

Monitoring the Elk Creek Channel Restoration

Wease Bollman
Rhithron Biological Associates

Macroinvertebrate Biomonitoring of a Reconstructed Placer-Mine

Elk Creek, which originates in the Garnet Mountains of western Montana, is a tributary of the Blackfoot River. Reconstruction of the Elk Creek channel in the upper reaches of the creek to restore placer-mined areas was undertaken in November 1994. The reconstructed reaches are about 10 air miles southeast of the Highway 200 crossing of the creek. Placer mining probably began in the study reach in the 1860's and continues to this day. The years of mining left many parts of the canyon in a highly disturbed condition, with some reaches barren of vegetation and with stream channels extensively altered. In some places, channels were obliterated, with resulting overland flow or total loss of surface flow. The channel reconstruction project resulted in restoration of contiguous surface flow throughout the study reach. However, the activities of November 1994 additionally caused disruption of stream geomorphic features and nearby riparian areas, at least initially, in those reaches where channels were built using heavy earth-moving machinery. The machine-formed channels, interspersed with reaches not disturbed by the 1994 reconstruction events, created a unique opportunity to measure recovery of macroinvertebrate communities in new channels. The results of biomonitoring include a demonstration of the time-to-recovery of macroinvertebrate communities as well as a documentation of the improving biotic condition of the entire upper reach of Elk Creek.

Methods

Eight sites on Elk Creek were sampled for macroinvertebrates on eleven occasions: August 1994 (pre-reconstruction), November 1994 (immediate post-reconstruction), April, August and November 1995, April, August and December 1996, and April, August and November 1997. Organisms were identified to the lowest taxonomic level possible, typically genus or species. Community structure, function and sensitivity to impacts were characterized for each sample using a bioassessment metric battery comprised of six metrics. Each metric was individually scored using criteria developed for montane ecoregions of Montana by surveying metric ranges in data from a variety of montane streams in the state (Bollman, unpublished data). Individual metric scores were summed, and the total score for each sample was expressed as a percent of the maximum possible score. Graphical displays and simple statistical analyses were utilized to demonstrate whether improvements in biotic condition followed reconstruction. Trends of bioassessment scores for each site in all years and over all seasons were examined graphically as part of a site-by-site descriptive analysis aimed at illustrating the biologic manifestations of reconstruction and recovery. Finally, sites were categorized according to whether or not they had undergone reconstruction, and mean scores and confidence intervals of these categories for each sampling event were examined and compared. This analysis resulted in an estimate of the amount of time it took for bioassessment scores of reconstructed sites to become similar to those of sites that had not been reconstructed.

Results and Discussion

Upward trends in bioassessment scores were recorded at all sites over the years of the study. Immediately following reconstruction of the Elk Creek channel, bioassessment scores fell at most of the

reconstructed sites, and increased at most non-reconstructed sites. Lowest scores for reconstructed sites were usually those calculated for the first or second post-reconstruction samples, and suggest the magnitude of disturbance associated with reconstruction. Score ranges for non-reconstructed sites over the years of study are generally smaller than ranges for reconstructed sites, suggesting some stability in the benthic communities at these sites and resilience to the increases in suspended sediment accompanying reconstruction. Depression of scores at reconstructed sites was primarily due to precipitous loss of taxa associated with the channel reconstruction. Scores at all sites generally began increasing over the next two seasons, and continued to trend positively until monitoring ceased in November 1997. At that time, bioassessment scores indicated that macroinvertebrate communities at all sites were diverse, robust, sensitive and generally characteristic of an unimpaired montane headwater stream.

The data presented in Figure 2 suggests that it took about a year after reconstruction events for the recovery of biotic health at reconstructed sites to be realized. Although differences in mean bioassessment scores for reconstructed sites and non-reconstructed sites were no longer statistically significant by August 1995, the graphical display of the data strongly suggests the biologically significant differences persisted between the two groups until November 1995. While the improvement in bioassessment scores of reconstructed sites was more dramatic because initial scores were generally lower, it is worth noting that dramatic improvement in scores also occurred at non-reconstructed sites over the study period. Improvement of biotic health at these sites was probably due to the facilitation of colonization processes by the restoration of surface flow throughout the project area. Consequently, community similarity increased over the study period for most of the monitored sites. Restored hydrologic connectivity in these Elk Creek reaches may also have modified and enhanced habitat for macroinvertebrates at both reconstructed and non-reconstructed sites. Even after November 1995, when bioassessment scores of reconstructed sites became equivalent to those of non-reconstructed sites, the biotic integrity of benthic communities continued to improve.

In bioassessment studies, it is often typical to effect changes in watershed management for the sake of water and habitat quality, and to monitor the results with a single sample taken before the changes and a single sample taken afterward. An early end to the monitoring efforts at Elk Creek may have missed the recovery of biotic health at sites which were reconstructed, and almost certainly would have missed the subsequent changes in conditions which developed more slowly over the following years. Those changes included improvements in biotic integrity to levels approaching and even attaining expectations for unimpaired montane streams. The diversity, sensitivity, and trophic structure of benthic assemblages in Elk Creek in late 1997 appear to be nearly ideal in most reaches studies.