the 8 sub-watersheds. While all vary slightly in their structure, each works to solve natural resource issues collaboratively from within the community. Appendix A summarizes these local stakeholder groups, and Appendix B summarizes the geography, land-use, economics, environmental considerations, and needs for each watershed in the Basin.

Structure of the Partnership

A goal of this workplan is to develop and organize a collaborative network of stakeholders that builds drought resilience across the Missouri Headwaters landscape. Critical to the success of the plan is working with local groups to fully understand their capacity, expertise and needs, and then effectively link all efforts in a coordinated drought management workplan. One of the outcomes of the project is to define partnerships, agreements, shared resources, optimal methods of communication, and implementation of drought management tools across the landscape.

IV. WORKPLAN GOALS and OBJECTIVES

Water management in the Basin is complicated by the fact that it is administratively closed to new surface water appropriations, and Montana administers groundwater and surface water conjunctively, thereby limiting new developments. This means that water managers and stakeholders must have contingency plans in place that adapt to ever changing water supply and demand regimes, especially during times of drought. It also means that the efforts need to be well coordinated and meet multiple local and regional objectives while adhering to the prior appropriation doctrine.

When Montana NDRP partners and local watershed groups met in Dillon, Montana in September 2015, they considered many goals for drought preparedness and mitigation in the Missouri Headwaters Basin. Agreed-upon workplan goals follow, which directly address the ability of these partners to respond to drought in the Basin to maintain healthy and productive lifestyles and landscapes. The three overarching goals are equally important to the success of this 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 Resiliency**

Within each of these broad goals the group identified objectives and implementation tasks. All recognize that this workplan must itself be resilient, and remain open to refinement as the tasks are implemented and the project grows.

GOAL 1: PROVIDE TOOLS FOR MONITORING, ASSESSING AND FORECASTING
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Forecasting and monitoring is essential for any level of drought planning. During the workshop, watershed groups and Federal partners identified areas for improvement in and delivery of drought forecasting, soil moisture and dam sedimentation monitoring, installation of streamflow gages especially in tributaries, collection of precipitation data, identification of flow triggers, snowpack monitoring, irrigation scheduling and overall assessment of watershed hydrology and potential drought impacts.

Objective A: Develop a Drought Monitoring Network

The challenge lies in how to address data gaps and compile information. Insufficient soil moisture and stream flow data hamper local and regional efforts to inform drought assessments and forecasting. To predict and assess drought conditions, we need to address data gaps and ensure information is integrated and accessible to landowners. Both long-term and short-term forecasting tools are needed, and at a level of accuracy that is meaningful for informed decisions. Agencies need to deliver data that are organized, easily understood, and relevant to a particular watershed or basin. The Drought Monitoring Network will maximize the value of current resources and match data collection and dissemination to the need.

Implementation Task: Coordinate a monitoring network to support local and regional needs.

Survey watersheds to determine need to:

- Develop a monitoring network that is resilient and sustainable
- Raise awareness of the information that is available

- Develop a monitoring network guide for watershed groups
- Create an information clearinghouse portal
- Summarize hydrologic information across the watersheds

Implementation Task: Expand soil moisture monitoring.

Soil moisture monitoring provides indicators to assess local site conditions and improve irrigation system management. Installation of soil moisture probes locally and across the Basin will help predict future drought vulnerability and could be used to validate drought indices derived from satellite imagery. Developing a cost-effective soil moisture monitoring network that provides valuable information to local landowners while ensuring data collected are compatible with existing networks (e.g., Mesonet) will serve as a prototype for other areas across Montana and nationally.

Implementation Task: Expand streamflow monitoring to address data gaps.

Additional stream gaging information on tributaries can help track instream flow conditions, recognize when drought-planning action is needed based on temperature or flow conditions, and measure improvements resulting from drought resiliency efforts. This informs solutions and engages landowners in documenting progress. Stream monitoring can be expanded by using various rated options: Real time sensors, data loggers, seasonal gages, staff gages on smaller tributaries, etc. Specific locations will be identified through a regional monitoring network, and form discussions/interest of local coordinators, water users and landowners.

Implementation Task: Expand precipitation monitoring (CoCORaHS).

Like soil moisture monitoring, monitoring precipitation is important for individual landowners and for assessing drought conditions. The Community Collaborative Rain, Hail and Snow Network (CoCORaHS) is the largest coordinated provider of daily precipitation observations in the States. Expanding the CoCORaHS network in the Upper Missouri watersheds and integrated it into information collected from existing weather or AgriMet stations will refine the scale of precipitation data within the Basin.

Objective B: Develop a Portal to Share Monitoring, Assessment and Forecasting Information across the Network

Communicating monitoring information to landowners, watershed coordinators and local decision makers provides better understanding of current and historic conditions and informs decision making for drought planning at multiple scales. Satellite imagery to supplement on-the-ground data can be incorporated as another tool to improve our understanding of drought conditions.

Implementation Task: Explore and compile existing data to create a central information portal on Basin-specific data accessible to all water users.

The portal will disseminate data compiled from the Governor’s Drought Advisory Task Force, NOAA, NIDIS, and NDMC to users throughout the Basin.

GOAL 2: DEVELOP LOCAL AND REGIONAL CAPACITY TO PLAN FOR DROUGHT

Water is a shared resource that is already over-allocated in the Missouri Headwaters Basin. If drought occurs with greater regularity in the area, there will be more conflict among users, as well as increasing

impact on the environment and ecosystem services. One of the greatest and most fundamental challenges of drought response is engaging the community of water users to collectively agree on the best ways to use and distribute water during times of scarcity. This organizational task falls to the community watershed groups who first need capacity to carry out their work.

Objective A: Build and Engage Local Capacity for Drought Planning

This includes basic support to local watershed groups and conservation districts such as staffing (coordinator and/or BSWC member), project development and coordination, trainings, and support for travel and office supplies. Sources of funding will need to be explored, from local to Federal government capabilities.

Implementation Task: Assure adequate staffing and operational needs.

Community-based groups often operate with less than 1 FTE to carry initiatives forward, visit field sites, engage stakeholders, connect watershed activities, seek funding and implement projects. These chronically underfunded groups provide information and context for regional drought planning and the job cannot be done without their community relationships and outreach. Big Sky Watershed Corps AmeriCorps (BSWC) members provide valuable short-term assistance and can help a small organization build new programs or relationships. However, long-term capacity is often lacking in the day-to-day workings of local groups, and permanent staffing and basic operational support (computer, printer, laptop, etc.) are vital.

Implementation Task: Provide consistent drought mitigation trainings and technical assistance.

All watershed group representatives said that trainings and direct technical assistance would significantly improve their ability to follow through with drought planning. Technical assistance could be provided through webinars, newsletters, or directly through state or federal field staff assistance.

Objective B: Increase Local Awareness of Drought and Supply Planning, Forecasting and Mitigation.

Creative and consistent methods for communicating about drought will better engage people who live in the Missouri Headwaters landscape. Ultimately, regional messaging will help reduce workload burden on local groups, while offering digestible information that connects watershed groups to the larger effort and helps market and build drought resiliency. However, some communities are not generally receptive to this information because the region is typically arid and most feel that drought is just a way of life. Finding ways to talk about drought based on issues that resonate with the community (i.e., securing water supply) will build engagement. Future drought challenges associated with changing climate and growing populations may be of a magnitude not yet experienced by these communities.

Implementation Task: Inventory and assemble local community member lists and conduct awareness workshops.

Key to planning for drought and building drought resilience is getting the participation of the water users. This requires focused outreach and education within the watershed, and identification of local leaders who will carry the effort forward as new information is provided.

Implementation Task: Develop creative communication and outreach tools to engage local leaders in the planning process.

This may involve assembling and coordinating a Local Drought Task Force

Implementation Task: Develop a marketing or branding strategy for drought and the demonstration project.

This could include: 1) installation of road signs with information on drought conditions similar to fire warning signs, 2) a regional drought hotline where citizens or watershed groups can call for drought information (similar to a ski/avalanche report), 3) streamlined, consistent, easy-to-read drought reports that could be distributed within the watershed, and 4) development of a regional drought resiliency website with go-to tools and local contact information for drought assistance. Careful thought needs to go to messaging around meteorological, hydrological and agricultural drought triggers as appropriate for the local watersheds.

Objective C: Provide the Tools and Technical Assistance to Help Local Groups Strategize and Develop Drought Plans

Each watershed group is at a different stage of community engagement and participation in drought planning. Some watersheds have drought plans, some are working on them, and others have not even been able to start conversations with stakeholders. Developing these plans can be an intimidating and time-consuming process for small, capacity challenged organizations. Moving forward will require building capacity and community engagement (Objectives A and B), but also a systematic, regional approach to providing information on drought planning. Once local plans are in place, they can be integrated into a Missouri Headwaters Basin Plan.

Implementation Task: Monitor and identify risks, vulnerabilities and supply/demand triggers.

These include setting minimum flow targets that reflect communities' desire for overall healthy river systems and instream flows.

Implementation Task: Set systems in place to manage voluntary agreements.

Objective D: Connect Local Drought Plans at the Regional Scale

Existing drought plans establish triggers and water conservation measures based primarily on local water resources and do not consider downstream impacts. There is a need to marry these local plans into an overarching drought preparedness plan at the broader Missouri Headwaters scale. This regional-scale drought plan could also be integrated with the Lieutenant Governor's drought plan and build from key elements or lessons learned from the State Water Plan. An inherent challenge in this effort is ensuring that a regionalized plan is not perceived as top down, and is developed instead from the local level up to the broader scale. This approach hinges on communication among groups and offers an opportunity for testing innovative drought planning concepts.

Implementation Task: Review local plans and merge into a regional drought preparedness plan for the entire Missouri Headwater Basin

Implementation Task: Explore agency drought plans.

Connect local drought planning efforts with State and Federal agencies' drought plans, like those prepared by BLM and others.

Objective E: Develop a Regional Network to create a Streamlined Structure to Share Learning, Coordinate and Pursue Funding Opportunities, and Deliver Resources across the Basin

There are many local, State and regional partners and efforts already working in the Basin – each with their own unique tools, expertise, and funding mechanisms. Due to limited resources, groups often compete for the same funding sources for very similar projects. Small grants are often expensive to manage, especially for local watershed groups. A regional framework/funding mechanism could provide a clearinghouse for managing State and Federal funds that could then be sub-awarded to the smaller groups. Moving State and Federal funding to locals would increase the success of the community watershed organizations. This objective invests in building collaboration and communication among watershed communities and supports information-sharing among Federal, State, and local partners. Compiling and organizing these complementary tools, funds and activities into a collaborative regional network will increase understanding, improve efficiency and ensure successful implementation. A regional framework could clarify roles and responsibilities, build communication and outreach strategies, and streamline funding mechanisms.

Implementation Task: Build a network/framework that unifies, coordinates and simplifies the delivery and sharing of resources.

The framework should include:

- an agreement among stakeholders
- a support or backbone communications structure to coordinate the program, manage communications, organize shared learning and track progress.
- development of templates for long-term sustainability of the framework at watershed scale
- a communications outline to guide outreach strategies of the Montana NDRP stakeholders, and to share and distribute information at different levels (local, State, Federal)
- a model for subscriber-based funding and innovative ways to share funds.

GOAL 3: IMPLEMENT LOCAL PROJECTS TO BUILD REGIONAL DROUGHT RESILIENCE

Building drought resilience requires an integrated approach to balance changes in supply and demand. Activities and projects that build resilience must be initiated locally, but produce cumulative results. A suite of smaller, on-the-ground projects that work within the natural system to store water more effectively in wetlands, floodplains and riparian areas; improve soil health strategies; and increase conservation measures and the wise management of forests and uplands will all contribute to improved drought resilience.

Objective A: Increase Water Conservation Measures

Although Southwest Montana has experienced drought and water shortages many times, most communities rarely implement watering restrictions or think about how they might reduce household or on-farm water consumption. Simple water conservation measures, like high efficiency appliances and low flow toilets, especially in municipalities, can have a dramatic impact on water consumption. Improved irrigation management for both domestic lawns and farm/ranch operations can reduce the amount of water diverted and consumed by these sectors. This involves a greater understanding of return flow impact on agricultural operations and on streamflow. Education and outreach, efficient water metering, irrigation audits, and incentives can help communities better conserve their water.

Implementation Task: Work with the municipalities in the Basin to develop water conservation campaigns and measures.

Implementation Task: Work with the farmers/ranchers in the Basin to implement water conservation and irrigation efficiency and delivery measures.

Activities are underway in the Basin, and may provide avenues for project implementation and water conservation going forward. For example, the USDA, through the Farm Bill Environmental Quality Incentives Program (EQIP), and the efforts of the Natural Resources Conservation Service (NRCS), work with landowners to design and implement agricultural projects that improve irrigation and conveyance efficiencies, soil health practices, alternative cropping, and range and pasture management, etc.

Objective B: Ensure Riparian, Floodplain and Water Management Measures Are in Place

At the heart of drought response are effective agreements and projects that modify how water is managed in streams, in storage (in reservoirs, soils and riparian areas), in the ground, and in on-the-ground water conservation and management projects. Well thought-out agreements for storage and delivery often define drought mitigation plans and hinge on a number of factors including water rights enforcement, conservation practices, setting minimum flow targets, future supply and demand planning, and storage/delivery agreements.

Implementation Task: Inform the public of the value of riparian areas and floodplains for improved water holding capacities.

Most of the river bottoms and riparian areas are privately owned and are not subject to local zoning or land use regulations, unless they are subdivided. Local conservation districts have permitting authority over projects that lie within the mean high water mark of perennial streams and the banks immediately adjacent. Local floodplain administrators review building permit applications, but their role is to protect humans and structures from flood, not encourage it. Efforts should help landowners and communities understand the inherent value of allowing floodplains to maintain their natural function of mitigating during high water and storing for times of scarcity.

Implementation Task: Assess and improve natural storage capacity.

Assess floodplain limitations and review opportunities for increasing natural storage capacity. Include channel migration and floodplain mapping, as well as a survey of road crossings and culverts in floodplains that affect floodplain storage.

Implementation Task: Install off-stream stock water tanks to reduce impacts to riparian areas and to facilitate upland grazing management.

Implementation Task: Consolidate and maintain points of diversion to improve efficiencies.

Where prescribed, install high-tech water distribution networks with real-time gages on all head gates and major return flow points (See Goal 1).

Implementation Task: Implement hybrid sprinkler/flood systems that transition as flows change.

Consistent calculations and improved understanding of timing and amount of return flows are needed for making the best management decision for these systems.

Objective C: Ensure Effective Upland Management Measures are in Place

Managing uplands to enhance water quality and quantity builds drought resilience in the Basin. A large area of the headwaters contains federally managed public lands (USFS, BLM and USFWS) and good management of these lands is vital to water quantity and quality in the region. The USFS is the largest Federal land management agency in the Basin (38 % -3,367,706 acres). Prolonged drought increases the incidence and intensity of disease and catastrophic fires in the uplands. The area is also experiencing conifer encroachment on the lower slopes and along riparian areas, that some believe is impacting water availability. Management of these lands includes forest and riparian management, grazing and livestock management, and soil and weed control to protect and improve water supply and storage. The river valleys are primarily privately owned, but also important for floodplain and riparian management and are best managed through locally led land use planning efforts combined with education and outreach. Montana Conservation Districts have statutory authority through the Montana Natural Streambed and Conservation Act (310 law) that provides local oversight and governance for projects in the beds and banks of perennial streams. The NRCS and local CDs will be helpful partners in facilitating technical assistance, engaging private landowners, and working to implement collaborative conservation projects in both upland and river valley settings.

Implementation Task: Demonstrate integrated management on public lands, and collaborate to implement projects that protect water quantity and quality in the headwaters.

Ideas to explore include: geomorphological studies, channel migration and floodplain mapping, road and culvert assessments, soil/riparian improvements, off-stream water sites, increased habitat connectivity, increase natural storage and wetland capacity, beaver mimicry projects, upland mesic/wet meadow restoration, floodplain health requirements, soil health improvements, and improved landowner relationships.

Implementation Task: Develop a suite of soil and upland health demonstration projects in the Missouri Headwaters.

Installation of soil and upland health demonstration projects in different watersheds throughout the Basin can help educate landowners about the economic and ecological benefits of soil building techniques in times of seasonal and long-term drought. These projects will provide education and outreach tools and offer a proof-of concept.

Implementation Task: Explore the impacts of conifer expansion and water yield.

The NRCS, through the Sage Grouse Initiative and a network of partners, is producing spatial data that characterizes conifer coverage across Sage Grouse states. These data, coupled with efforts to identify areas where conifers have encroached into landscapes where they historically were not present, will help NRCS help landowners implement projects to reduce conifer expansion on appropriate sites.

Implementation Task: Study, understand, and implement practices that improve soil health and moisture holding capacities. Develop a suite of soil and upland health demonstration projects in the Missouri Headwaters that emphasizes the economic and ecological benefits of soil building techniques in times of seasonal and long-term drought. Coordinate with NRCS and Soil and Water Conservation Districts of Montana to host soil health workshops and technical outreach to area landowners interested in implementing soil health practices.

APPENDIX A. Montana NDRP Stakeholders

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

Last	First	Affiliation	Title
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	US Army Corps Of Engineers	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

Last	First	Affiliation	Title
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

Appendix B: Characteristics and Geography of Watersheds in the Missouri Headwaters Basin

WATERSHED	LOCALLY BASED GROUPS	GEOGRAPHY	NEEDS	ACTIVITIES & CHALLENGES	ECONOMY
Beaverhead and Red Rock Rivers	Beaverhead CD, Beaverhead WS Committee, Centennial Valley Association	<p>Watershed Drainage: 3,620</p> <p>Acre Feet of water produced (annually): 592,000</p>	<p>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.</p>	<p>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.</p>	<p>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.</p>
Ruby River	Ruby Valley Conservation District, Ruby Watershed Council, Gravelly Landscape Collaborative	<p>Watershed Drainage: 965 sq. mi.</p> <p>Acre Feet of water produced (annually): 216,000</p>	<p>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.</p>	<p>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</p>	<p>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.</p>
Big Hole River	Big Hole Watershed Committee, Big Hole River Foundation, Beaverhead, Mile High & Ruby Valley CDs	<p>Watershed Drainage: 2,500 sq. mi.</p> <p>Acre Feet of water produced (annually): 817,000</p>	<p>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.</p>	<p>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,</p>	<p>Cattle production; 70% public ownership and 30% private; fishing (blue ribbon trout stream). Fewer than 2,000 year-round residents</p>

<p>Jefferson and Boulder Rivers</p>	<p>Jefferson River Watershed Council, Lower Jefferson Watershed Council, Jefferson & Ruby CDs</p>	<p>Watershed Drainage: 2,445 sq. mi. Acre Feet of water produced (annually): 120,000</p>	<p>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.</p>	<p>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</p>	<p>Agriculture and fishing. More than 57% of the land is private; the rest administered by USFS, BLM, and DNRC Trust lands</p>
<p>Madison River</p>	<p>Madison CD, Madison River Foundation, Madison Valley Ranchlands Group, Wildlife Conservation Society Community Partners Program</p>	<p>Watershed Drainage: 2,510 sq. mi Acre Feet of water produced (annually): 1,310,000</p>	<p>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.</p>	<p>Development; changing land and water use; chronic dewatering; nutrient overload; irrigation conveyance and infrastructure; ice jams; high percentage of absentee landowners</p>	<p>Agriculture; tourism, abundant wildlife and trout fishing.</p>
<p>Gallatin River</p>	<p>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</p>	<p>1,800 sq. mi.</p>	<p>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.</p>	<p>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.</p>	<p>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</p>

