

**AFR Stewardship Project: Macroinvertebrate Survey and  
Water Quality Assessment within the Ashland Watershed**

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## **Introduction**

Fire is a naturally occurring event within the Ashland Watershed (John B. Leiberg, as prepared by Darren Borgias). However, it has been suppressed in this area for over 100 years, allowing an accumulation of fuels to build, thereby increasing the potential for severe fires to destroy late-successional forests and reduce the quality of water. Vegetation has changed from more open conditions composed of fire adapted species to dense forests composed of fire intolerant species. The result is increased risk of large-scale, high-intensity wildfires that threaten forest ecosystems adapted to lower intensity fires (Agee, 1993). The Ashland Forest Resiliency Stewardship Project (AFR) was put in place by US Forest Service, the City of Ashland, Lomakatsi Restoration Project, and The Nature Conservancy to reduce these hazardous fuels under the Healthy Forest Restoration Act of 2003 (USDA Forest Service Rogue River-Siskiyou National Forest). “The purpose of the action is to protect values at risk, reduce hazardous fuels, reduce crown fire potential, and create forest conditions that are more resilient to wildfires” (ROD). The main objectives of this project involve monitoring water quantity and aquatic condition, survival and retention of large trees, late successional habitat, birds as landscape condition indicators, herbaceous cover and recovery (City Of Ashland OR). The proposed action plan under the Forest Service is to treat a total of approximately 8,150 acres of forested land . 14,921 acres of the Ashland Creek watershed is under the jurisdiction of the USDA Forest Service. 780 acres are owned by the City of Ashland. The remaining area is privately owned (Ashland Public Works). The main treatment of the AFR includes density management, which selectively remove trees within the forest, increasing the spacing to allow growth of the remaining trees. Other treatments such as under-burning will take place to reduce the amount of fuels that are built up on the forest floors. Controlled burns will be repeated as time goes on to prohibit crown fires in this area (see figure 2). However not all areas within the boundaries of the project will be treated. Areas such as Spotted Owl habitat, Fisher nesting sites, Riparian areas (within 50 feet of perennial streams), and some late successional habitats will not be modified.

However, these treatments may lead to disturbances in the watershed that could affect the stream quality. Therefore, this bioassessment study was undertaken to monitor water quality and document any changes following treatment. Biological monitoring can be defined as “the systematic use of biological responses to evaluate changes in the environment with the intent to use this information in a quality control program” (Rosenberg 2-4). This study sought to evaluate water quality by analyzing the abundances and composition of macro-invertebrates. Key methods for evaluating water quality via the categorization of macro-invertebrates for bioassessment are as follows: biodiversity, Ephemeroptera, Plecoptera, and Trichoptera abundance, total taxa abundance and the functional feeding group in which the organism belongs. This assessment evaluated the fresh water tributaries that lead into the Ashland Watershed- Section 20 Northerly, Section 20 Southerly, Reeder Gulch, East Fork of Ashland Creek, and West Fork of Ashland Creek (see figure 1). Potential impacts of the AFR project on stream quality will be assessed by surveying the populations of macro-invertebrates in the listed tributaries of the Ashland Watershed over a course of many years. This baseline study will help us gain information on the water quality in the Ashland watershed before a disturbance event has occurred in the area.

## Methods

### Site Description

The East Fork of Ashland Creek, West Fork of Ashland Creek, and Reeder Gulch are the three tributaries that provide the majority of water to Reeder Reservoir. Section 20 Southerly connects with Ashland Creek below Reeder Reservoir. These are the sample sites that macroinvertebrates were sampled from.

Table 1. GPS readings were taken at upstream and downstream ends of sampled transects. Samples were taken from September 26<sup>th</sup> 2010 to October 31<sup>st</sup> 2010. Two more attempts within this time were made to sample Section 20 Northerly on the 30<sup>th</sup> of October and the 9<sup>th</sup> of November 2010 with no success, due to insufficient flow.

**Table 1. Boundaries of the transect locations of each tributary sampled for macroinvertebrates.**

Transect	Up/Down	Coordinates*	Date of Collection
East Fork	Downstream	42:09:135N, 122:42:555W	10/26/2010
	Upstream	42:09:121N, 122:42:553W	
Reeder Gulch	Downstream	42:09:135N, 122:43:343W	10/30/2010
	Upstream	42:09:278N, 122:43:426W	
Section 20 Northerly <sup>†</sup>	Downstream	42:09:927N, 122:43:118W	Attempted 10/30/10 & 11/9/10
	Upstream	42:09:918N, 122:43:190W	
Section 20 Southerly	Downstream	42:09:539N, 122:43:133W	10/31/2010
	Upstream	42:09:413N, 122:43:426W	
West Fork	Downstream	42:06:389N, 122:44:746W	10/26/2010
	Upstream	42:06:455N, 122:44:800W	

\* Coordinates within 20 feet.

† The flow of Section 20 Northerly's flow low to accurately sample.

### Macroinvertebrate Sampling & Analysis

At each site, starting at each downstream transect marker, a 1 square foot sample area using a surber sampler (500 micron) was taken to collect macroinvertebrates from randomly selected riffles. A total of 8 square feet is required for each sample location. Moving upstream for the repeat samples minimized disturbances in the sediment that might cause false increases in abundance of organisms that are sampled. A surber sampler net was placed into the stream in a position such that all the water flowing over the sample area passed through the opening of the net. Once the sampler was settled into position, substrate in the sample area (rocks and debris) was scrubbed and disturbed in a manner that all the particulate flowed into the sampler. This sifting process was continued until all the rocks had been scrubbed off and the sediment thoroughly disturbed for a period of approximately 5 minutes. After sampling a total area of 0.74 m<sup>2</sup>, sample contents were composited into a 5 gallon bucket. Contents of the 5 gallon bucket were then poured through a 500 µm sieve. In order to reduce the amount of debris, the larger pieces of filtered material (rocks, sticks and leaves) were cleaned of their macroinvertebrates in the field and discarded. Remaining filtered material was placed into Nalgene jars containing 95 percent ethyl alcohol. Each collection jar was labeled with the relevant collection data including site and date.

Once in the lab the contents of each tributary sample were placed onto a sorting tray and macroinvertebrates were removed using a pair of tweezers and a hand magnifying lens when needed. All organisms were preserved in 70 % ETOH and stored in vials. Extraneous materials in Reeder Gulch and Section 20 Southerly were sub-sampled leaving a quarter of the material to

sort. The sorted macroinvertebrates were then sent to the BLM/USU National Aquatic Monitoring Center (NAMC) in Utah to be identified.

**Results**

Macroinvertebrates have different ways of collecting their food. There are a couple of general ways they do this. Table 2 gives the percentages of each of these different types of feeding groups in the aquatic environment.

**Table 2. Macroinvertebrates within select functional feeding groups for tributaries sampled in the Ashland Watershed.**

Water body	Reeder Gulch	West Fork	Section 20	East Fork
Shredder Abundance	876	18	200	288
Scraper abundance	162	62	43	74
Collector-filterer abundance	773	42	86	59
Collector-gatherer abundance	292	124	200	155
Predator abundance	86	91	200	86

A large sample size is important to have when making inferences about qualitative data. EPT abundance and taxa in most cases is directly related to quality of an aquatic environment.

**Table 3. Parameters of the macroinvertebrates in the tributaries sampled in the Ashland Watershed.**

Characteristics	West Fork	Reeder Gulch	East Fork	Section 20 Southerly
Total Abundance	473	2643	799	795
Total Number of Taxa	40	28	34	26
EPT Abundance	273	1600	574	303
Number of EPT Taxa	23	14	19	11

Information about the morphology of a stream can be determined by analyzing the composition of dominant taxa.

Abundance of taxa is important to get a good sample size along with documentation of all the different species in the aquatic environment.

**Table 4. Hilsenhoff Biotic Index indicates the organic pollutants in the water system by rating the tolerance of all individual macroinvertebrates and averaging them as a whole.**

Water Body	Hilsenhoff Biotic Index
Reeder Gulch	2.773333333
West Fork	3.187943262
Section 20	2.130434783
East Fork	1.776666667

The rating for 0-3.5 indicates there is little to no organic pollutants in the areas which were sampled.

## **Discussion**

Referring to Table 2 the West Fork tributary shows a high percentage of scrapers. This functional feeding group is known for feeding on aquatic organisms such as algae. This functional feeding group may increase in population when more light penetrates through the forest canopy and reaches the water. However, this may not occur due to the buffers set in place around the riparian area.

The shredder functional feeding group in the Reeder Gulch tributary represents a large percentage of the composition of macroinvertebrates. This group is known for eating decomposing leaf litter and organic material in the stream. The percentage of these organisms may decrease due to the removal of debris caused by controlled burns and other debris removal. The collector-filterers also represent a large portion in this tributary. If sediments are released into the streams cause by disturbances around the tributary this could potentially cause these numbers to increase. This could also decrease the numbers of scrapers due to scouring when storms release sediment from exposed soils.

Referring back to table three we can see a high number of total abundance in Reeder Gulch. This could be due to the buildup in sediments in the slower moving stream. The other numbers in this category seem to be reasonable. There are sound amounts of total number of taxa in each tributary. EPT are used to help determine the quality of water due to the fact that most of these species are intolerant to disturbances. The sample shows that there is a healthy EPT abundance in each tributary. This helps support that the quality of water in the watershed is good. The different species of EPT can also be seen in table 3. These numbers are fairly diverse in each tributary, also a positive indicator of water quality.

Hilsenhoff Biotic Index indicates the organic pollutants in the water system by rating the tolerance of all individual macroinvertebrates and averaging them as a whole. When samples from the tributaries are evaluated in the Hilsenhoff Biotic Index the results show that there is very little to no organic pollutants in the water.

These hypotheses are constructed with data taxonomically keyed down to the Family level. Therefore the data may change when more specific data is assembled. Having only done one sample for each of the tributaries, this baseline study serves as a foundation for a more extensive experiment, however no conclusions can be drawn in relation to the AFR project.

**Figures**

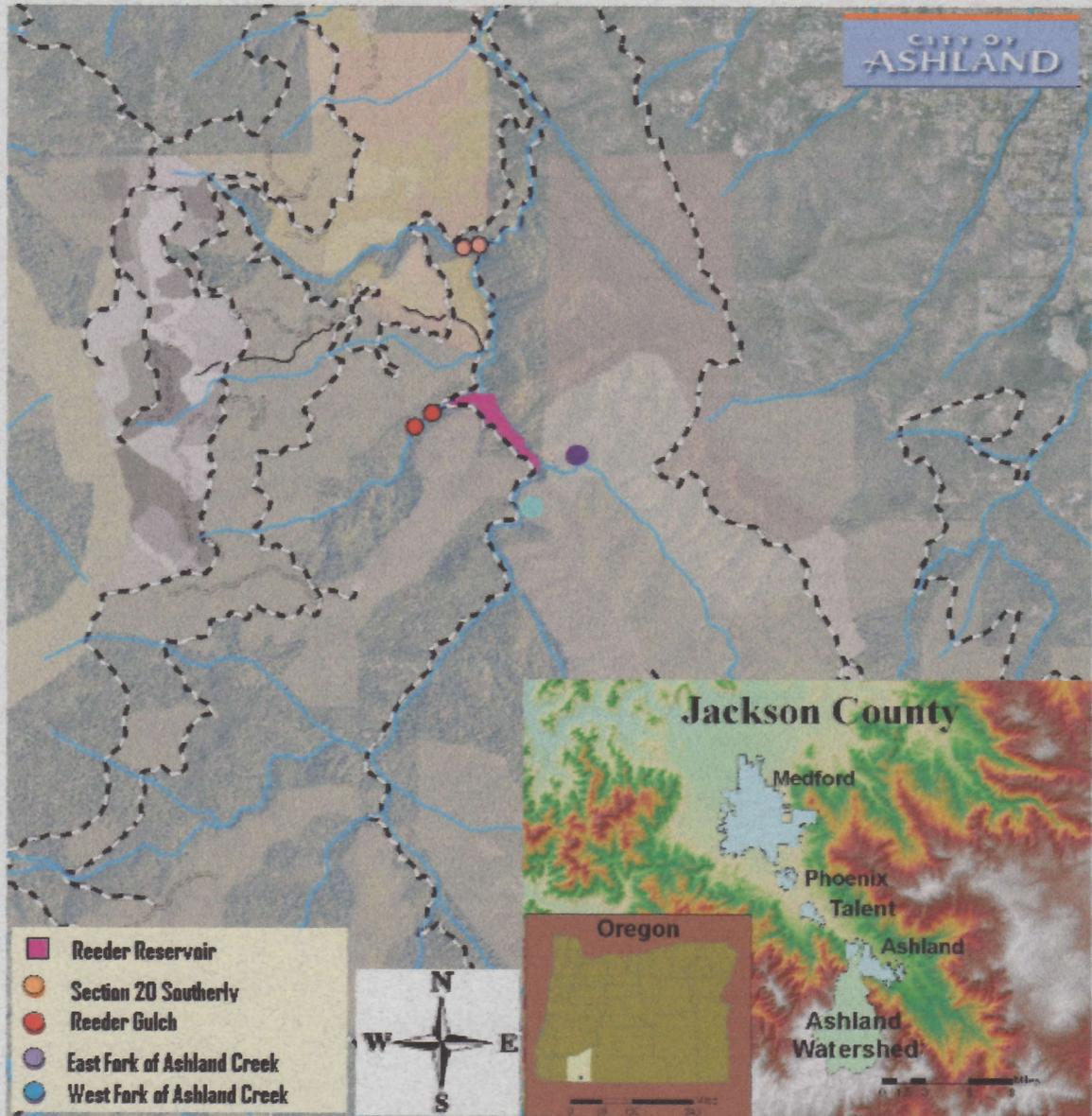


Figure 1. Locations of the four transects (Section 20 Southerly, Reeder Gulch, East Fork Ashland Creek, and West Fork of Ashland Creek) sampled.



Figure 2. Crown fire just south of Ashland taken on September 21, 2009 by Scott Harding.

## References

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