

# WILDFIRE AND RIVER RESTORATION WOLF CREEK, WASHINGTON

## HABITAT RESTORATION

Primary concerns for salmonids in the Wolf Creek watershed include riparian condition, side channel habitat, channel structure and form, and water quality

## WILDFIRE HISTORY

The Cedar Creek Fire in 2021 burned 55,000 acres of land, including 80% of the contributing watershed for Wolf Creek

## LESSONS LEARNED

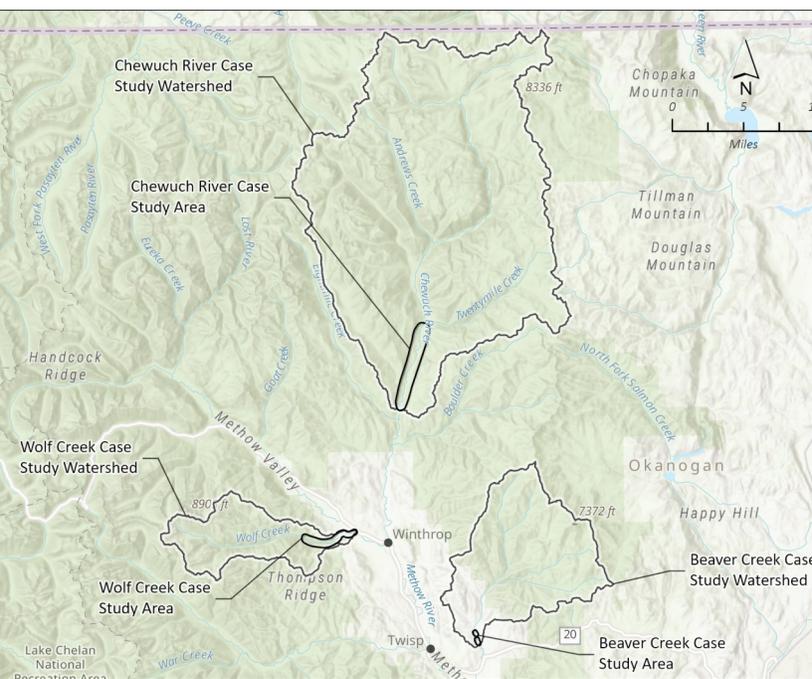
Future design considerations for restoration projects in the Columbia River basin include changes to large wood structure placement, understanding riparian recovery processes, and incorporating anticipation of wildfire impacts into designs





## 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

Wolf Creek lies in a contributing watershed that is relatively undisturbed by anthropogenic impacts in the form of roads, logging, and development. Eighty percent of the Wolf Creek watershed is in the Chelan-Sawtooth Wilderness; the remaining 20% is a National Forest and is relatively inaccessible for timber harvest or development due to steep topography. Wolf Creek was selected as a reference reach to be compared with the Beaver Creek and Chewuch River case studies because it has not seen any river restoration work and there is pre-fire data available from an assessment in 2020.

## HABITAT RESTORATION

No restoration work has been implemented on Wolf Creek; however according to the revised Biological Strategy for the Upper Columbia Region, the primary concerns in the Wolf Creek Watershed for salmonids are:

- Injury or mortality
- Riparian condition and large wood recruitment
- Side channel and wetland connection for habitat
- Instream structural complexity
- Decreased water quality

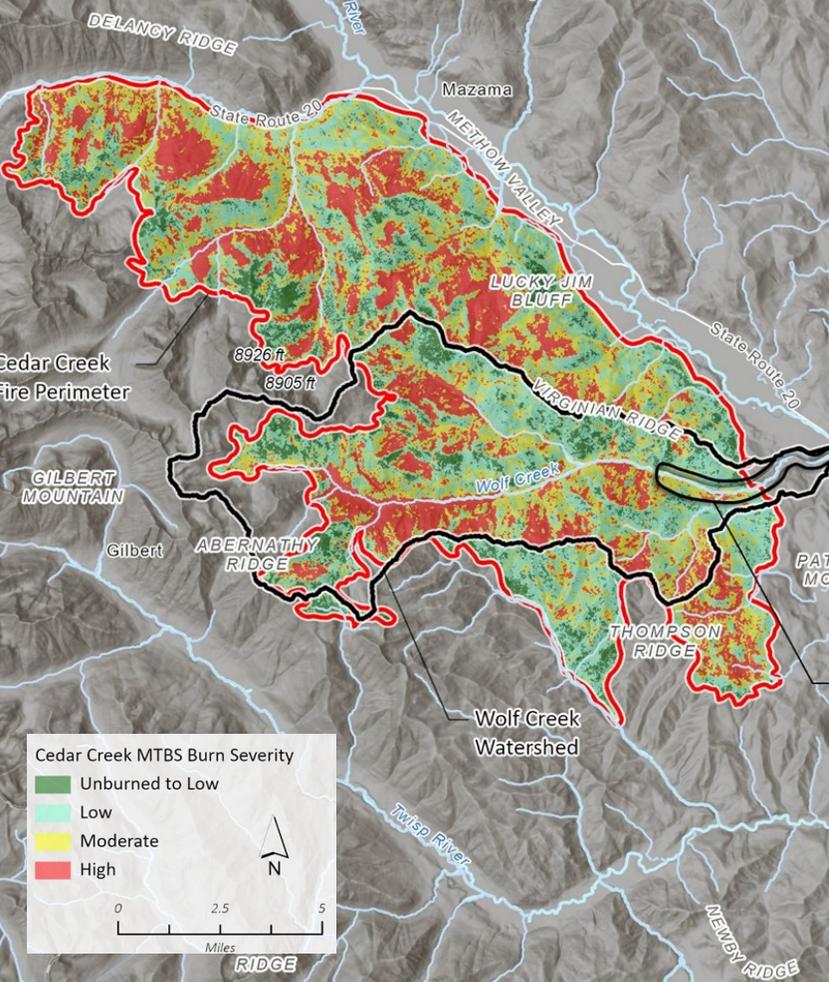
In 2020, the Wolf Creek Reach Assessment & Restoration Strategy identified the following actions for restoration on Wolf Creek:

- Planting of native riparian vegetation in areas disturbed by human infrastructure
- Fencing out grazing animals along riparian areas
- Upgrading bridge crossings
- Removing or decommissioning outdated irrigation withdrawals
- Installing large wood jams to increase habitat complexity
- Installing boulders to increase habitat complexity
- Excavating the inset floodplain along entrenched channels

## WILDFIRE HISTORY

The Cedar Creek Fire started on July 8, 2021, from a lightning strike. It went on to burn 55,000 acres before it was considered contained on August 15, 2021. The fire directly burned about half of the assessment area that is being considered in this case study and burned 80% of the contributing watershed. According to the U.S. Forest Service National Fire Boundary dataset, the Cedar Creek fire is the largest fire within the Wolf Creek watershed in recorded history. The fire history of this watershed shows relatively minimal fire activity in the past 100 years.

According to the Burned Area Emergency Response report, 48% of the burned area within the Cedar Creek Fire exhibited high or moderate soil burn severity with vegetation mortality in these zones ranging from 80 to 100%. Preliminary hydrologic models estimated flow increases in headwater channels to be greater than 100 times the pre-fire flow rates.



## WILDFIRE EFFECTS ON REACH

The wildfire effects on the Wolf Creek case study area include impacts to soil, channels, hillslopes, and large wood. A technical memo published in 2021, *1-year Post Cedar Creek Fire Site Walkthrough and Restoration Strategy Recommendations*, made the following observations:

- In areas with high and moderate severity of burn, vegetation and organic matter—including large wood jams—were burned and covered with a layer of ash debris. Less severely burned areas only saw brush and the top layer of soil burned; trees and riparian vegetation survived.
- Large wood jams in areas of Wolf Creek were already below minimum requirements for channels to provide basic habitat complexity for salmonids. The fire burned most existing large wood jams, contributing to a continued lack of large wood pieces.
- The study area saw minimal changes to channel form. Bank erosion from subtle channel widening occurred in areas where the hillslope had failed due to burn-related riparian vegetation loss.



## WILDFIRE EFFECTS, CONTINUED

- Increased erosion processes in the first year after the fire produced and transported fines (silt and fine sand) and ash from adjacent unvegetated surfaces into the river channel. Alluvial accumulations of fines rich in ash were observed in low flow velocity areas.
- Large, unstable areas on hillslopes along the river valley are expected to have an increased risk of hillslope failure in the next decade as fire-damaged trees on the hillside decay.



## LESSONS LEARNED

In Wolf Creek, a watershed relatively free of anthropogenic disturbance, the following lessons were learned about post-fire stream response following the Cedar Creek Fire:

- Vegetation regrowth observed one-year post-fire was primarily groundcover recovery on the floodplain, banks, and hillslopes. Recovery was patchy and appeared to be related to soil burn severity.
- Riparian shrub and tree regeneration was most successful in low and moderate severity burn areas where roots survived and could produce fresh shoots.
- Natural log jams that were partially burned were within the active channel, had key members that were partially submerged or in contact with the low-flow channel, and were ballasted by alluvium and very large boulders.
- Wood accumulation in the channel post-fire remains small material (less than four inches in diameter) for at least the first year.
- Subreaches and sites that were previously identified as potential locations for large wood accumulations (both natural and constructed) remained post-fire as locations that were functioning to accumulate wood and sediment. These locations have characteristics that can be used to guide future restoration actions involving wood placement.

## 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.

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