



**Riparian Restoration Project Maintenance  
On Lower Klamath River Salmon and  
Steelhead Tributaries  
2003-HR-06**

**FINAL REPORT**

**USFWS Agreement #113333J006**

**Terms of the Agreement: November 1, 2002 through December 31, 2006**

**Project Completed by  
California Conservation Corps, Northern Service District  
Fortuna and Del Norte Centers**

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# Riparian Restoration Project Maintenance

## Abstract

Survival rates of approximately 40,000 conifer and deciduous trees along eight Lower Klamath River salmon and steelhead streams were improved by reducing competition, providing browse protection and reducing canopy cover. Establishing conifers in the riparian zone will improve flood damaged areas, provide for future LWD recruitment and increase tree diversity. These factors will create a more complex habitat for fish and other wildlife.

## Project Information

### **FWS Contract**

**Number:**.....113333J006

**Project Date:**.....011/01/2002 - 12/31/2006

**Total Personnel Hours:**.....1024

**Total FWS Project Cost\*:**.....\$16,617.00

(\* see budget sheet)

## Introduction

Many of the riparian areas along Lower Klamath River tributaries are alder dominated with little to no conifers for future large woody debris (LWD) recruitment. The lack of LWD for instream cover, pool formation, and gravel sorting is one of the primary limiting factors to salmonid habitat in the Klamath basin. Historic extensive timber harvest is responsible for the lack of large conifers in the riparian corridors of Lower Klamath tributaries. In addition, a large storm event in 1997 damaged miles of riparian habitat along these streams. To improve future habitat conditions, the California Conservation Corps (CCC) in cooperation with the California Department of Fish and Game (CDFG), US Forest Service, and United States Fish and Wildlife Service (USFWS) have implemented numerous riparian restoration projects over the past ten years. Sixty thousand dollars of funding provided by The Federal Emergency Management Agency (FEMA) 1046 grant with \$20,000 of matching funds provided by the DFG SB271 grants program have enabled thousands of conifers to be planted along Ah Pah Creek, Hunter Creek, McGarvey Creek, Tarup Creek, and Terwer Creek located in the lower Klamath subbasin. Reestablishment of conifers in the riparian area will increase salmonid habitat through the establishment of future LWD as well as protect streams and riparian habitat from potential ecosystem damages associated with future timber harvest activities.

During the 2002 winter season, approximately 30,000 trees were planted on these Lower Klamath River tributaries through the North Coast Riparian Restoration Project. In appropriate areas, alders were cut down to open up the dense canopy and increase the sunlight reaching the newly planted conifers. However, the increase in sunlight also accelerated the growth of invasive Himalaya berries along with understory grasses and brush. This burst of new growth threatened to inhibit and strangle the newly planted

conifers. Maintenance on these sites became essential to ensure the projects' success by improving tree survival, and thus improving future habitat for Coho and Chinook salmon and steelhead trout. Through the maintenance of planting sites, we hoped to increase our survival rate beyond the average of 50% survival.



**Photo 1.** Lower Klamath River tributaries are largely dominated by Red Alder. The lack of conifer trees accounts for the limited LWD salmonid habitat found in the creeks. In an effort to increase future LWD recruitment and to restart the natural seeding process, the conifers above are being planted on an old logging road on Turwar Creek.

The Riparian Restoration Project Maintenance on Lower Klamath River Salmon & Steelhead Tributaries fits into the Lower Klamath River Sub-Basin Watershed Restoration Plan developed by the Yurok Tribal Fisheries Program and the Yurok Tribal Watershed Restoration Program. The plan assessed that a lack of instream large woody debris and large riparian conifers along riparian corridors of the Lower Klamath River tributaries was one of the limiting factors for anadromous fish in the Lower Klamath subbasin. The plan states “Reestablishment of mature conifers within tributary riparian corridors is a primary instream restoration objective. Only when a healthy, diverse riparian canopy is reestablished will proper bank and channel stability, as well as long-term natural LWD recruitment be achieved” (Lower Klamath River Sub-Basin Watershed Restoration Plan, 60). Increasing the survival rate of the newly planted conifers will aid in accomplishing this goal of the plan.

In addition, the completed project is a Klamath River Basin Conservation Area Restoration Program category 1B project (Riparian Protection and Restoration) and meets program goals I and IV. Project maintenance will help the survival rate of newly planted conifers, thus providing future large woody debris recruitment, an important component to anadromous fish habitat in the Klamath River Basin, satisfying goal I.

## Project Implementation

The Riparian Restoration Maintenance Project completed work on nine streams including Upper and Lower Hunter Creek, Salt Creek, Mynot Creek, McGarvey Creek, North Fork Ah Pah Creek, Mainstem Ah Pah Creek, Tarup Creek, and Turwar Creek. During 2003, 2004 and 2005 crews spent a total of three weeks implementing this maintenance project.



**Photo 2.** Conifers planted in prior years were often completely buried by Himalaya berries. In the foreground of this picture the berries have been cleared around a small spruce tree. Such clearing allows the planted trees at least another full year of growth, and a better chance of out-competing the berries for space and light.

### Maintenance Methods

Maintenance implemented by CCC crews included the removal of encroaching native and invasive species, the adjusting or removal of protective Vexar tubes, the felling of alders within dense stands and the in-planting of conifers. CCC crews spent 1,024 hours over 3 years on such maintenance measures.

CCC crews scalped around 40,000 conifers and a total of 20 acres of non-native Himalaya berries were removed using hand tools, weed-eaters, and chainsaws. Crews also adjusted or removed Vexar tubes on planted trees. Ropel, a chemical browse deterrent, was applied to approximately 5,000 trees in areas where large deer and elk populations are known to exist. Each tree without Vexar received at least one application of Ropel each year.

In some of the project sites it was necessary to release dense stands of alders to further promote conifer tree survival. Up to 10 acres of alders were thinned to increase light for young trees.



**Photo 3.** The soft needles of redwoods make them especially vulnerable to deer browse. Vexar tubes were placed around the trees for protection in areas with a large deer presence. During the maintenance project, Vexar was removed or adjusted according to the trees growth.

In addition to these maintenance measures, 9,500 mixed conifer species were in-planted throughout the planting sites to add diversity and to compensate for die off. Tree species planted included Grand fir, Sitka spruce, and Coastal redwood. The trees were planted 10 to 15 feet from other established trees. All maintenance and tree planting was completed in accordance with CDFG's *California Salmonid Stream Habitat Restoration Manual* (2001) methodologies. On-site supervision was provided by a CCC Fish Habitat Specialist and Americorps Watershed Stewards Project members.

### **Tree Survival**

In an attempt to improve tree planting survival and effectiveness, records were kept evaluating the success of the various maintenance procedures used in relation to the habitat conditions present. Observations were also made on the growth rate of conifer planted within alder dominated reaches. Information gathered will be applied to future tree maintenance projects carried out by the CCC Northern Service District.

An initial tree survey was completed in the winter of 2003/2004 to assess the survival success of trees planted during the North Coast Riparian Restoration Project in 2002, and to make recommendation on maintenance measures required on specific creeks. It was found that the Douglas fir planted consistently had a 50% to 90% death rate with the majority of the plots having an 80% to 90% death rate. A large percentage of the Douglas fir planted on terraces were also found dead or in poor health. Winter flooding in 2003 caused many of the terraces along Lower Klamath River tributaries to be submerged for several weeks. Douglas fir planted higher on terraces that did not experience the flooding survived and showed 1-2 inches of growth. Coastal redwood and Sitka spruce had significantly better survival rates under these same conditions. Sitka spruce had mortalities between 10% and 30%, while coastal redwood had mortalities between 10% and 20%. Out of the three species planted, Sitka spruce appeared to be the most successful tree species. They seemed to survive a variety of conditions, were seldom browsed, and grew substantially over the summer months. Sitka spruce was found to be the most successful in conditions where other species had trouble surviving such as areas that are extremely wet, exposed or have potential browse problems. Recommendations for maintenance focused around alder canopy reduction and in planting of tree species appropriate for specific site conditions

In fall of 2005 a post project tree survey was conducted to assess the survival of in planted trees and those with associated maintenance. It was found that there was an overall increase in survival on most planting sites. Overall, the trees in-planted during this maintenance project had a high survival of 80% to 90%. There were a few defined sites where survival dropped to 10% to 20%. These sites included inappropriate tree species selection for densely shaded or low lying areas, and a dry terrace on Turwar Creek. A definitive tree survival rate was difficult to calculate due to the large number of sites and the diversity of conditions among the sites. Browsed trees observed in the initial tree survey were found to be healthy in the 2005 survey. In addition, many of the dead trees surveyed in 2003/2004 may have been difficult to find and therefore not counted in the most recent survey. This would account for the higher survival rate. Alder canopy reduction was implemented on the recommended stream reaches. Understory growth was accelerated on these sites where the opened canopy created light corridors. Planted trees had to compete with thicker understory vegetation instead of overstory canopy. It was therefore difficult to assess growth differences between trees planted in opened areas and non-opened areas.

### **Restoration Project Outcomes**

<b>Restoration Measure</b>	<b>Quantity</b>
Trees planted	9,500
<b>Miles of creek enhanced:</b> .....	7.5 miles
<b>Acres of riparian corridor enhanced:</b> .....	134 acres

### Photo Documentation

Sites were photographed prior to tree planting as well as during maintenance measure to accurately represent the work implemented. Following restoration measures, all sites were photographed again. Pictures enclosed are representative of the enhancement completed on Lower Klamath River tributaries. Pictures will be taken of sites periodically over the next several years to monitor the success of riparian plantings.

### Post Project Evaluation

The CCC, in cooperation with CDF&G personnel, and the Americorps Watershed Stewards Project will monitor the Lower Klamath River tributaries over the next several years. DFG restoration project monitoring protocols will be employed periodically to monitor effectiveness and survival of riparian planting sites. Photo monitoring will be used to document riparian corridor development. All information collected will be shared with DFG personnel.

### Summary and Conclusions

After implementing the North Coast Riparian Restoration Project, it was decided that in the future, proposals for this size of restoration project need to address site preparation and long term maintenance in order to ensure high seedling survival rates. In addition, the growing conditions of each planting site need to be evaluated to improve appropriate tree species selection.

The lessons learned from this project were well applied in the Riparian Restoration Project Maintenance on Lower Klamath River Tributaries. CCC crews in-planted approximately 9,500 trees and completed tree maintenance on eight Lower Klamath River tributaries. Tree species planted included Sitka spruce, Coastal redwood, and Grand fir. Most of the areas planted were stream side terraces dominated by alder and dense understory brush. These conditions required trees that could thrive in shaded, wet locations. Coastal redwoods were planted in densely shaded areas and lower terraces. Grand firs were planted in more open, sunlit areas, and Sitka spruce were planted at all the sites because of their high tolerance of stream terrace conditions. Douglas fir was not planted on any of the sites due to its intolerance of dense shade and seasonal inundation. The trees in-planted and maintained during this project had high survival rates of 80% to 90%. This was higher than the survival rates observed before the maintenance projects implementation. These increases confirm that the lessons learned from other riparian plantings were well-applied on this maintenance project. CCC crews attended a three day training in January 2005 focused around tree planting techniques, conditions preferred by tree species and common planting/ maintenance mistakes. The training was developed with the intention of providing crews better information with which to make planting decisions. These decisions would then be reflected in a reduction of tree mortalities caused by improper planting. At this time it is hard to judge how effective these trainings

were in improving tree survival rates for trees planted in February 2005. The survival surveys conducted were unable to separate tree mortalities by year.

The removal or readjustment of Vexar tubes also proved important to future tree survival. For example, the majority of the redwood trees planted on Hunter Creek over three years ago were greater than 2 feet tall. At this time, the Vexar tree protectors were no longer providing any protection from deer browse. Such instances reiterated the need for long term maintenance on planting projects. In addition, trees planted in flood prone areas with Vexar were found completely bent over. Flood events in the winter of 2004-2005 had pushed over and/or pulled the tree protectors from some of the trees. The Vexar had become a hindrance, weighting down and bending the trees in these areas. In the future, Vexar tubes will not be placed on seedlings planted in flood prone areas.

All successful projects are not without their difficulties though. In May of 2004, the CCC Del Norte Center was closed due to budget cuts. The closure of this facility made the tree maintenance outlined in the proposal difficult, as the nearest crews was more than 60 miles away in Arcata/Fortuna. The decision was made to use FEMA funds to cover the additional spike costs incurred to complete the project.

The *Recovery Strategy for California Coho Salmon* lists riparian restoration as one of its goals for the Klamath Glen area (task number KR-KG-07). Although the threatened Coho Salmon still face threats from excessive sediment loads and channel aggradations in the Lower Klamath coastal streams, habitat recovery is finally underway in the riparian areas. The success of this project was only possible due to the cooperation of Green Diamond Resource Company, the United States Fish and Wildlife Service, California Conservation Corps, and the Americorps Watershed Stewards Project. It is through collaborative efforts such as these that will hopefully assist in the long term recovery of the salmon and steelhead populations.