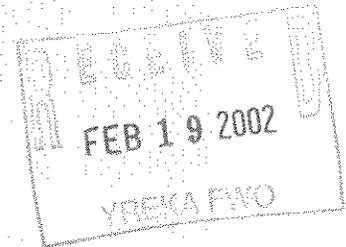


**Riparian Planting, for Fisheries Restoration,
Project at Four Locations in the Middle Klamath
Hydrologic Subbasin**

Final Report



Funding Organization:

**U.S. Fish and Wildlife Service, Klamath River FWO
USFWS Agreement #: 113338 G021
Project #98-HR-05**

Terms of Agreement: Oct. 1, 1997 through September 30, 2002

Cooperating Organization:

California Conservation Corps, Klamath Service District

Written By:

Scott Bauer, Fish Habitat Assistant

Riparian Restoration Project on Four Locations in the Middle Klamath Subbasin
USFWS Agreement #113338 G021
Project #98-HR-05

Abstract

The California Conservation Corps (CCC), Klamath Service District was funded in November 1997 by the U.S. Fish and Wildlife Service Klamath River Basin Fisheries Task Force to implement riparian restoration measures on Indian Creek, Clear Creek and Stanza Creek, all in the middle Klamath Subbasin. The Riparian Restoration Project on Four Locations in the Middle Klamath Subbasin was a cooperative effort undertaken by the CCC, California Department of Fish and Game (DFG), U.S. Forest Service, and the U.S. Fish and Wildlife Service (USFWS). Restoration efforts took place on lands owned and operated by the U.S. Forest Service. Two major flood events and a fire had left much of Indian Creek, Stanza Creek and Clear Creek devoid of healthy riparian zone and upslope areas. This restoration project, as well as past projects on these creeks, was implemented in order to reduce sedimentation and improve future large woody debris recruitment for development of pools, sorting of spawning gravels and instream cover for depressed populations of salmon and steelhead.

Restoration efforts on Indian Creek, Stanza Creek, and Clear Creek were implemented by CCC crews using hand labor and power tools. Four crews of up to fifteen young men and women logged a total of 960 hours on the stream and unstable up-slope areas. In the end, 11,200 conifer and hardwood seedlings were planted on more than 61 acres of riparian and upslope habitats. At least five miles of salmonid stream habitat will directly benefit from this project. The restoration of Stanza Creek, Clear Creek, and Indian Creek will improve spawning and rearing conditions for Coho and Chinook Salmon, as well as Steelhead Trout.

Introduction

Both human and natural disturbances have had a tremendous impact on anadromous fish populations along the Klamath River. Human influence on the natural environment has been significant. Logging, road building, grazing, irrigation, fishing, and many other activities have had detrimental effects on fish and their habitat. Massive floods in 1955, 1964, and 1997 further harmed already beleaguered stocks of salmon and steelhead by wiping out riparian vegetation, mobilizing unstable hillslopes, and burying pools and spawning areas under layers of silt. Native fish populations, an important food resource for people and wildlife, have been greatly diminished. With the extinction of many local populations of fish so close at hand, efforts to restore their habitat began in earnest.

The economic, social, and political importance of recovering and maintaining healthy salmon and steelhead populations brought together a diversity of groups to take on the effort. Federal and state agencies involved in the effort include the U.S. Fish and Wildlife Service, U.S. Forest Service, California Conservation Corps, California Department of Fish and Game, and the Wildlife

Conservation Board. The Yurok Tribe, private landowners and nonprofit groups have also been instrumental in this recovery mission. Although these groups often act independently of one another, cooperative efforts have brought about the most success during restoration efforts.

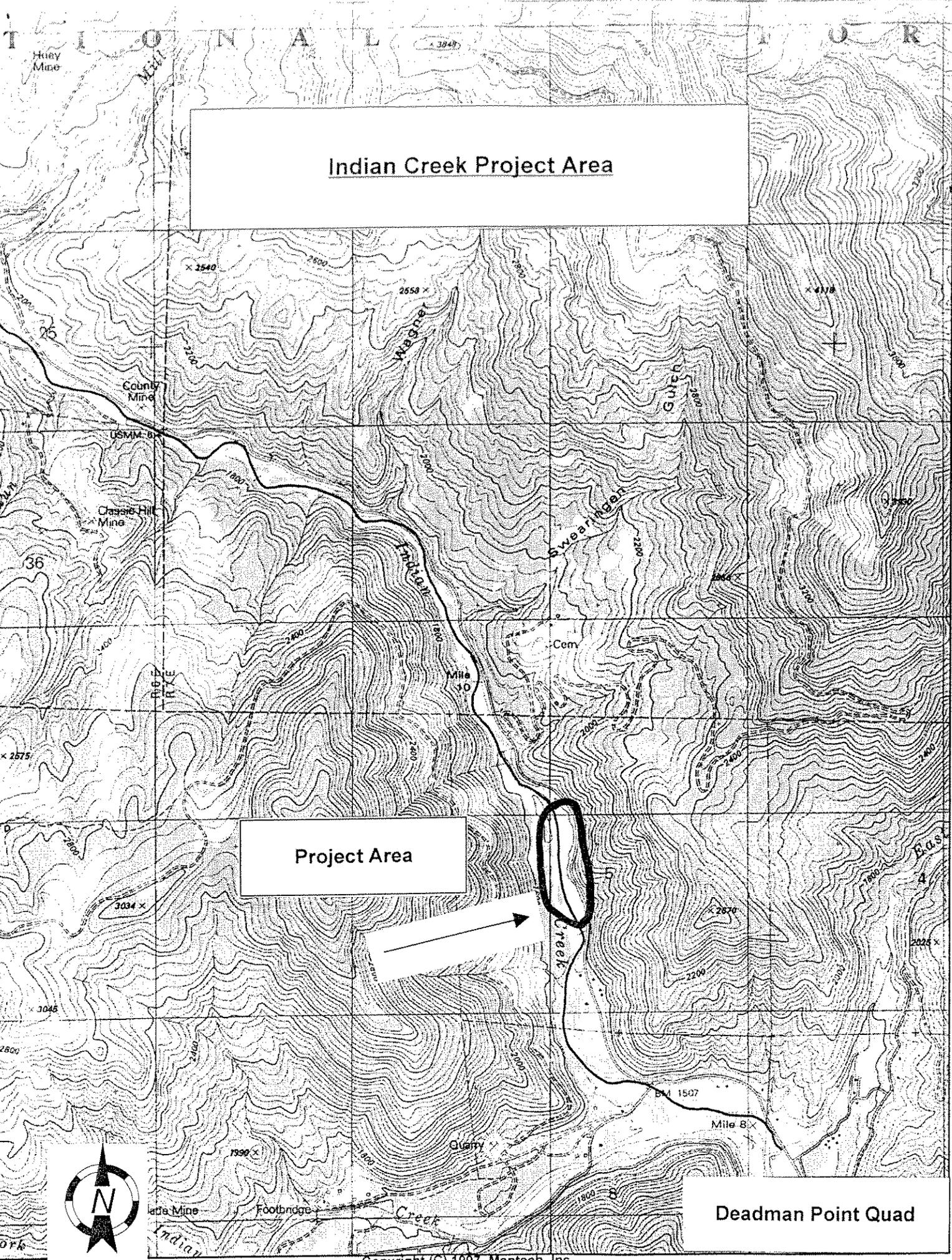
Since the late 1980's the CCC, in cooperation with DFG, Karuk and Yurok Indian Tribes, U.S. Forest Service, and U.S. Fish and Wildlife Service have performed restoration and enhancement work in the Mid-Klamath basin watershed. Restoration activities included instream structure placement, barrier modifications, riparian plantings, and stream channel modifications. While much has been done to improve habitat for anadromous fish, some reaches of the creek were still found in need of riparian restoration measures. Considering that populations of salmon and steelhead have yet to rebound from dangerously low levels, and in light of the devastating effects of the 1964 and 1997 floods, it was deemed important to continue restoration efforts on Indian Creek, Stanza Creek and Clear Creek.

In 1997, the California Conservation Corps, Klamath Service District, submitted a proposal to the USFWS Klamath Basin Fisheries Task Force for the Riparian Planting for Fisheries Restoration, Project at Four Locations in the Middle Klamath Hydrological Subbasin. The goals of the project were to improve fish spawning and rearing habitat by enhancing 61 acres of riparian zones on three streams. The project entailed planting 1,200 conifer and hardwood seedlings over 11 acres on Indian Creek above the confluence with the South Fork of Indian Creek; planting 9,000 conifer seedlings on 45 acres along Clear Creek near No Mans Creek; and 1,000 conifer seedlings were planted over 5 acres along Stanza Creek, a tributary to Elk Creek. Approximately five miles of creek was proposed for restoration. The proposal was approved for funding under the Klamath River Basin Conservation Area Restoration Program in fiscal year 1998. The following report summarizes the outcomes and achievements of this project.

Description of Study Area

The Indian Creek watershed is located in the Klamath National Forest, and flows into the Klamath River at the town of Happy Camp in western Siskiyou County, California (see map). The watershed encompasses approximately 86,197 acres, located predominantly in California with a small northern portion extending into Oregon. The watershed is bordered by the Siskiyou National Forest and the Siskiyou Wilderness on the north and west, Thompson Ridge on the east, and the Klamath River on the south. Indian Creek watershed is rugged and mountainous with elevations ranging from approximately 1,100 feet at the mouth of Indian Creek to just over 7,000 feet along its western boundary. The vegetation of Indian Creek watershed is primarily characterized by conifer dominated vegetation types. There are a number of diverse and unique vegetation types associated with soil types, elevation gradients, and other features. Populations of Port-Orford-Cedar occur in narrow, noncontiguous arrangements near streamside areas.

Private lands cover a total of 3,004 acres within the watershed and the remaining is National Forest System Land. Of this National Forest System Land, 32% is managed for a programmed, non-declining flow of timber production. 10% entails management activities that remain visually subordinate to the character of the landscape, while providing a sustainable harvest of wood



Indian Creek Project Area

Project Area

Deadman Point Quad

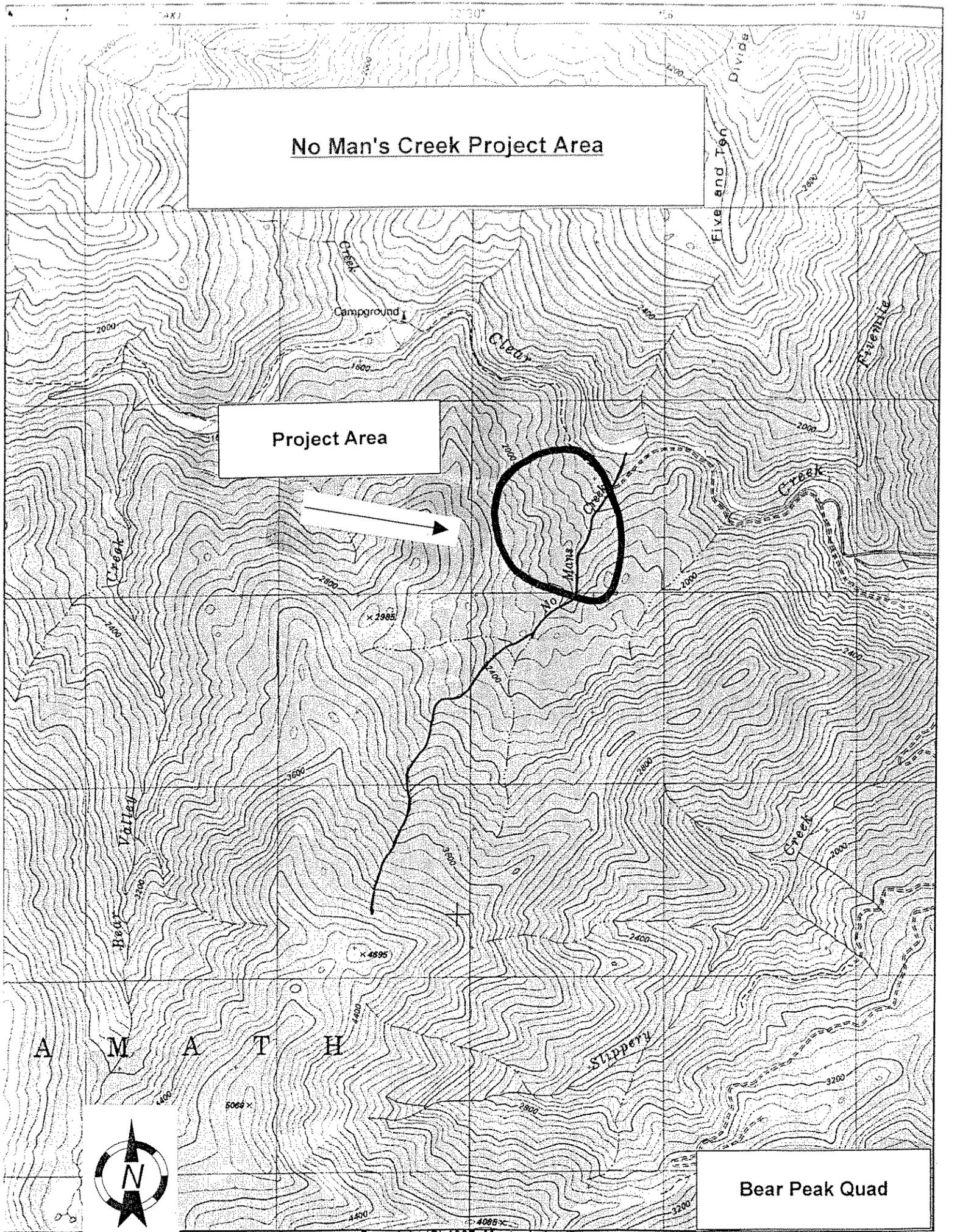
products. The remaining land is Managed Wildlife areas, Riparian reserves, and Late-Successional Reserves. The Siskiyou Wilderness encompasses approximately 12,323 acres or 14% of the watershed. Those acres are included in the above wilderness acreage total. There are three large LSRs (Late Successional Reserves) within the Indian Creek drainage and nine small LSRs. LSRs were designated to maintain and enhance conditions of late-successional forest ecosystems. The nine small LSRs are 100 acres in size. Some of the areas were burned by a wildfire in 1987 and there are significant, known, active landslides in the watershed, and under wetter climate and/or intense rainfall or rapid snow melt, these landslides are often major contributors of sediment to streams. All of these landslides are sensitive to road construction and/or road drainage and to disturbance of vegetation.

Fire is an important regulator of the ecosystem in the Klamath Basin. In the last 10 years, 130,000 acres have burned on or adjacent to the Happy Camp District. Peak years of fire activity were seen in 1987 and 1994. Within the Indian Creek watershed over 6,000 acres burned in 1987, while 250,000 acres burned on the Klamath National Forest, giving an indication of the role fire plays as an agent in the ecosystem process.

Indian Creek has been the focus of multi-agency cooperative restoration efforts for almost two decades. The CDFG and Karuk Indian Tribe operated a chinook rearing facility up until the year 1993 that produced 80,000 smolts annually. Chinook and coho salmon, summer, fall and winter-run Steelhead trout have historically utilized Indian Creek for spawning and rearing habitat. Stream habitat inventories have been conducted on the lower 17 miles of Indian Creek since 1989. Also, adult spawner utilization of available habitat has been monitored through fall and spring redd surveys conducted intermittently since 1988.

A primary cause of spawning and rearing habitat reduction and degradation in the Klamath watershed, including Indian Creek, is the loss of riparian zone vegetation. The flood in 1964 and 1997's New Year flood, along with past land use practices, have seriously impacted riparian areas. The January 1997 storm has had a significant impact on the fisheries habitat in Indian Creek. Existing wood has been moved downstream and into flood plain locations. New stream meanders have been located and islands have been created in new locations. Existing rock instream structures were sometimes shifted downstream or buried under several feet of new bedload. An increase in bedload has reduced pool depth and frequency, but has also increased the amount of spawning gravel in the main channels. Absence of both deciduous and coniferous trees has led to destabilized banks, increased sedimentation, elevated water temperatures, and decreased large woody debris recruitment. Additionally, the lack of trees reduces nutrient additions, limits stream complexity, and reduces cover for targeted fish species.

Clear Creek is a large and somewhat undisturbed tributary to the Klamath River. Clear Creek watershed encompasses 71,254 acres in the heart of the Klamath Physiographic Province (see map). The Klamath Physiographic Province is an area of nearly 10 million acres in Northwest California and Southwest Oregon that encompasses the Klamath and Siskiyou Mountains. The Klamath region occurs in the junction of several other distinct physiographic regions. To the North are the Oregon Coast Ranges, to the East is the Cascade Range, to the south are the Central Valley and North Coast Ranges and to the west is a narrow strip of the North Coast



No Man's Creek Project Area

Project Area

Bear Peak Quad



Ranges and, 25 miles away from the Clear Creek basin, the Pacific Ocean. Many plant and animal species reach their southern, northern, western and eastern limits in the Klamath region or reside in the area in small isolated island populations which are the remnants of populations that used to be much more widely distributed. A surprising number of plant species are endemic to the region. Many rare and sensitive plants find their home range growing in areas derived from Ultramafic bedrock found in the Clear Creek Basin. Ultramafic bedrock is rarely found on land, particularly elevated as it is in the Clear Creek Basin. The Klamath Region is known to be one of the most botanically diverse areas in North America. The region contains the largest remaining area of intact forests on the West Coast and encompasses a greater diversity of forest communities, in a more complex vegetative pattern, than any comparable area in the west.

Clear Creek watershed is delineated into specific management areas. Of 71,254 acres, 50,338 is designated as Wilderness areas; 751 acres as cultural areas for local Native American Tribes; 3,358 acres as Riparian Reserves; 2,247 acres as Late Successional Reserves to provide for the needs of all late-successional species; 8,838 acres as General Forest, managed by the U.S. Forest Service, and 5,722 acres designated as different levels of management by the Forest Service.

The soil in Clear Creek watershed is highly erosive, with 66% being granite bedrock, which has a high susceptibility to weathering. The two dominant sources of sediment in Clear Creek are landslides and surface erosion. There are five landslides in Clear Creek watershed that are of the most significant, known, active landslides in the basin. One of them, the Noslip Slide in No Mans Basin, was planted during the Riparian Restoration Project on Four Locations in the Middle Klamath Subbasin. This landslide occurred in response to the 1964 flood. Ground and aerial photographic evidence suggests that timber harvest activities in the late 1950s may have influenced activity of the landslide.

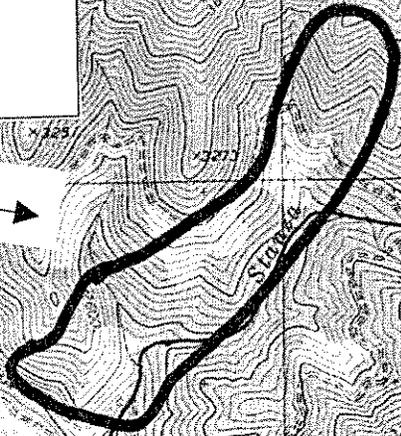
The water temperature in Clear Creek, just above its confluence with the Klamath River has been monitored for several years. The highest temperatures were recorded in early August each year and the lowest temperatures occurred in late fall and early winter. Water temperatures gradually cool from the end of August until the beginning of December and remain cold throughout the winter months. Water temperatures gradually rise from early spring to mid-August. Water temperatures in Clear Creek are presently suitable for the growth and survival of salmonid fisheries almost all the time, and optimal for growth and survival most of the time.

Stanza Creek is a tributary of Elk Creek, which flows into the Klamath River (see map). The Elk Creek watershed consists of mainly national forest land also administered by the Klamath National Forest. Less than 5% of this watershed is privately owned. Land Use in the Elk Creek watershed for the next fifteen years is described in the Klamath National Forest-Land and Resource Management Plan (LRMP).

The vegetation in Elk Creek watershed is characterized by conifers, including douglas fir, white pine, Jeffrey pine, ponderosa pine, knobcone pine; hardwoods such as tan oak, live oak, red and white alder, while the upper elevations consist of high elevation meadows, lakes and rock. Elk Creek has been identified as a Key Tier 1 watershed, which means that it has been identified as a crucial refugia for at-risk fish species. The Elk Creek watershed is approximately 60,780 acres.

Stanza Creek Project Area

Project Area



Huckleberry Mtn. Quad

Elevations in the watershed range from about 1000 feet at the mouth to 7000 feet in the headwaters. The watershed is approximately 18 miles long, and 6 miles wide. Elk Creek flows from north to south into the Klamath River just west of the town of Happy Camp. Stanza Creek watershed is 1,300 acres or 5.4 square miles, with 2 miles of blue line stream.

Streams in Elk Creek watershed are high gradient, coarse bedded and, due to ongoing uplift and climate of the region, erosion dominated. Because of the high gradient of stream channels in Elk Creek watershed, little sediment is stored in stream channels. Because of the erosive soil types in this watershed, there is less mechanical resistance to erosion. Most of the coarse sediment generated in stream channels is delivered by landsliding. Fine sediment is generated by surface erosion of disturbed areas, as well as landsliding. Coarse sediment production associated with rare, intense storms has been estimated by projecting the volume of landslide movement during the period 1964 through 1975. Landslide production rates for natural, harvested acres and roads were used to assess the relative contribution of these activities on geomorphic terrains. The conclusion of this estimate is that management related ground disturbances results in approximately doubling of intense storm related landslide production compared to an undisturbed basin. This change is likely expressed as an increase in the magnitude and duration of disturbance to the riparian habitat that results from such episodes of precipitation and sediment production.

Large flood events have caused the greatest changes in aquatic habitat in the Elk Creek watershed. Streamside vegetation was removed by the 1964 flood and large amounts of sediment were deposited within mainstem Elk Creek and its tributaries. Sedimentation filled in pools and covered spawning gravels. Large numbers of logs are introduced into the mainstem from its tributaries and headwaters. Since 1964, Elk Creek has been removing sediments and recreating pools in the vicinity of bedrock. Spawning gravels are reappearing in the tailouts of pools. Streamside vegetation has regrown to where the tributaries are usually full canopied. The general trend is for the aquatic habitat to continue to improve until reset by another large flood or catastrophic wildfire. Additional road building, timber harvesting, and other human activities have created a scenario where a storm event of less intensity than 1964 would have a similar impact on downstream aquatic ecosystems. Such an event occurred in the 1997 flood. To decrease the potential for future events such as what occurred during the flood of 1997, destroying riparian areas in Elk and Indian Creek watersheds, plantings on Elk Creek and Stanza Creek occurred in granitic soils, which have a relatively high rate of debris sliding. This project location was also a part of a program to reforest old road beds where width had been narrowed to reduce the impact of the road. Slides from road cuts were also planted where road fill had failed to help with stabilization.

Wildfires have been very common in all areas of the Klamath National Forest. Limited fire suppression began with the creation of the forests in 1905, and became very effective in the 1940's. Fire records are incomplete, but more than 200 fires have been suppressed in Elk Creek (records from the 1930's for small fires and the 1920's for large fires over 100 acres). The majority of the fires have been lightning caused. During the 20-year period from 1968 to 1987, the drainage averaged 4.6 fires per year. In spite of exclusion efforts, there have been 13 fires larger than 100 acres recorded since 1920. The most recent were the lightning caused wildfires of 1987 where 26,000 acres burned in Elk Creek. Only two of the large fires (1922, 160 acres, and

1924, 120 acres) were human caused. Several of the large fires returned or burned around previous large fires. This pattern is typical of the Happy Camp Ranger District where over half of the District has burned at least once since 1920 and a significant portion of that half two or three times.

Elk Creek is almost entirely Klamath National Forest Land. The Klamath National Forest is divided into seventeen separate Management areas (MA's). The majority of the land base in this watershed (except the upper third of Elk Creek which is wilderness) is both Partial Retention and General Forest, which means that timber harvest is possible in these areas. Activities in MA-5 Riparian Reserves are limited to actions that maintain or restore the health and integrity of riparian and aquatic functions and processes within the watershed. Riparian Reserves are designed to ensure that activities such as logging are protective of the riparian and aquatic environment.

Riparian Reserves buffer all perennial and intermittent stream courses and also consist of unstable lands such as inner gorge, active slides, toe zones, etc. Riparian Reserve land allocations override all other land allocations and MA standards and guidelines. This override protects watershed function and processes. Standards and guidelines of Riparian Reserves also provide good assurance that any restoration investments that result from this proposal will be protected from activities allowed in adjacent MA's.

Methods and Materials

Project sites on Clear, Indian, and Stanza Creeks were selected by their history of regular disturbance and a lack of adequate vegetation density. Proximity to anadromous fish spawning or rearing habitat was a high criteria for site selection. Project sites were flagged around the perimeter. Native trees such as Douglas fir, Ponderosa pine, Western Red Cedar, cottonwood, and willow were selected for planting. Fir and pine were the primary species planted in upslope areas. Native willow and cottonwood cuttings were taken from close proximity to riparian sites, grown out at a nursery, and later planted in disturbed areas. Trees ranged in size from 1' tall Ponderosa pines to 4' cottonwoods.

Planting techniques used on this project were derived from the DFG California Salmonid Stream Restoration Manual. Hand planting tools such as power augers, planting bars, hazel hoes and hoedads were used. Trees were planted along riparian corridors on 12'-14' spacings, and up to 100' wide on either side of the creek. Upslope areas, roadbeds, and landslides were planted on 15' spacings. Where grasses and noxious weeds dominated, areas 3'X3' were scalped to minimize competition for resources, encouraging optimum tree growth. Trees were also mulched in harsh soil areas along the creek to help maintain adequate moisture for growing trees. A U.S. Forest Service forester and a CCC Fisheries Technician were on-site to monitor planting techniques and procedures. A total of 11,200 trees were planted. Planting was accomplished by CCC crews in cooperation with U.S. Forest Service, and the California Department of Fish and Game. Crews stayed in USFS barracks in Happy Camp.

Results and Discussion of Accomplishments during the Project

A great deal of time and effort was expended developing, designing, and implementing the Riparian Restoration Project in the Mid-Klamath Subbasin. Development and design of the project were conducted by a team of CCC, DFG and U.S. Forest Service personnel. Several different CCC crews of up to fifteen individuals contributed to the implementation of the enhancement measures. Work was done in the summer during low flow conditions and outside of endangered species restrictions. A total of 11,200 trees were planted along Indian, Clear and Stanza Creeks during the spring of 2001.

A total of 1,200 conifer and hardwood seedlings were planted over 11 acres along Indian Creek above the confluence with the South Fork of Indian Creek; 9,000 conifer seedlings were planted over 45 acres along Clear Creek near No Mans Creek; and 1,000 conifer seedlings were planted over 5 acres along Stanza Creek, a tributary to Elk Creek. Corps members, guided by U.S. Forest Service personnel and CCC Fisheries Technicians, used hoedads, planting bars and power augers to plant trees.

Old roads and landslides were planted up-slope on Stanza Creek. Planting took place on decomposing granitic soil, which has a relatively high rate of debris sliding, and was part of a program to reforest old road beds where road width had been narrowed to reduce the impact of the roads. Slides associated with road cuts were also planted to help slow sedimentation of Elk Creek. Conditions were very unstable on steep slopes in rainy weather. Corps members climbed to the snow line to stabilize up-slope conditions. Old roads and unstable landslides with highly erosive soils were stabilized, undoubtedly reducing sediment influx into Stanza Creek.

Clear Creek had previously burned, creating a very precarious environment, with 200' tall snags on steep slopes. In such conditions, high winds could cancel working in such areas due to safety issues. Luckily, winds never escalated to dangerous levels. Indian Creek entailed planting on stream terraces. Willows and cottonwoods were utilized to stabilize erosive, steep banks. Such banks were often extremely high, up to 100', entailing repelling down from above with ropes to plant willows and conifers. Trees were planted in very cold temperatures, often accompanied by snow and/or rain. The creek had to be crossed several times to hit all terraces on Indian Creek, adding to the cold conditions. The terraces were composed of rock, making planting difficult. Because of the time of year in which planting took place, soils were not only rocky, but partially frozen as well. Many Corps members were afflicted with poison oak, as this area was covered with the plant, making contact with it unavoidable.

Summary

The following is a brief synopsis of enhancement measures implemented on the Riparian Restoration Project in the Mid-Klamath Subbasin. This summary, by all means does not include the long hours, hard work, and tremendous effort put out by all those involved on the project.

Accomplishments

<u>Name of Creek</u>	<u>Number of Trees Planted</u>
Indian Creek	1,200 conifer and hardwood seedlings
Clear Creek	9,000 conifers
Stanza Creek	1,000 conifers
Total Number of Sites:	3
Total Acres Restored:	61
Total # of Corpsmembers hours logged:	960 hours
Total Project Cost:	\$20,145.00

Summary of Expenditures

Final Budget- see Appendix A

Conclusions

The Riparian Restoration on Four Locations in the Middle Klamath Subbasin Project was conceived with the idea that restoring unstable, highly erosive up-slope conditions, as well as flood damaged, riparian corridors in impaired watersheds would help speed up the recovery of depressed salmon and Steelhead stocks. With the help of a grant from USFWS, the cooperation of the California Department of Fish and Game and the U.S. Forest Service, the CCC set out to enhance critical fish habitat. Through riparian, landslide, road and hillslope plantings, benefits have already begun to accrue.

Tree planting undertaken in the Stanza, Clear and Indian Creek watersheds will help reduce sediment influx into these systems. Areas that are notorious sedimentation problems in watersheds are on their way to being stabilized; including landslides, old roads, steep, eroding banks, and burn areas. Through all of these difficult planting conditions, tree survival is estimated to be very high at close to 90%. Not only will sedimentation be significantly reduced, but riparian corridor enhancement measures will decrease high temperatures that are lethal to salmonids, as well as improve future large woody debris recruitment for development of pools, sorting of spawning gravels and instream cover. These many benefits bode well for long-term recovery of the habitat and the species that depend on healthy and complex stream ecosystems.

The California Conservation Corps, Klamath Service District would like to thank the USFWS (Yreka Office), DFG, and USFS for all of their support on this endeavor.

**APPENDIX A: Riparian Planting, for Fisheries Restoration, at Four Locations
In the Middle Klamath Hydrologic Subbasin
FINAL BUDGET**

Category				Funding Requested	Other Federal Funds	Non-Federal Cost Share	
						Cash	In-Kind*
1) Personnel:	# Hours	Hourly Rate					
a. Wages							
General Labor	960	\$ 12.00		\$ 11,520.00			
Technical Assistant	200	\$ 8.00				\$ 1,600.00	
Fish Habitat Assistant	96	\$ 16.00				\$ 1,536.00	
Conservationist Overtime	64	\$ 31.47		\$ 2,014.00			
Subtotal Personnel:				\$ 13,534.00			\$ 3,136.00
2) Materials and Supplies	# Units	Cost/Unit					
Materials (total)				\$ 1,902.00			
Tree Planting Bags	15	\$ 48.96					
Hoedad Blades	13	\$ 32.95					
Planting Bars	9	\$ 26.95					
Collapsible Backpack Pump	2	\$ 137.00					
Misc. Materials				\$ 1,889.00			
Subtotal Materials and Supplies:				\$ 3,791.00			\$ 0.00
3) Operating Expenses	# Units	Cost/Unit					
Office Supplies		-----					\$ 200.00
Other (tool repairs)				\$ 500.00			\$ 350.00
Spike Food Costs				\$ 1,500.00			
Subtotal Operating Expenses:				\$ 2,000.00			\$ 550.00
4) Travel							
Vehicle Operations				\$ 820.00			\$ 0.00
Subtotal Travel:				\$ 820.00			\$ 0.00
Total Direct Costs							
5) Indirect Costs (Overhead): 5%							\$ 1,036.00
Totals				\$ 20,145.00			\$ 4,402.00
Total Project Cost (Including In-Kind Contributions): \$ 24,547.00							

* Indicates in-kind contribution from California Conservation Corps, Klamath Service District.