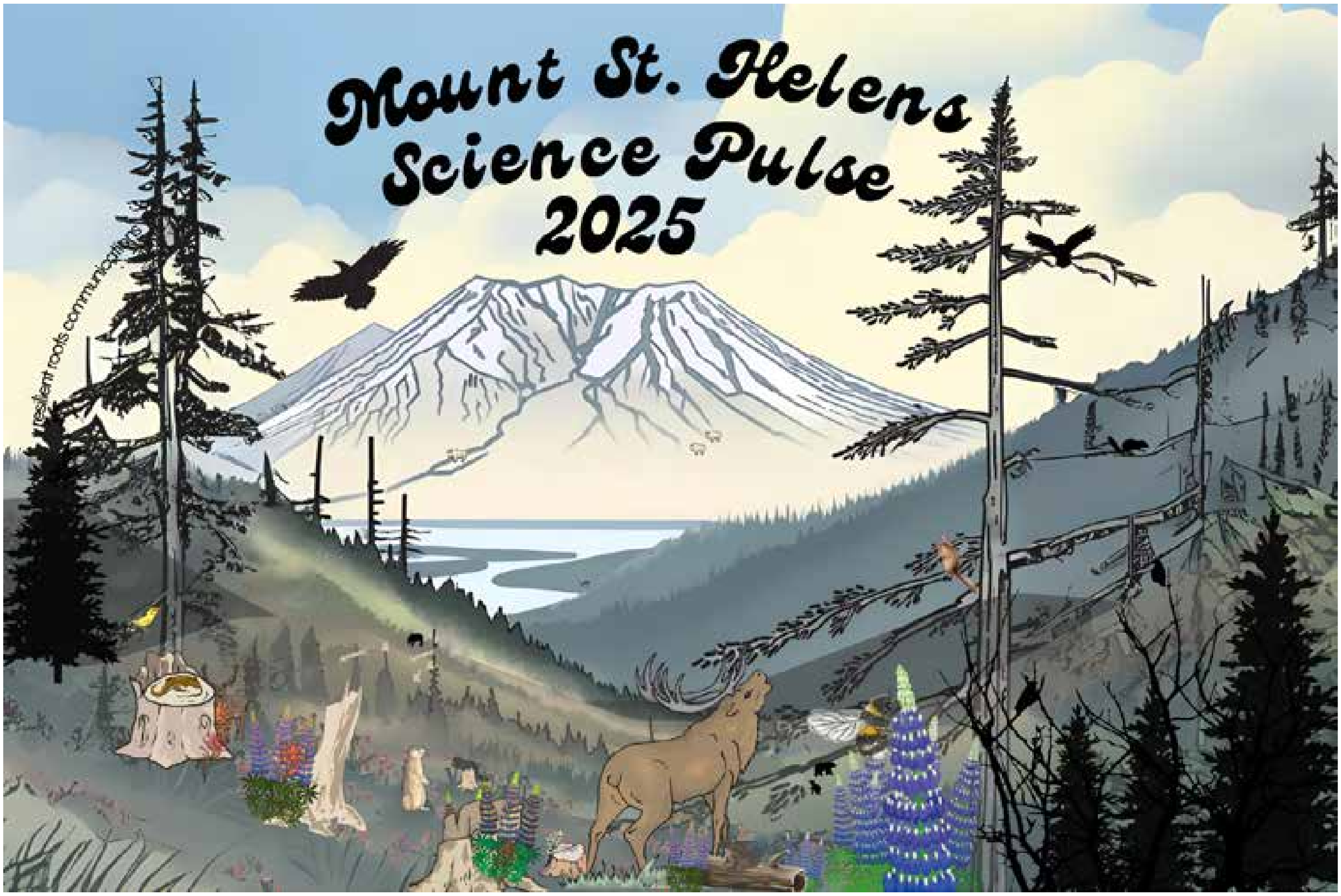

Friday 18 July–Tuesday 22 July 2025

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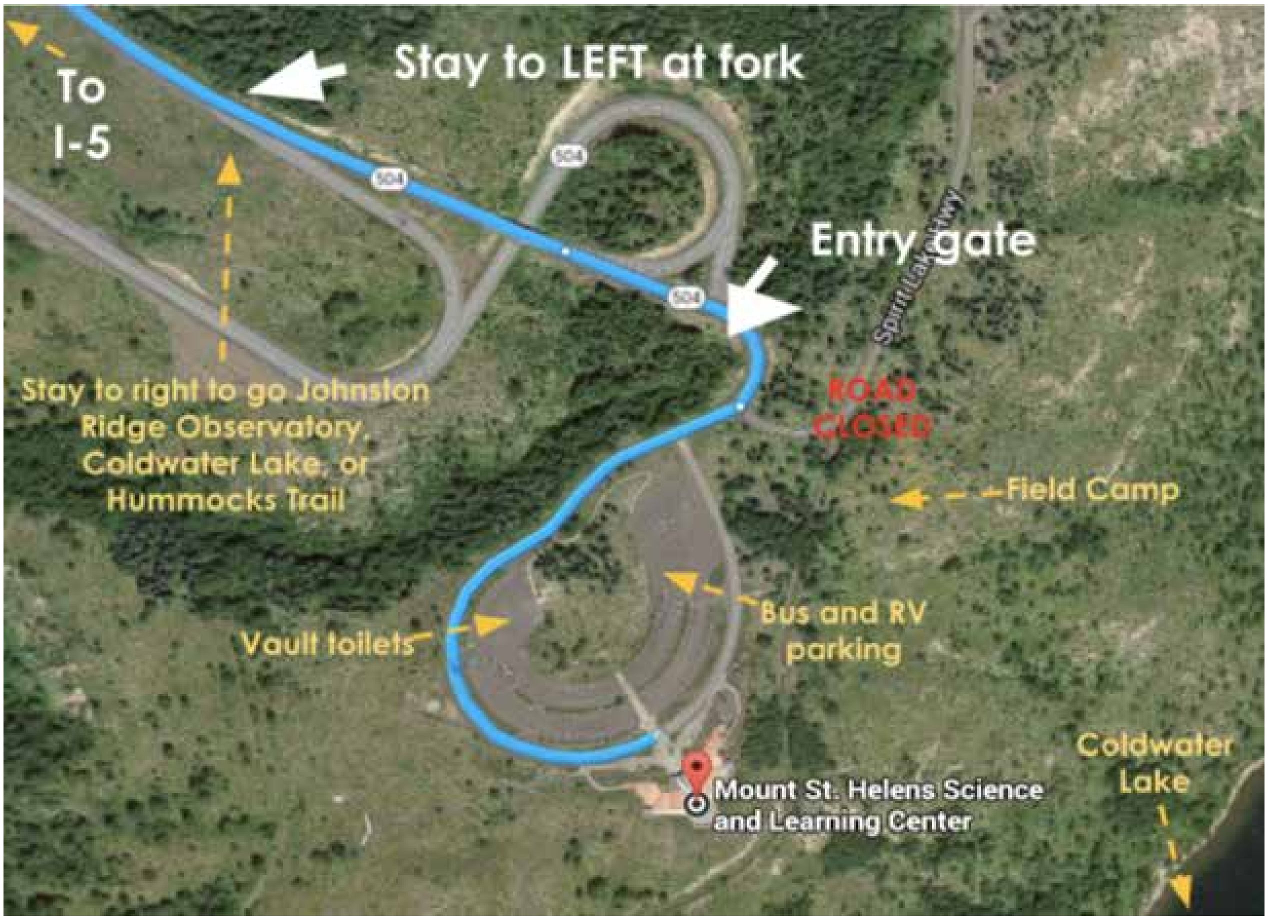
Hosted by:

MOUNT ST. HELENS
INSTITUTE

Cover art: Katey Queen

Design and layout: Kathryn Ronnenberg
USFS PNW Research Station

Facilities and Logistics



Coldwater Science and Learning Center vicinity with facilities available to Pulse participants and activity locations. Map courtesy of Mount St. Helens Institute.

Details of facilities and services available, along with camp rules, can be found in your Mount St. Helens Institute Pulse information packet.

Meals: all meals will be served in the dining hall at the SLC.

Presentations and evening events: all presentations and evening events will occur in the atrium at the SLC.

Field trips: All field trips will meet in front of the SLC.

Participating Agencies:

USDA

FOREST SERVICE U S DEPARTMENT OF AGRICULTURE

USGS science for a changing world

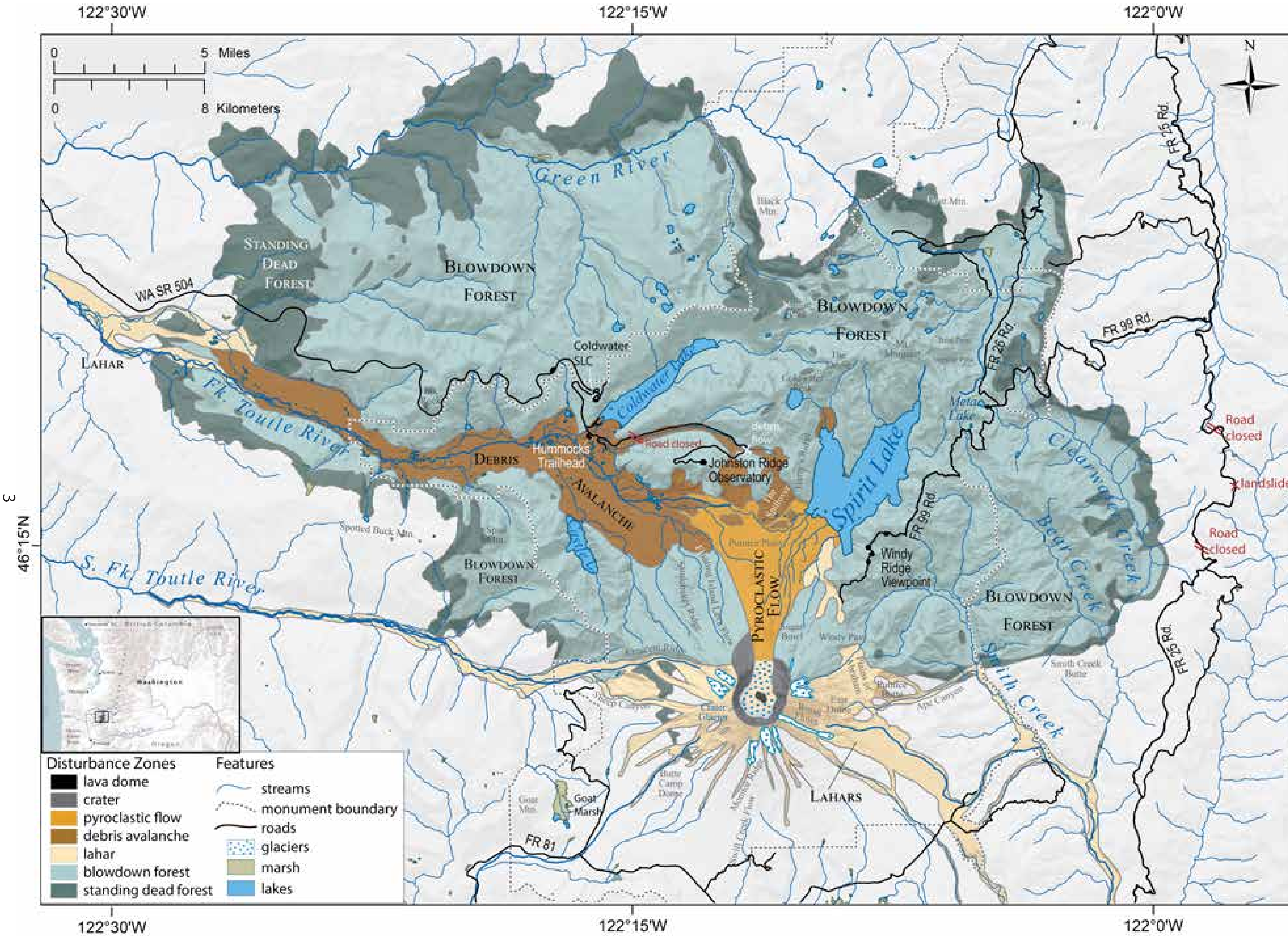


Figure 1. Mount St. Helens vicinity, features, and disturbance zones.

Schedule of Activities

Day 1: Friday 18 July

Time	Activity
10:00–16:30	Coldwater Visitors Center opens 10AM for anyone that wants to arrive early (self guided)
16:30–19:00	Attendee Check-in at Science and Learning Center Nametags, handouts for field trips, schedule, and sign ups
18:00–19:30	Dinner (SLC dining hall)
19:30–20:00	Cowlitz Forever People Tribal Welcoming (SLC atrium) *Introduction:* Suzanne Donaldson / Bald Eagle Woman, Cowlitz Indian Tribe Citizen *Title:* Sacred Land: The Cowlitz Indian Tribe and its spiritual connection to Mount St. Helens
20:00–21:30	Attendee Introductions (SLC atrium)

Day 2: Saturday 19 July

Time	Activity
07:00–08:00	Breakfast / Field trip prep (breakfast on-site or to-go, packed lunch) in the SLC dining hall
07:00–09:00	Attendee Check-in at Science and Learning Center for late Friday arrival Nametags, handouts for field trips, schedule, and sign ups
08:00	**JRO/Pumice Plain View field trip departs SLC parking lot**. Co-leads: Jon Major, Shannon Claeson, Carri LeRoy, Jim Gawel, Katey Queen See field trip handout for details (page 15).
08:30	**Toutle River Recovery and Management Tour departs SLC parking lot**. Co-leads: Colin Thorne, Jesse Burgher, Josua Holowatz, Donald Brown, Sarah Koppelman See field trip handout for details (page 17).
16:00–16:30	SR504 Toutle River Management and JRO/Pumice Plain field trips return to SLC
17:00–18:00	Seminar: Managing anadromous fish in the North Fork Toutle River basin (WDFW)
18:00–19:30	Dinner (SLC dining hall)
19:30–20:00	Mount St. Helens Institute: Mission and programs overview; opportunities for scientists to participate in programs; community science opportunities (SLC atrium)
20:00–21:30	Seminar: Historical perspectives on Mount St. Helens land, protection, and research. Presenter: Virginia Dale, University of Tennessee Knoxville (SLC atrium)

Day 3: Sunday 20 July

Time	Activity
07:00–08:00	Breakfast/Field trip prep (breakfast on-site or to-go, packed lunch)
07:30	**Blast Zone Tour departs SLC parking lot**. Co-leads: John Bishop, Mark Swanson, Pat Pringle, Peter Frenzen, Donald Brown, Sarah Koppelman. See field trip handout for details (page 19).
09:00	**Debris Avalanche Hike field trip departs SLC parking lot**. Co-leads: Virginia Dale, Elsie Denton, Katey Queen See field trip handout for details (page 21).
17:00	Debris Avalanche Hike field trip returns to SLC
18:00	FR99 Blast Zone Tour returns to SLC
18:00–19:30	Dinner (SLC dining hall)
19:30–20:00	Special event (SLC atrium)
20:00–21:30	Networking: Connecting established and new scientists

Schedule of Activities

Day 5: Monday 21 July

Time	Activity
07:00–08:00	Breakfast / Presentations prep (SLC dining hall)
08:00–18:00	Optional Goat Marsh self-guided tour. See field trip handout and driving directions (page 23).
	Note: All presentations and workshops will take place in the SLC atrium Abstracts for presentations begin on page 7, in order presented.
08:00–09:22	**Presentations: Completed Studies**
08:00–08:05	Welcome and moderator reminders — Tara Chestnut
08:05–08:17	Headwater stream assemblages across the Pumice Plain — Shannon Claeson
08:18–08:30	Highly variable physical and biological characteristics of hyporheic zones among young Pumice Plain streams — Deb Finn
08:31–08:43	Terrestrial-aquatic interactions in early-successional streams on the Pumice Plain — Carri LeRoy
08:44–08:56	Temporal and spatial hydrological variation in ponds created by the Mount St. Helens eruption — Angela Strecker
08:57–09:09	Contribution of log mat periphyton to benthic productivity at Spirit Lake, Mount St. Helens National Volcanic Monument, WA, USA — Kena Fox-Dobbs
09:10–09:22	Invertebrate herbivores and nitrogen addition influence soil carbon and nitrogen and the soil microbial community of a developing soil — Becca Evans
09:22–09:32	*Break*
09:32–10:36	**Presentations: Long-Term Monitoring**
09:32–09:44	Greening the SRS sediment plain on the NF Toutle River: If not now, when? — Colin Thorne
09:45–09:57	Long-term monitoring of vegetation using permanent plots on the debris avalanche deposit — Virginia Dale
09:58–10:10	Ten-year exclusion experiment demonstrates strong facilitation by *Lupinus lepidus* and countervailing effects of insect herbivores on Mount St. Helens' Pumice Plain — John Bishop
10:11–10:23	Recent developments on the upland secondary succession plot system at Mt. St. Helens, Washington: change in both vegetation and measurement approach — Mark Swanson
10:24–10:36	Forest plant growth forms and resilience over 40 years at Mount St. Helens — Dylan Fischer
10:36–10:46	*Break*
10:46–12:03	**Presentations: In-progress Studies**
10:46–10:58	Current USFS PNW Research Station ecological research and monitoring activities at Mount St. Helens — Donald Brown
10:59–11:11	Succession modeling on Mount St. Helens — Steven Quick
11:12–11:24	Multiple trajectories of land-cover change: disturbance severity influences patterns 40 years after the eruption of Mount St. Helens — Elsie Denton
11:25–11:37	Colonization and trophic integration of the New Zealand Mud Snail in Spirit Lake, Mount St. Helens, WA — Jim Gawel
11:38–11:50	Mount St. Helens ponds reveal contrasting zooplankton responses to leaf litter and browning across experimental and observational studies — Katey Queen
11:51–12:03	Post reintroduction movements of an extirpated mesocarnivore – lessons from habitat models and inclusive collaboration — Tara Chestnut

Schedule of Activities

Day 5: Monday 21 July (continued)

Time	Activity
12:03–13:00	*Lunch (SLC dining hall)*
13:00–13:30	**Special Event**
13:30–18:00	**Workshop: Revitalization & Synergy**
13:30–14:45	Workshop Session 1
15:00–16:15	Workshop Session 2 (breakout sessions will spread out around the SLC)
16:30–17:45	Workshop Session 3
18:00–19:30	Dinner (SLC dining hall)
19:30–20:00	Tribute to Jim MacMahon (SLC atrium)
20:00–21:30	Campfire: Pictures and stories from Mount St. Helens—Tall tales and some truths

Day 6: Tuesday 22 July

Time	Activity
07:00–08:00	Breakfast (SLC dining hall)
08:00–10:00	Share table groups (rose, root, seed, and thorn experiences) Last-chance networking
09:30–10:00	Group check-out
10:00	Coldwater Visitors Center opens for anyone who wants to stay (self-guided)
10:00	2025 Pulse adjourns

Mount St. Helens 2025 Pulse Presentation Abstracts

*For multi-author presentations, the presenter is denoted with *.*

Completed Studies

1. Headwater stream assemblages across the Pumice Plain. Shannon Claeson*, *USDA FS PNWRS, WA*; Carri LeRoy, *The Evergreen State College, WA*; Debra Finn, *Missouri State University, MO*; Rosalina Stancheva Christova, *George Mason University, VA*; Emily Wolfe, *Portland State University, OR*.

The goal of this study was to determine if riparian and lotic assemblages at an early successional stage were similar among neighboring catchments and showed predictable change along longitudinal gradients within catchments. In July 2016, we characterized environmental conditions and riparian, algal, and benthic macroinvertebrate assemblages at 21 stream reaches distributed within and among 5 catchments. We found minimal evidence that longitudinal gradients had developed within catchments. Increases in diatom and macroinvertebrate richness with downstream distance were the only biological responses with longitudinal trends. Conversely, we documented substantial variation in community structure of riparian plants, soft-bodied algae, diatoms, and macroinvertebrates at the among-catchment scale. Catchment differences consistently separated two eastern catchments from three western catchments, and these two groups also differed in stream water chemistry, temperature, geomorphology, and disturbance regime. Overall, we documented greater diversity in the young catchments than predicted by ecologists in the years soon after the eruption, yet functional traits indicate that these catchments are still in relatively early stages of succession. Similar to new stream channels formed following glacial retreat, our results support a tolerance model of succession in streams. However, contrasting abiotic templates among Pumice Plain catchments appear to be driving different successional trajectories of stream assemblages among neighboring small catchments sharing the same catastrophic disturbance history.

2. Highly variable physical and biological characteristics of hyporheic zones among young Pumice Plain streams. Debra S. Finn*, *Missouri State University*; Shannon M. Claeson, *USDA Forest Service, Pacific Northwest Research Station*; Iris Garthwaite, *The Evergreen State College*; David Fleshman, *Missouri State University*; Carri J. LeRoy, *The Evergreen State College*.

Pumice Plain streams provide a rare opportunity to study streams undergoing ecological primary succession. Prior to this study, we knew that benthic invertebrate assemblages in these streams were unexpectedly diverse ~35 years after the 1980 eruption and varied substantially among streams. Here, we emphasized the hyporheic zone (HZ), a subsurface ecotone where stream surface water mixes with true groundwater. Stream HZs provide unique habitat and act as hotspots for biogeochemical cycling. We asked if differential development of HZs among streams could help explain the observed variability in benthic invertebrate assemblages. In 2019, we measured several abiotic variables and collected HZ invertebrates from 4 Pumice Plain streams that varied substantially in successional trajectories. Notably, the stream subsurface was accessible to just ~30 cm below all streambeds due to a nearly impermeable layer of compacted ash. HZ invertebrate assemblages were low-diversity subsets of the benthos and lacked true groundwater taxa. Densities of HZ invertebrates varied by >2 orders of magnitude among the streams, and the stream with greatest density and richness had large median particle size, a stable bed, dense woody riparian vegetation, and was dominated hydraulically by downwelling. Following previous observations, streams occupying eastern vs western sectors of the Pumice Plain were strongly differentiated biotically and abiotically. Water stable isotope data indicated hydrological source differences, with eastern streams likely fed directly by glacier melt and western streams by warmer groundwater sources associated with the crater. All streams showed evidence of bed aggradation through our 5-month study period, indicating ongoing channel evolution. We are left with interesting questions, including whether a true HZ yet exists in Pumice Plain streams, given the impermeable boundary in the shallow subsurface and lack of evidence for groundwater connections. Continued observation can provide novel insight into both ecological succession and physical channel evolution.

3. Terrestrial-aquatic interactions in early successional streams on the Pumice Plain. Carri LeRoy*, *The Evergreen State College [TESC], WA*; Shannon Claeson, *USDA FS PNWRS, WA*; Joy Ramstack Hobbs, *Science Museum of Minnesota, MN*; Debra Finn, *Missouri State University, MO*; Iris Garthwaite, Madeline Thompson, Lauren Thompson, Brandy Kamakawiwoo'le, Marisa Fischer, Addison Leigh, Angie Froedin-Morgensen, Sorrel Hartford, Victoria McConathy, Jordan Moffett, Logan Lancaster, Nichole Criss, *all from TESC*; Lauren Walker, *Lewis and Clark College*; Christine Albano, *Desert Research Institute, NV*; Gina Wimp, Charles Minsavage-Davis, *Georgetown University, DC*; Rosalina Stancheva, *George Mason University, VA*; Rebecca Evans, *Washington State University-Vancouver, WA*; Sabrina Heitmann, Posy Busby, *Oregon State University, OR*; John Bishop, *Washington State University-Vancouver, WA*.

The early successional streams on the Pumice Plain of Mount St. Helens are developing riparian cover of willow and alder. For the Sitka willow (*Salix sitchensis*) in particular, the habit of dioecy (sex determination in plants) is influencing riparian development in interesting ways. Early surveys of the Pumice Plain found a 2:1 female:male establishment ratio that has persisted on the landscape (based on surveys in 2018/2019), as well as patterns showing female willows tend to establish nearer to stream edges than males (LeRoy et al. 2020). Several studies have shown that female willows are more likely to be infected by a stem-boring weevil (*Cryptorhynchus lapathi*) and clear-wing poplar moth (Paranthrene robiniae), potentially increasing the quantity of deadfall leaf litter inputs into Pumice Plain streams along with reproductive inputs like flowers and seeds, which have proven important to early successional stream communities (Garthwaite et al. 2021). These herbivores alter willow leaf chemistry (Ramstack Hobbs et al. 2022) and along with sex-based differences in litter quality, can influence leaf litter decomposition dynamics and both microbial and macroinvertebrate detritivores in streams (LeRoy et al. 2024). The extent of willow/alder riparian zones have expanded since the eruption, with dramatic growth in the years 2009 on, and the presence of riparian cover can alter organic matter processing both on land and in the adjacent stream (LeRoy et al. 2023). Finally, the development of willow riparian and upland shrubs has created a patchwork during primary succession that shows how landscape-scale connectivity of vegetation can influence metacommunity assembly of a range of host-associated insects and other leaf-modifiers (Minsavage-Davis et al. 2023). Taken together, this suite of research demonstrates various influences of dioecy and willow-insect interactions on the communities and ecosystem functions of early successional streams on the Pumice Plain.

4. Temporal and spatial hydrological variation in ponds created by the Mount St. Helens eruption. Angela L. Strecker*, *Western Washington University*; Heather A. Sauer, *University of Regina*; Peter R. Leavitt, *University of Regina*; Meredith A. Holgerson, *Cornell University*

Freshwater ponds are prevalent globally and provide critical ecosystem functions, yet little is known of their hydrologic processes early in their ontogeny, i.e., their natural development. Here, we analyze water isotopes ($\delta 2H$, $\delta 18O$) to characterize the hydrology of ponds created by the Mount St. Helens eruption, examining the extent of spatio-temporal variation of pond water budgets, and how interactions between climate and landscape features regulate local hydrology. Pond water was sampled in spring 2015, 2017, and 2018, as well as summer 2018, for isotopic analysis. Other variables were measured in situ (water temperature, specific conductance), collected from data sources (meteorological variables), or quantified with remote sensing (vegetation). Mass balance models characterized the water balance of ponds (evaporation: inflow; E:I), as well as water sources (rain, snow). We observed high inter-annual variability (as Bayesian ellipses) in the spatial variation among ponds, with variation in the importance of rain and snow in relatively dry years, and uniform spatial importance of snow in wetter years. Spring E:I was correlated negatively with total precipitation, whereas the importance of evaporation in summer varied with pond morphology, with large shallow ponds exhibiting the greatest evaporation. Water balance also varied with the degree of terrestrial development (as pond DOC), with evaporation being a more substantial control of pond hydrology in regions with high DOC influx. Our study shows that simple metrics of basin morphometry can predict seasonal changes in pond hydrology and allow managers to estimate pond sensitivity to future climate conditions.

5. Contribution of log mat periphyton to benthic productivity at Spirit Lake, Mount St. Helens National Volcanic Monument, WA, USA. Kena Fox-Dobbs* and Emma Sevier, *University of Puget Sound, Department of Geology*; Avery Cook Shinneman and Angelica Lucchetto, *University of Washington – Bothell, School of Interdisciplinary Arts and Sciences*; Jeremy Davis and James E. Gawel, *University of Washington – Tacoma, School of Interdisciplinary Arts and Sciences*.

Spirit Lake, in southwest Washington, USA, was changed as a result of the 1980 eruption of Mount St. Helens. The lake morphology was altered by debris flows and the water was sterilized of most living organisms. Trees felled by the lateral blast and subsequently washed into the lake comprise a floating log mat which now covers 20% of the lake's surface area, providing a novel substrate for benthic productivity. By investigating the succession in this volcanic landscape's rapidly recovering aquatic ecosystem, our research specifically addressed the following questions related to the role of the floating log mat and associated benthic periphyton on sedimentary inputs of organic material: (1) Do patterns of log mat occupancy and related deposition of benthic periphyton correlate to spatial variation in organic sedimentary inputs? (2) Has benthic productivity changed over the lake's 40-year history since the initial establishment of the log mat? To address our questions, we analyzed biological and geochemical data derived from sampling the floating logs, sediment traps in the water column, a set of shallow sediment samples, and collected two sediment cores in areas of differing log mat occupancy. We used carbon and nitrogen elemental concentrations and stable isotope values of sediment organics to estimate the relative contributions of organic source materials (phytoplankton, macrophytes, periphyton) and diatom assemblages to infer information about changes through time. We found that spatial trends in sources of sediment organics corresponded to patterns of floating log mat occupancy, with higher contributions of periphyton-derived biomass in areas with more frequent log presence. These results provide insight into the dynamic role of log mat-derived productivity in the ongoing recovery and evolution of the Spirit Lake ecosystem. Our findings also underscore the importance of understanding and managing coarse woody debris in oligotrophic lakes as a substrate for benthic primary productivity that supports the whole lake ecosystem.

6. Invertebrate herbivores and nitrogen addition influence soil carbon and nitrogen and the soil microbial community of a developing soil. Rebecca Evans* and John Bishop, *Washington State University*; Mailea Miller-Pierce, *Oregon Department of Environmental Quality*.

Soil carbon (C) and nitrogen (N) accumulation in developing ecosystems are shaped by interactions between biotic and abiotic drivers. We tested how insect herbivory and nitrogen (N) addition influence plant growth, soil development, and microbial community structure in primary and secondary successional sites at Mount St. Helens, WA, USA.

Using an eight-year factorial experiment with stem-boring weevil (*Cryptorhynchus lapathi*) exclusion and three N-addition levels, we found that herbivore exclusion dramatically increased *Salix sitchensis* (Sitka willow) growth in primary succession (160% over controls; 310–420% when combined with N). Plot-level soil C and N showed minimal changes, but beneath individual willows, exclusion increased soil C by 40% and enhanced litter, herbaceous biomass, and coarse organic matter. Structural equation models revealed that N addition indirectly increased soil C via enhanced willow growth, but had no effect on soil N. No treatment effects were observed in secondary sites.

Amplicon sequencing (ITS2, 18S, 16S) showed that herbivore exclusion shaped microbial communities, particularly in primary succession. Fungal evenness and Shannon diversity increased under exclusion, while AM fungal community composition in roots shifted significantly with an interaction between herbivory and N. In secondary sites, herbivore exclusion reduced ASV richness of soil and root fungi and soil bacteria, though composition remained unchanged. N addition alone rarely affected diversity or composition, except for bacterial shifts in secondary soils.

Our results highlight that insect herbivory, more than regional-scale N deposition, governs plant performance, soil C hotspots, and microbial community dynamics in early succession. These findings underscore the need to integrate aboveground-belowground feedbacks into successional theory.

Long-Term Monitoring

1. Greening the SRS sediment plain on the NF Toutle River: If not now, when?

Colin Thorne*, *Wolf Water Resources, WA - CThorne@wolfwaterresources.com*; and Josh Townsend, *jrtownsend8@gmail.com*; Matthew Stothard, *matthewstothard03@gmail.com*,
Harry Noon, *harry_noon@outlook.com*; and Liam Clark, *Liam.Clark1@nottingham.ac.uk, all affiliated with The School of Geography, University of Nottingham, UK*

In 1988 the US Army Corps of Engineers completed construction of the Sediment Retention Structure (SRS) on the NF Toutle River. Its purpose is to trap and permanently store sediment eroded from the 1980 debris avalanche and mudflow. During its first decade, sediment filled the 'dead storage' below the crest elevation of the spillway and the trap effciency of the SRS was high (~8.8 million cubic yards/year). At that time, Phase 1 of its mission to store sediment was complete. In Phase 2 it was expected that the river would rebuild its gradient to a value about half that of the river prior to construction of the SRS. This started to happen, but trap efficiency declined to about 2.2 million cubic yards/year. In 2009, the USACE organised an expert workshop to identify options for enhancing sediment management in the Toutle-Cowlitz system. One option identified was to build grade by forcing flow on the sediment plain to eddy and deposit sediment that would vegetate and create islands. In 2010, 14 large, engineered log jams (ELJs) were built to test their effectiveness. Since 2013, Nottingham University staff and students have monitored the performance of these ELJs. Initial results were discouraging: islands formed but were reworked as the river swept back and forth across the braid plain. However, in 2017 island formation took off and by 2022 vegetation was flourishing. In late-2022 beaver dams were spotted in the Wall Base Channel adjacent to the ELJs. In summer 2023, detailed investigations identified further beaver dams in Pullen Creek, Smith Creek, and on the sediment plain itself. Not only are the ELJs and beaver roughening the sediment plain and improving its trap efficiency, they are also greening it. In summary, by allowing vegetation to take hold, the ELJs are achieving their objective of building islands and retaining sediment, and beaver are accelerating that process. Now the Corps plan to increase phase 1 sediment storage by raising the spillway. This will create a relatively small volume of additional storage, while killing vegetation and potentially driving away the beaver. Only one further spillway raise is feasible. After that the sediment plain must be greened to unlock phase 2 storage, which dwarfs that gained by the planned spillway raise. Sometime, the sediment plain must be greened; if not now, when?

2. Long-term monitoring of vegetation using permanent plots on the debris avalanche deposit.

Virginia Dale* and Elsie Denton, *University of Tennessee Knoxville*.

The debris avalanche deposit consists of about 2.8 billion m^3 of the mountain that rushed down the north side of MSH and spread over 60 km^2 and extends 25 km from the crater into the North Toutle River valley. The heterogeneous topography of the deposit averages 45 m thick, with a maximum depth of 195 m. In the summer of 1980, my team surveyed much of the deposit for plants and only found a few vegetatively propagating plants near the margins. In 1981 and 1982, my team established 103 250-m^2 plots on the debris avalanche deposit, and 82 plots still remain in spite of massive erosion. In 1980, the United States Soil Conservation Service (SCS, now NRCS) aerially seeded using mostly non-native species over the western end of the debris avalanche —including 11 of our plots. This was an unsuccessful attempt to stabilize the recently emplaced volcanic substrates and to promote plant recovery.

My team has measured plant cover, composition, and percentage of bare ground, litter, and moss/lichen cover as well as information on the trees, soils, and microtopography in these plots ten times from 1981 to 2022. The debris-avalanche deposit has undergone extensive vegetation development. Plant species richness increased in the first 30 years since the eruption and continues to increase, as is expected for primary succession. However, cover of herbaceous vegetation plateaued at around 50% after year 20. In future years, ground cover may decrease as the overstory canopy closes, altering the light regime. The dominance of early-seral species has declined with time. Year 30 appears to have been a transition year, with species that are found in forest understories becoming more common. The present tree community is largely red alder (*Alnus rubra*), but all tree species associated with the surrounding conifer forests are present and are expected to eventually dominate the area.

3. Ten-year exclusion experiment demonstrates strong facilitation by Lupinus lepidus and countervailing effects of insect herbivores on Mount St. Helens' Pumice Plain. John Bishop*, James Moore, and Rebecca Evans, *Washington State University*.

Observational studies inferred that facilitation by *Lupinus lepidus* (Fabaceae) (hereafter, lupin) was inferred to be critical for establishment of plant communities on the Pumice Plain while specialist insect herbivores delayed facilitative effects. We took advantage of a 2006 debris flow that re-initiated primary succession over 0.4 km^2 to investigate whether strong facilitative and consumer effects recur, and to more rigorously identify their effects. To do so we excluded lupin or its leaf-feeding herbivores in a set of 100-m^2 plots for 10 years, beginning in 2013. We also quantified lupin cover and herbivory in permanent transects from 1998–2022. Lupins and their leaf-feeding herbivores more rapidly colonized 2006-initiated surfaces than previously occurred on 1980-initiated surfaces. As in earlier studies, leaf-miner damage reached high levels, exceeding 60% defoliation, but on average was lower than in the 1990s. Leaf miners were extirpated from our sites by the June 2021 heat event. Exclusion of folivores resulted in more rapid increase in lupin (to 35% cover by year 6, vs 17% cover in controls), and buffered against population pathogen and herbivore induced collapses. Lupin and leaf-miner exclusion strongly affected plant community assembly and soil development, while leaf-feeding herbivores partially suppressed that effect. The moss *Racometrium canescens* reached 59% in spray plots, compared to 32% in controls, and only 9% in lupin exclusions. Vascular plant cover (omitting lupin) in the lupin and herbivore exclusion plots was 16% and 2%, vs 6% in controls. Soil C and N in lupin exclusions was about 50% of the C and N of that in control plots, which in turn were ~50% of herbivore exclusion soils. In conclusion, both observational and experimental data indicate that specialist insect herbivores continued to have strong suppressive effects in newly initiated communities on Mount St. Helens, but these affects are diminishing as communities develop, and significantly affected by climate change.

4. Recent developments on the upland secondary succession plot system at Mt. St. Helens, Washington: change in both vegetation and measurement approach. Mark E. Swanson*, *Oregon State University*; Andres Holz, *Portland State University*; Charlie Crisafulli, *USDA Forest Service, Pacific Northwest Research Station*.

Beginning in 1981, a number of investigators established a system of plots in the secondary succession zone of Mt. St. Helens, distributed from Castle Lake in the southwest to the Upper Green River area of the blast zone. These plots tracked development of the vascular flora using 250-m^2 plots ("macroplots") arrayed along a 100-m transect, with nested 1-m^2 quadrats (8 per macroplot). Percent cover of all vascular taxa were censused in the 250-m^2 plots and in the nested 1-m^2 plots at approximately 5-year intervals or more. Owing to rapid increase in percent cover of the plant community and in vertical and horizontal structural complexity in the last decade, we are transitioning to a series of 0.25-m^2 plots arrayed along 16-m N-S and E-W transects that cross at the original macroplot centers. In addition, we have instituted tree tagging within the 250-m^2 macroplots to quantify demographic and structural change in forest trees, while also using vertical-sectioned pole surveys to catalog vertical and horizontal change in community structure. Recent remeasurements show rapid return to closed-canopy forest conditions at sites along the blast perimeter (e.g., Polar Star Mine and Ghost Creek), where a typical seral sequence with *Pseudotsuga menziesii* (Douglas-fir) and *Tsuga heterophylla* (western hemlock) is occurring. At these sites, understory plant composition is quickly trending towards shade-tolerant zonal vegetation. Plot locations in the interior of the blast zone still host either open early-seral communities dominated by early-arriving taxa such as *Anaphalis margaritacea* (pearlyl everlasting) and *Chamaenerion angustifolium* (fireweed) or forest-similar communities with an overstory of the tall shrub *Alnus viridis* (green alder) or snowbank-sheltered *Abies* (fir species). Sites that were subjected to timber harvest prior to the eruption remain more open and dominated by ruderal plant species such as grasses and the exotic aster *Hypochaeris radicata* (flatweed or false dandelion). Multiple successional trajectories are apparent, depending upon pre-eruption status (clearcut or intact forest), proximity to the perimeter of the blast zone, presence of snowbank refugia at time of eruption, and mesic conditions created by rapidly establishing tall shrub communities.

5. Forest plant growth forms and resilience over 40 years at Mount St. Helens. Dylan Fischer*, *The Evergreen State College*; Joseph A Antos, *University of Victoria*; Donald B Zobel, *Oregon State University*.

Responses of plants to disturbance are traditionally categorized using terms like resistance and resilience. At Mount St. Helens, 40+ years of measurement provide an opportunity to actually measure these variables. Our measurement of plant responses to tephra deposition from the eruption of Mount. St. Helens (USA) in 1980 has provided an excellent opportunity to evaluate trends in resilience in the forest understory. We use data from four sites and more than 600 individual plots to quantify changes in resilience among different plant growth forms to over 40 years of post-disturbance succession. Inertia (resistance) in response to disturbance is best predicted by plant deciduousness and clonality, driven by responses of non-clonal evergreen plants. Similarly, plant deciduousness provided the strongest predictive weight for post-disturbance recovery. Groups based on Raunkiaer life forms and localized growth forms had high within-group variability that made generalizations difficult. Additionally, resilience was not predictable by plant growth-form. Instead, species within plant growth-forms can demonstrate strikingly different patterns in resilience through time. Nevertheless, simple categorizations based on leaf traits (such as deciduous vs. evergreen) may play a role in determining responses, and especially inertia, to disturbance in an old-growth subalpine forest. Our sites are unique in that immediate post-eruption experiments provided the means to establish a measure of baseline (predisturbance) conditions—a prerequisite for quantitative measures of resilience.

In-progress Studies

1. Current USFS PNW Research Station ecological research and monitoring activities at Mount St. Helens. Donald Brown*, *USDA Forest Service, Pacific Northwest Research Station*.

The USDA Forest Service PNW Research Station has been heavily involved in ecological research and monitoring at Mount St. Helens since the major eruption in 1980. This presentation will provide an overview of several research and monitoring projects that have been initiated over the past 2 years, including projects focused on birds, bats, ground-dwelling mammals, streamflow dynamics, and weather monitoring.

2. Succession modeling on Mount St. Helens. Steven Quick*, *Mount St. Helens Institute*; Donald Brown, *USDA Forest Service, Pacific Northwest Research Station*; Dylan Fischer, *The Evergreen State College*; Deahn Donnerwright, *USDA Forest Service, Northern Research Station*.

The eruption of Mount St. Helens in 1980 and the establishment of a National Volcanic Monument created a natural laboratory for observing ecosystem recovery, largely free from human influence. Now, 45 years of ecological monitoring has generated a robust dataset for initializing, calibrating, and validating a model of forest succession on the monument. Modeling forest succession and disturbance enables us to investigate and forecast emergent properties like species composition and habitat change, which have implications for current and future research on the monument. Here, we present our ongoing study using the landscape disturbance simulation model, LANDIS-II to forecast species composition changes and responses to variable climate scenarios.

3. Multiple trajectories of land-cover change: disturbance severity influences patterns 40 years after the eruption of Mount St. Helens. Elsie Denton*, *University of Tennessee Knoxville*.

Our goal was to enhance understanding of land-cover changes after major disturbances in order to inform management of such areas. To understand land-cover change, it is necessary to study landscapes over long timescales. The 1980 eruption of Mount St. Helens provides an opportunity to study the recovery trajectories of areas undergoing secondary and primary succession with minimal management intervention. We assessed land-cover change using Land Cover Mapping and Projection data at 5-year intervals from 1985-2020. Non-water pixels within the Mount St. Helens National Monument were classified as Barren, Grass/shrubland, or Forest. We calculated land-cover changes for secondary successional areas created by a lateral blast and mudflows and for primary successional areas created by pyroclastic flows and a debris avalanche. Successional type strongly influenced which land-cover conversion was likely to happen and how much land surface converted. However, successional type had little influence over starting land cover (with the exception of Forest, which was initially only found in secondary successional areas) or when change would occur. Alternative successional pathways were found in all disturbances. Grass/shrub-to-Forest conversion has been accelerating across all disturbance types for 40 years after the eruption. We found that land-cover change at Mount St. Helens is ongoing contrary to earlier studies using satellite imagery and the Normalized Difference Vegetation Index, which detected only limited change after 20 years. To understand land-cover change over long timescales, including finer divisions in cover class beyond greenness improves the assessment of trends over time. Based on our findings, many aspects of land cover and land-cover change are unique to individual disturbances, so land managers must carefully assess their systems starting points before deciding whether interventions such as tree planting or burns to maintain grassland are necessary in a recovering landscape.

4. Mount St. Helens ponds reveal contrasting zooplankton responses to leaf litter and browning across experimental and observational studies. Katey Queen* and Angela Strecker, *Western Washington University*.

Understanding how terrestrial inputs shape aquatic communities is essential as climate-driven browning intensifies. Using a dual approach, we examined the effects of leaf litter type (deciduous, coniferous) and dissolved organic matter (DOM) inputs on zooplankton communities in early-successional ponds formed by the 1980 Mount St. Helens eruption.

In a 2022 mesocosm experiment, browning significantly altered water chemistry (Pillai's Trace = 0.995, $p < 0.001$), increasing DOC and light attenuation while reducing dissolved oxygen. Redundancy analysis (RDA) showed treatments explained 10.2% of zooplankton community variation ($p = 0.004$), with browning ($p < 0.001$) and coniferous litter ($p = 0.018$) as the strongest drivers. Generalized linear mixed models (GLMMs) revealed significant increases in zooplankton biomass under both leaf types ($p < 0.01$), and decreased richness with leaf–browning interactions ($p < 0.05$). Six indicator taxa, including *Microcyclops rubellus* and *Ceriodaphnia dubia*, were linked to specific treatments.

In a 2023 field survey of 12 natural ponds, canonical correspondence analysis showed DOC and canopy composition as key gradients, though not statistically significant ($p > 0.05$). GLMMs showed DOC significantly increased zooplankton biomass ($p < 0.001$) but reduced Simpson's diversity ($p < 0.001$). *Daphnia rosea* was a strong indicator of high-DOC, low-canopy ponds ($p < 0.01$).

Together, these results show that terrestrial subsidies—both experimental and ambient—drive distinct zooplankton responses, with browning and vegetation type shaping community structure through interacting physical and ecological mechanisms.

4. Colonization and trophic integration of the New Zealand Mud Snail in Spirit Lake, Mount St. Helens, WA. Jim Gawel*, Meg McCann, Hailey Germeau, Katrina Lester, Angel Sandoval, Archer Boday, Robert Jordin, Svea Hallberg, Emma Yeaman, *University of Washington*; Shaina Myers, *Mount St. Helens Institute*; Wyatt Cranston & Kena Fox-Dobbs, *University Puget Sound*; Charlie Crisafulli, *USDA Forest Service, Pacific Northwest Research Station*.

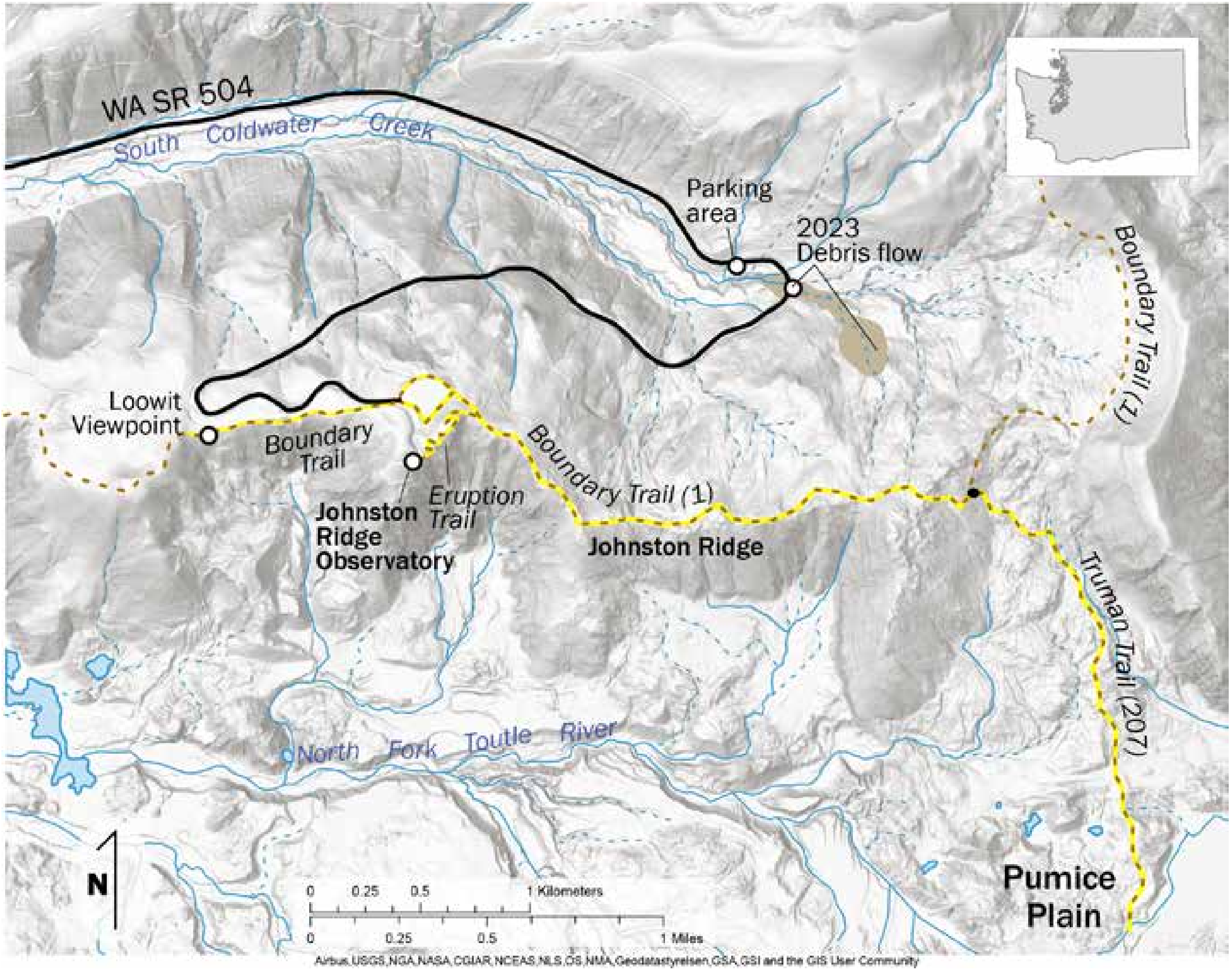
New Zealand mud snails (NZMS, *Potamopyrgus antipodarum*) are a small (4–6 mm), highly prolific species introduced to the US in the 1980s. A single female mud snail can result in a colony of 40 million snails in one year, they are incredibly resistant to common control methods, and they may pass through the gut of a fish unharmed. This highly invasive species entered Spirit Lake in Mount St. Helens National Volcanic Monument by 2015, as evidenced by long-term fish-gut samples collected in the lake. The invasive snails are dependent on access to aquatic plants for food, and currently there is a lack of habitat continuity that may limit their spread in the lake. The staging area planned for the Spirit Lake shore and repairs of the outlet tunnel promise to transport snails across this barrier and to spread aquatic vegetation to areas currently bare, creating a "bridge" for further invasion. In our initial work (Myers et al. 2024) we mapped the distribution and corresponding abundance of NZMS in Spirit Lake through visual detection surveys, aquatic macrophyte sampling, fish-gut contents, and eDNA analysis in order to establish the current spatial extent of NZMS habitation and provide a baseline from which to monitor future spread. We also conducted carbon and nitrogen stable isotope analysis of native and non-native snail specimens, as well as other abundant and common aquatic taxa, including rainbow trout (*Oncorhynchus mykiss*), to determine the potential for resource competition between snail species and elucidate the integration of NZMS into the Spirit Lake food web. This year, with UWT undergraduates, we will continue our work to (1) map the current spatial extent of NZMS in Spirit Lake and its receiving waters, and (2) collect data on habitat preferences including sediment grain size, bottom slope, stream velocity, water depth, vegetation type and density, water temperature, and conductivity. The opportunity to monitor such an invasive species so soon after its introduction is rare and will improve our understanding of factors that may speed or slow the spread of these snails in an undisturbed ecosystem.

5. Post reintroduction movements of an extirpated mesocarnivore—lessons from habitat models and inclusive collaboration. Tara Chestnut*, *USDA Forest Service, Region 5, Pacific Planning Service Group*

In the 1800s and early 1900s, Fishers (*Pekania pennanti*) were heavily harvested for the fur trade, predator control programs, and to dispossess Indigenous Peoples of the cultural and relational worlds they shared with their non-human kin. A mid-sized member of the weasel family, Fishers occurred in the coniferous forests of Washington until the early to mid-1900s. In 1998, fishers were listed by the Washington Department of Fish and Wildlife (WDFW) as a state endangered species. In 2006, the WDFW recovery plan identified reintroduction as the most viable means of recovery and source populations in British Columbia were favored. Nine candidate release sites were identified and the primary release site selected was the Cispus Learning Center, approximately 10 miles northeast of the blast zone. Although the Mount St Helens National Volcanic Monument was included in the South Cascades Fisher Recovery Zone, habitat models (which were based on % vegetative cover, % conifer cover, quadratic mean diameter, and elevation) omitted the Mount St Helens blast zone as suitable fisher habitat. Although in the first year only 23 individuals were released, Fishers quickly occupied the scorch forest and blowdown zones. Of the 64% of females that established home ranges in the first year, several were along the north and west edges of the blast zone. The Mount St Helens blast zone is a structurally unique landscape that can support species that are often characterized as late-successional obligates, such as the Fisher. Landscape-scale habitat models that include Mount St Helens National Volcanic Monument do not adequately capture the structural complexity of the scorch and blowdown zones that allow 'late-successional obligates' to occupy and thrive in this landscape. When modeling habitat suitability for species that require large cavities for denning and nesting, inclusion of a coarse wood data layer may improve model performance and better represent the monument as suitable habitat. Preliminary results suggest project success, that Fishers are well on their way to becoming reestablished over their former range in Washington state. However, success in science can and should be evaluated in different ways. The Washington Cascades Fisher Reintroduction Project provides an example of how including Indigenous relational values promotes successes in science that are immeasurable.

Johnston Ridge Observatory/Pumice Plain View Hike

Saturday 19 July 2025



Length: 5.6 miles, roundtrip to JRO **Elevation Gain:** 978 feet **Highest Point:** 4,314 feet

Notes: **No toilets or water available except at Coldwater Science and Learning Center.

Please bring with you:

- Sun hat and sunscreen. There is little to no shade available on the hike.
- Sufficient water for the day. No place to refill. No bathrooms.
- Binoculars (optional)

Leaders/Speakers

Jon Major – Scientist-in-Charge, USGS Cascades Volcano Observatory
Shannon Claeson – Aquatic Ecologist, USDA Forest Service, PNW Research Station
Carri LeRoy – Professor, The Evergreen State College
Jim Gawel – Professor, University of Washington
Katey Queen – Graduate Student, Western Washington University

Schedule and Route

Carpool in personal vehicles. 36 people are registered for this field trip. Last chance for water and bathrooms.

08:00 — Safety tailgate at CSLC, then depart Coldwater SLC, taking loop to the right toward Johnston Ridge Observatory to get on WA SR504..

Drive 6.5 miles to Hwy 504 washout. Parking area is on the right-hand side of the road at approximate coordinates of 46.283014 N, -122.197956 W.

08:30–09:30 — Hike 2 miles on Hwy 504 uphill to Loowit Viewpoint.
At the first curve above the parking area, you will pass the trail of the 2023 debris flow that destroyed the bridge over the Spirit Lake outlet tunnel and South Coldwater Creek, uphill on your left.

09:30–10:30 — **Loowit Viewpoint**

- Jon Major will give a 30-minute overview of the 1980 eruption and the geology and landscape of the Pumice Plain.
- Introduction of Pumice Plain researchers in attendance (30 min)

11:00–12:00 — Hike 0.7 mile on Hwy 504 or Boundary Trail (east) to Johnston Ridge Observatory

12:00–14:30 — **Johnston Ridge Observatory Viewpoint**

- Lunch
- Open discussion of research and landscape conditions.
- Hike the short Eruption Trail to the memorial or explore further on the Boundary Trail (east) from JRO. (optional).

14:30–16:00 — Hike 2.7 miles downhill from JRO to washout parking area.

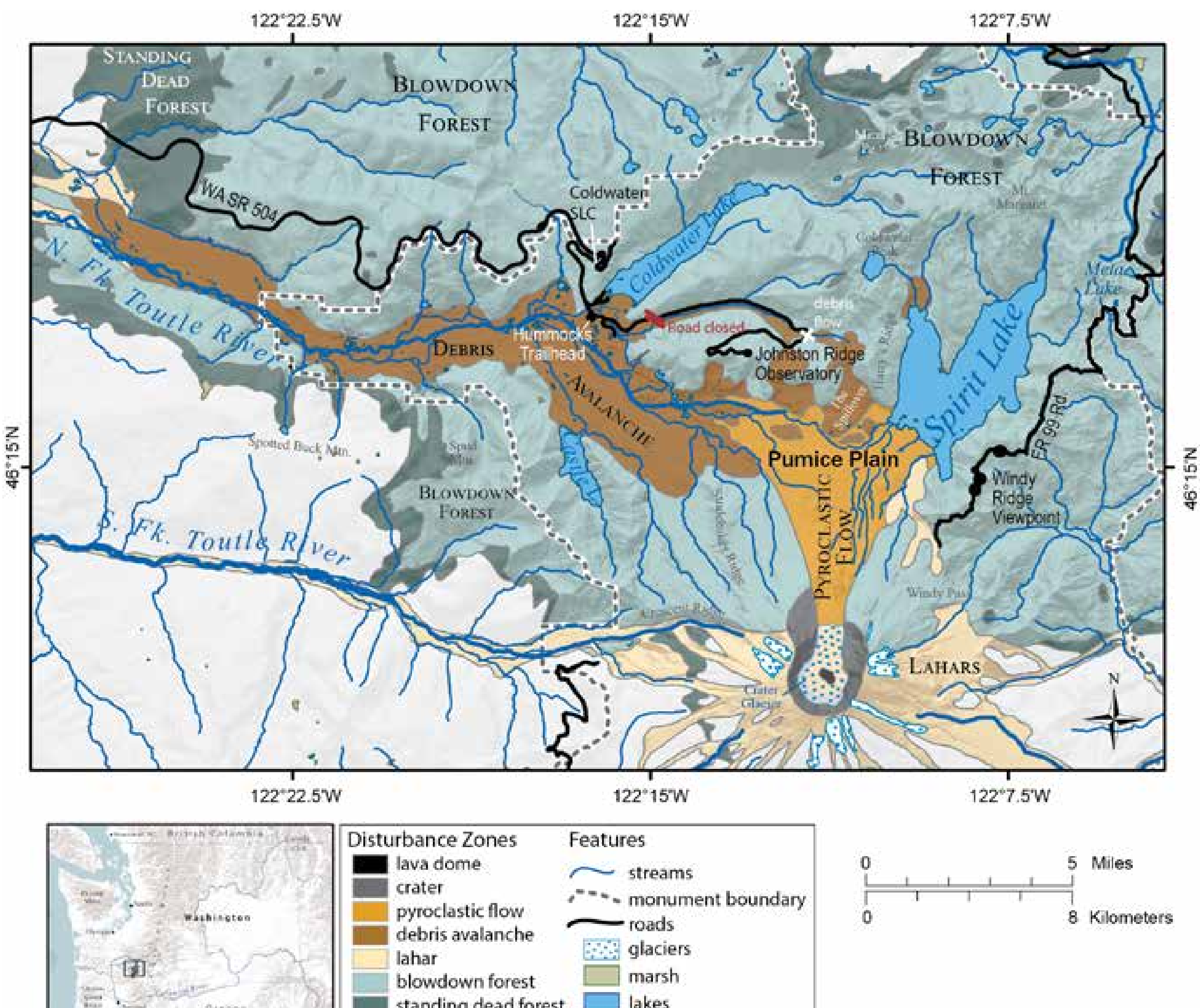
16:00–16:30 — Drive 6.5 miles to Coldwater SLC
***If people arrive at washout at different times, be sure to leave enough vehicles for people behind you.

17:00–18:00 — Coldwater SLC WDFW fish reintroduction presentation

18:00–19:30 — Dinner at Coldwater SLC

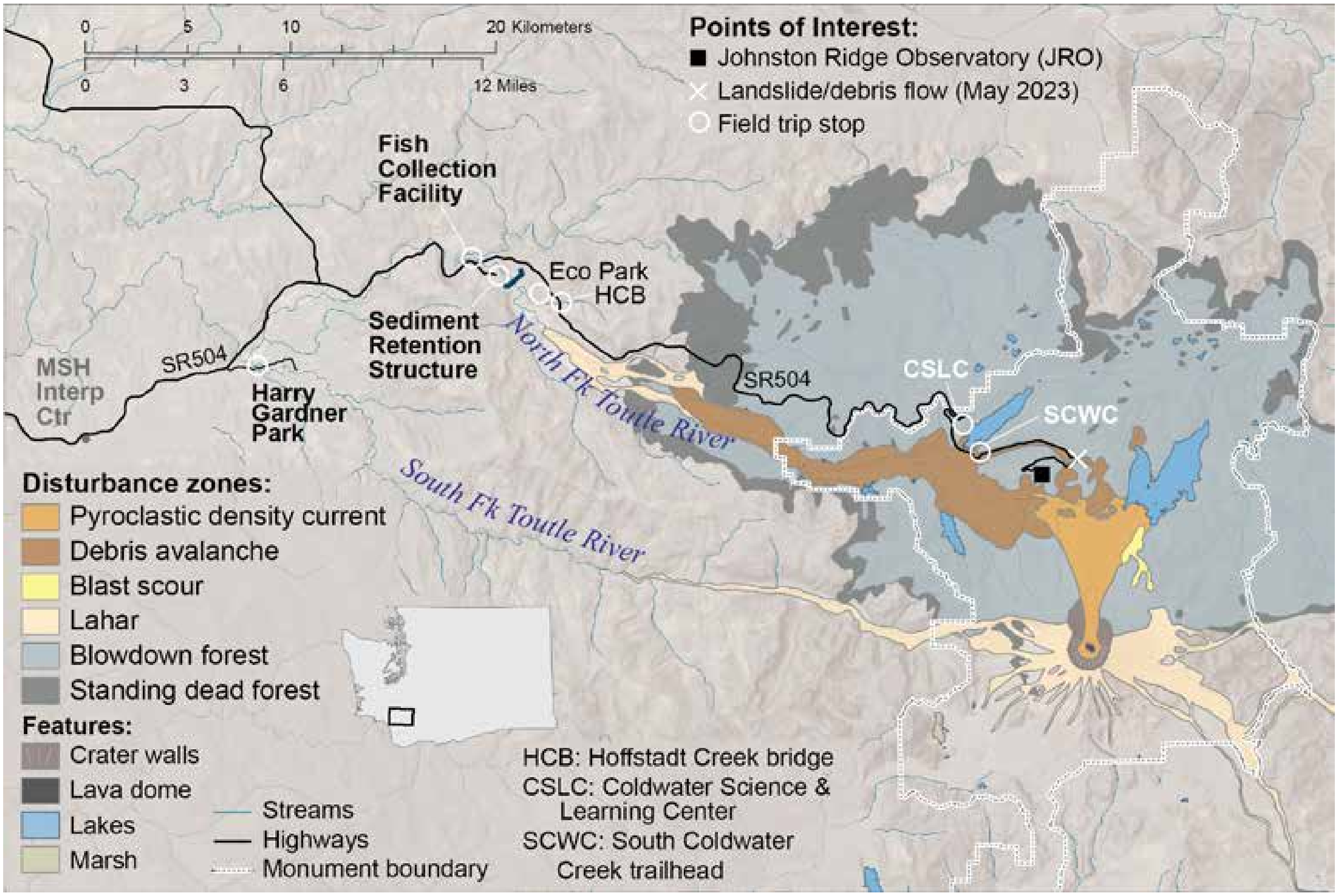
19:30–20:00 — Mount St. Helens Institute: Mission and programs overview, opportunities for scientists to participate in programs, and community science opportunities

20:00–21:30 — Seminar: Historical perspectives on MSH land, protection, and research. Virginia Dale, University of Tennessee Knoxville, Corporate Fellow Emeritus at Oak Ridge National Laboratory



Toutle River Recovery and Management Tour

Saturday 19 July 2025



Co-leads:

Colin Thorne – Professor Emeritus, University of Nottingham
Jesse Burgher – Wildlife Program Manager, Cowlitz Indian Tribe
Josua Holowatz – Fisheries Biologist, Washington Department of Fish and Wildlife
Donald Brown – Research Ecologist, USDA Forest Service Pacific Northwest Research Station
Sarah Koppelman – Development and Community Engagement Director, Mount St. Helens Institute

Schedule and Route

Three minivans will transport tour participants. Drivers: Donald Brown, Tara Chestnut, Steven Quick

08:30–08:45 — Safety tailgate at 08:30, then depart Coldwater SLC

09:30–10:00 — **Stop 1: Harry Gardner Park**

- Bathroom break
- Meet Colin at Harry Gardner Park
- Colin: Large wood structures, wetland creation

10:00–10:30 — Drive to WDFW Fish Collection Facility

10:30–10:55 — **Stop 2: WDFW Fish Collection Facility**

- Meet Josua and WDFW at FCF
- Josua: Tour of FCF, trap and haul program

10:55–11:00 — Drive to SRS

11:00–12:00 — **Stop 3: Sediment Retention Structure**
- Bathroom break
- Colin: SRS discussion

12:00–12:15 — Drive from SRS to Eco Park

12:15–14:00 — **Stop 4: Eco Park**
- Lunch break
- Bathroom break
- Hike to sites
- Jesse: Beaver reintroductions initiative

14:00–14:15 — Drive from Eco Park to Hoffstadt Creek Bridge

14:15–14:30 — **Stop 5: Hoffstadt Creek Bridge**
- Donald: Bridge facts

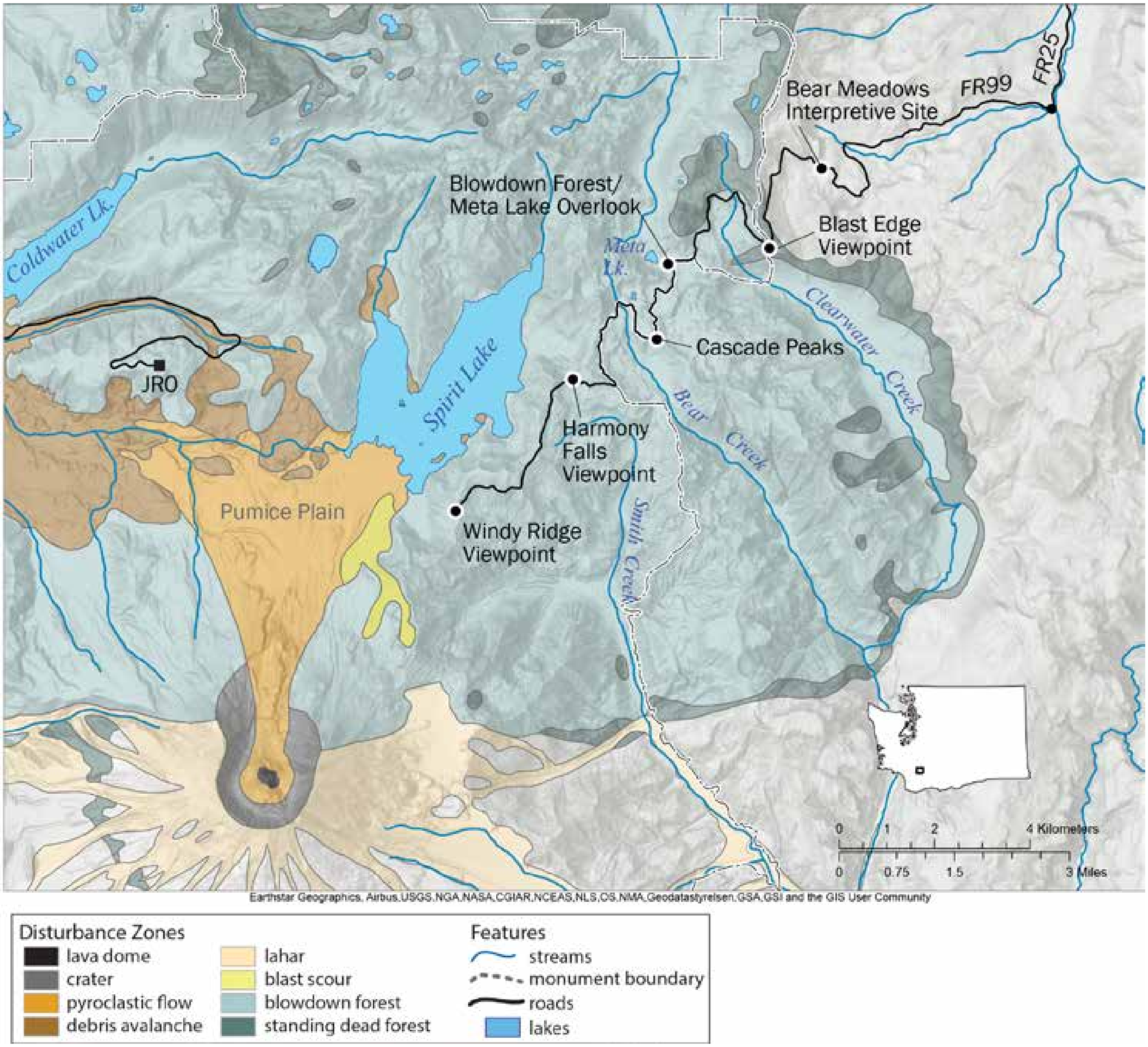
14:30–15:00 — Drive from Hoffstadt Creek Bridge to South Coldwater Creek Trailhead

15:00–15:45 — **Stop 6: South Coldwater Creek**
- Josua: Spring Chinook Salmon habitat and reintroduction goal

16:00 — Return to Coldwater SLC

Blast Zone Tour

Sunday 20 July 2025



Co-leads:

John Bishop – Professor Emeritus, Washington State University
Mark Swanson – Professor, Oregon State University
Pat Pringle – Professor Emeritus, Centralia College
Peter Frenzen – Ecologist (retired), USDA Forest Service Pacific Gifford Pinchot National Forest
Donald Brown – Research Ecologist, USDA Forest Service Pacific Northwest Research Station
Sarah Koppelman – Development and Community Engagement Director, Mount St. Helens Institute

Schedule and Route

Three rental vans will transport participants. Drivers: Donald Brown, Tara Chestnut, Steven Quick Note: Participants may choose to grab breakfast to go as well as their packed lunch.

07:30–07:45 — Depart Coldwater SLC

10:30–10:50 — **Stop 1: Bear Meadow Interpretive Site**

- Bathroom break
- Main speaker: Peter

10:50–11:00 — Drive to Blast Edge Viewpoint

11:00–11:20 — **Stop 2: Blast Edge Viewpoint**
- Main speakers: Pat, Peter

11:20–11:30 — Drive to Blowdown Forest/Meta Lake Overlook

11:30–11:50 — **Stop 3: Blowdown Forest/Meta Lake Overlook**
- Main speakers: Mark, Peter

11:50–12:10 — Drive to Cascade Peaks

12:10–12:20 — **Stop 4: Cascade Peaks**
- Bathroom break

12:20–12:30 — Drive to Harmony Falls Viewpoint

12:30–13:00 — **Stop 5: Harmony Falls Viewpoint**
- Lunch break
- Main speakers: John, Mark

13:00–13:10 — Drive to Windy Ridge Viewpoint

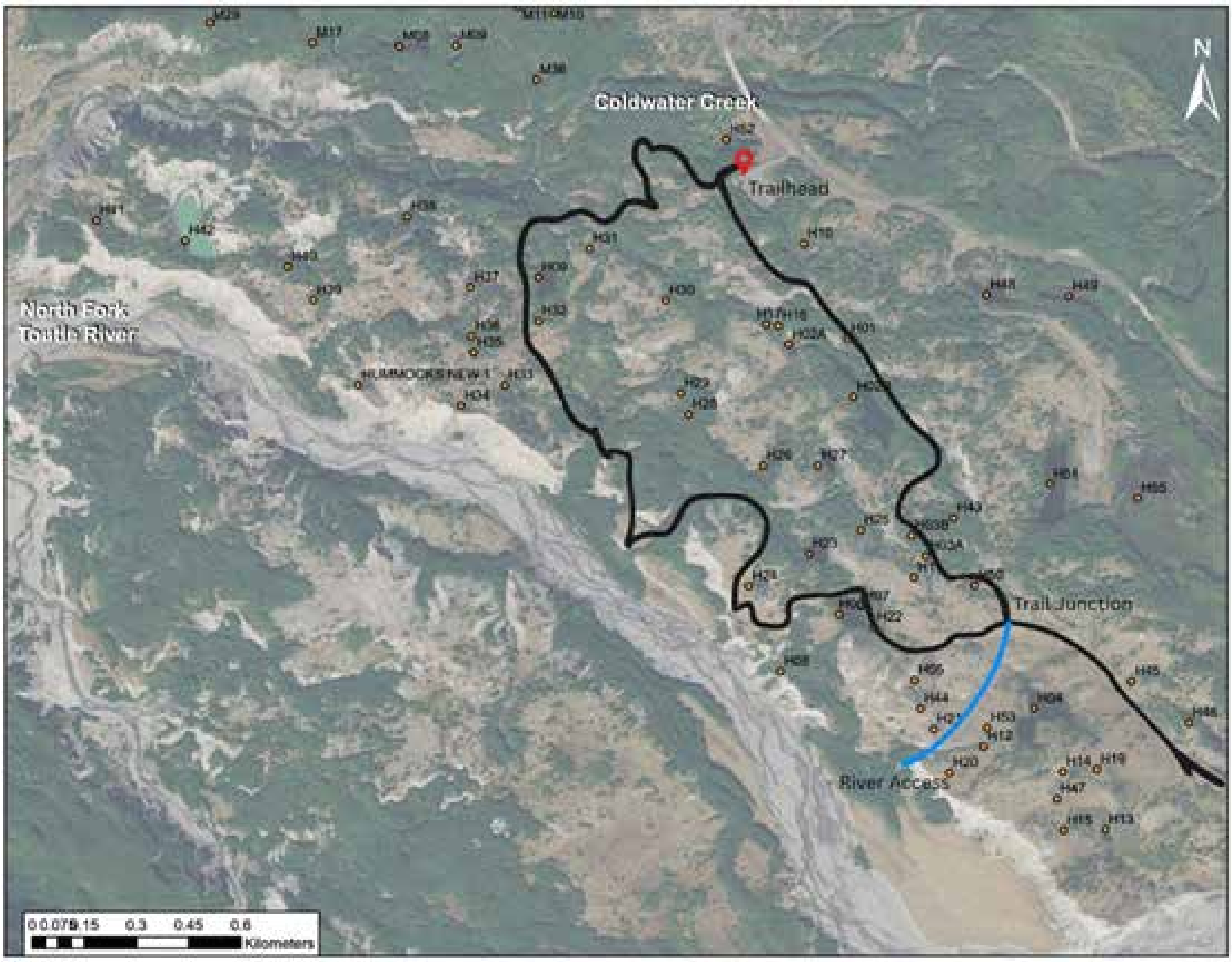
13:10–14:00 — **Stop 6: Windy Ridge Viewpoint**
- Main speakers: John, Pat, Mark
- Attendees can climb to the overlook if desired, but speakers will remain in parking lot
- Bathrooms available

14:00–14:30 — Drive to back to Bear Meadow Interpretive Site

14:30–14:45 —**Stop 7: Bear Meadow Interpretive Site**
- Drop off Peter and Pat
- Last-chance bathroom break

14:45–17:30 — Return to Coldwater SLC

Hummocks and Debris Avalanche Tour



Co-leads:

Virginia Dale – University of Tennessee Knoxville
Elsie Denton – University of Tennesee Knoxville
Katey Queen – Western Washington University

Notes:

- At the end of the day, there will be an opportunity to swim at Coldwater Lake. If you want to swim, you will need to bring a swim suit and towel. Restrooms are available for changing at the Coldwater Lake Picnic Site boat ramp area.
- Bring water for the day, sunscreen, a hat, and (optional) insect repellent, as there will be little shade for portions of the hike.

Schedule and Route

08:00 — Depart Coldwater SLC

Leaving SLC parking area, go right to take the loop to WA SR504/Spirit Lake Highway toward Johnston Ridge Observatory. Drive 2.2 miles to Hummocks Trailhead parking on the right-hand side of the road. Restrooms and water are not available at the trailhead. Nearest restrooms are at the boat ramp area of the Coldwater Lake Picnic and Boating Site, 0.55 miles away.

We will begin our hike at the Hummock/Boundary Trailhead, where the landscape tells the dramatic story of the 1980 Mount St. Helens eruption. This area features the “hummocks”—massive blocks of the volcano’s north flank that broke off during the catastrophic landslide. The debris avalanche traveled 14 miles west into the Toutle River Valley, reshaping the land. Once a barren expanse, the area now supports a regenerating forest, rich wetlands, and numerous ponds. We will explore this transformation on a relatively easy 2.5-mile loop trail.

Our route follows Hummocks Trail #229 for 0.5 miles to its junction with Boundary Trail #1, an area where elk are often seen grazing in open meadows. Just before reaching the junction, we will hike cross-country down to the North Fork of the Toutle River to observe erosion processes and stream conditions firsthand. After this off-trail segment, we’ll return to the Hummocks Trail and continue around the loop.

Further along the trail, we’ll stop at a viewpoint overlooking the river valley. From here, we’ll discuss the scale and impact of the debris avalanche, visualizing the westerly flow of the slide and observing ongoing ecological succession. Along the way, we’ll pause at several ponds and scenic points to explore the unique features of this post-eruption landscape.

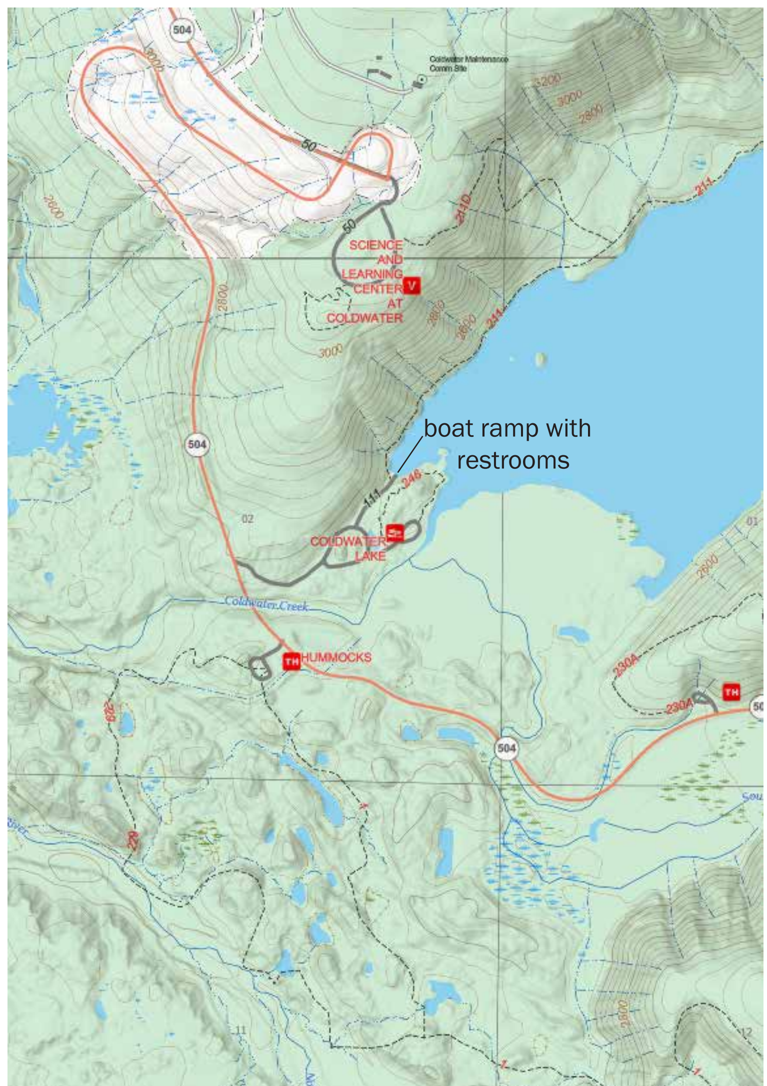
At the conclusion of the hike, we will visit the picnic and boating area at Coldwater Lake, with opportunities for swimming, a stroll around the margins of the lake, or just a seat in the shade at the end of a hot day. Restrooms are available at the boat ramp area for changing or a bathroom break.

From Hummocks Trailhead to Coldwater Lake:

Leaving the Hummocks Trailhead parking area, turn **left** onto WA SR504. Drive 0.18 miles to turn **right** into the access road to Coldwater Lake Picnic and Boating Site. Drive 0.18 miles to fork, follow one-way circle to right, but pass the first parking area and take the second right into the boat ramp area parking lot.

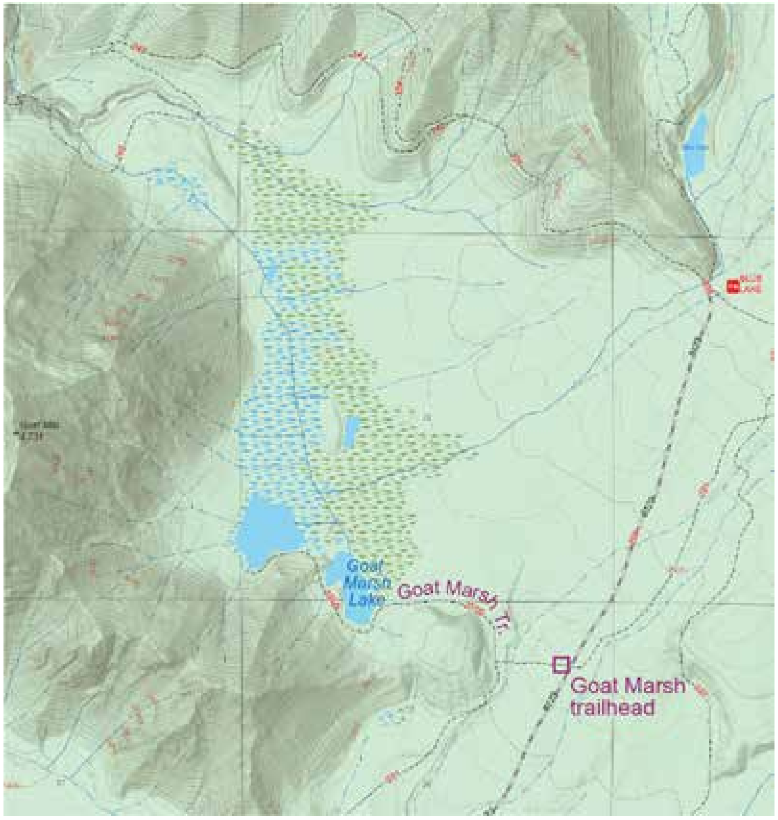
16:30 – Return to Coldwater SLC

From Coldwater Lake Picnic and Boating Site access, turn **right** on WA SR504 and drive 1.7 miles to CSLC interchange, bearing **right** to take the loop to the SLC parking area.



Goat Marsh Research Natural Area Self-guided Tour

Adapted from **Goat Marsh Research Area — Washington Trails Association**
South Cascades > Mount St. Helens 46.1545, -122.2692 Map & Directions



Map based on USDA Forest Service Interactive Visitor Map.

Length: 2.8 miles, roundtrip
Elevation Gain: 180 feet

Highest Point: 1,930 feet

Calculated Difficulty: Easy

Parking Pass/Entry Fee: None

Notes:
**No toilet at trailhead
**Bring water and insect repellent

- Dogs allowed on leash
- Good for kids
- Lakes
- Mountain views
- Old growth

A family-friendly easy walk into a tranquil forest of giant trees with views over a lake and marsh to Mount St. Helens, but don't forget the insect repellent.

Hiking Goat Marsh Research Area

Visit a forested basin with a small lake and extensive marsh created by pyroclastic flows from Mount St. Helens 300—500 years ago that blocked the flow of Coldsprings Creek. The 1980 eruption sent renewed flows down the Coldsprings drainage which have impacted the trail.

Goat Marsh Research Natural Area was established in 1974 to represent a mosaic of mountain marshlands, swamps, and ponds and a xeric Lodgepole Pine forest characteristic of mudflow and glacial outwash around Cascadian volcanoes. The center of the 1,300-acre RNA contains a wetland whereas the eastern portion contains marshes dominated by grasses and sedges. Lodgepole Pine (*Pinus contorta*) dominates pyroclastic flow forests in the harshest areas; Douglas-fir (*Pseudotsuga menziesii*) and Western Hemlock (*Tsuga heterophylla*) dominate areas with richer soils.

Goat Marsh RNA contains many of the largest and tallest remaining specimens of Noble Fir (*Abies procera*), including the "Goat Marsh Giant" (272 ft height, 8.3 ft diameter at breast height, 4430 cubic feet volume) and "Riker!" (253 ft height, 7.3 ft diameter at breast height, 3810 cubic feet volume). This forest also contains Douglas-fir trees measured at over 300 feet in height.

From the small, obscure trailhead, hike downhill along a closed road through Lodgepole Pine forest. In winter, this is the Kalama Ski Trail. Stay on the Kalama Ski Trail as it veers to the left off of the old roadbed and crosses a dry drainage at 0.2 miles. Climb up the opposite slope out of the drainage and find a trail junction at 0.3 miles.

Turn right onto the Goat Marsh Trail, continuing on pumice soils through Lodgepole Pine forest. Reach the entrance to the Goat Marsh Research Natural Area, marked by a wood fence and sign, in 0.5 mile. By now, the forest has transitioned to Douglas-fir and Western Hemlock.

Follow the wide trail over a small rise, admiring the large trees. Goat Marsh comes into view through the trees to your right.

In 0.5 mile after entering the Research Natural Area, reach Goat Marsh Lake, one of two deeper stretches of open water. Goat Mountain, 4965 feet, is visible to the west of the marsh.

For the best views of the lake and the marsh beyond, continue on the trail around to the west shore for 0.3 mile where you can see all of the lake and extensive marsh and view the southwest face of Mount St. Helens.

For more scenery, continue along the trail to where it ends at 1.4 miles at water's edge at the second, unnamed lake at the base of Goat Mountain. Bring binoculars to look for wildlife, such as Elk (*Cervus canadensis*), American Beaver (*Castor canadensis*), and Spotted Sandpiper (*Actitis macularius*).

Pro-Tip: In summer, be prepared for biting insects, including mosquitoes and flies.

Getting There—See full driving directions from CSLC

From Woodland, Exit 21 on I-5, drive east on SR 503 for 28 miles. Turn left on Forest Road 81, signed for Merrill Lake, (1 mile west of Cougar). Follow FR 81 for 11.6 miles; it is paved for 11.1 miles but watch for slumps and potholes. At a junction where gravel FR 81 turns right, continue straight ahead on FR 8123. This gravel road has some bad erosion, so it is best for high-clearance vehicles. In 0.6 mile, reach the small, obscure trailhead on the left with parking for two vehicles. The trailhead sign is posted high off the ground for winter users and is partially hidden by vegetation.

Note from Sept 2024 visit to Goat Marsh:

Following Google Maps took me right to the trailhead. You'll find the 2-car parking spot on the left and the Kalama Ski Trail sign on the right. I found parking on the road as the parking lot was full.

Getting to the trailhead was easy except for the last 0.3 miles. Required slow driving and maneuvering, but totally doable with my Subaru Outback. I wouldn't recommend trying it with a low-clearance vehicle. There are places to park before the road gets rough, so that's always an option.

Added note: If time, there is a viewpoint of the south side of Mount St. Helens a short distance along NF 81 from where you continued straight onto NF 8123 for the trailhead.