Appendix P

Aquatic Macroinvertebrates

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Sampling for macroinvertebrates at specific sites on the Umpqua National Forest has occurred since 1986 as part of Forest monitoring. As a survey tool, macroinvertebrates can be used to rate the condition of watersheds. Aquatic macroinvertebrates are excellent indicators of water quality as it relates to the need of aquatic biota including fish. Watersheds can be sampled and evaluated on an annual or semi-annual basis to determine if the invertebrate community is recovering, deteriorating, or remaining static. The Umpqua National Forest uses a protocol developed by Aquatic Biology Associates, ABA, for an intensive analysis of the benthic invertebrate communities present at the monitoring sites. The ABA Bioassessment was designed to detect detrimental impacts and trends in mountain watersheds where monitoring objectives were developed to document cumulative impacts from land management activities.

Two sites on the mainstem of Jackson Creek have been surveyed annually beginning in 1989. One site is located in Lower Jackson approximately 0.4 miles from the mouth and the upper site is located in the Luck Creek Flats vicinity. Squaw Creek was surveyed in 1990, 1993, and 1994. Beaver Creek was first sampled in 1993 but results are not yet available. Results from the macroinvertebrate sampling have been analyzed for 1989-1992. The following is a summary of the analysis for Upper and Lower Jackson Creek and Squaw Creek.

Lower Jackson Creek

The lower site on the mainstem of Jackson Creek is located at approximately river mile 0.4, in the same vicinity as the smolt trap. This site has been monitored since 1989. From 1989 through 1992 the macroinvertebrate community has been dominated by more riverine taxa and taxa tolerant of high summer water temperatures and fine sediment. Intolerant taxa are very rare or absent. The fauna present in both the riffle and margin samples indicate that summer water temperatures are sufficiently high throughout an extended period of time, enough to be a major influence on the community structure. Summer water temperatures are high enough to cause substantial mortality to stone-cased caddisflies that remain dormant throughout the summer before emerging in the fall (Wisseman 1993).

Fine sediment is also having a negative influence on the macroinvertebrate community in the riffle and margin habitats of Lower Jackson Creek. Pore and crevice spaces are heavily embedded. Many invertebrate species depend on interstitial spaces between rocks to shelter them from high water velocities. If these spaces are filled by sediment, the number of associated taxa decreases (Munther 1985). This may also indicate changing conditions for spawning fish and overwintering habitat because both are adversely affected by increased sediment accumulation. In Jackson Creek, taxa which are dependent on large crevices and interstitial spaces in the stream bed are rare. Scrapers intolerant of silting are rare. Some scrapers that feed on rock surfaces in the winter and spring after winter high water has scoured off filamentous algae and sediment are present. Taxa intolerant of high winter scour are also rare (Wisseman 1993).

The ABA protocol samples three different habitats at each site; riffle, margin, and coarse particulate organic matter (CPOM). Riffle samples include all erosional habitats and margin samples are taken in the slower water near the edge of the stream. CPOM consists of leaves, needles and other organic matter which collects behind logs, boulders, and in dead water areas. Macroinvertebrates called shredders are instrumental in the metabolism of CPOM. Shredders appear to be very sensitive indicators of certain habitat parameters. Unimpacted streams with relatively stable substrates and good retention of organic material will have a relatively high percent of the taxa present as shredders. CPOM could not even be found for sampling at the lower Jackson Creek site from 1989-1992 and the site showed little development of a shredder community. The few taxa that were present were omnivorous in their feeding habits. This means they are not totally dependent on detritus for a food source. Long term retention of detritus prior to colonization by shredders is necessary because leaves and needles must be colonized by microbes for approximately 30 days before invertebrates will consume them (Meehan 1991). The lack of CPOM and shredders is evidence of the inability of this site to retain organic material (Wisseman 1993) and indicates a lack of channel complexity to provide for diverse aquatic communities.

Upper Jackson Creek

The Upper Jackson site was originally located near mile marker 13 near Luck Creek Flats but was changed in 1993 to just upstream of Cover Camp. Upper Jackson has been monitored since 1989. From 1989 through 1992 the macroinvertebrate community has been severely limited by the lack of habitat complexity. The dominant bed substrate is bedrock and there is essentially no hyporheic habitat. The hyporheic region is the area below the bed of a stream where interstitial water moves by percolation. An extensive fauna can occur up to one meter in this zone (Merritt and Cummins 1988). As with the lower site, little crevice and interstitial space is available and, hence, very few species associated with them. The stream is wide at this site and solar exposure is high. Woody material is also lacking. Macroinvertebrate communities indicate that periodic scour of the site is extreme and where gravel and cobble deposits have accumulated, they are resorted every few years by floods. During periods of floods, refuge areas are limited (Wisseman 1993).

Ephemeroptera, Plecoptera, and Trichoptera (EPT) taxa are some of the more intolerant aquatic invertebrates to high summer water temperatures and fine sediment deposition. EPT richness appears to be a good indicator of the overall habitat and water quality. A substantial drop in the total taxa richness and EPT taxa richness was observed between 1989 and 1992 (the same trend was also observed at the lower Jackson Creek site). Besides the drop in taxa richness, the disappearance of many intolerant species that drift down from the upper watershed was also observed. This drop may be drought related. Some warm water, sediment tolerant and riverine taxa increased in numbers from 1989 to 1992 or appeared for the first time in 1992. The habitat at the Upper Jackson Creek site is now severely degraded but before road construction and timber harvest this site probably supported an extremely rich and diverse invertebrate community due to the stream size, elevation, vegetation, and gradient of the stream (Wisseman 1993).

Squaw Creek

Squaw Creek was first surveyed in 1990 and again in 1993 and 1994. The sampling site is located approximately 50-150 meters upstream from the mouth (Figure ?). Even though Squaw Creek provides good flow, cool water, moderate to high gradient, and large substrates, the bioassessment scores were poor. The invertebrate community is not limited due to high summer water temperature or access to substrate because of sediment or filamentous algae growth. Instead, due to the lack of channel complexity from large woody material in the stream, Squaw Creek is exhibiting the results from fast water velocities during winter flows. Without channel complexity, sand and fine gravel are mobilized and cause high scouring of the stream channel. The invertebrate community appears to suffer from habitat limitations produced by periodic high scour and resorting of substrates in Squaw Creek. The frequency at which rocks shift in a stream can significantly alter food abundance and macroinvertebrate communities (Richards and Minshall 1992).

Desired Future Condition

The ABA bioassessment gives an overall cumulative rating, expressed as a percent of the maximum score possible, for all the metrics of the three sample types taken. The following are the possible range of scores:

80-100 Non-Impaired = Excellent habitat and water quality.

60-79 Slightly Impaired = The benthic invertebrate community points to habitat limitations.

40-59 Moderately Impaired = The community reflects significant habitat and/or water quality limitations.

<40 Severely Impaired = The community present has developed under habitat conditions that represent a severe departure from the ideal conditions.

The ABA bioassessment evaluates the benthic invertebrate community with a comparison of current scores to scores in what is considered "ideal" habitat conditions. Variations of the overall ratings will occur due to stream order, gradient, and aspect. The mean riffle score for samples collected over a 3 year period (1989, 91, 92) from a wilderness stream, Boulder Creek on the North Umpqua, was 73. Boulder Creek was identified as having a lower than expected bioassessment score due to the flashy nature of the system that causes periodic high scour. The lower scores were also a result of the south facing aspect of the watershed which allows summer water temperatures to be warm. Two relatively undisturbed watersheds of the South Umpqua River, Castle Rock Fork and South Fork Cow Creek, had mean riffle scores for a four period (1989-92) of 70 and 82. From the three scores discussed, we can assume that the expected desired range for a mid-order stream in an unimpacted watershed would be 75-100. Streams, such as Lower Jackson Creek, which have characteristics of a larger riverine system with lower gradients and a more open riparian canopy will tend to have lower overall scores, 65-100. Table 1 shows the mean cumulative scores for the three sampling sites in the Jackson Creek watershed and the

desired future scores. Due to the inconsistency of margin and CPOM sampling, the 1989-1992 scores are based entirely on riffle samples as are desired future conditions.

Sampling Site	Year Sampled	Present Mean Score	Desired Future Score
Lower Jackson	1989-92	44	65-100
Upper Jackson	1989-92	60	75-100
Squaw Creek	1990	63	75-100

Table 1. Present and desired future bioassessment ratings for Lower Jackson, Upper Jackson, and Squaw Creek.

Threatened and Endangered Macroinvertebrates

In 1990, Entomologist Bob Wisseman found the following sensitive aquatic invertebrates to be present or suspected to exist on the Umpqua National Forest.

Apatania tavalus (Order Trichoptera: Family Limnephilidae)

Apatania tavalus is listed as a candidate Threatened and Endangered aquatic invertebrate taxa on the 1984 US Fish and Wildlife and the Regional Foresters Sensitive list. It is category 2 status, meaning that insufficient information is available on the species to determine if it is either threatened or widely distributed and more common than the available records indicate. To date, no intensive surveys for this taxa have been conducted across the species range to determine how common or rare it might be.

Larvae for the caddisfly A. tavalus are found in springs and low order spring-fed streams at higher elevations (over 4000') in the northern Oregon Cascades. This suggests that this species may be associated with glacial deposits. Populations appear to be patchily distributed , and probably occur in a limited number of streams or spring-fed streams. Larvae are scrapers, subsisting on algae and diatoms scraped from rock and wood surfaces (Wiggins 1977, as cited by Wisseman 1990).

A 1990 survey by B. Wisseman in the headwaters of Squaw and Donegan Creeks was conducted to determine the presence and distribution of sensitive aquatic invertebrates in the Whale Timber Sale Planning Area. Apatania tavalus was found to be widely distributed in small tributaries of Squaw and Donegan Creeks at elevations of 4000-5000' (figure ??). They were found on coarse gravel and cobble substrate in low gradient areas of low to moderate current. They were not found in high gradient tributaries or in fast velocity areas. A. tavalus are scraper caddisflies that may benefit from increased

algae production caused by the reduction of forest canopy and Apatania were often associated with openings created by roads. However, the low gradient habitat that Apatania larvae are associated with is more susceptible to increased sedimentation and embeddedness due to road construction and timber harvest. Larvae were not found where fine sediment embedded cobbles and filled interstitial spaces. Although A. tavalus was common in the headwater tributaries of Squaw and Donegan Creeks, populations at any given site were of low densities. It is possible that Apatania tavalus would be found at elevations over 4000' in the Jackson Creek watershed with similar glacial processes like those which have occurred in the headwaters of Squaw and Donegan Creeks. Several periods large scale glaciation events have occurred in the Jackson Creek watershed, developing a number of the landforms seen today. These glacial events are evident in cirques and glacial moraines in Lonewoman Creek, Falcon Creek, and Upper Jackson Creek (Paul Uncapher, personal communication). These would be potential areas where Apatania tavalus could be found.

Farula reaperi (Order Trichoptera: Family Uenoidae)

Farula reaperi was another category 2 status aquatic invertebrate taxon found during the 1990 survey of the Whale Timber Sale Planning Area for sensitive species. This species is also found on the Regional Foresters Sensitive Species List. In contrast to the wide habitat range of Apatania , Farula species typically display a very narrow habitat association. These caddisflies are most often associated with cold, large volume spring-heads at higher elevations in the Cascades and Sierras. Farula are found in spring channels having clean coarse gravel and cobble substrates supporting extensive growths of aquatic mosses. Larvae of Farula are always associated with small, cold, mountain streams of moderate to high gradient. Larvae of Farula appear to scrape fine detritus and algae from rock and wood surfaces for food (Wiggins 1977, as cited by Wisseman 1990).

Populations of Farula are typically confined to the immediate vicinity of large spring-heads. Entire populations are often found within stream reaches of 100 meters or less. Farula reaperi appears to occur only in isolated habitat islands at elevations above 4500' in the Western Cascades. The information available for this taxon indicate that it has a limited geographical distribution.

Farula reaperi were found at three sites in the headwater region of Squaw and Donegan Creeks (figure ???). All three sites were above 4500' and were small spring or spring-wetland systems which occupy an area of about one acre. These spring channels had cold water and were shaded by old-growth conifers, although one site did have some larvae in a more open area. The spring channel also had gravel and cobble which was free of fine sediment. Large amounts of woody debris and aquatic mosses were abundant. Larvae were found on cobble and wood surfaces, and in moss, in areas of moderate to fast current (Wisseman 1990). It is assumed that F. reaperi may be found in springs above 4500' in other areas through the Jackson Creek watershed with similar characteristics as those in the headwater region of Squaw and Donegan Creeks.

Populations of three sensitive Farula species can be expected to occur throughout the subalpine zone of the Oregon Cascades. Populations are probably patchily distributed, and restricted to source areas of cold spring streams. It is probable that an intact coniferous canopy in the riparian areas of small spring streams is important in maintaining populations of Farula reaperi.

Erobrachcentrus gelidae (Order Trichoptera: Family Brachycentridae)

Erobrachcentrus gelidae is identified as a sensitive species of category 2 status on the US Fish and Wildlife list of 1984. Most larval collections of this caddisfly have been made in springs and small, spring-fed streams at elevations over 4000'. Populations appear to be patchily distributed, and are probably found in glacial deposits. Populations occur in subalpine forests on many of the major peaks in the Cascade Range. All collections of Eobrachycentrus gelidae larvae have been made from small, cold, moderate to high gradient, perennial spring channels which are densely shaded by a coniferous overstory and a deciduous understory. Larvae are associated with aquatic mosses, and appear to be restricted to high elevation small first order spring channels having a significant amount of aquatic mosses. Larval association with aquatic mosses and gut content analysis show that vascular plant tissue and filamentous algae are the primary food source. Clearcutting of these areas may have lead to the local extinction of some species (Wisseman 1990).

A population of E. gelidae was found in a first order tributary in Upper Jackson off the 29-400 road in June of 1990. This population was found in a stream flowing through a small stand of old growth adjacent to recent clearcut areas. It is assumed that other populations of E. gelidae are present throughout the Jackson Creek watershed at elevation over 4000' and in old growth forest, perhaps of glacial deposits, but additional surveying should be completed to verify this.

Salmoperla sylvanica (Order Plecoptera, Family ?)

This stonefly was found at two sites during the sensitive invertebrate survey for the Whale Timber Sale Planning Area in the headwaters of Squaw and Donegan Creeks (figure ???). This stonefly taxa has not been officially listed as sensitive but is considered to be rare by B. Wisseman. The genus was first described in 1987 from material collected from a limited geographic area in northern California. This is the first record of the genus occurring in Oregon. One species, S. sylvanica, is currently known for the genus. It is assumed that the larvae collected from the headwater tributaries of Squaw and Donegan Creeks is this species, however, adult males are needed for positive species confirmation (Wisseman 1990).

Ceraclea vertreesi (Order Trichoptera: Family Leptoceridae)

Ceraclea vertreesi is a sensitive species and category 2 status on the US Fish and Wildlife Service 1984 list. This caddisfly is found in low to mid-elevation (2000-4000') large streams and riverine habitats in the Pacific Northwest. Ceraclea larvae are found in both lentic and lotic habitats, and are either detritus feeders or feed on freshwater sponges (Wiggins 1977, as cited by Wisseman 1990). Ceraclea vertreesi were found in an unknown location in the South Umpqua River in 1982 (Wisseman 1990) but have not been found at the S. Umpqua or Jackson Creek collection sites since the sampling of these sites began in 1989.

Larger streams and rivers at lower elevations in the Pacific Northwest have historically been highly impacted by anthropogenic activities. These larger, lotic systems integrate all point-source and

non-point source impacts from upstream tributaries. Development of lowland areas of Oregon, with a higher proportion of privately held land supporting more intense human activity, probably has a disproportionately greater impact on these species, than activities on federal forest land. Although populations of these species may have historically been found at lower elevations below the Forest boundary, impacts from increased sedimentation, and higher water temperatures from activities such as road construction and timber harvest on federal lands may have effected Ceraclea vertreesi downstream. Restoration activities which reduce sediment and lower stream temperatures on the forest will also benefit this species downstream (Wisseman 1990).

Ochrotrichia alsea (Order Trichoptera: Family Hydroptilidae)

Ochrotrichia alsea are listed as a category 2 candidate invertebrate on the Federal Rare and Endangered species list. These caddisfly larvae are an occasional component of the benthic community of larger streams and rivers at low to mid-elevations (2000-4000') on the west side of the Oregon Cascades. They can also be found in mid-size streams having a more open canopy allowing high instream algal production. Larvae of the genus Ochrotrichia are usually found on stable rubble and boulders, and perhaps associated with logs in areas of moderate current, such as glides, deeper riffles, and the head of pools. These caddisflies feed by scraping diatoms from rock surfaces. Ochrotrichia alsea larvae and pupae require rocky substrates that are reasonably free of fine sediments that could smother their periphyton food source or directly smother sedentary pupae attached to rocks. Nutrient enrichment of riverine habitats may shift the instream periphyton community from diatoms and algae that O. alsea scrapes from rock surfaces, towards filamentous algae and bacteria which may inhibit feeding. O. alsea have not been found on the Umpqua National Forest but are suspected by R. Wisseman to occur here. The absence of O. alsea in South Umpqua Basin above the Forest boundary may be the result of inadequate sampling for the species.

References

Merritt, R.W. and K.W. Cummins. 1988. Habitat, life history, and behavioral adaptations of aquatic insects. Pages 38-58 *in* An Introduction to the Aquatic Insects of North America. Kendall/Hunt Publishing Company, Dubuque, Iowa, USA.

Munther, G.L. 1985. Use of macroinvertebrates to monitor forest management activities. Western Wildlands 11(3): 8-11.

Murphy M.L. and W.R. Meehan. 1991. Stream ecosystems. Pages 17-46 *in* W.R. Meehan, editor. Influences of Forest and Rangeland Management on Salmonid Fishes and their Habitat. American Fisheries Society Special Publication 19, Bethesda, Maryland, USA.

Richards, C. and G.W. Minshall. 1992. Spatial and temporal trends in stream macroinvertebrate communities: the influence of catchment disturbance. Hydrobiologia 241:173-184.

Wisseman, R. 1993. Fall 1992 benthic invertebrate biomonitoring report and bioassessment interpretive manual. Umpqua National Forest, Roseburg, Oregon.

Wisseman, R. 1990. Sensitive aquatic invertebrates found or suspected to be present on the Umpqua, Rogue, and Siskiyou National Forests, Oregon. Workshop, Roseburg, Oregon. July 24, 1990.

Appendix Q

Fish Tributary Descriptions