

Beaver Management Planning

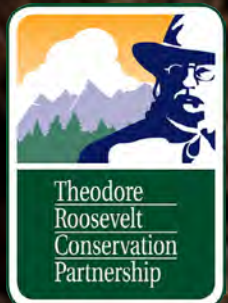
A REVIEW OF EXISTING PLANS AND PROGRAMS WITH
RECOMMENDED BEST MANAGEMENT PRACTICES



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Figure 1: Beaver lodge and pond, Telluride, Colorado. Photo Credit: Jackie Corday.

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I. Introduction

1.1 Purpose & Goal

The purpose of this report is to analyze and summarize existing approaches to beaver management plans or programs, including their composition, mission, pathway, decision matrices, and other defining characteristics. Beaver management can occur at a variety of jurisdictional levels (e.g., state, Tribal, city/county, and even watershed) but is typically done at the state level and often evolves from furbearer wildlife plans overseen by state wildlife agencies following the historical overharvesting during the 1800s commercial fur trade.

Often these plans were created through collaborative efforts by state agencies, Tribes, non-profits, conservation professionals, private businesses, and other entities. Effective beaver management has the potential to support and steward watershed health and biodiversity through education, coexistence measures, relocation, and, when necessary, trapping or lethal removal. Ideally, the development of management plans includes discussing successful pathways, sharing best management practices, offering diverse perspectives, and highlighting helpful management tools, such as decision matrices or cost-share programs.

The goal of this report is to inform beaver conservation and management processes by providing approachable and realistic examples that achieve the desired outcomes while simultaneously elevating watershed restoration work via human-beaver conflict resolution and education. This report can help at any stage of the process, from plan development to enacting, growing, or strengthening beaver management plans or programs. There are many factors that contribute to sound beaver management planning, and no two plans or programs are the same. It can be a daunting process to start, especially if the potential pathways are undefined. Additionally, while this is an area of expanding research, there are still significant data gaps, including knowing the current beaver populations in a given area, how to identify suitable beaver habitat, and understanding the extent of the impact of beaver-related restoration on severe drought, wildfires, and floods. Additionally, when working on any conservation or species plans, there are many viewpoints, lived experiences, and historical perspectives to consider. Involving all stakeholders and creating a

robust education and communication plan is an essential part of beaver management planning.

While some Tribal approaches to beaver management are included in this version of the report, we acknowledge that it is not exhaustive and a more thorough and inclusive exploration of both the cultural significance and Indigenous wildlife management practices related the beavers should be conducted. The authors propose a second report developed in collaboration with Indigenous wildlife agencies and communities to better understand and explore cultural significance, methodologies, as well as traditional knowledge associated with managing beavers.

1.2 Methodology

This report was created by reviewing and analyzing publicly available beaver management plans and programs across the United States. Additionally, relevant published research papers are also cited. Finally, email or phone interviews and site visits were conducted by Jacquelyn (Jackie) Corday, owner of Corday Natural Resource Consulting. While the site visits and in-person interviews focused on the Western United States, published research and publicly available resources are discussed from across the country.

This report uses the “weight of the evidence” approach, which assesses the strength, relevancy, and consistency of multiple sources of information to draw a conclusion where there is not a single answer. The report also acknowledges the breadth of topics, regions, and landscapes covered, and that plans and programs are strongest when completed through science- and stakeholder-driven processes.

1.3 What is a Beaver Management Plan or Program

There is no solitary definition or scope for a beaver management plan or program. In the United States, their purposes focus on the management of *Castor canadensis*, the North American beaver, but the plan itself can take many different shapes. Historically, plans have been rooted in defining the parameters around hunting and trapping post 1800s commercial fur trade through a furbearer management plan, as well as managing conflicts with humans. Beaver management can occur at the state level with a state beaver management

plan (SBMP), or through the furbearer management process, and it can also take a more localized approach through a county, city, watershed, or utility. While many plans originate with and are enforced by wildlife agencies, they can also be started by outside entities with a vested interest such as conservation organizations, though involvement of the relevant wildlife agencies is often foundational to success.

There is an increasing trend in newer plans and for updates of historical plans to include emerging research highlighting the improved climate resilience for beaver-led watershed restoration. When rivers and streams are fully connected to their floodplains, they increase their resilience to flood, drought, and wildfire; improve water quality and quantity; and support biodiversity and sensitive species conservation (Jordan & Fairfax, 2022). Beaver management plans and programs can solely focus on beavers for restoration benefits, or restoration benefits can represent one part of a broader SBMP that includes current and historical management approaches, such as trapping. This places beavers into a unique situation where they may occupy multiple roles – a furbearer, an ecosystem engineer or restoration partner, and even a nuisance. At times, these roles might appear conflicting, but with proper planning and communication, they can be successfully managed in tandem.

Traditional and emerging interests often coincide, and those looking to hunt or trap beavers and those centering beavers as a key component of watershed management should both be involved in state beaver management plans. Beavers are often labeled as nuisance animals by agencies and by the public, with beaver conflicts being a top concern for many wildlife agencies balancing wildlife management and human interests. Beaver dams can plug culverts and flood property and roads, which can be costly. However, this is another area of expanding research, and wildlife professionals, agencies, landowners, non-profits, and other private entities are partnering to create efficient and cost-effective solutions that help solve human-beaver conflicts and may allow beavers to remain on the property. State plans or programs may refer to human-beaver conflict resolution as the social tolerance of beavers in a landscape, while others may refer to it as coexistence. A natural overlap is the need for experienced or licensed trappers to assist in relocation services for beaver-led restoration work. A key component of successful plans or programs includes robust education, outreach, and human-beaver

conflict resolution programs, which can include lists of state-approved trapping services, as well as ordinances or laws related to removing or relocating beavers. Either way, the ability for humans and beavers to successfully live together will be a hinge point for any SBMP and will define its effectiveness and longevity.

Comprehensive beaver management plans or programs should also include a mechanism for measuring success that is tied to the purpose and outlined goals, which are ideally dependent on a robust review of stakeholders' interests and current science. For some plans, this can be a reduction in human-beaver conflict complaints and an increase in the number of human-beaver conflict resolution devices installed. For others, it can be an increase in spawning sites for sensitive fish species, or the number of beavers relocated to a new area that survived one year after release. Plans typically cover 5-year or 10-year horizons and may attach due dates to specific goals and assign responsibility for specific items to different stakeholders, such as the state wildlife agency. There are also examples of beaver management action plans, which tend to work on a 1-year to 3-year basis, and can be designed to pilot projects and gain watershed-specific results. Or, these action plans can go beyond wildlife agency management, such as including universities to conduct research. Shorter-term plans can help justify budget increases to build a more comprehensive state plan or program, such as convening an official beaver management working group or passing a SBMP.

1.4 Potential Stakeholders

A wide range of stakeholders are impacted by and benefited by the presence of beavers on the landscape, underscoring the need for comprehensive and diverse stakeholder engagement when developing, implementing, and updating a beaver management plan. Stakeholder engagement and support is vital for developing robust, responsive, and effective management plans or programs. While stakeholders can differ from place to place, there is a core list of stakeholders that appear frequently throughout the analyzed plans and programs. This list will provide a general direction for beginning stakeholder engagement.

- **State agencies:** Most people will inherently look to state wildlife agencies for guidance on species management and conservation and many state level agencies have interest in beaver management. States

typically manage beavers as a furbearer species, meaning an animal that is trapped recreationally for its fur or other biological products. They may also be managed under agriculture departments as a nuisance species with separate permitting or regulations than as a furbearer. The state land board or a natural heritage program may also be interested in beavers, and when considering beavers for watershed resiliency, the state water resources department should be involved. Finally, due to the potential for beaver dams to flood roads or block infrastructure, state transportation departments are often involved in human-beaver conflict resolution programs. State agencies may also offer grants, which can help start or advance beaver management programs or human-beaver conflict resolution programs.

A list of state funding opportunities is available in [Appendix A](#) and recent state legislation to promote human-beaver conflict resolution and watershed restoration is available in [Appendix B](#).

- **Local government and groups:** Many state plans or programs are born from local initiatives. These can be plans or programs drafted for cities or counties, local parks, water utilities, or streets departments. Irrigation districts, watershed coalitions, and other special interest groups may also be involved.
- **Tribal agencies and communities:** Tribal stakeholders should always be consulted and included when states or any other entities are developing a beaver management plan. Tribal communities and their associated wildlife agencies, water departments, environmental services, or agricultural programs may also have beaver management programs and enact their own wildlife, climate, or watershed restoration plans. In some cases where relocation or translocation is difficult on state or federal lands, tribal lands may be an option and should be consulted in the development of any relocation programs and criteria. The book *Wildlife Stewardship on Tribal Lands: Our Place Is In Our Soul*, edited by Serra J. Hoagland and Steven Albert with input from many Native American and Indigenous scholars, wildlife managers, legal experts, and conservationists, is a comprehensive look at how Tribes steward their lands and a great resource to learn more about Tribal wildlife stewardship.

- **Federal Agencies:** The U.S. Forest Service (USFS), U.S. Fish and Wildlife Service (USFWS), Bureau of Reclamation (BOR), Bureau of Land Management (BLM), National Park Service (NPS), National Oceanic and Atmospheric Administration (NOAA), Animal and Plant Health Inspection Service (APHIS), Natural Resource Conservation Service (NRCS), and others are integral for beaver management planning. Some can provide release sites for beavers (USFS, NPS and BLM) and have developed comprehensive beaver management materials (USFWS, NOAA, and [The Beaver Restoration Guidebook](#)), and fish hatcheries can be a potential holding facility for beaver translocation, and are often funded or managed by federal agencies (primarily USFWS). These agencies may also offer aquatic or watershed restoration grant opportunities that can help restore suitable beaver habitat, and low-tech, process-based restoration (LTPBR) or beaver-led restoration projects may qualify.

A list of federal funding opportunities is available in [Appendix A](#) and recent federal legislation to promote human-beaver conflict resolution and watershed restoration is available in [Appendix B](#).

- **Agriculture and private landowners:** Human-beaver conflicts can occur any place people and beavers mix, on private land in suburban neighborhoods, or in agricultural communities. Involving impacted landowners in the creation of plans and solutions will create better outcomes and help identify challenges and barriers. As understanding of the ecological benefits beavers can provide increases, landowners are increasingly requesting beavers return to their landscape to help reestablish wetlands, bring back native vegetation, increase forage, help attenuate floods, or reduce catastrophic wildfire risk.
- **Recreation community:** Hunters, trappers, and anglers are all invested in conservation and wildlife initiatives. Hunters and trappers may harvest beavers recreationally, while anglers may see the impact of beavers on waterways and fisheries. Trappers are also utilized by both private and public entities for nuisance removal. They will also play an important role in relocation programs by bringing their expertise to help trap and transport beavers.



Figure 2: Photo of a 2019 low-tech, process-based (LTPBR) project site at Beaver Creek State Wildlife Area west of Gunnison, Colorado, showing where beavers returned and improved stream habitat. Photo Credit: Jackie Corday.

- **Universities and researchers:** Research and interest in beaver-led restoration and its associated benefits continue to grow. Many agencies do not have the capacity to research and monitor different outcomes, so they partner with universities and researchers to help fill data gaps. Critical developments in tools and models, such as the Beaver Restoration Assessment Tool (BRAT), came from a partnership between a state agency and a local university.
- **Non-profits and non-governmental organizations (NGOs):** There are many non-profits and NGOs leading the way on low-tech, process-based initiatives, including installing beaver dam analogs (BDAs), working on models to identify suitable beaver habitat, and running human-beaver conflict resolution programs. With work completed across the country and in many different types of habitats, projects can offer valuable lessons learned, insights, and data. Non-profits and NGOs are especially important in states where the capacity of a wildlife agency may be limited, or initiatives are unfunded. In Montana, the Fish, Wildlife & Parks department partners with the National Wildlife Federation (NWF) to run a human-beaver conflict resolution program in identified priority wildlife regions as well as a beaver conflict hotline.

1.5 Best Management Practices

While reviewing and analyzing various beaver management plans and programs for successful strategies, we identified key components of effective and proactive planning, listed below. Each of these best management practices is covered more in-depth in different sections of the report. Additionally, below each recommendation are examples of plans or programs reviewed in this report that exemplify the practice being highlighted. It is important to remember that each plan or program is tailored to a region and stakeholders, and that while some plans or programs may be good examples of one practice, they may need improvement in others. Finally, these are iterative processes. Once a plan or program is passed or enacted, it is important to revisit these best management practices and to reevaluate success. When goals are achieved, new goals can be created, and processes should be updated as new information or science becomes available.

Successful and robust state beaver management plans or programs:

1. Collaborate and seek overlapping values

State management plans or programs are, by design, wide-reaching. It is vital for decision-makers, practitioners, and citizens to know why beavers need to be the focus of a concentrated effort and how it relates to their goals. To do this, it will be important to identify and use areas of overlapping values to create a unifying vision for beaver management that speaks to different lived experiences and viewpoints. This may require a robust education, outreach, and communication plan. States can also use a third party to help objectively identify these values or moderate discussions.

Examples: *In California, the WATER Institute, a part of Occidental Arts & Ecology Center (OAEC), created the “Bring Back the Beaver” campaign that focused on community organizing to build social capital. They created and published several reports, including the “Basins of Relations: A Citizen’s Guide to Protecting and Restoring Our Watersheds.” They recognized that ecosystems and human relationships are inextricable, and identified modeling resiliency, training change makers, building community capacity, and changing the rules as effective strategies for change.*

The 2020-2030 Maine Furbearer Management Plan hired a research firm to obtain public input regarding the management of furbearers in the state, including beavers. The firm objectively ascertained the public’s knowledge, attitudes, and concerns regarding trapping through scientific surveys with the results informing the plan’s creation.

2. Define and share responsibility, accountability, and expectations

It is important to know who is doing the work and what is expected from the work. Other components, such as budgetary or staffing needs, will also be factors that affect outcomes and success. While wildlife agencies inherently lead on state species plans, assigning specific tasks or deliverables to other stakeholders can help spread the burden of responsibility and create buy-in. Additionally, it is important to know who is responsible or accountable for different aspects of the plan or program, especially for conflict resolution, such as human-beaver conflict resolution device installation and funding. If there are unintended consequences, stakeholders will also want to know what processes are in place and who is available to help.

Example: *Oregon Department of Fish and Wildlife’s 3-year action plan for beaver-modified landscapes includes defined goals, four supporting pillars, lead names for each core action with anticipated completion dates, possible funding sources, confirmed financial support, and a table of these factors overlaid to create a timeline of events for various goal completions.*

3. Establish or expand human-beaver conflict resolution tools

Addressing human-beaver conflict is vital. Many stakeholders will not feel comfortable engaging with statewide efforts that increase beaver populations without robust support for human-beaver conflict resolution. This begins with education, which should be readily available both online and in print form. The materials need to be comprehensive, updated, and digestible with easy-to-follow instructions. It is good practice to include diagrams, material lists, cost, applicability, and real-life examples for each device type. Landowners also appreciate free site visits to help identify solutions and cost-share programs to help alleviate financial concerns. It is likely there is a shortage of trained professionals to assist with conflicts, so it

may also be necessary to create training modules or fund practitioners to attend existing training courses in other states or online. It is important that resolutions are responsive, especially in areas where the window for installing devices is short or if conflicts are more prevalent during specific seasons.

Examples: The **Montana Beaver Conflict Resolution Program**, in partnership with the Montana Beaver Working Group, aims to build greater tolerance for beavers on the landscape through innovative, non-lethal conflict mitigation strategies. The program launched a Beaver Hotline, conducts free site visits, covers Montana Fish, Wildlife & Parks Regions 2, 3, and 4, includes full-time staff as well as seasonal positions, and hosts online resources and education.

Vermont created guidance for resolving human-beaver conflicts. To make processes clearer, the program outlines three major types of conflict, their potential solutions, if or when authorities need to be identified, and any statutes or regulations related to beavers, dams, and their removal. **Vermont** also created the Beaver Wetlands Conservation Project, or the beaver baffle program, to assist landowners, road crews, and municipalities who were experiencing conflicts with beavers to maintain wetland habitat. The program includes site evaluations, best management practices, and installation services.

4. Partner with Tribes and respect traditional knowledge

Many Tribal communities have been stewarding their lands and waters in partnership with beavers for time immemorial and today are championing beaver-led restoration work. The **Blackfeet Nation** created the Ksik Stakii Project, which is a broad partnership aimed at protecting beaver, restoring rivers, and increasing natural water storage to be more climate resilient. It is a partnership between the Blackfeet Fish and Wildlife Department, Blackfeet Community College, Blackfeet Agriculture Resource Management Planning Team, and others. For many Pacific Northwest Tribes, stewarding beaver populations and the habitat they create and maintain is important to supporting many indigenous First Foods and food sovereignty. Tribal resources, agencies, culture, and structure may function differently than state processes, but the ecological lessons are universal and, more importantly, Tribal perspectives, collaboration, and knowledge must be a part of any comprehensive beaver management plan or program.

Examples: In **California**, when OAEC convened their first ad hoc California Beaver Working Group, Tribal partners were at the table. At their invitation, OAEC collaborated with tribal communities to bring beavers back to their ancestral homelands and included developing a beaver recruitment strategy at Tásmam Koyóm for the **Maidu Summit Consortium**. This site was selected as the recipient of the first beaver translocation in California in 75 years. Additionally, OAEC worked with the **Tule River Tribe** and other partners to assess beaver habitat and implement process-based restoration. The Tule River Tribe was also selected as a pilot translocation project.

5. Recognize history, legislation, and furbearer management

To know where to go, it is important to know where you've been. Beaver management plans and programs are naturally focused on the future, but the current and past layout of programs, legislation, and parameters will inform how that vision unfolds and what is necessary to achieve it. Even if the context of past programs or plans does not change the trajectory of future ones, stakeholders will look for planners to acknowledge and understand the current layout of relevant legislation and programming. Additionally, there are often older programs, plans, or legislation that could affect current beaver management, but are unknown to some stakeholders or not communicated effectively. These opportunities may exist in furbearer management plans, but they could also be present in drought, wildfire, or water resource plans, or in state wildlife action plans (SWAPs). Finally, furbearer plans are ubiquitous, and many include beavers. This is a natural starting point for beaver management, and it is important to involve trappers as a stakeholder in the process.

Examples: The **Beaver Management in Pennsylvania** report outlined establishing sustainable beaver populations within suitable habitat, monitoring harvest, minimizing complaints, increasing public awareness of beavers, and providing opportunities to use and experience beavers, all within the context of historical and current programs. The plan analyzes and synthesizes current practices through data collection and outlines a beaver management decision matrix showing regulatory action or response based on population social capacity (damage complaint level) and biological capacity (population density within suitable habitat).

Idaho's 2022-2027 Furbearer Management Plan covers many species, but the beaver section discusses improving the understanding of beaver habitat use, exploring non-lethal options to address beaver damage, working with stakeholders to identify priority areas for restoration, and developing a guidance document for beaver restoration projects.

6. Research state-specific data and knowledge gaps

It is important that beaver management plans and programs are data-driven. Common data gaps that need to be addressed include:

- **Beaver populations and distribution:** Trapper surveys, whether voluntary or mandatory, are often the main source of state level beaver population data. However, the types of questions asked may be informative for trapping regulations, but not for restoration work. Additionally, this data is often obtained via voluntary trapper surveys with varying response rates and thus extrapolated and naturally limiting.
- **Identify priority restoration areas:** A starter goal for many state plans and programs is to develop a model to identify potential restoration sites or to calibrate existing models or tools to make them applicable to the area's unique landscape characteristics. There is also a growing body of research, such as recent publications on beaver occupied streams, rivers, and wetland complexes and wildfire resiliency, but it is important to understand the context and parameters of this data for goal setting and project scoping. Partnering with local universities, non-profits, and other institutions to conduct research and fill knowledge gaps is a great way to make comprehensive and well-rounded management decisions.

Examples: *The Utah Beaver Management Plan, developed in consultation with the Beaver Advisory Committee, included a \$40,000 grant to Utah State University to help fund the development and application of the Beaver Restoration Assessment Tool (BRAT), which was used to set realistic expectations for where various management strategies involving beaver can be applied*

spatially. Additional research with support from the U.S. Forest Service assessed the degree to which beaver dams impact the movement of trout in Temple Fork, UT.

The Montana Beaver Working Group identified a goal of creating a white paper to provide a comprehensive overview of the keystone role of beavers within the state, and Montana Fish, Wildlife & Parks created the "Beavers and Their Role in Riparian Restoration in Montana" white paper. It covers many topics, such as project planning, which included spatial and temporal scaling for beaver restoration with project size expectations and recommendations.

7. Address known challenges and barriers

Beaver management plans are gaining traction, and many stakeholders are becoming familiar with process-based restoration, beaver mimicry, or beaver relocation programs. This familiarity may bring concerns about avocational trapping regulations, disease transmission, fish passage, and potential impacts to water rights. Proactively researching and answering these questions, which may involve piloting programs for watershed-specific impacts, will help garner support and create community buy-in. There are also programmatic barriers, such as staffing, training, funding, awareness, and time. Recommending new plans or programs without first considering and addressing these barriers may not be fruitful and may even delay plan adoption.

Examples: *In Washington, the Chimacum Creek Adaptive Beaver Management Plan involves preventative planning for riparian buffer projects, including designing riparian restoration and enhancement projects with beavers in mind. This includes considerations for plant species selection and planting location. The program is designed to prevent conflicts before they occur by addressing known factors.*

King County, Washington runs a comprehensive beaver management program that includes a matrix of solutions to different beaver challenges. The program has published many resources, such as white papers, reports, and guidance documents with diagrams. For restoration work to enhance habitat, they note that ecologists and engineers should assume that beavers will inhabit their projects. They developed a "Planning for Beavers Manual: Anticipating Beavers when Designing Restoration

Projects”, that covers topics like budgeting for beavers, planning for herbivory, and early decisions, analysis, and outreach.

8. Understand reintroduction versus recolonization methodologies

The most likely pathway for beavers to occupy new or previously occupied habitat is through natural recolonization of areas adjacent to where beavers currently exist. The other pathway is to relocate beavers to new or previously occupied habitats through trapping programs. In both cases, there will be upstream and downstream effects, including potential conflicts between human infrastructure and beavers. A good plan or program will reflect the costs, resources, and staffing required for including each pathway and weigh it against stakeholder goals and concerns. For instance, trapping and relocation efforts require adequate holding facilities, which may be an added cost or limiting factor. Encouraging current population spread may require modifying habitat to make it more suitable for beavers, such as installing BDAs or planting beaver-preferred vegetation.

Examples: In Oregon, the City of Portland Environmental Services created a beaver management plan, including a conflict resolution program, then piloted a beaver translocation program and holding facility. Partners included the BLM, City of Portland, Oregon Department of Fish and Wildlife (ODFW), Oregon Zoo, Multnomah County Drainage District, and U.S. Fish and Wildlife Service. The beaver management plan created a decision matrix and, when other options were exhausted, to avoid lethal removal and facilitate beaver-led restoration, the translocation program was piloted as the final option. It includes a Memorandum of Understanding, funding agreements, and a specified protocol with ODFW. The holding facility is at Oregon Zoo, and the release sites are on BLM lands. The pilot includes a maximum of one or two translocations per year over a 5-year term and there is heavy monitoring for measuring success and outcomes.

See [XII.Relocation Program Examples](#) for more examples of relocation and translocation programs.



Photo Credit: Tanner Saul

II. Why Focus Planning Efforts on Beavers

As communities consider removing, maintaining, or expanding the current range or population of beavers in a given area, a natural question will be, “Why?” Why do we need to do this work? Why do we need a beaver management plan? Why is this option being considered above other options? Knowing the answers to these questions will be fundamental to the design and success of a plan. While there are many benefits to creating beaver management plans, they are only useful if they are the correct solution for the identified problems.

Beavers are widely documented to provide many ecological benefits, from building drought and wildfire resiliency to acting as a natural disturbance regime on the landscape. The question for many beaver management planners is not if beavers provide a benefit, but rather at what location, cost, and timeline, and how to manage potential conflicts. Some benefits may not be salient for all stakeholders, while others can act as a lynchpin for discussions. While it is important to acknowledge the breadth of benefits, it is also necessary to consider those that align with stakeholder interests, and the goals of the agency or organization developing the plan. Benefits must be weighed against the feasibility of plan implementation and conflict resolution programs, including monetary

costs, time commitments, and staffing. A reality for many beaver management planners is that, while benefits exist, many landowners and wildlife agencies are looking to solve conflicts, not potentially introduce more by restoring beavers for their landscape benefits. To feel comfortable proceeding, benefits and the conflicts will need to be clearly and concisely considered.

The benefits associated with beaver-led restoration are an expanding area of research, and the following sections summarize the prominent findings from selected categories to provide a high-level overview. These benefits mainly focus on instrumental values, like ecosystem services, as they are more easily quantified in scientific studies. However, the benefits discussed here are not exhaustive and are not a substitute for completing a values framework with the stakeholders involved in a beaver management plan process. It is also important to note that our understanding of beaver-led restoration benefits continues to evolve as new research and ways for knowing becomes available.

2.1 Ecosystem Services: Floods, Wildfire, & Drought

Protected and restored headwater wetlands can provide important fire breaks from wildfires. They can also act as safe refuge for wildlife and livestock in the event of wildfire and may even be a form of emergency safety for firefighters. By using Normalized Difference Vegetation Index (NDVI) data to study riparian corridor greenness, a 2020 study of large western United States wildfires found beaver-dammed riparian corridors are relatively



Figure 3: Photos of a beaver lodge and wetland complex on a prairie stream in southeastern Colorado. While many people associate beavers with forests, beavers can create resiliency in many different types of ecosystems. Photo Credit: Jackie Corday.

unaffected by wildfire when compared to similar areas without damming (Fairfax & Whittle). In that same study the authors found that, on average, the decrease in NDVI during fire in areas without beaver dams is 3.05 times greater than areas with beaver dams, though plant greenness rebounded in the next year regardless of beaver activity (Fairfax & Whittle). This supports the idea of beaver dam complexes as fire breaks, and photos of these areas post-burn are powerful visual stories of that effect (Figure 4).

After the Bootleg Fire in the Upper Klamath Basin, an area home to multiple threatened and endangered species, including two fish that are culturally vital to the Klamath Tribe, fisheries biologists braced for disaster. A Scientific American article described areas of the river turning into black slurries from the ash and other debris, but roughly five acres of greenery survived along Dixon Creek, an area with approximately eight active beaver dams (Whitcomb, 2022). In the photo to the right, taken from the article, the difference between the beaver dam complex and the surrounding burnt vegetation is stark.

Beaver complexes affect the structure and function of river corridors. A comprehensive study from Larsen et al. 2021 summarizes these impacts, finding that a complex of beaver dams can:

- increase surface and subsurface water storage,
- modify the reach scale partitioning of water budgets,
- allow site specific flood attenuation,
- alter low flow hydrology,
- increase evaporation,
- increase water and nutrient residence times,
- increase geomorphic heterogeneity,
- delay sediment transport,
- increase carbon, nutrient and sediment storage,
- expand the extent of anaerobic conditions and interfaces,
- increase the downstream export of dissolved organic carbon and ammonium,
- decrease the downstream export of nitrate,
- increase lotic to lentic habitat transitions and aquatic primary production,
- induce 'reverse' succession in riparian vegetation assemblages, and
- increase habitat complexity and biodiversity on reach scales. (Larsen, Larsen, & Lane, 2021)



Figure 4: A complex of beaver dams at Dixon Creek highlighting the difference between green, riparian habitat and surrounding burnt vegetation. Photo Credit: Charles Erdman/Trout Unlimited, excerpted from Scientific American article (Whitcomb, 2022).

The complex processes and cascading impacts that can result from beaver activity can be difficult to understand and can be even more difficult to communicate. The same paper notes that the interpretation of impacts, the role of beavers in river management, public perception, and government policy, "...are fraught with uncertainty and a large potential for misunderstanding" (Larsen, Larsen, & Lane, 2021). While benefits of beavers are scientifically explored, how they play out within a specific landscape under different and sometimes unknown conditions is not certain. One interesting area of study is floodplain connectivity and its effect on water quantity and quality, especially considering floodplains are often not extended the same legal protections as river corridors. However, studies do not always share the same definition of floodplain connectivity, and that definition may impact the results of the research.

While studies indicate that healthy stream systems and restored floodplains and wetlands can recharge local aquifers, the role of beavers and their effects on groundwater recharge is still being explored (Serra-Llobet, et al., 2022). A Utah State University study analyzed how dam building activity alters the timing and delivery of stream water downstream and facilitates groundwater infiltration, overall increasing the natural water storage both behind and adjacent to dams (Hafen, 2017). In the Western US, mountain snowpack has traditionally acted as a natural reservoir, holding back precipitation collected over winter months and eventually melting during spring runoff. Hafen theorizes

that beaver dams could provide a conceptually similar function, albeit at a much smaller scale, to snowpack. As beaver dams slow water as it moves downstream, beaver dams also delay the delivery of precipitation and can mitigate flooding, increase the accumulation of surface water, and groundwater storage (Hafen, 2017). **Figure 5** illustrates the extended spring runoff in theoretical annual hydrographs under current conditions and with beaver dams.

Hafen indicates that, “While our results may suggest that increases to water storage from increased beaver dams are negligible in the context of water resources management and snowpack, they could be very significant locally” (Hafen, 2017). The author stresses that more studies need to be done to assess the cumulative effects of beaver dams and beaver dam complexes and their associated water storage or delivery capabilities but speculates that the effects will be more pronounced on the timing and delivery of water.

A five-year study conducted in the United Kingdom by the University of Exeter found that natural flood management, which included beaver mimicry installations such as BDAs and a beaver reintroduction project, was responsible for a statistically significant reduction in peak flow levels (23%), leading to an attenuation in peak flows during rainstorm events (Puttock, Frith, & Brazier, 2024). The study included an interim reporting and final reporting. At the interim reporting, the reduction in peak flows levels was observed at 17%, and in the final reporting, the reduction was at 23%, indicating that the beaver mimicry installations and beaver reintroduction

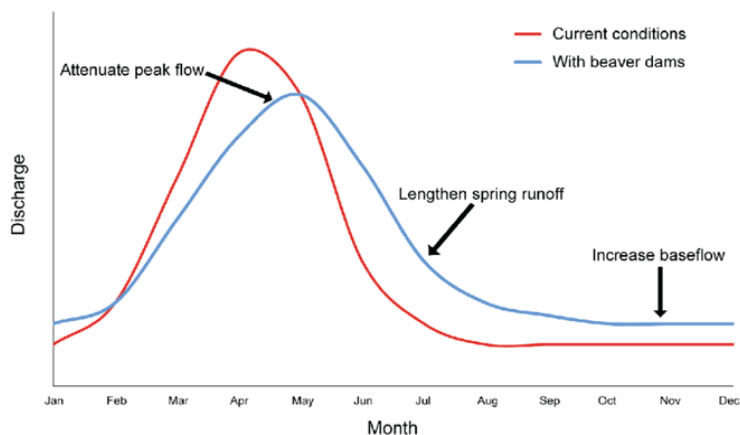


Figure 5: Theoretical annual hydrographs depicting the hypothesized effects of beaver dams on the timing of stream runoff, excerpted from Hafen’s Master of Science Thesis at Utah State University (Hafen, 2017).

efforts has become increasingly impactful over time (Puttock, Frith, & Brazier, 2024).

Before planning begins, it is vital for stakeholders to understand the applicability and limits of available science versus where there are current research gaps. For example, if one of the goals of a beaver management plan is to attenuate floods in high-risk areas, practitioners may look for ways to quantify flood attenuation at a beaver dam complex scale. Pragmatically, this approach may be unrealistic given the current tools and overall variation in floodplain characteristics on the landscape or catchment scale. A better goal in line with current research and available tools may be to focus projects on high-risk areas. Additionally, studies conducted in montane or alpine conditions may look different when applied to arid or ephemeral systems. The differences between these systems are not inherently bad, but they should be acknowledged and accounted for, especially when determining plan goals and expectations.

2.2 Low-Tech, Process-Based Restoration and Beavers

Over the past decade, LTPBR approaches to restoring incised streams have gained traction as published research indicates its effectiveness to restoring natural river processes. Methods include installing natural wood and rock structures that mimic beaver dams that slow flows, capture sediment, and, over time, help to reconnect the floodplain and re-establish riparian vegetation. LTPBR techniques may not require beavers to be present at the site, but when done correctly can bring about some of the same benefits that natural beaver activity can provide. LTPBR principles are covered in-depth in the American Rivers report [Restoring Western Headwater Streams with Low-Tech Process-Based Methods: A Review of the Science and Case Study Results, Challenges, and Opportunities](#) and are defined as actions that utilize, protect, or restore natural or modified ecosystems to protect people, enhance biodiversity, and create resiliency (Corday, 2024).

One potential benefit of implementing LTPBR projects near existing beaver populations is that beavers might take over BDA maintenance and perpetuate restoration investments over space and time. Maintenance of BDAs can be a burdensome process for practitioners even under the best conditions and is one of the most common causes of projects losing effectiveness over time. Lack

of maintenance on BDAs is a particular problem in remote project sites. As Lisa Foster, Restoration Program Director at Trout Unlimited, describes in a Cashmere Valley Record article, “We’ve built a ton of [restoration] projects, and it’s becoming a whole summer of just going back and doing maintenance on them. But if we can bring in beavers, they do that maintenance for free and much more efficiently than we do, so that’s the idea with [beaver] relocation efforts” (Caldwell, 2024).

Trout Unlimited is not alone in looking to beavers for cost-effective labor. Reliance on beavers to do maintenance work can also occur in more arid landscapes, including where organizations in Arizona and Mexico are working binationally to restore the San Pedro River. Partners in the region often use the colloquial Mexican phrase, “Mejor castor que tractor” when describing how effective beavers can be in restoring watersheds. In an Arizona Public Media piece, local conservation director, Joaquin Murrieta, says, “Mejor castor que tractor. It’s better a beaver than a tractor. Why do I need to be doing restoration when a beaver can do it better than we do? And they’re free” (Arizona Public Media, 2023):

In the University of Exeter study cited under [2.1 Ecosystem Services: Floods, Wildfire, & Drought](#), researchers compared the differences between beaver-assisted restoration and restoration solely through beaver-mimicry installations, which served as the control. The results of the study were confounded over the study period because the beavers migrated into the control areas. However, the results suggest that the spread of beavers positively affected the results, though to what extent or through what mechanism cannot be determined. Since beavers modify systems in complex ways and are present full-time in a landscape, humans installing relatively simple structures and leaving are not always fulfilling the same suite of ecosystem services. This leads to the idea of building structures to encourage the natural spread of existing beaver populations where appropriate. Relocation programs, while beneficial in areas with a high population of nuisance beavers, can be expensive due to the need for permitting, trapping, quarantining, transporting, and release monitoring. If it makes sense for the location and goals, encouraging beavers to move in on their own through LTPBR projects without using relocations may be a more efficient and socially acceptable way to bring about beaver-related restoration in an area.

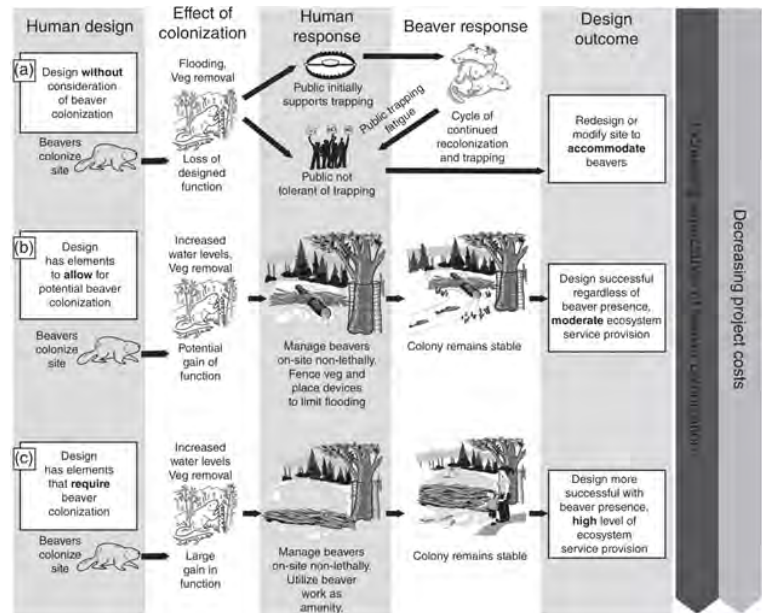


Figure 6: An excerpted diagram from King County’s “Planning for Beavers” manual (excerpted from Bailey, Dittbrenner, & Yocorn, 2018) illustrates the relationship between beaver planning levels and the design outcomes, project costs, and human response expectations.

In King County, Washington, salmon habitat restoration managers implementing LTPBR projects are now actively including the natural spread of beaver populations into their projects. Jennifer Vanderhoof, Senior Ecologist for King County, explains the county’s relationship with beavers as, “We’ve gone from tolerating them at best to, ‘Oh yeah, they provide some benefits,’ to ‘They provide benefits, period. We need them, period.’” (King County, 2024). The county’s salmon work included carving new stream channels and adding wood, trees, and shrubs to help increase the complexity of the stream and open new areas for fish, all of which is work a beaver can do. While King County did not originally do this process-based work to encourage beavers, their work naturally led to beaver recolonization. As a result, the county created a Planning for Beavers manual with the assumption that beavers will inhabit their restoration sites (King County, 2022). The manual outlines three possible scenarios with varying levels of beaver integration. **Figure 6**, an excerpted diagram from King County’s Planning for Beavers manual (excerpted from Bailey, Dittbrenner, & Yocorn, 2018) illustrates the relationship between beaver planning levels and the design outcomes, project costs, and human response expectations. The next version of the manual is currently under development and includes salient findings from on-the-ground experience, including the recommendation to overplant riparian vegetation at restoration sites to account for increased beaver activity.

2.3 Creating Habitat & Resources for Terrestrial & Aquatic Species

Beavers are an effective tool to help recover biodiversity. Beaver dam complexes increase the complexity of aquatic habitat by providing a mosaic of slow-water habitats from deeper to shallower edge habitats with varying temperatures that provide food and shelter to numerous species of fish, amphibians, waterfowl, aquatic invertebrates, and mammals (U.S. Fish and Wildlife Service, 2023). Beavers can also have an impact on the terrestrial invertebrate community, and that the effect may be present across multiple successional stages, though more research needs to be done (Andersen, Nummi, & Bahrndorff, 2024).

Specifically for wintering birds, a study found, “The beaver sites attracted primary cavity nesters, secondary cavity nesters and frugivorous species...[and] the engineering activities of beavers during the growing season have a delayed cascading effect on the richness and abundance of the bird assemblage in terrestrial habitats in winter” (Fedyń, Przepióra, Sobociński, & Wyka, 2023). This means the ecosystem engineering of beavers has the potential for carry-over effects, and impact of their activity does not become fully apparent until subsequent seasons (Fedyń, Przepióra, Sobociński, & Wyka, 2023). This would be an important consideration for how to measure the success of a beaver management plan or program if one of the goals is to enhance habitat for different species.

Habitat creation and modification by beavers with improvements to riparian vegetation is not just good for wildlife – it is good for livestock. Dr. Susan Charnley, a U.S. Department of Agriculture (USDA) social science researcher, studies different aspects of beaver-related restoration projects on public and private lands throughout the western United States. In 53 interviews with ranchers, Dr. Charnley was surprised by their enthusiasm for beavers, and respondents reported both ecological and economic benefits due to the changes in water and riparian vegetation, and in many cases increases and improvements in forage availability (Charnley & Kantor, 2020). Betsy Stapleton, board chair of the Scott River Watershed Council (California), who collaborates on projects with ranchers and other landowners, explains her “aha” moment when she noticed existing beaver complexes corresponded to significant residual water and fish habitat along one particularly dry

section of the Scott River, “I went from ‘Oh, aren’t beavers cute?’ to ‘geeze, maybe they could have a really beneficial effect, not only for ecosystems, but for the agricultural community’” (Charnley & Kantor, 2020).

Balancing the needs between all users, both human and animal, of a wetland area can be complex, but there are successful examples from across the United States. As forage availability increases, users may need to modify grazing practices to preserve benefits to other aquatic and terrestrial species, which can and should be accounted for in beaver management plans and programs. Charnley and Kantor (2020) state, “This can be accomplished through timing and intensity of use of riparian pastures, riparian fencing, or other means. For example, if establishing a project requires keeping livestock out of a stream, a rancher might need to invest in fencing materials or alter grazing management, in addition to installing a new water tank for an alternative source of water. The grazing management practices used by ranchers in all of the projects studied were compatible with beaver-related restoration. This was true on public and private land, whether the practices had been implemented specifically for beaver restoration, or to support other goals like restoring riparian vegetation for fish recovery.” While this might first appear daunting, Dr. Charnley notes that the prevailing sentiment with all 50 ranchers in the study was that the benefits were worth the costs.



Figure 7: Riparian vegetation with unrestricted summer grazing on Susie Creek, Nevada, in 1989 (top), and after timing and duration of riparian grazing changed and beavers colonized in 2017 (bottom). Excerpted from a USDA report, photo credit Carol Evans (Charnley & Kantor, 2020).

III. Human Dimensions

Managing beaver populations is a balance of benefits and conflicts. While beavers are considered master ecosystem engineers, humans are also uniquely equipped to alter the environment, and our modifications, such as irrigation canals and roads, are often impacted by beaver dam building activities. A historical solution to this problem has been to lethally remove beavers. One of the most common and important considerations that stakeholders mention is the ability to plan for human dimensions and conflict. There are many ways people view nature, beavers, and the perceived benefits or conflicts they are associated with. If planners center any one value, they risk alienating the lived experiences of others. This can create unnecessary conflict and halt beaver management progress before it begins.

Human dimensions as it relates to beavers and beaver management is an area of growing research at the national and international level. Research areas include exploring values-based frameworks, assigning responsibility or accountability for specific actions, and how to apply values-based approaches to create meaningful and effective policy changes. The topics covered in this section are examples of current salient issues in the beaver management space. Human dimensions will evolve with new experiences, research, and education, as will the values people associate with beavers in the landscape.

3.1 Values-Based Framework

Value often gets broken down into a dichotomic opposition, such as the idea of dignity (an intrinsic value) versus price (an instrumental value) (Himes, et al., 2023). An objective literature review of intrinsic, instrumental, and relational values of nature was conducted for the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, as part of the *Methodological Assessment of the Diverse Values and Valuations of Nature*. The authors determined core meaning types and explored their usefulness through the lens of policy, research, and values communication. Intrinsic (value expressed independently of any reference to people as valuers) and instrumental (values of nature to achieve human ends or satisfy preferences) are more

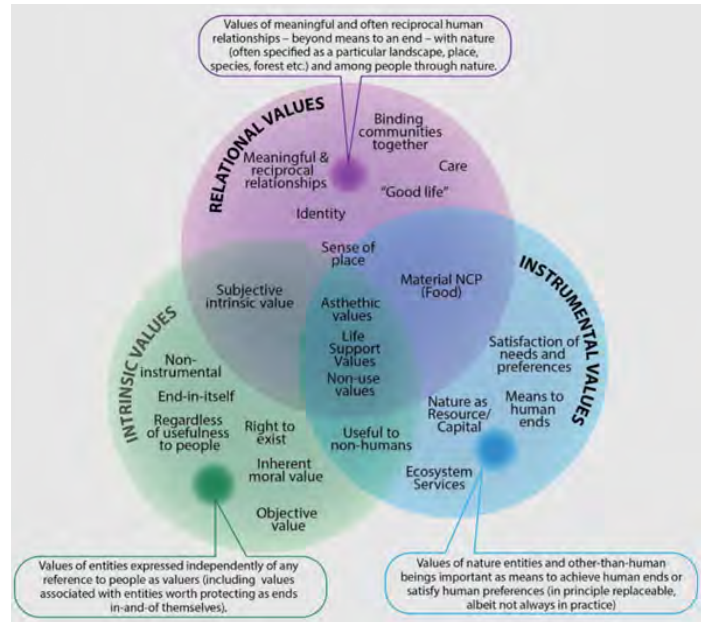


Figure 8: Venn diagram showing the three types of values (relational, intrinsic, and instrumental) and where they overlap, or the “fuzzy boundaries,” which are places of common values that may be particularly useful for state beaver management planning. NCP is an acronym for “nature’s contribution to people.” Diagram excerpted from “Why nature matters” report (Himes, et al., 2023).

readily understood. Relational values, or values of meaningful and often reciprocal human relationships with nature and among people through nature, can be more difficult to describe (Himes, et al., 2023). Additionally, the authors acknowledge there are “fuzzy boundaries” where these values overlap, and that these categories may also not capture all values, as showcased in Figure 8 (Himes, et al., 2023).

One good example of a fuzzy boundary is food, which crosses both the instrumental and relational values, and can further be defined by locality or regional practices. The authors note that, “Identifying fuzzy boundaries helps articulate the full measure of their importance to the community, which can otherwise not be adequately expressed by a single value type” (Himes, et al., 2023). Static thinking, or only considering one value category type, may lead to miscommunications and misunderstandings. The introduction of relational value types helps articulate areas where intrinsic and instrumental values often overlapped but were confusing or inconsistently applied in research and policymaking.

The historical use of trapping beavers for pelts and food can create an assumption that hunters or trappers are only identifying with instrumental values. Interestingly, those seeking to use beavers for watershed restoration are often conversationally paired with intrinsic values,

though the act of using beavers for restoration is itself also an instrumental value. Instrumental and intrinsic values are often wrongly pitted against each other. In the end, confining any group into one value category is misrepresentative and unhelpful. People may see beavers as satisfying a need (instrumental), but they can also incorporate them into a sense of identity (relational) and see them as inherently important (intrinsic).

These values may also change over time and space. The addition of the relational values along with the fuzzy borders helps to fully capture the spectrum of values within a community and move past assumptions. The authors note that, in policymaking specifically, “relational values...can help articulate, as has emerged from the literature review, the idea that a specific place – a forest, a river, a landscape, or a population – are essentially important to people because of the unique relationships, history, and traditions that bind them together” (Himes, et al., 2023).

When it comes to approaching state beaver management plans, the idea of value pluralism, or finding areas where values overlap, can be a great starting point for conversations between stakeholders. This can help identify common ground, reduce conflict, and acknowledge that beavers often fulfill more than one value in our respective lives and our communities. Conversely, finding and acknowledging the borders between value boundaries can illuminate areas of contention. Once identified, these can be prioritized and appropriately planned for, rather than waiting for these areas to emerge later and cause strife. For this process to work, before discussing values, stakeholders must define those values to ensure everyone is operating under the same understanding. The values identified and defined will be specific to the physical area and who is at the table, another reason why identifying all stakeholders is an important step in the planning process. As the authors summarize, “...it clearly emerges that each value type is critical for expressing some dimensions of why nature matters and that each value type can be a pragmatic leverage point for change, although the effectiveness of engaging with any single value type depends on the social, political, institutional, and ecological context” (Himes, et al., 2023).

3.2 Responsibility & Accountability

States agencies often are responsible for beaver management plans and programs, assuming the

responsibility and accountability for the goals and outcomes. However, it is not uncommon for these agencies to lack the necessary staff, budget, and time to take on this role. Additionally, they may not have the expertise, which can make responsibility and accountability an even more daunting proposal. Swan (2022) explored the barriers and constraints preventing the California Department of Fish and Wildlife (CDFW) from changing their policy on the translocation of beavers. At the time, CDFW did not allow the translocation of beavers, even for restoration projects. Swan identified nine themes that played a part in preventing policy change: 1. Human dimensional barriers, 2. Impacts to nonparticipating landowners, 3. Liability, 4. Institutional issues, 5. Political barriers, 6. Financial barriers, 7. Lack of knowledge or misperceptions, 8. Ecological barriers, and 9. Lack of organized influence (Swan, 2022). Swan conducted interviews with 18 different stakeholders, including ranch and farm owners. They expressed concerns such as increased regulations that would make it harder to eliminate nuisance beavers, granting access to their land if the wetlands result in habitat for endangered species, or landowners or the beaver relocation program accepting liability for beaver impacts to other landowners (Swan, 2022). In general, the lack of knowledge and uncertainty was a theme, and she created a diagram, **Figure 9**, to help identify educational needs to address the lack of knowledge and uncertainties.

The National Association of Wetland Managers (NAWM) and BLM collaborated to gather information from current beaver restoration professionals on experiences, questions, and needs encountered while completing projects. NAWM and BLM jointly created a list of 125

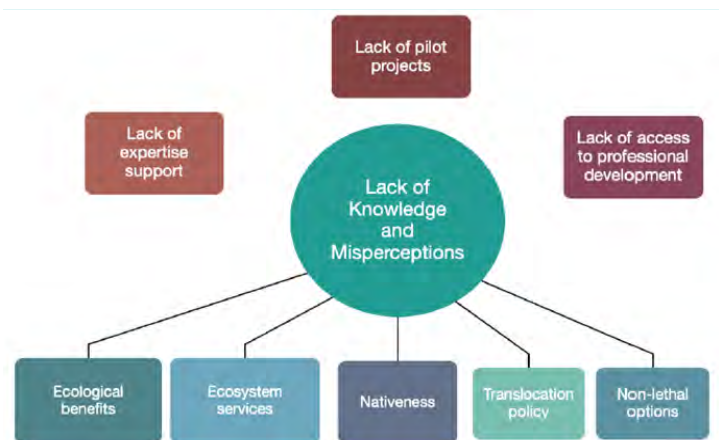


Figure 9: Figure highlighting the lack of knowledge and misperceptions that inhibited beaver management policy change in California (Swan, 2022).

professionals identified as working on beaver-related restoration and asked them to complete a survey, resulting in 34 respondents representing work in 15 states (Zollitsch & Dooley, 2021). Some of the common challenges associated with beaver-related restoration included lack of awareness, misunderstandings, and unfamiliarity with practices; logistical issues; lack of resources to support work; and a lack of trained professionals (Zollitsch & Dooley, 2021).

A social study from researchers in England conducted interviews with landowners who reported beaver conflicts within the vicinity of the River Otter Beaver Trial site. The authors identified key themes to consider when engaging with people during beaver reintroduction conflicts: 1. Proactive engagement prior to beaver reintroduction and/or a fast response to damage complaints, 2. Appropriate communication, and 3. Include stakeholders in the decision-making processes to improve outcomes for all parties (Auster, Barr, & Brazier, 2020). In regards to “appropriate communication,” the authors noted that, “...a sympathetic approach was likely to be received positively...a willingness to listen to and take the respondents’ concerns seriously [is] a key component of building trust” (Auster, Barr, & Brazier, 2020).

Often, the issue of responsibility and accountability is overlooked, but both state and federal agencies, as well as any private landowners or other entities involved, consistently identified it as a barrier. A way to overcome it is through thoughtful planning discussions to identify and overcome those barriers through collaborative solutions such as coexistence cost-sharing and technical support for landowners. As the plan develops, assigning responsibility for certain tasks, especially those that are designed to be responsive to conflicts, will also reassure affected stakeholders and help with timely responses. Finally, while many plans and programs often begin with a champion, it is important that whole teams and agencies are invested. A collective sense of responsibility will help ensure the longevity of the work should the champion no longer be involved in the plan or program.

3.3 Human-Beaver Conflict Resolution

Because human-beaver conflicts are often listed as a frequent complaint to state wildlife agencies, a substantial barrier to maintaining and growing current beaver populations is developing the necessary

resources to address these complaints. Some agencies track complaint calls, though the type of information collected can vary, while other agencies do not track complaints. Complaints typically stem from beaver dam building activity interfering with human infrastructure. This can create conflicts with landowners, water suppliers or managers, and transportation departments. Who is responsible for human-beaver conflict, and how much education and resources are available, can vary widely.

Before undertaking a beaver management planning process, it may be beneficial to gather and analyze any existing human-beaver conflict complaint data. If there is no official complaint tracking, instituting a process to gather data can help understand and contextualize the scope of the challenges. While there may be calls to create a statewide beaver management plan, the data may reveal that only a few entities, such as a transportation department or large, private landowner, are experiencing the most beaver conflicts. In this case, a statewide human-beaver conflict resolution program may not be necessary at that time. Managers may find more success by individually addressing these impacted stakeholders through targeted programs.

It is important to note that even if a stakeholder only encounters one human-beaver conflict, flooding and other destructive activity can be expensive and create long-term economic impacts, which can affect perceptions. This can understandably lead to future hesitations to re-establishing beaver populations as a plan goal to other challenges, especially if the landowners feel they may shoulder responsibility for solving human-beaver conflicts. In Alamosa, Colorado, employees of the Rio Grande National Forest, a local watershed NGO, and the Frisco Creek Animal Rehabilitation Center are working together to trap and relocate conflict beavers out of the valley floor and into the surrounding Rio Grande National Forest as part of a wet meadows restoration project. In an article for Alamosa Citizen, USFS fisheries biologist Rosalee Reese stated, “I think of this as much a service to irrigators and water rights holders in the Valley as it is a benefit to the forest” (Woods, 2024).

Acknowledging that there will be human-beaver conflicts and proactively designing programs to address and reduce them is vital to any successful state beaver management plan or program. The types of human-beaver conflict resolution devices and important information about their design and maintenance can be found elsewhere in this paper in section **X. Living With Beavers – Conflict Resolution**.



Photo Credit: Tanner Saul

IV. Trapping

Trapping discussions in the United States tend to center on the North American fur trade that culminated in the 1800s and led to the extirpation of several species, including the North American beaver, over much of their historical range. This isn't unwarranted as the effects of this fur trade are still felt today, and the images from this time are striking and memorable. While fur trading and trapping has origins in individual incomes, livelihoods, and ways of life, the North American fur trade was primarily fueled by commercial and even political interests. This contrasted with the longstanding, balanced relationship that Indigenous peoples enjoyed with beavers—a balance that, once broken, led to extensive degradation of many of our wetland and riparian ecosystems in the US. Commercial trapping was also not the only source of degradation. Land use practices, such as extensive sheep grazing, amplified the effects. In the end, commercial trapping contributed to beaver population decline, but it was not the only factor.

In the early 1900s, many states banned beaver trapping to allow recovery of the species, and over approximately 50 years, population recovered to a fraction of their historical numbers. In the 1950s, states began proactive management of furbearer species, including the creation of trapping seasons and regulations to manage rebounded populations. Today, fur trapping for beaver pelts is not as economically driven, partly due to the decline of pelt prices, though many still harvest pelts and other biological products from beavers.

Additionally, lower stream gradients, a river trait that attracts beavers for easy dam building, were also appealing to humans for similar reasons. Valley bottoms are a level place to build homesteads, and waterways were needed for transportation and fertile farmland. The remaining riparian habitat was also altered and often degraded, making it difficult to identify livable areas for rebounding beaver populations. What beavers remained after the commercial fur trade found themselves in direct competition with humans, and new areas absent from beavers were filled with human development. As beaver populations increased due to regulations, relocation, and natural recolonization, a new challenge arose - how to coexist with an ecosystem engineer in landscapes now dominated by human infrastructure. Trappers are now commonly involved in nuisance species removal to help manage this conflict. The public often sees recreational trapping as the main source of beaver harvesting, but it is likely nuisance removal is more impactful (Boyle & Owens, 2007). This misperception can influence beaver management practices by pulling attention away from much needed human-beaver conflict resolution programs, and further emphasizes the need for better data collecting of any harvests

When specifically discussing trapping, it is important to remember and center shared values, as expressed in the [3.1 Values-Based Framework](#) section. Like many environmental issues, the juxtaposition of existing transportation, water, and power infrastructure; the human populations that are reliant on it; the social and cultural importance of beavers to different groups; and wetland recovery efforts, are nuanced and complicated.

Trappers will continue to play a role in the future of beaver management planning, particularly in human-beaver conflict resolution programs and the relocation of beavers to new habitats for watershed restoration work.

4.1 Reasons for Trapping: Recreational & Damage Control

To create effective state beaver management plans or programs, it is important to identify the common reasons for trapping, which often fall into two categories: recreation or nuisance removal. It is also important to note that, in some states, nuisance removal can be done via shooting. For trapping, most recreational surveys gather information on the number harvested, regions harvested, traps used, and trapping nights. While these may be helpful for extrapolating population estimates, agencies also recognize this methodology is limited and potentially biased. Also, some states' annual surveys of trappers are only voluntary, and states often do not have the resources, staffing, and time to conduct more holistic field surveys. This is especially true for nuisance removal, which may not even require a permit or, if it does, the permits may not be tracked in some states. Additionally, when furbearer species are lumped under one plan, beaver information and data may not be prioritized. Regulatory agencies may focus more on furbearer species with larger economic impacts or on hunting and angling programs that bring in more revenue.

In *North American Beaver (Castor canadensis): A Technical Conservation Assessment*, prepared for the USFS, Rocky Mountain Region, the authors note, "Although commercial trapping is no longer a threat to the species, depredation trapping to mitigate beaver damage, and illegal shooting and trapping are localized threats" (Boyle & Owens, 2007). While there is a lack of robust data for recreational and nuisance trapping, a bigger gap in knowledge is illegal depredation trapping and shooting, which is virtually untraceable. There is a great need to gather better data for nuisance removal trapping and to better understand the motives and barriers for those who are illegally trapping or shooting. Those engaging in illegal, or unpermitted, trapping may feel it is their best, most affordable, or only solution. This makes robust, responsive, effective, well-funded, and well-advertised conflict resolution programs vital to state beaver management success.

There are few studies exploring the human dimensions of beaver trapping. Identifying and consulting with affected

individuals is an important step in better understanding motives, and motives are essential pieces of information for creating effective management plans. The data on when, how, and why beavers are trapped is difficult to gather as they may not exist, participants may not feel comfortable providing those data, or the data collection process is burdensome or complicated. For example, in Colorado, recreational trapping is managed under the state wildlife agency, while nuisance removal is managed under the state department of agriculture. It is important to understand this structure when analyzing state beaver trapping regulations and recommending changes.

4.2 Existing Trapper Data

The National Trappers Association (NTA), National Trappers Foundation (NTF), and Association of Fish and Wildlife Agencies (AFWA), which consists of federal and state wildlife agencies as well as non-profit organizations, are actively involved in education and research for wildlife trapping. AFWA created and published the [Best Management Practices for Trapping Beaver in the United States](#) handbook in 2016 and annually publishes the *Trap Use, Furbearers Trapped, and Trapper Characteristics in the United States Seasons* report.

The [AFWA 2023-2024 Seasons](#) report provides several key insights into trapping. First, it states that 82% of trappers reported that trapping is not at all an important source of income over the past three years. (Association of Fish and Wildlife Agencies; Responsive Management, 2024) Additionally, 69% of trappers indicate that the removal of nuisance wildlife plays some part in their trapping, and for 30% of trappers, most of their trapping involves nuisance wildlife (Association of Fish and Wildlife Agencies; Responsive Management, 2024). Nearly two thirds, 62%, have been contacted by a landowner to trap nuisance wildlife on their property (Association of Fish and Wildlife Agencies; Responsive Management, 2024). For nuisance removal, there are further figures breaking down trapping by state or region, but it does not include species-specific information.

A little less than half of trappers, 44%, reported taking a trapper education course, 47% have heard of AFWA's best management practices for trapping, and 29% reported belonging to a trapper organization (Association of Fish and Wildlife Agencies; Responsive Management, 2024). Each trapper could name up to four species that are important to their trapping, and beavers were listed as the third most important after coyote and raccoon,

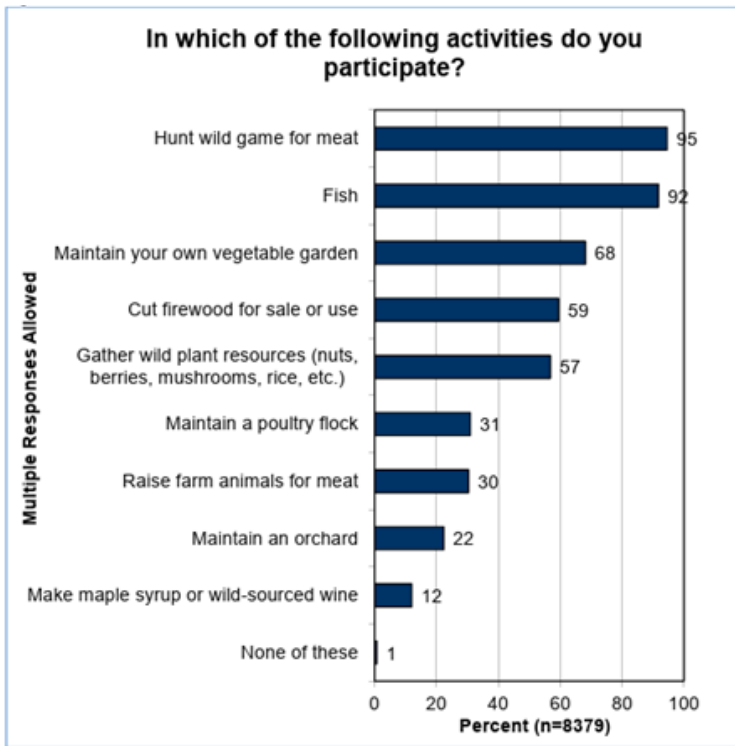


Figure 10: Results from a trapper survey that showcase different outdoor-related or self-sufficiency activities that trappers participate in (Association of Fish and Wildlife Agencies; Responsive Management, 2024).

respectively (Association of Fish and Wildlife Agencies; Responsive Management, 2024).

The 2023-2024 report included a new section for trends, and it noted that the percentage of trapping primarily on private land has increased with each survey, with 2023-2024 reporting 72% primarily using private land, and, for beavers specifically, there was a 12% increase in the percentage for trapping beavers as the primary species trapped on private lands as compared to 2015 (Association of Fish and Wildlife Agencies; Responsive Management, 2024).

A new question in the survey asked trappers what other outdoor-related activities they pursued, with the results shown in **Figure 10** (Association of Fish and Wildlife Agencies; Responsive Management, 2024).

Only 13% of trappers reported incidentally catching beavers (Association of Fish and Wildlife Agencies; Responsive Management, 2024). Beavers were most often incidentally caught when targeting river otters, with 73.7% of incidental captures while otter trapping being beavers (Association of Fish and Wildlife Agencies; Responsive Management, 2024). Several states create informational and educational brochures or webpages on how to avoid beavers when trapping river otters, though many are

the reverse, especially when river otters may have a more constrained trapping season or are uncommon for the area. Nutria, if present, may also represent similar challenges of incidental catch, with 33% of incidental captures while trapping nutria being beavers (Association of Fish and Wildlife Agencies; Responsive Management, 2024).

In 2019, the Maine Department of Inland Fisheries & Wildlife (MDIFW) contracted with Responsive Management to obtain public input regarding the management of furbearers, attitudes towards trapping, and human-wildlife conflicts of Maine’s residents, hunters, trappers, and landowners. This was a scientific report that specifically studied the human dimension of furbearer management, resulting in the [Human Dimension of Furbearer Management in Maine](#) report (544 pages) and an [abridged summary report](#) (59 pages). This study also guided the updated [2020-2030 Maine Furbearer Management Plan](#), covered in **6.2 Maine**.

While beavers are only one species covered, very few trapper reports focus on the human dimension. While there will be portions of the results that are Maine-specific, human perceptions can be universally applied. One graph shown in the report is approval and disapproval rates of regulated trapping in the US by region and various states, and it shows that, on average, most people approve of regulated trapping. It states, “The two common reasons for opposing trapping are concern over perceived inhumane treatment and concern over accidental or non-target catch (in some cases, this latter concern stems from an assumption that trapping is not properly regulated or is not regulated enough)” (Maine Department of Inland Fisheries & Wildlife, 2020). The report notes that simply informing residents that trapping is regulated by a state agency is vital outreach in dispelling misinformation, and that further education about modern trapping standards and exclusion devices could also help clarify regulations and relieve concerns over trappers accidentally capturing or injuring endangered species.

One of the most salient findings, particularly for beavers, is that the reason for trapping appears to affect the person’s approval or disapproval. The study found that some people generally oppose the idea of recreation trapping but approve of contracting a licensed trapper or animal control professional to resolve a conflict. The report states, “For many people, nuisance management is perceived as a necessity, and this perception allows

them to overcome their distaste for trapping...while they were not completely comfortable with the basic concept of trapping animals, they recognized the problems that beaver and fisher can cause..." (Maine Department of Inland Fisheries & Wildlife, 2020). Interestingly, landowners had a slightly different perception compared to the general population when it came to species causing them concern. While landowners commonly thought beaver populations are too high, the report noted that they enjoy seeing them and having them around if the damage can be minimized (Maine Department of Inland Fisheries & Wildlife, 2020). This is another reason why conflict resolution programs are important for statewide beaver management success.

In the end, the abridged report makes a point to highlight that all groups want what is best for their state's wildlife. "A number of trappers in the public meetings made an effort to explain to anti-trappers in attendance that trappers do indeed care deeply about wildlife and the sustainability of wildlife populations. Separately, many trapping opponents expressed similar sentiments about themselves. While not an overwhelmingly common occurrence, it is promising nonetheless that certain members of the two sides took the time to express conciliatory statements in the public venues. Despite the contentious nature of the subject matter, a major takeaway from the project is that trappers, non-trappers, trapper opponents, and the Department itself share as a chief concern the well-being of Maine's wildlife populations" (Maine Department of Inland Fisheries & Wildlife, 2020).

4.3 Review of Trapping & Nuisance Regulations in the Intermountain Region

The following sections contain information gathered from publicly available sources, such as on websites, and interviews or email exchanges with state regulatory agencies in the Intermountain Region. It is important to note that the information collected represents only some aspects of the state's trapping programs, and it is important to read the relevant regulatory and legal documents for a full understanding.

It can be difficult to find permitting, reporting requirements, closures, bag limits, trap regulations, and other information on each of the state's websites. The information is also seasonal, and the data for these tables

Trapping Regulations									
	END OF SEASON REPORT	HUNTING ALLOWED	LEGAL ON PUBLIC LANDS	DATA ONLINE	REGS ONLINE	LIMIT # OF TRAPS	HARVEST LIMIT	SEASON (APPROXIMATE)	CLOSURES
ARIZONA	YES, MANDATORY	NO	NO	NO	YES	NO	UNLIMITED	NOV 1 - FEB 28	YES, MANY
COLORADO	YES, VOLUNTARY	YES	YES	YES	YES	NO	UNLIMITED	OCT 1 - APR 30	NONE
IDAHO	YES, MANDATORY	NO	YES	YES	YES	NO	VARIES BY REGION	VARIES BY REGION	YES, MANY
MONTANA	YES, VOLUNTARY	NO	YES	YES	YES	NO	UNLIMITED EXCEPT CLOSED REGIONS	NOV 1 - APR 15 SEPT 1 - MAY 31	YES, MANY
NEW MEXICO	YES, MANDATORY	YES	NO	YES	YES	NO	UNLIMITED	APR 1 - 30, NOV 1 - MAR 31	YES, MANY
NEVADA	MANDATORY FOR TRAPPING, NOT FOR HUNTING	YES	YES	NO	YES	NO	UNLIMITED	APRIL 1 - 30, NOV 1 - MAR 31	YES
UTAH	NO, ENCOURAGED	YES	YES	YES	YES	NO	UNLIMITED	SEPT 14 - APR 1	YES, MANY
WYOMING	YES, VOLUNTARY	YES	YES, MOST	YES	YES	NO	UNLIMITED EXCEPT CLOSED REGIONS	OCT 1 - APR 30	YES, MANY

Table 1: Trapping regulations from western states. It is recommended to read available regulations and reports online for a more comprehensive look at trapping programs.

Nuisance Regulations				
	NON-LETHAL REQUIRED FIRST	PERMIT REQUIRED FOR LETHAL TAKE	PERMIT REQUIRED FOR RELOCATION	NUISANCE TRAPPING REPORT
ARIZONA	NO	NO	YES, BUT ONLY AZGFD OR WILDLIFE SERVICES CAN RELOCATE	VOLUNTARY
COLORADO	NO	NO	YES	VOLUNTARY
IDAHO	NO, BUT ENCOURAGED	YES	YES, BUT ONLY IDFG OR APPROVED ENTITY CAN RELOCATE	VOLUNTARY
MONTANA	NO, SOME REGIONS RUN CONFLICT PROGRAM	YES, WITHIN CERTAIN DATES	YES	VOLUNTARY
NEW MEXICO	NO, BUT ENCOURAGED	YES	YES	MANDATORY
NEVADA	NO, BUT ENCOURAGED	YES	YES	MANDATORY
UTAH	NO, SOME REGIONS RUN CONFLICT PROGRAM	YES	YES, BUT ONLY UDWR OR LICENSED FACILITY CAN RELOCATE	MANDATORY OUT OF SEASON, VOLUNTARY IN SEASON
WYOMING	NO, BUT ENCOURAGED	NO	YES, BUT ONLY WGFD CAN RELOCATE	VOLUNTARY

Table 2: Nuisance beaver removal regulations from western states. It is recommended to read available regulations and reports online for a more comprehensive look at trapping programs.

was gathered during the 2024-2025 season. It may be updated or changed in subsequent seasons.

Each state in **Table 1** and **Table 2** classifies beavers as a furbearer species. Some states, such as Utah, may define a species as “protected” with the protection stemming from the species being a furbearer and therefore being subjected to trapping regulations (i.e. any furbearer can be a “protected” species). Additionally, some states regulate the furbearer species dependent on a wildlife management area or some other geographic location. In one area, the furbearer will have a defined trapping season but, in other areas, the furbearer may be closed to harvest year-round. Each state lists specifications on the types of traps allowed. Some states also allow hunting of beavers in addition to trapping, and those regulations and reporting requirements vary. Some define hunting as dispatching a beaver with a firearm after it has been trapped, while others define it as taking a free-roaming beaver (i.e. not in a trap) with a firearm, and the legality of either or can be different based on the circumstances.

4.4 Potential Regulation Adaptations

Like with beaver management plans, there is no single way to create effective recreational and nuisance trapping regulations or supportive coexistence programs. They will vary from state to state depending upon many factors. Studies and consultations with wildlife agencies indicate regulated trapping seasons do not adversely impact beaver populations overall. However, beavers, “... are considered easy to trap and can be overharvested, especially at a local level” (Idaho Department of Fish and Game, 2023). Thus, this section looks at ways some states adjusted their trapping regulations to maintain stable beaver populations and employed education or changes in reporting strategies.

Overall, additional data collection around current trapping practices would provide valuable insight, transparency, and direction for management. There’s also the potential to partner with trapping associations or organizations to increase education and the adoption of science-backed best management practices for trapping. Trappers will also be an important stakeholder for any recreational or nuisance regulation changes, such as prohibiting traps within a certain distance of lodges or temporarily closing sites to trapping. This work

should also be done in conjunction with strengthening coexistence education and conflict resolution programs. The most successful plans and programs will not only be based on science, but on the lived experiences of the stakeholders and the unique characteristics of the community and landscape.

Improvements to Data Gathering Processes

While legal hunting and recreational trapping is not considered a significant threat to established populations, illegal trapping or shooting and nuisance trapping are likely factors. As shown in **Table 1** and **Table 2**, some states require mandatory reporting of all beaver takes, whether during the regular trapping season or outside of the trapping season for damage control, in an effort to gather more complete data versus voluntary surveys. State agency capacity is a consideration when determining reporting requirements, as states may only employ one furbearer manager to cover not just beavers, but several furbearer species. It is uncommon for state wildlife agencies to employ beaver-specific managers. Staffing restrictions, budgetary constraints, and timing (for example, many furbearer seasons overlap, or nuisance complaints may be more concentrated during certain times of the year) may play a significant role in the information, resources, and data available.

Some state reporting remains voluntary due to the difficulty of gathering data from practitioners across large, and often remote or rural, areas. Additionally, there may not be programmatic resources, staff, time, or knowledge to create effective communication plans, databases, digital permitting systems, or more sophisticated or detailed reporting methodologies. Due to these factors, agencies may seek a balance between gathering valuable information and imposing mandatory reporting, knowing that if a process is too cumbersome, it could lead to more unreported activity. It may be necessary to first address these hurdles to gather and synthesize data and create informed communications before adopting new practices or altering existing procedures.

Partnering with trapper organizations to amplify BMPs and education

When reviewing recreational trapping regulations, there appears to be a potential to partner more with trapping organizations for educational courses. The instructors

can promote existing trapping best management practices, such as those defined by AFWA, and include additional information on the ecosystem services of beavers, especially as many trappers also engage in hunting and angling activities or other hobbies that may benefit from watershed restoration, as seen in **Figure 10** (Association of Fish and Wildlife Agencies; Responsive Management, 2024). It may also be an opportunity to discuss the potential benefits for trappers to join trapping associations, such as receiving the latest research and data on best management practices, or how their work can help facilitate watershed restoration.

Temporarily closing specific trapping areas, particularly for relocated beavers

While recreational trapping does not appear to negatively impact existing populations at broad spatial scales, relocated beavers are particularly vulnerable. Depending on the state, relocating beavers may require a significant amount of research, permitting, funding, and staff hours, making their removal a loss of valuable resources. This is especially true in places where the legal trapping and relocation window is short, and the permitting and quarantine process to relocate more beavers is complicated. It is likely the trapping community will have questions about whether the closure will be permanent and under what parameters the closure will be lifted. It is important to have these discussions before undertaking projects or closures to ensure all stakeholders are operating with the same information and timelines.

Creating science-driven parameters for site reopening, such as measurable improvements in the watershed or

self-sustaining populations, may be helpful for trappers, wildlife agencies, and the restoration community. After a site is opened, it can be monitored for any significant changes and, if certain parameters are met, the site can be reclosed to protect populations. It will be important that these parameters do not feel arbitrary and are backed with scientific research and input from stakeholders. If an area is closed, it can be helpful to create signage explaining why with supporting entities listed (ex. wildlife agency, local trapper association, etc.) and a number or website for additional information, as seen in **Figure 11**.

Non-lethal methods and strengthening conflict resolution programs

Though not a trapping regulation, it is important to co-develop conflict resolution programs with nuisance beaver trapping regulation changes. If landowners do not have available resources and expertise to resolve a beaver conflict, they may feel unsupported, overwhelmed, and under resourced, leading to lethal removal (whether legal or illegal) as the most common and affordable option. This is especially true if stakeholders are considering making it legally required to utilize non-lethal options first in the state. The framework would need to be carefully constructed to allow for exemptions in the case of beavers or beaver dams actively causing property damage, flooding, or infrastructure harm, but not so strict that landowners feel powerless managing their own property. Additionally, if non-lethal options are required first in the state, and the programs that educate and support human-beaver conflict resolution are understaffed or underfunded, there may be a delay in helping impacted landowners, which can inadvertently cause property damage and undermine the credibility of the human-beaver conflict resolution program.

It will be important not only for landowners to understand the capabilities of the program, but for operators to feel comfortable and confident offering assistance, which may require training. Prior to creating any requirement or program, it may be beneficial to first gather any existing nuisance data and prioritize collecting and mapping additional data to better understand the scope and the extent of conflicts in the service areas. There may be tools or resources available to help ascertain whether a potential beaver reintroduction is likely to create human-beaver conflict.



Figure 11: Photo of a Utah Department of Water Resources beaver trapping closure sign in the Temple Fork area. Photo Credit: Dr. Joe Wheaton.

In many states, non-lethal options are encouraged, but not legally required, and some states are actively assisting landowners with human-beaver conflict resolution. Regardless, human-beaver conflict resolution information should be readily available online and easy to mail, updated periodically, and provide salient information on cost, use-cases, effectiveness, installation, and maintenance. It is also important that non-lethal conflict resolution resources are designed and outlined to be accessible and understandable to different stakeholders. Additionally, funding a rebate-style or cost-share program could significantly increase participation.

Barriers to using conflict resolution devices include knowledge of the devices, expertise installing the devices, capacity, and financial restrictions. To overcome those barriers, there needs to be effective communication, education, training, free or low-cost site visits, available labor for installations, and cost-share programs or rebates. For many states, it may be beneficial to develop and hone a conflict resolution education and device installation program before developing a statewide beaver management plan. If there are different wildlife management districts, the program can be adopted and implemented district by district to realistically scale resources, starting in the districts with the most reported conflicts. Creating a successful program can create confidence and buy-in for beaver management at a larger state scale and reassure potentially affected landowners that effective solutions are available and already working within their community.

V. Overcoming Existing Barriers & Concerns

Some of the biggest barriers to beaver-led restoration projects or keeping beavers where they currently reside are conflicts with landowners and water suppliers/managers, whether private or public, and local and state transportation departments. These social challenges are covered in **III. Human Dimensions** and **IV. Living With Beavers - Conflict Resolution**. This section covers other significant barriers and concerns, with some rooted in preconceived ideas, regarding beaver restoration and the translocation of beavers. If these barriers are not adequately addressed at the beginning of the planning process, they may stop stakeholders from coming to the table. Additionally, since beaver restoration work is underway in many states across the US, stakeholders will also want reassurance that any lessons-learned or emerging concerns will be thoughtfully considered and addressed. As plans and programs learn and grow, these barriers may no longer present a challenge, and new concerns will take their place.

5.1 Loss of Beaver Habitat

Studies estimate that 79% of the 3.3 million miles of rivers in the lower 48 states are altered by human activity, and 19% are flooded by reservoirs, leaving approximately 2% unaltered (Wheaton, Bennett, Bouwes, & Maestas, 2019). In upper rural watersheds, the main causes of altered floodplains are historical mining and timber harvesting practices, historical and present-day agriculture practices (e.g. intensive livestock grazing), alteration of river flows by dams and diversions, roads and other infrastructure development, and removal of beavers (Poff, Koestner, Neary, & Merritt, 2012). Common physical effects include lowered groundwater tables, loss of wetlands, lower summer base flows, and warmer water temperatures (Pollock, et al., 2014). Biological effects include the loss of riparian plant biomass and habitat diversity and the decline of fish and other aquatic organism populations (Pollock, et al., 2014).

The scale of the problem feels immense, and landowners, water right holders, and water managers are looking

for solutions. As these entities continue exploring LTPBR and beaver-led restoration, it can be overlooked that the habitats are not just degraded for humans and other species – they are degraded for beavers, too. We see beavers as potential solutions to these problems, and research confirms this at different scales, but beavers also need certain resources and structures within a watershed to survive. There are methods to help beavers succeed in restoring an area, such as pre-installing BDAs or other structures to create deep pools for beaver refuge, and those are covered more in-depth in **11.5 Release Site Standards & Actions to Increase Survival Rates**.

The threats to beavers move beyond just the current state of riparian areas. A report prepared for USFS, Region 2 succinctly sums up the challenges faced by beavers in the Rocky Mountain Region: “The principal threats to beaver populations are habitat destruction and degradation. Human population growth and increasing demands on water resources lead to water storage, diversion, and channelization projects that affect rivers, lakes, and wetlands. Water uses can cause short and long-term effects on beaver habitat by changing seasonal flow regimes and stream morphology, and by causing loss or degradation of riparian vegetation. Intense grazing by wild and domestic ungulates in a riparian zone is also a primary cause of beaver habitat degradation” (Boyle & Owens, 2007). In some cases, the general state of the wetland or river corridor is too degraded to feasibly support any LTPBR work, even installations without beavers.

If the restoration area is negatively affected by intensive livestock grazing, there are examples with grazing best management practices that can help reverse that damage (Swanson, Wyman, & Evans, 2015). Dr. Charnley, et al. studied the social factors of six beaver-related restoration projects on public lands and private ranches in five western states (Charnley, Gosnell, Davee, & Abrams, 2020). They determined it was critical to conduct conversations with interested landowners about the need to adopt riparian grazing BMPs for successful stream recovery. The report synthesized their findings and identified six important social factors, including, “...a regulatory environment that enables experimentation, flexibility, and adaptive management...” and, “...proponents, ranchers, and partners willing to take risks, innovate, be flexible, and stay committed” (Charnley, Gosnell, Davee, & Abrams, 2020).

5.2 Fish Passage & Fish Habitat

Fisheries biologists and other restoration practitioners are often concerned about fish passage through LTPBR structures or beaver dam complexes, and are often forced to balance the habitat benefits beavers and LTPBR provide with declining or imperiled fish populations. Typically, these concerns are focused on anadromous fish (most often salmonids) and their ability to migrate to spawning and rearing habitat, but it is also important to note that it may also be important to consider passability for non-anadromous species. There is no singular answer to address concerns related to fish passage as they are reliant on different factors, such as the species of fish, the condition of the stream, the concentration of woody debris, and/or reduced or concentrated forceful flows. However, beavers and many fish species did co-evolve, and historically beavers were pervasive across the U.S. in areas with suitable habitat while many of these fish species of concern thrived, indicating solutions for beavers and fish passage exist in many situations.

Some identified solutions include altering dams and directly assisting fish. Volunteers in Juneau, Alaska, with the help of USFS and the Alaska Department of Fish and Game, created a Beaver Patrol program to maintain the benefits of beavers while finding coexistence solutions to fish passage, trail flooding, and culvert blocking (Purdy, 2019). In a KTOO news piece, Mary Willson, a long-time Beaver Patrol member, said, “We can keep the beavers, keep the habitat they make for the fish, allow the spawners to come up, decrease the trail flooding – let’s try to do it all. It’ll never be perfect, but it’ll be a whole lot better” (Purdy, 2019). While the majority of the patrol’s work is time and labor checking the dams, they have designed and installed devices, including baffles and barricades out of metal mesh, stakes, and netting (Purdy, 2019). During the summer, the patrol occurs twice a week, Thursday and Sunday, and the nonprofit group relies on volunteers and self-bought supplies, such as waders (Purdy, 2019).

Potential Positive Impacts	Potential Negative Impacts
<ul style="list-style-type: none"> • Increased fish productivity/abundance • Increased habitat and habitat heterogeneity (which promotes biodiversity) (Smith and Mather 2013)) • Increased rearing and overwintering habitat • Enhanced growth rates • Providing flow refuge • Improved production of invertebrates 	<ul style="list-style-type: none"> • Barriers to fish movement • Siltation of spawning habitat • Low oxygen levels in beaver ponds • Altered temperature regime

Figure 12: Results of a meta-analysis for the potential impacts of beaver modifications on fish species.

Other fisheries-related concerns related to beaver activity can include stream temperature increases, lower dissolved oxygen, and siltation of gravels at potential spawning areas. [The Beaver Restoration Guidebook](#) provides an overview of available studies on beavers and fisheries. This primary literature meta-analysis, **Figure 12**, summarizes the most commonly cited positive and negative impacts to fish.

One of the most comprehensive studies on the topic of beavers and fish came from the Bridge Creek restoration project in Eastern Oregon in which the researchers hypothesized that beaver dams or human-constructed beaver mimicry, “...can greatly accelerate the incision recovery process...” of Bridge Creek, and that advancing channel incision recovery would alter, “... the hydrologic, thermal, geomorphic and vegetation characteristics of stream reaches and their associated riparian habitats, which in turn would improve habitat conditions for steelhead” without impacting upstream and downstream migrations. Their study data provided support for their hypothesis (Bouwes, et al., 2016). Four years after installing a series of hundreds of BDAs, which is more than a typical project would install, the project ultimately resulted in beaver recolonization. Additionally, the juvenile steelhead production in Bridge Creek increased by 175%, and the juvenile survival rate increased by 52% in comparison to Murderers Creek, a nearby control reach (Bouwes, et al., 2016).

In 2022, another study involved tracking PIT tagged juvenile coho salmon and steelhead trout to test their ability to cross BDAs. The authors hypothesized, “... because these salmonids have evolved in the presence of beaver dams for millions of years, that they have also evolved strategies for crossing them, and that by constructing dams similar to beaver dams in terms of size, location and materials, these fishes would also be able to cross these human-built structures.” Their study results documented that both species, “...had little difficulty crossing the BDAs, whether by jumping over a 40-cm waterfall or swimming up a short side channel with 8-11% slope” (Pollock, Witmore, & Yokel, 2022). They also noted, “...because out-migrating juveniles time their downstream movements to coincide with high flows, concerns over passability at this life-stage are less warranted. The same can be said for adult salmon, especially coho salmon, which generally time their movements to coincide with high flows” (Pollock, Witmore, & Yokel, 2022). They concluded by suggesting,

“...unless there is clear and compelling evidence that a beaver dam or BDAs are preventing the movement of fishes and that this is likely to have a population-level effect, such structures should not be removed. Options such as temporarily notching or installing fish passage structures may be an alternative under some conditions, such as the presence of adult salmon stacking up below a dam, but guidelines need developing” (Pollock, Witmore, & Yokel, 2022).

In addition to these studies and the [The Beaver Restoration Guidebook](#), Utah State University Restoration Consortium hosts a [webpage](#) with additional resources, information, and videos of fish passage through beaver dams. As projects continue to evolve, new questions emerge, such as whether studies account for the difference between species population increases versus habitat selectivity. For example, a BDA may attract more fish, but that may not mean a population increase. Additionally, new quality habitats may be increasing for non-native fish, which can increase predation or competition. While the answers to these questions continue to be debated, researchers continue to learn more about the relationship between fish and beavers, and there are case studies and educational resources to help concerned stakeholders navigate the process to find a solution that fits both beavers and fishery restoration goals.

5.3 Disease & Aquatic Invasive Species

It is important to consider and address any disease or aquatic invasive species concerns before undertaking beaver relocation efforts. While not all beaver management plans will have relocation components, those that do will benefit from addressing these concerns with wildlife agencies, anglers, recreators, and other stakeholders before proceeding with the planning process. The following are a few notable and prominent diseases that may be brought up in discussions.

Whirling Disease (WD)

A disease caused by the parasite *Myxobolus cerebralis*, it was introduced to United States from Europe around the mid-1900s, and it has been devastating to many trout populations in the intermountain states. “The spread of WD across the US appears to be primarily mediated through the movement of infected fish or fish products

by humans or predators. For example, WD is quite easily transferred through anthropogenic movement during recreational activities such as fishing, as anglers do not always clean their gear” (Turner, Smith, & Ridenhour, 2014). There are two hosts required for the parasite to complete its life cycle: a fish, and a tubifex worm that lives in water body sediments. When an infected fish dies, spores from the parasite are released and eaten by tubifex worms. The spores transform into another stage of the parasite called a triactinomyxon, which is then expelled by the tubifex worm, and fish contract WD from the free-floating parasites in infected water. Wildlife agencies and fishing organizations have worked hard over the past few decades to halt its spread.

Fish biologists express concern that the parasite could be carried on beavers relocated from an infected stream to a WD free stream. While the authors of a paper found that passage of viable myxospores through the digestive system of piscivorous birds, they did not find published research documenting beavers spreading myxospores on their fur (Steinbach Elwell, Stromberg, Ryce, & Bartholomew, 2009). As noted in [11.6 Beaver Holding Facility Best Management Practices](#), many beaver relocation programs created quarantine protocols that include keeping the beavers dry for the first 24 hours and keeping them at holding facilities for at least three days, partly to address the uncertainty of being a vector for WD. To mitigate risk, agencies can also adopt a rule that beavers captured in an area known to have WD can only be translocated to other areas known to have WD.

Chytrid Fungus

A fungus known as Bd, short for *Batrachochytrium dendrobatidis*, is causing significant declines in amphibians around the world. Bd has several life stages, including a swimming spore that lives in water and an encysted form that occurs on frogs’ and toads’ sensitive skin. Infected animals grow lethargic and malnourished, often dying within weeks. A 2005 study hypothesized that chytrid fungus could be spread by birds coming in contact with water bodies that contained the fungus and transferred it on their feathers to other water bodies (Johnson & Speare, 2005). The authors lab tested the ability of the zoospores to attach to various types of bird feathers and survive different drying periods, from one minute to three hours. Fungus zoospores survived two hours of drying, but not beyond three hours (Johnson & Speare, 2005). As noted in [11.6 Beaver Holding Facility](#)

Best Management Practices, there are beaver in-take and quarantine protocols that include keeping beavers dry for the first 24 hours and keeping them at holding facilities for at least three days. These protocols should also be sufficient to address the risk of transmitting Bd, but further research is needed

Aquatic Invasive Species (AIS)

New Zealand mud snails and other AIS can transfer on boats and waders, which causes concern for transfer on beavers during relocation processes. Montana Fish, Wildlife & Parks Beaver Restoration guidance on this topic, which are similar to protocols used in other states such as Utah and Oregon, provides the following: “In waterways where the AIS status is not known, beavers will be quarantined in a holding facility for at least 24 hours prior to transplant, or as long as it takes for beavers to dry completely, pass multiple rounds of feces, and show any signs of disease or illness. Beavers should first be allowed to dry completely after capture, then should be periodically rinsed with clean fresh water during the quarantine period” (Ritter, McGree, Schmetterling, Gower, & Boccadori, 2023).

Additionally, to properly clean all equipment used in beaver relocation (waders, traps, pickup beds, etc.), the Montana Fish, Wildlife & Parks Beaver Restoration guidance provides detailed information on cleaning agents that are reported to kill WD spores, chytrid fungus, and AIS species, such as New Zealand mud snails (Ritter, McGree, Schmetterling, Gower, & Boccadori, 2023). They also developed a beaver transplantation health screen form based on Oregon’s health screen form. The process of addressing disease and other AIS concerns should be a factor when determining the type of beaver management plan and goals. First, stakeholders will want to know if there are proactive management and forethought for these concerns. Second, to address these concerns there will be budgetary and staffing implications. If holding facilities are not currently available, it may be necessary to build facilities or partner with agencies or organizations with capacity. Additionally, staff need to be properly educated and informed on how quarantine and proper disinfection protocols helps control the spread of disease.

5.4 Permitting

The confusion around permitting is currently at the forefront of challenges for beaver restoration work. Permitting can happen at various stages of the process or in relation to various activities, including nuisance beaver removal, beaver relocation, LTPBR work, or coexistence device installations. While this report will not go into the specifics of permitting, it is important that any beaver management work is aware of any applicable permitting processes. Since many restoration pathways and projects are new, processes are changing in real time. It can be unclear what agency or authority should be involved, at what point should they be involved, or if they need to be involved at all.

When there is no required permitting process, it can simplify and speed up the implementation of projects, lowering the barrier of entry. However, the lack of permit requirements can also lead to faulty device installations or poor-quality work, which can cause conflicts and create negative views of restoration projects. Through the state beaver management plan or program process, it will be important to identify and find a balance of permitting processes that meet the needs of the stakeholders and the permitting agencies. Including updates or streamlining of permitting processes during the planning stages can help facilitate program or plan adoption.

Finally, in many states only wildlife agencies or an approved organization can relocate beavers. There may be additional requirements, such as knowing the exact destination for relocation, releasing between certain dates, and mandatory quarantines in a holding facility. It can also be difficult to find approved trappers and licensed professionals. [The Beaver Institute’s “Find a Beaver Professional in Your Area” webpage](#) includes a map to help with these endeavors. For planning purposes, it will be helpful to know if there are available resources in your area before undertaking a beaver management plan or program that includes coexistence device installations or beaver relocation services.

VI. Examples Of State Plans Or Programs

Statewide plans are effective management tools as they correlate with state fish and wildlife agencies being the regulatory authorities. A statewide plan can harmonize practices, such as aggregating permitting processes or creating decision matrices, to create a complete and logical blueprint for all stakeholders. Examples of a top-down state approach include Oregon, Pennsylvania, Utah, and Vermont. However, localized beaver management plans are also effective, especially in areas where beavers are of special interest due to historical, environmental, economic, or social factors. These local plans or programs, which can be more approachable and easier to kickstart, can then be elevated and serve as a model for creating regional or statewide plans. Examples of this bottom-up or grassroots planning include California and Montana. There is no correct way to approach a statewide plan or program, and top-down and bottom-up approaches often overlap. Arguably, the most effective route is whatever is currently palatable and feasible regarding current local or state processes, goals, and values.

This section contains examples of top-down and bottom-up plans, as well as furbearer management plans. Every plan or program creates its own goals, providing other states, regulatory agencies, and stakeholders examples for adapting to their needs. The goals are often informed by environmental factors, particularly the landscape and ecology of the state, which can help other states find examples that reflect their own characteristics. They can also help identify common conflicts and pinch points to inform more proactive programs. Boyle and Owens add, “Beaver management plans must consider landscape-scale habitat management. To maintain viable populations, managers should ensure that land uses maintain connectivity between watersheds to facilitate long-range dispersal and gene flow” (Boyle & Owens, 2007). State agencies are primed for this work and may already be enacting different types of species management or connectivity plans that naturally lead into beaver restoration goals.

Additionally, a recent literature review in beaver management concluded that, in the past five years, there is a noticeable increase in publications concerning the human dimension (Treves & Comino, 2023). While beaver-related restoration is still a small portion of the literature at 4.3%, the research shows a growing recognition of their potential in restoration work, suggesting human dimensions could be an emerging concern for stakeholders (Treves & Comino, 2023). Often, state management plans or programs include public surveys to help inform their work, which can also reveal insights into the human dimensions of beaver restoration. The authors note that imposing strong management actions without understanding local perceptions can create misunderstandings, affect perceptions of beavers, and make legal management more difficult (Treves & Comino, 2023). To be able to embrace a future of beavers being restoration agents in freshwater systems, it is important to “...stimulate stakeholder involvement and stewardship as a form of collaborative planning and responsible management...allowing the construction of strong communities closely connected to the territory in which they live and with a strong sense of stewardship” (Treves & Comino, 2023).

6.1 California

Beaver Restoration Program

Lead Agency/Partner: State plan by California Department of Fish and Wildlife (CDFW), beaver restoration planning and groundwork led by Occidental Arts & Ecology Center (OAEC)

Type: Beaver restoration and coexistence program, pending state management plan

- Adoption: 2023
- Updated: N/A
- Length: N/A

State Legal Status: Furbearer

Trapping Season: Varies by season and area, but generally November 1 through March 31 in specified counties, and there is no bag or possession limit. Additionally, there are areas where beavers or any part thereof may not be taken (California Fish and Game Commission, 2025).

Mission & Goals: “In 2023, CDFW established a Beaver

Restoration Program that strives to partner with tribes, non-governmental organizations, private landowners, and other state, federal, and local agencies to implement beaver-assisted restoration projects to support ecosystem conservation, habitat restoration, species conservation, and improve climate change, drought, and wildfire resilience throughout California” (California Department of Fish and Wildlife, 2025).

Structure: Currently, the program and its resources are laid out in a series of webpages and documents with no official state beaver management plan yet as it is currently being drafted. The Beaver Restoration Program became permanent in 2024 following the passage of legislation AB 2196. This includes a budget with staff members and various program goals, including the creation of a state management plan.

Decision Matrix: Yes, CDFW adopted a Beaver Depredation Policy in 2023 that takes a tiered approach to addressing beaver damage control by evaluating situations on a case-by-case basis to determine if feasible non-lethal methods can address the problem or if removal is needed (California Department of Fish and Wildlife, 2023).

Overview & Highlights:

Occidental Arts & Ecology Center (OAEC), a non-profit, established the WATER Institute in 2004 to increase the understanding of the importance of healthy watersheds for communities. In 2009, the WATER Institute launched the “Bring Back the Beaver” campaign to legitimize the importance of beavers and process-based restoration as a low-cost strategy to restore degraded watersheds. The campaign started in coalition building, then published peer-reviewed articles on the historic range of beavers in the [Sierra Nevada](#) (Lanman, Perryman, Dolman, & James, 2012) and [Coastal California](#) (Lanman, et al., 2013) to dispel beliefs that beavers were a non-native species. In 2012, an ad hoc California Beaver Working Group was convened and included researchers, agency staff, tribal partners, and advocacy organizations. Part of the strategy was to introduce beavers as a key to recovering salmon through the Salmonid Restoration Federation (SRF), to the restoration of mountains meadows through the Sierra Meadows Partnership, and to climate change resilience through the California Climate & Agriculture Network (CalCAN) (Occidental Arts & Ecology Center, 2025).

The WATER Institute specifically states it did not want to go through the route of lawsuits, instead focusing on partnerships, and in 2016 it released the first edition of the [Beaver in California: Creating a Culture of Stewardship](#) guidebook (Lundquist & Dolman, 2020). It also engaged the scientific community, co-developed the CASTOR beaver intrinsic potential model to help agencies prioritize location for possible beaver restoration, and built professional networks to gather information, share skills, and train.

At their invitation, the WATER institute collaborated with tribal communities in their efforts to bring back beavers to ancestral homelands. In 2018, OAEC, along with other invited partners, supported Maidu Summit Consortium (MSC) members in planning and implementing innovative restoration practices on their ancestral lands. This included the [development of a beaver recruitment strategy for Tásmam Koyóm](#) (Lundquist & Dolman, 2020). Similarly, in 2020, OAEC began working with the Tule River Tribe and other partners to assess beaver habitat and implement process-based restoration. In 2023, the first CDFW beaver translocation in nearly 75 years occurred at MSC’s site Tásmam Koyóm, and the Tule River Tribe was selected as another pilot translocation project, which successfully occurred in the summer of 2024.

Also in 2023, CDFW released a new document on beaver depredation guidance and redesigned its webpage. This was also the year the new CDFW-led Beaver Restoration Program launched, which was approved in the Governor’s budget in 2022. In 2024, OAEC was awarded \$2 million to design and launch the California Coexistence Training and Support Program, which provides financial and technical support through a California Beaver Help Desk to assist landowners in coexistence strategies. The next phase of the program will focus on growing, including the intent to officially create a state beaver management plan.

6.2 Montana

[Restoring Beavers for Montana’s Watershed Health: Montana Beaver Action Plan](#)

Lead Agency/Partner: Montana Beaver Working Group (MBWG)

Contributors: The 2023 update and revision action plan list several participating organizations, but also notes,

“The items offered here do not represent the positions of the participants’ employers or affiliated organizations, but rather capture the key ideas developed by individuals in the 2020, 2021, and 2023 workshops, meetings, and follow-up communications” (Montana Beaver Working Group, 2023).

Type: Voluntary action plan

- Adoption: 2020
- Updated: 2023
- Length: 7 pages - the additional white paper published in 2023 is 166 pages

State Legal Status: Furbearer

Trapping Season: Depends on Montana Fish, Wildlife & Parks regions. For regions 1, 2, and 3 (western 1/3 of the state) it is November 1 through April 15. For regions 4, 5, 6, and 7 (eastern 2/3 of the state) it is September 1 through May 31.

Mission & Goals: The goal of the plan is to, “...offer[s] applied direction to advance work with beavers for resilient, healthy watersheds” (Montana Beaver Working Group, 2023). It specifically notes that the goals, strategies, and specific actions are developed through continued collaborative conversations through the MBWG. The action plan lists four overarching goals:

- Integrate and expand beaver in the design and approach of stream and wetland restoration.
- Restore beaver-modified public lands to sustain ecological processes, support biodiversity, and build resilience to drought, wildfires, and flooding.
- Provide coordinated education and outreach on the benefits of beavers and beaver-related restoration.
- Streamline legal and policy obstacles to beaver habitat restoration and relocation of beavers to suitable prioritized habitat.

Plan Structure: Under the four main goals there are strategies with additional action items. Each action item lists partner organizations and specific names for contact.

Decision Matrix: Yes, Appendix A of the 2023 white paper provides a chart describing typical beaver conflicts (culvert plugging, flooding, etc.) with a list of possible solutions.

Overview & Highlights:

In 2019, the National Wildlife Federation assumed

a coordinating role for the MBWG, initially formed around 2014. In the beginning, the group was an informal coalition of approximately two dozen diverse professionals and was led by Amy Chadwick and Steve Carpenedo. The group created an action plan in 2020 and later reconvened to update it in 2021 and 2023. The MBWG hosts in-person annual meetings, conducts online meetings, posts newsletters, shares progress reports, and provides continuing education and research around beaver restoration.

It is important to note that this is a voluntary action plan with ongoing participation between different entities. One partner is Montana Fish, Wildlife & Parks, who took the lead on an original 2020 goal of creating a white paper to provide a comprehensive overview of the keystone role of beavers within the state. This 166-page document titled, [Beavers and Their Role in Riparian Restoration in Montana](#), was released in 2023 (Ritter, McGree, Schmetterling, Gower, & Boccadori, 2023). It provides an in-depth look at the history of beaver restoration in the state, core tenets of beaver restoration, responsibilities, various approaches, common scenarios,

Conflict Issue	Description	Solutions
Cutting and felling of trees	Beavers cutting and removing vegetation for food and construction materials that landowners may want or may be necessary for stream health.	<ol style="list-style-type: none"> 1) Fence trees with wire mesh fencing (Figure A3). 2) Fence entire patches of vegetation if beaver cutting is not restricted to trees. 3) Lethal removal or transplant of beavers as a last resort. Damage permits should not be issued for tree cutting unless damage to irrigation infrastructure or imminent risks to human safety are identified.
Damming of natural or man-made pinch points	Beavers building dams at pinch points such as at culverts, bridge spans, and irrigation headgates, which are highly attractive dam sites.	<ol style="list-style-type: none"> 1) Plan ahead when installing bridges, culverts, and headgates. Right-size culverts and bridges to make them hard to plug. Install mitigation structures as part of construction process if they are in a known occupied beaver area. 2) Exclusionary fencing on upstream end of pinch point structure (Figure A4). 3) Flexible pond leveler, beaver deceiver, or other flow device to lower pond level if exclusionary fencing does not work or only partially works (Figures A5 and A6). 4) Mechanical dam removal by hand or with heavy equipment depending on dam size. 5) Lethal removal or transplant of beavers as a last resort. Lethal removal can only be done with damage permit if beavers are causing damage to irrigation-related infrastructure or are an imminent threat to human safety.
Damming of areas without obvious pinch points (i.e., free-standing dams)	Beavers building dams at sites that do not seem to have a pinch point or other attractive structure. In this situation, beavers could essentially dam anywhere in the area and are not clearly focused on a single, convenient spot for the dam.	<ol style="list-style-type: none"> 1) Plan ahead when installing human infrastructure near or across streams and avoid creating pinch points if possible. 2) Flexible pond leveler, beaver deceiver, or other flow device to lower pond level (Figures A4, A5, and A6). 3) Mechanical dam removal by hand or with heavy equipment. 4) Lethal removal or transplant of beavers as a last resort. Lethal removal can only be done with damage permit if beavers are causing damage to irrigation-related infrastructure or are an imminent threat to human safety.
Excavation of channels and bank dens	Beavers burrowing and tunneling into banks, roadway berms, irrigation dams/canals, and rip-rapped banks.	<ol style="list-style-type: none"> 1) Plan ahead when installing human infrastructure near or across streams to avoid creating a tall and easily excavated bank right next to the stream that would be attractive for a den site. 2) Bank hardening to discourage digging is an option but should be a last resort and is unlikely to be permitted solely for beaver conflict resolution due to negative effects on fisheries and general stream health. 3) Lethal removal or transplant of beavers as a last resort. Lethal removal can only be done with damage permit if beavers are causing damage to irrigation-related infrastructure or are an imminent threat to human safety.

Figure 13: Excerpted from [Beavers and Their Role in Riparian Restoration in Montana](#), a summary of sources of conflict between beavers and humans and potential solutions. The “Solutions” column lists potential solutions in order from easiest and least impactful to most.

project planning, permitting, fisheries and aquatic considerations, other species considerations, and maintenance and monitoring. The appendices include the “Beaver Restoration Toolbox,” conflict management, land management changes, beaver mimicry, encouraging natural recolonization, and beaver transplantation. It is comprehensive in scope with interviews conducted across the state to add additional expertise and knowledge. The appendices are particularly helpful for quick insights into topics such as conflict management, including **Figure 13**, which outlines typical conflicts seen in Montana, relevant statutes, and potential solutions.

Additionally, in 2019, NWF, Clark Fork Coalition, and Defenders of Wildlife partnered to create the Beaver Conflict Resolution Program to increase tolerance for beavers on the landscape by implementing non-lethal conflict solutions where appropriate. From 2019-2024, the program provided 39 training courses and completed 87 beaver coexistence projects. Their expertise and non-lethal solutions are cost-effective for landowners while also promoting the ecological benefits of beavers in the landscape. Their partners also include state agencies, conservation organizations, and local communities. In 2023, the program moved under NWF with partner support, and in 2024, it launched a Beaver Hotline to report conflicts and receive technical help from members of their team.

These separate programs, united by an overlapping action plan and white paper, work collaboratively to implement beaver-led restoration projects while proactively addressing conflicts. Together they offer an alternative to traditional legislation avenues.

6.3 Oregon

ODFW’s 3-Year Action Plan for Beaver-Modified Landscapes August 2022-2025

Lead Agency/Partner: Oregon Department of Fish and Wildlife (ODFW)

Contributors: The report states the plan’s commitments are additive to ongoing work with their partners, including federal, tribal, and state agencies, watershed councils, soil and water conservation districts, non-governmental organizations, and private landowners (Oregon Department of Fish and Wildlife, 2023).

Type: 3-Year Action Plan

- Adoption: June 2023, acting as an action plan from August 2022 to August 2025
- Updated: N/A
- Length: 13 pages

State Legal Status: Furbearers – in 2023, the Oregon State Legislature passed HB 3464, also known as the “Beaver Bill,” which removed the complicated dual classification of beavers as furbearers and predatory animals. They are now solely managed as furbearers (Dennehy, 2024).

Trapping Season: In certain areas, November 15 through March 15, described via the Oregon furbearer hunting and trapping regulations.

Mission & Goals: ODFW’s mission is, “To protect and enhance Oregon’s fish and wildlife and their habitats for use and enjoyment by present and future generations” and the overarching goal of the action plan states, “ODFW staff will take action in the short term to accelerate the restoration of beaver habitat and beaver-modified habitat at the landscape-scale in Oregon” (Oregon Department of Fish and Wildlife, 2023).

Structure: The action plan is structured around four interconnected pillars, shown in **Figure 14**, that are aimed at improving adaptive management and coordination of ODFW divisions. It includes definitions for beaver emphasis areas, beaver habitat, beaver-modified habitat, and process-based restoration. Under each pillar are core actions with leads and intended completion dates.

Decision Matrix: No



Figure 14: ODFW’s mission and overarching goal for the action plan is supported by four pillars outlined in this graphic excerpted from the report (Oregon Department of Fish and Wildlife, 2023).

Overview & Highlights:

The action plan recognizes that using beaver and beaver-modified habitat restoration practices can be tools for bolstering the resiliency of Oregon’s sensitive and federally listed fish and wildlife species. It comments on how beaver dams and flood plain connectivity improve instream flow for different life stages of fish, as well as beaver dams creating key habitats via wetlands and slow-moving water for amphibians, reptiles, and birds. Additionally, “Protection and restoration of riparian-floodplain vegetative communities and beaver-modified habitats are strategies identified in Oregon’s migratory salmonid conservation and recovery plans and the statewide conservation plan for lampreys” (Oregon Department of Fish and Wildlife, 2023). The action hopes that, by more carefully considered beaver management in the state, “Oregon will have: (1) a better understanding of current beaver distribution and the opportunities for beaver-modified habitat uplift and (2) accelerated progress towards restoring beaver-modified landscapes” (Oregon Department of Fish and Wildlife, 2023).

The action plan includes four pillars with each pillar containing three to five goals. For each goal, there are not only lead agencies or stakeholders identified, but names of individuals in those roles, as well as anticipated completion dates and identification of any financial support. A final table breaks down the core action items by completion date, forming a timeline. Initial actions include a fish passage rule revision, a beaver damage complaint system, and non-lethal, coexistence response strategies. Additionally, the action plan outlines selecting one or more drainages, or 5th field Hydrologic Units (HUC10), in each ODFW watershed district to become a beaver emphasis area (BEA) for that watershed. With 10 watershed districts, this meant the creation of at least 10 BEAs. Other efforts are annual or ongoing, including implementing beaver coexistence strategies on private and public lands or conducting annual beaver surveys in each of the BEAs. Finally, some actions are dependent on funding or staff capacity, such as monitoring the effectiveness of beaver dam analogs, beaver dams, and coexistence devices.

The action plan concludes that these actions are just the beginning of laying the foundation for this work, and that ODFW will continue to report on the outcomes as they scale up beaver-modified restoration in Oregon.

6.4 Commonwealth of Pennsylvania Beaver Management in Pennsylvania

Lead Agency/Partner: Pennsylvania Game Commission

Contributors: Written and championed by Tom Hardisky. Moving forward, the current Pennsylvania Game Commission furbearer biologist oversees the plan.

Type: State management plan

- Adoption: 2011, acting as the state’s 2010-2019 plan
- Updated: No – however, they intend to begin the process of updating the plan in 2025 by incorporating it into a comprehensive furbearer management plan with expectations of the process taking two years with significant stakeholder and public involvement.
- Length: 106 pages

State Legal Status: Protected

Trapping Season: December 21 through March 31, with limits varying by wildlife management unit.

Mission & Goals: The mission of the plan is to, “Establish stable beaver populations in balance with their habitat for the benefit of wetland wildlife species and humans through proper population monitoring, harvest management, and damage control” (Hardisky, 2011). The listed goals are:

- Establish sustained beaver populations within suitable habitat.
- Monitor the beaver harvest.
- Minimize beaver damage complaints.
- Increase public awareness and knowledge of the benefits of beavers and their habitat.
- Provide opportunities to use and experience beavers.

Structure: The plan is split into objectives and strategies. Defined objectives identify the necessary steps to achieve each of the goals. To attain each objective, they developed strategies consisting of action and research needs, which listed these as the most important:

- Improved population and reproductive monitoring
- Harvest management
- Habitat management
- Habitat assessment
- Population management on public lands
- Trapping regulations

- Damage management
- Outreach
- Public engagement
- Youth participation

Decision Matrix: Yes – See **Figure 15**, “Possible beaver management decision matrix depicting regulatory action or response based on population density within suitable habitat and damage complaint levels within a WMU” (Hardisky, 2011).

Overview & Highlights:

The Commonwealth of Pennsylvania’s plan, written by Tom Hardisky, Wildlife Biologist, covers biology, habitat, management history, damage management, resource and economic values, population management, and research needs. The report notes that, at the time, established beaver populations occurred across much of the state, with only one district reporting beavers being absent. The report is a comprehensive source for beaver biology and habitat. It highlights some ecological and environmental benefits via soil conservation, water resources, ground water discharge, water quality improvement, consumptive and non-consumptive outdoor experiences, aesthetic beauty, and habitat creation for native wildlife, fish, and plant species. However, it also notes that, “...beaver activities have led to significant timber, agricultural, infrastructural, and homeowner damage” (Hardisky, 2011).

Additionally, the report highlights local Indigenous

perspectives of beavers, detailing the historical events leading to beaver extirpation and the subsequent management of the fur trade and trapping through 2002 to secure populations. The focus shifts to damage management of current populations, stating, “By far, the flooding effects of beaver-created blockages in or around streams, ditches, culverts, drainage pipes, bridges, and other waterway structures constitute the most common and costly damage” (Hardisky, 2011). However, the overall trend of beaver complaints decreased during a study period between 1995 and 2008, and they were not equally distributed throughout Pennsylvania, meaning management programs can and should plan for these disparities (Hardisky, 2011). A relatively simple task of mapping complaints over time can provide invaluable information for education and conflict resolution communication campaigns.

For economic values, the report focuses on beaver pelts and harvest management conditions. There is significant work dedicated to discerning trapping placement and bag limits in different wildlife management units (WMUs) to make regulations more understandable and improve trapper knowledge. Additionally, there is a call to better define lodges, dams, and food caches to help with misunderstandings or misinterpretations. A possible beaver management decision matrix, , was developed with the idea that, if biological and social carrying capacity of beaver populations are known within each WMU, then they could outline seasons, bag limits, and other regulation recommendations based on those capacities.

6.5 Utah Utah Beaver Management Plan

Lead Agency/Partner: Utah Division of Wildlife Resources (UDWR)

Contributors: Utah Beaver Advisory Committee, Utah Wildlife Board, Utah Division of Wildlife Resources Representatives (Mammal Coordinator, Game Mammals Coordinator, Wildlife Specialists, Aquatic Habitat Coordinator, Wildlife Habitat Biologists), Utah Trappers Association, U.S. Forest Service, Natural Resources Conservation Service, Utah Cattlemen’s Association, Utah Farm Bureau, Grand Canyon Trust, Bureau of Land Management, U.S.D.A. Wildlife Services

		Social capacity			
		Damage complaint level (3-year mean)			
Conditions within a Wildlife Management Unit		Extremely few or no damage complaints < 0.25 complaints/ 100 mi ²	Low to medium 0.25-5 complaints/ 100 mi ²	High 6-10 complaints/ 100 mi ²	Extremely high, socially unacceptable level > 10 complaints/ 100 mi ²
Biological capacity Population density within suitable habitat (3-year mean)	Extremely low density or no beavers <10 beavers/100 mi ²	Trap placement and bank den restriction B-gripping limit =2 Season =15 days Bag limit = 2 Device limit =2/4	Trap placement and bank den restriction B-gripping limit =2 Season =15 days Bag limit = 2 Device limit =2/4	Trap placement and bank den restriction B-gripping limit =2 Season =95 days Bag limit = 2 Device limit =2/4	Trap placement and bank den restriction B-gripping limit =2 Season =95 days Bag limit = 2 Device limit =2/4
	Low to medium density 11-200 beavers/ 100 mi ²	Trap placement and bank den restriction B-gripping limit =2 Season =95 days Bag limit = 5 Device limit =10/20	Trap placement and bank den restriction B-gripping limit =2 Season =95 days Bag limit = 5 Device limit =10/20	Trap placement restriction B-gripping limit =2 Season =95 days Bag limit = 5 Device limit =10/20	Trap placement restriction B-gripping limit =10 Season =95 days Bag limit = 5 Device limit =10/20
	High density 201-400 beavers/ 100 mi ²	Trap placement restriction B-gripping limit = 10 Season = 95 days Bag limit = 20 Device limit =10/20	Trap placement restriction B-gripping limit = 10 Season = 95 days Bag limit = 20 Device limit =10/20	Trap placement restriction B-gripping limit = 10 Season = 95 days Bag limit = 20 Device limit =10/20	Trap placement restriction B-gripping limit = 10 Season = 95 days Bag limit = 20 Device limit =10/20
	Extremely high density >400 beavers/100 mi ²	No trap placement restriction B-gripping limit = 10 Season = 95 days Bag limit = 20 Device limit =10/20	No trap placement restriction B-gripping limit = 10 Season = 95 days Bag limit = 20 Device limit =10/20	No trap placement restriction B-gripping limit = 10 Season = 95 days Bag limit = 20 Device limit =10/20	No trap placement restriction B-gripping limit = unlimited Season = 95 days or more Bag limit = unlimited Device limit = unlimited

¹Trap placement restriction (lodge/dam) = trapping not allowed within 15 feet of any beaver lodges, feed beds, dams, or other structures.
Bank den restriction = trapping not allowed within 15 feet of any beaver bank den above or below the water surface.
B-gripping limit = maximum number of body-gripping traps allowed.
Season = season length in days.
Bag limit = seasonal take limit.
Device limit = total traps allowed / total combined snares and traps allowed.

Figure 15: Possible beaver management decision matrix depicting regulatory action or response based on population density within suitable habitat and damage complaint levels within a MWU (Hardisky, 2011).

Type: State management plan

- Adoption: 2011
- Updated: 2017
- Length: 29 pages

State Legal Status: Protected wildlife

Trapping season: “There is an open trapping season, which generally runs from October through early April with unlimited take. Beaver causing damage may be taken or removed by the public during closed seasons provided a permit is obtained from UDWR. The UDWR also licenses nuisance wildlife control companies to lethally remove beaver causing damage at any time of year” (Utah Division of Wildlife Resources, 2010). There are instances of periodic site closures to reduce harvest.

Mission & Goals: “Maintain healthy, functional beaver populations in ecological balance with available habitat, human needs, and associated species” (Utah Division of Wildlife Resources, 2010).

Structure: The plan identifies issues and concerns, then defines objectives, strategies, and a management system for each. The identified issues and concerns are:

- Outreach/Education
- Population Management
- Harvest Management
- Damage Management/Beaver Conflict Management
- Disease/Aquatic Nuisance Specialist Management
- Research
- Watershed Restoration

Decision Matrix: No, but it identifies developing a memorandum of understanding between UDWR and USDA Wildlife Services for nuisance beaver management and response as a strategy, and provides two examples of matrices developed in Utah for specific sites that can be adapted as needed.

Overview & Highlights:

Utah’s revised 2017 beaver management plan contains the 1995 Utah GAP Analysis as well as survey information estimating the current distribution and population of beavers in the state and the capacity of individual stream reaches to support dam building activity. However, the report notes that this analysis is based on general assumptions and is not good for generalist animals such as beavers.

In 2010, the original Beaver Advisory Committee created a list of issues and concerns that needed to be considered during the planning process. The plan notes that many of the issues have since been addressed and that additional concerns were identified during the 2017 review. While there are listed concerns under all categories, including “Harvest Management” with issues such as trapping closures and considering unique harvesting regulations, the bulk of the concerns are under “Damage Management/Beaver Conflict Management” and “Watershed Restoration.”

The “Damage Management/Beaver Conflict Management” section covers a multitude of issues. Highlights include timely response, non-lethal options and education, dealing with nuisance beaver in specific areas (residential urban, city, landowners, UDOT, and others such as railroads), and how to maintain cooperative management and communication.

The “Watershed Restoration” section covers areas suitable for the establishment of beavers, the need for creating guidelines for release sites, permitting, protections for relocated beavers, water right issues, and landowner and water right holder cooperation, site characteristics for relocation, potential funding for non-lethal management structures, and potential benefits of co-current aspen/cottonwood restoration.

Under each category, objectives are outlined with additional strategies for achieving those objectives. This includes under the “Damage Management” section a strategy to, “Develop an MOU between UDWR and U.S.D.A. Wildlife Services for nuisance beaver management and response” with the below graphics (Utah Division of Wildlife Resources, 2010).

Not every objective and strategy note accomplishments in the 2017 review, but there are notable accomplishments in almost every category. These include completing statewide training with both UDWR staff and other agencies; developing a “Protocol for Live Trapping, Holding and Transplanting Beaver;” a \$40,000 UDWR grant to Utah State University to fund the development and application of the Beaver Restoration Assessment Tool (BRAT) to set more realistic expectations; and researching new considerations, including to what degree beaver dams impact trout movement and surface and groundwater storage.

A unique feature of Utah’s Beaver Management Plan is the inclusion of “Watershed Restoration” and the

subsequent funding of the Utah Watershed Restoration Initiative (WRI), which is the largest funding program in Utah for watershed restoration. A WRI “By the Numbers” factsheet states that from when the program was created in 2006 to 2023, \$377 million was awarded to 2,700 projects across the state, including 2,531 of stream miles improved (Utah’s Watershed Restoration Initiative, n.d.).

The Southern Region Beaver Relocation program, established in 2014, relocates nuisance beavers to help restore upper watershed streams, mainly on National Forests. In an interview with staff, they indicate that they prepare annual WRI funding applications requesting \$75,000 to cover the annual costs of the beaver holding facility, two seasonal technicians for trapping nuisance beaver, beaver care at the facility, and transportation costs related to relocation.

6.6 Vermont

Best Management Practices for Resolving Human-Beaver Conflicts in Vermont

Lead Agency/Partner: Vermont Fish & Wildlife Department and Vermont Department of Environmental Conservation

Contributors: The paper includes an acknowledgement, stating, “We would like to thank the New York State Department of Environmental Conservation for the framework for this document. The Northwest Science and Technology Groups in Ontario, Canada; the Massachusetts Division of Fisheries and Wildlife; and the University of New Hampshire Cooperative Extension all provided both text and illustrations. Skip Lisle, wildlife biologist with the Penobscot Indian Nation, generously contributed a major portion of the text under the section heading “Beaver Management in Vermont” (Vermont Fish & Wildlife Department, 2017).

Type: Best Management Practices. This document, “... has been prepared to simplify and unify the legal and regulatory framework related to beaver management. It describes Best Management Practices (BMPs), which provide a logical protocol with steps that should be considered and followed...” (Vermont Fish & Wildlife Department, 2017).

- Adoption: 2002
- Updated: 2004, 2014, and 2017
- Length: 53 pages

State Legal Status: Furbearers

Trapping Season: Fourth Saturday in October through the end of March the following year

Mission & Goals: : “The goal of the agency in dealing with human-beaver conflicts is two-pronged. First, as the Agency of Natural Resources, we are interested in maintaining, whenever possible, the valuable wetlands in Vermont that support biodiversity and vital ecological processes. Secondly, we hope to provide the public with the best information available for managing problem situations that result from beaver activity” (Vermont Fish & Wildlife Department, 2017).

Structure: The BMPs are broken into addressing three types of human-beaver conflicts with an additional dozen appendices covering a wide range of topics, from giardiasis to statutes and regulations pertaining to beavers and beaver dams. The three human-beaver conflicts are:

- Damage Prevention Techniques
- Obstructed Culverts and Dams Less Than Two-Years-Old
- Conflicts with an Established Beaver Dam or Dam Complex

Decision Matrix: No; however, there are problem descriptions, which define a specific challenge, with listed management responses.

Overview & Highlights:

The approach of the document is to be an educational resource, specifically for private landowners, so “...any person or organization who complies with these BMPs will need no further authorization from the agency to take the necessary actions to manage human-beaver conflict” (Vermont Fish & Wildlife Department, 2017). In both the document and the [Managing Human-Beaver Conflicts website](#), VFWD specifically calls out the increase in beaver populations and, therefore, human-beaver conflicts in the state (Vermont Fish & Wildlife Department, 2025). The website further links an infographic titled, [The Massachusetts Experience - Unintended Consequences of Banning Beaver Trapping](#) which describes how in 1996, Massachusetts passed a law that restricted the use of beaver trapping methods, which resulted in a significant harvest drop and a 90% increase in beaver-related complaints (Vermont Fish & Wildlife Department, 2025). The bottom line stated, “The

banning of regulated trapping did not stop the harvest of beaver. It just resulted in the killing, waste, and public disregard of these important species” (Vermont Fish & Wildlife Department, 2025).

The document acknowledges the beaver’s keystone species role in the environment and, specifically, their wetlands, noting that beaver-created habitat is essential for the survival and sustainability of other species in the state. It highlights how inappropriate dam removal methods cause significant environmental damage and, when one is destroyed, large amounts of sediment are discharged into the stream affecting other species and properties. The Vermont Supreme Court has also weighed in on the matter, holding the owner of the land on which the beaver dam is located or the municipality or state agency that removes a beaver dam liable for those damages. This is another purpose of the document – to reduce the risk to property owners and adjacent landowners when removing dams while also protecting wildlife habitat and water quality.

The bulk of the document outlines the three major human-beaver conflicts, their potential solutions, if or when authorities need to be notified, and any statutes or regulations related to beavers, dams, or their removal, including the 1272 Administrative Order found in Appendix 11 of the report. Throughout the report there are many examples of coexistence solutions with coordinating photos, diagrams, and construction material lists. VDFW also created the [Beaver Wetlands Conservation Project](#) also known as the “[Beaver Baffle Program](#)” to assist landowners, road crews, and municipalities who are experiencing beaver conflicts (Vermont Fish & Wildlife Department, 2025). Landowners who choose to participate in the Beaver Baffle Program by installing a water control device on their property are asked to contribute approximately 50% of the cost for the materials to build the device, but there is no fee for the on-site technical assistance (Vermont Fish & Wildlife Department, 2025). VDFW also maintains a [Beaver Management Dashboard](#), which provides a visual summary of data related to the department’s Beaver Baffle Program, including the number and types of devices installed and the wetland habitat influenced statewide (Vermont Fish & Wildlife Department, 2025).

VII. Examples Of State Furbearer Management Plans

If starting a standalone beaver management plan from scratch on either a local or state level is not viable due to staffing, budgetary, or time commitments, state wildlife agencies historically create furbearer management plans. Furbearer management plans typically cover hunting or trapping permits, trapping seasons, and bag limits, but they can include information on the importance of beavers and conflict-resolution programs. While beavers are often only a small portion of larger furbearer plans, the plans themselves are an accessible starting point for injecting new management strategies, updating historical information, and incorporating new research. There are also opportunities to create standalone brochures, handouts, or conflict decision matrices to boost community education. States also create drought, wildfire, and other environmentally focused plans, such as state wildlife action plans, which can be another avenue for incorporating beaver restoration principles without needing to create a standalone state beaver management plan.

7.1 Idaho

Idaho Furbearer Management Plan 2022-2027

In 2023, Idaho Department of Fish and Game (IDFG) adopted a 2022-2027 5-year furbearer management program that encompasses 19 different furbearer species in the state (Idaho Department of Fish and Game, 2023). The document is nearly 100 pages, and the beaver section is approximately four pages. The document also contains the results of recent trapper surveys. The survey results revealed that beavers are the third-most important furbearers to trappers and rank second in the number of participants (Idaho Department of Fish and Game, 2023). The trapper survey results for motivations for tracking is not broken down by the species trapped but show that “For recreation/pleasure” is the top reason with “For the challenge” and “To control predators” as second and third (Idaho Department of Fish and Game, 2023). The least motivational reasons are, respectively,

“To provide food,” “To take a trophy,” and “To make income” (Idaho Department of Fish and Game, 2023). These insights are then used to help inform the plan goals.

The plan also contains a map predicting beaver habitat and the presence of beaver dams. Under the “Management Goals and Direction” section, IDFG notes that beavers are found in all major river systems in the state, but that they are absent or patchy in smaller stream systems, therefore there is opportunity to expand their distribution to meet a variety of goals.

IDFG explains restoration via beavers is not a one-size-fits-all solution, and that enthusiastic but poorly executed proposals or translocation projects can harm overall efforts. To collaborate more effectively, IDFG identified the following management actions:

- Improve our understanding of beaver habitat use and sources of mortality in systems where beaver-mediated habitat restoration is being considered.
- Where opportunity exists, explore options to address beaver damage via non-lethal methods, such as pond leveling devices.
- Work with regional staff and stakeholders to identify priority areas where restoration of beaver populations will address wildlife habitat goals and landowner or land manager needs.
- Develop a guidance document for beaver restoration projects that identifies protocols to maximize beaver survival and dam building success while minimizing conflict with humans and disease transmission concerns.

While the plan is robust with newer and comprehensive trapper survey data, it is split amongst all furbearers, and additional resources, processes, or diagrams on these beaver-related management actions are not provided.

7.2 Maine

2020-2030 Furbearer Management Plan

Around 2014, Maine Department of Inland Fisheries and Wildlife (MDIFW) reviewed its traditional furbearer planning process and decided it needed to make some adjustments, particularly to be more adaptable to

scientific information and the emerging research in the field of human dimensions. In 2020, MDIFW completed a comprehensive 10-year furbearer management plan through an extensive multiyear public process. MDIFW did not want to solely rely on members of a Public Working Group for the public's perspective, therefore it contracted with Responsive Management to conduct a scientific study exploring public attitudes toward furbearer management in the state. The final plan is around 201 pages with the beaver section approximately 13 pages.

The extensive public engagement process is detailed in the management plan along with results from the surveys, including that, "Public attitudes toward beavers were positive, though knowledge of them could be greatly improved" (Maine Department of Inland Fisheries & Wildlife, 2020). There are geographic disparities, with a substantially higher percentage of residents in the southern part of the state responding that they knew a great deal about beavers but believe populations to be too high, meanwhile the residents in the north/east region were less likely to say the populations were too high but also know less about beavers (Maine Department of Inland Fisheries & Wildlife, 2020). MDIFW explains that maintaining beaver populations is both a social and biological balance, and that the Department promotes coexistence with beavers through a step-down approach to resolve human-wildlife conflicts:

- Education and Extension
- Prevention
- Use of Hunting and Trapping Regulations
- Live-Capture and Relocation
- Lethal Removal

In section 4.7 of the report, there is a detailed beaver management outline with goals and strategies for 2020-2030. There are six different goals ranging from one to over a dozen bullet points, with each bullet point noting a timeline and a priority level. The six overarching goals are:

- Maintain healthy, abundant beaver populations (2 bullet points)
- Maintain a sustainable beaver harvest (1 bullet point)
- Maintain trapper interest & trapping opportunities for beavers (8 bullet points)
- Increase public understanding of beavers & beaver management (4 bullet points)

- Minimize human-beaver conflicts (13 bullet points)
- Conservation of other species (2 bullet points)

Some notable bullet points include using GIS technologies to estimate and monitor beaver populations independent of fur harvest data (new, high priority); developing graphics that promote the ecological services that beavers provide such as altering wetland habitat (new, high priority); and increasing the promotion of beaver exclusion and/or water control devices to prevent and resolve conflicts (ongoing, high priority). The beaver section concludes that the results will be dependent on adequate staffing, funding, and public support, and it shows an anticipated outcome timeline for the next 10 years.

(BLM), ODFW, Oregon Zoo (Metro), Multnomah County Drainage District (MCDD), and U.S. Fish and Wildlife Service (USFWS). Together the five partner agencies agreed to a Memorandum of Understanding, to funding agreements (Oregon Zoo with COP, MCDD, and USFWS), and to a protocol with ODFW. The Oregon Zoo supplied the holding facility while BLM supplied the release sites in the Western Cascades. It is a 5-year term agreement with a maximum of one or two translocation events per year.

8.2 Jefferson County Conservation District, Washington

Chimacum Creek Adaptive Beaver Management Plan

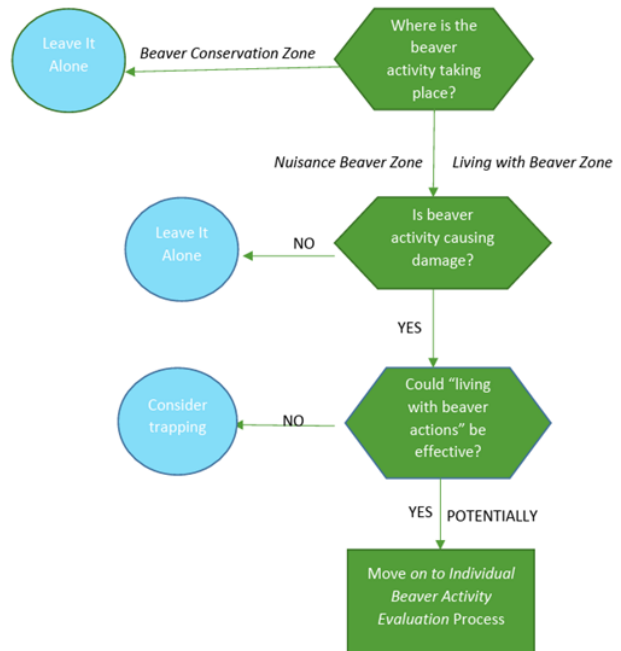
In January 2017, Jefferson County Conservation District prepared an Adaptive Beaver Management Plan for Chimacum Creek with funding provided by Washington State Department of Ecology and the U.S. Environmental Protection Agency (Jefferson County Conservation District, 2017). Project partners included the North Olympic Salmon Coalition, Jefferson Land Trust, Jefferson County Weed Control, and Washington State University. Its purpose is to assist landowners and conservation planners to make management decisions that balance the habitat needs of beavers with protecting private property with a focus on agricultural lands. It notes that the actions require ongoing maintenance and monitoring, making a flexible and adaptable plan well-suited to the needs of the watershed.

The plan covers the history of beavers in the watershed, preventative planning for riparian buffer projects, the adaptive management process, and future research areas and recommendations. The watershed is classified into three zones for beaver habitat: beaver conservation, living with beaver, and nuisance beaver. These are defined by their capacities to support beaver populations while not creating conflict or threatening infrastructure. It also explains that deterring beavers is easier than resolving conflicts, and it describes considerations for design processes such as selecting different species of plants, using plant protection mechanisms, installing pond levelers or culvert protection, and live trapping. If lethal trapping is necessary, the proper protocol along with guidance language is provided.

There are some images of flow devices and schematics for installation, along with two decision matrices, **Figure 17** and **Figure 18**.

Reach-scale Evaluation Process

Using the beaver habitat suitability classification categories, landowners and conservation planners begin to identify appropriate beaver management response(s) by conducting a simple evaluation at the reach-scale.



Individual Beaver Activity Evaluation Process

If the *Reach-scale Evaluation Process* determines that "living with beaver" actions could be effective, then, landowners and conservation planners move onto the site-specific evaluation of beaver activities. This evaluation results in specific beaver management recommendations to address the impact(s) of beaver activities in that location. "Living with beaver" actions will be described in detail following this section.

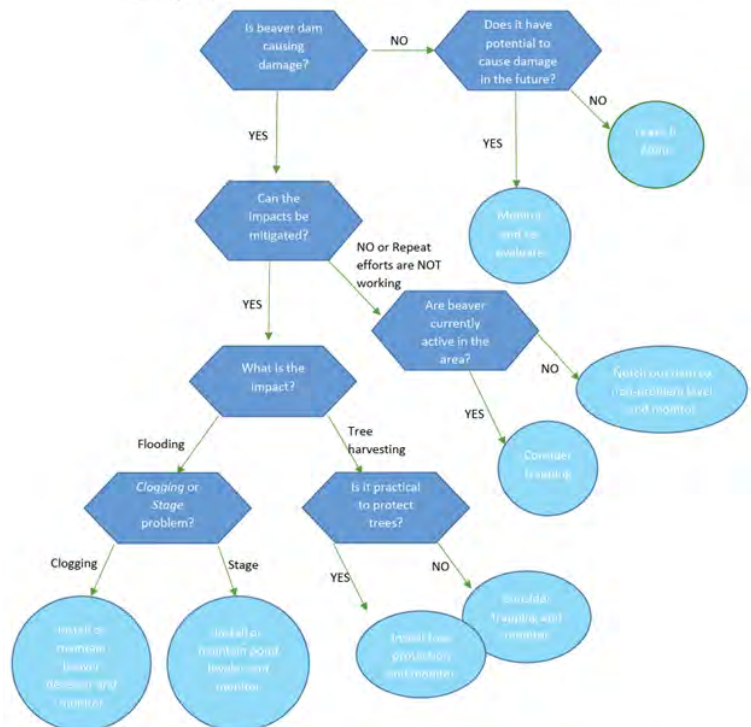


Figure 17 (top): Reach-scale Evaluation Process, excerpted from [Chimacum Creek Adaptive Beaver Management Plan](#).

Figure 18 (bottom): Individual Beaver Activity Evaluation Process, excerpted from [Chimacum Creek Adaptive Beaver Management Plan](#).

8.3 King County, Washington

Beavers in King County Program and technical papers:

- [Beaver Management Technical Paper #1: Beaver Management Tools Literature Review and Guidance \(2017, revised 2018\)](#)
- [Beaver Management Technical Paper #2: Current Laws, Policies, and Practices \(2018\)](#)
- [Beaver Management Technical Paper #3: Beaver Life History and Ecology Best Science Review \(2020\)](#)
- [Good Neighbor Workshops Report with Recommendations \(2020\)](#)

In 2023, legislation that required the Washington Department of Fish and Wildlife (WDFW) to develop and adopt a state beaver management plan was introduced but did not pass the Senate Ways & Means Committee. In March 2024, WDFW announced its intention to prepare beaver habitat management guidelines (BHMG) for agency staff, and it posted a request for proposals (RFP) to find a contractor that, "...will facilitate and document feedback within WDFW and among tribes and external stakeholders on the current state of and desired goals for statewide policies and management to maintain and/or restore beaver on the landscape for the habitat values they provide" (Washington Department of Fish and Wildlife, 2024). A draft report for WDFW's consideration is due by March 32, 2024, with a final report due June 30, 2025.

Meanwhile, King County, the most populous county in Washington, operates a comprehensive beaver management program (King County, 2025). The website details beaver biology and life history, environmental benefits of beavers, challenges and solutions, and resources for beaver management, including scientific papers, illustrations, and contact information for specific issues. For flooding, King County Drainage Services offers consultations, and the webpage notes that nearly all in-stream work in Washington requires a permit from WDFW and/or King County Department of Permitting and Environmental Services, but that, "Beavers don't need the same permits, so they have an advantage over people in their response times" (King County, 2025).

Along with the three technical papers and good neighbor workshop paper linked above, the resources

include [Planning for Beavers Manual: Anticipating Beavers when Designing Restoration Projects](#), several different infographics, and a [summary matrix of beaver management tools](#) from technical paper #1 with an additional decision flow chart, **Figure 19** (King County, 2025).

The information on beaver management devices covers pond levelers and other solutions, along with linking back to WDFW's beaver webpage, which includes designs for culvert fencing. All devices are covered more in-depth in technical paper #1, which also includes sections on plant species selection, a glossary of device terminology, live trapping and relocation protocols, and ideas for future areas of study.



Figure 19: Beaver management decision flow chart from King County.



Figure 20: Ute pictograph beaver family panel, Colorado Plateau near Grand Junction. Photo Credit: Randy Langstraat.

IX. Tribal Plans, Programs, And Partnerships

With hundreds of Tribes, Pueblos, and other Indigenous communities across the United States, perspectives on beavers and beaver-led restoration naturally vary. For some Tribes, low-tech processed based restoration practices, such as one rock dams, are a part of Traditional Ecological Knowledge (TEK), and for others, beavers are a culturally important species. TEK can include topics such as water management and conservation; sustainable hunting and fishing practices; or traditional agriculture and food preservation (Barberstock, 2024). Why beavers and their associated wetlands are important can also vary. Some tribes focus on the role beavers can play in restoring important fisheries, some focus on beavers as a resource and food, and others do not currently have a focus on beavers.

As noted in [1.5 Best Management Practices](#), partnering with Tribes and respecting traditional knowledge is vital to successful and collaborative beaver management

planning. There is no replacement or shortcut for completing a comprehensive stakeholder process or completing a values-based framework, and tribal perspectives cannot be assumed. The only way to ascertain the existing Tribal knowledge, perspectives, and connections to beavers, is by listening to and partnering with local tribes.

It is also important to reiterate that Tribal programs, particularly in relation to tribal fish and wildlife or recreation programs, can vary in scope, structure, jurisdiction, funding, staffing, focus, and culture. Some existing Tribal programs are sovereign efforts, and others are partnerships with state or local agencies. This section provides a summary of examples of different Tribal work to support beaver coexistence, operate relocation programs, or complete stream restoration projects to improve potential beaver habitat. It is important to remember that this is not an exhaustive list of Tribes or approaches and does not represent the views or lived experiences of all indigenous communities.

9.1 Blackfeet Nation

The Blackfeet Nation members, in their *Blackfeet Climate Change Adaptation Plan*, state that underlying their plan is, "...the Blackfeet understanding that people and

nature are one and that people can only be healthy if we ensure the health of the environment we are a part of” (Blackfeet Nation, 2018). The comprehensive plan was finalized in 2018 to protect communities and ecosystems from a rapidly changing climate and included input from Blackfeet Environmental Office, Blackfeet Nation Agriculture Resource Management Planning, Blackfeet Natural Resource Conservation District, Health and Safety, Blackfeet Nation Fish and Wildlife, and many others. The plan sets forth detailed goals and actions around a variety of topics, including fish, forestry, human health, land and range, water, and wildlife.

References to beaver are included under “Agricultural Adaptation Strategies: Goals and Actions,” with encouraging coexistence to promote riparian creation and restoration, and maintaining stream flows and understanding natural geomorphological processes, such as modification via beavers. Under “Fish Adaptation Strategies: Goals and Actions,” maintaining or restoring beaver populations is listed as an action to maintain or restore stream structure and function. Under the same section, building beaver dam analogs as a type of beaver mimicry is listed as a way to increase natural water storage to maintain higher flows and mitigate lower flows. In the “Water Adaptation Strategies: Goals and Actions” section beaver-mimicry is listed as a strategy to reduce the frequency of higher-intensity floods, which can help fight erosion and avoid property damage, with the possibility of live trapping and relocating to restore wetlands. Beavers are also listed under the “Wildlife Adaptation Strategies: Goals and Actions” to protect ecological connectivity and provide habitat structure.

One direct outcome of the climate adaptation plan is The Beaver Project, an on-the-ground collaborative effort using beaver mimicry to increase natural water storage and restore habitats. This includes *The Ksik Stakii Project Beaver Mimicry Guidebook: A Guide to Natural Water Storage in Blackfeet Nation*, a separate document published in October 2019 (Levitus, 2019). Topics in this guidebook include why do beaver mimicry, what to do before building, gathering supplies, enlisting a team, measuring and documenting conditions before beginning the work, building beaver dam analogs, and completing reporting requirements. Additionally, the Blackfeet Nation recently completed a beaver management plan for the reservation aimed at providing a framework for living with beavers and assisting tribal landowners with coexistence solutions.

9.2 Tulalip Tribe

In 2014, the Tulalip Tribe Beaver Project began relocating nuisance beavers from urban or suburban areas in the upper Snohomish Watershed to aid hydrologically impaired tributaries in the hopes of improving fish rearing habitat and freshwater storage (Tulalip Tribes Natural Resources, 2017). In addition to building a comprehensive relocation program, covered more in **XII. Relocation Program Examples**, the work included successfully advocating for [Revised Code of Washington 77.32.585](#), which expanded opportunities to release beaver in the state of Washington. In an article posted on the Northwest Treaty Tribes website, the history of the program is detailed, including how only tribal entities were allowed to legally relocate beavers west of the Cascade Mountains until the law was changed in 2017 (Northwest Treaty Tribes, 2020). Today, Washington Department of Fish & Wildlife (WDFW) runs its own projects and issues relocation permits to selected volunteers. The Tulalip Tribe assists and trains other tribes in the area as well as watershed groups on the importance of living with beaver through a partnership with [Beavers Northwest](#) for coexistence education and training.

9.3 Yakama Nation

The Yakama Nation runs its own and also partners on multiple beaver restoration projects. Their programs date back 20 years, and their projects are comprehensive. For example, the Yakama Nation is a member of the [Yakima Basin Fish and Wildlife Recovery Board](#), whose mission is to, “Conserve and Restore sustainable and harvestable populations of native fish and wildlife species in close partnership with the local communities of the Yakima River Basin” (Yakima Basin Fish & Wildlife Recovery Board, 2025). In 2010, the Recovery Board, together with WDFW, began a 5-year project aimed at increasing stream complexity and riparian system function by live trapping nuisance beavers from urban or agricultural areas and relocating them to priority upper Yakima River tributaries (Washington State Recreation and Conservation Office, 2015). The results are available through the [Salmon Recovery Portal](#), and broken down by funding sources and amounts, sponsors, project contacts, photos, locations, restoration metrics, and additional information and documents. The project trapped 140 beavers, relocated 128, and 12 of the 34 colonies reintroduced were successful (Washington State

Recreation and Conservation Office, 2015). The report also noted 14 beavers passed by PIT tag readers in other locations up or downstream of the release site indicating their survival.

The Yakama Nation Wildlife Resource Management Program also began the Yakima/Klickitat Beaver Restoration Project in 2015 with the mission to “Protect, restore and enhance the ecosystem integrity and traditional use of wildlife and other natural resources while supporting a culturally and economically strong, self-governing Sovereign Nation” (Blodgett III & Elliott, 2015). The program has several goals:

- Restore hydrological connection between channel and floodplain-inundation frequency and duration
- Increase area and quality of wetland and riparian habitat-ponding, complex habitat mosaic, meadows
- Increase beaver population in headwater streams
- Increase water quality and, potentially, quantity locally and downstream
- Develop low-cost restoration methods for smaller streams and meadows (Blodgett III & Elliott, 2015)

To achieve these goals, Yakama Nation integrates tribal knowledge values with scientific support through modelling, assessments, and monitoring. This included a run of BRAT, mapping beaver dams, a Rapid Meadow Assessment in 2011 (RMA), Meadow Vulnerability Assessment in 2018, and an adaptive approach-need to monitor in a cost-effective manner (Blodgett III & Elliott, 2015). The project was successful, and more sites were proposed for restoration.

Additionally, the Wishpush Working Group (WWG), spearheaded by the Yakama Nation Fisheries’ Southern Territories Habitat Project (STHP) is a collaboration with Mid-Columbia Fisheries Enhancement Group, Underwood Conservation District, Mt. Adams Resource Stewards, and other parties working toward beaver restoration in the north bank tributary basins to the mid-Columbia River. In an Executive Summary posted to the Yakima Basin Fish and Wildlife Recovery Board’s website, the objective of the STHP is to bundle two existing BPA-funded projects, the Klickitat Watershed Enhancement Project and Rock Creek Fish and Habitat Assessment, to expand the range and scope (Yakama Nation Fisheries, n.d.). The document includes funding details and the approach with four specific sub-goals:

- Provide educational opportunities and public

outreach related to salmon, habitat, water quality and watershed health.

- Assess watershed and habitat conditions to prioritize sites for restoration activities.
- Protect, restore, and enhance priority watershed and reaches.
- Monitor watershed conditions to assess trends and effectiveness of restoration activities.

In an email interview with Jeanette Burkhardt with the Southern Territories Habitat Project explained that the WWG is, “A beaver working group with partners in the region whose mission is to Retain, Restore and Re-home beavers—working on a multi-prong approach that includes education and outreach, technical assistance with in-place management/coexistence, habitat restoration and translocation. We are set up to translocate with trappers, a beaver husbandry facility and have a database of potential relocation sites.” In her email, Burkhardt also noted that, “The WWG has representatives on the Washington state Beaver Working Group, an Education & Outreach subcommittee, and a state Beaver Policy Working Group trying to affect positive change in acceptance of, policy and management of beavers.”

9.4 Tule River Tribe

On their website, the Tule River Tribe chronicles work to bring beavers back. Along with images, the site contains a section with news articles, website links, and other resources for information related to tribal efforts. The tribe is a part of a project spearheaded by the WATER Institute to bring beavers back to the state of California. A difficult hurdle for the group to clear was the impression that beavers were not native. However, tribes knew better.

A paper published in California Fish and Game in 2013 titled *The historical range of beaver (Castor canadensis) in coastal California: an updated review of the evidence* explains why beavers were originally excluded from native status, and why that assumption was misled (Lanman, et al., 2013). An article in Bay Nature about the paper explains that the then-definitive guide on fur bearing mammals in California was published in 1937, long after the commercial fur trade ended and beaver populations were depressed (Hawkes, 2014). The original 1937 document also omitted several key areas from consideration, including the Klamath River watershed and



Figure 21: A rock painting depicting beaver by the Chumash Tribe, located at 1,600 feet elevation, in the Sierra Nevada. Image taken from Bay Nature article, courtesy of Heidi Perryman (Hawkes, 2014).

the Sierra Nevada above 1,000 feet in the rivers draining into the Central Valley (Hawkes, 2014). The paper’s authors looked for evidence in fossils and historical furbearing accounts, and a rock painting from the Tule River Indian Reservation in the Sierra Nevada shows what can only be described as a beaver – and it dated at 500 to 700 years old (Hawkes, 2014).

Other evidence included the words for beaver from coastal Tribes, such as the Wappo in Sonoma, the Coast Miwok, and the Rumsen Coastanoan in Monterey.

In CDFW’s press release on the first release of beavers in the wild in 75 years, which occurred in the waters of the ancestral lands of the Mountain Maidu people, it mentioned that the second reintroduction effort will occur on the Tule River Reservation in the southern Sierra Nevada, which has now since been completed (Traverso & Cook, 2023). CDFW Director Charlton H. Bonham commented, “Getting to this moment of our first reintroduction really is a product of so much leadership from so many people. We would not be here without the Tule River Tribe of California who have been out front advocating for these actions for years, tribes around the state like Karuk, and, of course, Maidu Summit Consortium leaders. The future looks much better because of these leaders” (Traverso & Cook, 2023).

9.5 Yurok Tribe

The Yurok Tribe has been a strong advocate for beavers and their importance to ecological restoration of streams and wetlands. Frankie Myers, Yurok Tribe Vice-Chair, explained in a news piece, “Beavers are always right...

There is no beaver-human conflict. There’s only human conflict. What we’ve learned, having lived with beavers for thousands of years here, is that it’s an extremely important part of our way of life not only as Indigenous people, but as human beings here on this planet...Beavers are part of our community, part of our villages and our ecosystem. We know the incredible work that beavers do to help provide the absolutely critical habitat for juvenile salmonids and the robust benefits they have to our ecosystem as whole” (Rothrock, 2023).

For the past decade the Yurok Tribe has been implementing LTPBR projects within the Klamath Basin to restore streams to support salmonid recovery in preparation for the recent removal of the Klamath River dams. This restoration work has been productive, especially where beavers took over BDAs. In an email interview with Sarah Beesley, Yurok Tribes Fisheries Biologist, she writes, “Many of our watersheds in the Lower Klamath are severely impacted due to historic logging - stream networks have been greatly simplified and aren’t very conducive to dam building. We have been moving timber roads out of floodplains and taking other measures (installing wood jams, BDAs, ground water palisade structures, creating off-channel wetlands) to help improve channel complexity and greatly increase the amount of slow water habitat – perfect for fish and beaver.” Beesley shared a diagram example of this work, seen in **Figure 22**.

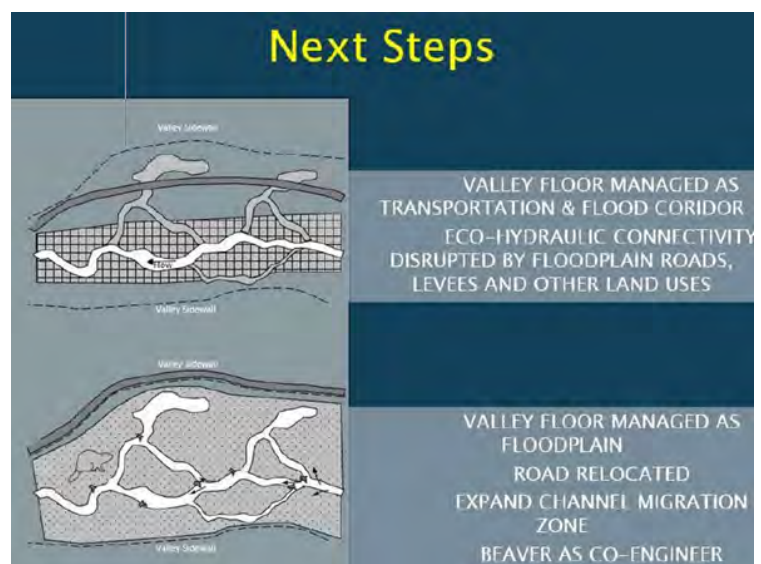


Figure 22: Diagram from Yurok Tribes’ fisheries biologist Sarah Beesley shows how moving a road outside the valley floor can help make room for floodplain expansion.

9.6 Tribal Collaboration and Partnership

When thinking about tribal wildlife work, many people first think of the movement to bring buffalo back to ancestral lands, and beavers can be an extension of those efforts. Many tribes have strong cultural ties to beavers, and both species were unduly targeted during westward expansion and the commercial fur trade. Without buffalo, the landscape shifted, and without beavers, the waterways changed. Now, current watershed practitioners ask the question, “What was the historical range of beavers?” without realizing or acknowledging that the answer can be found without resorting to modeling. It can be found in the stories of tribes, as shown by the work done in California to recognize beaver as a native species. And that is not all that can be learned through collaborative and supportive tribal partnerships.

Indigenous Led, an organization focused on healing land, people, and all of our relations, works to braid science and traditional ecological knowledge with a focus on a restorative movement. On their [website](#), they describe this movement looking like:

- Deploying diplomacy and strategic partnership to the forces of ecological and cultural fragmentation and socio-political division
- Providing scientific leadership that draws on Indigenous and Western science, as well as cultural knowledge, to advance cutting-edge research and inform decision-making and policy change
- Restoring ecological and cultural keystone species and ecosystems
- Proving the power of Indigenous-led conservation to meet the challenges of the biodiversity and climate crises
- Drawing on storytelling, art, and culture to inspire, activate, and transform

Both beavers and buffalo are called out as examples of important keystone species with cultural importance, and the organization is collaborating to develop an Indigenous-led intertribal beaver council. The council’s meetings consistently draw 37 tribes as well as other non-profits and partners. It aims to create hubs to better understand and address the different roles beavers play for tribes. While the work in the Pacific Northwest is often

focused on beaver restoration, beaver-related tribal efforts are also happening in other regions, from the Ute Mountain Ute in the southwest to the Penobscot Nation in Maine. Tribes are completing ethnographic mapping and habitat analysis, plus sharing lessons learned and overcoming common challenges, including partnering with researchers to learn more about salient issues, such as chytrid fungus.

It is important to understand that beavers do not just fulfill one role, and their importance extends beyond restoration tools. Many tribes are approaching beavers through the same pathways utilized for buffalo. This includes granting rights to beavers or writing ordinances to provide personhood, making their management easier. But this is hard work, and often emotionally and financially taxing. Some tribes are not federally recognized, limiting their ability to seek funding and support for their programs, and, even if they are, federal resources can still be competitive, if not nonexistent. While there has been a recent ground swelling of support for braiding science and traditional ecological knowledge, a *Science* article states, “While celebrating these developments, the responsibility of institutions should not be overlooked. It is crucial that new enthusiasm not take the form of “knowledge mining,” akin to a company suddenly recognizing the value of a previously overlooked mineral...” (Kimmerer & Artelle, 2024).

The article continues to state the importance of addressing well-documented institutional barriers that limit the full engagement and visibility of Tribes and their worldviews. One area this is apparent is in the definition of success, with the example that the number of published papers isn’t the aim, but the enhanced well-being of land and culture. It concludes with, “For centuries, Indigenous scientists have had to adapt to, and develop fluency in, Western modes of knowledge making. It’s now Western scientists’ turn to learn from, and respect, Indigenous science.”

X. Living With Beavers – Conflict Resolution

It is vital for any beaver management plan or program to proactively and effectively address conflicts. The concern for conflicts is a common stakeholder complaint, especially if a plan or program includes beaver relocation into areas where they currently do not exist. If complaints are not properly addressed, the community may not embrace keeping beavers in the landscape or a new state beaver management plan. Effectively resolving conflicts will require expertise, materials, funding, and labor. It is important that a state plan or program take these factors into consideration, especially if the availability of those resources is limited.

If available, gathering data from current beaver complaints can provide a starting point for building programs. If there is an existing gap between the number of complaints and the current capacity to address conflicts, it may be necessary to focus first on expanding the conflict resolution program before relocating beavers into new areas or expanding their current range. Additionally, it will be important to clearly define between stakeholders who is responsible and liable for the conflict resolution program and the installation and maintenance of devices. This report will only cover the highlights of conflict resolution strategies as there are publicly available resources that cover this topic in-depth (U.S. Fish and Wildlife Service, 2023). As an additional resource, [Appendix C](#) provides examples of agency and non-profit programs that assist landowners with identifying conflicts and implementing solutions.

It is important to understand that what defines a conflict between beavers and humans is subjective and site-specific. Defining conflicts and their appropriate solutions will be an important step for any state plan or program. One way to address this complexity is through a decision matrix, which outlines the different conflicts within an area and the potential solutions. Some plans and programs are also funding and staffing conflict hotlines for landowners that provide immediate support, advice, and resources to help implement solutions.

Some landowners may still prefer trapping or lethally removing beavers, but conflict resolution programs can help explain the benefits of leaving beavers in the landscape and offer alternatives. For example, if an area has sufficient beaver populations and habitats for beavers, it is likely beavers will recolonize the trapped or lethally removed area, perpetuating the problem (U.S. Fish and Wildlife Service, 2023). Additionally, the design of devices can be purposefully simple, consisting of fencing, pipes, and posts that take advantage of beaver behavior and instincts. Different installation types may have trade or regional names but are generically referred to as flow devices. Even though they can be simple in concept, it is recommended that they are installed by trained professionals or with the advice and guidance of a trained professional. The BeaverCorps training from the Beaver Institute is currently the only professional training and certification program in the United States.

While coexistence is encouraged, it is also important to know where it may not work. One example is in locations where streams intersect with densely housed neighborhoods. Due to the amount of concentrated infrastructure, there may be little to no social tolerance for beavers. The same can be true for highly engineered landscapes or systems, such as water control or conveyance structures. In these scenarios beaver dam building can also interfere with the design and safety criteria. Another challenging situation is along long, linear, human-modified waters, such as irrigation ditches or canals. In these cases, beavers can dam almost anywhere along the water to achieve ponding, rendering flow devices ineffective as beavers can easily move to dam up- or downstream to achieve their desired results. However, there are still many opportunities where a flow device will work and be a long-term and sustainable solution. This section will cover the most common conflicts and outline their potential solutions.

10.1 Pond Levelers

Use Case: Beaver damming creates ponds and slows down stream velocity, enabling the water to sink and spread, which raises the water table locally around the dam or dams. This same action can cause flooding of agricultural fields, roadways, or other land uses near riparian areas. One solution to this is a pond leveler, which can lower upstream pond depth and regulate water levels. Pond levelers are most applicable at free-standing dams where the water depth is greater than three feet.



Figure 23: Example of an installed pond leveler in Montana. Photo Credit: Elissa Chott.

How They Function: These devices work by creating a leak through the beaver dam with the pipe. The pipe inlet is placed inside an intake fence 20-40 feet upstream of the dam. Beavers can maintain the face of the dam, but the water is being taken away farther upstream through the pipe inlet. The intake fence keeps beavers away from the feel of water going into the pipe so they will not plug the inlet. The final depth of the pond is regulated by the elevation of the pipe through the dam.

Design and Materials: A pipe is placed through the dam with an intake fence around the pipe inlet that is submerged 20-40 feet away from the dam. Pond levelers are typically built from 4-6-gauge fence panels, metal posts, and 8-15" diameter HDPE pipes.

Cost: Pond levelers can cost between \$2,000 and \$5,000 to install, depending on materials and labor.

Maintenance: Pond levelers should be maintained at least 2-3 times per year to remove debris built up around the intake fence, check the pipe for damage, including ice damage after the winter months, and make sure the device is functioning as intended and water levels remain tolerable. With proper maintenance, pond levelers can last 8-12 years, after which they may need to be replaced due to corrosion, though pipes can be reused.

Considerations: If the pond depth needs to be lowered more than one foot, it must be done in stages, so beavers do not build dams up- or downstream to increase the

pond area. If ponds need to be lowered more than one foot, beavers can be temporarily trapped while the new water level is established. Depending on how long the process takes, new beavers can move into the habitat and adjust to the lowered water level while the trapped beavers can be relocated to a new area.

10.2 Exclusion Fences

Use Case: The most common human-beaver conflict is the plugging of various infrastructure, such as road culverts, water intake structures, irrigation ditches and pipes, or areas where water flow is concentrated. Pinch points, such as culverts, are attractive to beavers because their damming instinct is triggered by the feel and sound of water flowing into the constricted space. With minimal effort, beavers can create a large water impoundment upstream by plugging a culvert instead of damming across an entire stream width. Culvert plugging may cause erosion and safety issues as water flows over the road, or it may back-up water and flood adjacent land. It can potentially cause structural issues as water running across a roadbed or "washing out" can continually saturate the materials, causing integrity problems.

How They Function: Exclusion fencing works for three reasons. One, the shape of the fencing increases the total length of the dam required to block the culvert. An exclusion fence typically has a perimeter of 30 to 36 feet for culverts with diameters 3 to 6 feet, increasing

the amount of effort beavers need to block the culvert. Two, the fencing shape directs beavers away from the sound and feel of water flowing into the culvert inlet. Three, if beavers start damming on the fence, depending on the fence shape, as they move along the perimeter, the opening the water flows through becomes larger, and it decreases the flow and movement of water, which dampens their damming instincts. Preventing damming at the pinch point ensures water can flow through the unblocked culvert in a single channel.

Design and Materials: Exclusion fences keep beavers away from the feel and sound of flowing water at pinch points and prevent beavers from directly damming a culvert or similar structure. They are typically built from 4-6-gauge fence panels and metal posts. It is important to note that each site needs a specifically designed and installed device based on local conditions, emphasizing the need for trained professionals.

Cost: Exclusion fences are generally the least expensive type of flow device, with the cost of building one ranging from \$1,000 to \$2,500, depending on the materials and labor.

Maintenance: Exclusion fences need to be maintained 3-4 times per year to remove debris from the fence perimeter and ensure the device is functioning as intended. Other factors to look for during maintenance checks are new damming downstream that may be affecting culvert capacity and making sure the culvert is clear all the way through.

Considerations: An exclusion fence is most applicable when there is a blocked culvert on a wide waterway less than three feet deep and with enough space for at least two feet of water around the fence perimeter. With proper maintenance, exclusion fences can last 8-12 years, after which they may need to be replaced due to corrosion.

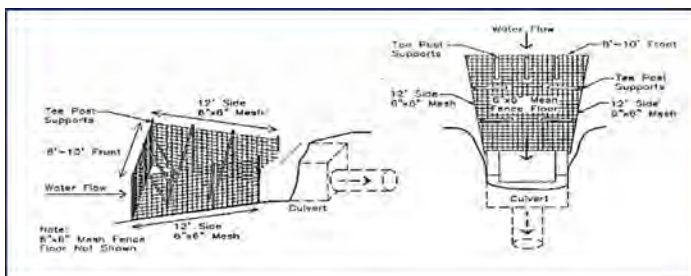


Figure 24: An example exclusion fence schematic from BeaverInstitute.org. Each exclusion fence needs to be designed and adapted to the local site conditions, including mesh size and fence shape.



Figure 25: Exclusion fence installations are all site-specific and using the basic design principles, can be adapted by a trained professional for a variety of different waterways and needs. Photo Credit (left): Aaron Hall; Photo Credit (right): Elissa Chott.

10.3 Fence & Pipe Devices

Use Case: Another solution for plugging infrastructure is a fence and pipe device, which is a combination of a fence that prevents beavers from accessing a culvert and a pipe device that brings water inside the dammed culvert fence from deeper in the pond, creating a leak through the dam. The beavers can maintain the dam around the culvert fence, unaware of the leak through the dam.

How They Function: The fence and pipe system encourages beavers to dam on the small exclusion fence near the culvert because the fence is built smaller and closer to the culvert inlet. Since beavers are closer to the culvert inlet, they likely will key into the sound and feel of water flowing into the culvert and start damming the fence perimeter. The pipe creates a leak through the dammed exclusion fence, allowing water to flow into the culvert. Water levels are determined by the height of the pipe through the dammed fence. To successfully install one of these devices, properly sized pipes are a necessity to ensure base flows can be carried into the culvert. Fence and pipe devices are only appropriate in areas that can accommodate a pond directly upstream from the culvert.

Design and Materials: Fence and pipe devices are usually built from 4-6-gauge fence panels, metal posts, and HDPE pipes that are 8-15 inches in diameter. Each site needs a specifically designed and installed device based on local conditions. Again, a trained professional is recommended to help with the design and installation.

Cost: Fence and pipe devices are more expensive, with the average cost to install one approximately \$2,000 to \$5,000, depending on materials and labor.

10.4 Diversion or Starter Dams

Use Case: The final solution is a diversion or starter dam, which are fences built upstream of a culvert or headgate to encourage beavers to build on these fences, leaving the culvert unblocked. Diversion dams are most applicable at a blocked culvert where an upstream pond is tolerable and where there are no low-lying, adjacent infrastructure. Instead of plugging the culvert, beavers dam on the diversion structure upstream of the culvert. Water still flows through and over their new dam, then through the unblocked culvert.

How They Function: The device provides a platform and starting area for beavers to take over and maintain a dam directly upstream from the culvert or pinch point inlet.

Design and Materials: While these devices are typically constructed from fencing and posting, they can also be made with a variety of other materials, such as wood, rocks, stones, or mud. The goal is to mimic a small beaver dam and encourage the beavers to continue building in a desired location.

Cost: Diversion dams are an inexpensive option, costing approximately \$500-\$2,000 to install, depending on labor and materials.

Maintenance: Generally, little to no maintenance is needed for these devices, since beavers will be building and maintaining a structure on top of the provided material. Check the culvert to make sure no damming is occurring inside and that any damming downstream is not negatively impacting culvert capacity.

Considerations: Flashier stream systems may not be appropriate to install diversion or starter dams due to the risk of having the dam wash out and affect the culvert. Diversion or starter dams can only be successful in areas that tolerate ponding directly upstream of culverts or other pinch points.



Figure 28: Diversion dams are site-specific. The same design principles can be adapted for a variety of different waterways and needs by a trained professional. Photo Credit (right): Jackie Corday (Colorado); Photo Credit (right): BeaverInstitute.org.



Figure 26: An example fence and pipe device installation. Device designs are site-specific and using the basic design principles, can be adapted for a variety of different waterways by a trained professional. Photo Credit: Elissa Chott.

Maintenance: Fence and pipe devices should be maintained at least 2-3 times per year to remove debris build up around the pipe intake fence, check the pipe for damage, including ice damage after the winter months, and make sure the device is functioning as intended and water levels remain tolerable. Do not remove damming materials from around the small exclusion fence, as the dam is critical for the device to function properly. Other factors to look for during maintenance checks are new damming downstream that may be affecting culvert capacity and making sure the culvert is clear all the way through. With proper maintenance, fence and pipe devices can last 8-12 years, after which they may need to be replaced due to corrosion, though pipes can be reused.

Considerations: Fence and pipe devices are most applicable at a culvert or headgate where the waterway is narrow or when the water level is deeper than three feet.

Fig. 1 – Undammed Div. Fence

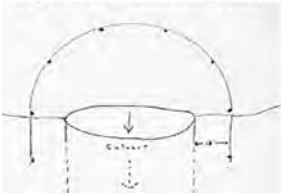


Fig. 2 – Dammed Div. Fence

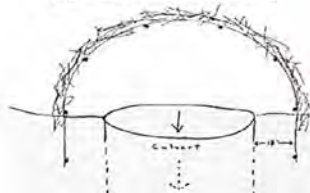


Figure 27: An example diversion dam schematic from BeaverInstitute.org. Each diversion dam needs to be designed and adapted to the local site conditions by a trained professional.

10.5 Tree Protection Fencing & Gritty Paint

Use Case: In urban or rural areas, the loss of trees from beavers can be concerning for landowners. Beavers are central-place foragers, meaning they use their lodge as a base and forage within a short distance, typically less than 100 meters from the pond margin. They use the trees for both food and building materials for their dams and lodges. This activity is especially apparent in newly colonized areas as beavers can fell many trees in a short period of time. Beavers in well-established colonies tend to fell fewer trees. Tree felling also increases in the fall as beavers shore up their dams and establish a winter food cache.

Options and Materials: One solution for tree felling is tree protection fencing. This option consists of 3-4-foot-tall wire mesh fencing placed in a circle around the tree trunk, leaving a large enough gap for the tree to grow without becoming girdled. In snowy locations, a taller fence may be needed as beavers can use snowpack as a stepping stool to chew above the top of the fence.

Tree fencing can be done with or without wooden or metal posts, which are fastened to the ground with landscape stakes, or cut and flared at the bottom of the fence to prevent beavers from nudging underneath, as seen in the diagram below. Tree fencing can be done singularly, or it can be done around multiple trees. While more expensive, electric fencing can be suitable for high-value crops or orchards.

Another solution is gritty sand paint, which is latex paint mixed with masonry sand and applied to tree trunks to a height of 4-6 feet. Sand painting works by discouraging beavers from chewing due to the gritty feel of the sand, but it may be toxic to beavers depending on the type of paint. In general, sand painting is less reliable, and trunks must be repainted every few years. Since beavers can still fell sand-painted trees, it is up to the landowner to decide if this is tolerable or if they need to seek other solutions. Sand painting saplings may also kill the tree, and it may be detrimental to ornamental trees, making fencing a better option.

Cost: Tree fencing and other protection methods have varying costs depending on the size of the trees and how many need to be protected. An investment of several hundred dollars can protect a few dozen trees.

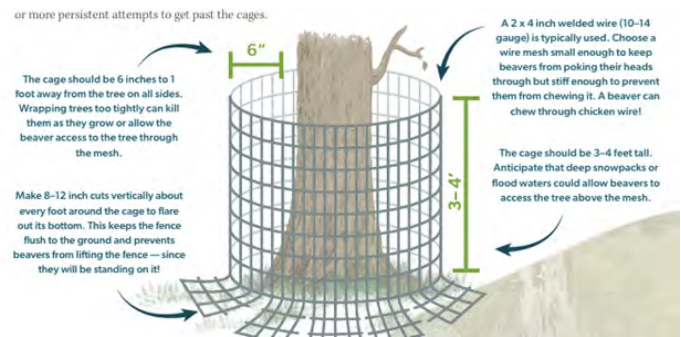


Figure 29: Fencing guidelines excerpted from a Project Beaver [handout](#), credit Jakob Shockey.

Maintenance: Tree fencing should be checked periodically to make sure there is no damage to the fencing and tree growth is not restricted. Electric fencing needs more maintenance and vegetation management to keep grass from shorting out the wires. Sand painting requires reapplication as the trees grow and paint becomes weathered. Reapplication frequency will vary depending on weather, tree growth, and other factors.

Considerations: There are multiple ways to protect trees, with pros and cons to each. For the best long-term solution for a site, consider the goals and reasoning for protecting trees, tolerable levels of chewing, and the maintenance commitments for the chosen protection method.

10.6 Modifications or Options for Fish Passage

In the habitat of at-risk fish or other aquatic species, the ability of these aquatic species to move up- or downstream and through or around a beaver flow device is an important consideration. Flow devices might present a passage barrier depending on the local conditions and the species present. In areas where fish passage is a concern, device modifications can help minimize negative impacts. Consulting with regional fish biologists early in the design process to leverage their expertise can properly highlight and address concerns to avoid potential conflicts.

One solution is changing the fence mesh size. Fence panels come in a wide variety of mesh sizes and wire spacing. Flow devices have successfully use both 6x6 inch and 6x8 inch mesh sizes for fence panels. For example, to accommodate the size of salmon or bull trout, both species of concern in some areas, designers can utilize the larger 6x8 inch spacing. Another solution

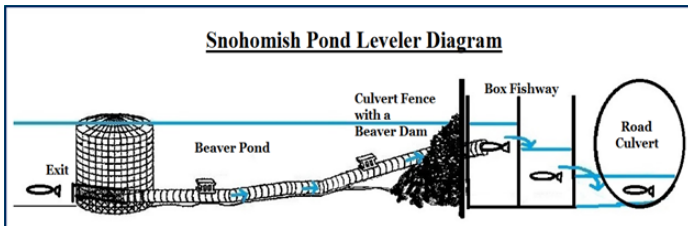


Figure 30: An example schematic of a Snohomish Pond Leveler, which allows fish to pass through the pipe from BeaverInstitute.org.

is the Snohomish Pond lever, which is designed to allow for fish passage through the pipe of a pond leveler or fence and pipe device. At the downstream end, a series of slotted boxes encourage fish to enter, provide a place to rest, create a series of steppingstone pools to approach the outflow pipe, and backwaters the pipe so fish can swim through. Within the intake fence on the upstream end of the pipe, fish are guided out with additional fencing and a one-way door that allows the fish to leave the intake fence and enter the pond.

Another solution is the notch exclusion fence, which is designed to function like a pond leveler by reducing the upstream pond depth. Instead of a pipe, the device lowers water levels via a notch through the dam. A narrow exclusion fence is placed over the notch and extended up- and downstream to keep beavers from repairing the notch. Fish can swim into the exclusion fence, pass over the dam via the notch, and continue migrating upstream.



Figure 31: Example of a notch exclusion fence in Washington that allows for fish passage while still maintaining the desired water level behind the dam. Photo Credit: Beavers Northwest.

10.7 Conflict Resolution vs. Removal Cost-Benefit Analysis

In addition to the ecological benefits of keeping beavers in the landscape, conflict resolution can also provide financial benefits. Traditional methods, such as removal of dams, trapping, and culvert unplugging, can be expensive and repetitive, creating labor and time costs. If beavers are at a site, it likely means there is suitable habitat within dispersal distance of a source population. In this scenario, beaver management through the traditional method of removing beavers will be an ongoing effort, but installing conflict resolution devices can offer an option for a long-term solution.

There are several studies that explore the long-term cost-savings of conflict resolution devices over traditional methods. One study, in Billerica, Massachusetts, showed that the installation of 43 pond levelers between 2000 and 2019 resulted in an annual cost savings of 44% (Callahan, Berube F.E., & Tourkantonis P.W.S., 2019). Another study from 2007 to 2017 in Andover, New Hampshire showed that eight flow devices installed to protect road culverts equated to approximately 75% savings versus the repeated costs of cleaning culverts and trapping (Beaver Deceivers). The study calculated these results by taking the 10-year cost of culvert cleaning and trapping (\$160,000) and comparing it to the 10-year cost of installing and maintaining flow devices (\$31,300) (Beaver Deceivers). In Virginia, 40 flow devices were installed between 2004 and 2006, and in 2007, 39 of the 40 devices were still functioning properly (Boyles & Savitzky, 2008). The study calculated that flow devices saved \$8.37 per dollar spent on installation, monitoring, and maintenance (Boyles & Savitzky, 2008).

The Miistakis Institute of Mount Royal University in Calgary, Alberta, compared the costs of addressing flooding issues using traditional beaver management, such as dam removal or trapping, to the cost of coexistence measures. The chart in [Figure 32](#) is an excerpt from a [study fact sheet](#) comparing local government cost savings

The Institute's Working with Beavers program also developed an [online cost calculator](#) to help landowners determine how quickly the installation of a pond leveler will pay for itself with reduced maintenance costs.



Figure 32: Example calculations of cost savings of flow devices at two locations in Alberta, Canada, from the Miistakis Institute Fact Sheet: [Cost-benefit Analysis of Beaver Coexistence Tools](#).

There are additional benefits to conflict resolution strategies that are not as easily quantified in studies. Some workers feel safer installing devices because it avoids needing to go into culverts to remove beaver dams. Additionally, as beavers stay in the landscape, they can continue providing benefits, such as those explored in [2.1 Ecosystem Services: Wildfire, Floods, & Drought](#).

10.8 Conflict Resolution Challenges & Limitations

While conflict resolution can be an option that provides many benefits, there are challenges and limitations. One is the amount and consistency of funding for device installations, training, and programs. While some funding opportunities exist, this is a newer topic, and what exists may be constrained by where a landowner is located, the season, and staff capacity. Additionally, some states now require a permitting process, which may include one or more permits, before installing devices. They can be issued on the state, county, or local municipality level. This process can be well-established and navigable, but too often it is unclear or unknown. This creates a barrier for practitioners and landowners. It can be difficult to plan a business around unknown permitting processes and costs, and landowners may be hesitant to commit to an unknown timeline and cost, especially if the conflict is currently impacting their operations.

Finally, the availability of qualified and trained practitioners is a barrier. As discussed previously, there is only one professional-level training program, and there is limited overall knowledge of proper design and installation requirements. Installation by well-meaning

but untrained or unqualified people may lead to device failures, which can create a negative perception of conflict resolution devices.

There are existing programs and resources that focus on human-beaver education and conflict resolution that may help overcome these challenges and limitations. Some of the more comprehensive sources are included in [Appendix C](#). As beaver-related work becomes more common, these programs are increasing capacity to help more thoroughly address concerns. As this space grows or potentially even becomes restricted, it is important that educational resources and diagrams remain publicly available to spread awareness and best management practices. Much of this work is highly localized and specific, making it imperative that communities have an avenue to share lessons learned and ask for advice.



Photo Credit: Adria Surovy

XI. Beaver Relocation & Translocation

This section will broadly cover beaver relocation programs, salient findings from beaver holding facility visits, and other relevant programmatic information. There are existing resources, such as [The Beaver Restoration Guidebook](#) created by the USFWS, and other sections in existing beaver management plans that detail beaver relocation and watershed planning for beaver restoration projects. Topics covered in these resources include planning and implementation frameworks, project area, time management, potential collaborators and resource assessment, assessing quality habitat, relocation methodologies, live trapping techniques and equipment, holding facilities and care, intake processing, site preparation, transportation and release, and follow-up monitoring. However, when it comes to designing and running relocation programs, the best sources of information will be the wildlife agencies, Tribes, non-profits, universities, zoological societies, and other organizations that run them. While relocation and translocation can be used interchangeably throughout

the literature, relocation is often associated with moving beavers within the same area where there are existing established populations. Translocation often refers to trapping beavers to move them into identified and vetted suitable habitats where there is not an established population. Both relocation and translocation can serve several purposes, including, but not limited to a final solution to non-lethal conflict resolution and/or stream or riparian restoration in systems absent of beaver populations within suitable habitat.

Relocating and translocating beavers is not a new concept and was a relatively common approach to reestablishing beaver populations in the early 20th century. While programs in this era didn't have to operate under the same level of ecological, biological, or societal scrutiny as they do today, "Most reintroduction programs were successful to the point that trapping bans were lifted so that populations could be controlled" (U.S. Fish and Wildlife Service, 2023). People often think of the beaver parachute drop conducted in 1948 by the Idaho Department of Fish and Game (IDFG). During this experiment, IDFG dropped beavers via parachute into the Chamberlain Basin in Central Idaho with the goal of re-establishing beaver populations to help in restoring riparian wetland wildlife habitat. New goals for relocation and translocation programs include watershed restoration, fish habitat creation, and other benefits outlined in **II. Why Focus Planning Efforts On Beavers.**

When considering beaver relocation and translocation as a possible solution to human-beaver conflict, issues such as cost, time commitment, and a high risk of beaver mortality due to the stress of capture, transport, or holding must be factored (McKinstry & Anderson, 2002). Human-beaver conflict resolution options such as culvert fences and pond levelers (see **X. Living With Beavers - Conflict Resolution**) should be considered first, with relocation or translocation serving as a secondary intervention option when coexistence strategies cannot be successfully implemented or when site conditions make non-lethal conflict resolution impractical. Additionally, some practitioners interviewed believe if there is suitable habitat to support beavers and there are beaver populations in the area, then the trapping site will likely be recolonized, making any relocation efforts only a temporary solution. For long-term human-beaver conflict resolution, coexistence measures and devices may be more successful, though there are specific applications where relocation may be the most appropriate.

Often, people think of capturing beavers where they are unwanted, and relocating them to areas where they are wanted, imagining a win-win scenario. However, the reality is far more complicated with a multitude of factors to consider. [The Beaver Restoration Guidebook's](#) Release site factors include the seasonal timing of relocation; quality and quantity of existing food and shelter at the relocation site; presence of disease in the beaver population; risk of transporting aquatic nuisance species; and potential of human-beaver conflicts up- or downstream of the release site. Practitioners can control some factors through methodology, such as quarantining periods and protocols for aquatic disease, but others may be harder to mitigate, such as existing infrastructure that could be a target for dam building activity and therefore human-beaver conflict.

When and where relocation or translocation makes sense, there are existing programs and protocols to guide development. As programs evolve, how they define success also changes, and the programs themselves are becoming more effective as they discover new insights through research and experimentation. This will be another area that continues to evolve, and the sections below are only a snapshot in time of existing programs and protocols.

11.1 When to Consider Relocation & Translocation

Baker and Hill outline questions for those considering relocation and/or translocation programs, stating, "The first step in any reintroduction program should be to determine the purpose and feasibility of attempting to establish new beaver populations" (Baker & Hill, 2003). This includes:

- An understanding of why beavers are absent from the site
- Why they are important to the site
- Justification for relocation rather than natural dispersal
- Likelihood of movement beyond the intended relocation site
- Potential conflicts with landowners

Relocation decisions and expectations are typically based on professional judgment after considering all available data, but also on mathematical simulation models (Baker & Hill, 2003).

The reality is that beavers are living creatures that are not beholden to restoration goals, deadlines, or boundaries. While their actions may lead to benefits, their behavior stems from a desire to modify habitat to suit their needs, not provide ecosystem services for others. There is no guarantee that beavers will stay after relocation, and Baker and Hill add that most beavers do not. There are methods to encourage beavers to stay, such as providing preferred food species and building materials, which will be discussed in this section, but there is still a risk of predation or other unpredictable outcomes (Baker & Hill, 2003). Additionally, stakeholders should understand and accept the inherent unpredictability of these programs. If restoration professionals release beavers into a previously extirpated site without established populations, there is a tendency for the local communities to hold whatever agency or group relocated the animals accountable for all outcomes, whether they are positive or negative. Practitioners should expect and plan for these scenarios.

The responsibility for the health and well-being of trapped and released beavers is partly what drives the complexity in relocation and translocation programs. It will be important to discuss at what point do attempts to repopulate a site stop, should practitioners supply

supplemental aid and at what amount, and if there are any scenarios where it is appropriate to provide additional veterinary care after release. However, due to the degradation of current watersheds, increasing water scarcity, uncharacteristically intense wildfires, and a continued decline in biodiversity, the challenges of relocation programs can be worth the benefits. This is especially relevant for targeted restoration sites, which are becoming easier to identify with new modeling tools.

11.2 Tools for Identifying Restoration Sites

There are many geographic information systems (GIS) based tools that can help identify sites for restoration or translocation, including the [Beaver Restoration Assessment Tool \(BRAT\)](#), created by the Utah State University Riverscapes Consortium. BRAT, "...is a planning tool intended to help researchers, restoration practitioners, and resource managers assess the potential for beaver as a stream conservation and restoration agent over large regions and watersheds" (Utah State University Restoration Consortium, n.d.). The creators describe the heart of BRAT as being a capacity model, which estimates the upper limit of dam density (dams/kilometer) for individual stream reaches throughout a drainage network with a focus on predicting where beavers could build dams and to what extent, not just where they could make a living. Practitioners can run the model with free national data sets or higher resolution data. BRAT moves from a capacity model to an assessment tool through its ability to model potential risk, unsuitable or limited dam building opportunities, and conservation and restoration opportunities.

The BRAT model can also be refined and recalibrated for different areas, and in 2024 the Colorado Natural Heritage Program (CNHP) debuted the [Colorado Beaver Activity Mapper \(COBAM\)](#) as part of their [Watershed Planning Toolbox](#). COBAM hosts, "Beaver-specific wetland layers, including mapped beaver pond clusters from 2013-2021, historical National Wetland Inventory beaver-modified wetlands and modeled beaver dam building capacity using the Beaver Restoration Assessment Tool (BRAT)" and, "Recent beaver activity areas in the Colorado River Basin can also be viewed in the [Colorado River Basin Dynamic Wetland Mapper](#)" (Colorado Wetland Information Center, n.d.).

California also utilized BRAT to build realistic expectations for partnering with beavers for conservation and restoration. The main goal of the project was to, "...implement the Beaver Restoration Tool (BRAT) over 78,835 km of perennial rivers and streams within the Sierra Nevada, Cascades, Coast, and Klamath mountains of California and to help meadow and stream restoration practitioners identify the most appropriate locations for Beaver Dam Analog (BDA) and beaver-assisted restoration projects" (Wheaton, n.d.). The webpage dedicated to the project includes a StoryMap and deliverable data.

The BRAT model itself has undergone iterations, which is detailed on the [Beaver Restoration Assessment Tool \(BRAT\) webpage](#) (Utah State University, n.d.). If a plan or program is considering applying or refining the BRAT tool, it would first be beneficial to reach out to the Riverscapes Consortium via their Support page to learn more about model availability, applicability, and what workflows may already exist in the targeted area.

While BRAT is one of the most recognized tools, there are others, including the Beaver Intrinsic Potential Model (BIP) and EEAGER. In 2018, Dittbrenner et. al. described BIP models as an alternative to habitat suitability index (HSI) models, which "...predict currently suitable beaver habitat, but have less utility for predicting where beaver could be if they modify the landscape, or appropriate restoration actions or land-use management actions were taken. Because vegetation often does not meet criteria that a traditional HSI model would identify as suitable, many potentially suitable areas are not considered for restoration planning or relocation actions" (Dittbrenner, et al., 2018). More importantly, the imagery's spatial resolution is not always high enough for use in landscape-scale HSI models. The BIP provides an alternative to HSI by using geomorphic variables that are less likely to change over time. Restoration professionals already utilize these variables in fish habitat restoration work, and these variables can also be useful for beaver restoration work. The model Dittbrenner et. al. developed is within the Snohomish River Basin, Washington State, and they validated it within the Skykomish River sub-basin.

EEAGER is an image recognition machine learning model. While it is important to monitor beavers at a landscape scale, this is difficult due to the time and effort it takes to identify beaver dams in satellite and aerial imagery. EEAGER can automatically find beaver dams in satellite and aerial imagery, and it shows potential for locating other landscape features. The authors developed the

model in the western United States using 13,344 known beaver dam locations and 56,728 nearby locations without beaver dams (Fairfax, et al., 2023). The model favors recall over precision, resulting in a more complete catalog, but also a higher incidence of false positives which need to be manually removed during quality control (Fairfax, et al., 2023).

Overall, it is important to note that with any model, ground truthing and/or manual review will be necessary while considering temporal and spatial context/scale. Practitioners should account for this when scoping out projects and programs. Modelers often train programs in specific landscape types and, when utilized across a variety of landscape types or in different states, it may be more apt to correctly identify potential habitat or beaver dams in similar landscapes. For example, a model trained in montane habitat may not be as effective when evaluating grasslands. This is another area of developing research, and there is continuous development, honing and sharing of new or updated models.

11.3 Tracking & Monitoring

Relocation and translocation programs provide an opportunity to gather additional data through tracking and monitoring to investigate individual or colony level spatial and temporal behavioral patterns before, during, and after relocation. There are several types of tracking and monitoring tools available with varying costs, time commitments, and data analysis considerations. Practitioners and planners should evaluate the practicality of each option for their specific needs.

To identify a PIT tagged beaver, practitioners can either recapture an individual and scan for the tag with a hand-held reader or place a specialized antenna along a river that will sense a PIT tagged beaver nearby. Hand-held PIT tag readers cost \$300-500 while mobile PIT tag readers cost \$7,000-8,000. Other methods for tracking and monitoring beavers post-relocation may include attaching a small ear tag to track individual colony members, the use of eDNA sampling, or the use of Global Positioning System (GPS) transmitters (Figure 33). GPS transmitters are often secured to the beaver's tail which then can be tracked using a handheld radio telemetry device to locate the beaver. Relocation programs can also keep track of colony members during the holding period by attaching a small plastic ear tag, assigning each colony a distinct color. Each of these methods come with different benefits

and vary in cost that should be considered based on time and resources for tracking and monitoring.

A 2013 guide, titled [Captive Management Guidelines for Eurasian Beavers \(*Castor fiber*\)](#) notes, the body shape and size of beavers preclude them from neck radio collars, and due to their semiaquatic lifestyle harnesses may be a drowning risk if they become snagged (The Royal Zoological Society of Scotland, 2013). Additionally, they are highly sociable animals and diligent groomers, so any device may warrant additional scrutiny from the individual or from family members (The Royal Zoological Society of Scotland, 2013). Finally, devices must be waterproof. Gluing is a recognized short-term methodology, but recommendations include not using it on highly stressed or injured animals and not saturating fur with the glue. PIT tags, while potentially more expensive, retain the advantage of not being on the outside of the animal, therefore avoiding the need to waterproof, grooming concerns, and overall discomfort and health of the beaver. (The Royal Zoological Society of Scotland, 2013)



Figure 33: Michael Dello Russo tracks tagged beavers with a hand-held radio-telemetry antenna. Radio-telemetry for beavers, Alex Pavlinovic/Trout Unlimited, Public Domain, <https://www.fws.gov/media/radio-telemetry-beavers>.

11.4 How to Define Success

Defining relocation success can vary widely and is dependent on the goals of the relocation effort. One practitioner may measure success based on the survival of an individual beaver or colony over a temporal scale often as a percentage (i.e. 10% survival vs 50%) (Alves, 2024). A second practitioner may set success criteria as no mortality during the capture, care, and release process. Finally, another practitioner may want to document signs of reproduction by the relocated beaver at or near the release site, with dispersal of juveniles (Alves, 2024). For example, during an interview, a biologist from Wyoming Game & Fish Department defined partial success as the relocated beaver making a dam at or near the release site, but moving upstream or downstream, and full success as the beaver staying at or near the release site, building a dam, and surviving until next spring.

Documentation of success can be time consuming as it typically involves returning to the release sites to look for new beaver activity or other methods, like setting up and reviewing camera traps or flying drones. Interviews with relocation program staff indicated that capacity is limited, and staff leans toward using their resources for relocating more beavers, especially as the seasons for trapping and relocation can be short. The authors of a beaver relocation study in Utah proposed expanding the definition of translocation success to include most or all waterways in a watershed, writing, "Provided that the potential for human-wildlife conflict is addressed and minimized, this large-scale perspective of success permits higher tolerance for the movement of translocated beavers away from release sites since even those individuals who emigrate from release sites could still provide restoration services in degraded areas" (Doden, Budy, Conner, & Young).

Alves' findings, interviews for this report, and various published studies find success rates vary widely, from 20% to over 70% beaver survival post-relocation. There are many factors that can affect these numbers, including variations in capture and release practices and conditions at the release site, which also makes it difficult to compare studies. Even a low success rate can signify a productive program if the alternative is not having any beavers on the landscape. Ultimately, success is determined by the individual practitioner, program, agency, state, or Tribe, weighing their own individual goals with data driven outcomes.

11.5 Release Site Standards & Actions to Increase Survival Rates

Through research, on-the-ground experience, and modeling, practitioners can identify characteristics of suitable release sites and actions that can be taken at those sites to bolster success. Many researchers and practitioners have published documents describing their experiences, lessons learned and best management practices. Some notable resources include the Montana Fish, Wildlife & Parks Project Planning Checklist (Beavers and Their Role in Riparian Restoration in Montana, 2023), Chapter 5: Relocating Beaver in the Beaver Restoration Guidebook (Pollock et al. 2017), Methow Valley Beaver Project (Brick and Woodruff 2019), among others cited below.

Release Site Standards

- **Sufficient water flow, depth, and velocity:** A key habitat feature at release sites is the availability of pools of water at least three feet deep year-round for security from predators (Petro 2013). It is also important to consider steep gradients (over 6%) and flows that are too strong that can blow out beaver dams (Retzer 1956).
- **Sufficient food and shelter building materials:** It is important to ensure food sources and shelter materials critical to survival are present at the release site. While the recommendation typically includes willows, aspens, or cottonwoods, as beavers move into new, previously unoccupied spaces, they are known to occupy sites absent of riparian woody vegetation. Additionally, a sufficient riparian footprint is helpful, meaning portions of streams and drainages where there is already some channel complexity (e.g. meanders, backwaters, side channels, tributary confluences, oxbow pools), woody riparian vegetation that extends well beyond the stream channel, and where fully built beaver dams can force at least some stream flow out into the floodplain (Beaver and Their Role in Riparian Restoration in Montana, 2023). The Western Beavers Cooperative guidelines on sufficient release site forage recommends sites with 8,000-12,000 trees and shrubs (Western Beavers Cooperative, 2025). Their website also includes a comprehensive list of research and reports related to beaver food and forage requirements.

- **Avoiding territorial conflicts:** Release locations should be selected where there are no known current beaver colonies (Boyce 1981). It's estimated that beaver should not be released within at least 1 km of a known beaver colony to avoid potential colony conflict (Boyce 1981, Petro 2013).
- **Avoiding human-beaver conflicts:** Initial evaluation of potential human-beaver conflicts can utilize the BRAT tool which identifies sections of stream that may experience conflict. On-the-ground evaluation, local knowledge, and landowner considerations should all be considered before relocating beaver to a new site.



Figure 34: Methow Okanogan Beaver Project BDA installation showing beaver beginning to build upon the BDA that is located near a beaver relocation release site near Twisp, WA. Photo Credit: Jackie Corday.

Actions for Increasing Survival

- **Assessing and managing conflict risk:** It is important to proactively think about potential human-beaver conflicts both up- and downstream of the release site. It is good practice to perform outreach to landowners and other interested stakeholders and to budget for installing culvert protection or other coexistence devices. A passage from The Beaver Restoration Guidebook is salient, stating, "Most watersheds exist within a community of people, and it is important to gauge the level of local community support for beaver restoration activities before proceeding with a project. Although beaver can be established at specific locations without community support, if the goal is to create or expand a sustainable population of beaver within a watershed, a certain amount of educational effort will be needed so that people better understand that the benefits of beaver far outweigh the problems they may create, and that most of the problems can be addressed with proper management."
- **Installing BDAs or finding natural log jams:** The Beaver Restoration Guidebook also notes that, "Enhancing pools could substantially improve the likelihood that the released beaver will establish a colony." BDAs or natural log jams can increase water depth and provide a starter dam for beavers to improve. The Montana Fish, Wildlife & Parks' Beavers and Their Role in Riparian Restoration in Montana white paper notes, "One of the most important factors is the creation of dam complexes (i.e., a series of dams that back up water and sediment to the base of the next dam upstream), and not just one or two BDAs and a single human-built lodge. Practitioners should provide

beavers lots of options for where the core of future beaver colonies will be, then defer the final decision to the beavers. What may appear to be ideal habitat to practitioners may not be so attractive to beavers, and there are many things we do not know about beaver habitat selection at the colony scale. So, the key will be to provide beavers multiple dams and lodges to choose from and let the beavers that do arrive decide where to spend their time establishing a colony."

- **Providing temporary shelter or a lodge:** It can be beneficial to build a temporary shelter close to or in the stream, such as a logjam, especially in high predator areas. Opinions on this tactic are varying and evolving as more programs utilize translocation as a restoration practice. In an interview with Wyoming Game & Fish Department's Terrestrial Habitat Biologist, who is experienced in beaver relocation work, stated they will often build a temporary lodge for the beavers using four straw bales placed adjacent to the creek. They utilize the straw used by the beavers in their holding facility. These bales used as the bottom of the lodge, then they build a roof with willows. There is trail camera footage from the program showing released beaver using the lodge for 2-3 days before building their own bank den.
- **Providing temporary food and dam building materials:** Depending on the predator risk and ease of foraging near the release site, relocators can leave assorted sizes of cut-up forage for a temporary food supply and for dam building materials. If the beavers are stressed or predator risk is high, practitioners can monitor and restock the supply.

- **Involving wildlife professionals:** It is universally recommended to involve experienced wildlife professionals from a wildlife agency or zoological society to lean on their expertise and knowledge. Professionals can review a relocation permit application, ensure proposed release sites are suitable, evaluate holding facilities, or lead relocations. It is recommended that wildlife veterinarians lead health checks upon in-take and consult for any concerns during the holding period. During transport, beavers are prone to overheating, especially on warm days or in direct sunlight, and having wildlife veterinarians or experienced relocators can help monitor their health. Additionally, these professionals will know best management practices for handling and transporting wildlife or know where to go for relevant resources. Capture myopathy or other stress-induced health outcomes are also possible, and wildlife professionals will know how to best reduce this risk.
- **Releasing beaver units vs. individuals:** A common recommendation is to capture and release beaver families or mated pairs. Published research indicates release success is significantly increased when beavers are released with a mate (Boyle & Owens, 2007). While discussing the practice of capturing and releasing colony members one-by-one versus taking them to a holding facility while each member is captured, The Beaver Restoration Guidebook states, “In some cases success has been accomplished with immediate release. However, given the easy mobility of beavers in watersheds and the social, gregarious nature of this animal, it is unlikely that individual beavers would wait for others to arrive over succeeding days in an unfamiliar location—and that they could avoid detection and predation long enough to become established at the new location.”

11.6 Beaver Holding Facility Best Management Practices

Beavers require specialized care and consideration while in a holding facility. Practitioners who run these facilities provide valuable knowledge based on years of experience that we summarize under the best management practices in this section. They share lessons learned and review past mistakes and updated procedures. Depending on the state wildlife agency, there may already be protocols in place for beaver



Figure 35: Kodi Jo Jaspers and Alex Pavlinoic wheel beaver cages along a forest trail, taking the animals to a new home on public land. Carting beaver to a new home, Michael Dello Russo/Trout Unlimited, Public Domain, <https://www.fws.gov/media/carting-beaver-new->

transport and care. Even if there is no protocol specific to beavers, protocols from other species may be relevant, particularly for disease transmission and sanitization procedures.

Below is a summary of common care protocols compiled from existing programs that were developed to lower the risk of spreading beaver diseases among beavers; spreading fish diseases and aquatic invasive species (AIS); and maintaining beaver health. These protocols are not exhaustive, but they do provide a general idea of the processes necessary to help ensure a safe capture, holding, and relocation. It will be important to consider these processes in addition to doing additional research while evaluating the necessary staffing, expertise, and supplies when seeking out or building holding facilities. Not having a facility or staff that can adequately handle these procedures and needing to build one or hire expertise may significantly impact the startup cost of a translocation program.

- **Regularly disinfect the holding facility and trapping supplies:** Begin by treating the holding area with bleach or a similar disinfectant and, if possible, let it completely dry. Practitioners should regularly disinfect/sanitize equipment used in the capture process, such as waders, traps, pickup beds, etc. If building or looking for a holding facility, consider the surfaces and materials used. Options like stainless steel work better in situations where practitioners need to frequently disinfect.
- **Quickly process the animal, look for signs of disease/injury, and record vitals:** A veterinary professional or someone trained and qualified should perform health checks on each beaver and look for diseases or AIS. The professional should pay specific attention to:
 - Endoparasites like tularemia, giardia, & worms. Professionals can administer dewormer and, if necessary or prudent, consider blood tests or fecal analysis.
 - Ectoparasites, such as beetles or mites, or other visible issues on the body. In an article published on their website, Heather Talley, Utah Division of Wildlife Resources Wildlife Recreation Programs Specialist and confirmed “beaver wrangler,” describes a process where, after washing and drying the beavers with a short stay in decontamination, the beaver is administered a special drug combination to sedate the animal. The task requires several people, especially if they want to get the animal processed quickly and reduce the amount of time on sedation – one person holding an oxygen mask, another monitoring vitals, another sampling gums and paws for things like fungus, and a last one examining the fur with a comb to look for ectoparasites or preexisting injuries (Davis, 2018).
 - Ascertaining gender and other body measurements. Talley describes the process for determining gender as messy and not as straightforward as other species. It involves expressing anal glands and examining the secretions under a microscope (Davis, 2018). The beaver should also have its body measurements taken, including weight.
- ◊ The [Beaver Restoration Guidebook](#) lists sexing beavers as a key part of successful relocation. Accurately sexing beavers helps reduce peer-induced conflicts and death in captivity; raises the chances that breeding colonies will become established; predicts whether beavers will remain at a trapping location; and helps infer the demographics of beavers in the watershed.
- See [The Beaver Restoration Guidebook](#), [Beavers and Their Role in Riparian Restoration in Montana](#), and [Captive Management Guidelines for Eurasian Beavers \(Castor fiber\)](#) for more detailed information on recommended in-take and care protocols.
- **If possible, attach a tracking device:** Depending on the device, these may be injected, glued, or attached via a puncture. See 11.3 Tracking & Monitoring for more information on tracking device recommendations. It is advisable to install the tracker under sedation both to ascertain if the tracker is causing any issues with the beaver and to allow time to see if the tracker is functioning properly before release.
- **Control temperature:** The initial 24-hour drying out phase helps to stop the spread of AIS and other diseases, such as chytrid fungus. During the drying phase, beavers must be protected from overheating. Shade is necessary if the ambient temperature is over 60 degrees. In general, beavers can easily become overheated, especially out of water, and care should be given to ensure they stay cool during transport and holding. If selecting or building a holding facility, practitioners should keep in mind the annual temperatures during translocation seasons and select for areas that have favorable temperatures or prepare to control temperature through other means, such as air conditioning or misting systems. Relocators can place cool, wet towels over transport cages to help control temperature while blocking out other stressors.
- **Limit stress:** While beavers are sociable animals within their own family units, they do not readily tolerate other beavers or humans (Boyce, 1981). Holding facilities can be limited for space, and enclosures often share walls. It is important these walls have solid screening to prevent individuals or family units

from seeing each other. Practitioners should monitor family units and individuals daily to watch for signs of aggression or distress, including capture myopathy.

Capture myopathy is a non-infectious disease mostly associated with capture, but it can result from other stressors. Keeping the environment calm, quiet, cool, and safe can help reduce the overall stress on beavers in holding facilities. Capture myopathy is difficult to treat, making prevention the best option. It is also advised to create a structure that can be used as a temporary lodge where beavers can hide and sleep. Options include concrete blocks with stainless steel ceiling and floors; upside down metal livestock watering tanks lined with hay; or hay bales, which can be transferred with the beaver to the release site, with willow or other vegetative roofs. Along with a structure, having deep pools of fresh water where beavers can submerge themselves and eliminate waste can also reduce stress, but it is important that this water is changed daily.

- **Clean the holding pen and replenish water and food daily:** Staff should clean waste and uneaten food, change the water, and provide fresh food daily. Interviewed facilities indicated that, if possible, they feed beaver what they were typically consuming prior to capture, with aspens and willows being common. However, some staff indicated they needed to entice beavers who were not eating well. They used vegetables, such as celery, cabbage,



Figure 36: A beaver kit being processed at the Beaver Bunkhouse as part of the Beaver Ecology & Relocation Collaborative (BERC), Utah. Photo Credit: BERC volunteer, Liz Hadfield.

carrots, and sweet potatoes. Some facilities also supplemented fresh food with rodent chow. “One of the major health issues beavers seem to develop during captivity is related to the gastrointestinal tract, particularly colic from abrupt changes in diet and stress from the capture, handling, and housing process . . . practitioners should do everything they can to reduce stress and to mimic a natural diet for the beavers while they are being held” (Ritter, McGree, Schmetterling, Gower, & Boccadori, 2023).

- **Minimize human interaction and holding time:** When working with wild animals, it is always best to minimize interaction and direct handling. Beavers typically stay at least three days in the facility to account for the necessary drying out time, health checks, and recovery before release. However, with the recommendation for capturing and releasing family units together or at least in pairs, individual beavers may end up staying in a facility for longer while relocators capture and quarantine others. It will be up to the wildlife professionals on the team to determine the best course of action for each beaver.
- **Plan for escape and intrusion:** Beavers naturally chew, dig, build, and climb. The enclosure should be prepared for this behavior and use materials and a design that will not harm the beaver should they attempt these practices. Many interviewed facilities reference escape stories. Additionally, particularly if the facility is remote or outdoors, the fencing should also be prepared and designed to keep predators and scavengers out.

11.7 Types of Holding Facilities

Part of the research for this report included visiting existing beaver holding facilities in Utah, Washington, Idaho, and Wyoming. The purpose was to better understand the differences in structure, size, design, care, maintenance, staffing, and management. These choices are often based on available financial support and staff resources, with many operations utilizing volunteers. This list is not intended to be exhaustive, and there are other beaver holding facility examples across the states, plus practitioners can expect more advances will be made in the coming years. Many of these facilities are part of model relocation and translocation programs that will be covered more in-depth in **XII. Relocation Program Examples**.

Fish Hatchery Runs

Utilizing existing fish hatchery runs for beaver relocation programs can be a great way to save money and concentrate resources as many states already run fish hatcheries. The facility is already designed for water, sanitization protocols, and may have lab services available onsite. Even with additional support, these programs still need dedicated staff to monitor and process beavers for release. These types of facilities are more common in the Pacific Northwest, where there are robust fishery programs. Beavers can play a key role in fishery recovery, as outlined in [2.3 Creating Habitat & Resources for Terrestrial & Aquatic Species](#), and fishery staff may be interested in partnering in beaver-led restoration work.

Examples of fish hatchery run programs:

- **Tulalip Tribes, Washington**: The Tribe dedicated two runs of an active fish hatchery for their Tulalip Beaver Project that has been on-going for approximately 10 years with many lessons learned about preventing beaver escape, providing a good lodge, feeding and health care, and pairing up single adults (Tulalip Tribes Natural Resources, 2017).
- **Methow Okanogan Beaver Project, Washington**: The Methow Okanogan Beaver Project partnered with USFWS to utilize runs in the Winthrop National Fish Hatchery for their beaver relocation program (Methow Okanogan Beaver Project, 2025).
- **Wenatchee Beaver Project, Washington**: Trout Unlimited partnered with USFWS to create the Wenatchee Beaver Project, a combination of supporting landowners with coexistence solutions and, if necessary, relocation. They utilize fish runs in the USFWS Leavenworth Fish Hatchery as well as a pond located on site for beaver relocation efforts. The aim is to, "...reduce conflict between beavers and landowners in Chelan and Douglas Counties, while helping support the important environmental benefits this unique mammal can generate" (U.S. Fish & Wildlife Service, n.d.). The program offers free consultation to those experiencing beaver conflict and notes that, "Other beaver groups in the state, such as the Methow and Tulalip beaver projects, paved the way for this project" (U.S. Fish & Wildlife Service, n.d.).



Figure 37: Figure 4 Peach and Chewy groom after reuniting in the holding pond at Leavenworth National Fish History. Beaver family, Michael Dello Russo/Trout Unlimited, Public Domain, <https://www.fws.gov/media/beaver-family>

Kennel Runs & New-Builds

A kennel-type facility is the most common facility utilized in beaver relocation and translocation programs. Depending on the funding, resources, and lands available, these designs can be simple or complex. These facilities should be designed around holding and circulating water, supporting natural beaver behavior, and withstanding routine sanitation protocols. The efficiency and capacity gained from designing kennels to meet the needs of beavers and staff may quickly counteract the costs associated with insufficient holding facilities, saving money in the long term.

- **Idaho Fish and Game**: In 2019, for approximately \$15,000, IDFG constructed a 6-kennel beaver facility located on their property near Boise. The kennels are placed on a concrete slab and incorporate water drainage for both ease of cleaning and for providing a fresh change of water every day in the metal livestock tank. The facility provides shade, water misters, and screening from other beaver families and human activities.
- **Utah Beaver Ecology & Relocation Collaborative (BERC)**: BERC built the beaver bunkhouse on Utah State University property near Logan, Utah. The concrete floor is designed to include a pond area that has a drain for easy clean-out. Each kennel contains

a metal hut/lodge that is covered with a thick felted cover that is moistened to regulate the temperature and misters.

- **Wyoming Wetlands Society:** In 2023, south of Jackson, the Wyoming Wetlands Society built a new holding facility on their property. This facility significantly increased their capacity for relocation work. The facility contains four holding kennels on a concrete slab that slopes into a ponding area where beavers can immerse in water that is changed daily by a drainage system. The kennels are shaded, and screening keeps adjoining beaver families from seeing each other. Release sites are located on National Forests. (Wyoming Wetlands Society, n.d.)
- **Wyoming Game & Fish Department (WGFD):** In 2023, WGFD Terrestrial Habitat Biologist Jerry Altermatt designed a new beaver holding facility by improving upon the best features of existing facilities. He centered his design around two functions: how to reduce stress on captured beaver, and how to make the facility daily cleanup more efficient. WGFD staff built the facility for approximately \$80,000 in 2023 using mainly donated funds. Some design elements are featured in **Figure 22**, including a continuous water circulation and filtration system and an underwater entrance to the den.

Zoos

If building a facility is not possible, and there are no fish hatcheries, partnering with an accredited zoo may be an option. These facilities are well-versed in wildlife husbandry care, employ wildlife veterinarians, and often have their own laboratories and other medical



Figure 39: Wyoming Wetlands Society's beaver holding facility near Jackson, WY. Photo Credit: Jackie Corday.

equipment. Reaching out to other vetted sanctuaries or rehabilitation centers could also be an opportunity. Some of these programs are also actively involved with public outreach and engagement, which may be an added benefit for beaver relocation and translocation programs.

Oregon Zoo, Oregon: A 2020 presentation by City of Portland Environmental Services, titled Pilot Beaver Translocation Program and Holding Facility, explains that many partners came together to, "Develop a humane and beneficial method for non-lethal removal" of nuisance beaver in the Portland area (City of Portland Environmental Services, 2020). They created a Memorandum of Understanding (MOU) between the five partner agencies and included a funding agreement with the Oregon Zoo. The Oregon Zoo Jonsson Center for Condor Breeding, with no public access, houses two enclosures with wet and dry sides. The maximum capacity is 10 beavers with a maximum occupancy of four weeks. The center will perform medical screening, tests, examinations, and care. The release site is on BLM in the Western Cascades, with a maximum of one or two translocation events per year over a 5-year term. The program stresses these relocations are a last option for addressing nuisance beaver.

Zootah, Logan Utah: The Utah Beaver Ecology & Relocation Collaborative is partnering with Zootah to expand the capacity of the program and offer additional education to the public. For beavers that may be injured or too young to stay at the bunkhouse, the program is offering a secondary solution at Zootah (Casper, 2025). There is also an anticipated beaver exhibit with educational components about the importance of beavers in Utah's watersheds. Zootah is excited



Figure 38: The bunkhouse designed by Utah's Beaver Ecology & Restoration Collaborative. Photo Credit: Jackie Corday.

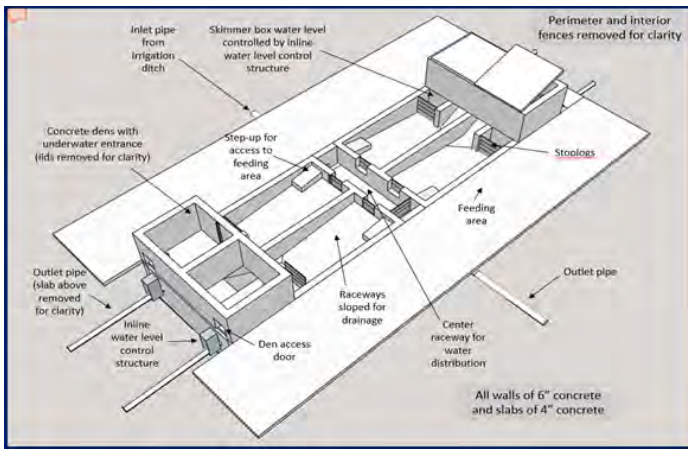


Figure 40: A diagram of the beaver holding facility designed by Jerry Altermatt, WGFD Terrestrial Habitat Biologist.

to showcase a different form of conservation, but it anticipates the exhibit will cost \$200,000, and they are still raising money (Casper, 2025).

Mobile Holding Facilities

Finally, while mobile sites may not house beavers for long periods of time, they can be used to transport beavers between capture and release sites over a short time span. Additionally, a mobile unit may be loaned out to cross state lines and work in another state, though beavers themselves are prohibited from being transported across state lines. Both the WGFD and BERC built trailers to aid in beaver transport. At BERC, they designed an enclosed trailer to hold and transport beavers as another part of their beaver translocation program. The inside is stainless steel for ease of cleaning, and there is a cooling and heating system. The trailer also houses a large tank of fresh water, holding pens, and space for an ATV for transporting the beavers from the trailer to the release site.

XII. Relocation

Program Examples

State or federal wildlife agencies, Tribes, or non-profits typically operate relocation programs, partnering together to work on various aspects. For many of these programs, volunteers are a necessity as funding can be limited. This section will provide examples of all three of these entities managing a relocation program. Most of the information in this section comes from in-person, telephone, and email interviews, as well as select site visits, conducted by Jackie Corday.

12.1 Utah

Beaver Ecology & Relocation Collaboration (BERC)

BERC built and operates a beaver holding facility in partnership with Utah State University near Logan, Utah. It was founded to enhance and support relocating beavers to improve degraded riverscapes in the state. They relocate about 75 beavers each year, and beavers can be trapped by their staff, by landowners with loaned live traps, or by local paid trappers. The translocation program is a last resort after coexistence solutions are determined to be unviable and, in some cases, where the landowner did not want to proceed with installing devices.

Main partners include UDWR, the USFS for release sites, local trappers of nuisance beaver, and Zootah to rehabilitate injured beaver for later release when healthy. BLM and private landowners are also showing interest as potential release sites. BERC relies heavily on volunteers for daily chores, including keeping the kennels clean, providing fresh water and food, and watching for any changes in health. BERC adopted protocols for beaver intake to the holding facility and beaver care while at the holding facility.

Utah Division of Wildlife Resources Southern Region

The Utah Division of Wildlife Resources (UDWR) Southern Region's beaver relocation program was established in 2014 to relocate nuisance beaver to help restore upper watershed streams mainly in National Forests. Wildlife

Program Manager, Teresa Griffin, and her staff annually submit a [Utah Watershed Restoration Initiative](#) funding application requesting approximately \$75,000. This amount covers the costs of operating a simple beaver holding facility, hiring two seasonal technicians to trap nuisance beaver, caring for beavers at the facility, and transporting beavers to pre-determined locations. Since 2014, their program has relocated about 250 beavers within the Southern Region, which is about one-third of Utah's landmass.

A key factor in the success of the relocation program is working closely together with the USFS, which goes beyond providing release sites. USFS staff drive to Cedar City to pick up beavers and transport them to National Forest release sites. They also help UDWR check traps when UDWR doesn't have the capacity. Other USFS staff are assisting UDWR with trapping, monitoring, and horse packing beavers into the Pine Valley Mountain Wilderness. Since the program has gained traction, they can no longer fulfill all beaver relocation requests.

Utah Division of Wildlife Resources Northern Region

The UDR Northern Region is also working on watershed restoration using beaver coexistence solutions and nuisance beaver relocation. Instead of establishing a UDWR holding facility, they partnered with the BERC program for the beaver care needed prior to release. Like the Southern Region, they annually apply for a Watershed Restoration Initiative grant and put the majority towards supporting BERC and some towards living with beaver education. Staff consider BERC an "absolutely critical" partner for the beaver care and relocation work so they can focus on finding suitable locations for release.

12.2 Washington

The Tulalip Beaver Project

The Tulalip Tribes utilize two runs of an active fish hatchery for their Tulalip Beaver Project, which is now over 10 years old. Their work is a significant source of lessons learned through experience and how to partner with beavers to help restore watersheds and salmon habitats. The program relocates 30 to 60 beaver each year (Alves, 2024). Main partners for the Tulalip Beaver Project include the Washington Department of Fish & Wildlife, the USFS and other Tribes for release sites,

and [Beavers Northwest](#) for assisting landowners with coexistence strategies.

[The Methow Okanogan Beaver Project](#)

The Methow Okanogan Beaver Project, a program of the Methow Salmon Recovery Foundation, a 501(c)3 nonprofit in Washington state. Another leader in Washington state, the project has been working to develop and implement a comprehensive beaver program since 2008. For approximately the first six years they focused on nuisance beaver relocation, primarily on National Forest lands, and they partnered with USFWS to utilize the Winthrop National Fish Hatchery for their beaver holding facility. The project now focuses heavily on education to support coexistence solutions for landowners, if possible, and utilizes relocation as a last resort. The organization is a member of the statewide beaver working group, which includes statewide and regional policy work. The project helped to create protocols for beaver capture, intake exams, care guides for the holding facility, and parameters for release sites.

[The Lands Council](#)

The Lands Council based in Spokane, like the Tulalip Tribes and the Methow Okanogan Beaver Project, takes a multi-faceted approach to beaver-led watershed restoration in Eastern Washington. Their efforts include education and outreach, offering landowners consultation and assistance with conflict resolution, relocation of nuisance beaver (140 thus far) and, "...actively shaping beaver population management policy and connectivity at the state and regional scale by informing and engaging governing agencies and authorities."

12.3 Idaho

Idaho Department of Fish & Game

Since 2019, Idaho Department of Fish and Game (IDFG) regions around the state have been implementing a program to translocate nuisance beavers, usually in urban or agricultural areas, to release sites in priority upper watersheds. In the Southwest Region, release sites are on BLM lands in the Owyhee Mountains and on private lands; in other regions, release sites are on National Forests. IDFG is prioritizing locations where beaver complexes will benefit species of greatest conservation needs, like certain species of birds and



Figure 41: IDFG Southwest Region beaver holding facility near Boise, which cost approximately \$15,000 to build in 2019. Photo Credit: Jackie Corday.

frogs. Each IDFG Region is at a different stage of implementing the program, with some having developed key public lands partners, constructed a holding facility, and are actively relocating beavers, while others are only beginning.

When visiting the Southwest Region's beaver holding facility near Boise, IDFG staff explained that they work with local pest control trappers to pay \$250 per adult beaver, described as approximately 35 pounds or heavier. This usually occurs in May through July, because, once temperatures exceed 90 degrees Fahrenheit, live trapping and transport becomes too stressful. Beavers are held for a minimum of three days for quarantine and health checks. Volunteers do the daily chores changing out water, cleaning kennels, providing fresh food, and observing any health changes. If there is an issue, it is reported and handled by IDFG veterinarians.

Their early program approach was to live-trap and relocate the whole family, but this strategy changed after a two-year analysis of relocated beavers indicated the highest survival rate was found in large adults without young kits. Lower survival of kits has been documented in other programs, but to fully understand the reasons why adults with kits may experience lower survival rates would require more studies. One theory is that young kits are unaware of predation risk, which puts them and the adults in greater danger at new release sites without the safety of lodges or deep pools of water. Additionally, in email correspondence a representative from IDFG noted



Figure 42: Beaver release site in the Owyhee Mountains on private land. This site was prepared with BDA installations before reintroducing beavers. Originally, water only flowed in one narrow channel against the streambank in the foreground. The relocated beavers not only built upon the BDA with sticks and mud, but extended the dam far out to the right, substantially widening the pond in just one year of their release and almost tripling its size within three years.

“The overall novelty of the new site and all the specific, stressful factors contained within that novelty (different predator pressure from original trapping location, varying water depth, lack of established territory, unfamiliarity of where the best food resources are, etc.), combined with the added energetic penalty of raising kits and keeping them safe, is what likely reduces survival.” Measuring the success rate of relocated beavers is still a work in progress, but staff expressed confidence in emails, stating the expense is worth it because, “...alternative stream restoration approaches are so much more expensive.”

To improve monitoring at the landscape-scale of water and vegetation changes post-beaver release, a new partnership formed in 2023 between Boise State University, NASA and others to utilize fine-scale satellite data to measure changes. In an online NASA article, Cory Mosby of IDFG expressed excitement around satellite imagery’s ability to expand his crew’s capacity to monitor miles of waterways. He wants to establish more vegetation or, in his words, “more green groceries” to support wildlife and livestock (Keck, 2023).

12.4 Wyoming

Wyoming Game & Fish Department

The Cody Region Wyoming Game & Fish Department (WGFD) gave a presentation to the Draper Natural History Center in 2023 titled [Ecosystem Engineers: The Role of Beaver in WY’s Riverine Ecosystems](#) (Altermatt, 2023). During this presentation, WGFD describes their beaver relocation program, which targets relocating nuisance beavers to upper watersheds. The program began in the

late 1940’s, continued into the mid-1950s, and worked on re-establishing diminished beaver populations and improving river corridor health. The program experienced a renewed effort in the 1990’s by the University of Wyoming, then, years later, WGFD once again took control. Since 2019, 70 beavers have been trapped and translocated in family groups into the Cody region, which resulted in 10 successful established colonies with 65+ dams (Altermatt, 2023).

WGFD has found partnering with beavers versus relying on other methods of river restoration to be advantageous because no water use permits are required, beavers do the work better, and beavers provide free 24/7 maintenance. WGFD, with the help of donated funds, constructed a beaver holding facility in late 2023 near Cody to grow their capacity for beaver-led habitat enhancement.

Wyoming Wetlands Society

The Wyoming Wetland Society (WWS) is a nonprofit focused on wetlands restoration for Trumpeter swans and utilizes beaver coexistence and, when necessary, relocation as one of their main strategies. The WWS has relocated over 400 beavers since 2004. The beavers are relocated to the Gros Ventre River drainage and other permitted National Forest areas to restore and enhance wetland habitat. The WWS previously used a mobile trailer, but with the help of donated funds, constructed a beaver holding facility south of Jackson in late 2023 to help improve their program’s capacity and beaver care. Partners for the program include USFS for release sites, WGFD, and local trappers that are paid \$300 per beaver.

12.5 Colorado

Rio Grande National Forest and the Rio Grande Headwaters Restoration Project

Approximately three years ago, the Rio Grande National Forest (RGNF) and Rio Grande Headwaters Restoration Partnership (RGHRP), a local nonprofit focused on watershed restoration in the greater San Luis Valley area, teamed up on beaver-led restoration for the headwater streams of the RGNF. The work involves several strategies, including coexistence education, LTPBR, and nuisance beaver relocation to RGNF locations approved by Colorado Parks and Wildlife (CPW). In an online article for the Alamosa Citizen, Connor Born, stewardship coordinator for the RGHRP, notes that the future is

coexistence, but says, "There's always going to be a place for trapping and relocating " (Woods, 2024). The area the program primarily traps out of is heavily agricultural, and conflict resolution is not always attainable. He notes there are many more beavers on the Valley floor than they can trap. This means establishing a priority list and targeting beavers giving people the most trouble. The program worked with CPW to develop quarantine and beaver care and release site protocols, borrowing from ones developed by IDFG. The CPW Frisco Creek Wildlife Rehabilitation Center near Del Norte created space to hold beavers for the minimum 3-day quarantine and while the whole family is being trapped. A local USDA Animal and Plant Health Inspection Service (APHIS) trapper is paid approximately \$250 for each beaver.

XIII. Closing Thoughts

While the distribution of beavers today is nowhere near what we believe to be their historical reach, it would be hard to argue that they've ever had a moment like this. Many Indigenous communities had a more symbiotic relationship with beavers, while Western society has yet to fully embraced their value and importance for healthy watersheds. Beavers fulfill many roles, and those roles are often managed in siloes. Beaver management plans offer the unique ability to bridge these desperate identities to cohesively and effectively manager beavers for their sustainability and for watershed restoration while also solving human-beaver conflicts.

As we've explored in this report, it is difficult to analyze, synthesize, and summarize existing plans and programs as they continually sprout and evolve. The eight best management practices we've outlined are an attempt to distill the multitude of lessons learned across plans and programs into realistic guidelines. While the details and minutia throughout the report provide valuable insights and vital turning points, the overarching best management practices provide the map. If there is one lesson it is that there is no correct path to better beaver management and coexistence – only guiding principles – and those are rooted in solving local human-animal conflict for the betterment of both. As science continues to evolve, so will management practices and approaches, but successful programs will always share tangible traits, such as filling data gaps, engaging diverse stakeholder groups, creating effective communication plans, and running robust conflict resolution programs. However, it is a plan's seemingly intangible qualities, its stakeholders' flexibility, commitment, experimentation, and willingness to collaborate, that determine their level of success and longevity.

Appendices

Appendix A: Funding programs that support beaver-related restoration

Funding Navigator Tools

- **National Wildlife Federation, Nature-Based Solutions Funding Database:** A database for communities and organizations pursuing federal funding or technical assistance identifying and applying for federal funding to implement nature-based solutions.
- **Colorado River Resilience, Federal Funding Database:** A list of federal funding sources for climate resilience strategies in the Colorado River Basin and other western watersheds that could include co-existence and restoration strategies.
- **USFS Community Navigators:** The USFS provides funding and technical assistance that can help rural communities, private forest landowners, Tribes, businesses, and others with projects that improve watershed health. While many of these groups are eligible for and would benefit from such funding and assistance, some obstacles limit equitable access to these resources. The Community Navigator establishes USFS employees to assist the intended communities in navigating the complex array of available programs and requirements - more information at <https://www.fs.usda.gov/working-with-us/navigators>

Federal Funding Programs

No dedicated federal program currently provides financial and technical assistance to support beaver-related restoration or human-beaver conflict resolution measures. The following presents a snapshot of federal funding programs that have been known to be utilized to fund beaver-related restoration and LTPBR efforts.

- **USFWS Partnership for Fish and Wildlife Program:** This program provides free technical assistance and funding to landowners, Tribes, corporations, and non-profits interested in improving wildlife habitat on their land. USFWS staff offer free technical and financial assistance to plan, design, supervise, and monitor

customized habitat restoration projects. These projects range in size from a wetland of a few acres to a grassland restoration covering several hundred thousand acres.

- **NRCS, Multiple Programs:** NRCS offers multiple voluntary conservation programs that support beaver-related restoration efforts. Specific programs include the [Environmental Quality Incentives Program](#) and the [Regional Conservation Partnership Program](#). Under the Inflation Reduction Act, these programs received a significant increase in funding to support [climate-smart agriculture and forestry mitigation practices](#) that sequester carbon/greenhouse gases, LTPBR and other riparian restoration techniques.
- **BOR, WaterSMART Grants:** BOR's WaterSMART Initiative provides grants to support investments in water and climate resilience activities, including ecosystem restoration efforts. Specific WaterSMART grant opportunities that have previously supported beaver-related restoration include the following:
 - [Cooperative Watershed Management Program](#)
 - [Environmental Water Resources Projects](#)
 - [Aquatic Ecosystem Restoration Program](#)
 - [Project Design Grants](#)
 - [Water Strategy Grants](#)
- **USFS:** USFS provides funding through multiple grant programs and other authorities to support watershed restoration efforts. Specific grant programs include:
 - [Joint Chiefs Landscape Restoration Partnership](#),
 - [Collaborative Aquatic Landscape Restoration Program](#), and
 - [Landscape Scale Restoration Program](#).

The USFS can also support implementation through contracting authorities, including its [Good Neighbor Authority](#), [Stewardship Contracting](#), and Wyden Authority, allowing the agency to enter into cooperative agreements with partners to implement

restoration work. For example, here is an August 2024 announcement of a \$30 million partnership: [More than \\$30 million in restoration projects taking place in North-Central Idaho - Northwest Public Broadcasting](#) between the Nez Perce-Clearwater National Forests, the Nez Perce Tribe, the Idaho Department of Lands, Idaho Fish and Game and Idaho County that will include restoration projects to improve wildlife habitat and fisheries.

- **NOAA:** NOAA offers various funding opportunities to support habitat restoration and coastal resilience, including investments in beaver-related restoration efforts. Specific opportunities include the [Pacific Coastal Salmon Recovery Fund](#) and the [Transformational Habitat Restoration and Coastal Grants Program](#).
- **BLM:** BLM supports beaver-related restoration efforts across its managed landscapes. BLM does not typically offer traditional grant programs but will enter into cooperative agreements with partners to develop and implement beaver-related restoration work when funding is available. For example, [BLM announced in September 2023](#) that they entered into a “...\$9.9 million partnership with The Nature Conservancy to increase the scope and speed of low-tech process-based restoration (such as creating natural-looking beaver dams and rock structures) in key western watersheds to support healthy riverscapes and intact sagebrush ecosystems. The partnership will include up to seven landscapes in Montana, Wyoming, Idaho, Colorado, Oregon, and Utah where The Nature Conservancy will work with BLM offices to accelerate implementation of these restoration methods.” The press release also lists a \$8.9 million partnership with Trout Unlimited for “...aquatic restoration initiative across arid landscapes of the Upper Colorado Basin, California-Great Basin, and Columbia Pacific Northwest regions.”

State Funding Programs

The following presents a snapshot of state funding programs that have been known to be utilized to fund beaver-related and low-tech process-based restoration efforts.

- **California:** The California Department of Fish and Wildlife’s [Beaver Restoration Program](#) recently created a process for submitting external project proposals and is now soliciting proposals.
- **Colorado:** The Colorado Water Conservation Board (CWCB) and Colorado Parks and Wildlife (CPW) offer grant programs to support beaver-related restoration and LTPBR efforts. CPW’s [Wetland Wildlife Conservation Program](#) is a voluntary, incentive-based program that supports wetland and riparian restoration efforts focusing on reversing the status of declining or at-risk species. In 2021, CPW amended grant priorities to include the restoration of beaver habitat. CWCB offers multiple grant opportunities, including [Colorado Water Plan Grants](#) and [Colorado Watershed Restoration Grants](#). Both of which may be utilized to support beaver-assisted restoration efforts.
- **Utah:** The [Utah Watershed Restoration Initiative](#) (WRI) is the largest funding program for watershed restoration in Utah. Funding for WRI comes from federal partners, including USFS, BLM, NRCS, and state hunting permit fees. For FY25, over \$44 million was awarded to 121 projects, two of which will directly fund beaver restoration programs established in the Southern and Northern UDWR Regions. See [Southern Region Riparian Restoration ID#6990](#) and [Northern Region Riparian Restoration ID#7028](#).

Other Funding Opportunities

- **National Fish and Wildlife Foundation:** The National Fish and Wildlife Foundation (NFWF) provides multiple grant programs supporting beaver-assisted restoration efforts. Some examples of programs that can support this work include:
 - [American the Beautiful Challenge](#)
 - [California Forests and Watersheds Program](#)
 - [Klamath Basin Restoration Program](#)
 - [RESTORE Colorado Program](#)
 - [Rocky Mountain Rangelands Program](#)
 - [Southwest Rivers Headwaters Fund](#)

- **Business for Water Stewardship:** Business for Water Stewardship works with corporate partners to align projects with water stewardship/replenishment opportunities as part of environmental, social, and governance (ESG) and water development offset initiatives. “Over the past eleven years, the BWS program has worked with corporate partners to invest over \$24 million in community-driven water restoration projects across North America, and increasingly globally.” [Collective Water Action - Business for Water Stewardship](#)

Appendix B: Recent federal and state legislation to promote human-beaver conflict resolution and beaver-related restoration

State Legislation

California AB 2196 (Enacted 2024): Codifies California's new Beaver Restoration Program at the California Department of Fish & Wildlife. The program, initiated by an act of the state budget in 2022, works with tribes, NGOs, private landowners, and others to implement coexistence and other beaver-assisted restoration projects to promote habitat restoration and climate change resiliency. AB 2196 requires CDFW to expand its program for issuing permits to capture, handle, transport, and release beavers on public and private lands.

Maryland HB 0631 (Introduced 2024): Authorizes counties to enact laws to promote, protect, and support the population and habitat of beavers.

Massachusetts S 2469 (Introduced 2024): Establishes a study order for legislation to regulate the use of trapping devices to take beaver and muskrat.

Minnesota SF 3444 (Introduced 2024): Establishes a grant program to assist individuals and communities with nonlethal beaver management and damage deterrence; Appropriates \$500,000.

Minnesota HF 4115 (Introduced 2024): Eliminates Minnesota's beaver damage control grants program which provides grants for the lethal control of beaver activities.

Oregon: (HB 3464), signed into law on January 1, 2024, changed beaver's designation from being a "predatory animal" (which allowed killing at any time) to being a "furbearer" (which requires a trapping season among other rules). The bill also encourages landholders to prioritize non-lethal solutions when dealing with beaver-related issues. The new law introduces permit requirements for landholders who wish to trap or remove beaver. Permits will be issued for specific cases where non-lethal methods have been exhausted or are impractical. For the first time, all beaver kills now need to be reported to the Oregon Department of Fish and Wildlife and ODFW will collect and keep track of this data (previously beaver kills were not tracked). ODFW

staff developed rules to implement the new bill, which were presented to the Oregon Wildlife Commission in June 2024 and adopted. [ODFW Beaver Take Rules Presentation](#) and ODFW website news post June 14, 2024 [Commission adopts rules to implement the "Beaver Bill"](#).

The [bill's preamble](#) cited the need for the changes due to the ever increasing frequency of droughts and wildfires and how beaver "have a significant role in increasing the quantity and quality of water on a landscape and decreasing the risk of wildfire, and therefore act as a buffer against climate extremes."

[HB4014 2024](#) - To help pay for those tools, Rep. Pam Marsh, D-Ashland, who sponsored the beaver bill, is pursuing a grant program for private property owners in the next legislative session. The program would compensate private landowners for implementing mitigation tools. [Oh, dam: Oregon, the beaver state, learns to live with its flat-tailed mascot - oregonlive.com](#)

Washington SB 5846 (Passed first committee 2024): Requires the establishment of a grant program to provide for beaver education and outreach, assistance for landowners with beavers on their property, and support for beaver relocation programs consistent with the beaver ecosystem management plan.

Federal Legislation

Developing Alternative Mitigation Systems for Beavers Act (DAMS Act) - Introduced by Representative Suzan DelBene (D-WA). The legislation would establish a five year pilot grant program within the U.S. Fish and Wildlife Service to support the use of nonlethal methods to solve human-beaver conflicts. The program would provide \$3 million annually for nonlethal beaver coexistence projects.

Beavers for the Enhancement of Aquatic and Vegetative Ecosystems Restoration Act (BEAVER Act) - Yet to be introduced. Led by Senator Alex Padilla (D-CA). The legislation would create a Beaver Habitat Restoration Grant Program within the National Fish and Wildlife Federation to support process-based restoration techniques and beaver-assisted restoration approaches to maximize environmental benefits of beaver-modified landscapes.

Appendix C: National and statewide programs with coexistence as a main focus

Organization	Program Components & Focus Areas	Region
Beaver Institute	Technical and financial coexistence assistance, education and outreach, research support, Beaver Corps Training course on how to implement nonlethal methods, Find a Professional tool to locate practitioners, BI Help Desk	National
Beavers Northwest	Technical and financial coexistence assistance, education and outreach	Western Washington
Beaver Works Oregon	Technical coexistence assistance, education and outreach, restoration support	Oregon
Defenders of Wildlife	Technical and financial coexistence assistance for the Rocky Mountains, education and outreach	National, program serves Rocky Mountains
Human-Beaver Coexistence Fund	Technical and financial coexistence assistance, educational and school programming, outreach and resources	Virginia
Methow Okanogan Beaver Project	Technical coexistence assistance, beaver relocation, education and outreach, beaver policy	Methow-Okanogan Valley, Washington
National Wildlife Federation	Technical and financial coexistence assistance program in Montana, education and outreach, beaver resources	National, program serves Montana
Occidental Arts and Ecology Center	Building a statewide coexistence program in partnership with California Department of Fish and Wildlife, beaver relocation, education and outreach, research support, and other resources	California
Working with Beavers	Miistakis Institute and Cows & Fish partner on providing technical coexistence assistance, beaver education and outreach, beaver resources including cost-analysis of coexistence	Alberta
Wyoming Wetlands Society	Technical coexistence assistance, beaver relocation	Wyoming

State and Federal Resources

- Montana Fish, Wildlife and Parks: <https://fwp.mt.gov/conservation/living-with-wildlife/beavers>
- Washington Department of Fish and Wildlife: <https://wdfw.wa.gov/species-habitats/species/castor-canadensis#conflict>
- Wyoming Game and Fish Department: <https://wgfd.wyo.gov/About-Us/Wyoming-Wildlife/Articles/a-family-matter>
- U.S. Fish and Wildlife Services Beaver Restoration Guidebook: https://www.fws.gov/sites/default/files/documents/The-Beaver-Restoration-Guidebook-v2.02_0.pdf
- U.S. Department of Agriculture, Animal and Plant Health Inspection Service: <https://www.aphis.usda.gov/operational-wildlife-activities/beaver>
- U.S. Department of Agriculture Natural Resources Conservation Service, Working Lands for Wildlife: <https://www.nrcs.usda.gov/programs-initiatives/working-lands-for-wildlifeA>

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