



Process-based Riverscape Restoration Education and Training Needs Assessment

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Table of Contents

BACKGROUND AND CONTEXT.....	2
DEFINING THE AUDIENCES.....	2
WHAT TRAININGS AND EDUCATION OPPORTUNITIES ALREADY EXIST?	4
WHAT TOPICS SHOULD BE INCLUDED?.....	5
UNDERSTANDING RIVERSCAPE SYSTEMS AND PROCESSES	6
PROJECT DESIGN AND IMPLEMENTATION	7
MANAGING PROJECTS AND PEOPLE.....	8
EDUCATION/TRAINING OPPORTUNITIES AND WORKFORCE NEEDS	9
PROJECT DESIGN WORKFORCE NEEDS	10
AGENCY PBR TRAINING NEEDS	11
TRIBAL PROGRAMS AND ADDITIONAL NEEDS	13
FIELD CREW WORKFORCE NEEDS	13
RECOMMENDATIONS	16
FRAMEWORK FOR TRAINING AND EDUCATION NEEDS	16
SPECIFIC RECOMMENDATIONS	17
APPENDIX A: CURRENT TRAININGS	18
APPENDIX B: INTERVIEW QUESTIONS.....	26
APPENDIX C: ORGANIZATIONS INTERVIEWED	27

Background and Context

In May 2024, Meridian Institute (Meridian) facilitated a meeting to explore opportunities to advance nature-based solutions on public lands with support from the Walton Family Foundation. The convening brought together more than 30 public agencies, nonprofits, scientists, consultants, and others working to increase the pace and scale of riverscape restoration on public lands in the Colorado River Basin. As an outcome of that convening, participants developed an action plan focused on enhancing workforce development and training to expand the capacity needed to do restoration projects. Participants also expressed a need to better understand the current suite of process-based restoration (PBR) education and trainings available.

This document summarizes the findings of an assessment of the education and training¹ needs conducted by Meridian through a combination of desk research and informational interviews. The Meridian team conducted a total of 23 interviews with 34 individuals from federal agencies, nonprofit organizations, private consultants, and universities. Below we summarize the audiences that require training, compile information on existing training resources and programs, and identify the greatest gaps that exist in delivering the skills and knowledge needed by PBR practitioners. Finally, we also present recommendations to strategically address these training needs with the broader goal of advancing the pace, scale, and effectiveness of PBR on public lands in the West. The focus of this work is primarily on public lands in the West due to the significant restoration potential of public lands in the West, as well as the recent increase in funding from the Bipartisan Infrastructure (BIL) and Inflation Reduction Act (IRA). However, many of these PBR insights and recommendations could, with additional contextual considerations, be effective on private and tribal lands as well.

While conducting this assessment, several people spoke to the importance of education and training on PBR. They mentioned that there is currently increased attention and support for PBR and characterized this as a “golden moment,” emphasizing the importance of ensuring that projects are done well, in the right locations, and using the right approaches to demonstrate the effectiveness of this approach and build the case for ongoing support. There are a limited number of experienced practitioners who feel overwhelmed trying to meet the current demands for project quality control. Furthermore, the field of PBR itself is relatively new – it is appropriate that opportunities for education and training in this emerging discipline and restoration practice mature alongside it. These reflections underscore the timeliness of this assessment and the compelling need to develop, amplify, and deliver trainings that bring the knowledge required to the folks who are conducting, approving, and funding this work.

Defining the Audiences

There are a variety of agencies and organizations involved in implementing process-based restoration on federal lands, each serving a particular role throughout the project lifecycle. Depending on their relationship to and scope of involvement in the project, each of these entities may require custom education and training. This table categorizes these audience types as Meridian came to understand

¹ We use the terms education and training throughout this document. Education generally refers to more in-depth exploration of the concepts and the foundational science. Training implies a narrower focus on skills building or one-off education opportunities. We heard that both are important to successful PBR.

them through this assessment, listing specific audience member types as well as the general role they play in getting PBR projects on the ground. We reference these audience categories throughout the interview summary.

AUDIENCE	SPECIFIC AUDIENCE MEMBERS	ROLE IN PBR PROJECTS
Project Owners and Managers²	<ul style="list-style-type: none"> - Federal agency staff, including local decision-makers (e.g., BLM Field Managers, USFS District Rangers) - State fish and wildlife and parks management agencies - Non-government organization (NGO) staff - Watershed groups - Consultants 	Directly or indirectly responsible for initiating, implementing and managing projects. This can include oversight of project implementation, watershed planning to identify specific project sites, as well as receiving and dispensing project funds. Also includes decision-makers who have sign off authority.
Project Designers²	<ul style="list-style-type: none"> - Consultants - Internal agency technical staff 	Responsible for the restoration project design based on a multidisciplinary understanding of geomorphology, hydrology, and biology.
Field Crews	<ul style="list-style-type: none"> - Conservation Corps - Job Corps - Seasonal/temporary staff working for project design consultants - Contractors within restoration and adjacent industries - Volunteers 	Perform the on-the-ground labor for building projects. Sometimes unskilled or low-tech, other times involving skilled heavy machinery or equipment operation.
Regulators	<ul style="list-style-type: none"> - US Army Corps of Engineers - State Water Rights Commissioners - Dam and Ditch Operators - Higher-level decision-makers within USFS & BLM 	Review and permit projects for compliance with National Environmental Policy Act (NEPA), Clean Water Act (CWA), and water rights.
Funders	<ul style="list-style-type: none"> - Grant application reviewers within federal agencies and for other public land project funders - State agencies and water boards - Private foundations 	Decide whether to award funding to support projects. Recent public lands projects are primarily funded through IRA and BIL.

² There are a range of professionals who play a role in the initiation, design, oversight, and implementation of projects. For the purposes of this report, we are conceptualizing them into two categories: project owners and managers; and project designers. These two roles can be distinct and at times require different skills and knowledge. Generally, project owners and managers hold the bigger picture vision for a project and are responsible for making it happen while project designers are more technical experts. However, in practice, the roles often overlap.

What trainings and education opportunities already exist?

Through a combination of interviews and desktop research, Meridian collected information on the suite of PBR-focused educational and training programs currently offered and under development. The full list of current trainings is included in Appendix A.

Trainings were identified that supported the variety of skills and knowledge needed throughout all stages of the project lifecycle, including design, planning, permitting, implementation, monitoring, and stewardship. Our findings suggest that a breadth of trainings exist, each varying by topic, depth, and format based on the audience the training is meant to serve. The primary audience existing trainings currently serve are project owners, managers and designers; there are fewer opportunities tailored to field crews, decision-makers, and funders (this gap is discussed more in the following sections).

Generally, current trainings fall into three categories: long courses and training series; short courses and workshops; and conference sessions and add-ons.

1. Long courses and training series

This category includes in-depth courses and training series delivered by a university, federal agency, or a private organization over an extended period (anywhere from six weeks to two years). They are generally more comprehensive in both the breadth and depth of topics covered and are targeted to individuals whose primary occupation is or will be process-based riverscape restoration. Curricula includes a mix of classroom and field learning, cost thousands of dollars, and often come with a professional certificate. The audience for these trainings are generally project designers as well as project owners. Those courses affiliated with universities and federal agencies are of particular note:

- **University-affiliated courses.** This assessment uncovered two university-affiliated courses for riverscape restoration currently available in the United States. These include [Portland State University's River Restoration Professional Certificate Program](#) and [Utah State University's Graduate Certificate in Aquatic Ecosystem Restoration](#). While both programs are intended for matriculated graduate students, they are either available to or have variations that are adapted for professionals as well. The [University of Georgia's Institute for Resilient Infrastructure Systems \(IRIS\)](#) is currently developing a certificate program, though this will be focused more broadly on natural infrastructure and engineering solutions in both the Colorado and Mississippi River Basins.
- **Agency internal trainings.** With the rise in federal funding and support for nature-based solutions within the Departments of Agriculture and Interior, federal agency staff are developing approaches to not only increase the pace of PBR on lands they manage, but to develop programs to train their staff in how to successfully conduct these approaches as well. The Bureau of Land Management (BLM), for example, has worked with Utah State University and the Natural Resources Conservation Service (NRCS) to develop interagency training for staff. This [Federal Training Series](#) is offered online over one semester, aligns with both BLM's and NRCS's own training

center standards, and is accessible to anyone who is interested (i.e., not exclusively federal employees). This represents the most advanced and successful example of an agency training included in this assessment. The US Forest Service (USFS) does not currently have a similar training program, however staff interviewed for this assessment are developing an internal PBR-focused training to be piloted at the regional level in 2025.

2. Short courses and workshops

These trainings include courses and workshops that are shorter in duration, generally from two to five days in length. They can be hosted by universities, federal agencies, nonprofits, private contractors, or a combination of the above. Generally, these courses do not offer the depth of knowledge and training required to leave participants fully equipped to lead PBR projects. Interviewees appreciate when this format includes both classroom and field experience and felt it greatly expanded the learning and impact of these shorter trainings. The “learning by doing” component in the field was repeatedly noted as beneficial by many interviewees. To be most effective, it should be paired with several days of conceptual learning beforehand. A few examples include site-specific, in-person workshops (often in partnership with a local watershed group or conservation district); the [Process-based Stream Restoration Workshop](#) hosted by Colorado Healthy Headwaters Working Group in June 2024; and the [CalPBR Build Like A Beaver Workshops](#).

3. Conference sessions and add-ons

The final category of trainings encompasses those offered through sessions and add-on field trips at conferences related to river restoration, watershed management, beaver habitat restoration, and other adjacent topics. These are generally no more than a few hours in length and serve as high-level introductions to the priorities, components, and benefits of PBR.

Appendix A contains a full list of training programs compiled by Meridian staff and interviewees, including program descriptions, topics covered, priority audiences, formats, and links with additional information. Note that the list is not intended to be comprehensive of all PBR-focused trainings and is likely missing some activities such as specific workshops. It also reflects a specific point in time—it is possible that the PBR classes offered in the future might differ in geography, audience, or content than those identified in 2024 through this assessment.

What topics should be included?

This section summarizes the prevailing topics that interviewees saw valuable to understanding and implementing PBR. These might represent a gap in the existing curriculum or be a reflection on the priority topics, skills, and context that the interviewees felt were important for effective riverscape restoration. Within each topic, we note which audiences would benefit most from increased learning in this area (as identified by both themselves and others), and ideas for how such learning could be more effectively delivered. While some audiences will require more in-depth training (most often project owners, managers and designers, but also in some cases field crews), others may require only an introduction to or basic understanding of the topic (including decision-makers, regulators, and funders).

UNDERSTANDING RIVERSCAPE SYSTEMS AND PROCESSES

One of the greatest needs expressed by interviewees was for a more comprehensive understanding of what healthy riverscapes look like and how they function. Interviewees spoke about needing to move beyond the idea that healthy riverscapes can be restored through form-based designs, a paradigm that has dominated the restoration industry for decades. Instead of trying to “create and control the system,” interviewees suggest embracing approaches that work towards restoring natural riverscape functions and processes, enabling “the system to do the work.” This broader understanding of riverscape health requires taking into consideration the multiple processes influencing river system function, including physical, chemical, and biological. As one interviewee plainly stated, “you cannot manage or restore what you don’t understand.”

Multiple interviewees also expressed concern that the current practitioner community is running the risk of too narrowly defining PBR by specific restoration methods and tools rather than being informed by a more holistic understanding of what key riverscape processes and functions need to be restored (if any at all). While low-tech process-based restoration (LTPBR) and tools such as beaver dam analogues (BDAs) and post-assisted log structures (PALS) are popular, identifying when and where their use is appropriate requires a comprehensive understanding of riverscape function. Without this knowledge, projects may be implemented that are not well-suited for a specific site and do not result in the intended outcomes, ultimately posing a reputational risk to the field.

While all of the audiences involved in implementing PBR on public lands would benefit from a greater understanding of this topic, it is especially important for those involved in project design and management. Additional specific needs and training format by audience type include:

- **Project Designers.** Interviewees emphasized that knowledge required to effectively design PBR projects takes time to acquire, often requiring an advanced degree or extensive field experience. There was a concern that some practitioners would participate in a week-long training and be overly confident in their ability to design PBR projects. Project designers require longer, more in-depth training on this topic.
- **Project Owners and Managers.** Project owners and managers would benefit from a multi-day training to gain an understanding of how riverscapes function and some initial ideas about how to conduct PBR in a variety of ecosystems.
- **Field Crews.** While field crew staff do not require the same depth of education project designers do, interviewees did emphasize the need for these individuals to have a basic understanding of riverscape principles and processes. In some cases, field crew leaders will need to be able to adapt designs and make site-specific adjustments in response to local conditions and context. Ideally this is done in coordination with a project designer, but some training can be helpful to make sure the field crew leaders know when to raise concerns or seek additional guidance. Trainings to adequately convey this knowledge may be targeted at field crew leaders and should be multiple days (e.g., a 3-day workshop that involves both classroom and field components) and/or iterative (e.g., experiential learning by participating in multiple projects over time). Field crew members would be well served by a half day training, especially if it includes a field component. This is especially true for crews or contractors who might be doing many PBR projects over a field season.

- **Funders, Regulators, and Senior Level Agency Decision-makers.** Interviewees emphasized that the decision-makers involved in funding and signing off on projects would benefit from a fundamental understanding of riverscape systems and processes. Some spoke to seeing approval of PBR projects stalled because those in the position to approve projects do not feel like they have enough knowledge to evaluate a proposal. This also could include understanding the difference between form-based and process-based approaches and understanding why in some cases a process-based project may be better suited to achieving certain restoration goals. Training for these audiences could be offered virtually or as a full-day workshop and include more fundamental content that relays the what, why, and how of PBR. In addition to potential virtual training opportunities, some interviewees felt strongly that a “walking and talking” approach to educating these audiences in the field is preferred when the option exists to do so. The ability to ask questions of one another, exchange ideas, and build common understanding in the context of specific projects is deemed valuable and supports more inclusivity and relationship-building that can pay dividends in the long run (i.e., result in less litigation, faster permit approval, or more funding).

PROJECT DESIGN AND IMPLEMENTATION

There were a number of topics specific to project design and implementation that interviewees emphasized were particularly important to include in education and training efforts. In some cases this is knowledge held by one group (e.g., project designers) that would be beneficial to cover with others (e.g., project owners and managers).

CONDUCTING SITE ASSESSMENT AND SELECTION

Many of the project owners and managers we interviewed expressed an interest in better understanding how to conduct a site assessment and select appropriate areas for restoration projects. This came up in several conversations with agency staff who are project owners. This assessment would ideally include looking at historic conditions and root causes that are contributing to degradation, doing an analysis of the current conditions, and evaluating a system’s future potential. Education in this area could help project designers learn to assess – not assume -- for example, whether BDAs are appropriate or whether an area will be able to support beaver re-establishment. Furthermore, some interviewees said they saw poor site selection as being one of the most significant contributors to project failure, underscoring the need for more robust training in this area.

Interviewees identified two specific areas related to site assessment and selection that could be improved:

- **Using and applying modeling tools.** Both agencies and nonprofits expressed an interest in knowing how to utilize landscape prioritization tools to identify high-value restoration sites. Forest Service staff in particular expressed interest in more training on the appropriate use and application of the variety of site selection tools, data, and imagery that are available (e.g., BRAT, LiDAR, Geomorphic Grade Line, REM, etc.). How to use these tools to determine the extent of historical floodplains and wetlands is also of interest. The Riverscape Consortium includes an [overview of tools](#), but training is needed to support their appropriate use.

- **Reading the riverscape.** Some project designers – usually those with more experience – also spoke about the importance of “reading the riverscape” as part of the site assessment process. A visual assessment is critical to use in combination with data-informed models to identify an appropriate restoration approach that matches the system (and, in some cases, whether or not PBR is the correct approach entirely). While this visual site assessment has been described by some as an “art,” experienced practitioners we spoke with likened it more to a “craft” that takes years of practice to hone and suggested that their community could do a better job articulating why they are making certain decisions based on this visual analysis. One interviewee suggested that a group of advanced PBR practitioners could undertake a process to document and catalogue these visual cues, and then collect and share them with the broader restoration community.

INTERDISCIPLINARY KNOWLEDGE

Many interviewees emphasized that project designers need to understand that riverscape restoration is inherently interdisciplinary. To do it well, a variety of fields are required like geomorphology, hydrology, biology, engineering, etc., and a team of people with this knowledge needs to be thinking and designing the project together to maximize success. This interdisciplinary nature of PBR requires that practitioners know enough to be able to identify what they do not know and when and where outside expertise is warranted. They should be aware of the limits of their own skills and abilities and be able to identify when to consult with or bring in people from other disciplines. One participant shared a long-term goal of a new discipline emerging that focuses on riverscape health and incorporates fundamentals from a wide range of disciplines.

PROJECT DESIGN FOR IMPLEMENTERS

Project design responsibility typically is done by a highly-trained, highly-specialized professional within an agency or a consultant. However, interviewees suggested that even a wider range of professionals would benefit from at least a conceptual understanding of PBR-specific techniques. There can be situations where project managers and even field crew leaders need to make site-specific decisions or adjustments.

MANAGING PROJECTS AND PEOPLE

Interviewees from the project owner and manager category also spoke about the importance of and/or expressed an interest in acquiring the skills, knowledge, and capacity to manage projects and people throughout the project lifecycle.

MANAGEMENT AND RELATIONSHIP SKILLS

Some interviewees emphasized the skills around managing people and relationships. This includes the ability to coordinate schedules, hiring and work with contractors, volunteers, Conservation Corps, and/or tribes was also often cited as a current gap in knowledge. The individuals leading field crews would require and benefit from skills in project and people management as well.

Beyond science, individuals also spoke to the need to pull in people with business skills who know how to source materials, hire labor, etc. Social skills are also required – for example, knowing how to direct a team, engage with local communities, and resolve conflicts.

WORKING WITH TRIBES

There is also a need for project owners and managers to better understand how to work with Tribes, when applicable. When it is included in existing training materials, Tribal engagement often only includes a brief description and lacks the nuance that is relevant to working with highly-diverse Native communities. For example, tribal interviewees emphasized the importance of incorporating local tribes at the outset of a project, co-creating the process, incorporating traditional ecological knowledge (such as the significance of the beaver and the role the species plays in maintaining healthy riverscapes), and co-stewarding the project along the way.

PERMITTING

Navigating permitting was cited as a significant challenge in and of itself. Project managers within federal agencies mentioned how it can be challenging for staff to stay current on the permitting processes required to do projects on federal lands, and said a reference to turn to with up-to-date information on the Endangered Species Act (ESA), National Environmental Policy Act (NEPA), Clean Water Act, and state-level water rights would be useful. Furthermore, due to limited staff capacity to undertake NEPA, some federal agency staff expressed a desire to subcontract NEPA to outside groups such as non-government organizations (NGOs). Agencies (and specifically USFS) felt other project management responsibilities could be outsourced, as well.

A resource that was shared with Meridian that addresses many of the common questions that arise related to project management is The Nature Conservancy's "[LTPBR Playbook](#)." The organization recently developed this go-to guide for project managers within their organization to reference for how to do low-tech process-based restoration. It includes project checklists, links to training and education resources, RFP templates, a contractor directory, tips on navigating NEPA, and many other resources to address questions that come up over the project lifecycle. While this resource is currently under development and only available for employees, TNC is planning to distribute it more broadly and host it on partner websites in the future. It does provide initial information on many of the topics and issues identified in the interviews and could be a good compliment to education or trainings on these topics.

Education/Training Opportunities and Workforce Needs

The greatest opportunities for enhanced trainings for those involved in project design and management are described here. When asked how they came to know how to design and implement PBR projects, many of the more experienced practitioners we spoke with said they learned by doing. This was true for those within agencies, nonprofits, as well as the private sector. This may be because PBR is a somewhat novel approach so many current professionals may have taken different career paths than the PBR workforce of the future.

While various training programs already exist to serve project designers and manager (as described in the Existing Training Programs section), this section describes where opportunity may exist to enhance these offerings. It also incorporates what we heard about the current constraints related to the PBR workforce.

PROJECT DESIGN WORKFORCE NEEDS

In general, interviewees felt like the limiting factor for project designers is not a lack of individuals who have taken some training, but enough seasoned professionals. This is especially limited right now with the abundance of new projects resulting from Inflation Reduction Act (IRA) and Bipartisan Infrastructure Law (BIL) funding, which is resulting in a lot of near-term projects. A few consultants are in high demand due to their reputation, skills, and experience. However, many professionals have participated in trainings and/or have strong transferable skills relevant to the PBR field. It can be hard for professionals to bridge the gap between having taken a course or two or received a certificate in process-based restoration and gaining enough professional experience to lead projects (see the peer network suggestion below). There was also a concern that local practitioners with some training but lacking extensive experience pose a reputational risk if their projects are poorly designed. Or that existing restoration professionals will use some of the PBR terminology or tools because of the surge in popularity in these strategies, but without really understanding the concepts or appropriate design.

Overall, the river restoration professional world tends to be dominated by form-based restoration. As a result, there is a lot of restoration design capacity and individuals with useful backgrounds and trainings for this field (e.g., fluvial geomorphology, etc.), but a much smaller field trained in PBR principles and approaches. And even fewer of those professionals have the hands-on experience required.

A few people raised the potential for tapping skilled professionals from the broader river restoration field (including compensatory mitigation banking). They have much of the background knowledge, business model, and project management skills needed in the PBR space. However, there was also a concern that without a detailed education in PBR there is a risk of trendy terms (e.g., LTPBR, BDAs) being poorly applied.

PEER NETWORKS AND MENTORSHIP

Many project designers including both private consultants as well as federal agency staff, indicated an interest in having a professional peer network they could consult for judgement calls, quality assurance, and to review what they are doing. They spoke to their experiences taking trainings with PBR experts but then not having a support network for continued learning afterwards. If the most experienced practitioners were able to regularly mentor newer practitioners through on-site project visits, many felt this would be an effective way to train the next generation of project designers and lead to more successful projects being done. There are some existing online efforts to build this practitioner network, such as the [Riverscape Consortium Communities](#), but most interviewees felt that a virtual community is not a substitute for in-person peer-to-peer learning. \

A PBR CERTIFICATION PROGRAM

During the interviews, we assessed the interest in, and potential benefit of a certificate program focused on PBR.³ Interviewees often referenced the Natural Channel Design (NCD) approach as a corollary example and had mixed feedback on this idea.

First, interviewees expressed concern that a certificate program runs the risk of oversimplifying PBR. They felt that perhaps you could certify individuals in an understanding of riverscape health principles and sideboards, but that training should not be required on specific approaches or methods because those are by necessity site-specific in design. Some felt that NCD trainings left “everyone feeling like an expert” in stream restoration, but without the knowledge base or experience to back it up. They would not want to see this repeated with PBR. A few also said they would not want to see a PBR certificate program be as expensive as NCD trainings offered and cost-prohibitive for some audiences. On the other hand, interviewees also felt that formal certification could help elevate awareness of PBR as an alternative to NCD and be helpful for embedding recognition and support for the approach within federal agencies.

Finally, when we asked those in hiring positions whether a certificate would make a potential staff hire or contractor more attractive, these individuals said they were unlikely to require or rely on such a qualification to make their decision. They did not rule out, however, that it could be beneficial for those in field-level positions to have a PRB certificate for the purposes of career development.

AGENCY PBR TRAINING NEEDS

Many, if not all, of the federal agencies we spoke with expressed an interest in more opportunities to learn PBR processes and approaches with agencies. While some agencies are already creating and participating in interagency PBR trainings (e.g., BLM and NRCS), others who are not expressed an interest in doing so or attending trainings offered by other agencies. This section describes the common interests, needs, and potential constraints faced by federal agencies with regard to participating in interagency trainings, and also includes considerations of note that are unique to specific agencies.

We will also note that the Meridian team spoke to anywhere from one to five representatives from each federal agency, ranging from field-level to manager/supervisor-level staff. We did our best to corroborate what we heard with partners outside the agency. However, the perspectives presented here may not represent all perspectives within the agency.

The common interests, needs, and constraints identified by federal agencies involved in PBR projects on public lands include:

- **Efficiency and effectiveness.** Agencies recognized that combined training opportunities would be a more efficient use of limited time and resources. They would allow the staff involved in project design and management to build shared knowledge and capacity that

³ Through conversations and desk research, Meridian also learned that two graduate and/or professional certificate programs for riverscape restoration already exist at Utah State University and Portland State University.

benefits their own work while also enabling them to identify and leverage opportunities to do projects together.

- **Limited time and budgets.** Agency staff spoke to having limited time available, limited budgets to support travel costs and registration fees, and that for these reasons, it can be difficult to get approval from supervisors to participate in trainings. This constraint was expressed by nearly all agencies participating in this assessment.
- **Organizational capacity.** Agencies are already stretched thin and often do not have the time to organize and coordinate trainings, either for their own staff internally or for multiple agencies together. They suggested instead that trainings be organized by outside entities, relieving staff of the challenge of finding the time (and ability) to coordinate and deliver the training themselves.
- **Build on existing models.** The BLM, in cooperation with NRCS and Utah State University, recently developed a “[Federal Training Series](#)” that involves online and field-based learning. This training appears to meet the needs of multiple federal agencies involved in PBR and could be supported and amplified. Other examples of interagency training models that interviewees thought were successful and offered as potential inspiration for a PBR-focused training modules included [Southeast Aquatic Resources Partnership](#), [River Management Society](#), and the [Forest Service Aquatic Organism Passage Training](#).

While many federal agencies expressed common training needs, some additional considerations arose in interviews that are unique to a specific agency:

- **US Forest Service (USFS).** Staff within the agency are currently developing a PBR training program that will incorporate both online and field-based components. For the online component, they are exploring whether existing curricula (such as that included in the Federal Training Series mentioned above) will be appropriate for their own agency’s needs. Field trainings will take place on USFS lands where PBR projects are already underway and be accessible to staff from local field offices. USFS staff acknowledged the extensive resources that have been developed by others, notably BLM, and expressed interest in better understanding what these include and potentially utilizing them to ensure they aren’t reinventing the wheel. Furthermore, USFS staff said that certain agency-specific components would need to be included in trainings (e.g., how to claim accomplishments for wildfire-risk reduction).
- **Fish and Wildlife Service (FWS):** While not many PBR projects occur on FWS-managed lands, these interviewees did speak to the role they play in coordinating with other agencies. They would like to see more interagency collaboration on trainings and it would not be a barrier for their employees to attend non-FWS hosted training courses. FWS also emphasized that field training should be tailored to specific landscapes (e.g., approaches appropriate in more arid southwest landscapes versus wetter northwest landscapes).
- **National Park Service (NPS):** This agency rarely designs and implements PBR projects internally so instead spoke to a need for staff involved in project management to learn enough about PBR to be able to identify and hire qualified contractors and to give them direction on project design (e.g., encouraging approaches beyond Natural Channel Design). To ensure participation, NPS staff recommended that a training not be longer than a few

days in length. They also did not see the need for NPS-specific training and felt it would be more efficient and attract more participants if multiple federal partners were included.

- **US Army Corps of Engineers:** Engineered and form-based restoration approaches are still the prominent paradigm within the agency. Knowledge of PBR varies greatly by district and may delay permit approval in those districts that lack an understanding of these approaches. Interviewees from outside the Corps felt more could be done to help staff understand and embrace existing authorities, and acknowledged this goes hand-in-hand with a better understanding of riverscape function and the overarching goals of PBR approaches. Interagency trainings would likely be well-received, though prioritizing staff time to attend will be a challenge. A shorter, virtual training might be better suited for this audience.
- **Bureau of Land Management (BLM) and National Resources Conservation Service (NRCS):** Of the federal agencies, BLM and NRCS are offering the most PBR trainings (see above and Appendix A). Within NRCS, they noted challenges associated with high rates of staff turnover and a high degree of regional variation making a single training approach challenging. Their existing training materials could be useful for interagency trainings.

TRIBAL PROGRAMS AND ADDITIONAL NEEDS

The First Nations Development Institute (FNDI) is providing grants and technical assistance to Tribes and Native organizations to advance nature-based solutions founded in Native knowledge. Several of the projects the organization funds prioritize beaver restoration or the reintroduction of additional ecocultural species and plants. The interviewees familiar with this initiative emphasized the cultural importance of beaver for many Tribes, and that the species' presence on the landscape is irreplaceable (as compared to structures that imitate their work). In addition to funding, FNDI provides technical assistance that is customized to the specific Tribal community, their management practices and needs.

When asked about training needs, interviewees underscored the need for additional funding to support these approaches rather than training, noting that specific restoration strategies vary across landscapes and Tribal communities. There was a frustration that non-Native organizations are receiving funding for these restoration practices (including PBR concepts and tools) while Tribes are not receiving the same level of recognition or funding. Additional funding for Tribal-led restoration efforts could support scaling of FNDI's pilot project (the organization received 67 applications requesting in excess of \$13M and were only able to fund six projects with \$200,000 available), build local capacity rooted in Tribal knowledge and expertise through Tribal Colleges and Universities, and support workforce development through more long-term investment in youth corps.

FIELD CREW WORKFORCE NEEDS

Conversations with interviewees about PBR training needs often lent themselves to exploring the persistent bottleneck related to a lack of field-level workforce capacity. We summarize interviewees' perspectives characterizing this issue here, as well as ideas for potential solutions to train and build the PBR project workforce.

One of the greatest gaps in getting PBR projects completed relates to the lack of a qualified workforce to do the implementation. The skills and knowledge needed by this group includes a basic understanding of PBR-specific restoration techniques, how to run and fix mechanical equipment (e.g., chainsaws and other heavy machinery), how to staff and direct a team, and first aid. These skills are common to, and transferable from, other trade industries like forest management, firefighting, construction, and landscaping.

While volunteer crews are sometimes cited as a way to help address this need, a few interviewees noted that volunteers still require a significant amount of oversight and in some cases may end up doing techniques incorrectly, requiring project managers to re-do work and ultimately not saving on labor costs. Some suggested volunteers may be better positioned to help with post-project implementation tasks like revegetation. Alternatively, Youth Corps, Job Corps, and Conservation Corps are more formal skill development programs that may present a better opportunity to incorporate PBR-focused training curricula and learning experiences. Some companies are also hiring their own seasonal staff or entry-level staff to do field work. These companies indicated this can be a more involved staffing strategy, but has the advantage of better pay, long-term mentorship and career growth for the individuals, and a professionalism in their workforce.

Finally, because riverscape restoration is a relatively new field, interviewees also spoke to a lack of clear career development pathways. Once individuals are exposed to the field, there is a lack of a “next step” on the career ladder. Seasonal crews in agencies, for example, help meet workforce demand temporarily, however agencies expressed interest in creating opportunities to hire longer-term or full-time staff with the goal of establishing their careers in restoration. More formalized trainings and experiential learning opportunities tailored to field-level positions and responsibilities would be useful.

Ideas that came up in interviews to address workforce capacity and career development that are either already underway or could be developed include:

- **River Conservation Corps.** An AmeriCorps-affiliated program beginning in January 2025 that will place 10 members throughout Colorado to support river restoration site selection, project implementation, monitoring, and maintenance. While the term of service is just one year, members earn three certificates during their time with the program that, in combination with their experience and professional networking, could lead to future employment opportunities.
- **Forest Service Job Corps.** The Forest Service has a well-established program for training youth in technical and trade skills and supporting career development. The program emphasizes in-the-field experiential training, equipping students with the “soft skills” required to succeed, and places an emphasis on permanent employment – in the Forest Service or beyond – upon completion of the program. While the program does not currently offer a watershed restoration-focused trade, efforts could be made to incorporate it into the Department of Labor’s recognized job list.
- **Interagency “roaming restoration crews.”** A representative from the BLM spoke to an effort to establish national-level “roaming restoration crews” within the agency that build on staffing models already developed for wildfire fuels reduction work. These crews could include staff from other federal agencies, as well, and address restoration opportunities across ownerships.

- **Recruit from adjacent industries.** There may be opportunity to attract individuals and businesses currently in the construction, forestry and landscaping industries that already have related skillsets. These businesses may be interested in expanding their client base, however currently lack the knowledge required to successfully bid on and qualify for projects (e.g., design construction sequences, required insurance coverages, specific equipment needs). This training and recruitment could take the form of job fairs and/or short trainings that incorporate PBR concepts and field visits to project sites.

Recommendations

This section summarizes some specific recommendations and next steps for addressing gaps in training and education programs. We hope these recommendations are useful to funders, agency staff, and practitioners when developing additional education opportunities or trainings.

FRAMEWORK FOR TRAINING AND EDUCATION NEEDS

Below is a conceptual framework that summarizes training needs by potential audience, the type of content covered by the trainings, and notes on the potential format/duration. This is shared as a conceptual framework for thinking about matching audience need, content, and format. It generally aligns with the existing trainings (Appendix A) and audiences outlined above.

CONTENT	AUDIENCE	FORMAT
<p>PBR Conceptual Overview Trainings should cover riverscape systems and processes (i.e., how rivers work) and the what, why and how of PBR at a high level. It should socialize the terminology, concepts, and build confidence for this audience to integrate PBR into programs and decisions (funding, permits).</p>	<p>Funders, project owners, regulators, field crews, federal agency staff</p>	<p>Half-day or one-day virtual trainings that incorporate field visits when possible.</p>
<p>PBR Concepts and Project Management Training that covers both PBR concepts as well as the principles of site selection, project design, and implementation. The content needs to also include practical considerations, such as hiring crews, permitting processes, and selecting design teams. Field components are extremely valuable.</p>	<p>Project managers and owners, potentially field crew leaders, federal agency staff</p>	<p>Multi-day training (e.g., 2 days + field visit) or series of webinars that also incorporate a field visit when possible</p>
<p>PBR Design and Implementation More in-depth training in design and implementation specifics for professionals with relevant advanced degrees (e.g., geomorphology, biology, etc.) that builds on existing knowledge with more specialized PBR knowledge. Requires multidisciplinary knowledge (biological and geomorphologic). Would also be helpful to (at least lightly) touch on social dimensions, business model, and project management skills.</p>	<p>Project designers that already have advanced degrees and multi-disciplinary restoration expertise. Or, natural resource students or professionals wanting to enter the field.</p>	<p>Full-week short course for restoration professionals. Alternatively, semester courses or degree program for students intending to enter the field. Exact format might depend on technical background and current knowledge gaps.</p>

SPECIFIC RECOMMENDATIONS

Based on the needs and gaps discussed above, we recommend the following approaches to support training PBR practitioners in the knowledge and skills they need to successfully deliver projects. These are specific, actionable ideas and immediate opportunities:

- **Develop trainings for Field Crews or Crew Leaders.** A short course could be developed to help work crews understand the riverscape concepts before engaging in project work. This could be a two-hour virtual course or a half-day field course (or a combination). It could also be targeted at Conservation Corps crew leaders, with the goal of them passing along the information to the crew members.
- **Further develop training content for priority topics.** There were a number of issues and topics identified as priorities for incorporating into existing trainings, especially those aimed at project owners and managers (e.g., site selection, managing projects and people, permitting, etc.). It would be useful to further build out educational content and materials with a focus on these topics. Ideally the information could be incorporated into existing and future trainings, as well as highlighted in the TNC playbook.
- **Expand in-depth trainings for agencies.** The “Federal Training Series” was developed with federal agencies in mind and is accessible to all who are interested. There may be an opportunity to expand the participation in this existing training, offering additional trainings for staff from other agencies.
- **Develop and offer short courses and field visits for a wide-range of audiences.** Regulators, funders, agency decision-makers, and local leaders would all benefit from more field visits and/or short courses to understand riverscape health principles and see a local project. There have been a few of these offered recently – additional field visits could be an appropriate and effective way to get buy-in from a wider range of decision-makers who currently can be unaware of or reticent about PBR.
- **Regional three-day trainings.** Regional trainings have the additional benefit of building relationships and incorporating local knowledge. Specific regional trainings could target practitioners, agency staff, and other local stakeholders, and provide context-specific information. A field component could feature a local project and expand on site-specific decision-making. Local watershed groups could be heavily involved.
- **Pilot a professional mentorship program.** Explore with a few of the current “PBR experts” what would be needed for them to serve as a peer resource for practitioners earlier in their career to consult on project design and implementation. Funding could support the time and travel costs for experienced practitioners to visit projects and discuss proposed restoration designs and approaches.

Appendix A: Current Trainings

AS OF OCTOBER 15, 2024

The following list compiles current training for designing, planning, permitting, implementing, and monitoring process-based restoration. The trainings included below were identified through the interviews, based on past conversations, and desk research. The specific trainings offered are always changing, so this list reflects a specific point in time (Summer and Fall 2024).

LONG COURSES AND TRAININGS

Longer in duration, often convened over months or a semester. May or may not include a field component.

Training and Lead Organizer	Topics Covered	Primary Audience	Format
The Beaver Institute–BeaverCorps Program	Non-lethal beaver management techniques as well as LTPBR	Wetland professionals	Year-long program including virtual lessons and exams, and 4 project installations. Includes Beaver Wetland Professional Certificate.
Bureau of Land Management Riverscape Health Decision Support Toolkit	Riverscape health decision support Tools developed by the agency	Agency employees across the West	In-person, day-long trainings as well as a helpdesk to facilitate use of the toolkit.
Portland State University River Restoration Professional Certificate Program	The Certificate Program offers five core courses across a range of topics in river science and management including physical processes,	Environmental professionals in the western US and beyond, including project funders, managers, designers, implementers, land	A professional certificate comprised of five core courses offered every year and varying in length from three to five days. Some courses are fully virtual, while others are field and classroom based. A few courses offer a hybrid option.

	stream ecology, site evaluation and assessment, restoration design, and project management. The program also offers an Advanced Certificate with courses in physical and biological processes, engineering, and management.	owners, agency employees, and others interested in river restoration.	
<u>University of Georgia Institute for Resilient Infrastructure Systems (IRIS)</u>			A Certificate Program and regional capacity hubs for community engagement training through the at UGA.
USFS Internal Training <i>(under development)</i>		USFS Staff	Currently being planned by USFS staff. Likely launched Spring 2025 (regional pilot)
<u>Utah State University Graduate Certificate in Aquatic Ecosystem Restoration</u>	Intro to LTPBR, Planning, Design, Implementation, Adaptive Management, and other optional elective courses	Graduate students matriculated at USU	12-credit certificate for graduate students at USU
<u>Utah State University LTPBR Federal Agency Training Series (developed in partnership with BLM and NRCS)</u>	Intro to LTPBR, Planning, Design, Implementation, Adaptive Management, and other optional elective courses	BLM and NRCS employees (USU adapted the above course to align with BLM and NRCS National Technical Training Centers.)	Level 1, 2 & 3 Courses offered. Each online; semester-long; and include one field day. Also adapted to a 2-day field format.

SHORT COURSES AND WORKSHOPS

Typically 2-5 days in duration, often includes a field component.

Training and Lead Organizer	Topics Covered	Primary Audience	Format
<u>Anabranh Solutions On-site Workshops</u>	LTPBR background, design, planning, permitting, implementation		1-2 day site-specific, in-person workshops
<u>California Process-based Restoration Network–Build Like A Beaver Workshop</u>	Design, permitting, implementation; Building BDAs and PALS in the field		1-hour Zoom followed by 2-day field training hosted in 2022 and 2023; additional training planned for October 2024
<u>Colorado Healthy Headwaters Group Process-based Stream Restoration Workshop</u>	Planning, identifying best opportunities of where to work, permitting, communication, water rights issues, and partnerships	Local, state & federal agencies, watershed groups, nonprofits, and restoration practitioners	2-day in-person workshop that took place June 17-18, 2024
<u>Methow Beaver Project Workshops</u>	How to implement process-based restoration, promote coexisting with beavers, and develop skills to relocate beavers	Wildlife and watershed restoration professionals	1-day to multi-day workshops in Methow, Washington
<u>National Association of Wetland Managers Beaver-Related</u>	Restoration of aquatic ecosystems through the reintroduction of beavers,		Six webinars and an optional module quiz and certificate of completion for use in applying for

<p><u>Restoration Training Series</u> (developed in partnership with BLM)</p>	<p>the use of beaver dam analogues (BDAs), or restoration designed to attract beavers to an area.</p>		<p>Continuing Education Credits. (\$25 fee per model if not a NAWM member)</p>
<p><u>NOAA Fisheries– Restoring Riverscapes Workshop</u></p>	<p>Not a how-to session or a science conference, rather a structured, logical progression that will take you on a journey of learning and sharing, and in the end, working to find pathways for scaling up riverscape restoration.</p>	<p>Managers and staff from federal and state agencies, tribal communities, students, watershed councils, and conservation organizations who oversee, fund, or regulate riverscape restoration.</p>	<p>A 3-day workshop hosted virtually in Spring 2023. The recordings are available on their website and offered as a self-paced online course.</p>
<p><u>Portland State University Environmental Professional Program Courses</u></p>	<p>Planning, Design, Wetland Delineation as required by USACE</p>	<p>Environmental Professionals in the PNW</p>	<p>3-5 day courses; in-person and online</p>
<p><u>Sagehen Creek Field Station River Restoration Course</u></p>	<p>Sustainable river restoration</p>		<p>Week long course at Sagehen Creek Field Station near Lake Tahoe, California</p>
<p><u>The Nature Conservancy</u></p>	<p>Stream Improvement Training; focused on building beaver dam analogs (BDAs) to benefit riparian habitats, wildlife, and forage quality</p>	<p>Landowners or individuals interested in process-based restoration for working landscapes</p>	<p>2-day course with classroom and field components in Meeker, CO</p>

<p>University of Georgia IRIS Professional Training <i>(under development)</i></p>	<p>An overview of natural infrastructure with a focus on options, challenges, and considerations.</p>		<p>1 day professional trainings in the Colorado River Basin to occur late 2024/early 2025.</p>
<p><u>Utah State University LTPBR Workshops</u></p>	<p>Design, Planning, Implementation, Permitting, and Adaptive Management</p>	<p>Managers and staff from federal and state agencies, tribal communities, watershed councils, and conservation organizations who oversee, fund, or regulate riverscape restoration.</p>	<p>Online; semester-long; one field day; tuition-based. Also a 2-day version in the field for private audiences. Also offered as a free, self-paced online module.</p>
<p><u>Utah State University Sediment Transport in Stream Assessment and Design</u></p>	<p>Intended for those who wish to understand and apply the principles of sediment transport to alluvial channel assessment and design.</p>	<p>Participants familiar with basic principles of river geomorphology</p>	<p>Week long in-person course in Logan, UT offered in late July.</p>

CONFERENCE SESSIONS AND ADD ONS

Typically range in length from a few hours to a full day.

<p>Training and Lead Organizer</p>	<p>Topics Covered</p>	<p>Primary Audience</p>	<p>Format</p>
<p><u>BeaverCon</u></p>	<p>Multiple sessions on riverscape restoration and beavers</p>	<p>The vision for BeaverCON is to bring professionals, practitioners, and</p>	<p>Biennial 3-day conference with add-on full-day field trips. Taking place in Boulder, CO in October 2024.</p>

		<p>others dealing with beaver issues and wetland restoration together to share the latest research and best management practices for “Nature’s Engineer”, the North American beaver.</p>	
<p><u>National Association of Wetland Managers and University of Georgia Institute for Resilient Infrastructure Systems</u></p>	<p>This training, “Implementing an Ecological Approach for Reviewing Compensatory Stream Mitigation Projects” is organized by three main topics: 1) Compensatory Stream Mitigation Review, 2) Reviewing Hydrology and Geomorphology and 3) Reviewing Stream Designs.</p>	<p>These modules are for staff whose duties include the review and comment on stream mitigation proposals; other interested parties may include water quality/resource professionals at state agencies, local municipalities, non-governmental organizations, and private consulting companies.</p>	<p>Three training modules with videos and online assessments to receive a Certificate of Completion. Each video is between 20-30 minutes.</p>

<p><u>River Restoration Northwest Annual Symposium</u></p>	<p>Almost always includes PBR sessions. Short courses on a variety of restoration topics are held the day prior to the annual Symposium. Other short courses are offered at other times of the year.</p>	<p>River restoration professionals with different disciplinary backgrounds including: aquatic and fisheries biology, geomorphology, landscape architecture, hydrologic and hydraulic engineering, wetland science, and soil science.</p>	<p>Sessions and national/international invited speakers within the annual conference, one day workshops on the day prior to the conference, and multi-day workshops/courses at other times of the year.</p>
<p><u>RiversEdge West Riparian Restoration Biennial Conference</u></p>	<p>Riparian restoration research and management conferences and workshops with a focus on impacts to riverside habitat in the arid western U.S. Driven by RiversEdge West's commitment to advance the knowledge and practice of riparian restoration. The primary goal is to share the latest scientific findings in the field of riparian restoration with practitioners, students, and researchers alike.</p>	<p>River restoration professionals, including but not limited to: land managers, scientists, non-profit organizations, watershed groups, private landowners, consultants, students, river enthusiasts, biologists, you!</p>	<p>3-day conference in March 2024 in Grand Junction, Colorado</p>

Sustaining Colorado Watershed Conference– Riverscape Restoration Project Management for Project Owners and Funders	Project Management	Project owners and funders	Peter Skidmore currently designing
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Appendix B: Interview Questions

We asked interviewees the following questions:

- How did you come to know what you know about how to do process-based restoration? Have you attended trainings or have a formal education on the topic?
- Are you aware of training programs for designing, planning, permitting, implementing, and monitoring PBR projects that are not already on this list? (*A list of training programs was shared with interviewees prior to the interview.*)
- Within your agency/organization, what are the greatest needs and/or gaps in the skills and knowledge required to successfully carry out these projects?
- Do you think all the audiences that need or would benefit from training are effectively being reached? Who do you interact with that would benefit from additional or different trainings?
- What suggestions would you offer to enhance training opportunities to develop the skills and knowledge needed to do this work? Are there specific topics or materials that would be beneficial to include in trainings?

Follow up questions were customized to the interviewee.

Appendix C: Organizations Interviewed

Bureau of Land Management	River Restoration Network
Corday Natural Resources Consulting	River Science
Dipper Consulting	Round River Design
EcoMetrics	Trout Unlimited
First Nations Development Institute	U.S. Army Corps of Engineers
National Forest Foundation	U.S. Bureau of Reclamation
National Oceanic and Atmospheric Administration	U.S. Fish and Wildlife Service
National Park Service	U.S. Forest Service
Natural Resources Conservation Service	U.S. Forest Service Job Corps
The Nature Conservancy	U.S. Fish and Wildlife Service
Portland State University	University of Georgia
Rio Grande Return	University of Nottingham

ABOUT MERIDIAN INSTITUTE

Meridian Institute is a mission-driven, non-profit organization that has helped our clients and partners develop and implement solutions to complicated, often controversial problems—big and small, global and local—for over two decades.

We do this with an innovative approach that brings together three elements: our deep understanding of the issues at hand, as well as the people, politics, and power dynamics that surround them; our dedicated, expert team; and our ability to foster constructive discussions, manage decisions, and support actions that shape the world for the better. We work not only to shape meaningful consensus and action in the near term, but also to build our partners' capacity for cooperation that often continues for years, even decades.

We focus on five key services: collaboration, implementation, strategy, research, and philanthropic support. We bring our skills to bear on a diverse range of issues, including environment & natural resources, climate change, agriculture & food systems, forests, health, oceans & coasts, resilience, science & technology, and water. Across issues, boundaries, and systems, our work is a catalyst for powerful impact.

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