



Adaptively Managing Restoration Initiatives

A GUIDE PREPARED FOR
*Oregon Watershed Enhancement Board's
Focused Investment Partnership Program*



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What is OWEB's Focused Investment Partnership Program?

The Focused Investment Partnership Program awards grants to high performing partnerships that apply a collaborative, results-oriented approach to restoration based on strategic planning. Partnerships that receive FIP Implementation grants are eligible for funding of up to \$12M over six years to implement a set of pre-defined restoration strategies addressing one or more of OWEB's Board-approved ecological priorities of significance to the state.

The Focused Investment Partnerships program therefore represents both a significant investment by the state of Oregon as well as a prime opportunity to improve the practice of restoration in each ecological priority area.



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Introduction

The complex and dynamic nature of ecosystems make efforts to successfully restore and conserve them challenging. Restoration practitioners operate with imperfect knowledge about the ecosystems they hope to improve and the effectiveness of strategies they design to reach desired ecological outcomes. The formal practice of **adaptive management** offers a way to address these uncertainties through an iterative process of learning by doing, which cycles through the steps of planning, implementation, evaluation, and adjustment. With sustained commitment to ongoing learning and the willingness to make changes in response to new information, an adaptive management approach to an ecological restoration initiative has the potential to reduce uncertainties and improve ecological outcomes.

This guide, developed within the context of the **Oregon Watershed Enhancement Board's (OWEB's) Focused Investment Partnership (FIP) program**, is intended to help restoration partnerships design, build, and maintain an adaptive management approach that overcomes common challenges and meets their specific needs, ambitions, and capacity.

As a funder, OWEB is interested in helping grantees and other restoration partnerships apply the elements of an adaptive management framework to better understand and improve the impact of their investments. OWEB also believes in the potential for this approach to contribute to the larger body of knowledge and practice of ecological restoration. While this guidance is written with specific references to the Focused Investment Partnership program, it is intended to be useful for any program or initiative aimed at improving restoration outcomes.



The Benefits of Adaptive Management

Applying an adaptive management approach requires commitment and investment of resources at each step in the cycle. When implemented effectively, this approach can yield substantial value, including:

- reducing uncertainty about the effectiveness of specific restoration actions;
- learning from and avoiding past mistakes;
- responding to new information and evolving conditions;
- achieving stated restoration goals and objectives more efficiently and effectively;
- increasing confidence and buy-in among partnership members and other stakeholders;
- developing and institutionalizing a practice of ongoing learning and improvement; and
- documenting lessons that can be applied elsewhere.

Achieving this full suite of benefits may be possible with a relatively modest investment at each of the steps of adaptive management, described in this document as **Adaptive Management Fundamentals**. However, in many situations the complex ecological, social, and political context of restoration requires additional attention and resources at different steps in the process to effectively implement adaptive management and fully realize these benefits. These are described as **Added Investments in Adaptive Management**.

A successful adaptive management program can be defined as one in which:

- 1** restoration practitioners and key partners are committed to and engaged in learning,
- 2** results from research and monitoring are used to affirm and/or improve decisions about restoration, and
- 3** progress is made toward achieving restoration objectives.

How to Use this Document

This guide is designed to help partnerships structure and manage an adaptive management process that delivers the benefits previously described. It will also benefit those that may have already integrated elements of an adaptive approach in their work but desire to enhance its potential.

This guide is meant to be a companion to the guidance offered in the **Oregon Watershed Enhancement Board's Strategic Action Planning for Prospective Focused Investment Partnerships** (OWEB Strategic Action Planning Guidance). A number of the sections in that document address steps in the adaptive management process. In this document, relevant sections of the OWEB Strategic Action Planning Guidance are referenced where they address elements of adaptive management.

This document is comprised of
two interrelated sections:

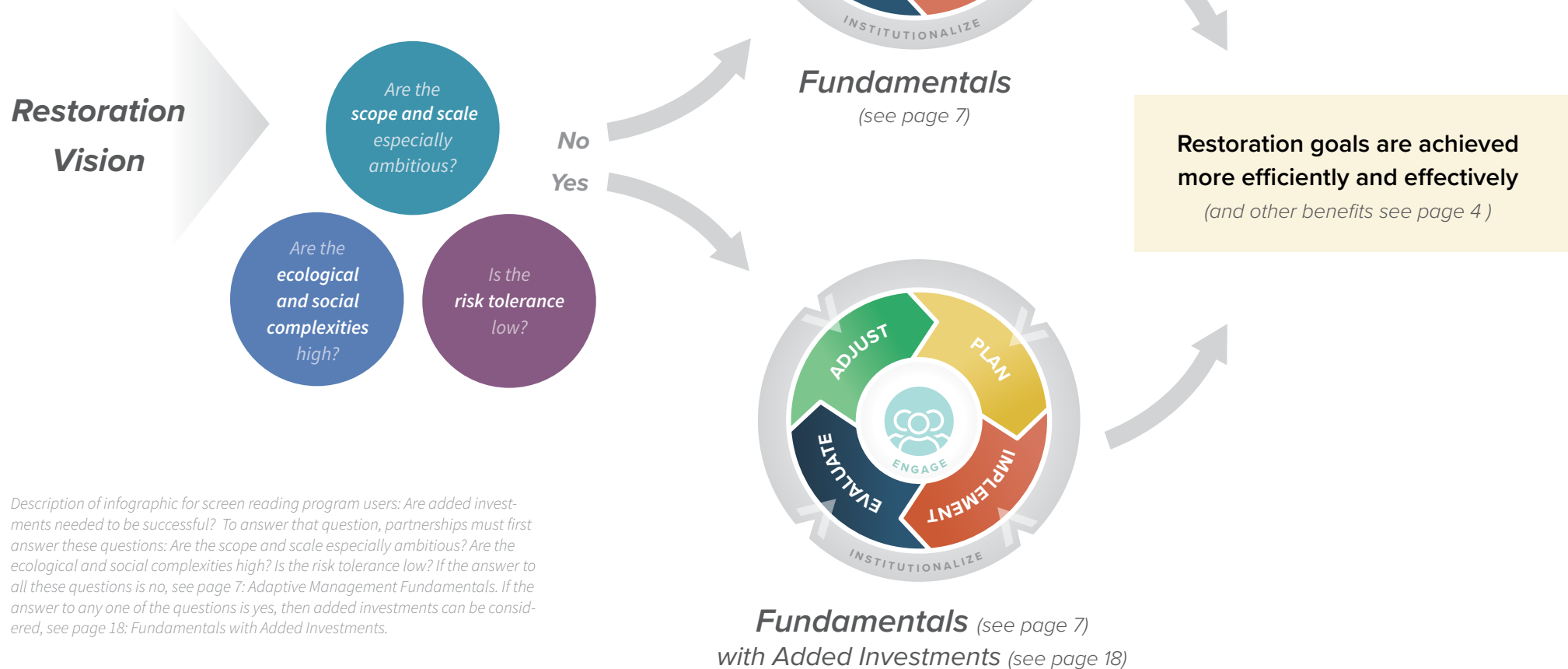
Adaptive Management Fundamentals

This section describes the basic steps required for adaptive management (plan, implement, evaluate, and adjust), as well as two underpinnings of successful adaptive management: ongoing partner engagement and institutional processes that support and sustain the effort. As noted above, these require at least a modest investment of partnership time and budget beyond what is typically needed to plan and implement a restoration initiative.

Added Investments in Adaptive Management

This section describes efforts that can be layered onto the fundamental adaptive management steps to address common challenges and more fully realize the expected benefits described above. In particular, these additional investments may be desirable for more complex, larger-scale, novel, or controversial restoration initiatives. They can help partnerships answer questions about restoration outcomes with a higher level of confidence and buy-in and more directly link learning to decision-making, but require greater commitment and investment than the steps described in Adaptive Management Fundamentals.

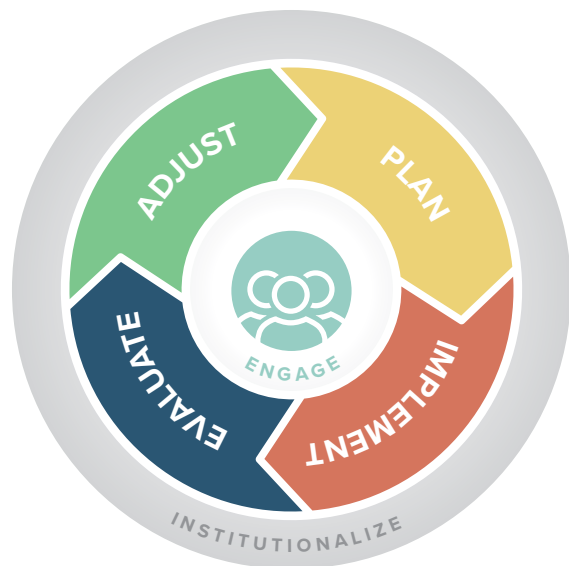
Are added investments needed to be successful?



Description of infographic for screen reading program users: Are added investments needed to be successful? To answer that question, partnerships must first answer these questions: Are the scope and scale especially ambitious? Are the ecological and social complexities high? Is the risk tolerance low? If the answer to all these questions is no, see page 7: Adaptive Management Fundamentals. If the answer to any one of the questions is yes, then added investments can be considered, see page 18: Fundamentals with Added Investments.

Adaptive Management Fundamentals

FIG 2. Adaptive Management Cycle



Adaptive Management

Adaptive management is a systematic process for continually improving by learning from ongoing experience. The process is commonly depicted as an iterative cycle of planning, implementing, evaluating, and adjusting (Figure 2).

During the planning phase, partnerships define their goals and objectives and develop their proposed actions and monitoring plans.

During implementation, partnerships undertake their planned actions and monitoring.

During the evaluation phase, partnerships analyze and interpret their monitoring results, review other lessons learned during implementation, and determine whether restoration and monitoring should continue as planned or be adjusted in light of new information.

During the adjustment phase, partnerships implement appropriate changes to plans and management actions.

In addition, adaptive management is more successful when partnerships **engage participants** with diverse knowledge and skills, particularly during planning and evaluation.

Institutionalizing adaptive management fundamentals by embedding them in the partnership's programs and procedures helps streamline and sustain the process.

Keys to successful adaptive management

Experience has shown that effective adaptive management includes each of the following components.

Champion: an individual with primary responsibility for leading and supporting all aspects of the adaptive management process

Strategic plan: a document developed and agreed to by the partnership describing the initiative's context, selected strategies and actions, and expected outputs and outcomes

Monitoring plan: a document detailing key outputs and outcomes to be measured, associated indicators, the methods and schedule for data collection, the process for analysis and sharing results, and organizations or individuals to complete each task

Information management: a process for recording and storing monitoring data and other lessons learned so they can be used to evaluate activities and adjust future work as appropriate

Review schedule: a structure and timeline for regularly discussing lessons learned from project implementation and monitoring, and for revising planned activities as appropriate

Funding: sufficient resources committed to plan, monitor, evaluate, and adjust restoration strategies and work plans for the duration of the initiative

Flexibility: organizational and individual willingness to question assumptions about planned actions and predicted outcomes, accept undesirable outcomes as learning opportunities, and adjust future plans and actions in light of new information

Commitment: organizational and individual willingness to dedicate time and resources to each step in the adaptive management cycle

Communication: ongoing effort to share new learning and adaptive changes with all partnership members and other key stakeholders at each stage of the adaptive management process

Institutionalizing adaptive management: integration of the adaptive management process into organizational procedures to solidify commitment to and sustain the adaptive management effort



Engage Key Participants

A breadth of different players need to be involved for adaptive management to be successful. Most of these will be members of the partnership, but partnerships will also want to consider external funders, technical reviewers, scientists, landowners, and others whose endorsement, expertise, or consent is helpful or necessary for the initiative to be successful. Regular communication with partners and other key stakeholders is essential to progress through the adaptive management cycle. In particular, for adaptive management to be successful, partnerships will likely need each of the following roles represented:

► **Champion:**

Adaptive management can easily break down without leadership and continuity – ideally provided by an individual or team committed to the practice of monitoring, evaluating, and adjusting. An adaptive management champion holds the broader vision of the initiative and is a strong advocate for the adaptive management process; cultivates a broad adaptive management network; synthesizes and presents technical information to a variety of audiences; and facilitates communication among partners and other stakeholders. Broad participation and commitment from the partnership's members is critical to successful adaptive management, but it is usually valuable to have an individual responsible for spearheading the effort and keeping everyone involved. Many partnerships find that leading and coordinating monitoring and adaptive management is a half-time or full-time job.

► **Practitioners:**

The people directly responsible for restoration project planning and implementation are necessary to help articulate planned actions and their desired results, identify lessons learned during project implementation, help evaluate the implications of monitoring data and other new information, and discuss the feasibility and potential unintended negative impacts of suggested adjustments to restoration plans and actions. They may also be responsible for gathering and analyzing monitoring data and conducting outreach with landowners or other stakeholders.

► **Scientists and other technical experts:**

It is important to have reliable monitoring results to accurately and objectively measure progress toward ecological goals and reduce key uncertainties about the results of restoration strategies. When developing monitoring plans, partnerships should involve people who can help define measurable goals and objectives, identify appropriate monitoring indicators and methods, and help analyze and present monitoring data in a way that clearly serves the partnership's self-defined adaptive management needs. Some partnerships find this expertise within their partner organizations, while others may reach out to external scientists or monitoring professionals. Scientists and other technical experts may also be involved in project design and technical review.

✚ **Added Investments:** *When working with external experts to design, implement, or evaluate monitoring, it is important to ensure that discussions and monitoring plans align with the needs of the partnership and do not diverge into other research interests of external partners (see page 26).*

► **Landowners and land managers:**

In many cases, restoration projects span a mix of private and public land ownerships that are managed for a variety of purposes, such as agricultural production, recreation, timber management, and wilderness protection. Landowners and land managers have a direct interest in the result of a project, including expected benefits and potential risks. Projects cannot be successfully implemented without their consent, participation, and willingness to steward projects into the future. Additionally, landowners and managers can contribute knowledge and experience, especially with respect to local conditions and feasibility considerations, that can be invaluable to project planning, implementation, monitoring, and adaptive management.

► **Decision-makers:**

Adaptive management also requires ongoing involvement from partnership members with the authority to decide which activities get implemented and how they will be funded. Without decision-maker involvement at the organizational and partnership level, monitoring may not be adequately funded, results may not be evaluated, and necessary adjustments to restoration activities or plans are unlikely to be made. Decision-maker flexibility and commitment are key to an effective adaptive management process that translates monitoring and learning into action. The individuals involved in decision-making will vary depending on the type of decision to be made.



► **Funders:**

Funders and funding review committees also influence decision-making because their decisions almost always determine whether and when a project is designed and implemented. Consistent communication with these groups, engaging them throughout the adaptive management process, helps ensure that changes to proposed actions are well understood and not a surprise. Some funders can have a significant interest in the outcomes of a restoration initiative and are therefore motivated to participate in and support a monitoring and adaptive management process.

► **Regulatory agencies:**

Restoration actions must comply with existing land and resource management laws, regulations, and plans. These often require lengthy permitting processes with regulators representing federal, state, and local jurisdictions. Maintaining communications with regulatory agencies from the beginning of the restoration project design process and throughout discussions of adaptive change to the restoration plan ensures as much time as possible is available to navigate the regulatory process.

► **Other stakeholders:**

In some cases, there may be other people or organizations that are not formal members of the partnership but have a particular interest in planned actions and their outcomes. For instance, when working on public lands or within larger conservation contexts (e.g., landscape-scale forest restoration projects) there likely will be interest groups that want to track progress and comment on planned activities and their outcomes. Adjacent private landowners and other resource managers may have relevant information, or may be interested in applying adaptive management learning to other areas.

✚ **Added Investments:** *With increased investment in stakeholder engagement, a partnership can access broader input, proactively involve even skeptical stakeholders, and share monitoring results externally for increased credibility (see page 21).*





Plan

Adaptive management is based on the premise that restoration takes place within highly dynamic and complex ecological and social systems, so it is not possible to know all of the possible effects of planned actions. Therefore, an important part of adaptive management planning is to examine assumptions and hypotheses about the predicted results of selected strategies and actions. This requires a willingness on the part of all partnership participants to acknowledge that, in some cases, restoration actions may produce results that are different than they expect, and that they may need to consider different approaches to achieving restoration outcomes. Collaborative planning which engages diverse partnership members helps ensure that broader organizational, social, economic, and political variables are represented in adaptive management discussions and addressed in project plans.

✚ **Added Investments:** *Engaging project partners in a process of identifying and prioritizing restoration priorities and uncertainties to be addressed through monitoring helps participants better understand their own and others' assumptions and values and builds a common understanding of the system as well as support for adaptive management (see page 23).*

Adaptive management is more focused, efficient, and effective when a partnership has a clearly written strategic action plan, annual or project-level work plans, and a monitoring plan. These plans provide measurable objectives that serve as benchmarks for discussing progress and lessons learned.

► **Strategic action plan:**

A strategic action plan describes a partnership's vision, geographic scope and time-frame, ecological goals, strategies and actions designed to work toward those goals, and objectives against which to track implementation progress. Strategic action plans are ideally developed with full participation of the partnership to ensure that relevant perspectives are represented and key ecological priorities are addressed. Often, it is useful to work with a facilitator to help participants identify and examine assumptions about planned actions and expected results.

A variety of decision-support processes and tools are available that can help diverse stakeholders express and clarify restoration values and concerns, identify available options to address them, and discuss the pros and cons of different options. For example, a theory of change process is used to help a partnership articulate and collectively identify and examine assumptions about the near- and long-term outcomes of restoration actions. In the theory of change process, groups map out the hypothesized relationships between proposed strategies, actions, outputs, and ecological outcomes. A theory of change can help the partnership prioritize actions and design a monitoring plan to determine if predicted results are actually observed. If expected results are not realized, a theory of change can then help the partnership identify alternative restoration actions it may want to explore. A results chain, as described by the *Open Standards for the Practice of Conservation*¹, is one effective tool that can be used to develop a theory of change.

The OWEB Strategic Action Planning Guidance was created to help partnerships develop all the elements described above. For example, section 5 of the Guidance describes identifying ecological priorities and defining goals. In section 8, the Guidance describes a theory of change process for Focused Investment Partnerships.

✚ **Added Investments:** *In addition to helping identify predicted near- and long-term results that can be measured to evaluate restoration progress, a results chain can also help a partnership identify critical uncertainties associated with hypothesized linkages between actions and ecological outcomes (see page 22).*

► **Monitoring plan:**

One purpose of adaptive management is to avoid erroneous conclusions about the linkages between actions and observed outcomes. Therefore, adaptive management emphasizes review of empirical data and observations rather than just theory, logic, or anecdote. Without an intentional focus on using empirical data to evaluate the effectiveness of restoration actions, groups can become overly confident with techniques that they intuitively believe will work, even if they are not necessarily supported by data.

¹ *Conservation Measures Partnership 2013.*



A partnership's monitoring plan is built around quantifiable and time-bound implementation objectives and target values (or ranges) associated with key ecological outcomes. A monitoring plan also describes indicators or metrics that will be used to measure change toward or away from implementation objectives and ecological outcomes, along with the methods that will be used and a data collection schedule. By focusing monitoring on key predicted results, identifying appropriate indicators and methods, and detailing when and by whom data will be collected, a monitoring plan helps ensure that the partnership will have reliable, empirical feedback on its actions.

Developing monitoring plans requires input from individuals with expertise in measuring the particular outcomes of concern, but broader participation also is important to ensure that monitoring activities align with all partners' restoration objectives and key uncertainties about restoration outcomes. The adaptive management champion plays an important role in promoting open communication and alignment across all related planning efforts.

The development of a theory of change as described in the OWEB Strategic Action Planning Guidance, section 8, includes a process for defining measurable implementation objectives and ecological target values for key outputs and outcomes. Selected outputs and outcomes become the focus of a monitoring framework, described in the OWEB Strategic Action Planning Guidance, section 9.

✚ **Added Investments:** *Partnerships can increase the rigor and relevance of their monitoring results by engaging partners in developing monitoring priorities (see page 22), applying principles of experimental design (see page 23), and developing partnerships with researchers or monitoring experts (see page 26).*

► **Work plans:**

Work plans detail the set of restoration actions a partnership will carry out over a specified time period – typically one or more construction seasons or rounds of funding – to accomplish implementation objectives contained in the strategic action plan. Project specifications, treatment prescriptions, or project design reports are also useful for later evaluation of what worked, what didn't, why, and what the partnership might want to do differently in the future.





Implement

During implementation, actions and monitoring are undertaken according to the methods and schedules outlined in work plans, monitoring plans, and project specifications. In addition to keeping careful monitoring records, people responsible for implementing restoration actions can track their progress against plan objectives and note where activities were implemented differently than planned. For instance, economic or weather conditions may cause delays, which could affect project outputs or outcomes. Similarly, operational innovations may lead to efficiencies or more effective outcomes. It is important to keep a record of these changes so that they can be taken into account during project evaluation and inform decisions about future work.

► **Data management:**

Management and quality assurance/quality control of monitoring data, including implementation and operational field notes and records, are essential for data to be useful, specifically to ensure their accuracy and to make monitoring data accessible for analysis and reporting. Establishing a written record of standardized data management systems can institutionalize data management best practices and establish accountability. Ideally, protocols identified in monitoring plans specify how data are collected and recorded. In addition, an agreed-upon process for sharing data in a format that is accessible to all partners is key to incorporating monitoring data into restoration planning.

The adaptive management champion keeps track of planned monitoring to ensure that data are being gathered, recorded, and stored as planned. Practitioners are typically responsible for implementing planned actions. In the context of adaptive management, they keep written records of any unexpected conditions encountered and adjustments made during implementation, so that these can be discussed during scheduled reviews and incorporated in future restoration planning.

✚ **Added Investments:** *Partnerships can streamline data collection, analysis, and reporting by developing a shared database and formalizing a data sharing agreement (see page 25).*



Evaluate

During the evaluation step of the adaptive management process, participants collectively reflect on their experience with past actions, review monitoring data, and compare outputs and outcomes to targets described in strategic plans, work plans, and/or monitoring plans. This process of evaluation promotes learning, increases knowledge, and reduces uncertainty about the outcomes of past restoration actions. Based on group discussion, participants may develop and recommend adjustments to future plans or actions.

It is critical to schedule meetings and site visits to discuss lessons learned, monitoring data, and the implications of new information for future work, because without this step, informed adaptation doesn't happen. It is helpful to establish an evaluation timeline and process and engage a broad group of participants.

At the evaluation step, the adaptive management champion, or more often a team, is responsible for synthesizing and presenting monitoring results, relevant research, and other new information to the full partnership or even a broader group of stakeholders. Restoration practitioners, monitoring professionals, and scientists are particularly important to this discussion as they have the expertise to interpret monitoring data to inform the evaluation. In cases where a partnership's activities have regional or regulatory relevance, such as recovery of species listed under the Endangered Species Act, representatives from agencies should be informed and invited to participate. Finally, landowners and other interested community members may be invited as a way to ensure their perspectives are considered, they can participate in problem solving, and they are receptive to any conclusions reached. Ideally, the evaluation process will be facilitated to ensure that all partnership members have an opportunity to participate in the discussion.

Treatment design specifications can be very helpful for these review discussions. For example, a fish habitat restoration project might include objectives for restoring floodplain connection, removing artificial fish passage barriers, and restoring riparian plant communities. Design specifications for that project would detail where, when, and how floodplain connectivity would be restored; where, when, how, and how much woody debris would be added to the stream channel; and where, when, and what riparian plant species would be planted. Reviewing the design specifications versus what actually was implemented is useful for evaluating what worked, what didn't, why, and what the partnership might want to do differently in the future.



Annual evaluation of Blackfoot Drought Management

The Blackfoot Drought Committee in western Montana was established in 2000 to address declining fisheries in the Blackfoot River and its tributaries and inequitable distribution of water resources among irrigators during drought periods. Together, this group of state and federal agency representatives, conservation group members, anglers, and landowners developed the Blackfoot Drought Response Plan, which describes specific actions to be triggered when specific water flow and temperature thresholds are reached.

Every fall, the committee meets to review river flow, temperature, and other monitoring data along with conservation activities from the previous summer. In this one-day meeting, participants revisit the Drought Response Plan, discuss how well implementation worked that year, and decide whether they want to make any changes to the plan or its implementation based on lessons learned that season.

Based on these reviews, technical assistance to irrigators and drought response actions have been expanded and the plan has been refined. For example, additional temperature and flow thresholds with associated irrigation responses have been added, and fishing restrictions have been revised based on angler concerns and an analysis of water temperature monitoring data.²

² Moote 2013

► Annual or biennial reviews:

While it can take several years to gather enough monitoring data to understand the ecological outcomes of a restoration effort, it is important to regularly discuss ongoing field work and interim monitoring data to capture lessons learned and, when appropriate, address them in the short term. Many partnerships schedule annual or biennial reviews at the end of the field season to accomplish this (see example at left).



Useful questions to guide discussion at these meetings include:

- What did we plan to do?
- What unexpected things happened?
- What do the monitoring data show?
- Do we need additional information before we make a change?
- What did we actually achieve?
- How did we respond?
- What should we do differently next time?

To encourage open sharing in these evaluation discussions, a facilitator begins by acknowledging that there is some uncertainty when restoration is implemented and explaining that the process is not a critique nor a performance evaluation. Discussions should be grounded in mutual respect, without judging people or their individual actions, and facilitated so participants are encouraged to talk freely without fear of repercussion.

► Strategic action plan review:

It is recommended that partnerships plan a strategic action plan review with evaluation of longer-term monitoring data every five to ten years. For OWEB Focused Investment Partnerships, this would occur toward the end of their six-year funding cycle. Strategic action plan review also may be triggered when strategies cannot be implemented as planned or where there have been major changes to the system, such as an extreme weather event or major political or economic changes, that bring the likelihood of success into question. Alternatively, an interim strategic plan review may be appropriate when a partnership is ahead of schedule in achieving their goals. The purpose of the strategic plan review is to focus on how well the partnership's overarching purposes and goals are being met and consider whether strategies or the plan itself need to be adjusted.

In addition to the questions listed above, partnerships doing a strategic action plan review may want to explore questions such as:

- How well are we achieving our overarching goals?
- Are we focusing on the right geographic area to meet our objectives?
- Are we addressing critical limiting factors or threats?
- Are the right people and organizations involved?
- How accurate are our initial assumptions about the effectiveness of our strategies?
- How are we incorporating new scientific understanding of the ecosystem or restoration practices?



► **Partnership process review:**

As part of periodic review meetings, partnerships may choose to review the internal functioning of the partnership itself, and how well it supports adaptive management. As noted above, adaptive management requires a collective willingness and ability to share information, experiment, learn from mistakes, and foster innovative solutions in what are often complex social and ecological circumstances. The success of an adaptive management process depends in part on the effectiveness of things like communication, decision-making, accountability, and leadership.

Some questions to guide discussion about the internal functioning of a partnership might include:

- *How satisfied are participants with internal communication?* Do all partners have access to relevant information when they need it? Do people feel comfortable sharing feedback and asking tough questions? Are leaders and decision-makers open to feedback?
- *How well do partners work together* during planning, implementation, evaluation, and adjustment? Are roles and responsibilities clearly defined? Are they adjusted as needed to reflect what people actually do and how people want to work together?
- *How satisfied are partners with external communications?* Are external stakeholders involved in ways that help the partnership achieve its goals? Are there key stakeholders who are not involved and need to be?
- *How satisfied are partners with decision-making?* Could the decision-making process be improved? Is the partnership able to reach decisions in a timely manner?
- *How satisfied are partners with the distribution of funding*, considering implementation, monitoring, and partnership operations? Are funding and staffing appropriately allocated to reflect partnership priorities and support key functions?
- *How does the partnership deal with partner turnover?* Is there a process or plan for transferring knowledge and responsibilities to new individuals? Is there a process or plan for sharing or passing on champion responsibilities?

✚ **Added Investments:** With increased investment in clarifying roles, responsibilities, and decision-making procedures, a partnership can increase partner accountability and trust in the process and make it more efficient (see page 27).



Adjust

Adaptive management doesn't happen without partners' commitment and ability to make changes based on what is learned during evaluation. Adjusting plans and actions requires responsiveness and flexibility from the partnership as a whole, individual partner organizations, and funders and regulators with a stake in the outcomes or with regulatory responsibilities.

Participants in this step need to consider the cost, benefits, and feasibility of recommended changes to restoration plans and actions and make final decisions about what should change. In addition to technical and cost considerations, these decisions may be influenced by legal and regulatory requirements, management priorities, funding priorities, and planning and implementation practicalities that may preclude rapid adjustments. In some cases, social and policy constraints may preclude adoption of a change that is recommended for ecological reasons, for example an air quality policy that restricts prescribed burning. If recommended changes are not made, it is important that the partnership communicate back to stakeholders involved in the evaluation step to help them understand what influenced their decisions and maintain working relationships and trust in the process.

Keeping written records of what was changed, and why, is important for ongoing learning and adaptation. Agreed-upon changes to planned restoration or monitoring activities, policies, or plans are recorded and communicated to the full partnership and relevant stakeholders, especially people with implementation responsibilities, funders and people directly impacted by decisions, such as elected officials, landowners, and land managers.



Dolores River, CO Photo by Jim White



CASE STUDY

Adaptive management on the Lower Dolores River³

From 2010 to 2012, stakeholders in the Lower Dolores River basin in southwestern Colorado came together to develop a management plan to provide sufficient habitat for three declining native fish species and habitat improvements for other plants and animals in the river corridor. Participants included representatives from local irrigation districts, county governments, state and federal water and land management agencies, conservation organizations, and boating groups working in the basin. The Lower Dolores Implementation, Monitoring, and Evaluation Plan was finalized in 2014 and is being implemented by water management organizations. The Dolores River Native Fish Monitoring and Recommendations Team (M&R Team) oversees ecological monitoring and makes management recommendations based on monitoring results.

One management adaptation came after monitoring data showed that managed reservoir releases were impeding native fish spawning. Traditionally, large releases for boaters begin in the early spring, typically peaking around Memorial Day weekend. Data showed that holding water in the reservoir and releasing only base flows until late spring was causing water below the dam to warm prematurely, so fish were spawning early. Then boating releases of over 1,000 cubic feet per second of cold water were thermally shocking fish eggs and newly hatched larvae and reducing their survival. Based on the group's evaluation of these data, the irrigation district began experimenting with early releases while scientists monitored water temperature and fish populations below the dam. Based on the monitoring data, they are working to refine the amount of early release that is needed to hold off spawning until large boating releases begin. The boating community, which is part of the M&R Team, now supports maintaining higher spring base flows even though the changes in release times and sizes can reduce the number of boating days. Boaters have come to support the ecological health of the river as an important contribution to the boating experience.

³ Preston 2019, Colorado Parks & Wildlife et al. 2018, American Whitewater et al. 2012.

Institutionalize adaptive management

Engaging in the adaptive management process, from planning through evaluation and adaptation, requires a sustained investment of resources, and particularly time, from all partnership members.

It may also require shifts in the way partners think about their work. In particular, adaptive management asks people to question established thinking and practices. By identifying adaptive management responsibilities and allocating staff time and budget lines to them, partnerships solidify their commitment to adaptive management, which then has a better chance of withstanding changes in leadership and staffing.



► *Foster a culture of learning:*

Underlying successful adaptive management is a willingness to question assumptions and generally accepted practices, consider alternative and novel actions, and engage in discussion and debate with people with different experiences, educational backgrounds, and values. At the partnership level, this means inviting more people, often with diverse perspectives, into a partnership's planning and decision space. At the individual level, it means developing the capacity to give and receive criticism. Ideally, people engaging in adaptive management have a tolerance for failures, recognizing that undesirable outcomes offer important feedback for learning and improving their work.

Partnerships can help foster a learning culture by encouraging frequent discussion and reflection both informally among team members and more formally at project team meetings. Activities that help develop this culture include scenario building and modeling exercises, where people describe their assumptions about how the system works and how restoration actions are expected to yield desired ecological outcomes. As these scenarios or models are revisited over time, groups develop a habit of talking openly about assumptions, comparing expectations to actual results, and working through differences to decide a course of action. The benefits of investing in a learning culture include building trust in the partnership and its projects and deepening working relationships, which in turn fosters more effective and rapid information exchange, learning, and adaptive change.

✦ **Added Investments:** *Partnerships can help foster a learning culture by investing in professional and peer learning networks that support ongoing information sharing, training, and critique with other restoration professionals (see page 28).*

► *Allocate and fund staff time:*

Adaptive management requires significant time commitments from partners in various roles. Important planning and review meetings are typically half-day to full-day events that are substantially more productive with participation from the full partnership and others with relevant knowledge or expertise. Partners also typically need to review information before and after meetings. In addition, time and expertise are needed to develop and implement monitoring plans, synthesize scientific information, and maintain communication among project partners and other stakeholders outside of scheduled meetings.

As noted above, successful adaptive management efforts often have a designated adaptive management champion tracking monitoring plan development and implementation and ongoing communication. This person is often responsible for engaging outside experts as well. For an effective adaptive management process, it is critical

CASE STUDY

Institutionalizing adaptive management in the Deschutes Partnership

With the launch of their Focused Investment Partnership restoration initiative, the Deschutes Partnership recognized a need for increased coordination of monitoring efforts across the geographic scope of their restoration initiative. The Crooked River Watershed Council, a member of the Deschutes Partnership, submitted a proposal to develop an integrated monitoring plan that would provide consistency in data collection across Deschutes Partnership organizations. The proposal included staff time for both the Crooked River Watershed Council and Upper Deschutes Watershed Council to participate in planning. Deschutes Partnership members updated and expanded their analysis of restoration actions and expected outcomes with a particular focus on an intermittent stream where the outcomes of restoration were expected to be different than those for other streams in the Partnership's geography.

The Deschutes Partnership Progress Monitoring Plan that resulted from this effort identifies monitoring indicators for each restoration strategy (e.g. stream habitat restoration, stream flow restoration), based on the theories of change developed through results chains, that can be consistently applied by Deschutes Partnership organizations and other restoration partners.⁴ Data for each indicator will provide a basis for evaluation of the outcomes of restoration actions and inform adaptive management of existing as well as future restoration projects.

⁴ *Deschutes Partnership 2018*

Harney Basin Wetlands Initiative Communication Plan

Recognizing the importance of maintaining effective communication between partnership members and external stakeholders, the Harney Basin Wetlands Initiative (coordinated by the High Desert Partnership) created a comprehensive strategic communication plan. The plan's purpose is to help the partnership successfully carry out its planned restoration actions, leverage funding, demonstrate its successes to a variety of audiences, enhance understanding and build trust among its stakeholders, and influence behavior and perceptions.

The plan identifies specific target audiences (members of the partnership and their constituents, local and regional communities, funders, scientific community, landowners, and others) and describes key messages tailored to each audience type. It also lists and suggests a variety of tools and techniques for successful delivery of information and messaging. The plan presents a logic model that articulates how communication activities address identified needs and how predicted long-term desired outcomes are linked to actions and outputs. Lead roles for each of the plan's actions are identified and associated objectives and measurable targets defined. The plan's implementation and ongoing management is led by a standing committee of partnership members. Finally, the plan outlines a 6-year budget to ensure that related activities are financially supported.

that partnerships allocate staff time to these activities. For sustained success, it is also important to recognize and incentivize the valuable contributions of staff in these key roles. By including these responsibilities in job descriptions and performance reviews, the partnership both attracts staff who have the interest, skills, and flexibility to thrive in an adaptive management process and provides incentives for staff to invest the time and energy needed to promote a culture of learning and engagement.



► **Budget for monitoring and adaptive management:**

In addition to the costs associated with staffing, communications, and regular participation in adaptive management meetings, monitoring can be a costly undertaking where the full benefits may not be realized for some years or decades. Building and maintaining the capacity to engage in adaptive management may require an adjustment in expectations for how funding is allocated for all aspects of the initiative, including project implementation and post-implementation monitoring, evaluation, and adaptive changes to actions or strategies.

Including resources in grant proposals for an adaptive management champion's time, and external contracted expertise if needed, is an approach to secure at least partial funding for the capacity to implement adaptive management. Cost-share or funding agreements with federal or state agencies, NGOs, tribes, or universities may be another way to resource technical work with a direct link to state and regional conservation priorities.

► **Maintain communication:**

Communication among members of the partnership is essential at all stages of the adaptive management cycle. Ideally, all partners are engaged in key steps of planning, evaluating, and adapting restoration activities. Realistically, however, it may not be possible to have all practitioners, landowners and managers, technical experts, and other key stakeholders at every important meeting. It may be necessary to solicit their input prior to meetings and keep everyone in the partnership updated by regularly communicating about monitoring and implementation work completed to date, evaluation results, and any adjustments made. A critical role of the adaptive management champion is to ensure communication is maintained through both formal (e.g. email or newsletter) and informal (e.g. individual visits and phone calls) channels. In addition, representatives from different partner organizations play an important role in keeping others within their organizations informed of project goals, progress, and adaptations.

Partnerships also increase their credibility and support for their work when they provide regular updates to external stakeholders, such as funders, technical reviewers, scientists, adjacent landowners, and others whose endorsement, expertise, or consent may help the initiative be successful. Regular communications keep people informed about lessons learned and the success of restoration actions, while highlighting opportunities to engage in learning or provide input. To avoid misunderstandings, it is important to let partners and other stakeholders know when and how they can receive adaptive management updates and give feedback, and how their input may or may not be used.

Some partnerships have a communications and outreach plan that identifies objectives for outreach, key audiences, the most effective ways to reach them, and a timeline for updates and outreach (*see sidebar example*).

Added Investments in Adaptive Management

Potential areas of added investments

Restoration activities take place in complex and dynamic biophysical and sociopolitical systems. Some restoration initiatives require a more ambitious approach to achieve their goals and a willingness by partners to take on more risk for the potential benefits they may yield. For example, restoration goals may necessitate that partnerships undertake initiatives that include expensive projects implemented at large scales or in complex landscapes. These situations are characterized by greater uncertainties and often require greater financial investment to be successful. Depending on the sociopolitical context – specifically the risk tolerance of decision-makers, key stakeholders and funders – these bolder approaches may only be possible and successful if they are implemented as part of an adaptive management process, and the decision points are clearly described.

*scope and scale
are especially
ambitious*

*ecological
and social
complexities
are high*

*risk tolerance
is low*

Factors to consider

The following factors can help partnerships decide what types of additional investments might be warranted. IF one or more of these scenarios exist, consider additional investments.

Scope and scale. When the scope and scale of a restoration initiative fits comfortably within the partnership's range of experience and selected interventions are generally accepted and well-tested, a modest investment in monitoring and periodic evaluation meetings, as described in Adaptive Management Fundamentals, can provide adequate feedback for meaningful improvements. However, when the scope and scale of an initiative stretches beyond the past experience of the partnership or its stakeholders, or the partnership is applying a novel approach or using less-tested techniques, uncertainty may be greater and projects can become more controversial and subject to increased scrutiny.

Ecological and social complexities. Choosing the level of investment in adaptive management also depends on the complexities and responsiveness of the ecological and social systems in which restoration activities are implemented. Some ecosystems respond quite predictably to treatments and can produce useful information in a few months or years, which can readily be applied to improving future restoration activities; in these cases, the process described in Adaptive Management Fundamentals may suffice. Other ecosystems may be slow to respond and/or responses can be masked by natural environmental variability which complicate monitoring and evaluation. Ecosystems characterized by interdependencies and non-linear dynamics, for example cycles of drought in rangeland systems and cycles of flooding and disturbance in riparian systems, are also much more challenging to monitor and evaluate because they do not follow linear assumptions about change over time. In these cases, many years may be needed to produce meaningful results and realize the expected benefits of adaptive management. Also, some partnerships may want to identify new and emerging threats or increase their understanding of how the ecosystem functions.

Risk tolerance and strength of evidence needed. The strength of evidence needed to justify restoration treatments depends greatly on the levels of uncertainty and risk associated with those decisions and the risk tolerance of partners and stakeholders. When the impacts of planned actions are reasonably predictable and well-understood, a much lower level of evidence is a more cost-effective way to promote learning. For example, a partnership may choose to do a post-implementation field trip to review outcomes and discuss the effectiveness of a restoration treatment. If, however, risk of failure is great, either in terms of return on investment or potential for unintended consequences, then partners and other stakeholders tend to push for more robust evidence.



Added investments to consider

Engage external stakeholders. Soliciting and addressing input from the broader public, particularly potential critics, allows a partnership to address concerns and can build trust in the partnership and support for the restoration initiative.

Prioritize restoration and monitoring options. Identifying underlying assumptions about restoration outcomes and engaging partners in prioritizing which key uncertainties to address through monitoring can help mitigate risk and increase confidence in proposed restoration projects.

Use appropriate experimental design. A higher level of rigor may be desired by practitioners, funders, and key stakeholders when attempting more ambitious restoration treatments with high levels of uncertainty. In these cases, monitoring should be designed using appropriate statistical design and data collection methods that support a high level of confidence in the results.

Design an information management system. Developing a shared database for coordinated information management, including a formalized data sharing agreement, allows partners to collect comparable data, more seamlessly integrate consistent data collection into their workflow, and dependably follow through on agreed-upon protocols for data sharing, evaluation, and reporting.

Partner with researchers. When researchers and monitoring experts are engaged as partners instead of simply consultants or contractors, they participate in framing issues and interpreting results relative to the steps in the adaptive management cycle, which deepens learning opportunities for the full partnership.

Clarify roles and decision-making procedures. As they work through the adaptive management process, partnerships will likely need to address implicit assumptions and questions about established procedures. Doing so can help to build accountability and trust in the process and make it more efficient.

Provide ongoing learning opportunities. Adaptive management flourishes in a culture that supports ongoing learning, informal reflection, and discussion. Training and peer-to-peer exchanges on topics from restoration techniques and monitoring protocols to science communication and periodically reviewing new and emerging science can lead to further innovation.

Engage external stakeholders

Committing to regularly communicating with external stakeholders about the restoration initiative and adaptive management process is an additional investment that can increase trust in the process and the credibility of decisions made. This is particularly important in situations where restoration activities are controversial and viewed skeptically or even opposed by some stakeholders. For complex or controversial projects, progress toward restoration goals may stall out or encounter gridlock without this next level of investment.

When partnerships understand the interests of external stakeholders, they are better able to speak to common interests and engage them in the adaptive management process when appropriate. External stakeholders can present roadblocks to adaptive management when they lack confidence in either proposed restoration actions or the restoration partnership itself. Stakeholder risk aversion may be due to past experiences with restoration treatments or a history of conflict with some of the parties involved in the restoration initiative. Directly engaging potential critics during project planning - and particularly monitoring plan design - allows the partnership to address their concerns before implementation and potentially avoid delays later on. Maintaining regular communication with external stakeholders as work progresses and monitoring results become available can further build trust in and support for the initiative.

Hosting forums for dialogue, such as listening sessions, interactive workshops, or town hall meetings, before project designs have even been started can build relationships and transform seemingly intractable conflicts. Some external stakeholders may have expertise, knowledge, or influence that warrant including them in adaptive management planning and evaluation discussions such as prioritizing restoration and monitoring options, discussed below.

When engaging external stakeholders, it is important to manage expectations about the timing and extent of information sharing, including how and when stakeholder input and feedback will be addressed by the partnership. In some cases, concerns about planned restoration actions may be due to value differences or misinformation that will not lead to changes in planning or monitoring. Depending on the level of stakeholder concerns, the partnership may want to provide an explanation as to why it is not using some input in decision-making.



Prioritize restoration and monitoring options

Restoration practitioners can be very confident in their understanding of the status and function of ecosystems and the probability their selected restoration strategies will produce desired outcomes. However, some partners or external stakeholders may not share the same certainty about ecosystem dynamics, limiting factors, or the effectiveness of restoration actions. It may be unclear how best to proceed without a clear process for identifying and prioritizing restoration options and uncertainties. Engaging partners in a prioritization process can help build a common foundation for collective planning.

Involving decision-makers, restoration practitioners, land managers, and scientists will allow the group to develop the most complete list (and understanding) of options and identify priorities that reflect the interests and values of the partnership as a whole. Recruiting policy experts and other affected stakeholders will allow prioritization to be grounded in what is feasible and desirable within the larger socio-political and legal context. With this foundation, partnerships are more likely to secure commitment for priority restoration actions and monitoring.

Monitoring plan development is often delegated to a subset of monitoring specialists. However, additional investment to engage a breadth of partners in prioritization can help all participants better understand and communicate the connectivity between the uncertainties prioritized, monitoring data, relevant restoration decision points, and the partnership's readiness to act on learning. Further, without this broader engagement, decision-makers may find that they don't have the data to justify the types of changes they would like to make.

► **Identify options:**

Before starting a prioritization process, the partnership identifies a range of potential restoration options and relative uncertainties about predicted outcomes. For monitoring, it can be helpful to articulate these uncertainties as questions or competing hypotheses.

The OWEB Strategic Action Planning Guidance, section 8, describes a Theory of Change process that partnerships can use to graphically depict underlying assumptions about the expected results of planned restoration actions.

Some partnerships may choose to engage technical experts and use models to explore possible outcomes using different assumptions about system dynamics and environmental variation. As relevant, in addition to ecological uncertainties, groups may consider uncertainties related to social, economic, and operational factors that might affect restoration outcomes.

Develop prioritization criteria:

Developing prioritization criteria is an explicit step that helps partners articulate their interests, values, and ultimately decisions about which options to fund and implement. Therefore, it is important to include people with a range of backgrounds and perspectives, as different criteria will likely be important to different partners. Criteria for prioritizing restoration options and monitoring questions will vary depending on a partnership's geographic, political, social, and ecological context and should be re-evaluated periodically as these may shift over time with the evolution of the partnership. Examples of criteria that may be used to compare restoration options include the level of confidence that the action will achieve a desired outcome, implementation cost, and adaptability (i.e., the extent of the legal, social, and operational flexibility to make changes if something is not working).

Commonly used criteria for prioritizing monitoring questions include:

- **Relevance:** the uncertainty is closely linked to selected strategies and restoration priorities
- **Feasibility:** the uncertainty can be reduced through monitoring using reliable and affordable methods
- **Usefulness:** reducing this uncertainty would inform the design of future restoration plans and activities
- **Level of controversy:** addressing this uncertainty would reduce conflict or build support for the restoration initiative
- **Transferability:** reducing this uncertainty could inform restoration efforts in other places or could be scaled up to a larger landscape

Ultimately, determining which uncertainties should be addressed through monitoring or other information gathering may come down to a “need to know” versus “nice to know” distinction. A “need to know” uncertainty is one that directly informs choices between different restoration treatments.

► **Rank options:**

Once the partnership has selected appropriate criteria, it can use them to rank restoration options or monitoring questions (see example below). Partnerships may choose to develop a matrix to compare how well different options satisfy each criterion and discuss tradeoffs among different criteria. At this step, transparency and broad participation are important. It is less important whether criteria are evaluated qualitatively or quantitatively.

Prioritizing uncertainties to engage stakeholders and focus monitoring resources⁵

The Washington Department of Natural Resources used the following process to identify and prioritize uncertainties for monitoring on the Olympic Experimental State Forest.

The agency convened an Adaptive Management Advisory Group, made up of resource managers and scientists, to identify uncertainties related to the condition, function, and management of the experimental forest. As part of a larger forest planning effort, the group identified a comprehensive list of uncertainties that ranged from broad to specific, for example from the effectiveness of riparian buffers to provide riparian functions to the rate of tree regeneration in small forest openings with high edge density.

Based on input from the advisory group and external science advisors, agency staff developed one-page briefing papers describing a proposed study to address each uncertainty. Each briefing paper described the uncertainty, the study questions that could address it, its relevance to management decisions, the expected time needed to reduce the uncertainty, a budget estimate for the data collection needed, possible impacts of the study on management operations, and acres affected by the uncertainty being addressed. These summaries were distributed to participants in the prioritization process for their review prior to the prioritization meeting.

⁵ Example drawn from Minkova and Arnold, 2019, and Minkova 2018.

Participants in the prioritization process included agency decision-makers as well as scientists and managers. Each participant was given a prioritization sheet so they could individually rank the study projects using the following criteria:

- **Linkage to future decisions** (*the extent to which information produced by the study is likely to influence management decisions*)
- **Level of impact to agency revenue and conservation objectives**
- **The degree of uncertainty** (*nature and degree of the knowledge gap*)
- **Feasibility of getting answers in a reasonable time and at a reasonable cost**
- **Potential for research partnerships** (*to help design and conduct the study*)

The group discussed each proposed study project and participants then assigned ranked them in order of priority. The individual prioritizations were then averaged and projects were ranked in the order of the averages. The top five study projects were presented to agency decision-makers who adopted and funded them as priority monitoring and research questions. Notably, resources were committed and research relationships were developed to leverage those investments. Decision-makers took ownership of these projects as the focus for adaptive management and were so satisfied with the prioritization process that they applied it across their research programs in other parts of the state.

Use appropriate experimental design

In most adaptive management efforts, a single restoration treatment is applied, with learning occurring from monitoring the near-term outputs and intermediate ecological outcomes of the treatment. Quantitative data collection and analysis is commonly used to measure restoration outputs and outcomes. However, other approaches may be complementary and more credible with specific audiences, such as experiential learning based on qualitative observations. Some partnerships find approaches such as pre- and post-treatment field trips and photo points adequate to provide feedback for adaptive management.

In situations where restoration activities aim for more ambitious goals, for example where partnerships are willing to take on greater risk or make greater investments because of the potential for greater reward, a higher level of rigor in monitoring and study design may be needed to justify investments or mitigate for uncertainties. On federal or state lands, for example, external stakeholders may advocate for a higher level of evidence, such as environmental advocates in the context of environmental review. On private lands, landowners may require “proof of concept” before they are willing to implement practices on their property. Conversely, if practitioners and stakeholders are comfortable with a commonly used restoration approach, more robust evidence may be needed to effectively make the case that trying an alternative is warranted.

In complex socio-ecological systems, it can be daunting to develop an experimental study design that attempts to distinguish clearly between localized effects of restoration treatments, effects of other activities and land uses, landscape-scale variability, and environmental stochasticity. However, in situations where a very high level of rigor is desired or where there is no single preferred treatment, alternative treatments and controls may be used to test competing hypotheses and attempt to determine cause-and-effect relationships between actions and outcomes.

To achieve a high level of rigor, attention must be paid to framing alternative hypotheses, establishing a sampling approach with adequate controls and replication to capture the full extent of variability relevant to competing hypotheses, using data collection protocols that can be reliably implemented for a desired level of accuracy and precision, and collecting data before and after treatments over a time period needed to detect change.

Friends of the Teton River, ID Photo by Robert Warren



Ideally, the statistical analysis approach is determined during the design phase, and if appropriate, a statistical power analysis can be completed to determine the sample size needed to determine statistical significance. Involving researchers, monitoring specialists and/or statisticians early in the development of the treatment design and study plan is key to increasing the likelihood that the methods used will yield results that are meaningful in the adaptive management process, are credible to partners and stakeholders, and can be used to enhance the effectiveness of restoration actions. For an example of highly rigorous experimental design, see *Asotin Creek Intensively Monitored Watershed: Updated Study Plan*.⁶

The cost and complexity of implementing an experimental study design increases significantly depending on the spatial extent of the treatments, the extent of interdependencies in the system and the time needed to detect change in the system. For systems that are more responsive to treatments, such as ecological forest thinning or flow restoration in aquatic systems, a cost-effective experimental study design with treatments and controls may be more feasible than in more complex systems that take decades to respond, such as restoring stream channel habitat quantity and complexity to support salmon recovery.

⁶ Bennett et al. 2015.

Design an information management system

Investing in development of a shared database or other information management system can increase the utility of monitoring data and make it easily accessible to practitioners and managers and to other interested parties. Developing a shared database helps ensure data are reported in ways that permit aggregation and analysis. Databases can be particularly useful in more complex restoration and management contexts where multiple entities contribute data, analyze it, or extract it for reporting purposes.

In these situations, it is especially important to agree on the structure of a shared database so that all partners can access the data relevant to their needs, while respecting access limitations for how sensitive data will be shared and who will have access to it. For example, sensitive data may include locations of listed species, cultural resource data for tribes, or personally identifiable information for landowners. A Memorandum of Understanding (MOU) can be a valuable tool to clearly document guidelines for data use and sharing, which is often an important step in building the trust necessary for commitment to a larger adaptive management process.

Development of a shared database likely requires funding for a database specialist to conduct a needs assessment, to gather input from partner organizations and potentially other stakeholders about data formats and potential concerns about sensitive data. Establishment of clear guidelines for data use and sharing requires an investment of time for partners to discuss needs and priorities within their organization and come to agreement as a partnership. Additionally, it is important for partners to remain engaged with database design throughout the design process to ensure the resulting product meets the data and data sharing needs of partners. This is particularly true when data will be used in broader regional or regulatory contexts.



CASE STUDY

A data management needs assessment

The Oregon All Counties Candidate Conservation Agreement with Assurances Steering Committee

is an OWEB Focused Investment Partnership focused on sage-grouse recovery composed of Soil and Water Conservation Districts from three Oregon counties, the US Fish and Wildlife Service, the Natural Resources Conservation Service, and the Oregon Department of Fish and Wildlife. This partnership commissioned a data management needs assessment shortly after entering the Focused Investment Partnership program.

Their goal was to create an integrated data management and reporting system that would:

- 1 enhance communication** between partners,
- 2 help coordinate** sage grouse habitat improvement efforts across a very large landscape,
- 3 improve the efficiency and cost effectiveness** of Site Specific Plan development and reporting, and
- 4 ensure the partners maintain compliance** with the Candidate Conservation Agreement with Assurances agreements.

Collected data will allow the partnership and agencies to describe baseline conditions, track ecological changes resulting from actions, and prescribe future treatment or management changes in a consistent way across the full recovery geography. The development of this database is underway with funding from OWEB and will be fully operational by the end of 2021.



Partner with researchers

Recruiting a team of researchers or monitoring specialists can boost the ability of partnerships to address more complex uncertainties and provide more robust evidence to justify continued investment in or adjustment to restoration activities. As consultants or contractors, these experts can help develop appropriate study designs and implement appropriate data collection methods. There is a risk, however, that contracted experts may develop a research plan that extends beyond, or even diverges from, the monitoring needs defined by the partnership. When researchers and monitoring specialists are engaged as partners instead of simply consultants or contractors, they participate in framing issues and interpreting results relative to the steps in the adaptive management cycle, which deepens learning opportunities for the full partnership.

Research partners may include people from academia, agencies, tribes, consulting firms, or other groups working in similar ecological systems and using similar restoration approaches. The “right people” will be those who have the necessary expertise in study design, monitoring, and the ecology of the system and, also importantly, want to serve the needs of the partnership. The role experts play can range from advisor to assuming full responsibility of designing and implementing research or monitoring projects and analyzing data. Researchers must understand and be motivated by working within an applied adaptive management context where their work would feed into decision-making. Care must be taken to identify research partners who are genuinely interested in the partnership’s high priority monitoring or research questions.

It is important to set clear expectations for roles, work products, and timelines and to maintain open channels of communication so that any complications or changes can be addressed proactively by the partnership. The adaptive management champion often plays a key role in recruiting research partners, setting clear expectations, maintaining communication, and connecting their work to the larger partnership, especially as challenges emerge and study plans are adjusted and fine-tuned. The champion may also help interpret the work of research partners for communication with the broader partnership, including non-technical partners.

In some cases, when interests genuinely align, research partners may be able to leverage funds, for example through cost-sharing agreements with research institutions, agencies or tribes, to address the partnership’s top priorities for monitoring and research.

Clarify roles and decision-making procedures

Partnerships typically have governance documents describing partner roles and decision-making procedures. However, as they adopt a culture of ongoing learning and adjustment, and particularly as external stakeholders and technical experts become involved, partnerships can expect questions about and suggested changes to established procedures. When that happens, it is helpful to examine assumptions and revisit operational documents to ensure that communication channels and decision-making processes are clear to all parties.

Ideally, roles of partners and other adaptive management participants are described in written documents. Technical advisors, scientists, and other stakeholders who engage in aspects of the adaptive management process should know who has ultimate decision-making authority over different project planning and adjustment decisions, and how their input will be used to inform those decisions. Similarly, the roles and responsibilities of scientists and other stakeholders should be clear to everyone, including how these differ from partner roles and responsibilities.

As a partnership advances through the adaptive management process, it is likely that unspoken assumptions about roles and responsibilities will emerge. For example, there may be an expectation that certain partners will maintain communication with their constituencies, keeping them informed of the objectives of the restoration initiative and changes that are made and bringing stakeholder concerns back to the partnership to be addressed. Or partners may have an expectation that project implementation will be adjusted if empirical data show target outputs or outcomes are not being met, but exactly what adjustments should be made, and at what point, may not have been explicitly discussed. Ideally, partners will identify and address such questions when they arise.

Over time, partnerships may find it useful to more explicitly define communication and feedback procedures. For example, some partnerships have adaptive management working groups or other advisory committees with external stakeholders who make formal recommendations regarding things like partnership goals and objectives, monitoring priorities, and proposed adjustments to plans or practices. In turn, partnership members with decision-making authority may report back to an advisory group



to communicate which recommendations were adopted, which were not, and why or why not. Formalizing these communications can foster ongoing learning among all participants and reduce the potential for confusion and conflict.

Keeping a record of decisions, including the rationales for making them, also can be very useful for future reference, ongoing learning, and adaptation. Transparency, in terms of communicating what types of decisions will be made, at what points along the adaptive management cycle, and what information and data will inform decision-making, is important to maintaining trust in the partnership and the process.

Peer learning in the Fire Learning Network⁷

The U.S. Fire Learning Network (FLN) was created in 2002 by an agreement between The Nature Conservancy, the U.S. Forest Service, and the U.S. Department of the Interior to promote the restoration of fire-adapted ecosystems. FLN does this by supporting public-private landscape partnerships in fire restoration planning, monitoring, training, community engagement, and media outreach efforts. The local landscape partnerships are made up of resource management professionals with fire restoration experience and land management responsibilities who work together across multiple jurisdictions and organizations to plan and implement restoration strategies. In 2019, FLN included 31 landscape partnerships, including hundreds of participating organizations, active in 20 states.

The landscape partnerships are organized into eight regional networks that host biannual workshops where participants exchange information, learn new restoration techniques, and give and receive feedback on their individual plans and practices. For example, in the early years of the FLN, regional networks organized planning sessions as part of their biannual workshops, where each partnership presented on a specific aspect of their ecological fire restoration plan. After the presentations, participants engaged in a review process that included questions, critique, and brainstorming to resolve challenges and address inconsistencies. FLN participants also attend hands-on prescribed fire training exchanges and other cooperative burning efforts and offer field tours and workshops to local community members and practitioners from other landscapes.

In addition to these in-person peer learning opportunities, FLN maintains a website with extensive publications, including local and regional FLN newsletters and reports, tools, webinars, and field guides. Evaluations of the FLN have documented extensive on-the-ground restoration work completed by the landscape partnerships, funding leveraged through FLN participation, expanded capacity for cross-jurisdictional and multi-organizational planning and project implementation, improved restoration planning, and much restoration learning and innovation.

Support ongoing learning

In addition to developing an internal learning culture, partnerships can tap into external networks and meetings focused on peer learning, where participants discuss plans and practices being used in different situations. For example, the U.S. Fire Learning Network uses regional and national workshops, mentoring, and trainings to help people working in fire-dependent landscapes share different restoration approaches, cross-pollinate ideas, and bring local knowledge to larger scales (*see sidebar*). River Restoration Northwest offers an interdisciplinary forum for professionals engaged in restoring aquatic ecosystems and hosts an annual symposium that includes short courses, field trips, and conference presentations covering a wide breadth of relevant topics. Providing access to training and mentoring opportunities on topics from experimental design and monitoring protocols to science communication and facilitation helps partners build skills for adaptive management and better contribute to partnership learning.

Sharing results externally can also contribute valuable knowledge about restoration approaches and outcomes and elevate the work of the partnership. Sharing results through professional networks and/or peer-reviewed publications can infuse new ideas and innovation from outside the partnership and also give partnership members access to new and emerging science and management innovations that may be applicable to their work. Encouraging staff to present or publish their results can provide individual incentives in terms of an expanding professional network and professional accolades, which can motivate staff to invest the time and energy needed to strive for excellence in the context of adaptive management.

Methow Beaver Project, WA Photo by Robert Warren



⁷ Goldstein, Butler, and Hull 2010, The Nature Conservancy 2019.



Conclusion

Adaptive management can improve restoration initiatives by reducing uncertainty about the effects of restoration actions and focusing work on practices that are shown to be more efficient or effective at achieving desired outcomes. In doing so, partnerships help increase confidence in and support for restoration initiatives and build the restoration knowledge base.

To achieve these benefits, however, restoration partnerships must be willing to invest time and money to engage participants in program and project planning, record-keeping during implementation, regular project and program evaluations, and adjustments to plans and practices. One key to successful adaptive management is to **identify and fund an adaptive management champion** to lead the effort. Another is to **foster a learning culture** that acknowledges the uncertainties inherent in restoration science and practice and supports open communication and flexibility.

In situations where proposed restoration interventions have not been well-tested or are unusually large or controversial, or the systems being restored are not well understood, additional investments of time and money may be needed to realize the benefits of adaptive management. These added investments may include additional stakeholder engagement, an in-depth assessment of restoration options and uncertainties, more rigorous experimental design and data management, or revisions to partnership procedures. In all cases, but particularly when a restoration initiative is experimental or unusually ambitious, partnerships and restoration science will benefit from added investment in peer learning with people doing similar work in different landscapes.



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