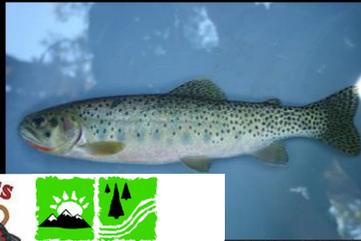


# Coupling Westslope Cutthroat Trout Monitoring with Climate Resilient Habitat Restoration Activities

Cast of Characters: Gabriel M. Temple, *FP-C* (Presenter), Scott Coil, Stefan Woodruff, Patricia Hesselgesser, David 'Bouta, Ryan DeKnikker, Rebecca Wassell, William Meyer, and Kevin McPhee

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A large cast of characters representing a diverse suite of entities have initiated a collaborative project to monitor and improve cold-water habitats in the Teanaway Basin located in the Yakima River headwaters. This presentation was developed for the American Fisheries Society meeting held in Spokane, WA in August 2022, but has been formatted to share with the 2022 Virtual Yakima Basin Science and Management Conference given its relevancy to our local science audience.



The Teanaway Basin is a large watershed located in the upper Yakima River Basin headwaters. It has three major river forks (the Middle, West, and North Forks of the Teanaway River) and numerous other tributaries that combine into the Mainstem Teanaway River that flows downstream and meets the Yakima River near the town of Cle Elum. It was thought to have been a major contributor of anadromous fish to the Yakima Basin.



**Natural Log Jam in Middle Fork Teanaway River, circa 1900, Ponderosa forest on East slope of Cascades, Washington**

Source: Russell, I. C. 1909. Rivers of North America. G.P. Putnam's Sons, New York. 327pp. Figure B, Plate XII, page 239. (Scan by T. Abbe)

The basin represents typical East slope Cascade Mountain range habitat dominated by coniferous, dry forest. This photo from the early 1900's shows the magnitude of wood that were likely common in within the basin streams.

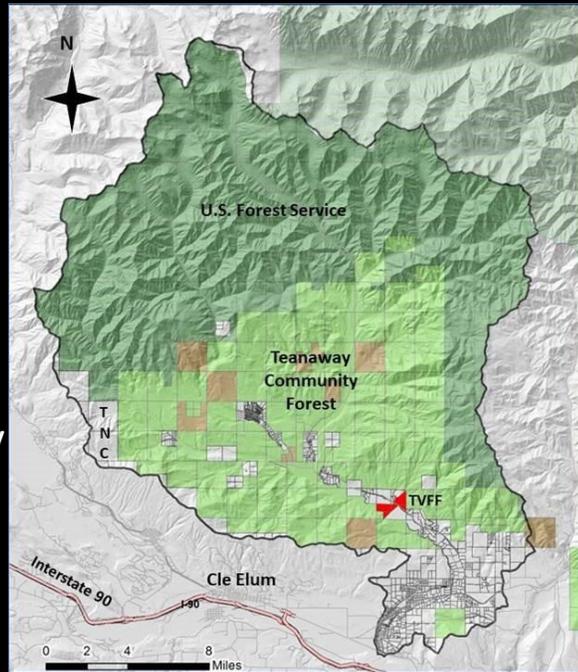
## Study Area – Historic Land Use



Following the turn of the last century, timber harvest became the dominant activity in the Teanaway Basin. These historic photos show the magnitude of timber harvested during this period. One common strategy used to move timber from the hillside to the mill was splash dam logging. As I understand it, logs were transported to the stream channel and small dams were constructed to check the water level up. Once the stream channel was filled with the timber, the dam was breached and the logs floated downstream to landing areas where they could be loaded onto rail cars and transported to the mills. This form of logging was very destructive to aquatic habitats as many meandering stream channels were straightened to facilitate log transport, and stream beds were scoured out.

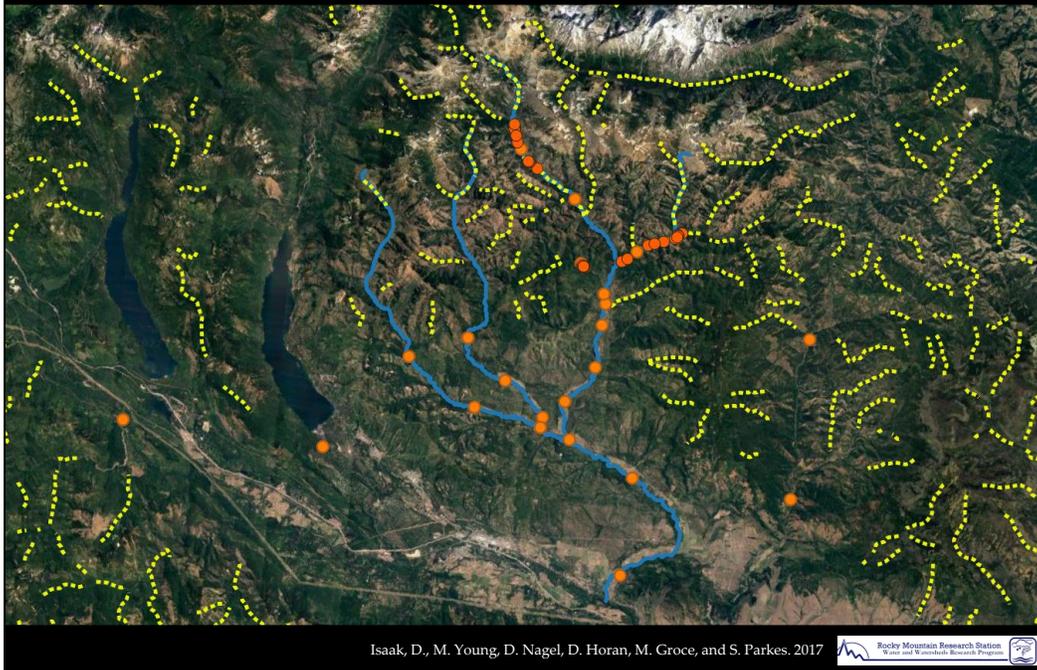
## Study Area – Current Land Use

- Wa. State's first community forest established 2013 with the purchase of 50k acres
- Headwaters primarily in public ownership



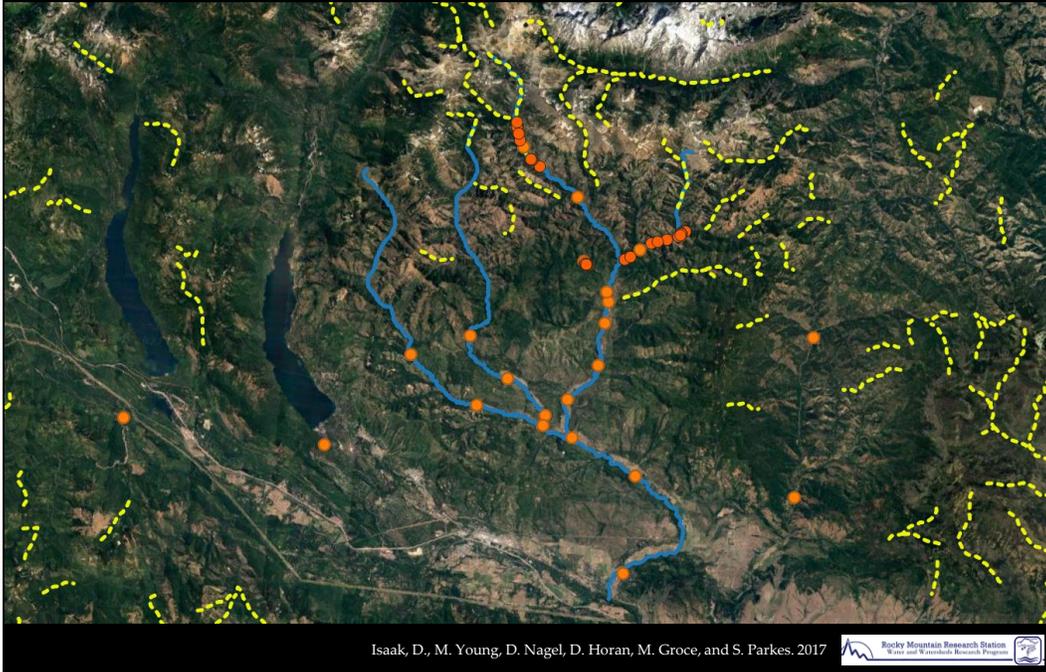
Fortunately, the State of Washington acquired approximately 50,000 acres of land in the mid- and lower- elevations of the Teanaway in 2013 and established the state's first community forest in 2013. This move placed the majority of the Teanaway Basin into public ownership which has opened many doors for more progressive conservation actions. The higher elevations are also in public ownership managed under the U.S. Forest Service.

## WCT Distribution - Baseline – (1980s)



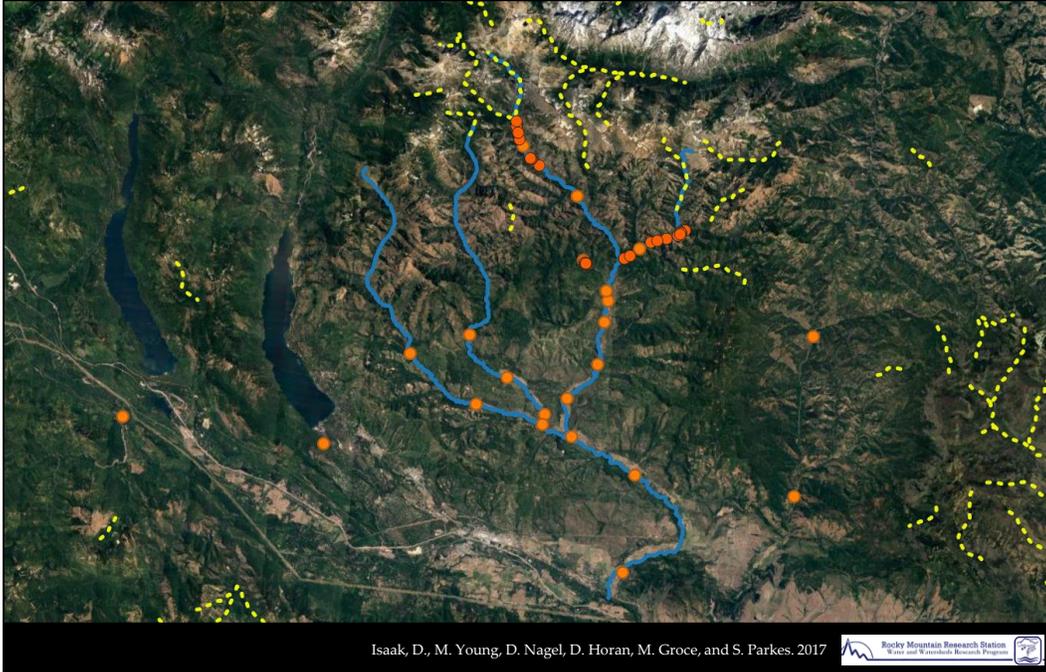
Researchers have developed probabilistic models that predict the probability of Cutthroat Trout occupancy in most major watersheds across the West Coast. If we drill into the Teanaway Basin, their models illustrate what Cutthroat distribution might look like under baseline conditions (illustrated as yellow dashed lines above). The orange dots indicate actual Westslope Cutthroat trout detections by research conducted under the Yakima Klickitat Fisheries Project (YKFP) since the 1990s.

# 2040s



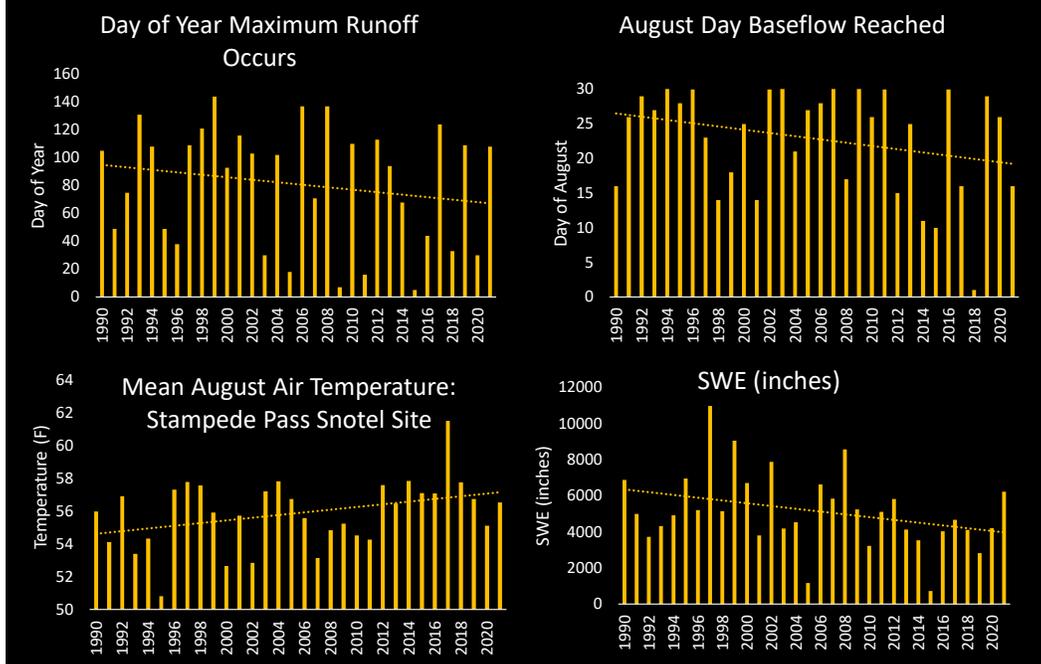
These models were then forecast into the future to illustrate what suitable stream conditions might look like for Cutthroat Trout under several climate change scenarios. You can see how Cutthroat Trout suitable habitat may be reduced by the year 2040 if stream conditions continue to warm due to a changing climate as predicted.

2080s



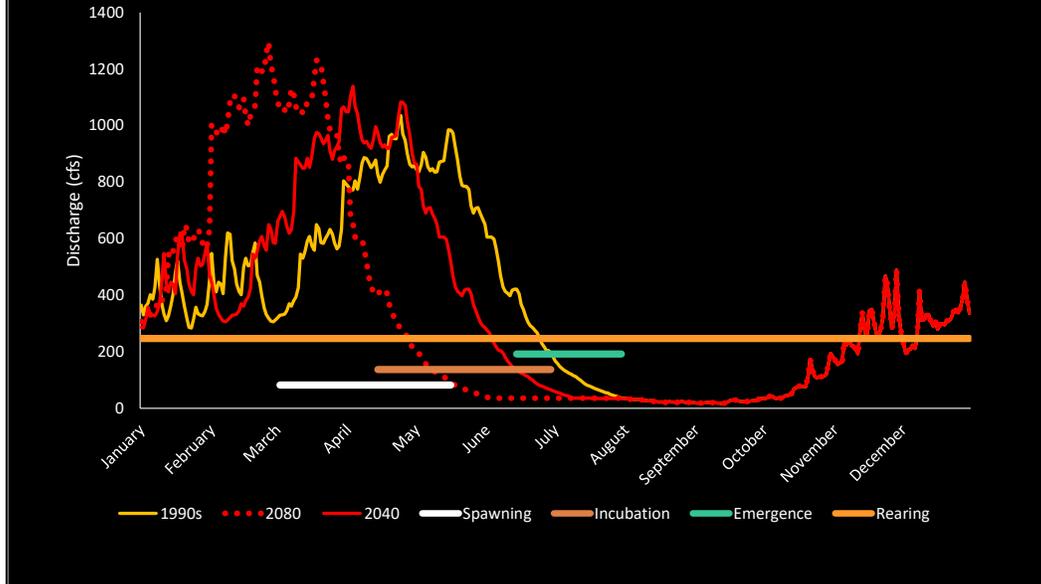
And finally, models predict a substantial reduction in Cutthroat Trout suitable habitat by the year 2080.

# Local Climate Change



Climate change predicted by the models great, but they are predictions of the future which are unknown. However, we can also look at actual data and recent trends that we have observed to help us understand how the climate is actually changing at a local level. In the charts above, trends in several environmental measures were generated over the last three decades. This time scale is arbitrary, but 1990 represents the first year fish monitoring data were collected by the Yakima Species Interactions Studies (YSIS) under the YKFP. In the upper left panel, the day of the year the big spring runoff events occur are plotted for each year since 1990. While there is a lot of annual variability, the long term trend indicates that big spring runoff events are occurring earlier in the year and are advancing at the pace of approximately 1 day per year (or 1 month earlier relative to 1990). Similarly, the day summer low flow conditions are met in the Teanaway Basin are occurring earlier, mean August air temperatures in the headwaters are increasing, and precipitation in the snowpack has been decreasing on average. These observations are consistent with what the climate change experts suggest will occur as the climate changes.

# Teanaway River Discharge Scenarios vs. Life Stage Timing (spring spawning)



In a rudimentary modeling exercise, I forecast what the hydrograph might look like by the year 2040 and 2080 using the trend observed over the last three decades. The orange line indicates the annual hydrograph as measured at the Bureau of Reclamation Teanaway Gauge (TNAW) during the 1990s. The redline forecasts what it might look like by 2040, and the dashed line by 2080, if the current trend continues into the future. These trends are overlaid with critical life stages observed for our spring spawning species such as Westslope Cutthroat Trout. Lots of important critical life stages are associated with the big water periods in the late winter and spring, from spawning, to eggs incubating, and emergence during the declining limb of the hydrograph. You can see that these critical stages are left behind as the hydrograph advances to an earlier period. Most likely the fish will adapt by shifting the timing of these critical life stages to keep in sync with the water. However, some research suggests this may lead to maladaptive traits which can lead to reduced overall survival as the timing falls out of step with what would have occurred historically.

# Problem Statement

- Westslope Cutthroat Trout at risk of decline in the Teanaway Basin in response to a legacy of degradation coupled with impending climate change.

# Call to Action

- Establish partnerships with any and all local entities having interest in cold-water fish conservation and to participate in conservation actions (monitoring; habitat restoration actions) to inform and mitigate.

These and other concerns prompted the Yakima River Headwaters Chapter of Trout Unlimited to develop a Problem Statement as described above, and to initiate a call to action. The intent was to partner with all entities interested in cold water fish conservation to generate information, help mitigate for past practices, and prepare for an uncertain future.

# Strategy

- Phase 1 – Begin collecting environmental data
- Phase 2 – Begin collecting WCT distribution data
- Phase 3 – Participate in restoration activities

The chapter set out to establish baseline environmental data, collect Westslope Cutthroat trout data, and to participate in active restoration activities.

# Monitoring Stream Conditions

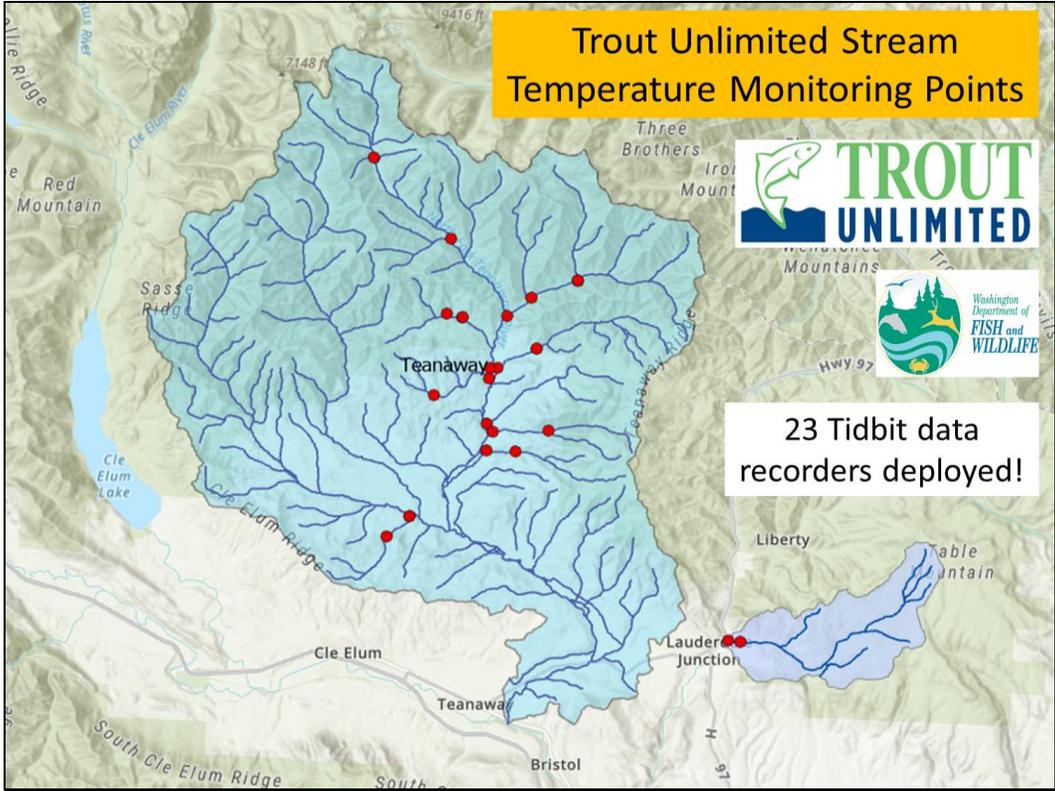
Document  
Current  
Water  
Quality



Document  
Current  
Water  
Quantity



Under Phase 1, volunteers from the Trout Unlimited chapter deployed numerous water temperature loggers throughout the Teanaway Basin under consultation with Washington Department of Fish and Wildlife habitat Biologists and land managers. They began assimilating water quality and water quantity information for the Teanaway.



The distribution of water temperature monitoring sites is illustrated above.



In phase 2, Chapter partnered with the WDFW to monitor current distribution of Westslope Cutthroat trout in several monitoring reaches in the Teanaway Basin. The WDFW has PIT tagged and released several hundred Cutthroat Trout in the Teanaway. Chapter volunteers then conduct roving PIT tag surveys during summer baseflow conditions and document the distribution of these tagged fish. These roving recapture surveys document current habitat use. Several habitat variables are measured within the monitoring reaches with the hope to identify those habitat features utilized by Westslope Cutthroat Trout which will help inform restoration projects.

# Implement Habitat Restoration Actions

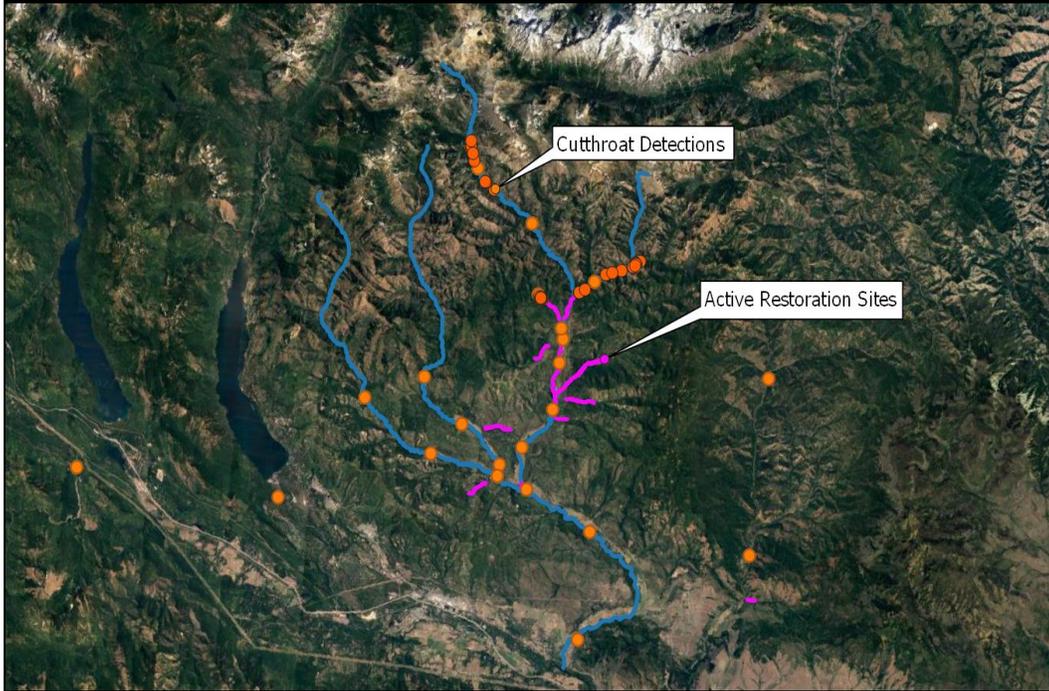


There are several large-scale habitat projects underway in the Teanaway to help restore the system. The Yakama Nation has an ongoing large wood replenishment project in the basin, and Mid-Columbia Fisheries has been installing large in-stream structures to increase wood retention in the stream. Chapter volunteers participate in riparian planting projects to restore degraded riparian vegetation along the stream banks. Phase 3 is described as collaboration among the entities performing restoration actions in the Teanaway.



This example illustrates the magnitude of the wood replenishment in the stream channel. Notice the homogeneous nature of the existing stream channel. Increasing wood structure will help add some diversity to the channel.

# Habitat Restoration Sites



The pink polygons illustrate the scale of the habitat restoration reaches. Future expansion is planned for the Middle and West Fork's as well.

# Restoration Objectives

- IMPROVE WATER STORAGE
- ATTENUATE THE HYDROGRAPH
- IMPROVE THERMAL CONDITIONS
- IMPROVE HABITAT SUITABILITY FOR BEAVER
- IMPROVE FLOODPLAIN CONNECTIVITY AND EXTENT OF FLOODPLAIN WETLANDS
- INCREASE CUMULATIVE CHANNEL LENGTH

There are many objectives associated with the habitat actions, but essentially the intent is to restore stream function, which will in turn, benefit cold-water fish species. This coupled with Cutthroat Trout monitoring will help us document the biotic benefits to the Cutthroat trout population in this system.

## Summary

- Models predict retraction in Cutthroat Trout distribution in Teanaway Basin headwaters
- Climate change is already occurring in the Teanaway
- Documenting current conditions facilitates long term biotic and abiotic trend monitoring
- Documenting current Westslope habitat use and preference can help inform mitigation actions
- Habitat restoration actions can help mitigate for the past and prepare for a changing climate (riparian planting can shade streams and reduce solar input reducing water temperatures)
- The need for conservation actions can be elevated by grassroot movements for lower prioritized species and building strong partnerships can help fuel action

In summary, we know the climate is changing in the Teanaway Basin and models predict reductions in suitable habitats for Westslope Cutthroat Trout. We believe that collecting fish and habitat data now will help us document current conditions and will facilitate trend monitoring into the future so we can track change and develop roadmaps for recovery. Our hope is that implementing large restoration actions will help improve degraded habitats and will restore stream function to buffer against a changing climate. Finally, many management agencies must grapple with decreasing budgets and associated project prioritization. In many cases, grassroots movements can help elevate the need for action within the prioritization schedules and building strong partnerships can help fuel action on the ground.

