Low-Tech Approaches for Salmon Habitat Restoration

Knowledge Exchange Workshop March 12th, 2026 ~ 9:00am – 3:30pm PST

Workshop Summary Report

Introduction

Moderators Laura Weatherly (DFO, Mike Meneer (PSF) and Greer Maier (GSRO)

Laura Weatherly welcomed everyone to the virtual workshop, noting another record with over 2,000 registered from BC, Washington, and from across the rest of Canada, the USA and internationally (including the UK, New Zealand, Ghana and Mexico). Participants include many affiliated with governments, plus consultants and private industry, non-profits and First Nations. This high level of interest speaks to the value of low-tech approaches in habitat restoration.

This workshop is the latest in a series linked to the co-hosts' broader work to support salmon and their habitat. Links were provided to resources and recordings for the current and past workshops, with the next workshop planned for June, when Simon Fraser University will join as a co-host to focus on cumulative impacts in salmon watershed recovery.

Mike Meneer stressed the importance of partnerships and collaboration in this work, noting PSF will host its second BC Salmon Recovery and Resilience Conference in October 2026.

Greer Maier noted that our watersheds are broken in ways we are just starting to understand, and these strategies help us get out on the ground to advance both our understanding and the work needed to advance recovery.

Low-Tech, High Impact: Process-Based Tools for Salmon Recovery

Joe Wheaton, Utah State University

Presentation highlights include (See PPT for details):

- Low-tech tools: Many of these are not new; they encompass simple techniques that have been around forever, and the toolkit is broader than BDAs (Beaver Dam Analogues).
- Form-based restoration vs Process-based restoration: Process-based restoration is about trying to engage wider spaces and to get there and stay there using natural processes.
- Tools of the trade: These solutions can be achieved with simple tools, and can be used successfully by a wide range of participants.
- Low-tech is hand-built: Often it's more affordable, but it needs to be professionalized to scale it up.
    - Engaging volunteers is important for ownership and buy-in, but you need more than that — good intentions don't ensure high impact or effectiveness.
    - Low-tech alone is not enough. Real solutions involve sustained processes, so while high-tech tools may not ensure impact, they do position us to learn and objectively evaluate.

    - The key to success is to keep the focus on the key processes (beaver dam activity, wood accumulation and root map production) that involve and support life.
- The scale of degradation is massive so what excites me about this is the ability to engage natural processes that can scale beyond our efforts in space and time, so we've tried to formalize that in standards of practice.
    - LTPBR Website: Overview of resources.
        - Why is LTPBR getting so much attention recently? Because the early science was able to show a population level response to our efforts (beaver took over, expanded effects, with multiplier effects).
    - Riverscape Consortium: Invitation to join (create a free account) this community to support knowledge exchange and collaboration, with the goal of healthy riverscapes for all.
- Riverscape definition: More than just the channel, it's the landscape/connected network that could plausibly flood in the contemporary natural flow regime.
    - Mapped all of the US Lower 48 states, where riverscapes constitute 20% of the land surface area. But what's functionally floodplain now is currently only about 3%.
- They've conceptualized principles of riverscape health, with emerging consensus on a definition:
    - First, healthy riverscapes need space. Then structure forces complexity, and inefficient conveyance is also key.
- How to solve the problems: Role of the Riverscapes Consortium community platform and data exchange.
    - Summary of current users.
- PBR phases, scales and apps: The Riverscape Consortium attempts to pull together the tools that people are using for different phases of work and to connect the many different groups that are often working in isolation.
    - PBR Explorer: A place to share who is doing what, where and when, also a place to keep track of your own projects, see what others are doing. — a way to track and quantify effort.
    - Riverscape Studio - QRiS: A free plug-in for the free QGIS system which allows users organize input, capture data and perform analysis.
        - We've pulled together curriculum and standards of practice in the LTPBR manual: QRiS operationalizes those standards for practice:
        - Planning steps: What are the key questions, what to consider in project design, how to evaluate info.
        - Seeks to promote flexibility and creativity, but standards do matter (to avoid repeating past missteps, reinventing the wheel).
        - QRiS includes protocols but users can add their own: these should speak to outcomes for the whole riverscape (not just for the channel or remnant riparian habitat).

- QRiS protocols explained, how to access and use protocols in QRiS to design and manage projects.
- Role of metrics and indicators tied to principles of riverscape health.
- Setting up analysis based on all the above — doesn't guarantee success but provides transparency and a way to assess whether you're achieving the intended outcomes over time.
- Tutorials: option to use or contribute.
- When we are working at our best, we learn from the ecosystem engineer.

Q & A

- What can technical specialists do that will most improve our ability to design effective low-tech projects?
    - Specialists and practitioners have been too divided, so we need effective ways to package and share information about projects, including project goals, measures of riverscape health and population response. We hope the tools discussed can support the dialogue needed to improve understanding.
- Is this broadly applicable or is there a size/situation where it's best suited?
    - These principles scale, so they do work in bigger systems, though you may need more adult supervision and more resources/diesel power as well.
- How do we incorporate learning from what didn't work, i.e. better learning from our failures?
    - We took on a lot of projects in marginal situations and it's important to share the results, however variable, e.g. in PBR explorer. A lot of this is not about "one and done" solutions so it requires patience and revisiting, as opposed to the desire to just share our successes.

Posts, PALS and Pitfalls: Hard-Won Lessons in Low-Tech Restoration

Reid Camp, Snake River Salmon Recovery Board

Presentation highlights include (See PPT for details):

- Given the global scale of degradation, we wanted to support a movement to empower local communities that is scalable.
- Challenges: Inconsistent support for recovery when these approaches are applied inconsistently.
    - LTPBR comes with uncertainty because we defer decisions to the river, while our funders, legislators, etc want certainty.
- Balancing certainty with LTPBR principles: using available resources — the field of restoration is not new, so there are lots of places to learn what worked.
- Important lessons:

    - Understanding of fluvial processes: leave the complex math to engineers but practitioners need to understand basic fluvial process features and how they interact to create the desired outcome.
    - Site selection: Where will LTPBR be effective/provide more bang for the buck? Use available data to better understand the river and floodplain to identify the most promising sites.
    - Design reports: You need to clearly describe what you're doing and why to support monitoring, explain to funders and construction crews. This includes reach-level and structure-level designs; importance of justifying field-fit designs.
    - Improvement comes from experience: Yours and that of others, so include ongoing learning and good project documentation.
    - Good BDAs take time: bury, weave, repeat.
    - A little extra effort during construction leads to a lot more stability: It needs to last long enough to support restoration of natural stability.
        - Example of structure features that support stability.
    - Monitoring is essential until the natural process takes over.
        - It can be simple — annual project monitoring could just involve walking the reach and asking the key questions.
    - Most projects require maintenance, until beavers return to take over the work and/or the system recovers.
- The great thing about low-tech is it's so adaptable, and each site is different. It's also important to identify the limitations. Think of it as a toolbox, not a tool — and about the importance of sharing and continued learning. With so much to be done, it highlights the importance of scaling up.

Q &A

- Expand on what sites would be unsuitable for LTBPR.
    - If the river is too big or too powerful, if the stream gradient is greater than 5%, or incision depth is greater than 1 metre (in which case you could perhaps take a phased approach). This speaks to the importance of understanding geomorphology and fluvial processes.
- How best to deal with typical coastal BC streams, with low summer flows but very flashy?
    - Most of our streams are incised. If low-tech alone is not an option, you may first need engineered approaches to reconnect the floodplain, then low-tech approaches on the floodplain, or to have more, smaller structures to dissipate the energy.
- Why is BDA seen as a bad acronym?
    - In some rural areas, "beavers" are unloved; "dams" are also triggering to some people, so it's important to read the room and uses the right language for the context.

Maximizing Low-Tech Restoration in Diverse Stream Systems

Allison Lutes, Streamline Environmental

Presentation highlights include (See PPT for details):

- Overview of constraints and challenges.
- Alluvial water storage model: helps to identify opportunities and appropriate tools.
- Changing hydrograph: Earlier, flashier flooding due to climate change + legacy land use impacts, with deleterious impacts to salmonids.
- Model developed to contextualize how much water storage has been lost and helps prioritize sites for restoration.
    - Further model modifications to answer more specific questions.
    - Illustration of filtering for low-tech opportunities — factors considered.

Bryan Maloney, Chelan County

- Finding the right tool for the job: the design questions to be considered.
- Case studies: Range of structural approaches undertaken (from small to large machine built).
    - 2017: early low-tech, hand-build work.
    - Examples: subsequent low-tech projects.
    - Larsen Creek 2025: inclusion of leaky dam structures.
    - Bjork Creek: inclusion of post assisted slash structures.
    - Brush Creek 2026: Plug, buck and jam.
    - BDAs+ vegetated coir: Camas Meadow 2024 to present.
    - Hybrid approach: Engineering + low-tech — Camas Meadow (mid-elevation meadow with low sediment input); 1-6% gradient/1-10 feet of incision, mitigation of undersize culvert.
- Monitoring strategies; sample results.

Q &A

No time for questions.

Stage-8 Strategies for Riparian Activation and Mega-sized BDAs for Full Floodplain Inundation

Matt Gamel, Lower Columbia Fish Enhancement Group

Presentation highlights include (See PPT for details):

- Harrington Creek: Existing conditions included highly incised channel, no riparian trees.

    - Key lesson: If you can fix the hydrology, the plants will follow.
    - Engineering for lower banks to create the right conditions for riparian tree species to seed and survive.
- The “Meadow Maker” — Mason Creek: Problem child with great potential.
    - Striped invasive canary grass (used for building material), built up dams, using excavator to significantly speed up post driving.
- Environmental amnesia: Beaver dams can be very large and very stable.
    - Reasons to go big with these projects. Only attempt this in low-risk areas.
    - Requirements to establish a big beaver colony

Q &A

No time for questions.

Nature-based Approaches for Recovery and Resilience After Fire

Jenn Rogers, BC Wildlife Federation

Presentation highlights included (See PPT for details):

- Wildfires increasing in frequency, extent and intensity, with growing impact (more runoff, erosion, flashy flows, especially in first few years after fire).
    - So important to be prepared to respond as soon as possible to prevent substantial damage.
    - Use of BDAs, woody debris and hybrid structures to dissipate energy and support recovery.
- Shetland Creek wildfire: Twaal Creek project in partnership with local First Nation.
    - Project planning, community meetings, field assessment using the stream evolution model to assess restoration potential and feasibility of different sites.
    - Range of tools used to repair or mitigate further damage and support recovery, including BDAs and reinforced natural dams.
- Post-fire building considerations:
    - Dangers include working around unstable trees, unstable slopes.
    - Early timing is key (so start talking to regulators early).
    - Use local materials where possible.
    - Post-fire systems are especially dynamic, so important to be flexible and ready to adapt as needed via follow up work.
- Next steps at Twaal, including re-introducing beavers once sufficient vegetation is established.

Q & A

- How do fire-ravaged sites differ from clear cutting?
    - Both involve rapid exposure of surface soils, but it's always context dependent.

Morning Panel Discussion

- How do you determine potential benefits vs costs for sites where salmon are already present?
    - Avoid over-building — there is often too much focus on stability and avoiding messiness. The main thing is to ensure fish passage when the fish are moving.
    - We try to be mindful about ensuring a balance of rearing and spawning habitat.
    - We'd make our leaky dams leakier if salmon are present.
- When you design a project, how do you translate broad goals into measurable project objectives?
    - Examples of marking posts to denote desired incision/bankful depth.
    - Important to not skip the planning stage and to relate the intent of the specific work proposed to the broader landscape-scale and project/management goals.
    - Chelan looks at water infrastructure broadly and the multi-scale benefits of that — so we look at more than the fish recovery objective.
- What are some of the engineered structures that combine well with low-tech in your hybrid projects?
    - It's not just about adding engineered pieces — it's about Stage Zero thinking and integrating that where it makes sense.
    - In our Meadow project, we used natural systems design, with engineered posts and logs driven in by an excavator where that made sense. In another project, we installed interlacing large logs with other materials to integrate messiness.
    - In another example, we used an excavator to place a whole tree with intact root wad.
    - We may include something more like an engineered logjam or catchers mitt to avoid the risk of downstream damage.
- How readily will you work on a system where you know there is likely to be continuing degradation?
    - In Chelan, we're often working with loggers and landowners, and we focus on building partnerships and relationships, so that we can proactively go in and install mitigating structures, knowing there will be effects from future work.
    - Land management has gotten better but there will always be degradation. We work with forestry companies, using their equipment and expertise on solutions that help them too.
    - It can be easier to work with one timber company than with multiple community interests, and to look for win-wins, e.g. we're ensuring healthier forests for them in future, or using their slash piles as building materials.
    - PSF has had good success working in partnership with BC farmers and ranchers.

    - It's not all or nothing. There are significant benefits to taking incremental steps and seizing opportunities wherever they can be found.
    - It's important to look beyond funder-driven norms and 5-year plans and to build those long-term plans and relationships.
- What do you do at sites where you can't drive in posts?
    - Where logs are already on site, we may use those instead of trying to drive posts, or else direct fell trees to use as a starting point.
    - We also use boulders on site, or just boulder reconfiguration as a starting point. You can even just use a pile of slash if you monitor the risks.
    - Bring in bigger pieces to provide the necessary stability.
    - Posts are just a temporary thing; we need to expect that some of these things will move, and possibly catch somewhere else downstream ("velcro"). Even if they do move at some point, it will still have made it easier to come back and build a second step.
    - If it's just for a problem spot section in a structure, we've used living willow.
    - Instead of post and weave, we use other methods, like "lasagna" or "growing posts" (live trees tilted over that continue to grow).
    - We exist in a world that is certainty-centric, so we need to have the necessary conversations to build more acceptance of uncertainty.
- What are the unique issues and solutions in using low-tech in urban stream habitat restoration?
    - There's more rigorous permitting and more eyes on the project, so it requires more planning, but a great spot for low-tech is in parks and schools, where you can bring the public in to get involved and see what we're doing.
    - It's about expectation management, but it doesn't have to be a lot more expensive, e.g. using Riverscape Studio to map concerns, articulate risks and opportunities, while recognizing that each place is different.
    - Our conversations with landowners about water and wildfire resiliency are landing particularly well — so it's about understanding their priorities too.
- How are you integrating First Nations/Tribes or traditional knowledge into your projects?
    - BCWF tries to partner with local groups in all our projects. That often means reaching out to local First Nations to explore partnerships. We've found a strong appetite for such partnerships, and that they can offer a lot of valuable context.
    - Example where outreach to local Tribes confirmed the historical site context. They also share common values and goals.
- Significant opportunity noted for practitioners to collaborate to address how this work fits within current permitting constructs — e.g. how to reduce lengthy permitting timelines for low-tech strategies.

Evolving Low-tech Restoration Tools in Modified Landscapes

Chris Hoag, Hoag Riparian & Wetland Restoration & Julie Vanderwal, Sparrow Song Consulting

Presentation highlights included (See PPT for details):

Julie Vanderwal, Sparrow Song Consulting

- We're using structures that look very familiar but in evolving ways, e.g. willow wattles.
- Influence of Michael Pollock's 2014 paper on using beaver dams to restore incised stream ecosystems.
- We're typically working in very simplified, straightened systems that have lost complexity.
    - Example of how a barrier increased sinuosity and met our objectives for the reach
    - Evolving methods to address scouring during high flows, both above and above the barrier (plunge and toe scour)
    - Beavers came back very quickly and were eating the willow boughs. We were pleased but not ready for them yet, so switched to conifer boughs and more of a brush mattress, which helped address toe and plunge scour..
- Evolving weave techniques: original post line wicker weave, next gen conifer brush mattress, best of both worlds hybrid, lasagna style BDA (more soil, less vegetation.
- BDA fish passage: current science is based on post line wicker weave and natural beaver dams — so as designs diverge from those studied, we need more research on implications of these new approaches for fish passage.
    - Case Study: lasagna style structure with conifer boughs and logs in what was believed to be a non-anadromous system, but where they subsequently found 39 coho that died due to BDA construction (low dissolved oxygen, or trapped in the barrier).
    - Adaptive response: substitute a series of barriers that did not entirely span the channel, or return to designs that have been more closely studied.
- LTPBR centres on increasing channel complexity. But in a modified landscape the stream cannot be allowed to move in particular locations, so we rely on alternate tools:
    - Native plant stream bank techniques/nature-based stream bank solutions.
    - Hybrid solutions that combined LTPBR + nature-based stream bank solutions.

Chris Hoag, Hoag Riparian & Wetland Restoration

- Description of use of dormant unrooted cuttings in restoration: Single cuttings, cluster planting, clump planting, planting with a waterjet stinger, brush mattress, fascine and stakes.
    - Model and photos of a sample site.
- Sample project" construction, results 1, 5 and 12 years later.
- Vertical bundle technique.

- Brush spurs: angled 45 degrees upstream to divert flow away from the eroding bank.
- Role of willow wattle.
- Resources for learning/training on installation techniques.

Julie Vanderwal

- Case study: How these techniques were used in a hybrid approach for a challenging site adjacent to a road.
- It may require several treatments in combination to address the issues.

Q & A

- Does the use of green materials including live confer boughs affect oxygen levels?
    - We haven't observed that but would love to see a study to answer that.
- Lots of focus on willow and dogwood — does that help address canopy?
    - At one site we were using these larger tree species because we wanted future cover, so it was not just about using willow to support beavers. It's site-dependent so consider the future implications, including benefits of large wood falling into the stream. Also consider planting a diversity of species to ensure that something works if the future conditions are uncertain at time of planting.
- Are particular strategies better at arresting the degree of incision seen in some of the examples and to protect adjacent features?
    - Brush spurs and BDAs are good ways to arrest incision. Then map out where you want the stream to go and address that, along with strategies to stabilize banks.
    - Usually we're trying to raise levels via BDAs and PALS, then we use those stream bank treatments in places where we have constraints but need to stabilize the banks.

Growing Trees Amidst an Abundance of Beavers

Jenn Vanderhoof, King County

Presentation highlights include (See PPT for details):

- Overview — beneficial functions of beaver activity.
- But it can be challenging to protect replanting in areas with high beaver populations, especially smaller areas where the main vegetation is reed canary grass.
    - Beavers preferentially chose taller stakes, so using (some) shorter stakes for replanting may help.
    - Willow species preference: Sitka seems least preferred, so use species composition strategically.
    - Clump planting and fencing (significant improved canopy cover).
    - They're also testing treated and density effects.
- Case study: Fenced clumps for 5-6 years, add preferred species a year before removing the fence, and wrap a few trees.

Q & A

- Have you tried feeding beavers their preferred foods at a site.
    - Have not tried it yet, but suggest trying that.
- Do you have survival data beyond the 5 year period.
    - Suggest wrapping the trees — be proactive.

Low-Tech Log Jams? Somebody Better Knock on Wood

Justin Peterson, Nez Perce Tribe

Presentation highlights included (See PPT for details):

- Knock on Wood Project: Goal was to save near-extinct Snake River steelhead in a challenging watershed on very limited budget — decided to adopt a Go Big or Go Home approach.
- Given the urgency, proponents adopted “condition-based management” to speed up the planning phase and to streamline large-scale implementation.
- Roads are typically a constraint, but they made use of the extensive road network to collect and transport wood, and to install it at priority sites adjacent to roads without disturbing stream banks; also used wildfire salvaged wood.
- Used “catchers mitt” downstream structure — need to monitior and sometimes revisit where the wood moves.
- Now running out of road-adjacent sites so need to shift tactics to address more remote sites; will need to find other ways to engineer structures where there are more downstream risks.

Q & A

- We initially did little geomorphic assessment, but using more advanced tools.
- How do you avoid putting the roads at risk?
    - We look for sites that have a balance of enough vegetation to protect the road, but not too much to make it inaccessible for this method.

Clearing the Way for Salmon Habitat: A Proven Way to Remove Reed Canarygrass Before Restoration

Dr Catherine Tarasoff, Agrowest Consulting Scientists

Presentation highlights included (See PPT for details):

- Reed canary grass: features and ecological impacts.
- Benthic barrier method, using PVC vinyl cover, with 15 cm. deep flat steel edging bars to stop underground rhizomes.
- Results: willow, soft-stem rush natural re-colonization, some reed canary grass returning.

- Transplanted species mostly survived and thrived.
- In areas with extensive reed canary grass, start with areas that will achieve multiple overlapping objectives.

Q & A

- The materials are expensive but re-usable ($1,000 for 1,500 square feet of plastic cover; metal edging is ~$1.50/linear foot. You might be able to cut costs by digging a deep enough ditch instead of using steel bars.
- Is the native plant regeneration enough to prevent Reed Canary Grass returning?
    - We are seeing “haloes” around the shade zone, and where it hasn’t flooded.
- Re timing, leave the cover on for a full year to 1.5 years and then do spring or fall planting.

Afternoon Panel

- How do you integrate low-tech methods with broader watershed or salmon recovery strategies?
    - Use stream bank nature-based strategies with broader process-based strategies in specific situations where others are not possible.
    - We typically work in watersheds that have a range of contexts, so perhaps low-tech in the more remote headwaters, and hybrid or more engineered approaches in places where there are more concerns about certainty.
- How to support more integration and overlap, fewer silos?
    - I’m encouraged by the collaboration I’m seeing in the Okanagan.
    - We’ve seen success in places using prioritization at the landscape scale, rolling that into programmatic agreements and then using low-tech tools to implement.
    - PSF has been working with US colleagues on how to address the silo approaches we have in BC.
    - It’s important for us to connect more with the broader non-fish constituencies and dry sectors in the watershed (e.g. addressing grazing practices can be a very effective low-tech solution). Many opportunities for low-tech solutions exist in these broader areas and expanding the focus is crucial if we want to look at these whole systems.
    - The big challenge in King County is the regulatory code is mainly designed to get water out of the way ASAP instead of to slow it down for salmon.
- What are tips to navigate rigidness re BDAs and fish passage.
    - Important to build relationships with regulators: establish trust and share clear objectives.
    - Fish co-evolved with beaver for thousands of years, so it’s odd to see perceptions that they are now blocking fish passage.
    - Bringing regulatory people out on build days can really help. You can find the same regulations at other levels of government interpreted to support these projects.

- What in the low-tech realm is exciting you?
    - Excited about the use of virtual fencing (shock collars for cows) to keep them out of restoration areas or support rotational grazing. It's very helpful if we can approach farmers with a solution, not just an ask.
    - Brock Dolan is doing innovative things beyond the stream zone.
    - Excited that this is happening quicker in new areas as more people try this, in part due to exchange of knowledge and lessons learned. Also adopting a "foodie mentality" where we share recipes but adapt and do it our way.
    - It's very important to have a strong focus on sharing learning, including our mistakes.
    - Very excited about the innovation we're seeing in riparian planting, even right in the channel to jump-start process.
- Which of these approaches are more appropriate in situations where we're engaging and relying on community volunteers?
    - Most of the riparian planting techniques are designed to be done by volunteers (planning, installing, monitoring). For monitoring, volunteers can measure and count, but you need someone with more experience to coordinate and report.
    - A key challenge with volunteers in where the devil is in the details. So you need someone who can troubleshoot, and it helps to break down the tasks so participants get good at that particular sub-task.
    - I do training workshops for supervisors.
    - I provide training for project leads, then I get them to report metrics on what they've accomplished and how many others they've trained. It's very effective for getting more funding.
    - It's very effective to work with small groups of 4-5 volunteers. When you needs to scale up, ensure enough trained leadership to break up and supervise small specific task groups.
- What challenges and lessons learned have we not talked about (e.g. blowouts, bulltrout)?
    - The value of tools for exchanging learning. There is no excuse to not monitor, given there are many cheap, easy ways to do it, and there is value in being able to identify clear signals, even if it's not precise.
    - Communication:
        - It's very important to think proactively about joint approved communication around collaborative projects.
        - Importance of signage when placing large wood adjacent to roads to ensure people don't take it for firewood.
        - Value of signage explaining the purpose of black plastic or new plantings.
- Further thoughts on balancing fish passage with restoration that involves withholding water?
    - It's not withholding water so much as slowing it down to ensure it's there all summer.

- It's about re-establishing complexity in systems that have been simplified, which greatly benefits fish in the long run and vastly outweigh any short term risks.
- There is safety in variability, and we may be asking the wrong question about fish passage. Fish care less about thermal averages if there is high variability within the system.
- Fish may be holding below dams because it's cooler water, not because they're blocked.
    - Example where thermal sanctuaries were intentionally created — with signage to explain why they're holding there.

Mike and Laura thanked all the speakers and the technical team and invited participants to compete the workshop survey.

Adjourned: 3:30 pm