

Final Report – NPLCC

1. ADMINISTRATIVE INFORMATION:

Project Manager: Patrick Edwards

Organization: Portland State University

Project Title: “Using Beaver for Climate Change and Conservation Benefits – the state-of-the-science and workshop dissemination for assessing the stream restoration potential of beaver”

Agreement #: F13AC00451

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Report Period: July 1, 2013 to June 30, 2016

2. PUBLIC SUMMARY:

Beaver are being hailed as one of the most cost effective and sustainable solutions for ecological restoration and climate change resilience. This project synthesizes the scientific context through which beaver related restoration is undertaken in a comprehensive guidebook. The goal of this guidebook is to provide an accessible, useful resource for anyone involved in using beaver to restore streams, floodplains, wetlands, and riparian areas. It provides a practical synthesis of the best available science, an overview of management techniques, and case studies from throughout the western United States. During the winter and spring of 2015, five interactive workshops focused on the use of beaver in aquatic restoration were conducted to solicit input from land owners/managers, restoration funders, project reviewers, and practitioners actively involved in beaver restoration and management which bolstered the guidebook with practical review and experience-based content.

3. EXECUTIVE SUMMARY:

Beaver as a Partner in Restoration

More and more, restoration practitioners are using beaver to accomplish stream, wetland, and floodplain restoration. This is happening because, by constructing dams that impound water and retain sediment, beaver substantially alter the physical, chemical, and biological characteristics of the surrounding river ecosystem, providing benefits to plants, fish, and wildlife. The possible results are many, inclusive of: higher water tables; reconnected and expanded floodplains; more hyporheic exchange; higher summer base flows; expanded wetlands; improved water quality; greater habitat

complexity; more diversity and richness in the populations of plants, birds, fish, amphibians, reptiles, and mammals; and overall increased complexity of the riverine ecosystems.

In many cases these effects are the very same outcomes that have been identified for river restoration projects. Thus, by creating new and more complex habitat in degraded systems, beaver dams (and their human-facilitated analogues) have the potential to help restoration practitioners achieve their objectives. Beaver can be our new partner in habitat restoration.

Yet even though the potential benefits of restoring beaver populations on the landscape are numerous, so, too, is the potential for beaver/human conflicts. These conflicts can arise from an overlap of preferred habitats by both humans and beavers, misunderstandings of how beavers modify their habitats, and a lack of planning or use of adaptive management on restoration projects. Reviewing the information provided in this guidebook will help interested parties approach beaver-based restoration from a more informed perspective, so that they can manage expectations and increase success.

Goals of This Guidebook

This guidebook provides a practical synthesis of the best available science for using beaver to improve ecosystem functions. If you are a restoration practitioner, land manager, landowner, restoration funder, project developer, regulator, or other interested cooperator, this guidebook is for you.

Our overall goal is to provide an accessible, useful resource for those involved in using beaver to restore streams, floodplains, wetlands, and riparian ecosystems. Although the guidebook summarizes current information about how to use beaver in restoration and conservation, the knowledge base on this subject is rapidly expanding. This means that not all of the information provided has been peer-reviewed in scientific journals; some of it is instead based on the real-life experience of restoration practitioners who are conducting ongoing experiments on using beaver to restore habitat. Thus the guidebook is a compilation of the current best available science, and we expect to update it regularly as the science progresses, readers provide information from their ongoing restoration experiments, or from restoration efforts of which we are currently unaware. See Table 1 for the different types of data presented in this document and the relative ranking we used for assessing scientific credibility.

Much of the information presented here is applicable across the beaver's range, but the guidebook focuses on beaver restoration in the western United States. Much of the interest in beaver restoration is occurring in the context of restoring habitat for declining populations of Pacific salmon and trout while simultaneously improving stream flows, particularly in drought-prone regions.

Structure and Content

The chapters of this guidebook fall into two broad sections; beaver ecology (chapters 1-3) and beaver restoration and management Chapters 4-10. The "Beaver Ecology," chapters discuss both the general life history characteristics and the effects that beaver dams have on physical and biological processes within river ecosystems. This includes "Frequently Asked Questions" about beaver (Chapter 2) and beaver "Myth Busters" (Chapter 3), which dispel common myths or misperceptions about beaver,

including those that, unfortunately, can influence funding and permitting decisions. Readers already familiar with beaver ecology may opt to skip the first section and move directly to the latter portion of the guidebook, which addresses topics related to beaver restoration and management.

Chapters 4 through 8 discuss common emerging techniques for using beaver and beaver dams (both natural and human created or assisted dams) to improve ecosystems; Chapter 9 describes methods for mitigating the unwanted effects of beaver activity; Chapter 10 introduces the Beaver Dam Viability Matrix, which grew out of the Project Screening Risk Matrix—one of several tools generated by the River Restoration Analysis Tool Project (RiverRAT), a broad federal effort to more efficiently and effectively evaluate stream management proposals; and Chapter 11 presents real-life examples of pioneering practitioners who have used beaver restoration tools in the field. These case studies include lessons learned that will help guide future restoration efforts.

Future Resources

We originally intended to include a chapter on “Beaver Rules and Regulations” as they pertain to restoration in western states, but the process of researching this subject revealed a confusing patchwork of state, federal, tribal, and even local rules governing beaver and beaver dams that varies by land ownership, state and federal agencies, and other factors. Untangling the web of rules and policies into a tractable discussion was beyond the scope of this initial document, but we hope to pursue this topic in the future and appreciate any relevant information that readers want to provide.

We have also developed a comprehensive beaver ecology library of more than 1,400 references from scientific journals, “gray” literature, websites, legislation, regulations, and presentations that is available for readers either in Endnote or as a text document. We have copies of many of the articles and are building a library of beaver articles, with particular emphasis on the more obscure references that are difficult to obtain from the Internet. Yet, as comprehensive as this library might sound, many references related to beaver ecology are not yet included, particularly those from the gray literature. We look forward to including additional references as they are provided by readers.

Finally, since this is a “living document”, we will be updating regularly, including the addition of other beaver restoration-related products so please check the US Fish and Wildlife website for the latest information: <http://www.fws.gov/oregonfwo/ToolsForLandowners/RiverScience/Beaver.asp>

We will also be sending out occasional notices when updates to the beaver restoration guide become available or additional tools are produced. It won't be quite as smooth as the automatic software updates on your phone or computer, but we will do our best. Thank you for your interest. We hope that this guidebook facilitates beaver restoration approaches underpinned by sound scientific principles, such that a more comprehensive, evidence-based understanding of beaver ecology, restoration, and management emerges.

4. PURPOSE AND OBJECTIVES:

Recognition of the climate change and conservation benefits of beaver has resulted in a need to consolidate and summarize current techniques for reintroducing beaver, including artificial beaver dam and lodge construction, short-term supplemental food and building supply provision, and riparian planting strategies for long-term beaver food and construction supply. Further, because our collective understanding of how to best address these issues will continue to evolve as additional information is acquired, there is a need to provide outreach and develop a community of practice for scientists, conservationists, and private and public land managers to continually develop information and to share successes and failures of on-ground efforts related to the use of beaver as a climate change and conservation tool. This project will provide the necessary tools to address these needs, and provides a solid foundation for future work.

The specific objectives are as follows:

1. Provide a comprehensive synthesis of the science underpinning beaver recolonization and techniques for successful reintroduction or population expansion, including research gaps, data needs, and implementation recommendations;
2. Provide four beaver reintroduction workshops throughout the NPLCC to disseminate information related to the use of beaver for climate change and conservation purposes, and to ascertain if practitioners and landowners are applying new techniques that are not yet documented in the published or gray literature.

5. METHODS, ORGANIZATION AND APPROACH:

Objective 1. A comprehensive synthesis of the science

Developed an online "textbook" (with figures and illustrations) that provides readers with state-of-the-science information regarding working with beaver to restore degraded and impacted streams. The science synthesis includes a section on beaver ecology, followed by management techniques, and culminating with case studies. The project also produced an extensive beaver bibliography.

Objective 2. Provide dissemination workshops and establish a community of practice

Six workshops, plus numerous conference presentations and informal talks, were developed to disseminate the comprehensive science synthesis to project funders, designers, regulators, and implementers. The workshops provided an opportunity for practitioners to share information, including their on-ground successes and failures, and to provide suggestions that guided revisions to the science synthesis that was developed as part of this project.

Portland State University's Environmental Professional Program (EPP) handled all logistics and registrations for the workshops, and used their extensive network to ensure that environmental professionals from throughout the NPLCC were aware of the science synthesis and workshops.

We had planned to coordinate with River Restoration Northwest (RRNW) to reach out to hundreds of stream restoration practitioners from throughout the range of the NPLCC, including California, Oregon, Washington, British Columbia, the Yukon, and Alaska. Because of the tremendous response to a simple email distribution, additional outreach was not warranted for the workshops. The funds were redirected to hire a technical editor for the science synthesis, which dramatically improved the readability of the document.

A website, including workshop videos, was included as part of this project even though this was not part of the original proposal.

6. PROJECT RESULTS:

The project was completely successful. The science synthesis document was completed on-time and within budget, and is posted on a publically accessible website (<https://www.fws.gov/oregonfwo/promo.cfm?id=177175812>). All workshops were filled to capacity, and the demand was so great that we opened another workshop in Portland, Oregon, which also filled to capacity (50 individuals per workshop). Another workshop was added in conjunction with the American Fisheries Society National Meeting in Portland, and 130 people attended.

7. FINDINGS AND CONCLUSIONS:

There is a tremendous interest and need for beaver-prompted restoration in the Pacific Northwest. The demand for additional information and workshops by restoration practitioners and agency personnel overwhelmed our capacity, and hence we recorded the workshop presentations so that they would be available to a much larger audience. Beaver-prompted restoration is an inexpensive and relatively low-tech restoration approach that is being increasingly applied throughout the Pacific Northwest and beyond.

8. LESSONS LEARNED AND RECOMMENDATIONS:

The most significant problem encountered during the project was managing the scope, and hence the length, of the science synthesis. While there was a massive amount of information available, refining and distilling that information into a useable and accessible format proved challenging. We eventually brought in a technical editor to help with the final draft of the science synthesis, but it would have been more effective to bring a technical editor in at the beginning of the project to help guide development of the document.

Based on the level of interest, and the number of beaver-related restoration projects that are being designed and implemented, additional workshops and short courses are highly recommended. More research on the efficacy, regulatory constraints, and long-term benefits of beaver dam analogues and other techniques are also warranted. Future work may include management strategies in areas where beaver populations have significantly recovered.

9. MANAGEMENT APPLICATIONS AND PRODUCTS:

The primary product of this project is the Beaver Restoration Guidebook. While we also provided outreach through numerous presentations and workshops, the material presented was extracted from the Guidebook with the purpose of increasing the utilization of the Guidebook in restoration projects. Several large scale restoration projects are now including beaver and beaver dam analogues in their project proposals (specifically the Forest Service). Three major restoration programmatics (PROJECTS, ARBO II, and HIP III) now cover beaver habitat restoration as a proposed action.

We fully expect an increase in the number and extent of beaver-prompted restoration projects as a direct result of this project, but this will be difficult to specifically quantify due to confounding variables.

Below is a list of the Beaver Restoration Guidebook principle authors, editors, the technical editor, and an alphabetical list of contributors, followed by other individuals and organizations who provided funding and/or assisted with the workshops.

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The North Pacific Landscape Conservation Cooperative
US Fish and Wildlife Service
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US Forest Service

Workshop Invited Speakers

Melissa Babik of the Mid-Columbia Fisheries Enhancement Group, Shelly Blair, California Department of Fish and Wildlife, Mark Cookson, US Fish and Wildlife Service, William Meyer, Washington Department of Fish and Wildlife, Thomas Stahl, Oregon Department of Fish and Wildlife and Charlie Corrarino (retired), Oregon Department of Fish and Wildlife.

Workshop Organizers

Brian Turner, Mary Anne Schmidt and Patrick Edwards of Portland State University, Environmental Professionals Program.

10. PROGRESS TO DATE:

During the 36 months of this project, we: (1) convened the beaver research team on at least a monthly basis, (2) conducted a thorough survey of the literature that includes 100s of references, (3) interviewed numerous individuals currently implementing beaver restoration projects in the western United States, (3) visited restoration field sites, (4) compiled an annotated bibliography, (5) developed four case studies, (6) compiled a peer reviewer list of over 40 individuals, (7) completed version 1.0 of the Beaver Restoration Guidebook, (8) partnered with the Wetlands Conservancy to add an additional chapter on beaver in urban areas, (9) presented at a variety of conferences and meetings throughout the PNW, (10) conducted all five scheduled workshops, plus provided an additional workshop with 130 attendees at the American Fisheries Society National Conference in Portland, Oregon, and a short course at River Restoration Northwest, in Stevenson, Washington, (11) conducted outreach regarding the workshops, and (12) established a website to post information for the public regarding beaver restoration.

11. PROJECT TIMELINE:

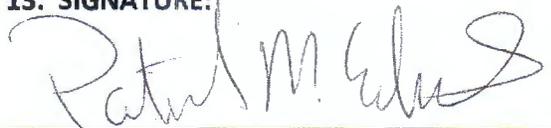
The project was completed ahead of our extended schedule – June 30, 2016. The science synthesis is complete and is posted on our website at <http://www.fws.gov/oregonfwo/promo.cfm?id=177175812>, along with all of the videos and presentations from the workshops.

Action	Date
Start date	July 1, 2013
Project initiation meeting	August, 2013
Objective 1: Science synthesis complete	September, 2014
Objective 2: Workshops	November, 2014 -- February, 2016
Objective 1: Final synthesis report	June, 2015
Close-out meeting	June, 2016

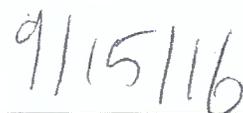
12. PUBLICATIONS AND OUTREACH:

Our primary publication is the Beaver Restoration Guidebook, which is posted on our dedicated USFWS website at: <http://www.fws.gov/oregonfwo/promo.cfm?id=177175812>. We conducted outreach through six workshops and numerous invited presentations over the past three years. We have posted project information on various social media networks. Beaver research team members have also provided information to various groups through webinars and teleconferences. The PSU Environmental Professional Program intends to offer ongoing outreach through a yearly class, which will be offered in the autumn of 2016.

13. SIGNATURE:



Patrick Edwards, Director



Date