

UNIVERSITY OF MONTANA/MTNHP WETLAND PROGRAM PLAN

CREATING COMPREHENSIVE WETLAND/RIPARIAN MAPPING, TOOLS, AND SCIENCE-BASED
INFORMATION FOR MONTANA AND THE WEST

PLANNING YEARS 2021-2025



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Background

The mission of the Montana Natural Heritage Program (MTNHP) is to be Montana's source for reliable, objective information and expertise to support stewardship of our native species and habitats, emphasizing those of conservation concern. The MTNHP was created by the Montana legislature in 1983 as part of the Natural Resource Information System (NRIS) of the Montana State Library (MSL). MTNHP is "a program of information acquisition, storage, and retrieval for data relating to the flora, fauna, and biological community types of Montana." (MCA 90-15-102). The MTNHP's activities are guided by statute (MCA 90-15) as well as through ongoing interaction with and feedback from principal data source agencies. Since the first staff was hired in 1985, the Program has logged a 35-year record of success, and developed into a highly respected, service-oriented program. Currently the program has an annual budget of approximately \$3 million and a staff of over 20 professionals with expertise in zoology, ecology, botany, database management, and geographic information systems. MTNHP is widely recognized as one of the most advanced and effective of over 80 natural heritage programs throughout the western hemisphere.

The enabling legislation for the MTNHP provides the State Library with the option to contract the operation of the Program, and to make available state resources and facilities as part of the contract for services. Since 2006, MTNHP has been operated by the University of Montana (UM) through a renewable 2-year contract with the Montana State Library. MSL receives legislative funding for the core program operations, and the MTNHP leverages that core funding to acquire additional funds through the University of Montana's Office of Research, Sponsored Programs and Creative Scholarship. MTNHP currently has over \$2 million in state, federal, and private contracts.

MTNHP's Wetland Program is part of our Ecology Program, under the direction of the Senior Ecologist and the Spatial Analysis Lab Director (separate positions since 2018). We have offices at the Montana State Library in Helena, Montana and at the University of Montana in Missoula, Montana. Staff working in the Wetland Program include an Ecologist/Projects Manager, a Staff Ecologist, a Wetland Mapping Coordinator, an Ecologist/Remote Sensing Specialist, eight Ecologist/GIS Specialists, a Vegetation Ecologist and two Ecologist/GIS Analysts. During the summer, these staff are assisted in field surveys and assessments by trained seasonal botanists and ecologists, many of whom return to MTNHP each year. We also benefit from paid and unpaid interns and graduate students who fill roles ranging from field support to data entry. Collectively, Wetland Program staff have decades of experience with spatial analysis, monitoring and assessment, site descriptions, reporting, and project management. We are actively involved with professional societies and regularly report on our research findings at local, regional, and national conferences.

The University of Montana and the Montana State Library are currently negotiating the future organization and management of the Montana Natural Heritage Program. The likely outcome is that information services staff who manage databases and websites will become employees of the Library, while science-based staff (which includes all staff of the Ecology Program) will remain with the University. The two parts of the program will continue to ensure that collected and created data will be

made available to all through a data dissemination site housed at the Library.

Partnerships and collaboration

MTNHP's planning and activities are informed through annual meetings and informal communications with a partner committee that includes representatives of the major federal land agencies, the NRCS, the EPA, state agencies, Tribes, NGOs, and the private sector. We have regular data exchanges with the USFS and the BLM, and provide wetland data in response to data requests from agencies, planning departments, weed districts, private landowners and other stakeholders. We work collaboratively with the NRCS on land cover classification and analysis, and share information formally and informally with members of the Montana Wetland Council (MWC), the NatureServe network, Montana Tribes, and university faculty and students. We have several interactive web applications that allow users to identify species and habitats of concern, and download custom maps. We support Montana Department of Environmental Quality (MT DEQ) Wetland Program, which has seen reductions in staff, by providing outreach and training. For example, our staff remain active members of the Montana Wetland Council, and we hosted its only public science-based meeting in 2019. Our Spatial Analysis Lab in Missoula is actively engaged in a number of state and region-wide training and applied research projects for the US Fish and Wildlife Service, BLM, BIA, and Macrosystems Biology, National Science Foundation. We collaborate regularly with Regional Specialists in ecology, botany, wildlife, fisheries, and planning. Since 2018, the Ecology Program has been partnered with the Bureau of Land Management's National Operations Center to conduct lotic, riparian and terrestrial surveys, and to map wetlands and riparian areas, on BLM lands across the West, including most Region 8 states (Montana, South Dakota, Wyoming, Utah and Colorado). We are active participants in regional and national wetland mapping consortia, the National Wetland Monitoring and Assessment Workgroup, the Association of State Wetland Managers, the Montana Association of Geographic Information Professionals, and several professional societies. We are theme stewards for the Montana Spatial Data Infrastructure (MSDI) Wetlands and Land Cover Themes, and collaborate with other theme stewards, especially Hydrography and Elevation. In addition to funding from the BLM, our wetland mapping work is currently funded by the National Wetlands Inventory (USFWS), the US Forest Service, Glacier National Park, the Natural Resource Conservation Service, the Montana Department of Fish, Wildlife and Parks, and the Prairie Pothole Joint Venture. We are also using return on overhead from the University of Montana to fund mapping of private land areas without agency sponsors.

Montana is unique in that we have two state agencies, The University of Montana MTNHP and the MT DEQ, working to advance the goals defined in Wetland Program Plans. Although staffing cuts at MT DEQ have reduced opportunities for collaboration, MTNHP staff are members of the MWC Steering Committee. We are working with MT DEQ and other partners to develop the new Strategic Framework for Wetland and Riparian Area Conservation and Restoration in Montana. This Wetland Program Plan, as well as the 2016-2020 plan it replaces, is designed to advance common objectives of the University of Montana MTNHP and partners across the state.

Accomplishments under the 2016-2020 Wetland Program Plan

In our previous Wetland Program Plan (MTNHP 2016), we articulated a goal statement and identified nine strategic actions to advance it. The goal statement was:

“Public and private partners rely on the Montana Natural Heritage Program as Montana’s authoritative source for wetland and riparian mapping, monitoring and assessment tools, and science-based information on the distribution, extent, condition and biodiversity significance of the state’s wetlands and riparian areas. All mapping, data and information is readily available and easily accessed in multiple formats, including interactive web-based delivery.”

The actions included 1) Completing statewide wetland and riparian mapping, and developing a plan for ongoing remapping in areas where rapid land cover or land cover change has occurred; 2) developing an MT-NWI+ product; 3) Refining our wetland assessment methodology; 4) Promoting the identification, description and voluntary protection/restoration of biologically and ecologically significant wetlands; 5) Continuing to establish a network of sites for long-term trend monitoring; 6) Developing integrated databases of assessment data; 7) Ensuring that MTNHP maps and data are compatible with the National Vegetation Classification Standard; 8) Participate in scientific and professional meetings, workgroups, interdisciplinary teams and the Montana Wetland Council; 9) Deliver high-quality training to agency and private sector professionals to help them identify, manage and restore wetland biological resources.

While some of this work is ongoing and included in this successor WPP, we made significant accomplishments under each objective. For example:

- We have mapped over 3.2 million acres of wetlands and riparian areas in Montana, completing almost 2500 USGS quadrangles (1:24K scale). Working with the National Wetlands Inventory and the Montana Department of Environmental Quality, we have assembled a statewide layer of digital wetland mapping that combines our current mapping, historical mapping which has not yet been replaced by current mapping, and USGS scalable mapping for areas where not even historical mapping exists. This statewide layer can be accessed from our webpage, from our MapViewer web application or from the Montana Geospatial Data Clearinghouse. We have also prepared extensive metadata, handouts, and information resources to help users understand the limitations and appropriate uses of each type of digital mapping.
- We have continued to attract funding from partners for mapping. During the period covered by this WPP, in addition to support from the EPA, we have received funding from the BLM, USFWS, US Forest Service, Montana Fish Wildlife and Parks, the Prairie Pothole Joint Venture, and others.
- We have trained a new cadre of wetland mappers who are cross-trained in range and aquatic ecology. In the past year, we have added ten full and part time wetland mappers.
- We developed and applied a methodology to identify areas where land cover/land use change has affected the extent, distribution, or types of wetlands and riparian areas. This allowed us to attract targeted mapping funding from the Montana Department of Environmental Quality, the Montana Department of Fish, Wildlife and Parks, the Montana State Library, the Natural Resource Conservation Service, the Bureau of Land Management, the US Forest Service, Glacier National Park, the US Fish and Wildlife Service, and the Prairie Pothole Joint Venture, as well as from the US EPA.

- We developed a MT NWI++ product, which is continually updated as new mapping is completed. This product includes a user guide, ArcGIS models, and automated routines.
- We enhanced our existing wetland mapping through the addition of Landscape Position, Landform, Water Flow Path, and Waterbody Type (LLWW) descriptors. In 2019 and 2020, we collaborated with St. Mary's University of Minnesota, the Colorado Natural Heritage Program and the Utah Geologic Survey to finalize a common, west-wide set of LLWW descriptors, and secured Bureau of Land Management funding to develop scripts and models that could automate most of the attribution process.
- NHP's Senior Ecologist, Linda Vance, published a chapter on wetland functional assessments using LLWW in Dorney, Savage and Tiner's *Wetland and Stream Rapid Assessments* (Elsevier 2018).
- We carried out surveys for the 2016 National Wetland Condition Assessment in Montana.
- We established reference standards for forested wetlands, an ecologically significant class of wetlands in Montana.
- We built a suite of GIS screens and tools to identify "Wetlands of Special Significance" in Montana, and added this attribute to our mapping. We also presented on this project at the 2018 Region 8 wetland meeting in Boulder.
- Following work done in Oregon, we created an Index of Alien Impact for Montana wetlands, and presented on this project at the 2018 Region 8 wetland meeting in Boulder.
- We identified fire-affected wetlands in Montana, described their characteristics, collected baseline data, and analyzed the factors predicting fire response. We presented on this work at the National Monitoring Conference in Denver in 2019.
- We selected a number of sentinel wetlands that could be monitored over time to detect climate change impacts, and added these wetlands to our monitoring database.
- We expanded our network of documented reference wetlands to include more wetland types in the full range of conditions.
- We integrated multiple years of monitoring and assessment projects into a single searchable database.
- We worked with multiple land management partners and agencies to help them identify, monitor and protect their wetland resources, including but not limited to the Bureau of Land Management, the US Forest Service, and the National Park Service.

Wetland Program Planning 2021-2025

As part of a research University, the MTNHP partners with federal agencies, other Heritage programs, University researchers, and non-profits both in Montana and beyond. Some of this is done through the NatureServe network of Heritage programs, but increasingly, we form and join partnerships to respond to particular funding opportunities or specific resource management needs. For example, the Montana Natural Heritage Program, the Colorado Natural Heritage Program and the Wyoming Natural Diversity Database have partnered on a 5-year contract with the Bureau of Land Management for stream assessments in Montana, Wyoming and Utah; MTNHP works with St. Mary's University of Minnesota to map wetlands across the West; and MTNHP and private partners are conducting rangeland surveys in Montana and Wyoming. While our Wetland Program is still Montana-focused, we see opportunities to leverage partnerships to create a strong Western network of Wetland Programs, and to take the lead on some program elements so that others can benefit from the skills and knowledge we have developed over

years of program development. In the next five years, we will continue to develop our Montana Wetland Program using funding from Montana-based partners and Region 8 WPDGs, but we will also work to establish regional leadership in mapping and remote sensing. We will also engage in regional to national efforts with other partners, pursuing funding from federal partners and National WPDGs.

Goal statement:

The University of Montana's Montana Natural Heritage Program is recognized as an authoritative regional source for wetland and riparian mapping and remote sensing of wetlands and wetland condition. While we emphasize the creation of science-based information on the distribution, extent, condition and biodiversity significance of wetlands and riparian areas in Montana, we collaborate with other Region 8 states and Tribes whenever doing so can bring mutual benefits. We have strong partnerships with other University-based programs in the West that are working on common methods for the assessment, inventory and monitoring of lentic and lotic systems. We actively pursue a sustainable funding model that integrates grants and contracts from multiple agencies and non-governmental partners.

Strategic Actions:

To achieve our goal, we have identified ten Strategic Actions. These are:

1. Continue to complete and update Montana's wetland mapping while working with federal land management agencies to expand our wetland mapping efforts to other states.
2. Build regionalized expertise in photointerpretation and image analysis, sharing informational and educational resources with university, governmental and non-governmental partners.
3. Develop tools, methods and instructional material to demonstrate how remote sensing can be used to track and predict wetland and water permanence, identify hydrologic connectivity, predict landscape-level impacts on wetlands, and provide information to resource managers and decision makers at all levels.
4. Build a regionally respected staff, emphasizing cross-training and professional development in GIS/remote sensing and field ecology, with a particular focus on lotic and lentic systems.
5. Create field guides (online and print) to aid in the identification of wetland and riparian plants commonly found in areas of Region 8 for which no current field guides exist or are planned.
6. Collaborate with other university and agency partners working on standardized wetland assessment methods that can be uniformly applied throughout western states and fed into common databases for analysis and dissemination.
7. Promote and conduct scientific research on wetland and riparian ecological systems, including research on assessment, inventory and monitoring approaches; responses to human and natural stressors; management strategies; and conservation, protection and restoration approaches.
8. Coordinate with NHP's information services staff to ensure that data collected or developed at the University can be linked to interactive web applications and tools, and remains discoverable and

downloadable from the Montana State Library website and linked to other websites.

9. Participate in scientific and professional meetings, workgroups, interdisciplinary teams and the Montana Wetland Council (or its successor entity) to facilitate awareness of our information resources and tools and to support the development of integrated mapping, assessment and reporting solutions.
10. Deliver high-quality training to agency, Tribal and private sector professionals to help them identify, manage and restore wetland biological resources.

MTNHP's Strategic Actions, the EPA's Core Elements Framework, and Montana's Strategic Framework

In 2009, the EPA National Wetlands Division developed the Core Elements Framework (CEF) to guide development of wetlands programs. Within this Framework, the four elements of a program are: 1) Monitoring and Assessment; 2) Regulation; 3) Voluntary Restoration and Protection and 4) Water Quality Standards:

http://www.epa.gov/sites/production/files/201510/documents/2009_03_10_wetlands_initiative_cef_full.pdf.

In Montana, both MTNHP and MT DEQ engage in activities related to Monitoring and Assessment. The Army Corps of Engineers (ACOE) has primary responsibility for regulating wetland impacts under the Clean Water Act section 404, and MT DEQ is currently expanding its section 401 certification efforts. Voluntary restoration and protection are undertaken by a wide range of entities, from watershed groups to non-profits to state and federal agencies, often with science-based guidance from MTNHP. Currently, there are no water quality standards for wetlands at the state level, although some Tribes have attempted to identify parameters that could be used.

The Strategic Actions in this Plan focus primarily on Core Elements 1 (Monitoring and Assessment) and 3 (Voluntary Restoration and Protection). However, data and information resources developed under the Plan are critical to other agencies' activities. For example, while our NWI mapping is explicitly non-jurisdictional, it is frequently used by the ACOE and the Montana Department of Transportation for preliminary screening of sites where section 404 waters may be present. Similarly, while we are a non-regulatory program, our data resources and assessment methods are important elements in the development of narrative biological criteria for water quality.

The Montana DEQ, with input from members of the Wetland Council, including MTNHP staff, is currently revising the Council's Strategic Framework. While the release date for the Framework is not fixed, we assume it will emphasize the same elements as the 2013 Priceless Resources document that preceded it (<https://deq.mt.gov/Portals/112/Water/WPB/Wetlands/StrategicFramework2013-2017.pdf>): 1) Restoration, Protection and Management; 2) Mapping; 3) Monitoring and Assessment; 4) Planning and Policy; 5) Vulnerable and Impacted Wetlands; 6) Public Communication; 7) Montana Wetland Council.

In the following pages, we expand on each of our Strategic Actions, identify the relevant Core Element(s) and Strategic Direction(s) from *Priceless Resources* which the Action supports, and list the specific

activities, with a time frame, that we intend to undertake in support of each Action. While the Plan is ambitious, we believe that with solid support from the EPA and our other state, federal, Tribal and nonprofit partners, we will be able to continue the current staffing level and degree of expertise, and thus carry out the Plan. However, specific activities should be understood to be dependent on funding and staffing, and time lines should be seen as projections, subject to change.

Action 1. Continue to complete and update Montana’s wetland mapping while working with federal land management agencies to expand our wetland mapping efforts to other states

Core Elements: Monitoring and Assessment (Primary); Voluntary Restoration and Protection (Primary); Regulation (Secondary); Water Quality Standards (Secondary).

Strategic Directions: Restoration, Protection and Management (Primary); Mapping (Primary); Monitoring and Assessment (Primary); Planning and Policy (Secondary); Public Communication (Secondary).

Overview: Since 2007, digital mapping of Montana’s wetland and riparian areas has been one of the keystones of our Wetland Program. Partners use the digital data to locate wetland resources, to evaluate potential project impacts, to assess habitat potential, to prepare watershed plans and identify areas where wetlands may offer water quality benefits, and to support large-scale restoration. Unfortunately, while we have been able to put together an impressive array of funders over the years, the areas without current mapping are largely in private or Tribal ownership, and therefore difficult to fund. To ensure that we could maintain mapping capacity, we bid on an Indefinite Duration, Indefinite Quantity contract for wetland mapping with the Bureau of Land Management. In late 2018, we were awarded a contract to map wetlands in portions of Colorado; in 2019, we received additional contracts to map BLM lands only in parts of Wyoming and Utah (along with other state outside Region 8). We believe that continuing this out-of-state mapping provides the best way to maintain capacity to take on smaller projects in Montana, and to ensure that science and GIS staff in other Region 8 states are actively engaged in the creation of maps and interpretive projects. While we have great respect for the work St. Mary’s does, having a mapping center based in the West helps develop a regional repository of mapping skill and ecological expertise. Furthermore, because mapping extent varies by funder (e.g., BLM only funds BLM lands, Utah funds mapping by watershed rather than by quad), working with regional partners having a home base means state-based programs can leverage local partnerships and contacts to complete contiguous areas. Therefore, we plan to continue this effort to map wetlands and riparian areas in other states, working with current funding partners (the USFS, the BLM, and the NWI), and initiating new partnerships as opportunities arise.

The following activities are intended to address this Action.

Action 1 Activities:

1. Complete all currently funded wetland and riparian mapping in Montana, and continue to solicit funding to achieve statewide contemporary mapping (ongoing).

2. Maintain a single, statewide data layer consisting of the best available digital mapping (historic and contemporary) and make it available, with metadata, from the Montana State Library website, including annual updates (Spring 2021, and annually thereafter);
3. Update the web page on the MTNHP website with a current wetland mapping status map so that users have a quick, visual indicator of the mapping available for a given area of interest (Spring 2021, and annually thereafter);
4. Update the MTNHP MapViewer (<http://mtnhp.org/mapviewer/>) web application annually with the statewide data layer to ensure that users without GIS access can view wetland and riparian mapping (Spring 2021, and annually thereafter);
5. Work with existing partners (BLM, USFWS, USFS) to develop wetland mapping projects in Region 8 states where contemporary mapping is not complete, and collaborate with Region 8 wetland programs to identify additional opportunities (ongoing)
6. Collaborate with EPA staff and state partners to make Tribal nations and private landowners in Region 8 aware of opportunities for wetland mapping (ongoing).

Action 2. Build regionalized expertise in photointerpretation and image analysis, creating and sharing informational and educational resources.

Core Elements: Monitoring and Assessment (Primary); Voluntary Restoration and Protection (Primary); Regulation (Secondary); Water Quality Standards (Secondary).

Strategic Directions: Restoration, Protection and Management (Primary); Mapping (Primary); Monitoring and Assessment (Primary); Planning and Policy (Secondary); Public Communication (Secondary).

Overview: Although there are some local wetland and riparian mapping efforts in other Region 8 states, it is difficult for smaller programs to attract, train and keep staff busy when funding is uncertain. In previous years, several western wetland programs (e.g., New Mexico, Wyoming Natural Diversity Database) have chosen to contract wetland and riparian mapping to outside sources. While we think the mapping products themselves are fine, wetland and riparian mapping can and should yield more results than simply maps, and when possible, should build on and encourage the development of additional local resources or the sharing of knowledge. For example, in 2019, MTNHP staff on the way to Colorado met with Utah Geologic Survey mappers to spend a day in the field looking at wetlands. MTNHP staff have also worked closely with CNHP GIS staff, developing automated LLWW attribution regimes that can be applied to older mapping already completed by CNHP. In 2020, as we begin mapping BLM lands in Utah, our lead mapper is a former mapper from the UGS, while much of the QAQC work is being done by the former Utah Wetland Mapping Coordinator. To date, these efforts have been undertaken opportunistically. As part of this wetland program plan, we intend to identify intentional and deliberate activities that can undertake independently and with partners to advance wetland and riparian mapping and knowledge across Region 8 while maintaining our

presence in Montana.

Action 2 Activities

1. Working with partners in Region 8 states, create a “signature database” of wetlands and riparian areas encountered across the entire region (2021-2022).
2. Collaborate on the creation of a Wetland Mapping Manual and webinar/video series to teach the basics of FGDC-compliant photointerpretation and wetland mapping. Our Program will focus on materials geared towards staff in Montana and Region 8 states (Tribal and state/university) who want to learn how to map wetlands from aerial imagery, but we will also work on creating similar products for the CONUS and Alaska if funding can be secured. Introductory materials will be suitable for anyone who wants to understand the possibilities and limitations of NWI mapping (2021-2023)
3. Convene semi-annual or quarterly mapping informational meetings among all interested partners to discuss specific mapping questions, mapping program development, innovative approaches to mapping, and new open-source tools (quarterly beginning in Winter 2021).
4. Complete the automated attribution of LLWW modifiers to all wetland types encountered across Region 8 so that they are consistently applied and interpreted (Winter 2021-Spring 2022).
5. Conduct field verification and model validation for the automated LLWW attributes and modifiers applied to Montana wetland mapping (Summer 2022).
6. Create and compile examples of functional analyses that can be conducted using LLWW attributes, and develop training webinars for regional mapping users (Fall 2022 or Spring 2023).
7. Demonstrate and discuss mapping and map use at Regional meetings (as possible).

Action 3. Develop tools and methods to demonstrate how remote sensing can be used to improve wetland mapping, track and predict wetland and water permanence, identify hydrologic connectivity, predict landscape-level impacts on wetlands, and provide information to resource managers and decision makers at all levels.

Core Elements: Monitoring and Assessment (Primary); Voluntary Restoration and Protection (Primary); Regulation (Primary); Water Quality Standards (Secondary).

Strategic Directions: Restoration, Protection and Management (Primary); Monitoring and Assessment (Primary); Vulnerable and Impact Wetlands (Primary); Planning and Policy (Secondary); Public Communication (Secondary).

Overview: The MTNHP has had a Spatial Analysis Lab at the University of Montana since 2007, initially under the direction of the Senior Ecologist, who doubled as the Lab Director. Although the Lab used established remote sensing practices to model land cover, and developed GIS-based analyses to address wetland issues, we felt that we were not fully exploiting the capabilities that exist in the field. In 2018, we hired a full-time Spatial Analysis Lab Director with extensive training and expertise in remote sensing so that we could expand our services to partners. The Lab now has two image analysts and a remote sensing post-doc, as well as housing five wetland mappers. With NHP wetland program staff expected to stay with the University as parts of NHP are integrated with the Montana State Library, we have an excellent opportunity to further our remote sensing research and applications by establishing a space for continued interdisciplinary growth in areas at the interface of wetland ecology and imagery analysis. Results will improve wetland mapping, identify new approaches to wetland identification and classification, increase our efforts in hydrologic modelling, and develop more sophisticated tools for assessing function and biological integrity of ecosystems and landscape and disturbance monitoring.

Action 3 Activities:

1. Develop methods and approaches that improve heads-up digitizing through incorporation of remote sensing inputs, e.g., optical/radar fusion for detecting forested wetlands (2021-2024).
2. Refine object based image analysis approaches to wetland mapping by building supplemental datasets as: 1.) a “first cut” across new areas 2.) a way to produce maps rapidly while more time-consuming FGDC-compliant methods (i.e., heads-up digitizing) is underway, and 3.) a tool for improving interpretation in areas of confusion (2021-2023)
3. Explore remote sensing tools for improving and/or extending wetland mapping from photo-based “snapshots in time” to representations of size, inundation and connectivity on decadal or longer time scales using or adapting products such as global surface water extent ([Global Surface Water Explorer](#)), subpixel water fraction (Wu and Lane 2016), lidar connectivity modeling (Wu and Lane 2017), and hydrologic permanence (Sando et al. 2018) (2021-2023)
4. Create informational resources, including but not limited to story maps, webinars and online tutorials to demonstrate how and when remote sensing can be used to answer questions about wetland distribution, extent, and condition (ongoing)
5. Collaborate with colleagues at other universities and Heritage programs around the Region and the West to promote remote sensing applications in wetland science and management (ongoing).

Action 4. Build a regionally respected staff, emphasizing cross-training and professional development in GIS/remote sensing and field ecology, with a particular focus on lotic and lentic systems.

Core Elements: Monitoring and Assessment (Primary); Voluntary Restoration and Protection (Primary); Regulation (Primary); Water Quality Standards (Secondary).

Strategic Directions: Restoration, Protection and Management (Primary); Monitoring and Assessment (Primary); Vulnerable and Impact Wetlands (Primary); Planning and Policy (Primary); Public Communication (Primary).

Overview: Like Action 3, Action 4 is fundamentally a wetland program development action. While MTNHP's program is well-established and well-respected, we have lost experienced staff over the past two years, and the Senior Ecologist will soon retire. While we have some continuity—the Wetland Mapping Coordinator has been with the program since 2011, for example—and have brought on staff who were formerly with other Region 8 wetland programs, we will need to make a concerted effort to maintain our reputation and capacity going forward. This is especially true in light of the proposed decoupling of science and information services staff. One of the challenges we have faced in recent years a loss of seasonal staff to permanent positions in government and industry. Staff develop knowledge and expertise during their employment with us, but when we are unable to bring them on full-time, that knowledge and expertise is lost. We began to address this in 2018/2019 by aggressively pursuing contracts for lotic and terrestrial surveys across the West. This allowed us to build a talent pool from which we could hire and train promising wetland mappers, in turn supported by West-wide mapping projects. We currently have 8 full time staff who work on surveys during the summer, either as crew leads or crew managers, and map wetlands during the winter. These staff, while in the field for surveys, can also visit, examine and photograph the wetland areas they or their colleagues will be mapping. They will also be available in 2021 for the EPA's National Wetland Condition Assessment, which will include 27 sites in Montana. We hope that in the coming years, as the BLM adopts its new lentic assessment protocol and puts lentic surveys out for bid, we will be able to continue and expand this cross-training. In the meantime, we plan to take advantage of training opportunities in GIS, remote sensing, and wetland ecology/restoration as they arise, and develop workshops of our own for both our staff and interested agency/consultant personnel.

Action 4 Activities:

1. Ensure that all wetland mapping staff can join at least one professional science society, and attend at least one regional or national conference a year (ongoing)
2. Conduct in-house training on remote sensing and advanced GIS including state-of-art mapping techniques and large dataset handling (annually)
3. Give each wetland mapping staff member the opportunity to develop some of the informational resources described under Action 2 above, working with a seasoned NHP scientist (2021-2023 and ongoing as possible)
4. Provide opportunities for all wetland mapping staff to participate in the NWCA 2021 (pending contract between EPA-MTDEQ-UM). These opportunities will focus on learning; for example, a wetland mapper/range ecologist would work with a field botanist or identifying botanist to learn more about riparian plants; a wetland mapper/stream ecologist might work with the soil scientist to develop a better understanding of hydric soils (2021)

5. Encourage staff to find their own “ride-along” opportunities with state, Tribal, federal and private sector wetland scientists or wetland resource managers in Region 8. Allow each staff member to have at least two days of interaction per year, plus travel time as needed (annually).
6. Reestablish wetland and riparian plant ID classes. These were originally developed as part of a subcontract with DEQ, and discontinued when DEQ dropped them from their WPDGs. Because they were well attended whenever they were offered, we plan to reestablish them, offering at least two per year in Montana, and one or more in other Region 8 states (2021-2023, thereafter as interest demands)
7. Send two selected wetland mapping staff per year to receive formal training in wetland delineation or wetland/riparian restoration. Staff will be chosen based on longevity with the program, future plans, and interest (annually)
8. Encourage staff to take UM or MSU courses relevant to aquatic ecology, hydrology, soils, statistics or remote sensing. As UM employees, most of our wetland mappers are eligible for fee-only (i.e., tuition-free) enrollment in Montana University System classes. Under this action, staff would be allowed to attend one course per semester as part of their work time (upon request).
9. Build a library of books and field guides, including full sets of flora for all Region 8 states where we are mapping wetlands (2021-2022).

Action 5. Create field guides (online and print) to aid in the identification of wetland and riparian plants commonly found in areas of Region 8 for which no current field guides exist or are planned.

Core Elements: Monitoring and Assessment (Primary); Voluntary Restoration and Protection (Primary); Regulation (Primary); Water Quality Standards (Secondary).

Strategic Directions: Restoration, Protection and Management (Primary); Monitoring and Assessment (Primary); Mapping (Secondary); Vulnerable and Impact Wetlands (Primary); Public Communication (Primary).

Overview: As part of this larger Wetland Program Plan, we expect to continue mapping wetlands and riparian areas in Region 8 states for the foreseeable future, and to conduct surveys in lotic and lentic habitats across the Region as well, working with our partners in other states. Although Montana has a good, current general flora, and the Colorado NHP has produced an excellent field guide to Colorado’s wetland plant species, wetland- and riparian-specific floras are hard to come by. Our field botanists rely on multiple resources, including the 8-volume Intermountain Flora, published in 1984; a recent guide to sedges and rushes that covers the entire Pacific Northwest, and includes many species not found in Region 8; photocopied guides to willows published by individual National Forests, and so on. These

challenges are multiplied for consultants, agency staff and others who spend less time in the field, have little or no access to an herbarium, and don't have the time to comb through multiple resources to identify a plant to species. As a result, we see multiple records from surveys across the Region where riparian and wetland plants are lumped together as "mesic forbs" or "hydrophytes," making it difficult to monitor any kind of change over time, calculate floristic quality scores, or determine the true status and extent of a species.

MTNHP's online field guide is widely viewed as a model resource for other western Heritage programs, and indeed we have contracted with programs in Wyoming, Utah, and across the West to turn their own data into state-specific field guides, with the ultimate goal of creating a common online field guide for Western states. However, even when complete, this field guide will not be a good resource for plant identification, either in the field or in the office, as no dichotomous keys are currently planned. Similarly, the field guide includes all species, with no real assessment of whether it is common or widespread. We intend to create a field guide to common wetland and riparian plants in the Northern Rocky Mountain and Intermountain West that will address the need for a good, portable flora that will greatly improve plant identification and calculation of vegetation-based metrics, as well as being a resource for the plant ID workshops to be developed under Action 4.

Action 5 Activities:

1. Search NHP assessment databases to develop a list of the species which have been found at 5% cover or greater in individual reference network wetlands in Montana (2021-2022).
2. Update and revise our Montana Field Guide entries for these species to emphasize identifying features (2022-2023).
3. Adapt our current "Custom Field Guide" application to allow users to download a PDF field guide appropriate for the ecoregion of Montana and class of wetlands or riparian areas in which they will be working (e.g., Prairie Potholes, Fens, etc.) (2022-2023)
4. Search BLM AIM and Multiple Indicator Monitoring databases to develop lists of species encountered in other Region 8 states (2022).
5. Collaborate with Region 8 wetland programs to create similar custom PDF field guides, based on their existing electronic resources (223-2025)
6. Collaborate with other western wetland programs to develop field guides to common wetland and riparian plants for the Intermountain West and for the Northern Rocky Mountains (2023-2025)

Action 6. Collaborate with other university and agency partners working on standardized wetland assessment methods that can be uniformly applied throughout western states and fed into common databases for analysis and dissemination

Core Elements: Monitoring and Assessment (Primary); Voluntary Restoration and Protection

(Primary); Regulation (Secondary); Water Quality Standards (Secondary).

Strategic Directions: Restoration, Protection and Management (Primary); Monitoring and Assessment (Primary); Vulnerable and Impacted Wetlands (Primary); Planning and Policy (Secondary); Public Communication (Primary).

Overview: We were early participants in the development of local, regional and national Ecological Integrity Assessments, including protocols developed by the EPA for the National Wetland Condition Assessment. While we still consider EIA protocols to be the gold standard for assessing wetland condition, we know that federal and state land managers do not have the time, expertise or money to adopt these methods for their own use. For the past three years, the Colorado Natural Heritage Program has been developing a Lentic Assessment, Inventory and Monitoring protocol for the Bureau of Land Management. This protocol – still built on the EIA concept, but faster to use in the field-- is in its final stage of development and testing, and will likely be released as the BLM's new wetland assessment standard in 2021. We expect that it will be considered for adoption, or will be adopted, by the Forest Service as well. Because these two agencies –longtime partners for MTNHP-- collectively manage most of the public lands in Montana, we anticipate that they will look to us for guidance in applying this protocol and interpreting the results. In turn, we think that this will encourage Tribes and state agencies towards adoption.

Action 6 Activities:

1. Test the vegetation data collection approach of the Lentic AIM protocol alongside the EPA EIA protocol during the 2021 NWCA effort, and compare Floristic Quality Assessment scores derived from each method (using Montana-based coefficients of conservatism) (2021-2023)
2. Build Survey 123 and Collector Applications (modelled on what the BLM produces) so that data collected by MTNHP and Montana partners can be absorbed directly into our databases for dissemination and analysis (2021-2022).
3. Create appropriate ancillary resources (plant lists, training materials, etc.) that will facilitate use of the Lentic AIM protocol by other agencies (2021-2022)
4. Work with the BLM to develop training opportunities for other agencies interested in adopting the Protocol (2023-2025).
5. Make all assessment data discoverable through the MTNHP MapViewer web application (Summer 2023).
6. Revise the MTNHP Wetlands Data page and ancillary pages to better inform users of the kinds of data and tools we have available, provide live links to the data and tools, and offer guidance in their use (Summer 2023, and annually thereafter).

Action 7. Promote and conduct scientific research on wetland and riparian ecological systems, including research on assessment, inventory and monitoring approaches; responses to human and natural stressors; management strategies; and conservation, protection and restoration approaches

Core Elements: Monitoring and Assessment (Primary); Voluntary Restoration and Protection (Primary); Regulation (Secondary); Water Quality Standards (Secondary).

Strategic Directions: Restoration, Protection and Management (Primary); Monitoring and Assessment (Primary); Public Communication (Primary); Montana Wetland Council (Secondary).

Overview: The Wetland Program at MTNHP has been one of the leaders in applied wetland research among Region 8 and national programs. We have been involved in developing Ecological Integrity Assessments since the early 2000s, and worked with scientists and managers from across the country to help the EPA develop the National Wetlands Condition Assessment. We work with state and federal partners to develop Coefficients of Conservatism and integrate these into Floristic Quality Assessments. We partnered with the Colorado Natural Heritage Program and the Wyoming Natural Diversity Database to develop reference standards for widespread wetland ecological systems. We were one of the first programs in the country to take on the daunting task of mapping all wetlands and riparian areas in the state, and have been active in regional and federal mapping consortia. We were early adopters of the LLWW to add functional characteristics to wetland polygons. Both our work on Landscape Integrity Models and our approach to identifying geographically isolated wetlands have been adapted in other states within the Region. We have also spent over a decade creating a wetland reference network, a group of sentinel wetlands for long-term monitoring, and most recently, a suite of fire-impacted wetlands that can be studied over time. We have developed an Index of Alien Impact for wetlands, and continue our efforts to build and distribute succession models for wetland systems. Going forward, our plan is to continue to utilize the tools and information we have already developed to answer questions related to wetland function at the local and landscape levels. In a rapidly changing natural and political environment, we want to continue our work evaluating disturbances such as wildfire; creating and disseminating predictive models and analyses; and revisiting monitoring sites to track change over time, especially in sentinel and fire-affected wetlands. Above all, we want to maintain a research program that can provide information on the management, restoration and conservation of wetlands to meet the needs of our land management partners and local decision makers. This means retaining an agile, creative and committed staff, and having a Wetland Program Plan that can be amended as new challenges arise.

Action 7 Activities:

1. Continue to update and improve landscape-level analyses based on wetland mapping that can answer questions about the extent, distribution, functions and ecosystem services of wetlands, as well as the risks they face from both natural and human disturbances (2022-2025).
2. Improve wetland mapping and analysis by developing time series and multi-sensor analysis tests to

evaluate feasibility and gains in workflow automation (2021-2023)

3. Engage with research partners to further measure, model and document surface water permanence in wetlands (2021-2023).
4. Explore and recommend improved approaches to evaluating riparian integrity in both floodplain and low-flow hydrologic systems (2023-2025)
5. Continue to Investigate local and landscape level interactions between wildfire and wetlands to determine if wetlands mitigate fire spread and if wetlands tend to remain unburned within and adjacent to fire perimeters, potentially acting as important fire refugia (2021-2023).
6. Investigate the role of wetland characteristics, such as hydrologic regime and dominant vegetation, in wetland-wildfire interactions (2021-2023).
7. Collaborate with university, agency and non-profit partners to improve and disseminate our interactive Montana Beaver Restoration Assessment Tool (BRAT), incorporating citizen science where appropriate to validate model outputs (2021)
8. Determine the potential for BRAT to be used to identify wetland restoration/creation sites in landscapes where fire refugia or mitigation of fire spread is of particular concern (2022-2023).
9. Continue partnerships with agency staff to establish multi-parameter (e.g., amphibian, fish, plant) monitoring sites (ongoing)
10. Identify new opportunities and actions required to respond to local and regional information needs (ongoing)

Action 8. Coordinate with NHP's information services staff to ensure that data collected or developed at the University can be linked to interactive web applications and tools, and remains discoverable and downloadable from the Montana State Library website and linked to other websites.

Core Elements: Monitoring and Assessment (Primary); Voluntary Restoration and Protection (Primary); Regulation (Secondary); Water Quality Standards (Secondary).

Strategic Directions: Restoration, Protection and Management (Primary); Monitoring and Assessment (Primary); Public Communication (Primary); Montana Wetland Council (Secondary).

Overview: This Action is included in our WPP as a placeholder. Because negotiations between the Montana State Library and the University of Montana are on hold due to COVID19, we do not know if, when or how reorganization will occur. At the time this is known, we will prepare a revised WPP with details for specific activities to be carried out under Action 8.

Action 9: Participate in scientific and professional meetings, workgroups, interdisciplinary teams and the Montana Wetland Council (or its successor entity) to facilitate awareness of our information resources and tools and to support the development of integrated mapping, assessment and reporting solutions.

Core Elements: Monitoring and Assessment (Primary); Voluntary Restoration and Protection (Secondary); Regulation (Secondary); Water Quality Standards (Secondary).

Strategic Directions: Restoration, Protection and Management (Primary); Monitoring and Assessment (Primary); Public Communication (Primary); Montana Wetland Council (Primary).

Overview: For partners to rely on MTNHP as the authoritative state source for wetland mapping, data and tools — the goal of this plan — they need to be aware of the resources we have created and manage, and understand how they can be applied to address planning, management, protection and restoration questions. At the same time, we need to be aware of what our partners are doing, and stay abreast of scientific and technical innovations, both in wetland science and in remote sensing and geostatistical analysis.

MTNHP Wetland Program staff are actively engaged with local, regional and national partners, both in an ad hoc way and through participation in working groups, steering committees and review panels. Over the past few years, we have participated in the Interagency Wetland and Riparian Assessment Group, the Association of State Wetland Managers, the Western Governors' Association Sage Grouse Task Force, and the National Wetland Assessment and Monitoring Workgroup, among others. We have presented posters and papers at regional and national conferences (Society of Wetland Scientists, the EPA Region 8, the North American Lake Society, Intermountain GIS), and have been active as conveners or members of local meetings (e.g., Montana Native Plant Society, Montana Wetland Council). We work formally and informally as part of the Interagency Group on Hydrography, which is currently integrating our digital mapping of rivers and streams into a Montana version of the National Hydrography Dataset (NHD), and we lead Montana's Land Cover Working Group. We work with the US Forest Service on GIS-based tools and models for restoration and protection of aquatic and wetland habitat, and have co-authored Technical Reports. We collaborate with the Oregon Natural Heritage Program (ORBIC), the Colorado Natural Heritage Program, Natureserve, the Wyoming Natural Diversity Database, private consultants and the BLM on lotic and terrestrial surveys in Wyoming, Montana and Utah, as well as other Western states. We coordinate with the Utah Geological Survey and St. Mary's University of Minnesota on wetland mapping efforts. However, all this engagement comes at a time cost that has to be covered by salaries, or by voluntary contributions of personal time to participate in these efforts or make up for project time lost. Therefore, as part of this project plan, we underscore the importance of securing funding for these sorts of activities.

Action 8 Activities

1. Provide current memberships for science staff in the Association of Wetlands Managers and the Society of Wetland Scientists (annually).

2. Support at least two science staff to attend the Association of State Wetland Managers meeting (Spring 2021 and annually thereafter).
3. Work with the Department of Environmental Quality to strengthen and support the Montana Wetland Council and present science-based meetings in Montana (Spring 2021 and ongoing).
4. Provide current memberships for all mapping and GIS staff in the Montana Associated of Geographic Information Professionals (January 2021, and annually thereafter).
5. Support each Wetlands Program staff member (science or GIS) to participate in at least one professional or technical working group through underwriting of salary and travel (January 2021, and annually thereafter).
6. Meet at least once every two years with our 6 Tribal partners (3 per year) on their Reservation or at Tribal conferences to discuss potential collaboration, technical needs, and if possible, data sharing (June 2021, and annually thereafter).

Action 10. Deliver high-quality training to agency and private sector professionals to help them identify, manage and restore wetland biological resources.

Core Elements: Monitoring and Assessment (Primary); Voluntary Restoration and Protection (Primary); Regulation (Primary); Water Quality Standards (Secondary).

Strategic Directions: Restoration, Protection and Management (Primary); Monitoring and Assessment (Primary); Public Communication (Primary); Montana Wetland Council (Primary).

Overview: Interactive web applications, GIS and database tools, sophisticated maps, and complex assessment tools all add to the resources that wetland professionals can draw upon to identify, manage, protect and restore Montana's wetlands. However, the increasing sophistication of our information resources comes with an increasingly steep learning curve, which may itself become an obstacle if our partners are left to navigate through these resources by themselves. Therefore, it is important that we offer a full range of training and technical resources to our agency and professional partners, whether in the form of dichotomous keys, technical manuals, online Help resources, presentations and workshops, or hands-on trainings.

Action 10 Activities:

1. Revise our Wetlands web pages as a portal to provide clear and consistent information, links, and access options for our data and mapping, and link to our social media outlets (September 2021).
2. Develop training on uses of wetland mapping and LLWW, including handouts, materials, and PowerPoints (June 2021).

3. Deliver two trainings a year at no cost to agency and professional partners interested in our wetland data resources (September 2021, and annually thereafter).
4. Support all wetland staff to develop and offer at least one professional presentation highlighting our data and information resources every two years at a local, regional or national meeting (2021, and biennially thereafter).

Conclusion

Montana is widely respected for its well-integrated and collaborative wetland protection, restoration and mitigation activities. At the heart of these activities is a solid foundation of science-based information, including literature reviews, field guides, assessment results, models and spatial and tabular data, plus training and guidance in putting this information to use. The Montana Natural Heritage Program has built the relationships and networks that have allowed it to make great progress towards becoming a “one-stop shop” for data and information. This Wetland Program Plan is an ambitious vision for taking the next steps towards fulfilling the MTNHP’s mission, and reaching the overarching goal of “no net loss” of wetlands and riparian areas in Montana and across the Region.

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