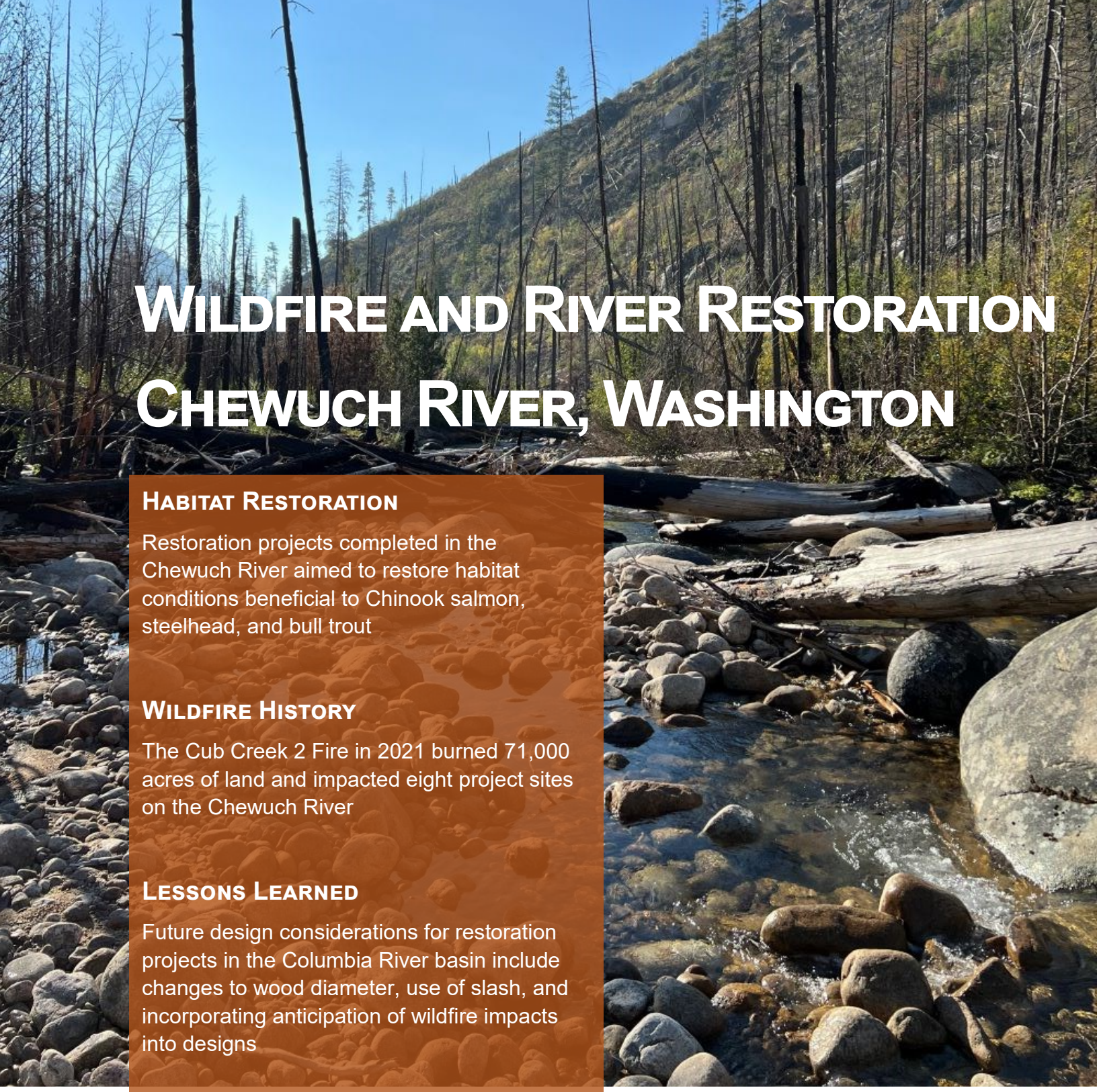


Wildfire and River Restoration
Chewuch River, Washington

Habitat Restoration

Restoration projects completed in the Chewuch River aimed to restore habitat conditions beneficial to Chinook salmon, steelhead, and bull trout

Wildfire History

The Cub Creek 2 Fire in 2021 burned 71,000 acres of land and impacted eight project sites on the Chewuch River

Lessons Learned

Future design considerations for restoration projects in the Columbia River basin include changes to wood diameter, use of slash, and incorporating anticipation of wildfire impacts into designs

Rio ASE

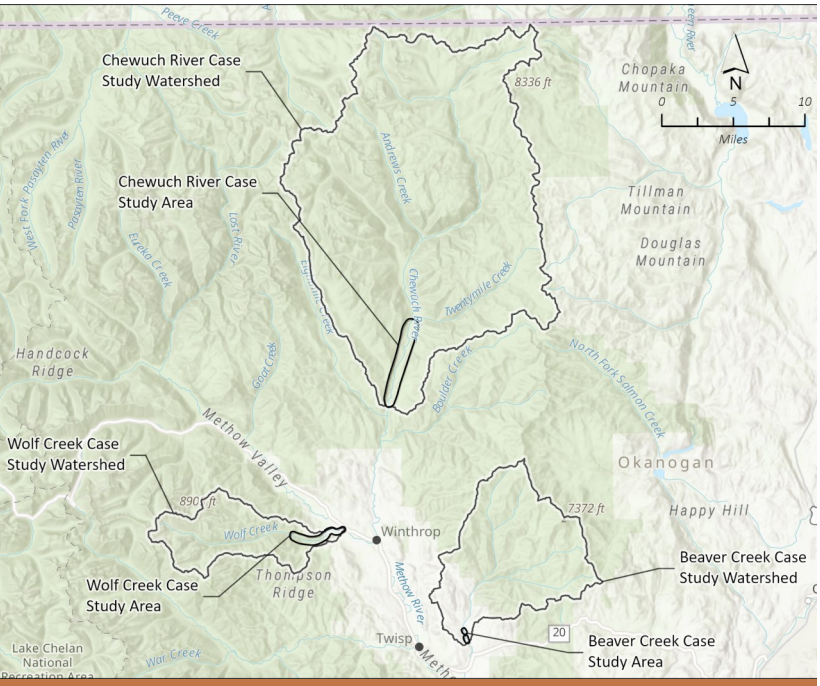
inter·fluve

Fire and Restoration Case Studies

July 2023

Case Study Purpose

Wildfires have impacted river restoration projects throughout the Columbia River Basin. Lessons learned from case studies can inform future restoration designs and identify opportunities to enhance river corridor resilience to wildfire disturbance cascades.



Study Area

The Chewuch River is a tributary to the Methow River in northern Washington State on the east side of the Cascade Mountains. The Chewuch River watershed area is 531 square miles with elevations ranging from 8,600 feet on Remmel Mountain to 1,720 feet at the mouth of the Chewuch River. The continental climate results in annual precipitation of 5 feet at upper elevations to 0.8 feet in the driest regions. Vegetation associations include treeless alpine, subalpine forests and meadows, dry coniferous forests, and riparian forests. The project reach extends from river miles 13 to 20 along the Chewuch River.

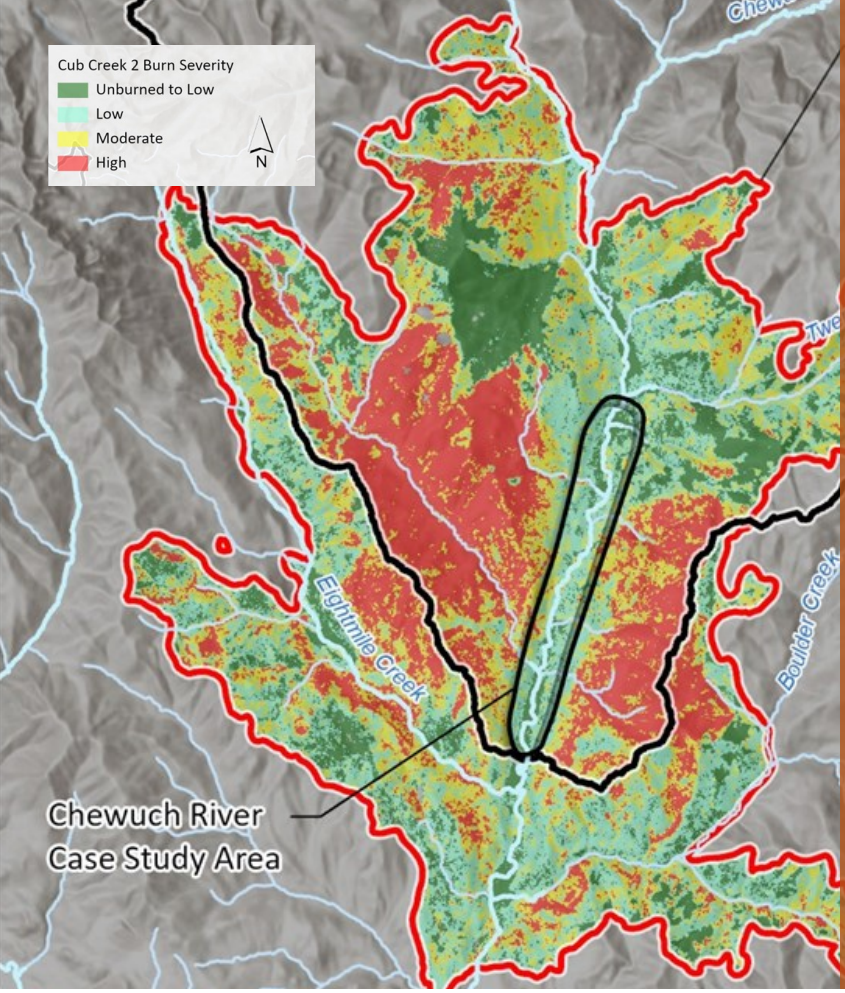
Habitat Restoration

The goal of habitat work completed on the Chewuch River was to restore habitat conditions that are beneficial to Endangered Species Act-listed fish species, including Chinook salmon, steelhead, and bull trout. These species spend one or more year in freshwater streams during their life cycles and rely heavily on quality freshwater habitat. Restoration projects throughout the Chewuch River aimed to address ecological concerns and improve habitat conditions to support salmon recovery goals.

In the Chewuch River, three primary treatment types have been used in restoration projects to improve habitat for salmonid species: large wood, pool habitat, and off-channel habitat. The U.S. Forest Service used regional research data, conditions in undisturbed channels similar to the project reach, and professional judgment to determine the desired conditions for each treatment.

Wood structures were constructed and either buried in the bank or pile ballasted. These structures enhanced deep pools and cover habitat for salmonid species throughout each project reach.

Upstream of alluvial fans that tend to control the valley, wider floodplain valleys, flatter slopes, and complex wetland habitat are ideal locations for side channels. In locations that could support high quality habitat during low summer flows, side channels were designed and constructed. Apex large wood structures were added at side channel inlets to help maintain the inlet conditions on the newly created side channels.



Wildfire History

The Cub Creek 2 Fire started on July 16, 2021, and burned approximately 71,000 acres of state, private, and USFS land within the Chewuch River watershed. Fire intensity varied depending on time of day, weather, and fuel loads from the start date until snowfall.

- 41% of the burned area had high or moderate soil burn severity
- 80% to 100% vegetation mortality in moderate and high burn severity areas
- Post-fire hydrologic models predict tributary stream flows to increase by a factor of 50 to 200
- Post-fire debris flow models predict high (60-80%) to very high (>80% probability) of debris flow occurrence in subwatersheds near the center of the burn area
- Three debris flows observed in summer 2022
- Leroy Creek debris flow in 2022 reached the Chewuch River, depositing large volumes of fine sediment
- Post-fire analysis and modeling predicted high debris flow risk for Leroy Creek

Wildfire Effects on Restoration

The Cub Creek 2 fire burned segments of the Chewuch River valley bottom and constructed restoration projects between RM 15.1 and 18.7. Eight out of fifteen project sites (53%) were fire-impacted.

2015 Restoration, Site Q

- Buried large wood structure remained similar in shape and function until fire
- Structure still has structural integrity
- Alluvial fan and structure partially buried by mudflow
- Mudflow generated in a steep, severely burned side drainage.

2017 Restoration, Sites B, E, and J

- Inlet apex structure and significant pieces of jam burned, but base layer did not
- Reduced structural integrity and strength at all sites; risk that portions of jams will mobilize during future flows
- Logs, piles, and other key pieces have smaller diameters (some down to 12 inches)
- Some pools and habitat remain after fire

Wildfire Effects, Continued

2018 Restoration, Sites L, M, N, and P

- All sites featured pile-ballasted large wood structures extending into channel
- Most of slash and log jam components consumed
- Design integrity lost; possible remaining portions will be removed by future flood flows
- Bottom layers largely remain intact and may collect wood from upstream over time
- Some habitat still maintained after fire
- Largest diameter classes of wood maintained design stability and continues to function and cultivate habitat

Lessons Learned

Large wood structures, pool habitat, and side channel habitat were the three key components of habitat work completed in the Chewuch River. All three were impacted to some degree by the Cub Creek 2 Fire; their outcomes can inform future habitat restoration projects in the Columbia River Basin.

- Bank buried and pile ballasted structures with limited projection into the active channel were particularly susceptible to burning. Increasing submergence of the structure would increase resiliency to burning.
- Logs ballasted with alluvium remained part of a structure that did burn and lose wood mass, suggesting a need to build lower elevation structures in greater contact with wetted channel.
- Structures that used larger diameter wood material better withstood burn periods and had more material left unburned after the fire; they were also more able to remain viable and positively impact post-fire habitat.
- Structures with larger volumes of slash burned easier, longer, and ignited more of the larger diameter structural pieces than those without much slash. Distribution of slash within structures should be considered in fire-prone projects.
- Some natural repair is possible from wood rafting into the upstream face of fire-damaged structures.

Additional Information

To learn more, read the full report: Rio ASE and Inter-Fluve. 2023. Wildfire and River Restoration: Case Studies from the Methow River Watershed. Prepared for U.S. Bureau of Reclamation, Boise, Idaho.

tim@rioase.com | mbrunfelt@interfluve.com