

Red Clover POCO Restoration Project

Post-Project Monitoring Report



Red Clover POCO Project Area: April 11, 2011

Feather River Coordinated Resource Management

Plumas Corporation

February 3, 2012

Background

The primary purpose of the Red Clover POCO Restoration Project is to restore the function of the channel/floodplain system. Benefits anticipated to be gained by these projects are reduced erosion, increase groundwater storage, improved water quality, floodplain infiltration leading to flood attenuation, increased base flows, reduced maximum daily water temperatures, and improved aquatic and riparian habitats for fish and wildlife. This document is reporting on the post-project condition of the above mentioned attributes in the Red Clover POCO project area.

Methods

- What is the project's effect on groundwater recharge?

Three parameters are being measured to answer this question; vegetative transects, photo monitoring, and groundwater wells.

Four 100 ft vegetative transects were permanently established throughout the project area in 2010. The point-intercept method was used to record plant type and understory at 50 points along the transect. These are being analyzed to assess conversion from xeric plant communities to mesic plant communities.

Photo point monitoring are being used to visually show changes to the landscape at the vegetative transects. The goal is to show reduced sagebrush in the floodplain meadows.

Three existing wells are measured monthly between June and November to monitor the groundwater levels within the project area.

- What is the project's effect on the annual hydrograph?

Continuous recording stations place throughout the watershed record stream flow continuously throughout the year. Two of these stations, at Notson and Flournoy Bridges are being used to analyze base flows and flood peaks. These stations have been in place for eleven years and comparable water years will be used to evaluate the project effects on these two metrics.

- What is the project's effect on water quality?

Three parameters are being measured to answer this question; water temperature, fine sediment, and macroinvertebrate community.

Instream HOBO temperature loggers were placed above and below the project area from May through October in 2009-2011, recording every hour and a half. A goal of the Red Clover POCO Project is to decrease maximum daily water temperature. In addition, water and air temperature has been continually recorded at the downstream continuous recording stations, Notson and Flournoy Bridges, since 2000.

Fine sediment is being measured through storm event turbidity grab samples. These are collected at the top of the project area and downstream from the top of the project about 2

miles. This downstream sampling location is the farthest point downstream that is accessible to storm event monitoring with snowmobiles.

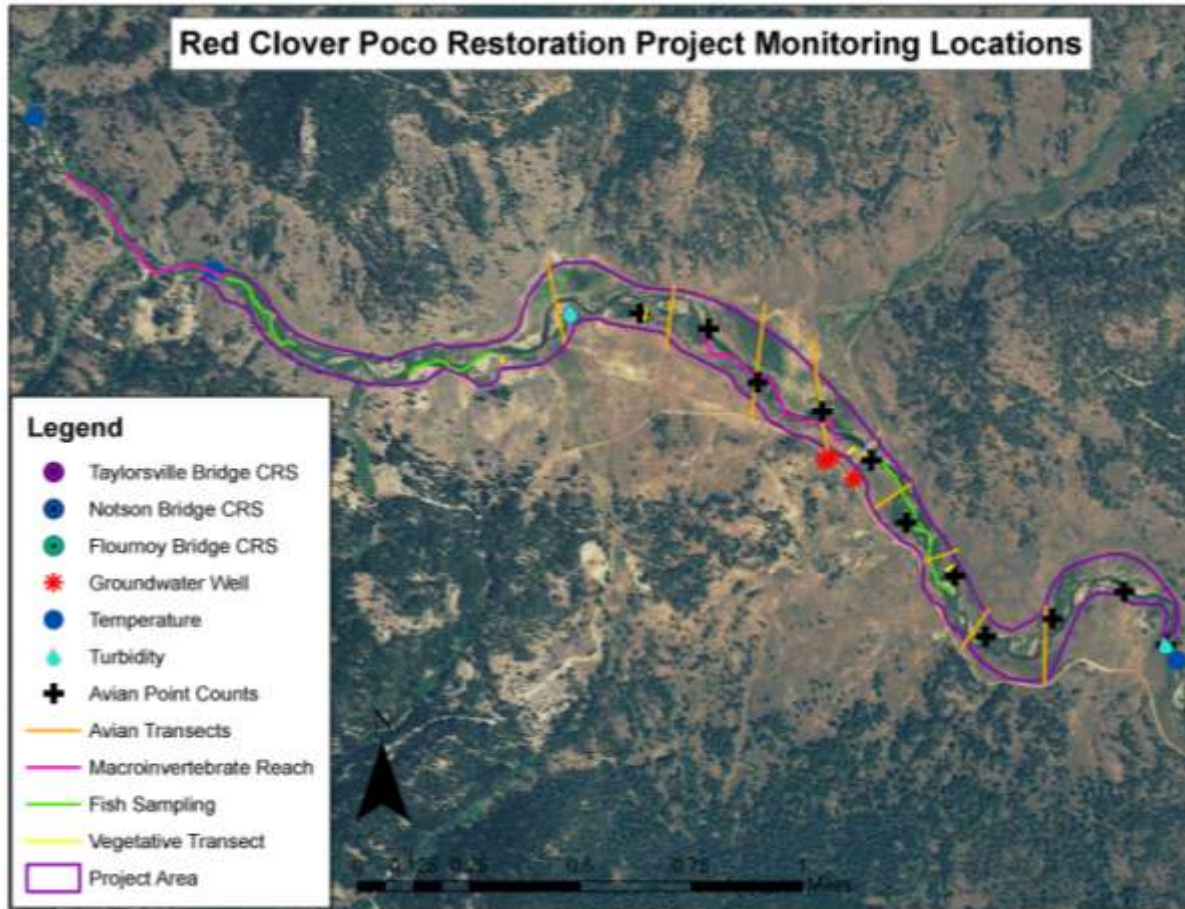
Macroinvertebrate community samples are being collected by the US Forest Service, a project partner, and used to assess percentage of intolerant taxa within the project area. Macroinvertebrates are good indicators of water quality because they live in the water for most of their lives, they are sensitive to change, they are easy to collect, and they have limited mobility. Macroinvertebrate taxa differ in how tolerant they are to varying levels of water quality. Percentage of intolerant taxa will show how many taxa present can withstand degraded water quality. Macroinvertebrate samples were collected and analyzed from three riffles within the monitoring reach in 2010 and 2011. Samples may take up to 2 years for lab processing.

- What is the project's effect on the coldwater fishery?

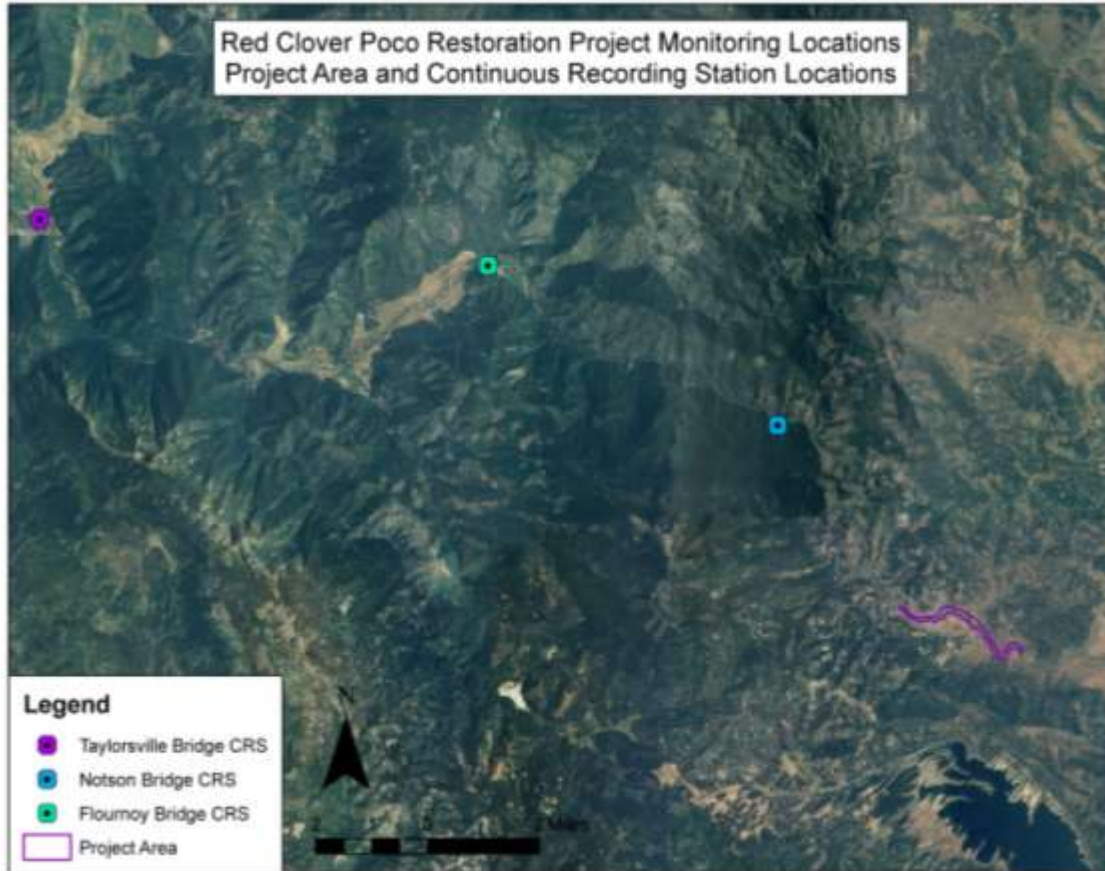
Repeatable fly-fishing efforts are being used to estimate the number of trout in the project area. In the past the FRCRM has conducted electroshocking surveys to estimate the size of the trout population within other project areas. This has proven to be difficult, since the habitat created by the ponds (where many trout have been found) is too deep for backpack electroshocking. There has been a trial boat electroshocking effort in the ponds on other projects. This effort showed that many trout were in the deep water, but accessibility to the ponds was extremely difficult. Fly-fishing with volunteers will help with accessibility issues. Data will be analyzed to express catch per unit effort.

- What is the project's effect on avian production?

Avian surveys are being completed by two project partners. California Department of Water Resources (DWR) completed several pre-project line transect surveys in 2009 and 2010, and PRBO Conservation Science conducted pre-project and post-project point count surveys within the project area in 2010 and 2011 respectively.



Map 1. Red Clover POCO Restoration Project Area and Monitoring Locations



Map 2. Red Clover POCO Restoration Project Area and Downstream Monitoring Locations

Post-Project Condition

Groundwater Recharge

Vegetative Transects

Percent dry dependent species was considered the aspect of the vegetative transects that would change the most with groundwater recharge in the meadow. Percent wet species was included to show the percentage of mesic reliant species on each transect. Table 1 shows the percent dry species and the percent wet species for each of the four transects measured in July 2010 and July 2011. On all four transects percent dry species decreased and percent wet dependant species increased. Post-project on all four transects there was a 52% decrease in dry dependent species and a 97% increase in mesic reliant species.

Transect	Percent Dry Species		Percent Wet Species	
	Pre-Project 2010	Post-Project 2011	Pre-Project 2010	Post-Project 2011
1	59	6	34	63
2	41	31	8	16
3	39	31	14	28
4	44	19	8	19

Table 1. Pre- and post-project condition of vegetative transects July 2010 and July 2011

Photo Monitoring



Photo 1: Vegetative transect 1, Station 0, Pre-project Photo 2: Vegetative transect 1, Station 0, Post-project

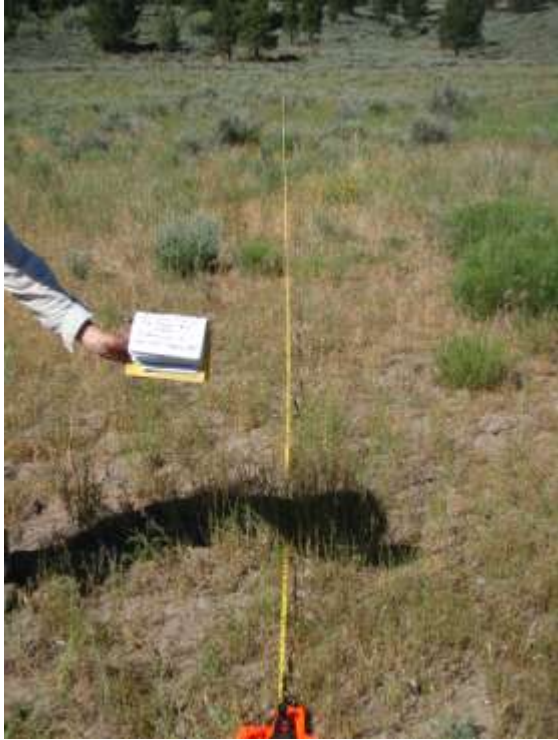


Photo 3: Vegetative transect 2, Station 100, Pre-project Photo 4: Vegetative transect 2, Station 100, Post-project



Photo 5: Vegetative transect 3, Station 0, Pre-project Photo 6: Vegetative transect 3, Station 0, Post-project

Pre-project vegetative transect monitoring photos were taken July 15, 2010. Post-project vegetative transect monitoring photos were taken July 25, 2011. The above photos illustrate the projects effect on groundwater recharge. The goal was to show reduced sagebrush in the floodplain meadows. Photos 2 and 4 show dead sagebrush in the meadow, which indicates that the increase groundwater recharge is causing mortality in the dryland species of sagebrush (*Artemisia tridentata*). Photo 6 suggests little mortality of sagebrush in the floodplain meadow along transect 3. The sagebrush along vegetative transect 3 is a moisture tolerant species of sagebrush, Silver Sage (*Artemisia cana cana*).

Groundwater Wells

Figure 1 displays the groundwater level in three wells within the Red Clover Poco project area. This chart shows the depth to groundwater from the surface in feet. Zero feet represents ground surface elevation. The missing data on SE and South wells are due to the wells becoming dry. 2009 was pre-project conditions, 2010 and 2011 were construction years for the project. In 2010 and 2011 the depth to groundwater was not as deep as in pre-project conditions, but the groundwater still drained out of the meadow relatively quickly. This is expected to change in the coming years as the groundwater table recharges.

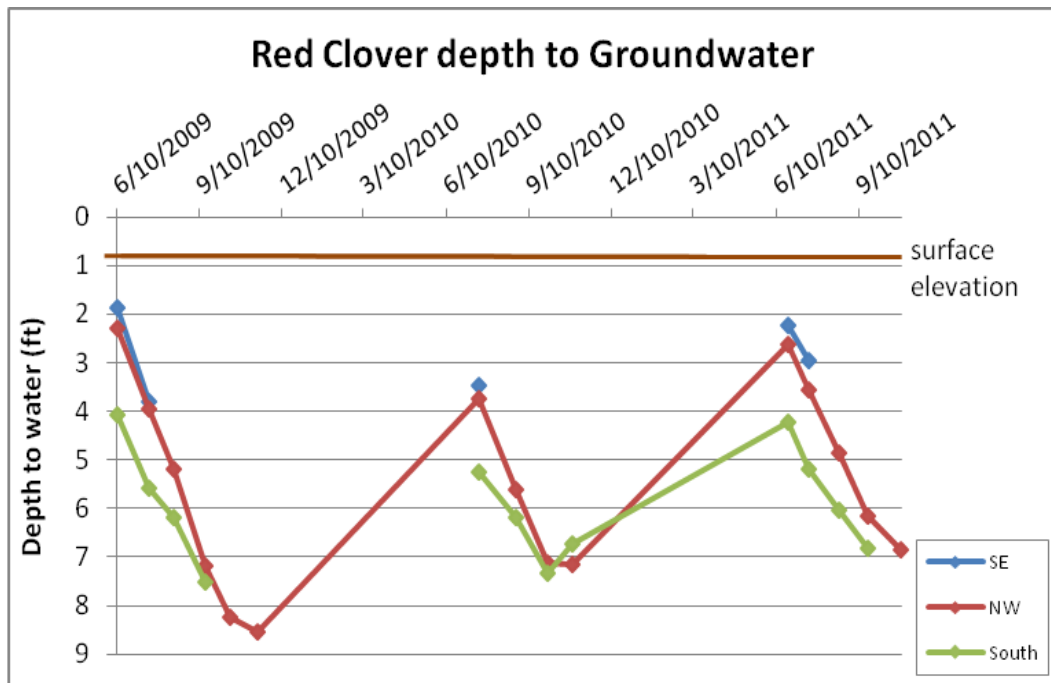


Figure 1: Groundwater levels in SE, NW, and South Wells within the Red Clover Poco Project Area: June-November 2009, 2010, and 2011.

Annual Hydrograph

Project effect on base flows and flood peaks were analyzed by looking at pre- and post-project conditions in similar water years. The 2006 water year, with 156% of normal precipitation in the Feather River basin, is the most similar water year to 2011, with 142% of normal precipitation.

Baseflow

A project goal is to increase the daily average flows in Aug-September (low-flow season) at Notson Bridge and at Flournoy Bridge. This increase was analyzed between the 2006 and 2011 water years. Flournoy Bridge does not have flow data for 2006, so is not included in the analysis. Figure 2 shows a low-flow season average of the average daily flow at Notson and Bridge. The average daily flow in 2011 is 0.2 cfs more than in 2006. The standard deviation bars show that this increase in flow is not significantly different. This metric will continue to be monitored in 2012.

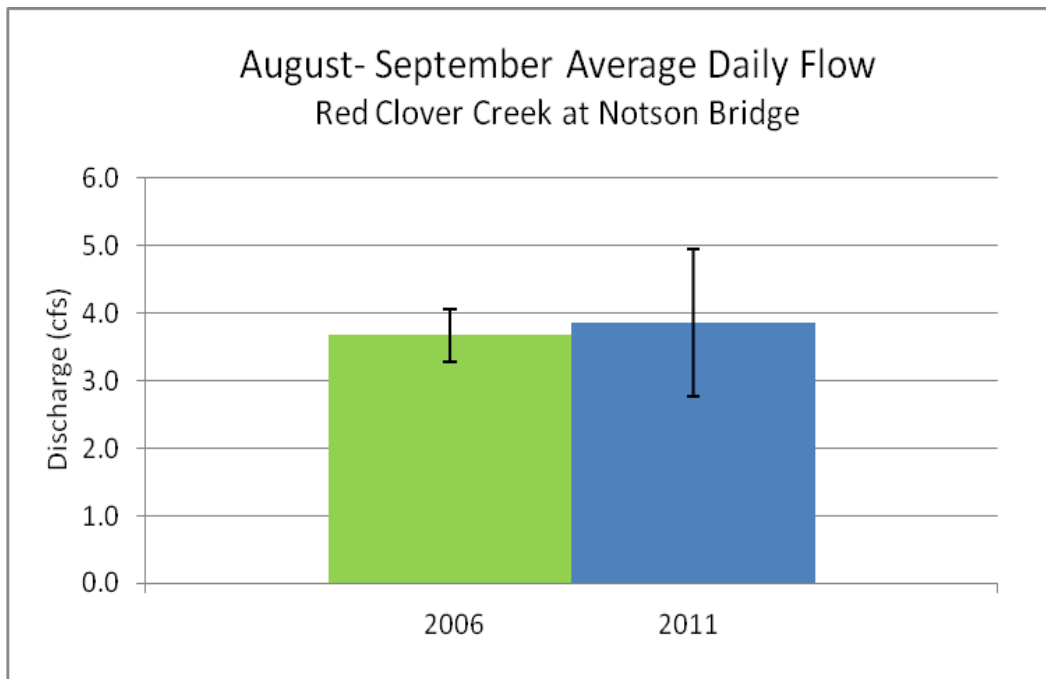


Figure 2: Average Stream Flows in Red Clover Creek July-September 2006 & 2011

Flood Peaks

Project effect on flood peaks was analyzed by looking at storm recession length pre- and post-project in 2006 and 2011 respectively. Meadow restoration projects are expected to spread water out across the meadow floodplain, which in turn slows water down. This is expected to prolong storm recession in a post-project condition. Two similar storm events were analyzed from comparable time periods in both years. The stochasticity of flood peaks and variability in timing, temperature, and intensity of storm events can make comparing flood peaks between

different years difficult. Both storm events post-project displayed shorter storm recession lengths than the pre-project storms. This metric will continue to be analyzed in 2012.

Water Quality

Water Temperature

Figure 3 displays maximum daily water temperature 0.6 miles below the Red Clover Poco project area. A maximum daily water temperature over 75° Fahrenheit is lethal to a coldwater fishery. Pre-project (2009) Red Clover Creek, below the project area, saw 43 days above 75° F. Post-project (2011) there were only 15 days with a maximum daily water temperature above 75° F.

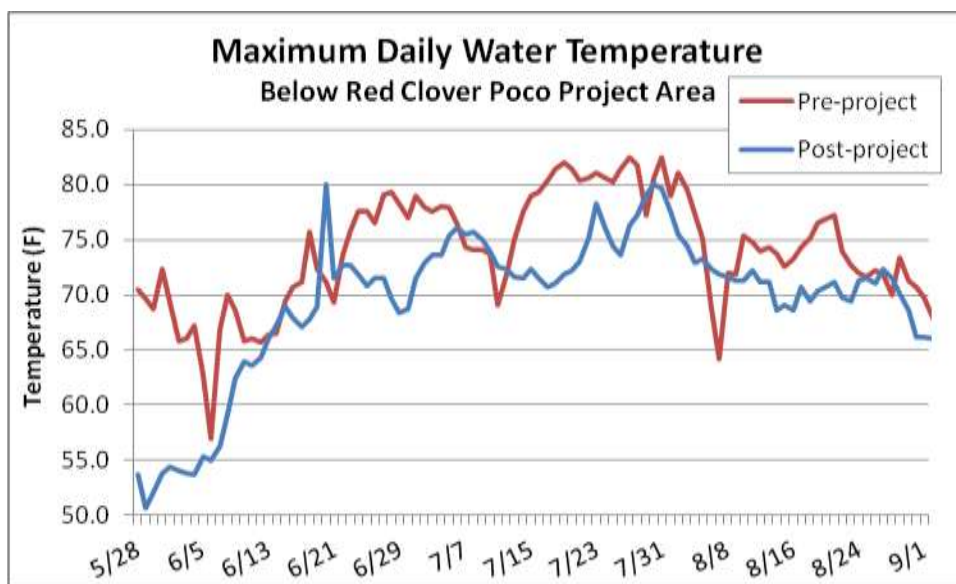


Figure 3: Maximum Daily Water Temperature, below Red Clover Poco Project Area, May-August 2009 & 2011

Fine Sediment

Pre-project turbidity measurements were taken during one storm event in February 2010. Post-project turbidity measurements were taken during two storm events in 2011, one event in February and one event in April. Results from the two post-project events were averaged together. Figure 4 shows a 1,131% increase in turbidity pre-project from the top to the bottom of the project within the project area and a 106% increase in turbidity post-project from the top to the bottom of the project. Although currently turbidity is still increasing through the project, it is considerably less of an increase from pre-project conditions. Turbidity is expected to decrease through the project area. Turbidity monitoring efforts will continue within the project area.

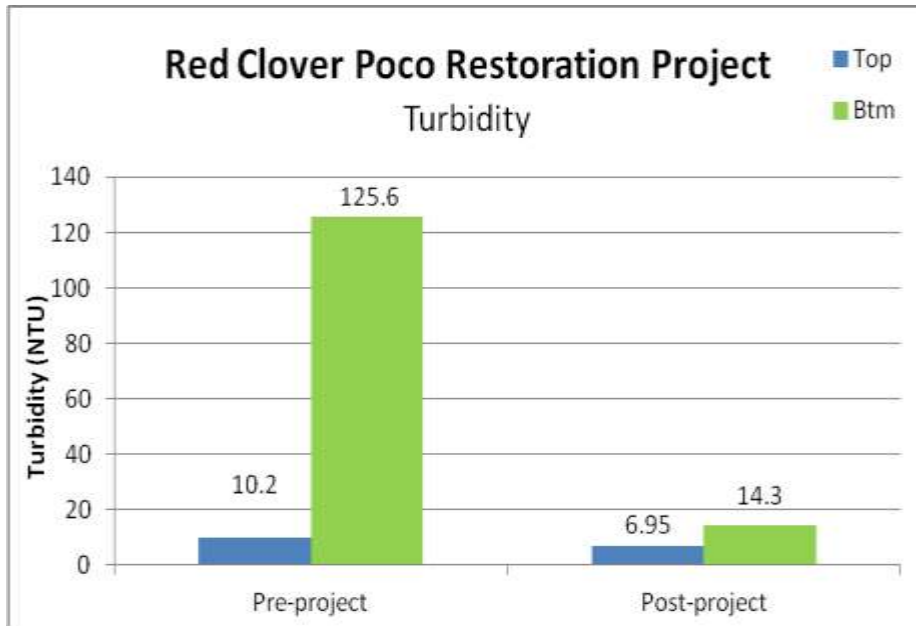


Figure 4: Storm Event Turbidity Monitoring Pre- and Post-project in Red Clover Poco Project Area

Macroinvertebrate Community

Year	Shannon Diversity Index	# of EPT/EPT Abundance	# of intolerant species/ Abundance	# of tolerant species/ Abundance
2010	2.61	11/868	3/138	2/78
2011	Data not available yet			

Shannon Diversity Index = a commonly used macroinvertebrate index, which becomes primarily useful in trend analysis over time.

EPT taxa = This parameter was calculated for this report by taking the total number of Ephemeroptera, Plecoptera, and Trichoptera taxa.

of tolerant and intolerant species= numbers of species labeled tolerant or intolerant based on the Hilsenhoff Biotic Index.

Abundance= the quantity or amount of individuals in the above categories.

Coldwater Fishery

Three areas within the project area were fished in July 8, 2010. Enticing volunteers to fish the degraded project area proved challenging, so an advanced fly-fisherman was hired to fish the project area. Post-project monitoring was conducted by volunteers. Volunteers fished the same time of year (June 26, 2011) and in the same areas. Seven volunteers fished, but no fish were caught. Two volunteers fished the top of the project area in early September. Table 2 below shows results from all fishing efforts. The average catch per unit effort pre-project was 2.06 fish per hour. The average catch per unit effort in September 2011 was 2.25 fish per hour.

Year	Fishing Area	Time Spent (hr)	Length (mi)	Fish Caught	Length (in)
2010	1	1.2	0.22	5	2 x 9-10" 3 x 6-8"
	2	0.65	0.27	0	
	3	0.58	0.4	0	
2011	1	2.0	0.75	0	
	2	0.83	0.27	0	
	3	1.5	0.45	0	
	Top pond	1.33	0.10	3	4", 7", 9"

Table 2: Fly-fishing results from July 8, 2010 and June 26, 2011 in the Red Clover POCO Project Area

Avian Production

DWR pre-project surveys were conducted in 2009 and identified 72 bird species within the project area. Post-project surveys will not be completed until 2012.

PRBO Conservation Science continued with their point count monitoring in the project area. Some metrics of avian abundance and richness at Red Clover POCO declined in the breeding season of 2011 with respect to the 2010 breeding season following FRCRM restoration activities in the fall of 2010. The same metrics at other sites in the Red Clover Valley increased or were stable across the same period, indicating a short-term disturbance impact from the restoration activities on the avifauna. From 2010 (pre-restoration) to 2011 (post-restoration), total bird abundance at RCPO declined from 4.9 to 3.3, but was stable at other Red Clover sites. Similarly, total species richness and focal species richness declined at RCPO, but total species richness and focal species richness were stable or increased at other Red Clover sites. We did not detect a difference in Song Sparrow abundance or Yellow Warbler abundance at Red Clover POCO, whereas at other Red Clover sites there was a significant increase in both species. These results were expected, since the Red Clover POCO project area had more existing riparian habitat pre-project than other non-restored areas in Red Clover Valley. Once the vegetation in the project area becomes established it is assumed that this short-term effect will be reversed. Figure 5 below displays the metrics of avian abundance and species richness in the breeding seasons of 2010 and 2011 in the Red Clover POCO project area. The same metrics for other transects in the Red Clover Valley (Red Clover Reference) are included for comparison. Brackets with an asterisk indicate a paired-*t* test statistic with a *P*-value lower than the alpha 0.05 level; without an asterisk indicates significance to the 0.1 level, a relaxed threshold due to the low sample size (*n* = 10 points) at Red Clover POCO.

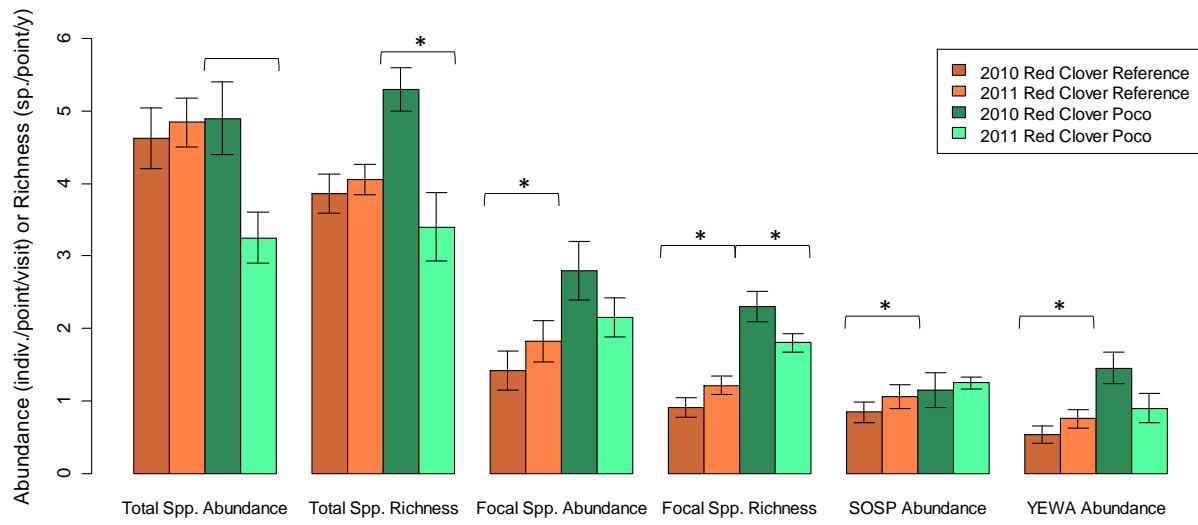


Figure 5: 2010 and 2011 Red Clover Poco Point Count Summary: Avian Abundance and Species Richness