Leveraging the Work of Multiple Wildfires in a Fire-transformed Landscape

In June 2025, the Washington State Department of Natural Resources Resilience Division (DNR) and Northwest Fire Science Consortium (NWFSC) convened a field-based meeting and workshop with the Okanogan-Wenatchee National Forest in central Washington. The broad goal was to bring together a diverse group of ~40 researchers, managers, and practitioners to explore key topics in fire ecology, landscape restoration, and wildfire management in an interactive, field-based setting. This workshop followed a successful inaugural workshop in 2024 on the Colville National Forest that showed clear value in accomplishing this intent and in convening annually to explore a key landscapes and fire topics in different locations across the state.

The 2025 gathering focused on landscape change and management strategies in locations with multiple recent fires and reburn pathways. A reburn refers to a fire burning in an area that has previously experienced a wildfire. Reburn extent has increased substantially in recent decades, resulting in different combinations of high, moderate, and low severity burns with unique management challenges, including fuel loading and regeneration challenges. As managers and scientists seek a greater understanding of how forests will change with increasing reburn, these areas provide numerous opportunities for learning and adaptive management to support landscape resilience.

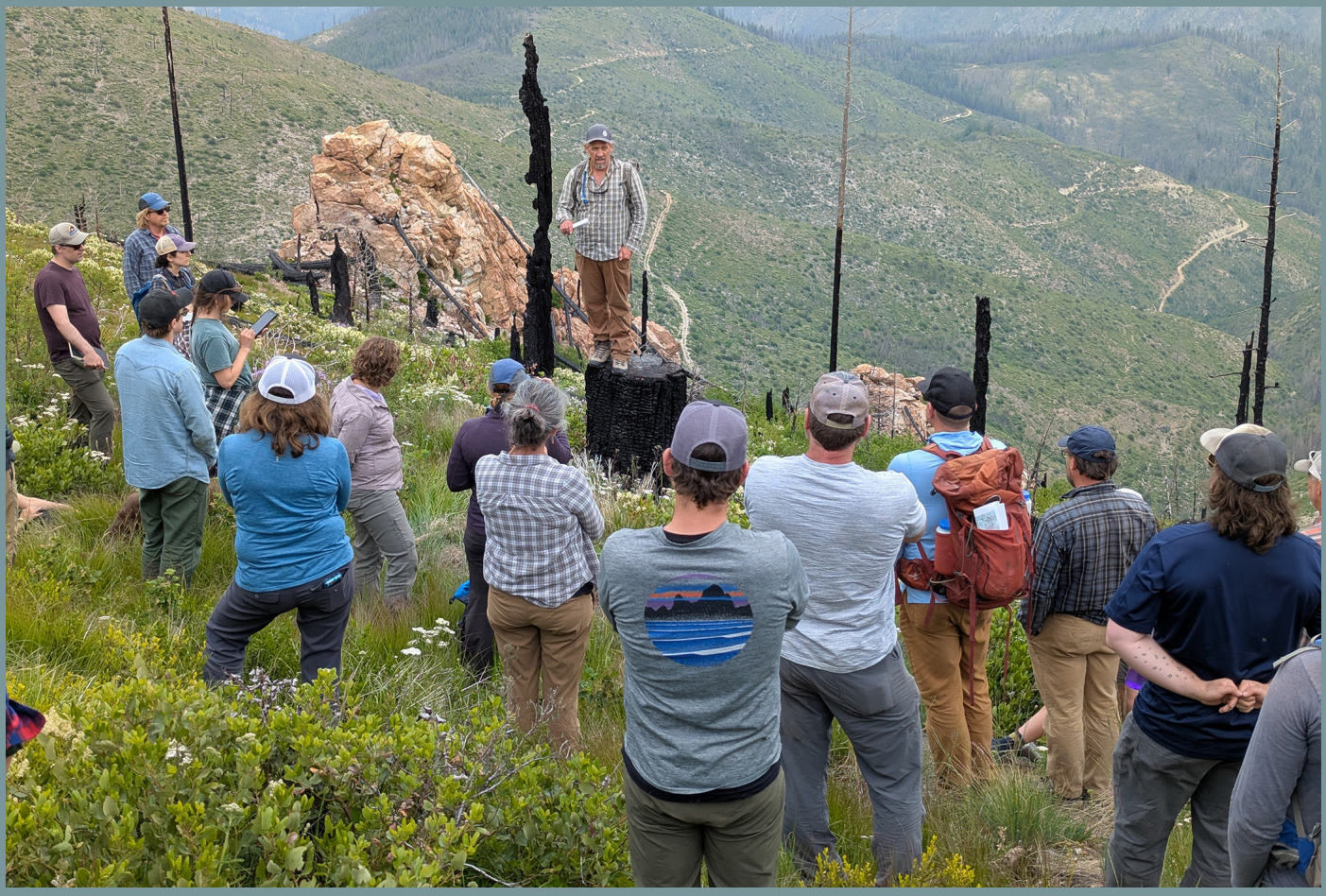


Photo: John Marshall

Workshop themes & objectives:

- Build relationships among scientists and managers to facilitate information exchange, partnership opportunities, and new ideas.
- Discuss management planning and priorities in burned landscapes, including future management needs, options, and opportunities.
- Observe post-fire landscapes while learning about site histories and reburn pathways evident at each site, including effects of management and regeneration needs/challenges.
- Discuss approaches to increasing the extent of beneficial wildfire in burned landscapes, including the design and location of treatments before, during, and after wildfires.
- Learn about related recent and ongoing research relevant to the landscapes and their management, discuss implications, and help identify ongoing research or resource needs.

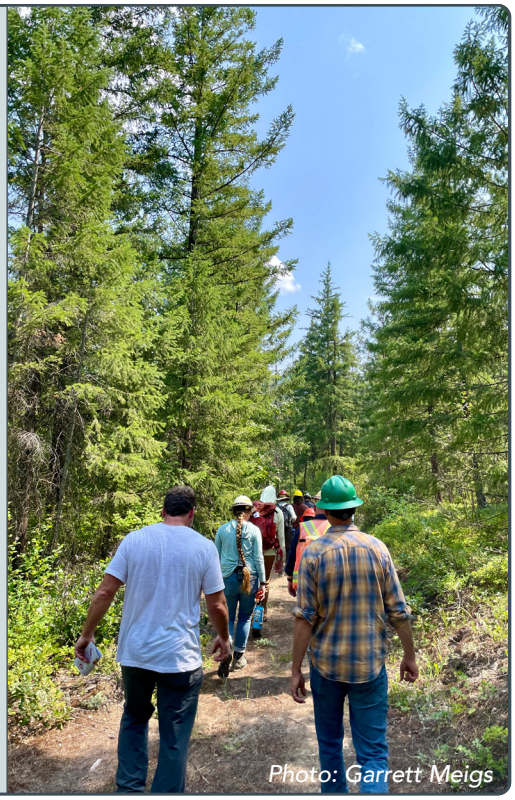


Photo: Garrett Meigs

Key recommendations from the 2025 and 2024 workshops:

Quantify effects of increasing reburns in eastern Washington State (EWA).

- Almost half of 2024 fire in EWA reburned in areas that had burned in the past 30 years (i.e., reburn).
- Reburns often burn at high severity, especially in areas with small trees and prior moderate-severity fire, which can accelerate transitions to non-forest and the loss of large/old trees.
- Currently, most reburn acres occur during hot and dry conditions. Reburns under moderate conditions can consume fuels from the first fire with less tree mortality.

Increase post-fire management that is geared towards landscape resilience.

- More post-fire thinning and fuel reduction in moderate-severity areas are needed to "finish the job" of the wildfire and decrease risk of future high-severity reburn.
- Integrating post-fire management with restoration in unburned portions of landscapes through longer-term, holistic, adaptive management approaches is needed.
- Institutional and policy changes are needed to reduce barriers to resilience-based, post-fire management and address social concerns. A categorical exclusion for post-fire projects that are guided by a post-fire landscape evaluation is one idea.

Recognize that high-severity wildfire can restore important non-forest patches.

- These include wet meadows, shrublands, and grasslands.
- Improved mapping is needed to identify where transitions to non-forest are positive and create a resilient landscape mosaic vs. where reforestation makes sense.

Re-assess fire regimes and management needs in higher-elevation, cold forests.

- Evidence suggests more frequent and low- and moderate-severity fire than the common narrative that cold forests were dominated by infrequent, high-severity fire.
- Cold forests in EWA would benefit from more active management given climate change and the large extent of fire over the last 40 years.

Amplify indigenous knowledge and practices.

- Indigenous communities used fire as a tool to achieve multiple objectives.
- Recognizing the deep history of cultural burning will improve management and is one of most promising ways to increase beneficial fire effects.

Strengthen science – management communication and partnerships.

- There is more need than ever for field-based collaboration, long-term partnerships, and place-based science that involves researchers, managers, and other partners.
- Managers need decision-support tools that are practical and accessible.
- Researchers would benefit from more time in the field and learning how planning and implementation work on the ground.

Research & policy needs identified during 2025 and 2024 workshops:

- Clearly define the **positive work of high-severity fire** in a research article and other outlets, especially related to restoration and maintenance of non-forest patches within a landscape mosaic. Additionally, develop improved tools to identify wet and dry meadows where trees have encroached, as well as good sites for shrubland and grassland patches in forest-capable areas.
- Quantify **reburn pathways, regeneration, and drivers of severity for the next fire**, including the role of shrub development (e.g. *Ceanothus*). Evaluate when and where to plant after one or multiple burns.
- Assess **treatment effectiveness over time and maintenance**: guidance on timing and longevity of treatments, particularly shaded fuel breaks and thinning in burned areas.
- Conduct a review to **assess policy barriers to implementing ecologically based, rapid post-fire management** at scale that is integrated with green restoration work.
- Develop approaches to **meaningfully engage communities and the public** around topics of post-fire ecology and treatments, including reburn risk management and climate adaptation.
- Improve **burn severity mapping**, particularly in low density forest and reburned areas (*Active project*).
- Articulate the need for and a framework for **resilience-oriented post-fire managemen**t in a synthesis article (*Active project*).

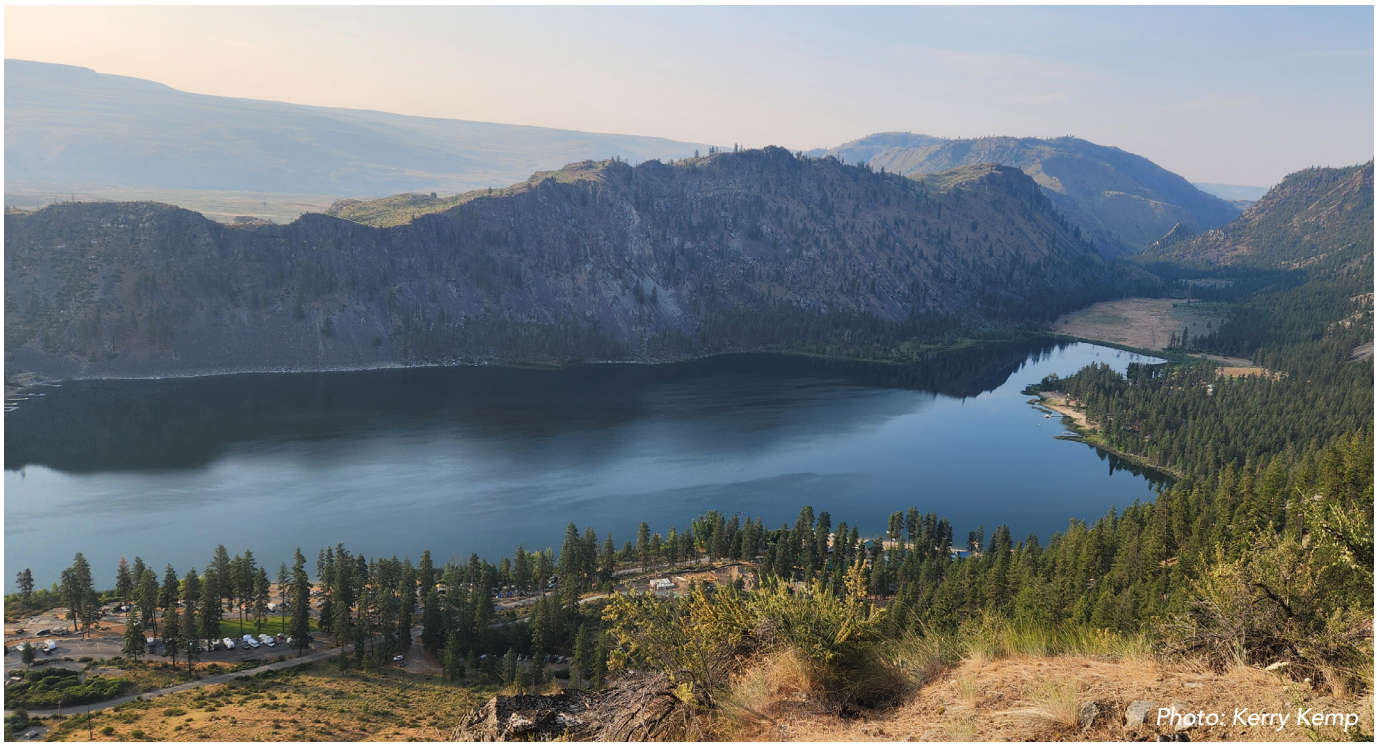


Photo: Kerry Kemp

Workshop approach & feedback

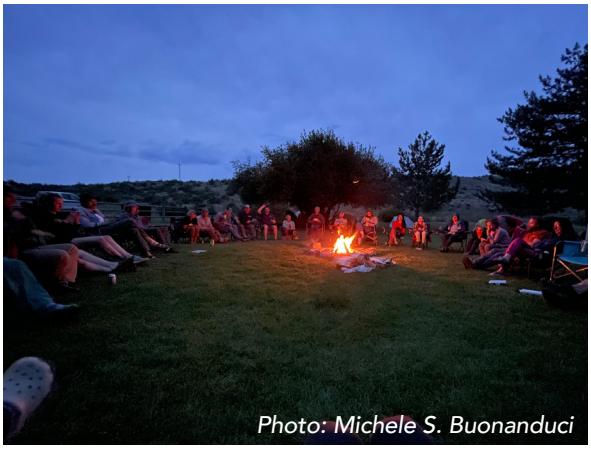


Photo: Michele S. Buonanduci

A collaborative team of individuals from DNR and the NWFSC met for several months to design the meeting objectives and agenda. The concept for the first field-based workshop (held in June, 2024 on the Colville National Forest, see workshop summary) was drawn from California, where a group of scientists and managers have conducted an annual field retreat over the last decade to build relationships and shared knowledge. For this second iteration of the workshop, we drew on these original aims along with lessons learned and takeaways for worked well during the 2024 Washington workshop. Organizers sought to build on the themes established in 2024, which focused on the work of wildfire, in a setting that could highlight multiple different scenarios for reburns in fire-transformed landscapes. The diversity of recent fires, fire behavior, and reburn outcomes in the lower Methow Valley and around Lake Chelan, alongside the willingness of Okanogan-Wenatchee National Forest managers to help identify sites and present information and perspectives, led organizers to focus on this landscape in 2025.

The 2025 meeting consisted of site visits to five different locations across one and a half days in the field. Participants shared insights from maps, fire histories, management strategies, and field observations.

- **Day 1** focused on a portion of the 2014 Carlton Complex that had been treated with thinning and prescribed fire, which resulted in sequential low-severity effects. The area provided an opportunity to observe how different management strategies affected fire behavior, vegetation response, and post-fire outcomes and served as a contrast to large patches of high-severity fire in the broader landscape.
- **Day 2** focused on the south shore of Lake Chelan, where the 25 Mile Fire burned through multiple prior fires in 2021. At the first stop, participants hiked through untreated dry forest that burned at low severity in the 2004 Pot Peak Fire, then with mixed severity in the 25 Mile Fire. The second stop featured different fire reburn pathways, including low- followed by mixed- and high-severity fire. The third stop, at Grouse Mountain, illustrated how non-commercial thinning and pile burning efforts contributed to low severity during the 25 Mile Fire, sparking discussion of management priorities, planning, and strategic implementation across burned landscapes. The final stop provided an overlook of Lake Chelan and robust discussion of reforestation challenges and climate adaptation in a Late Successional Reserve (LSR) that experienced three high-severity wildfires events in 1988, 2021, and 2024.

> ***"I really enjoyed the discussions in the field as a way to explore new ideas and concepts around post-fire restoration. I also enjoyed getting scientific presentations from researchers who are actively working in the post-fire restoration space."***
>
> *— 2025 attendee*

In addition to observation and discussion alongside the information on fire and management histories at each site, scientists working on related research topics presented on projects including summaries of research questions and key findings thus far. At the final site, participants broke into three groups to have targeted discussions on needs and opportunities for enhanced cooperation between scientists and managers that could benefit both ongoing research and management on the observed landscapes; each group identified science, management, and social needs to share with the larger group at the campsite that evening (see page 8 for takeaways from this session).

Like the 2024 workshop, organizers arranged a group campsite and participants stayed for two nights to socialize, debrief, and participate in small group exercises to elicit key priorities for research, management, and policy. An important co-benefit of this workshop magnified by the camping component was the opportunity to build relationships. Multiple participants emphasized that the workshop provided opportunities to spend time and engage in deeper conversations with people they had only known via online interactions previously, and some participants who attended who had attended last year's inaugural workshop shared examples of new collaborations

[1] *"Work of wildfire" refers to "The degree to which fire effects are consistent with science-based landscape resilience and wildfire risk reduction objectives." For reports and more information: https://deptofnaturalresources.app.box.com/s/gjnmcm0py2f3n447ba18wz5zkyjuwdgq*

and efforts that had emerged because of discussions from that workshop. This format facilitated sustained discussions about the themes of the workshop, which resulted in the identified priorities in this report.

Research presentations

Across the site visits, researchers involved in various efforts presented on nine different efforts. **Key themes from research projects included:**

- Modeling severity outcomes, considering treatments effectiveness and longevity, past wildfires.
- Mastication treatment effectiveness and impacts in different scenarios and in combination with other treatments, impacts on post-fire regeneration.
- Post-fire decision support tools that diversify planning considerations to include monitoring, stakeholder engagement, and ongoing evaluations.
- Regeneration assessments and areas for improvement with new data and innovative methods.
- Factors that drive different reburn pathways and their mosaics on the landscape, e.g., what factors stabilize or destabilize forest conditions or create new ecological opportunities in post-fire landscapes?
- Fuel mapping and modeling at landscape scale that include inventories of the most relevant values at risk along with wildfire spread models to assess wildfire risk.
- Incorporating Potential Operational Delineations (PODs) and Potential Control Lines (PCLs) in long-term management—what are opportunities, pitfalls, and needs?
- Tools and simulations to show how landscapes and reburn outcomes might differ on the landscapes today if previously suppressed widlfires had been allowed to burn, and advancements in tools to better identify opportunities for safe and beneficial fire use.

Emergent project from the workshops:

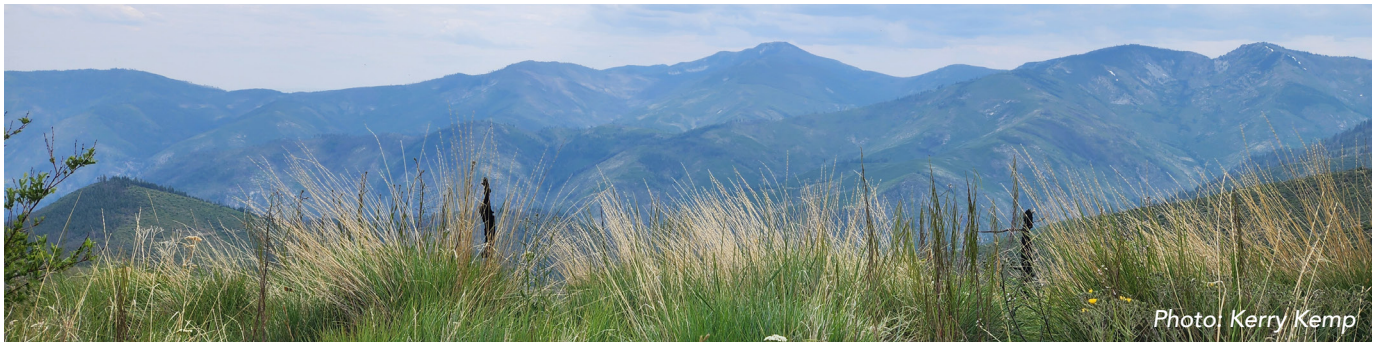
During the 2024 workshop, a senior agency forest ecologist talked first-year graduate student about her interests and potential research projects. The ecologist then suggested landscapes that would work well to investigate questions that the student was interested in, and the student ultimately chose to do her research in the DNR Chumstick to LP Planning area, using LE data to train new iLand models that she was building (instead of more generic departure analysis data that she originally planned on using). In the year between the workshops, the ecologist, the graduate student, and her faculty advisor had met regularly to provide and go over data and review results. Since the June 2025 workshop, the student has submitted proposals for additional funding and plans to continue building on the research project in ways that will provide insight to both her models and to land mangers on the Okanogan-Wenatchee National Forest.

Workshop feedback

Workshop organizers sent a post-event evaluation survey to attendees after both the 2024 and 2025 workshops and had good response rates with each effort (n=16, ~35% in 2024; n=26, ~60% in 2025). Key feedback included:

- All respondents from both years reported that the workshop was either very beneficial (78+%) or somewhat beneficial to their work in wildfire science and/or management.
- Attendees expressed strong support for having similar workshops on a regular schedule; most respondents wanted to see this workshop repeated in different locations annually, although a few respondents each year selected "every two years" as their preferred frequency.
- When asked to identify the most beneficial outcomes of the 2025 workshop, respondents most often selected: "Networking with researchers, land managers, etc." (selected by 96% of respondents), "Group discussions related to management and research presentations" (84% of respondents), and "Identifying issues facing land managers and research needs" (72% of respondents).

"I liked having some research flash talks interspersed with the information about treatments and fire effects that falls to the lands managers…the research flash talks broke things up a bit and allowed the dialog to go different directions which was fun and useful!" *— 2025 attendee*



Discussion themes and overarching questions

Together, the overviews of management and fire histories at each site and the presentations on relevant research led to many sustained discussions relevant to the themes of the workshop. Many of the discussion topics were similar to those identified during the first workshop in 2024 that more broadly explored the work of wildfire in relation to landscape resilience and post-fire management, while some new themes emerged relative to different reburn trajectories. Here we summarize the key discussion themes shared between the 2024 Colville and 2025 Okanogan-Wenatchee workshops:

- ***Fire severity and reburn pathways:*** Discussions focused on questions of fire severity in the contexts of reburns, and how fire severity of one fire event may influence the severity of the next fires on the landscape. Reburn dynamics discussed included:
  - How **high-severity wildfire** can set up vegetation and fuel loads that increase the likelihood of future high-severity events. Surface fuels such as grasses and shrubs returning to an area post burn can set the stage for a high-severity surface fire next.
  - **Low-severity fires** may not reduce biomass sufficiently and may allow biomass accumulation that contributes to higher severity in subsequent fires. Multiple low-severity entries may be necessary to restore fire regimes.
  - **Moderate-severity fire** plays a larger ecological role than is often acknowledged and has often been overlooked in fire history literature. Moderate fires kill only a portion of trees, reduce surface fuel, and create snags that may later contribute to fuel buildup. Participants discussed how moderate short-interval reburns are becoming more common and how these patterns can be modeled or observed as far back as the 1940s in some landscapes.
  - **Reburn sequencing matters**: The order of fires and associated burn severity matters: low-severity followed by a moderate- or high-severity fire will create different post-fire conditions than a high-severity fire followed by a low-severity fire.
  - **Fuel treatment effectiveness**, especially the performance of pre-fire treatments under extreme weather conditions. Questions on whether thinning or prescribed fire can truly protect legacy trees under extreme conditions.
  - **Burn severity maps**: Participants expressed concern about over-reliance on satellite-derived severity maps, particularly for second-entry fires. Severity models are trained on first-entry fire effects and may misclassify reburn severity, obscure important ground-level details such as the presence of seedlings or viable seed trees, and overlook other factors that contributed to loss such as bark beetles, drought, or increased prior surface fuels due to related mortality.
- ***Recognizing the role of high-severity wildfire in restoring landscape mosaics that include non-forest patches:*** Discussions centered on how historically, large, non-forested areas like meadows, wetlands, and cold forests helped break up fire continuity and reduce the scale of large wildfire events. However, participants discussed the need for better information and tools for helping to identify which post-fire sites might trend toward non-forest conditions or should be managed as shrublands.
- ***Post-fire management outcomes.*** *Participants focused on developing a better understanding of how post-fire forest management decisions can alter subsequent burn severity:*
  - Considerable need for **post-fire management** to capture the positive work of wildfires and restore fire regimes and forest structure. This includes greater emphasis on post-fire management in moderate-severity areas as well as planning for the next fire by identifying when and under what conditions future fire is needed.

- Management objectives that focus on supporting post-fire conditions that can remain **resilient to the next wildfire event**. Achieving this objective may require fuel reduction treatments in some post-fire landscapes to promote low-severity reburning, but there can be uncertainty about where and when to prioritize these treatments over treatments in unburned forests.
- Management reflections including **staff and funding limitations**, how fires in other areas often draw resources away from planned work, and how an entire NEPA process often needs to be revisited when a fire occurs in a planning area.
- **Policy considerations**, including addressing NEPA planning and other barriers to implementing rapid post-fire management in moderate-severity portion of fires. Accelerate reforestation in areas determined to have high reforestation needs, or that are unlikely to recover on their own without management intervention.

- ***Restoration and climate-adaptation work in higher-elevation, cold forests.***
  - Discussion focused on how mature and old forests have historically helped break up fire continuity and reduced the scale of large wildfire events as natural buffers (meadows, wetlands, etc.) have allowed cold forests to remain intact under frequent fire. Cold forest systems often have thin-barked trees species and relatively low canopy heights, which increases surface-to-crown fuel connectivity and crown fire vulnerability.
  - Our commonly held assumption that cold forests historically had primarily high-severity, low-frequency fire regimes needs to be re-examined. Based on contemporary burn severity in cold forests and new understanding of these forests, including Indigenous fire stewardship, it is likely that cold forests burned more frequently with a more balanced mix of severities.

- ***Social and economic context.*** Discussion highlights included:
  - The 2014 Carlton Complex Fire was a major event that changed the management landscape of the Okanogan-Wenatchee forest.
  - The importance of considering human use of fire by Indigenous communities that has affected the landscapes and fire histories for a very, very long time.
  - Considerations for smoke tolerance and air quality constraints when planning management actions, including prescribed fire.
  - The importance of establishing clear science-management communication pathways and aligning tools.

- ***Institutional and policy factors.*** Discussions in both 2024 and 2025 workshops focused on the same general topics: Green restoration and post-fire actions are typically planned separately and with different policy and management requirements, making it challenging to integrate them through longer-term, holistic, adaptive management approaches. Replanting requirements for sites "suitable" for timber cultivation can drive reforestation versus potentially more climate-adaptive, landscape-scale approaches such as leaving and enhancing non-forest for heterogeneity.

New discussion themes in 2025:

- ***Fire refugia:*** Fire refugia, locations with relatively less frequent or severe fire than surrounding areas, are more likely on north-facing slopes, in valley bottoms, at stream intersections, and in moist settings. Fire refugia provide natural buffers that limit fire spread and may persist across multiple fire events, particularly when key features are stacked in a single location. However, open questions remain about whether refugia truly persist in place or shift across the landscape over time, and some models trained on recent high-severity fires suggest that <1% of refugia are likely to persist under extreme fire weather.

- ***Historic reference conditions:*** In many places, management is moving beyond historical reference conditions and toward considering a "future range of variation" as a result of climate change, the need for adaptive management, and shifting landscapes on the ground.

- ***Science-management partnerships:*** Stronger science-management partnerships are essential to change forest structures, fire regimes, and outcomes on the ground. Participants encouraged a stronger shift toward coordinated science and manager communication, collaboration, and planning can work together and adapt in real time to offer additional capacity and critical, timely insights.

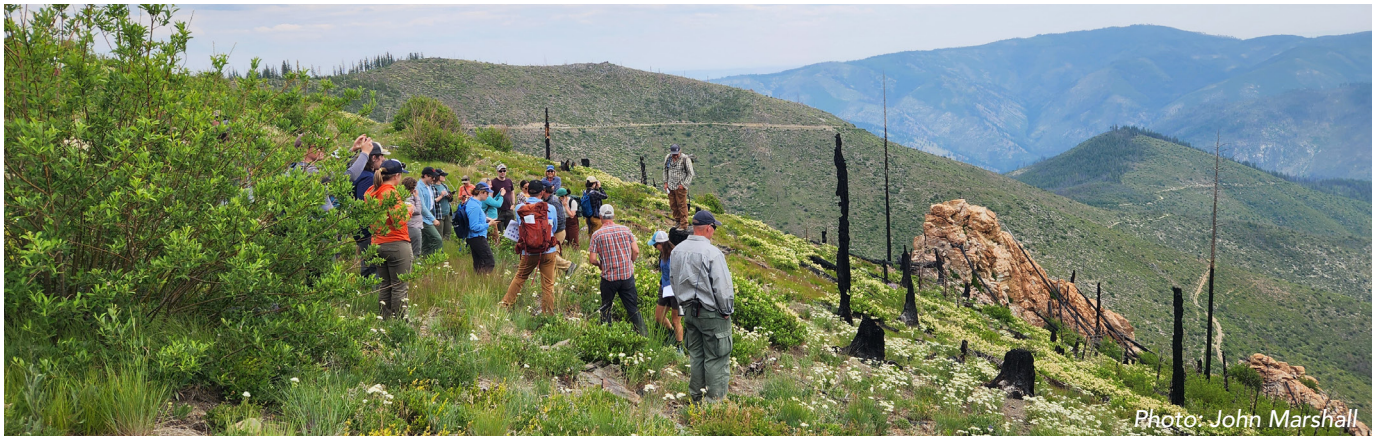


Photo: John Marshall

Bridging science and management

At the final site, participants broke into three groups to have targeted discussions on needs and opportunities for enhanced cooperation between scientists and managers that could benefit both ongoing research and management on the observed landscapes. Key takeaways across the groups included:

1. **Strengthen two-way communication & co-production.**
   - Managers and researchers both emphasized trust, consistent communication, and co-production of plans and knowledge.
   - Scientists should spend time in the field to learn how planning and implementation work on the ground.
   - Managers suggested "Adopt-a-Scientist" or "Dial-a-Manager" programs to increase mutual understanding.
   - Science communication should move beyond academic papers toward usable, scenario-based insights that fit real decision timelines whenever possible.

2. **Make tools and models usable and relevant.**
   - Managers can get overwhelmed by too many models and need refined, practical tools that are intuitive and regionally relevant.
   - There is a need for simplified fire modeling tools that include moderate (not only extreme) scenarios.
   - Researchers can provide clearer guidance on when and how tools should be applied during different management phases.
   - Better integration of HRV (Historical Range of Variation) and FRV (Future Range of Variation) models to guide restoration in a changing climate.

> ***"I really appreciated the small group discussion at the end of the second day. I would also like more of this activity in the future, especially if groups were randomized and discussions were scattered throughout the day."***
>
> *— 2025 attendee*

3. **Accelerate science-to-action during wildfire and post-fire phases.**
   - Managers shared that science is often easier to use in planning and fuels work than during and right after active fire incidents.
   - Managers need faster post-fire assessments to inform timely decisions and help landowners.
   - Even limited use of new science during fires can have big impacts—e.g., slowing spread or improving recovery outcomes.

4. **Prioritize targeted research needs for fire and vegetation management, including:**
   - Treatment effectiveness over time—how long do treatments last, when should they be maintained or re-done.
   - Reburn and planting dynamics—when and where to plant after one or multiple burns.
   - Treatment intensity, spacing, and interval research to optimize landscape-scale planning.
   - *Ceanothus* control—scientific validation of anecdotal management methods (e.g., repeated burning).
   - Shaded fuel break maintenance—guidance on timing and longevity of older structures.

5. **Build practical collaboration and capacity support.**
   - Managers want research that can help prioritize prescribed fire and allocate limited funds more effectively.
   - Researchers can assist through decision-support tools, workshops, and embedded partnerships.
   - Recognize long-standing collaborative relationships (e.g., DNR-PNW Research Station) to build from.

Future workshops:

Based on the success of both the 2024 and 2025 workshop and enthusiastic feedback from participants, both WA DNR and NWFSC are interested in organizing additional workshops in subsequent years with rotating themes and locations. Other organizations interested in supporting or participating in future workshops are welcome. WA DNR and NWFSC are planning the next Washington meeting and workshop in June 2026.

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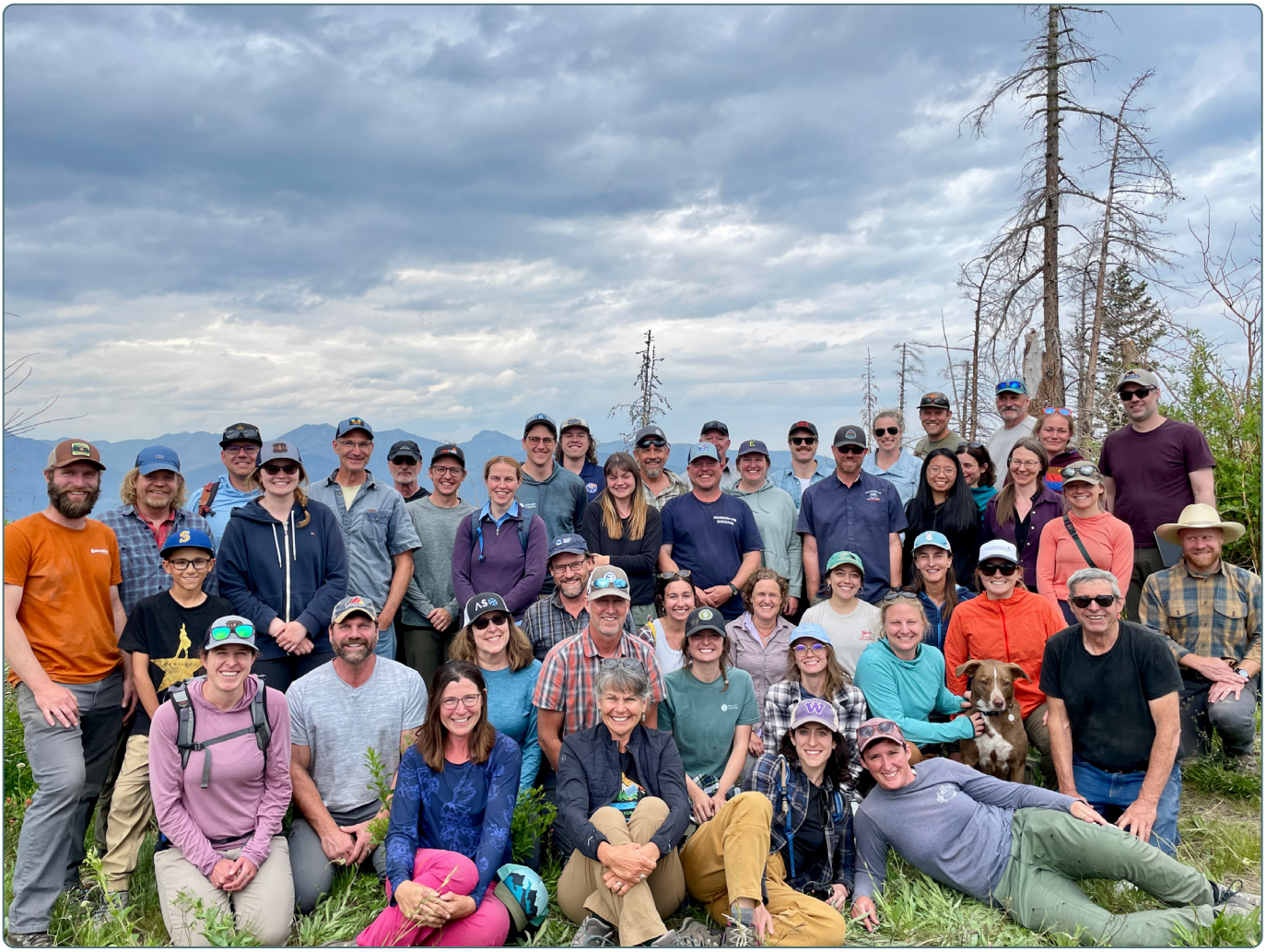
> ***"Thank you to everyone that put this workshop together. It is such a great place to get together and have conversations about wildfire and treatments."***
>
> *— 2025 attendee*



Attendees of the 2025 workshop at the final stop overlooking Lake Chelan. Photo by Garrett Meigs.

The Northwest Fire Science Consortium works to accelerate the awareness, understanding, and adoption of wildland fire science. We connect managers, practitioners, scientists, and local communities and collaboratives working on fire issues on forest and range lands in Washington & Oregon. To learn more: www.nwfirescience.org/