

# Cantara Trustee Council

Grant Summaries 1996-2007

## *Battle Creek Wildlife Area Acquisition*

**DATE FUNDED:** 1996

**DURATION OF PROJECT:** Six months

**GRANTEE:** Wildlife Conservation Board

**AMOUNT GRANTED:** \$165,000

**AMOUNT SPENT:** \$165,000



**BACKGROUND:** The acquisition of a 47.7 acre addition to the California Department of Fish and Game's (DFG) Battle Creek Wildlife Area was completed in 1996. Purchase of the property established a link between two DFG parcels, creating a continuous wildlife corridor of over 500 acres. The parcel is located along Battle Creek, near its confluence with the Sacramento River, in Tehama County. Valuable valley foothill riparian, upland, and wetland habitats are found on-site.

The property was incorporated in DFG's management plan for the Battle Creek Wildlife Area (BCWA). Objectives of the management plan were to:

- Protect, enhance and restore riparian habitat, including control of exotic plant species
- Protect, enhance and develop wetland habitat
- Protect, enhance and restore fishery habitat for salmon and steelhead
- Protect habitat for rare, threatened, endangered, and species of concern
- Provide environmental education opportunities and interpretive services
- Provide outdoor recreation opportunities

As objectives were implemented, the acquisition helped achieve the goal of replacing and enhancing riparian and stream resources lost during the Cantara spill.

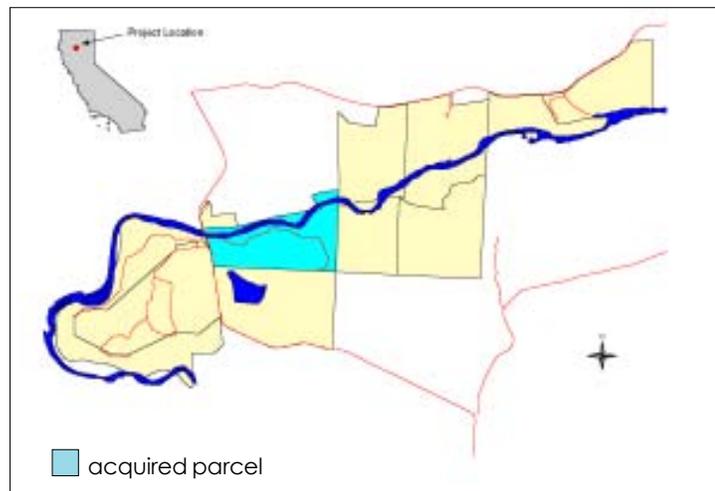
**BENEFITS:** This acquisition protects and enhances some of the most critical resources in the state (riparian, wetland, and aquatic habitats). It fills a gap between two previously unconnected units of the wildlife area, creating a contiguous, diverse habitat and adding substantially to the riparian resources currently under protection. Large adjacent blocks of similar habitat have more resource values than smaller, unconnected ones. Habitat protection for special status organisms, as well as improved public access, are provided by the property.

Seven listed special status plant and animal species are known to occur in the immediate area of the acquisition site. The site has provided breeding territory for at least one bald eagle pair. Bank swallows and osprey have been observed nesting on BCWA. Four distinct runs of chinook salmon depend on the Sacramento River and its tributaries. In recent years, all except the winter-run chinook have been documented in Battle Creek. In time, as the habitats expand and mature, valley longhorn beetles, yellow-billed cuckoos, and migrating peregrine falcons could begin using the property.

The acquisition provided new public access to parts of the wildlife area. Increased public use for recreational opportunities including sightseeing, bird watching, photography, and hiking are available. Private and public groups may also use the area for environmental education opportunities.

**PRODUCTS RECEIVED:** The Cantara Trustee Council has received a copy of the recorded deed showing change in ownership of this property to the State of California, Department of Fish and Game.

*DFG Battle Creek Wildlife Area*



## *Big Bear Creek Meadow Restoration Monitoring*

**DATE FUNDED:** 1999

**DURATION OF PROJECT:** Five years

**GRANTEE:** CalTrout

**AMOUNT GRANTED:** \$43,600

**AMOUNT SPENT:** \$43,591

The Bear Creek Meadow Restoration Project was a multi-agency/private partnership to restore a 2.2 mile reach of Bear Creek, a primary tributary to the Fall River. The Bear Creek Meadow restoration was one of three major activities in the project with the overall goal of reducing sediment in Fall River. The Cantara Trustee Council (Council) funded CalTrout to conduct monitoring for the Bear Creek Meadow portion of the project. Other project participants included private landowners, California Nature Conservancy, Fall River Resource Conservation District, National Fish and Wildlife Foundation, University of California at Davis, U.S. Fish and Wildlife Service (USFWS), and the Wildlife Conservation Board. Total project costs, funded through agency and private funds, were about \$540,000.

Bear Creek is located in northeast Shasta County and southeast Siskiyou County. It has coldwater lotic and montane riparian habitats similar to those injured in the Cantara spill. The creek is important habitat for rainbow and brown trout and for Shasta crayfish. The project was cited by the USFWS as a Priority One Action to prevent further decline of the Shasta crayfish, a federal and state listed endangered species.

Bear Creek Meadow is in the lower reach of the creek. The 500 acre meadow had a deeply incised gully which was contributing approximately 41 percent of the sediment load in Fall River, according to a 1998 watershed management study.

Bear Creek Meadow restoration work was completed in 1999. The eroded gully was filled and the creek redirected to its historic channel. Twenty acres of ponds were created; material removed from these was used to fill the eroded creek bed. Finally, the newly created creek channel and ponds were planted with native riparian species, such as rushes, sedges, willows, ash, and black cottonwood. The project was planned as a five-year effort to include long-term post-project monitoring to evaluate restoration success.

**BENEFITS:** This project provided an off-site, in-kind benefit and helped meet the Council's restoration objectives. Monitoring reports were prepared annually and tracked changes in the condition of erosion, trends in stream migration, vegetation recovery, and bird diversity. Monitoring included topographic, piezometer and vegetative transect surveys, hydrograph comparisons, sediment transport data collection, and photo point monitoring.

The new creek bed increased groundwater surface elevation, restoring the meadow groundwater table. Thanks to low to moderate water flows during the initial project years, the new creek channel proved to be stable throughout the monitoring period. It was estimated that, when comparing 1995 to 2004 flows, total sediment decreased 31%. Sediment reduction in flood flows is expected to be even higher. Recovery rates for bank vegetation, meadow vegetation, fishery usage, and water table recharge were rapid and robust. Bird surveys, fish spawning count surveys, and macro-invertebrate analysis showed increases in riparian obligate species and waterfowl abundance, and overall positive improvements for the fishery.

**PRODUCTS RECEIVED:** Annual reports



*Bear Creek, in its restored condition.*

## *Big Bear Restoration Design*

**DATE FUNDED:** 2000

**DURATION OF PROJECT:** One year

**GRANTEE:** Fall River Resource Conservation District

**AMOUNT GRANTED:** \$34,863

**AMOUNT SPENT:** \$34,841



**BACKGROUND:** The Fall River watershed is located in extreme southeastern Siskiyou County and northeastern Shasta County. Fall River is a premier wild trout stream and is unique in having nearly constant flow and cold water temperatures throughout the year. This is because a large proportion of water in Fall River is fed by springs. One of the larger tributaries to Fall River is Bear Creek.

Prior to the 1960's, logging, overgrazing, road building, and other vegetation and soil disturbing activities in the watershed decreased the watershed's capacity to absorb water from storm events. Subsequently, large storms brought flood events that moved upper Bear Creek out of its historic channel, eroding thousands of cubic yards of sediment. Deposited in the Fall River, the sediment accumulated in underwater dunes and plumes.

Trout anglers became concerned with the growing sediment and its effects on aquatic vegetation, invertebrates (insects and mollusks), and the trout dependent upon vegetation for cover and invertebrates for food.

In 1996, the Fall River Resource Conservation District (FRRCD) began concerted efforts to understand the sources and possible remedies for the sediment movement from Bear Creek into Fall River. In 1999, a meadow at a lower reach of Bear Creek was returned to its historic channel. This restoration work was viewed as a test project for the much larger restoration needed for the meadow at Big Bear Flat.

The meadow at Big Bear Flat is so large and had undergone such extensive degradation through erosion that the FRRCD decided a "design plan" was needed prior to application for restoration funds. The Cantara Trustee

Council funded the request for a design plan to restore the Big Bear Flat meadow. The design plan evaluated alternatives, engineering options, revegetation needs, and monitoring requirements to restore the meadow.

**BENEFITS:** The FRRCD coordinated design plan activities: Task 1, Site Review (secure landowner agreements, solicit contractor for design plan and sign agreement, monitor site, identify stabilization strategies); Task 2, Assessment (identification/analysis, mapping); Task 3, Design Alternatives and Needs (engineering, revegetation, monitoring); Task 4, Design Review (solicit comments from Bear/Dry Creek advisory committee, and jurisdictional agencies); Task 5, Complete Design Plan (with maps, engineering plans, aerial photographs, evaluations, and narrative).

The design plan noted that, "The channel in Big Bear Flat is perhaps the most highly impacted reach in the watershed. The channel has incised from three to twelve feet below the historic floodplain level and is currently eroding laterally in an effort to re-establish a floodplain of sufficient width at its current elevation to dissipate the energy of flood flows."

Based on evaluation of feasible alternatives, the plan's authors recommended relocating Bear Creek to a stable design channel north of the active channel. The active channel needed sections filled, and stabilized, to prevent it from recapturing the creek flow during peak-flow storm events. The new channel would use historic remnant channels that were augmented and modified to mimic historic flow conditions. The report further identified the culverted crossing of Bear Creek, just north of Big Bear Flat by the McCloud River Railroad, as a historic problem in the peak-flow conditions of Bear Creek. The report made cost estimates for the recommended alternatives to restore: (1) Big Bear Flat Meadow, and (2) McCloud River Railroad Culvert Repair.

**PRODUCTS RECEIVED:** The Cantara Trustee Council received the *Big Bear Flat Restoration Design Plan*, completed July 5, 2001, for the Fall River Resource Conservation District, prepared by StreamWise (Mt. Shasta) and SHN Consulting Engineers and Geologists, Inc. (Redding). The Council also received *Final Report, Big Bear Restoration Design, a Report to the Cantara Trustee Council, December 2001*, submitted by the Fall River Resource Conservation District.

## *Butler Slough Riparian Restoration Design Project*

**DATE FUNDED:** 2002

**DURATION OF PROJECT:** Five years, nine months

**GRANTEE:** California State University,  
Chico Research Foundation

**AMOUNT GRANTED:** \$353,617

**AMOUNT SPENT:** \$225,771\*

**BACKGROUND:** In 2002, the Cantara Trustee Council funded the California State University, Chico Research Foundation (Foundation) to implement a two-phase project related to the California Department of Fish and Game's (DFG) Butler Slough Ecological Reserve (BSER). Located in Tehama County, BSER's 54 acres lie between Butler Slough and Antelope Creek about one mile from the Sacramento River. Antelope Creek is a high quality creek able to support a small anadromous fish population. BSER is also adjacent to Dye Creek Ranch Preserve, a 37,540 acre environment-healthy working ranch managed by The Nature Conservancy.

The first phase of this project was to convert old orchards to native riparian habitat. The Grant funded activities included permitting, removing the old remnants of a plum tree orchard, field and soil preparation, irrigation installation and maintenance, site layout, planting, ongoing irrigation, pest control, monitoring, and reporting.

The second phase was the development of a management plan for BSER. The plan was developed in conjunction with DFG staff to serve as the guiding document for BSER maintenance and management. Plan development included special status species surveys, habitat mapping, wetland delineation, soils mapping and profiling, hydrologic mapping, and archaeological and cultural surveys. The Foundation contributed matching funds for the project manager's salary.



**BENEFITS:** Though this project represented off-site, out-of-kind habitat restoration, the valley oak riparian habitat of the BSER site has some similarities with the spill-damaged montane riparian habitat in the upper Sacramento River. The restoration improved habitat for fall and spring-run salmon, native resident fish including steelhead and rainbow trout, and improved the migration corridor for neotropical nesting and foraging bird species.

Overall, 54 acres of habitat were restored, including 10 acres of willow cottonwood thicket. Monitoring indicated an 80% vegetation survival rate, for an end total of 8,000 native riparian plants newly established in BSER.

A BSER management plan was successfully developed and is currently in use by DFG. The plan provides guidelines for appropriate public uses of the property, a descriptive inventory of fish, wildlife, and native plant habitats that occur on or use BSER, and an overview of the reserve's operations and maintenance including personnel requirements and budget needs.

**PRODUCTS RECEIVED:** Quarterly and end of season progress reports  
Restoration plan  
BSER management plan  
Final report

\*Grant still open as of March 2007.

## *California Welcome Center*

**DATE FUNDED:** 1997

**DURATION OF PROJECT:** Twenty-five years

**GRANTEE:** Shasta Cascade Educational Foundation

**AMOUNT GRANTED:** \$75,000

**AMOUNT SPENT:** \$75,000

**BACKGROUND:** In 1997, the Cantara Trustee Council (Council) funded the Shasta Cascade Educational Foundation to construct a California Welcome Center (Center) in Anderson, California. The amount granted was a portion of the construction costs. Completed in 1997, the Center provides information on attractions, communities, and public lands to northern California visitors.

**BENEFITS:** For the Council's contribution to the Center, they contracted up to 200 square feet of interpretive space for a minimum of 25 years. A photo display regarding the Cantara spill, recovery efforts, and the Council's role is currently on view. The area also contains a rock waterfall and cold-water aquarium stocked with rainbow trout and a three dimensional model of the Shasta Cascade region, including the upper Sacramento River Canyon. The Center provides thousands of travelers each year the opportunity to learn about the spill and the Council's program and recovery efforts.

**PRODUCTS RECEIVED:** The Council received an interpretive display at the California Welcome Center.



## *Cantara / Ney Springs Enhancement*

**DATE FUNDED:** 1996

**DURATION OF PROJECT:** Five years

**GRANTEE:** Mr. Alan Pardee, Landscape Architect

**AMOUNT GRANTED:** \$39,500

**AMOUNT SPENT:** \$39,500

**BACKGROUND:** The Cantara and Ney Springs properties were acquired by the California Department of Fish and Game (DFG) in the 1980's. At the time of the 1991 spill, many of the management plans for these properties had not been implemented. This area was recognized by DFG as an intact montane-riparian habitat corridor. As these properties are located directly above the spill site (approximately ¼ mile upstream), this area of the river played a critical role as a source for restocking rainbow trout and riffle sculpin. With an increase in use after the spill, potential impacts to the area, such as damage caused by vehicles, threatened the health of the ecosystem. This project was designed to minimize detrimental human impacts and restore degraded resources. It was felt that the health and stability of this area was vital to the natural restoration of the entire river system.



**BENEFITS:** Areas with vehicle damage lost vegetation and suffered from soil compaction. Restoration was accomplished by removing dead or dying vegetation; loosening compacted soil through mechanical and manual means; mixing on-site forest duff into loosened soils to help restore them; planting seed stock and willow cuttings gathered on-site; placing native leaf-mulch over prepared and seeded soils to protect from compaction and raindrop erosion; and installing silt fencing, water bars, and other erosion control methods between the revegetated areas and the river.

Several activities were implemented towards the preservation and protection of resources. At the Cantara Loop site, a handicapped accessible fishing access was constructed, a handicapped accessible restroom was provided, an informational kiosk was built, and wheelchair accessible picnic tables and bear resistant garbage cans were installed. Throughout the properties, access roads were repaired, trails were improved, and site management signs were posted.

Both recreational use and the natural habitats benefited from the enhancements. Direct improvements to the montane riparian terrestrial and the cold water lotic aquatic environments indirectly assisted a wide variety of aquatic and terrestrial plants and animals; from algae to alders, and from rainbow trout to raccoons.

**PRODUCTS RECEIVED:** The Council received four progress reports measuring project performance and success in the areas of habitat restoration, resource preservation and protection, public access and services improvements, and stewardship promotion.

## *Cantara Video*

**DATE FUNDED:** 2001

**DURATION OF PROJECT:** One year

**GRANTEE:** Cantara Productions

**AMOUNT GRANTED:** \$53,008

**AMOUNT SPENT:** \$53,003

**BACKGROUND:** The Cantara Trustee Council (Council) funded this project to produce a broadcast quality video documentary regarding the Cantara spill, recovery, and restoration. Cantara Productions began collecting interviews and footage for the documentary shortly after the spill occurred. When the production company approached the Council for funding to produce a final documentary, the project was approved as a valuable tool to help meet public information and education goals.

**BENEFITS:** In all, over 70 hours of video footage was edited to create the 56-minute documentary. Through interviews, animation, and live shots, the film features the Cantara spill derailment, its environmental effects, and the subsequent economic impact on Dunsmuir from tourism losses. The documentary reviews recovery and restoration efforts, and raises questions on policy issues for rail safety and notification of residents in the case of a toxic spill. The film also acknowledges the Council's restoration efforts and touches on the importance of environmental stewardship. The video premiered to Dunsmuir residents at a local showing in April 2003, and aired on public television stations locally and across the nation that spring and summer.

**PRODUCTS RECEIVED:** Monthly progress reports  
Fifty copies of the final video

## *Castle Crags State Park Himalayan Blackberry and Scotch Broom Control*

**DATE FUNDED:** 1998; 2001

**DURATION OF PROJECT:** Four years, eight months; Three year augmentation

**GRANTEE:** California State Parks and Recreation, Northern Buttes District

**AMOUNT GRANTED:** \$121,913

**AMOUNT SPENT:** \$118,838

**BACKGROUND:** The Cantara Trustee Council (Council) funded the California Department of Parks and Recreation (DPR), Northern Buttes District, to control and monitor *Rubus discolor* (Himalayan blackberry) and *Cytisus scoparius* (Scotch broom) within Castle Crags State Park. Located south of Dunsmuir, Castle Creek, in Castle Crags State Park, is a tributary of the upper Sacramento River. Himalayan blackberry and Scotch broom are non-native invasive species listed as top priority for eradication and control by the California Invasive Plant Council. These invasive weeds smother and displace native plants and plant communities, reducing plant and wildlife biodiversity.

The Council funded an initial project in 1998, and later funded a project expansion in 2001. The DPR subcontracted herbicide application, removal, and monitoring of control efforts throughout the treatment area (80 acres of Himalayan blackberry and 5 acres of Scotch broom). To facilitate monitoring, treated areas were mapped with a Global Positioning System (GPS) at project start, and in each subsequent year, to evaluate progress. Following treatment and mapping activities, large patches of either species were cut, piled, and burned; smaller patches were cut and left to decay.

Initially, the DPR treated 31 acres of Himalayan blackberry and one-half acre of Scotch broom. Three areas were treated: Lippencott Meadow, the Sacramento River Picnic Area and Campground, and the Park Entrance Station and Main Campground. Herbicide application was conducted in fall, 2000. Monitoring and reapplication took place in 2001 and 2002. The program was then expanded to continue monitoring and treatment of the initial acres and to treat and monitor the remaining 50 acres of Himalayan blackberry and 5 acres of Scotch broom in the park. Herbicide application in the new area was conducted during the fall of 2002. All treated acres were monitored and retreated as needed in 2003 through summer, 2006.

GPS mapping showed a significant reduction in area and extent of these two species in the treatment areas. The original target was to reduce the total coverage to one percent or less of the coverage prior to the project. Actual results were a reduction of the plants to 27 percent of the original coverage by project end. This represented an overall reduction of 68 acres of Himalayan blackberry and 2.4 acres of Scotch broom.

**BENEFITS:** Coverage reduction allowed native plants to colonize the liberated patches, inhibiting re-invasion by these undesired species. Promoting native plants increased biodiversity and improved habitat quality for wildlife and native plants. These improvements in diversity and habitat also improved the experience by park visitors. The previous expanding monoculture of blackberry and Scotch broom was unpleasant and, over time, had led to a steady decline in habitat quality for nearly all wildlife and native plant species.

These efforts restored five acres of montane riparian terrestrial habitat directly affected by the Cantara spill, and an estimated 70 acres of wetland and upland habitats and ephemeral streams that are part of the upper Sacramento River watershed. Future maintenance and control work will be funded by DPR's natural resource facilities maintenance fund.



*A blackberry thicket, after herbicide treatment.*

**PRODUCTS RECEIVED:** ArcInfo files of target species distribution  
Monthly pesticide reports  
Periodic progress reports  
End of season reports for 2003 and 2004 and related maps  
Final report and maps, including plans for continued maintenance of the control efforts

## *Castle Crags State Park Interpretive Coordinator*

**DATE FUNDED:** 1998

**DURATION OF PROJECT:** Two years

**GRANTEE:** California State Parks and Recreation, Castle Crags State Park

**AMOUNT GRANTED:** \$27,595

**AMOUNT SPENT:** \$27,595

**BACKGROUND:** In 1998, the Cantara Trustee Council (Council) awarded a grant to the California Department of Parks and Recreation (DPR) to provide an interpretive coordinator at Castle Crags State Park. The interpreter was hired to work six months a year over a two-year period, during the summers of 1999 and 2000. The interpreter worked with permanent park staff, Department of Fish and Game (DFG) personnel, the Upper Sacramento River Exchange, and local schools to develop interpretive materials and programs at the park. The programs emphasized the natural resource values of cold water lotic and montane riparian ecosystems, their relationship to the surrounding watershed, and their vulnerability to human impacts such as the Cantara spill.



**BENEFITS:** During 1999, the interpreter developed several programs for park visitors. A guided school field trip program, "Forest Habitat", was designed for local schoolchildren. This program centered on forest ecology, including an introduction to watershed education. Five classes requested this program before the end of the 1999 school year. Interpretive programs for the summer camping season included two scripted slide shows, one on wildflowers and the second on wildlife. Guided interpretive walks complemented the slide shows. In addition, the coordinator developed three junior ranger programs for seven- to twelve-year-olds on aquatic insects, water quality and rainbow trout, and the local watershed. Four guided field trips were prepared for school groups to utilize the following year.

In 2000, the coordinator redesigned the school field trip packets and curriculum guides and produced the Safari Series: Forest Safari, River Safari, Wildlife Safari and Bird Safari for grades kindergarten through 6<sup>th</sup>. The four Safari field trips were written in a self-guided form, to allow teachers to utilize the programs without an interpretive guide. A guided program called "River Fun Day" was also developed for all grades. Ten groups reserved these field trips during 2000. The final program designed in the fall of 2000 was an overnight camping program for 6<sup>th</sup> through 8<sup>th</sup> grade students, called Wildlife Safari Overnight. It included a slide program, wildlife educational games, and hands-on exhibits.

The interpreter organized efforts centering on park resources and brought focus to the fragile ecosystem at the Castle Crags State Park. Field trip packets and curriculum guides educated the public, promoted stewardship of resources, and developed an ongoing program beyond the life of the interpretive coordinator position. The coordinator facilitated volunteers and a potential labor force to continue with restoration projects and educational presentations. The interpretive coordinator also generated interest and cooperation of outside agencies to use the park for environmental education purposes, therefore perpetuating the preservation of park resources.

**PRODUCTS RECEIVED:** The Council received copies of the grade-based curricula, field trip packets for local schools and other groups that use Castle Crags State Park, and a final report summarizing the interpreter's accomplishments over the two year grant period.

## *Dunsmuir Schools Watershed Education Project*

**DATE FUNDED:** 1997; 1998; 2000

**DURATION OF PROJECT:** Three years

**GRANTEE:** Dunsmuir Elementary School District & Dunsmuir Joint Union H.S. District

**AMOUNT GRANTED:** \$535,932

**AMOUNT SPENT:** \$535,932



**BACKGROUND:** In 1998, the Cantara Trustee Council (Council) funded the Dunsmuir Elementary School District in conjunction with the Dunsmuir Joint Union High School District to refine and implement a Watershed Education Program. The initial curriculum was developed through a 1996 Council grant to the Siskiyou County Office of Education<sup>1</sup>. Pleased at the program's success, the Council funded an endowment in 2000 to support the project in perpetuity.

Elementary school project goals were to enhance the current "Adopt-A-Watershed" (AAW) curriculum and to implement AAW in four new classrooms. The AAW curriculum includes field trips, restoration projects, participating in community service projects, developing computer programs for each AAW unit, participating in a "buddy teaching program", and work with local community mentors.

High school project goals were to partner with the Department of Fish and Game (DFG) in trout population studies, expand the curricula to align with field projects, participate in water quality field studies with the City of Dunsmuir, monitor logging effects on the water quality of Soda Creek, write about Cantara spill effects on riparian species, produce training videos for equipment use and field study protocols, produce video interpretive presentations to promote community stewardship, and promote river safety awareness.



**BENEFITS:** In 1998, elementary students conducted studies of the watershed environment through classroom projects, field trips, and working with local mentors. Wildlife survey training was provided by the U.S. Fish and Wildlife Service. Projects included constructing bat and bird boxes, bird feeders, raising trout fry from eggs, building a trail on a forested hill, and restoring an eroded hillside. Studies included forest ecosystems, landforms, geology, and comparisons between riparian and forest communities. Students also learned about wastewater treatment processes and the impact of storm drains on water quality. They learned how to test water quality by sampling several seasonal creeks.

Seventh and eighth grade students conducted studies on fish, birds, stewardship, native plants, amphibians, the river, and the Cantara spill. A year-long study on aquatic invertebrates was made, including collecting and identifying the watershed's most common insects. Students produced an illustrated aquatic insect guide and sold over 300 copies. Other projects included: water quality monitoring, volunteering with the Forest Service, assisting with renovation at historic Girard Ridge Lookout, and trail work along the upper Sacramento River at Dunsmuir City Park.

High school students monitored water quality on the upper Sacramento River and Soda Creek. They also participated in DFG electrofishing studies on the upper Sacramento River. The Math Analysis Class analyzed and graphed the data and English students prepared year-end reports to send to DFG and the State Water Quality Control Board.

The entire year of watershed projects and studies culminated at the Dunsmuir River Festival. The three-day event provided kindergarten through high school students an opportunity to teach adults and peers about their watershed, and gave the students recognition in their community. Items such as bird feeders and native plants were offered for sale. A large watershed mural created by all students in the program was displayed at the River Center. The festival also featured slide show programs, fishing clinics, and a celebration of the Watershed Education Program. The event was attended by over 300 people. "Celebrating Watershed Education" was the theme of the Dunsmuir Elementary School Open House. Students performed an original watershed operetta and read student authored books for over 150 people.

**PRODUCTS RECEIVED:** Dunsmuir schools have provided the Council with quarterly status reports, examples of student's work, technical reports written on water quality and electrofishing surveys, and a copy of the enhanced watershed education curricula for both schools.

## *Fall River Aquatic Monitoring and Assessment*

**DATE FUNDED:** 1996

**DURATION OF PROJECT:** One year, five months

**GRANTEE:** Department of Water Resources

**AMOUNT GRANTED:** \$75,000

**AMOUNT SPENT:** \$74,749

**BACKGROUND:** In 1996, the Cantara Trustee Council funded the Department of Water Resources to conduct aquatic monitoring and assessment of the upper Fall River, a tributary to the Pit River, which feeds into one of the three main arms of Shasta Lake. The Fall River begins near Dana, in northeastern Shasta County. This project was developed to serve as a starting point for the analysis of sediment deposition and movement, and its possible impacts on aquatic vegetation in Fall River. Another project goal was to determine the status of aquatic resources in the upper 10 to 12 miles of Fall River. This study complemented and integrated with other watershed-wide resource assessments and rehabilitation studies underway at the time. Cross-sections and sediment corings were completed for 12 sections of the river. Transport rates for bedload, suspended sediment, and suspended sand were measured at four stations, generally over a range of four streamflow events. Gradations of the bedload samples were provided; water quality and macroinvertebrate data were also collected. This information provides a baseline and a protocol for future studies.



**BENEFITS:** Data was collected from September 1996 through June 1997. Physical cross-section monitoring was conducted to document changes in sediment measurements. Results indicated little change in sediment measurements between sites, considering the magnitude of flows during a January 1997 flood event. There was an 80 square foot increase in sediment in the cross-sections above the Spring Creek confluence (a tributary to Fall River), and a 17 square foot loss downstream of the confluence.

Sediment coring to determine the nature and thickness of bed material found only minor distinctions between deposits. These were typically limited to slight variations in grain size and sorting. No evidence of true bedrock was noted. Sediment layers were less consistent upstream from Spring Creek, with more variation in the channel profile and the sediment depth. Sediment depth downstream from Spring Creek was more consistent across the entire length of the channel.

Samples of bedload, suspended sediment, and suspended sand were collected at four pre-selected locations during the fall and winter 1996-97. Results indicated that very fine sand constitutes a major portion of the granular material transported by Fall River. Additionally, this probably comprises a significant portion of the bed material.

Macroinvertebrates were sampled at seven sites during September through November of 1996, and in May of 1997. Transects were established across the river and five equally spaced sampling units along each transect were monitored. A wide variety in the numbers and diversity of organisms and species occurred between stations. Monitoring sites downstream from Spring Creek contained a far greater number of organisms than sites above Spring Creek.

In its original state, the Fall River represents a cold-water lotic system similar to the upper Sacramento River. This grant provides an off-site benefit in that the study findings can be used to restore habitat similar to that damaged by the Cantara spill. Additionally, the monitoring results benefit future watershed studies and activities in the Fall River watershed. For example, the data was later used to prepare an environmental report and, subsequently, several proposals for experimental dredging have been developed.

**PRODUCTS RECEIVED:** The Cantara Trustee Council received a memorandum report titled "*Aquatic Monitoring and Assessment for the Upper Fall River*".

## *Fall River GIS Mapping Project*

**DATE FUNDED:** 1998

**DURATION OF PROJECT:** Eleven months

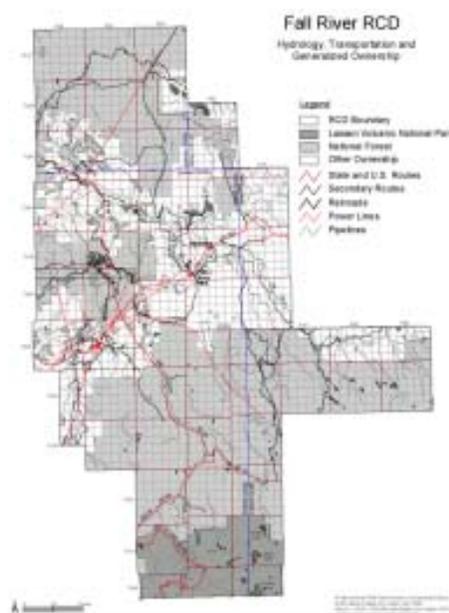
**GRANTEE:** Fall River Resource Conservation District

**AMOUNT GRANTED:** \$7,500

**AMOUNT SPENT:** \$7,500

**BACKGROUND:** The Fall River Resource Conservation District (RCD) was actively involved in obtaining funding for many restoration projects affecting the Fall River watershed in eastern Shasta County. There was an urgent need for the RCD to have Geographic Information System (GIS) -style mapping to effectively plan large scale projects, and enhance its presentations to funding agencies. The Cantara Trustee Council (Council) chose to fund this GIS mapping effort.

The RCD subcontracted with the Shasta Community College GIS Department to produce GIS data layers, as well as paper and electronic copies of several district maps. Layers developed included hydrology, transportation, and generalized ownership.



**BENEFITS:** An enhanced capability to obtain funding for future restoration projects was the primary benefit for the RCD. To the baseline datasets obtained from this project, the RCD will be able to add layers delineating wetlands, fencing projects, soil erosion profiles in meadows, and stream bank erosion conditions. GIS mapping is also used for such interests as range management, streamcourse access, and exotic plant distribution.

The GIS map products were used to explain proposed restoration projects to the local public. Also benefiting were the five Shasta College students who completed the project. All successfully completed their GIS training at the college and several are now working with local agencies and private firms, applying GIS skills to solve local resource problems.

**PRODUCTS RECEIVED:** The Council received monthly progress reports, hard copies of the produced maps, and electronic copies of all GIS layers.

## *Freeman Ranch Cattle Exclusion Project*

**DATE FUNDED:** 1996

**DURATION OF PROJECT:** Six years, five months

**GRANTEE:** Great Northern Corporation

**AMOUNT GRANTED:** \$61,531

**AMOUNT SPENT:** \$58,213

**BACKGROUND:** The Cantara Trustee Council (Council) funded the Great Northern Corporation to restore one river-mile of the Shasta River, where it flows through the Freeman Ranch. The collective results of similar projects throughout the length of the river have increased the health of the entire aquatic and riparian ecosystems.

The Shasta River is the main spawning tributary in the Klamath drainage for Chinook and coho salmon, and steelhead trout. Long-term grazing impacts reduced woody riparian vegetation and destabilized river banks. In turn, this led to increased river siltation and higher water temperatures, compromising the survival of salmon, trout, and other organisms that rely upon well-oxygenated cold water. During the 1950's, the Shasta River was the most heavily fished trout stream in Siskiyou County. Over time, increasing habitat damage and degradation led to declining fish reproduction and survival. Today, very few anglers fish this river.



**BENEFITS:** To eliminate grazing impacts, thirty-two acres of riparian vegetation along the Shasta River were protected from excessive livestock grazing and trampling with fencing. Both banks of the river, for a distance of one river-mile, were fenced. The area was replanted with native vegetation, propagated from local stock. Approximately 2,000 cuttings of willow, water birch, alder, and cottonwood were planted in the spring of 1997. Of these, over 87% survived the first summer, 63% the first year, and 43% the second summer (as of fall, 1998). An additional 1,000 cuttings were planted in spring, 1998, of which 66% survived when the last formal monitoring was conducted in fall, 1998. Over time, more trees and increased vegetation reduced river temperatures by providing shade, and stabilized the river banks, decreasing siltation. Sediment reduction decreased spawning gravel embeddedness, both on-site and downstream of the project area. Increased bank vegetation also improved rearing habitat for fish, including steelhead, Chinook and coho salmon, and rainbow trout. Other species benefiting from this project were: beaver, otter, waterfowl, amphibians, turtles, deer, bobcat, weasel, mink, raptors, songbirds, and insects.

**PRODUCTS RECEIVED:** The Cantara Trustee Council received annual progress reports for the three years that active work was completed. The grazing exclusion fencing will be in place for a period of ten years. Project data was collected annually for three years. Data was recorded and stored in the Klamath Resources Information System (KRIS) database, including information on fencing (number of feet and fence effectiveness), planting (number of trees and species, tree survival, and growth), and stream cross-section data (terrestrial and emergent plants, bank angle, bottom substrate, long-term water temperature changes).

## *Hat Creek Bank Stabilization Project*

**DATE FUNDED:** 2003

**DURATION OF PROJECT:** Two years, four months

**GRANTEE:** California Trout, Inc.

**AMOUNT GRANTED:** \$27,770

**AMOUNT SPENT:** \$27,723

**BACKGROUND:** In 2003, the California Department of Fish and Game proposed that the Cantara Trustee Council (Council) fund California Trout, Inc. (CalTrout) to implement a stream bank enhancement demonstration project on Hat Creek, which had been a premier wild trout fishing water. In recent years the quality of fishing in the stream had declined, in large part due to stream bank degradation from cattle grazing, burrowing by non-native muskrats, and foot traffic. Though grazing was no longer a problem, muskrat burrowing, exacerbated by foot traffic, continued to cause stream bank collapse, which eliminated overhanging bank cover for trout.

The council approved project funding to stabilize 750 feet of the Hat Creek stream bank. The project was located on a stretch of Hat Creek between State Highway 299 and the Hat Creek 1 Powerhouse in Shasta County. The planned method had been successfully implemented nearby on private land and the same construction consultant was used for this effort. Pacific Gas and Electric Company agreed to contribute \$30,000 worth of materials to the project.

**BENEFITS:** This project supported the Council's goal to restore resources lost in the Cantara spill, such as trout habitat and trout fishing in Northern California. Along 750 feet of stream bank, CalTrout installed logs with a fill of 2-3 inch rocks placed in-between the logs and damaged stream bank areas. Soil was filled in behind the rocks and planted with native sod mats collected from zones adjacent to the project.

The installation was monitored for two years to evaluate stream bank stability, vegetation growth, and subsequent muskrat activity in the project site. The project proved effective at stabilizing the stream bank and reducing muskrat burrowing — though some follow-up burrow filling was necessary.

This project supported the Council's goal to restore resources lost in the Cantara spill, such as trout habitat and trout fishing in Northern California. Along 750 feet of stream bank, CalTrout installed logs with a fill of 2-3 inch rocks placed in-between the logs and damaged stream bank areas. Soil was filled in behind the rocks and planted with native sod mats collected from zones adjacent to the project.

The installation was monitored for two years to evaluate stream bank stability, vegetation growth, and subsequent muskrat activity in the project site. The project proved effective at stabilizing the stream bank and reducing muskrat burrowing — though some follow-up burrow filling was necessary. Monitoring found successful revegetation in the restoration area but noted that the area where the sod mats were placed required some follow-up work to prevent invasive weeds. Ranger observation, angler comments, and snorkel diving documented fish use by juvenile trout, the presence of larger trout, and development of the stream bank cover habitat they prefer.

The restoration improved trout habitat, reduced sediment, improved public safety, and reduced muskrat burrowing. As a demonstration project, it documented that the techniques used were effective. However, the relatively high cost per linear foot of stream bank stabilized indicates it should be reserved for areas where problems are severe enough to warrant the expense.

PRODUCTS RECEIVED: The Cantara Trustee Council received a final project installation report and, after monitoring was concluded, a final project report titled *"Hat Creek Streambank Enhancement Project — Final Report: A Cooperative Effort of the California Trout, Department of Fish and Game, The Cantara Trustee Council and PG&E, 14 June, 2006."*



## *Hedge Creek Falls and River Trail Project*

**DATE FUNDED:** 2002

**DURATION OF PROJECT:** Four years, one month

**GRANTEE:** Upper Sacramento River Exchange

**AMOUNT GRANTED:** \$225,000

**AMOUNT SPENT:** \$183,349\*

**BACKGROUND:** In 2002, the Cantara Trustee Council (Council) funded the Upper Sacramento River Exchange (River Exchange) to repair and extend access trails at Hedge Creek Falls. Hedge Creek is a tributary to the upper Sacramento River. The 30-foot high falls are a popular destination for visitors and residents in Dunsmuir. Previously, access was along a rough, eroded trail that led to the falls, but did not continue on to the upper Sacramento River, which is close by. The trail head, at Hedge Creek Falls Park, had limited parking.

The River Exchange implemented the project in partnership with the city of Dunsmuir and the Dunsmuir Garden Club. The entire project took place on city property. The Garden Club's first project upon forming in 1998 had been to landscape the park at the entrance to the trail.

This project is a stand-alone first phase of a larger effort by the River Exchange to improve public access to Hedge Creek, the upper Sacramento River, and Mossbrae Falls (another popular local tourist attraction).

**BENEFITS:** The River Exchange repaired and realigned approximately 250 feet of trail from Hedge Creek Park to Hedge Creek Falls and upgraded the trail for multiuse (handicapped accessible). Slopes were stabilized; native vegetation was planted along the trail and at the trail head. Workers installed a bridge over Hedge Creek, below the falls, and extended the multiuse trail by 300 feet along Hedge Creek to an overlook platform above the Sacramento River. A 70-foot angler access trail was developed from the overlook down to the river. Construction included 300 feet of fencing along the northern property line to reduce access to adjacent private property.

At Hedge Creek Park, parking was increased and two handicapped spaces added. An informational kiosk and interpretive and directional signs were installed. These trail enhancements improved access and enjoyment of these resources, reduced sediment from trail erosion, and improved water quality and habitat.

PRODUCTS RECEIVED: Bimonthly progress reports  
Restoration plan  
Final report



## *Lake Siskiyou Watershed Conservation Plan*

**DATE FUNDED:** 2000

**DURATION OF PROJECT:** Five years

**GRANTEE:** Siskiyou County

**AMOUNT GRANTED:** \$98,200

**AMOUNT SPENT:** \$47,724

**BACKGROUND:** The intention of this project was to develop a conservation plan for the Lake Siskiyou watershed to be adopted as a component of the Siskiyou County General Plan Conservation Element. The planning and preparation process began to develop the Lake Siskiyou Watershed Assessment (LSWA), with the following goals:

- characterize the watershed's natural resources
- identify key issues and questions
- define existing conditions of water quality and land
- discuss reference (baseline) conditions
- provide recommendations and discuss opportunities.

A technical advisory committee was established with representatives from public and resource management agencies, city and county agencies, land owners, and other stake-holders to guide the development of the draft LSWA. The draft LSWA was released in January 2004. After this date, no further work on the LSWA or the conservation plan for Lake Siskiyou occurred under this grant agreement, because the project manager, representing the Siskiyou County planning department, left to take another position. This left the project without a dedicated manager and the Council disencumbered the remaining grants funds in 2006.

**BENEFITS:** The *Administrative Draft of the Lake Siskiyou Watershed Assessment* contains a good summary of the natural resources of the watershed. Discussion of land uses and disturbance to the watershed needs further investigation. The evaluation of the effects of the dam is poor, and needs to contain an evaluation of the tributaries to the Sacramento river. This document will be a good starting point when Siskiyou County or another entity attempts another watershed assessment of this area.

**PRODUCTS RECEIVED:** Monthly reports  
*Administrative Draft Lake Siskiyou Watershed Assessment*



## *Land Agent Funding*

**DATE FUNDED:** 1999

**DURATION OF PROJECT:** Four years

**GRANTEE:** Wildlife Conservation Board

**AMOUNT GRANTED:** \$20,000

**AMOUNT SPENT:** \$1,704

**BACKGROUND:** This grant funded the Wildlife Conservation Board (WCB) to act as real estate agent for the Cantara Trustee Council (Council). WCB staff arranged for appraisals, boundary surveys, inspections, and real estate transactions for properties identified by the Council. Originally, the Council relied on the California Department of Fish and Game (DFG) for real estate acquisition services. It was later determined that a separate service through WCB would be more effective as it enabled the Council to make grants directly to applicants for acquisitions.

**BENEFITS:** This grant facilitated billing for personnel, per diem and travel, and other miscellaneous expenses incurred in providing real estate acquisition services, required for the Council to pursue its acquisition strategy. Based on Council priorities, or at the request of agency or community partners, the WCB conducted several property investigations and appraisals. These led to the purchase of four parcels: CalTrout, Dewey, and Rhinesmith that are on the upper Sacramento River, and Billings, which is on Clear Creek in Shasta County. The CalTrout property borders a wildlife area owned by DFG and includes the area around the Cantara Loop. The Dewey parcel abuts the north end of Dunsmuir City Park and may permit expansion of the park in the future. The Rhinesmith property helps provide linkage between Tauhindauli Park and Trail<sup>1</sup> and Dunsmuir City Park. The Billings parcel connects with Bureau of Land Management properties and provides a near in-kind habitat acquisition. Clear Creek is an important fishery tributary to the Sacramento River containing valley foothill riparian habitat.

**PRODUCTS RECEIVED:** Quarterly progress reports on the status of pending acquisitions.

<sup>1</sup>See Tauhindauli Park and Trail summary.

<sup>2</sup>See Sacramento River Property Acquisition

## *Lassen Creek Restoration - Bishop Ranch*

**DATE FUNDED:** 1998

**DURATION OF PROJECT:** Two years

**GRANTEE:** Goose Lake Resource Conservation District

**AMOUNT GRANTED:** \$116,570

**AMOUNT SPENT:** \$606

**BACKGROUND:** The Cantara Trustee Council (Council) funded the Goose Lake Resource District (RCD) to implement restoration activities on Lassen Creek and the surrounding meadow at Bishop Ranch in Modoc County, 25 miles north of Alturas. The Lassen Creek drainage is a tributary to Goose Lake and an important support for spawning runs of Goose Lake redband trout (*Oncorhynchus mykiss* ssp.), considered by the state of California to be a species of special concern. The existing stream had incised a large gully in the meadow which lowered the water table and negatively affected riparian vegetation, fish passage and habitat, and caused erosion. Goose Lake RCD had developed plans to relocate the stream to a stable channel north of the existing gully and to cover the gully using fill from the excavation of five ponds.

**BENEFITS:** Bishop Ranch and water rights to the Lassen Creek drainage are under private ownership. Just as initial surveying was getting underway, the land owner decided to back out of the project. Therefore, the contract with Goose Lake RCD was cancelled and funds were returned to the Council.

**PRODUCTS RECEIVED:** This grant was cancelled before any products were completed.

## *Lassen Creek Restoration Design Project*

**DATE FUNDED:** 1997

**DURATION OF PROJECT:** Six months

**GRANTEE:** Goose Lake Resource  
Conservation District

**AMOUNT GRANTED:** \$15,000

**AMOUNT SPENT:** \$14,754



**BACKGROUND:** The Cantara Trustee Council (Council) funded the Lassen Creek Restoration Design Project in 1997. Located in Modoc County, Lassen Creek is one of the few spawning streams for Goose Lake redband trout, which is listed as a California Department of Fish and Game (DFG) “species of special concern”. The stream channel in the meadow area was damaged by extensive livestock grazing and trampling, irrigation, water extraction structures, and attempts to modify the channel to maintain fish passage; in some locations the channel was downcut as much as ten feet. Stream banks were undercut and during high flows large sections of the bank fell into the stream, adding further sediment to the creek. As the creek eroded down through the meadow the water table dropped, which affected the plant community, with dry upland species replacing meadow wetland species.

The project goal was to develop alternate plans to create a new stream channel through the existing floodplain. Project objectives included: 1) eliminating the source of erosion from gully walls of the existing channel; 2) arresting the current rate of bank erosion; 3) restoring fish habitat and passage; 4) restoring the water table to prior conditions; 5) restoring floodplain function, and 6) protecting riparian corridor health and function.

To achieve the objectives, the Goose Lake Resource Coordination District (RCD) developed methods to restore 17 miles of lower Lassen Creek by creating a new stream channel through the existing floodplain. Prior to developing the restoration plan, existing data was assembled on stream flows, watershed condition, plant community composition, geomorphology of drainage patterns, land uses, diversion needs, and sediment transport. Field data were collected on current gully conditions, former channel conditions,

sediment transport capabilities, bankfull discharge, and floodplain capacity. Four permanent channel monitoring transects were established to accurately portray the present channel dimensions. Four valley transects were established across the project site to determine the width of the floodplain and the extent of inundation across the meadow surface at various flood stage heights.

**BENEFITS:** A restoration plan was developed containing five alternatives to restore Lassen Creek: 1) placing structures to prevent further channel incision; 2) stabilizing existing gully channel walls by sloping them back and revegetating; 3) a no-action alternative to allow natural recovery; 4) a limited geomorphic restoration, and 5) a full geomorphic restoration to mimic prior stable conditions.

The plan provided a direction and options for future restoration of lower Lassen Creek, which were later used to obtain grant funding, through the Environmental Protection Agency's Clean Water Act, for restoration efforts. Fencing to create a specific riparian pasture was constructed to control cattle access along the lower reaches of Lassen Creek. Prescriptive grazing management was implemented in conjunction with in-stream erosion control structures that were completed by the DFG (these activities are most consistent with Alternative 1, above).

Stream temperature studies were completed along with other water quality monitoring studies. These studies, which aid in understanding the watershed and help guide restoration efforts, were conducted jointly with the University of California Cooperative Extension, Goose Lake RCD, Central Valley Regional Water Quality Control Board, and local landowners.

**PRODUCTS RECEIVED:** The Cantara Trustee Council received a final report titled "*Lassen Creek Meadow Restoration Design*".

## *Oregon Gulch Access Barrier Project*

**DATE FUNDED:** 2003

**DURATION OF PROJECT:** Eleven months

**GRANTEE:** Western Shasta Resource Conservation District

**AMOUNT GRANTED:** \$36,414

**AMOUNT SPENT:** \$36,258

**BACKGROUND:** The Cantara Trustee Council (Council) approved a 2003 grant to the Western Shasta Resource Conservation District (RCD) to install three access barriers in the Oregon Gulch watershed, which begins west of Redding in Shasta County and flows through the city. A tributary to the Sacramento River, Oregon Gulch Creek is an ephemeral creek except at its lowest reach near the Sacramento River. Streams in the Sacramento River watershed below Keswick Dam, like Oregon Gulch, play an increasingly important role in the survival of threatened and endangered anadromous fish, as well as rainbow trout.

The Oregon Gulch watershed was negatively affected by illegal off-road vehicles and dumping. Barriers to key access points were identified by the Western Shasta RCD as a crucial first step in their long range plans for repair and restoration work in the watershed. Due to erosion from damage caused by off-roading, Oregon Gulch was identified as contributing more silt into the Sacramento River than any other Redding creek. This project focused on access points to a 360-acre set of parcels owned by the City of Redding.

**BENEFITS:** This grant supported the Council's goal for habitat protection and restoration. Prior to installing barriers, Western Shasta RCD developed a Conceptual Restoration Plan for Oregon Gulch watershed. The plan identified four areas of activity: barrier installation, litter removal, erosion control, and revegetation. For this project, Western Shasta RCD successfully installed three "big foot" gates at access points on Kenyon Drive, Texas Springs Road, and Power Line Road. Additionally, a combined total of 620-feet of concrete K-rail barriers were installed to either side of the gates. These efforts significantly reduced illegal off-roading and dumping, while still providing needed access by maintenance crews. The barriers will also help protect future revegetation and other restoration measures.

After the grant was completed, approximately 100,000 pounds of previously illegally dumped items were removed from the watershed, including 30 abandoned vehicles. Based on informal California Department of Fish and Game warden observations, one year after installing the barriers, it appeared that illegal access had been virtually eliminated, stream sediments were reduced by as much as 90 percent, and wildlife and local fish were returning to the area.

**PRODUCTS RECEIVED:** Conceptual restoration plan  
Final report on barrier installation



## *Pollard Gulch Access Enhancement Project*

**DATE FUNDED:** 2002

**DURATION OF PROJECT:** Three years

**GRANTEE:** USDA Forest Service — Shasta-Trinity National Forest

**AMOUNT GRANTED:** \$18,940

**AMOUNT SPENT:** \$18,109\*

**BACKGROUND:** In 1997, the Cantara Trustee Council (Council) funded the USDA Forest Service (Forest Service) to improve the Pollard Gulch access site<sup>1</sup>. In 2002, the Council approved a second grant to further enhance the site by installing a crib ladder stairway.

Located in the Shasta-Trinity National Forest about six miles upstream from Shasta Lake, Pollard Gulch is immediately east of the Pollard Flat exit on Interstate 5 (I-5). This site is one of just six public access locations along the upper Sacramento River between Box Canyon Dam and Shasta Lake. Pollard Gulch provides access to approximately  $\frac{3}{4}$  miles of river frontage. The site is on National Forest Service lands (except for the last 300 feet of trail to the river, which is owned by the State of California). The site is unique because the public can access the river without having to cross the Union Pacific Railroad tracks.

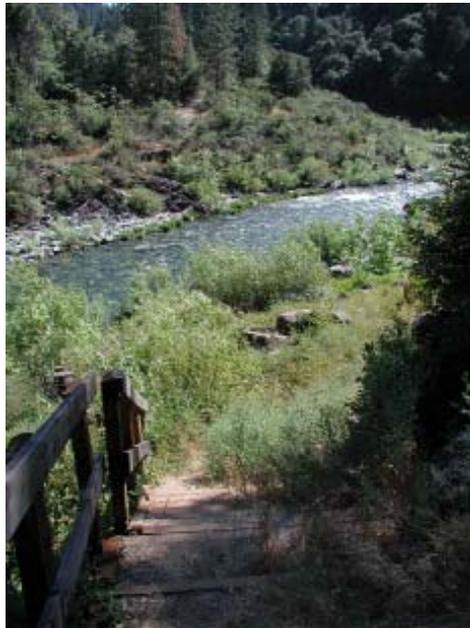
Primitive access to the site was created in 1989, during California Department of Transportation work on I-5. Based on a 1995 forest land and resource management plan, and a 1996 watershed analysis, the Forest Service identified Pollard Gulch as a top priority for improvement. In 1997, a Council grant improved site access through road and parking enhancements, brush clearance, adding picnic tables, and installing a handicapped accessible path and restroom. However, an actual trail down to the river was not included. This new grant focused on adding a trail down the canyon-side to the river.

\*Grant still open as of March 2007.

**BENEFITS:** Improved public access and resource protection are among the Council's primary goals. In addition to benefiting local residents, because of its location on a major north-south travel route, use and enjoyment of this site extends to all.

A 30-foot long crib ladder stairway was installed at the end of the paved trail at the Pollard Gulch day use area. The stairway was located where there is river backwater, thus ensuring the stairway will not receive the full force of the river during flood events. Additionally, the stairway was built in sections so that, if a log or rock did hit the stairway, only a portion would be damaged. While under construction, this design feature was put to use when the lowest stairway section was washed away in the winter of 2003-04 and subsequently rebuilt in 2005.

**PRODUCTS RECEIVED:** Progress reports  
30-foot long ladder stairway  
Final report



<sup>1</sup> See Pollard Gulch River Access Project.

## *Pollard Gulch River Access Project*

**DATE FUNDED:** 1997

**DURATION OF PROJECT:** One year, nine months

**GRANTEE:** USDA Forest Service — Shasta-Trinity National Forest

**AMOUNT GRANTED:** \$175,000

**AMOUNT SPENT:** \$170,411

**BACKGROUND:** Public access improvement and resource protection are among the primary goals for the Cantara Trustee Council (Council). In 1997, the Council funded the USDA Forest Service (Forest Service) to improve the Pollard Gulch access site. Located in the Shasta-Trinity National Forest about six miles upstream from Shasta Lake, this site is immediately east of the Pollard Flat exit on Interstate 5 (I-5). Initially called Pollard Flat, the site was renamed to Pollard Gulch to distinguish it from the exit and related truck stop. Pollard Gulch is one of just six public access locations along the upper Sacramento River between Box Canyon Dam and Shasta Lake.

Pollard Gulch provides access to approximately  $\frac{3}{4}$  miles of the river. The site is on National Forest System lands (except for the last 300 feet of trail to the river, owned by the State of California). It is unique in that the public can access the river without having to cross the Union Pacific Railroad tracks. Primitive access to the site was created in 1989, during California Department of Transportation (Caltrans) work on I-5. An environmental assessment at that time approved further access improvements to the site; these never occurred, due to lack of funds. Based on a 1995 forest land and resource management plan, and a 1996 watershed analysis, the Forest Service identified Pollard Gulch as a top priority for improvement.



**BENEFITS:** Access to Pollard Gulch was improved by widening the road, providing turnouts, and resurfacing the road and parking area. Approximately 70,000 square feet of road and parking lot surface was enhanced. Brush was cleared along the trail to the river and a 500-foot wheelchair-friendly paved path, from the parking lot to a river overlook, was installed.

Mainly used previously for fishing and kayaking access, the site improvements expanded recreational uses by providing four picnic tables (one handicapped accessible), and a handicapped accessible restroom. Approximately 8,000 square feet of brush was cleared for the picnic area and other site improvements. The overall capacity for the site was increased from eight to twenty persons.

Public awareness of the site was increased by installing directional signage at the I-5 exit onto Eagle Roost Road, the access entrance, and on-site. Pollard Gulch was also promoted via a brochure on river access points developed by Council staff – *“Your Guide to Outdoor Family Recreation on the Upper Sacramento River”*.

In addition to benefiting local residents, because of its location on a major west coast travel route, use and enjoyment of this site extends to all the recreating public, including international visitors. The anticipated useful life of the facility is at least 20 years. Continuing site maintenance and access road upkeep will be provided by the Forest Service and Caltrans.

**PRODUCTS RECEIVED:** Progress reports  
Final report



## *Prospect Avenue Fishing Access Project*

**DATE FUNDED:** 1997

**DURATION OF PROJECT:** Two months

**GRANTEE:** City of Dunsmuir

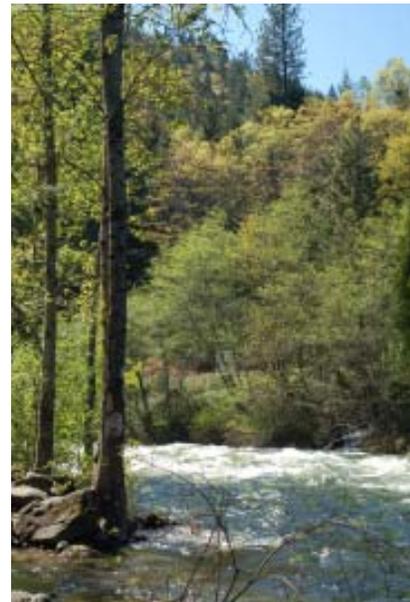
**AMOUNT GRANTED:** \$10,000

**AMOUNT SPENT:** \$3,944

**BACKGROUND:** In 1997, the Cantara Trustee Council (Council) engaged in a cooperative project with the City of Dunsmuir to repair flood damage at the Prospect Avenue fishing access. The damage occurred during an 84-year flood event on the upper Sacramento River on January 1, 1997. Both the access road and parking area sustained damage from high water and heavy runoff. The City of Dunsmuir coordinated repairs through an Upper Sacramento River Exchange volunteer and provided heavy equipment and an operator. The Council provided funding for materials.

**BENEFITS:** This project supported the Council's goal to support and improve river access along the upper Sacramento River. The access road to the site was re-graded, drainage improvements were made, the parking area was reconstructed, and an angler survey box was reinstalled. New signs and information boards were also placed. The information board was reconstructed and installed by the Siskiyou Flyfishers.

**PRODUCTS RECEIVED:** The site repairs and improvements were the final products for this project.



## *Resource Radio Project*

**DATE FUNDED:** 1998

**DURATION OF PROJECT:** Three years, six months

**GRANTEE:** Helen Chambers-Aria

**AMOUNT GRANTED:** \$73,735

**AMOUNT SPENT:** \$71,019

**BACKGROUND:** Early in its program, the Cantara Trustee Council (Council) produced a public relations and educational operational plan to promote recovery, restoration, enhancement, public support, and public stewardship of natural resources injured by the Cantara spill. Radio Public Service Announcements (PSAs) are able to facilitate these goals because PSAs can effectively communicate messages to the public and reinforce messages delivered in other formats. For example, a person may read about an upcoming event in a newspaper; their interest to attend may also be increased by hearing a PSA about the event.

With this grant, the Council funded Ms. Chambers-Aria to produce and distribute a series of PSAs to California radio stations. Ms. Chambers-Aria worked under the direction of the Department of Fish and Game's North Coast-Northern California region information office. She also received input from Cantara Program staff.

**BENEFITS:** At the rate of approximately one per month, a total of 36 PSAs were produced. The announcements were designed to increase public awareness of Council programs. They also reinforced Council messages regarding the ecological and economic values associated with healthy river ecosystems. Additionally, they promoted development of a stewardship ethic for resources injured by the Cantara spill.

PSA topics promoted Council publications such as the "*Guide to Outdoor Family Recreation on the Upper Sacramento River*" and public events related to the upper Sacramento River, such as the Dunsmuir River Festival and the annual Sacramento River cleanup. Some PSAs had fishing related subjects

such as Free Fishing Days and opening day of trout season. Others explained new fishing regulations for the upper Sacramento River, the recovery status of various resources, and restoration and public access projects on northern California waters. All 12 of the 2001 PSAs were released to coincide with the 10<sup>th</sup> anniversary of the Cantara spill.

Overall, the radio spots substantially boosted Council visibility and induced public support for its programs. Each of the PSAs was typically distributed to 25-125 radio stations, depending on the topic and target market. Over 2,850 distributions were made. Many of these were to stations in Siskiyou and Shasta counties. A significant portion, with topics of broader appeal, was also distributed in the Sacramento and Bay areas, and some were distributed statewide.

**PRODUCTS RECEIVED:** The Council received written scripts of all the PSAs, compact disc copies of all recordings, and periodic reports regarding station distribution of the completed spots.



## *Rhinesmith Development Plan*

**DATE FUNDED:** 2003

**DURATION OF PROJECT:** One year

**GRANTEE:** Upper Sacramento River Exchange

**AMOUNT GRANTED:** \$35,810

**AMOUNT SPENT:** \$35,810

**BACKGROUND:** Acquisition of the Rhinesmith property<sup>1</sup>, by the Cantara Trustee Council (Council), was proposed by the City of Dunsmuir and the Upper Sacramento River Exchange (River Exchange). Adjacent to the Tauhindauli Park & Trail<sup>2</sup>, the Rhinesmith property could potentially be linked to the Dunsmuir City Park by a river trail.

The River Exchange applied for, and received, Council funding to develop a plan for the Rhinesmith property, including a needs assessment and an evaluation of required permitting. Prior to the receipt of funds, the River Exchange coordinated three meetings to solicit community input for developing a River Center on the Rhinesmith property. Participants in these meetings included representatives of the City of Dunsmuir, the Council, USDA Forest Service, Dunsmuir schools, and the local community.



**BENEFITS:** Under this grant, the River Exchange coordinated a second series of community design meetings in spring of 2004. Input was solicited based on guidelines provided by Council staff. Meeting attendees included representatives of the USDA Forest Service, Siskiyou County Public Schools, City of Dunsmuir, Dunsmuir Garden Club, Council staff, and local community members. The River Exchange reviewed ideas received from the meetings for feasibility from the perspectives of project needs, organizational capacity, support from educational partners, compatibility with Council guidelines, and funding.

Recommendations from the feasibility study were presented to the Council. The River Exchange coordinated with Council staff on a formal development plan that proposed a River Center on-site, gardens and trails, a handicapped fishing area, and parking. Under the plan, existing dwellings would be converted to provide a visitor service and exhibition area, classroom facilities, and a meeting and workshop area. The plan also identified other possible upgrades and site improvement projects. If implemented, the resulting River Center could provide services and programs to promote awareness and stewardship of the upper Sacramento River.

The proposed plan includes transfer of property ownership to the City of Dunsmuir with site management by the River Exchange. The Council's Memorandum of Agreement (MOA) specifies that all property acquisitions go to the California Department of Fish and Game (DFG). Negotiations to amend the MOA to permit transfer of property ownership were coordinated by Council staff and are pending at the time of this report. Meanwhile, the River Exchange is proceeding with efforts to secure funding sources for property restoration and ongoing maintenance, should the plan be implemented.

**PRODUCTS RECEIVED:** Periodic progress reports  
Final project report, including final site plan

<sup>1</sup> See Sacramento River Property Acquisition summary

<sup>2</sup> See Tauhindauli Park & Trail summary

## *Saramento River Property Acquisition*

**DATE FUNDED:** 1999

**DURATION OF PROJECT:** Five years, eight months

**GRANTEE:** Wildlife Conservation Board

**AMOUNT GRANTED:** Board

**AMOUNT SPENT:** \$1,319,130  
\$1,019,106



**BACKGROUND:** This grant provided funds for use by the Wildlife Conservation Board (WCB) to survey, appraise, and purchase approved properties for the Cantara Trustee Council (Council). WCB staff also provided real estate agent support for the purchases via a separate agreement<sup>1</sup>. The Memorandum of Agreement, which created the Council and described how settlement funds were to be utilized, required that all property purchases transfer title to the California Department of Fish and Game (DFG).

One of the primary goals for the Cantara Trustee Council (Council) was habitat acquisition and resource protection. Habitat acquisition is one of several activities that can contribute towards effectively protecting resources. To assist in this effort, Council staff developed the Upper Sacramento River Resource Protection Plan (RPP). The plan included detailed analysis of habitat features desired for acquisition, including GIS data<sup>2,3</sup>, which was used to identify and evaluate prospective parcels. Based on Council direction, the WCB successfully purchased four properties.

**BENEFITS:** Three of the acquisitions represent in-kind montane riparian and coldwater lotic habitat on the upper Sacramento River: CalTrout, Dewey, and Rhinesmith.

The CalTrout property's 61 acres includes RPP priority areas around the Cantara Loop. This property has excellent river access and montane riparian habitat. It includes the site of the Cantara spill and areas both up and downstream from the site that were significantly affected by the disaster. An added benefit is that the property provides contiguous habitat protection as it borders a wildlife area owned by the DFG. The property was purchased at its appraised value of \$290,000.

The Dewey parcel includes 700 feet of riverfront habitat on both sides of the upper Sacramento River. The purchase contains six undeveloped acres adjacent to the north end of Dunsmuir City Park and may enable future park expansion. The property was purchased at its appraised value of \$ \$230,000.

The Rhinesmith property's three parcels total nearly seven acres. It is one of very few large flat sites along the upper Sacramento River corridor and contains over 1,700 feet of river frontage. Adjacent to Tauhindauli Park and Trail<sup>4</sup>, the property includes two residential dwellings in good repair which could be converted into a learning center, museum, and/or other public facility. The property was purchased at its appraised value of \$375,000.

The fourth property purchased, referred to as Billings, is on Clear Creek in Shasta County. The 20 acre Billings parcel connects with Bureau of Land Management (BLM) properties and provides a near in-kind habitat acquisition, and includes approximately 1,000 feet of creek frontage. Clear Creek is an important fishery tributary to the Sacramento River and contains valley foothill riparian habitat. The parcel is one of four in the area that were identified as important resource protection acquisitions. Purchase agreements could not be reached with owners of two of the parcels; the fourth was obtained by the BLM. The Billings property was purchased at its appraised value of \$86,300.

PRODUCTS RECEIVED: The Council received copies of all grant deeds transferring property ownership to the California Department of Fish and Game.



<sup>1</sup> See Land Agent Funding Summary

<sup>2</sup> See the Cantara Trustee Council's *Upper Sacramento River Resource Protection Plan*

<sup>3</sup> See Upper Sacramento River Watershed Gap Analysis Summary

<sup>4</sup> See Tauhindauli Park and Trail Summary

## *Salt and Olney Creeks Barrier Modification*

**DATE FUNDED:** 2001

**DURATION OF PROJECT:** Two years

**GRANTEE:** Western Shasta Resource Conservation District

**AMOUNT GRANTED:** \$90,000

**AMOUNT SPENT:** \$53,982

**BACKGROUND:** This grant by the Cantara Trustee Council funded the Western Shasta Resource Conservation District to modify existing barriers to fish passage on Salt and Olney Creeks. The creeks are tributaries to the Sacramento River, located in Shasta County and the city of Redding. The project was to remove fish migration barriers on both creeks. On Salt Creek, a road crossing with an undersized, collapsed culvert caused sediment deposition and was a partial barrier to up-migrating spawning and juvenile fish, as well as out-migration at low flows. On Olney Creek, the project focused on removing a slat dam and non-functioning culvert in a portion of the creek owned by the Bureau of Land Management. This dam, and excessive sediment behind it, caused by four-wheel drive roads and motorcycle trails, periodically blocked fish passage in the same manner as at Salt Creek.



Olney Creek, pre-project appearance.

**BENEFITS:** The project successfully removed 75 cubic yards of sediment build-up behind the Salt Creek road crossing and removed the collapsed culvert and the concrete retaining wall. After consulting with the landowners, the road crossing was replaced. On Olney Creek, the project began with an archeological report on the historical importance of the dam; this was done to clarify that structural modifications could be made. The dam likely originated as a water diversion for mining, perhaps as early as the 1880's. However, it was determined to be insignificant for historical preservation. Approvals and permits for modification were obtained. The central section of the dam and 150 cubic yards of sediment behind it were removed to allow gravel to move downstream, and enable fish to migrate unimpeded. Elsewhere, rock barriers and a gate were placed at entry points and tank traps installed on secondary roads and trails, closing access to motorized vehicles. All disturbed sites were revegetated. Access to a road for power line maintenance was retained and that route will continue to be available for motorcycle use.

The modifications reduced future sediment in Salt and Olney Creeks and in the Sacramento River, improved spawning habitat, and re-established access to the tributaries by migrating fish, including trout and salmonids.

**PRODUCTS RECEIVED:** Monthly progress reports  
Final report



Olney Creek, post-project appearance.

## *Scott River Riparian Restoration Project*

**DATE FUNDED:** 1996

**DURATION OF PROJECT:** Eight years

**GRANTEE:** Wildlife Conservation Board

**AMOUNT GRANTED:** \$200,000

**AMOUNT SPENT:** \$190,775

**BACKGROUND:** The Cantara Trustee Council funded the Wildlife Conservation Board (WCB) to rehabilitate a 4.5-mile section of the Scott River, which is a major tributary to the Klamath River. Located in the upper reaches of the Scott River, this section runs through agricultural land used mainly for pasture. Primarily barren gravels, the project site provided no desirable habitat to riverine organisms. Planting and establishing a riparian zone was the first step in restoring this reach of the river.

Historically, the Scott River provided a corridor of riparian and montane habitat for fish and wildlife in the Scott Valley. Over time, native vegetation on the valley floor was cleared for farming and raising livestock. The river was further disturbed by extensive dredge gold mining. During the 1930's, flooding brought great amounts of debris into the river. The US Army Corps of Engineers cleared the debris and built levees along the midsection of the river, causing a channel shift. Later, the US Soil Conservation Service installed permanent bank stabilization structures and rock riprap, which further altered the river channel.



**BENEFITS:** Approximately 80 acres of native willow, cottonwood, and ponderosa pine were planted. Drip irrigation was provided until the plants were well established and able to survive summer without supplemental water. The river corridor was fenced to limit and exclude livestock from the project area. Approximately 26,000 feet of fencing was used for this purpose, 7,000 feet of which was newly constructed. Limited grazing was allowed in the project area (not more than 30 days per year and not during critical spawning periods).

Rehabilitation efforts included bank stabilization, installing in-stream structures, planting, screening diversions, and repairing or installing new livestock fencing. Benefits of the above actions included reduced erosion, improved in-stream diversity, creation of scour pools used by fish for holding and rearing, creation of an overhanging canopy, increased invertebrate populations, increased fish populations, and development of a healthy riparian zone.

Screens were put into place on the Barnes irrigation ditch (east side of the river), and another ditch on the west side of the river. These screens helped prevent the loss of thousands of juvenile fish per year, as well as other aquatic organisms. The screens were of a design that met California Department of Fish and Game specifications.

A number of further benefits are anticipated. Stabilized groves of trees will reduce water temperatures and increase sediment deposition and holding, thus reducing mobilization during high stream flows. A stabilized channel will improve river width-depth ratio, and reduce shade-intolerant noxious weeds that were colonizing the barren gravels.

The WCB provided an equivalent cost match of \$200,000 for this project, bringing total project costs to \$400,000. Post-project monitoring will continue for ten years following project planting.

**PRODUCTS RECEIVED:** A final report, "as built" design drawings and photos, photographs of completed projects, and annual reports documenting post-project monitoring.

## *Scott River Riparian Restoration Project II*

**DATE FUNDED:** 1997

**DURATION OF PROJECT:** Two years, three months

**GRANTEE:** Siskiyou Resource Conservation District

**AMOUNT GRANTED:** \$47,692

**AMOUNT SPENT:** \$47,692

**BACKGROUND:** The Cantara Trustee Council (Council) funded the Siskiyou Resource Conservation District to conduct rehabilitation work on the Scott River in Siskiyou County. The new project continued efforts to re-establish the river's riparian corridor by installing bank stabilization features and cattle exclusion fencing<sup>1</sup>. Planting to establish or enhance riparian habitat along the river section was funded by the U.S. Fish and Wildlife Service (USFWS).

Located in the upper reaches of the Scott River, a major tributary to the Klamath River, the project section ran through agricultural land used mainly for pasture. Though still heavily used by salmon and steelhead for spawning and rearing, eroding banks in the project reach lacked the pools, cover, and riparian vegetation needed for a quality fishery habitat.

Historically, the Scott River provided a corridor of riparian and montane habitat for fish and wildlife in the Scott Valley. Over time, native vegetation on the valley floor was cleared for farming and raising livestock. The river was further disturbed by extensive dredge gold mining. During the 1930's, flooding brought great amounts of debris into the river. The U.S. Army Corps of Engineers cleared the debris and built levees along the midsection of the river, causing a channel shift. Later, the U.S. Soil Conservation Service installed permanent bank stabilization structures and rock riprap, which further altered the river channel.

**BENEFITS:** This project provided off-site in-kind benefits that helped meet the Council's restoration objectives.

Bank stabilization structures totaling 1,290 linear feet were installed at three sites along the project reach. Large boulders and root wads were placed in

the banks and stream bed to armor the bank and deflect the stream away from eroding areas. Decreased erosion improved water quality by reducing sediment. By slowing water velocity, the structures enabled sand and silt deposition creating a lower gradient slope, reducing erosion potential, and allowing vegetation to become established. The deflectors also enhanced fish habitat by creating scour pools and providing cover.

To exclude cattle and sheep from the riparian corridor, 2,600 feet of fencing were installed and an additional 1,100 feet of existing fence were brought up to Natural Resources Conservation Service standards. Fence maintenance was provided by the landowner over a 10-year period. The fencing eliminated livestock from the entire project reach and connected to other fencing projects to provide 11 contiguous miles of riparian protection.

The riparian planting portion of the project, funded by USFWS, planted Pacific willow, black cottonwood, and Ponderosa pine. Over time, this will establish a riparian over story that will shade the creek and contribute detritus to improve the fishery habitat. The riparian vegetation also stabilized the stream banks, further reducing river sediment.

PRODUCTS RECEIVED: Semi-annual progress reports  
Final report



<sup>1</sup> See Scott River Riparian Restoration Project grant summary.

## *Scott River Watershed Water Quality Improvement Project*

**DATE FUNDED:** 2002

**DURATION OF PROJECT:** Five years, one month

**GRANTEE:** Siskiyou Resource Conservation District

**AMOUNT GRANTED:** \$509,861

**AMOUNT SPENT:** \$270,754

**BACKGROUND:** In 2002, the Cantara Trustee Council (Council) funded the Siskiyou Resource Conservation District (RCD) to implement several projects within the Scott River Watershed, located in Siskiyou County. Scott River is a major tributary to the Klamath River. Historically, the Scott River provided a corridor of riparian and montane habitat for fish and wildlife in the Scott Valley. Over time, native vegetation on the valley floor was cleared for farming and raising livestock. The river was further disturbed by extensive dredge gold mining. During the 1930's, flooding brought great amounts of debris into the river. The U.S. Army Corps of Engineers cleared the debris and built levees along the midsection of the river, causing a channel shift. Later, the U.S. Soil Conservation Service installed permanent bank stabilization structures and rock riprap, which further altered the river channel.

This grant represented continued support for restoration efforts on the Scott River<sup>1</sup>. This grant supported a variety of projects by the RCD to improve habitat conditions through addressing private land management practices:

- Sugar Creek Flow Enhancement
- Scott River Watershed Planning and Assessment
- Scott River Flow Enhancement
- Wolford Slough Groundwater Retention

These projects are part of a larger effort by the Siskiyou RCD to improve water quality and fish habitat.

**BENEFITS:** These projects supported the Council's goals for resource restoration and protection. The Scott River represents off-site in-kind montane riparian habitat.

The Sugar Creek Flow Enhancement project originally planned to replace 15 miles of diversion ditches with pipe. As of December 2006, a short portion of ditch was replaced with pipe. Increased efficiency reduces the total amount of water diverted from Sugar Creek which, in turn, improves coho salmon and steelhead habitat.

Siskiyou RCD created a Scott River Strategic Action Plan in 2006, funded primarily by the State Water Resources Control Board. The Council's funding for the Scott River Watershed Planning and Assessment project supported a coordinator for plan development and included assessing instream habitat in the watershed and collecting baseline data on water quality, habitat, and stream flow.

The Scott River Flow Enhancement project replaced a livestock watering system called Farmers Ditch with a groundwater-based system. The new system eliminated seasonal water diversion of 7-10 cubic feet per second from Scott River. All livestock watering needs of the diversion users are being met by the new system and the users agreed to maintain the system for the next 20 years.

The final project tested the efficacy of returning tail water to ground water aquifers rather than returning it directly back into the Scott River. Surface flow was raised by two feet into 2,800 feet of Wolford Slough, a small tributary to Scott River. Well and water table monitoring showed that tail water flowing into the slough successfully percolated into the neighboring aquifer and returned to the Scott River as cool groundwater. Effectively reducing tail water flow into the river eliminates injury to cold water fish such as salmon and steelheads thanks to decreased dissolved nutrients and heat typically contained in tail water.

**PRODUCTS RECEIVED:** Monthly progress reports  
Scott River watershed strategic plan  
Project monitoring plans  
Annual monitoring reports  
Project final reports

<sup>1</sup> See Scott River Riparian Restoration Project grant summary.

## *Scott and Shasta River Rotary Screw Trap Operations*

**DATE FUNDED:** 2003 and 2004

**DURATION OF PROJECT:** Two years, six months

**GRANTEE:** Shasta Valley Resource Conservation District

**AMOUNT GRANTED:** \$328,726

**AMOUNT SPENT:** \$328,726

**BACKGROUND:** The Cantara Trustee Council (Council) funded the Shasta Valley Resource Conservation District (RCD) to operate two rotary screw traps, one each on the Scott and Shasta Rivers, for the 2004 and 2005 seasons. Operating these rotary traps was started in 2000 by the California Department of Fish and Game (DFG), and the USDA Forest Service, to provide data on patterns and variations in juvenile salmonid rearing and emigration. This information on juvenile coho, steelhead, and chinook is important for managers to devise alternative water management schedules to benefit fish populations. The RCD provided administrative management and assisted DFG to collect data and provide direct personnel oversight on day-to-day operations. The screw traps were run six days a week, generally from February to August of each season. Data collected was tabulated and analyzed for juvenile salmonid population structure and on populations of other native and non-native fish species. This information was analyzed with numbers of spawning adults, water releases, and other data to determine how water management practices affect salmonid survival and reproduction.

**BENEFITS:** Data from this grant supported previous efforts to estimate juvenile salmonid production. Tracking the relationship between the number of spawning adults and juveniles led to a better understanding of limiting factors, impacts of natural and man made events in the watershed, and the effectiveness of restoration efforts to increase smolt production. Though anadromous fish were not a primary concern for the Council, it was determined that this project's secondary benefits for rainbow trout (*Oncorhynchus mykiss*) in the Scott and Shasta Rivers made it worthy of the Council's support. Improved water management also benefits the \$14 million of restoration work implemented in the two watersheds in the last 15 years, including several projects funded by the Council<sup>1,2,3,4</sup>.

**PRODUCTS RECEIVED:** Monthly progress reports  
Final project report



<sup>1</sup> See Scott River Flow Enhancement summary

<sup>2</sup> See Scott River Riparian Restoration summary

<sup>3</sup> See Scott River Riparian Restoration II summary

<sup>4</sup> See Scott River Watershed Water Quality Improvement Project summary

## *Shasta County Mini-Grant Project*

**DATE FUNDED:** 1996, 1998, 1999

**DURATION OF PROJECT:** Four years

**GRANTEE:** Cantara Program

**AMOUNT GRANTED:** \$49,500

**AMOUNT SPENT:** \$42,733

**BACKGROUND:** The Cantara Trustee Council (Council) implemented a mini-grant program in Shasta County using Council staff to review and monitor proposals, with final decision for funding or denial by the Council. In contrast to the full grant program, the mini-grant program was intended to provide a means to increase public involvement in restoration and resource stewardship at the local level. Grants were evaluated in keeping with the Council's Memorandum of Understanding and the Council's four priority areas: restoration, rehabilitation, and enhancement; habitat acquisition and resource protection; study and research; and public information and education. A maximum award of \$3,000 was used as a guideline and priority was given to on-site, in-kind projects.

Originally funded for one year at \$16,500, the Shasta Mini-Grant Project was continued for three years. Over this period, the Council awarded 19 mini-grants, four of which were funded again for a second year. Two other grants were awarded and later cancelled, with the funds being returned to the Council.

Restoration, Rehabilitation, and Enhancement:

- To Sacramento Watershed Action Group to install in-stream structures to prevent erosion in Sulphur Creek.
- To Upper Sacramento River Exchange for a pilot riparian re-vegetation program at railroad riprap sites on the upper Sacramento River.
- To Western Shasta Resource Conservation District for placing 250 tons of spawning gravel in Middle Creek watershed.

Acquisition and Resource Protection:

- To California Community Forests Foundation to implement a Focus on Risk workshop for watershed management.

- To McCloud River Coordinated Resource Management and Planning group for macroinvertebrate equipment to use to monitor the health of the McCloud river.
- To Sustainable Land Stewardship Institute for bioassessment techniques training for citizen monitors; funded for a second year.

Study and Research:

- To Humboldt State University for a study on rainbow trout growth rates. Funded twice - one year for initial study and a second year for continued and expanded study.
- To Thomas R. Payne and Associates for a food habits study of spotted bass in the upper Sacramento River.

Public Information and Education:

- To Castle Rock Elementary to implement a school river education program.
- To French Gulch Whiskeytown Elementary School District for a part-time watershed education coordinator, education materials, and restoration activities in Cline Gulch; funded for a second year.
- To Horsetown-Clear Creek Preserve for a part time watershed education coordinator.
- To Junction School District to build an outdoor learning demonstration pond to teach watershed education.
- To Sequoia Middle School to implement an adopt-a-stream watershed education program in Sulphur Creek; funded for a second year.
- To Western Shasta Resource Conservation District to provide three water rights seminars.
- To Western Shasta Resource Conservation District to develop, print, and distribute an eight-page "Watersheds and You" booklet.

**BENEFITS:** The overall project results were very positive and supported all four priority areas of the Council. Several mini-grants addressed more than one goal. Some of the activities such as Riprap Revegetation, and Sulphur Creek Restoration, later led to larger projects funded through the regular grant program. In particular, the mini-grant program proved successful in meeting its objective to involve local community organizations in resource restoration and stewardship by providing an alternative, simpler system for funding small projects.

**PRODUCTS RECEIVED:** Copies of mini-grant agreements  
 Copies of final reports from mini-grant recipients  
 Assessment of the mini-grant process and recommendations

## *Shasta River Restoration and Habitat Improvement Project*

**DATE FUNDED:** 2002

**DURATION OF PROJECT:** Three years, three months

**GRANTEE:** Resource Management Company

**AMOUNT GRANTED:** \$109,962

**AMOUNT SPENT:** \$109,962

**BACKGROUND:** In 2002, the Cantara Trustee Council (Council) funded Resource Management Company to implement four projects within the Shasta River watershed. The projects were originally proposed to the Council by the Shasta River Coordinated Resource Management Planning (CRMP) Group and later contracted directly to Resource Management Company for implementation. The projects are part of long-term efforts by the Shasta River CRMP to implement a variety of approaches to improve survival of salmon and steelhead in the Shasta River, recognized as the single most important spawning tributary for Chinook salmon in the Klamath Basin. The funded Council projects were:

- **Fish Screens:** Six screens were fabricated for use by irrigators within the watershed to protect trout. As irrigation water is removed from rivers and streams in the Shasta Valley, juvenile fish can be inadvertently diverted into fields and lost. Screens prevent losses by allowing water to be used, without accidentally killing fish.
- **Tail Water Capture:** Repaired and reconstructed an irrigation tail water capture reservoir serving the Montague area to prevent irrigation effluent from entering the river. Water that has been spread over a field and then allowed to flow directly back into the Shasta River, can carry high amounts of nutrients as well as substantial amounts of heat; both create unhealthy conditions for salmon and trout.
- **Fencing:** Extended fencing on both sides of Oregon Slough, a tributary to Shasta River, located on the Meamber Ranch. Fencing to prevent livestock damage to riparian vegetation is one of the CRMP's highest priorities. Unrestricted grazing near rivers and streams negatively impacts salmon and steelhead. Livestock control fences give riparian zones a chance to recover from graz-

ing, re-establish healthy vegetative cover, and allow controlled grazing within a riparian area, if needed.

- Riparian Planting: Planted riparian vegetation on the Shasta River within Rice Ranch to stabilize the stream bank and restore riparian habitat. Tree planting complements livestock control fencing to rehabilitate riparian zones. Habitat crews used rooted stock, seedlings, and cuttings to revegetate banks to create a healthier, more stable riparian zone.

**BENEFITS:** Resource restoration and protection are among the Council's primary goals. The Shasta River projects represent off-site in-kind restoration for montane lotic and riparian habitat similar to the upper Sacramento River.

Six fish screens were manufactured in 2004 and installed in 2005. Tail water holding pond construction in Montague was completed in 2005, enabling tail water capture for re-use in irrigation. A total of 6,400 linear feet of cattle exclusion fencing was installed in Meamber Ranch by 2005, supplementing 3,400 feet of fencing already in place. The landowner will provide routine fence maintenance for a minimum of ten years. Willow whips and rooted stock were planted along a  $\frac{3}{4}$  mile stretch of the Shasta River at Rice Ranch in 2004 and 2005 to enhance the riparian zone. Healthy vegetation in the riparian zone will contribute more shade for the stream, filtration of irrigation tail water, and stream bank stability.

**PRODUCTS RECEIVED:** Quarterly progress reports  
Final report



## *Shasta West Watershed Spawning Gravel and Erosion Inventory*

**DATE FUNDED:** 2000

**DURATION OF PROJECT:** Four years, six months

**GRANTEE:** Western Shasta Resource Conservation District

**AMOUNT GRANTED:** \$165,434

**AMOUNT SPENT:** \$164,875\*

**BACKGROUND:** This grant funded the Western Shasta Resource Conservation District to inject spawning gravel into the Shasta West watershed located in Shasta County. It also funded a soil erosion inventory for the watershed, which includes Middle Creek, Rock Creek, Salt Creek, Olney Creek, and several other unnamed tributaries to the Sacramento River. These ephemeral streams are used by resident rainbow trout, Chinook salmon, and steelhead for spawning, rearing, and migration. South of Lake Shasta, the Shasta West watershed provides some of the last tributaries available for fish migrating up the Sacramento River, prior to the Keswick and Shasta Lake dams. The spawning gravel injection sites were in Clear Creek and Middle Creek, which were previously used for a successful pilot gravel injection project funded by a Cantara Trustee Council mini-grant. The soil erosion inventory located, identified, and quantified specific erosion sources in the watershed that contribute sediment into the Sacramento River.



\*Grant still open as of March 2007.

**BENEFITS:** The gravel project improved spawning and rearing habitat for rainbow trout, steelhead, and Chinook salmon. Up to 500 tons of 1-2 inch clean spawning gravel was injected into the channel each year, depending on the extent to which the previous year's gravel was adequately washed downstream. A total of 1,500 tons of gravel was injected by the end of the grant.

The soil erosion inventory prioritized erosion sites based on the cause and nature of the problem, and on past and predicted future sedimentation volume. The inventory identified landowners with site-specific sediment sources, such as roads, utility rights-of-way, and other significant disturbances. The process proved to be slow and difficult due to the large number of private landowners; over 1,200 property owners were contacted. Potential treatments and costs were provided to landowners. The inventory will be used to support requests for new grant funding to repair and correct sediment sources. The spawning gravel and soil erosion inventory projects are critical components for restoring and maintaining cold-water lotic communities on tributary drainages to the Sacramento River.

**PRODUCTS RECEIVED:** Copies of required environmental permits  
Annual progress reports  
Photos of gravel placement  
Final report on gravel injection project  
Final soil erosion inventory report



## *Siskiyou County Minigrant Project*

**DATE FUNDED:** 1996, 1998, 1999

**DURATION OF PROJECT:** Four years

**GRANTEE:** County of Siskiyou

**AMOUNT GRANTED:** \$33,000

**AMOUNT SPENT:** \$33,000

**BACKGROUND:** Small grants can have large benefits, but the process for approving and monitoring them can be cumbersome. Therefore, the Cantara Trustee Council (Council) awarded a grant to Siskiyou County to administer a local minigrant program. The grants were reviewed and monitored by the Siskiyou County Fish and Game Commission (Commission). The Commission was charged to fund grants in keeping with the Council's own Memorandum of Understanding to use expenditures for resource protection, restoration, rehabilitation, enhancement, acquisition, and study or research. Likewise, the Commission was instructed to give priority to on-site, in-kind projects. A maximum award of \$3,000 was given as a guideline, but the Commission had flexibility to award more for a project it deemed worthy.

Originally funded for one year at \$11,000, the Siskiyou Minigrant Project continued for four years. Over this period, the Commission awarded the following 19 minigrants:

### **Restoration, Rehabilitation, and Enhancement:**

- Erosion Control of Sleepy Road/Ney Springs Area, awarded to Sisson Elementary School. Funded a student project to stabilize and revegetate an unused branch of dirt road to decrease erosion into Ney Springs and the Sacramento River.
- McCloud River Trail Fish Stocking Equipment and Little Castle Creek Fish Passage Projects, awarded to Department of Fish and Game. Purchased fish handling tanks, aeration equipment, and an ATV to facilitate planting catchable-sized trout in the McCloud River and built a boulder weir and pool on Little Castle Creek to provide access for juvenile trout to migrate another three miles upstream.

- Native Plant Propagation and Planting, awarded to Siskiyou County Schools. Purchased equipment and supplies to propagate native plants used in restoration projects in the Klamath River watershed.
- River Trail Enhancement Project, awarded to Dunsmuir Recreation and Parks District. Improved and repaired 1,200 feet of river front trail, constructed signage, and made other trail system improvements in Dunsmuir City Park.
- Shovel Creek Fish Screening Project, awarded to Blair Attridge, Copco Sportsman's Club. Contributed about half of the materials funding (just over half was provided by PacifiCorp) for two fish screen projects on Shovel Creek and its tributary stream, Negro Creek.
- Water Level Indicator, awarded to Shasta Valley Resource Conservation District. Purchased indicator to enable property owners to measure well-water levels as part of water use education and conservation efforts.

**Acquisition and Resource Protection:**

- Buckhorn Creek Fish Screening Project, awarded to Robert Rainy, rancher. Purchased supplies and materials to install a fish screen and bypass ditch on a pasture irrigation diversion from Buckhorn Creek to protect steelhead trout and other local fish.
- Riparian Fencing Crew Equipment, awarded to Great Northern Corporation. Purchased a two-man augur to replace hand-digging post holes and facilitate cattle exclusion fencing placement programs to protect streams from erosion.
- Scott River Water Temperature Monitoring Equipment, awarded to Siskiyou Resource Conservation District (RCD). Provided testing equipment for two Scott Valley High Schools to participate with the RCD in Scott River monitoring program.
- Streamside Protection Zones Monitoring, awarded to Department of Fish and Game. Purchased microclimate monitors to evaluate the effectiveness of Streamside Protection Zones.

**Study and Research:**

- Citizen Training, awarded to Sustainable Land Stewardship Institute. Provided bioassessment techniques training for citizen monitors.
- Dissolved Oxygen Meter and Temperature Recording Devices, awarded to Shasta River Coordinated Resources Management and Planning Committee. Purchased equipment to augment water-monitoring activities in the Shasta Valley.
- Rainbow Trout Study, awarded to Humboldt State University. Funded a study on rainbow trout growth rates.

- Spotted Bass Study, awarded to Thomas R. Payne and Associates. Funded a food habits study of spotted bass in the upper Sacramento River.

**Public Information and Education:**

- Classroom Aquarium Equipment, awarded to Siskiyou County Schools. Purchased ten aquarium chillers for classrooms participating in the Aquarium Incubation Project about trout and salmon life cycles and stewardship.
- Demonstration Pond, awarded to Junction School. Built an outdoor learning demonstration pond used to teach watershed education.
- Siskiyou County Stream Care Guide, awarded to Siskiyou Resource Conservation District. Paid about half the cost to print 1,000 guides applicable to most areas of Siskiyou County, but tailored to Scott River watershed landowners.
- Watershed Education Coordinator, awarded to Horsetown-Clear Creek Preserve. Provided funding for part time coordinator activities at Horsetown-Clear Creek Preserve.
- Watershed Education Materials, awarded to French Gulch Whiskeytown Elementary School District. Provided funding for part-time coordinator activities and education materials.

**BENEFITS:** Overall project results were very positive. Several addressed more than one goal. Seeing the benefits firsthand, the Commission augmented several projects with their own monies, including the school aquarium project. Equipment purchased for many projects was continually used, and the Dunsmuir river trail project was an important legacy of the program.

**PRODUCTS RECEIVED:** Copies of minigrant agreements  
 Copies of final reports from minigrant recipients  
 Summary report of minigrant projects  
 Assessment of the minigrant process and recommendations

## *Siskiyou County Watershed Education Project*

**DATE FUNDED:** 1996

**DURATION OF PROJECT:** One year

**GRANTEE:** Siskiyou County  
Superintendent of Schools

**AMOUNT GRANTED:** \$50,000

**AMOUNT SPENT:** \$49,957



**BACKGROUND:** In 1996, the Cantara Trustee Council (Council) funded the Siskiyou County Watershed Education Project. The project was developed to educate teachers about the recovery and restoration of the upper Sacramento River ecosystem and create a watershed education curriculum for the students of Dunsmuir Elementary and Dunsmuir High School.

The goal for the students of Dunsmuir Elementary School was to acquire knowledge of environmental systems, develop a sense of stewardship, and create products related to fishing as an economic and recreational resource. All of the studies within this program were centered on the upper Sacramento River watershed. Dunsmuir High School students collaborated with industry and resource agencies to develop “real world” field projects integrating science, mathematics, language arts and technology.



**BENEFITS:** Watershed education became a big part of the curricula in both Dunsmuir Elementary School and Dunsmuir High School during the 1996-1997 school year. Elementary school classes received education on watershed management and ecology. Six Adopt-A-Watershed units were implemented at Dunsmuir Elementary School: Apartment in the Woods, Streamside Communities, Landforms and Geology, Birds, Forest Ecosystems, and Wildlife. Five field trips complementing the above curricula gave 165 students opportunities for hands-on, on-site learning.

Students studied the effects of the spill on river dependent species and wrote books about what happened to these animals during the spill. Over 270 rainbow trout were raised in the classroom and released into the upper Sacramento River. Some classes assisted in a restoration project with the Department of Fish and Game (DFG) at Sims Campground by gathering and planting willow and cottonwood cuttings in spill and flood impacted areas. Students helped create a Cantara web page on the internet, while others started long-term erosion and land use planning projects on the Dunsmuir Elementary School campus.

Dunsmuir High School took an interdisciplinary approach to analyzing watershed problems. Science classes monitored water quality (turbidity, pH, total dissolved solids, dissolved oxygen, temperature, and conductivity). They monitored the upper Sacramento River to determine the effects caused by the City of Dunsmuir; and Soda Creek, to determine impacts caused by logging practices. They also participated in electrofishing surveys on the river with DFG. Math classes analyzed and graphed all field data that was collected. English classes prepared reports on species affected by the spill, and produced year-end reports on the field studies.

Approximately 120 students from both schools participated in the Dunsmuir River Festival held on April 25-26, 1997. Student booths featured a variety of watershed projects, demonstrations, and items for sale such as bird feeders and native plants. Kindergarten and first grade students performed an original operetta and fourth graders performed a verse choir about the life of a fish. High school students produced a video on the water quality and electrofishing surveys and shared it with the public at the festival.

The success of this project was measured by the amount of commitment shown by the schools, community, and agencies involved. Over 450 students in Dunsmuir Elementary School and Dunsmuir High School have benefited greatly from this watershed education grant.

**PRODUCTS RECEIVED:** Dunsmuir schools have provided the Council with quarterly status reports, examples of students' work, technical reports written on water quality and electrofishing surveys, and a copy of the watershed education curricula for both schools.

## *Slate and Boulder Creeks - Restoration of upper Sacramento River Western Tributaries*

**DATE FUNDED:** 2000

**DURATION OF PROJECT:** Four years, six months

**GRANTEE:** Northern California Resource Center

**AMOUNT GRANTED:** \$204,640

**AMOUNT SPENT:** \$197,029

**BACKGROUND:** This grant funded the Northern California Resource Center to restore 12 degraded sites along the headwaters of Slate and Boulder Creeks, which are western tributaries of the upper Sacramento River. The tributaries are located in Shasta County and feed into the upper Sacramento River area that was affected by the Cantara spill. USDA Forest Service staff (Shasta-Trinity) provided technical assistance and monitored restoration effectiveness. Restoration activities included stream bank stabilization, riparian planting, gradient control structures, culvert and fill removal, road drainage control, road decommissioning, skid trail drainage control, and wetland and wet meadow restoration.



**BENEFITS:** The restoration projects repair the effects of over 100 years of logging, road development, and other human activities in the area. This project helps fulfill the Restoration, Rehabilitation, and Enhancement goal of the Cantara Trustee Council. All project sites are located in the upper Sacramento River watershed. Restored areas provide refuge for riparian dependent species whose habitat was damaged by the Cantara spill, and new sources of flora and fauna by maintaining ecologically intact linkages to the River. The restoration is a good model of watershed stewardship and significantly contributes to the long-term water quality of the upper Sacramento River.

**PRODUCTS RECEIVED:** The Northern California Resource Center provided copies of all environmental documentation required for NEPA, CEQA, and other applicable environmental laws. Quarterly progress reports, and a final report documenting the status and completion of restoration work, were also submitted.

## *South Fork Sacramento River Cooperative Education Project*

**DATE FUNDED:** 1996

**DURATION OF PROJECT:** One year, three months

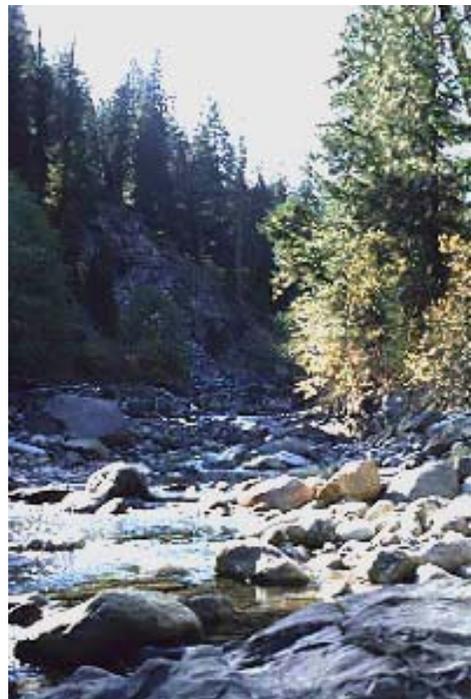
**GRANTEE:** USDA Forest Service — Shasta-Trinity National Forest

**AMOUNT GRANTED:** \$8,644

**AMOUNT SPENT:** \$6,253

The Cantara Trustee Council (Council) funded the USDA Forest Service (Forest Service) Mt. Shasta Ranger District to develop and implement a watershed education program. Program objectives were to educate students about local watersheds, river ecosystems, wildlife, fish, plants, and the effects of chemical spills and pollution. Elementary and secondary schools in the Mt. Shasta area were the focus of this program.

The watershed education was conducted in conjunction with instream restoration work on the South Fork Sacramento River, which lies within the headwaters of the upper Sacramento River watershed. Restoration work was located upstream and about five air miles northwest of the Cantara spill site. The South Fork Sacramento River is the major source of stream flow into Lake Siskiyou. In 1974, the riverbed was redirected from its original channel to protect a nearby road from flooding. However, the redirected channel ran through a shadeless boulder field, leading to increased stream water temperatures which created summer algal blooms and reduced suitability for trout. Restoration efforts sought to plant vegetation and improve the channel environment for riparian and lotic habitats.



**BENEFITS:** The program was implemented with Mt. Shasta High School, Jefferson High School, Sisson Junior High School, and Mt. Shasta Elementary School in fall, 1996. Through classroom and field instruction, students studied watersheds and river ecosystems and completed baseline monitoring for restoration work to be implemented on the South Fork Sacramento River in spring, 1997. Students collected field data with assistance from Forest Service professionals. A microwave dish was acquired to enable transmission from the field to classrooms so as to include more students in the project. A Forest Service representative also served as a public education liaison between the schools and resource specialists from other agencies and community volunteers that participated in the project.

Unfortunately, follow-up monitoring was not possible following a flood on New Year's Day, 1997. This 85-year event destroyed the stream reach under study and removed access points utilized by the schools. The fall portion of the program was well received by Mt. Shasta schools. However, due to student safety concerns and cancellation of the restoration work because of the flood, the project was discontinued. The restoration work was later resumed and completed under another Council grant<sup>1</sup>.

**PRODUCTS RECEIVED:** Initially, a formal final report was planned. After the project was discontinued early, an informal summary and thank you letter from the schools was accepted as a final product.

<sup>1</sup> See South Fork Sacramento River Fish Habitat grant summary.

## *South Fork Sacramento River Fish Habitat*

**DATE FUNDED:** 1996

**DURATION OF PROJECT:** Two years, five months

**GRANTEE:** USDA Forest Service, Shasta-Trinity National Forest,  
Mt. Shasta Ranger District

**AMOUNT GRANTED:** \$40,899

**AMOUNT SPENT:** \$40,899

**BACKGROUND:** The South Fork of the Sacramento River lies within the headwaters of the Sacramento River watershed. Flooding in 1964 and 1974, and subsequent relocation channel work in 1974, almost completely de-vegetated the floodplain. Because of this, fish habitat (pools, cover, and shade) was poor. This project was initiated to improve and increase instream cover, pool habitat, spawning habitat, streamside vegetative cover, and shade for resident trout.

The upper portion of the flood plain (between the Middle and North Fork confluence), being the most well-defined and stable, was selected for fish habitat improvement work. Stream banks in this zone had suitable soils for plant growth. Riparian vegetation was slowly becoming naturally established along some portions of the reach. Large boulders and bedrock in this area provided channel stability and offered opportunities to improve pool habitat and instream cover. A relatively stable 2,000 foot section of the river was selected for improvement.



**BENEFITS:** Fish habitat along a 2,000 foot section of the river was restored. Forty instream structures were put into place. Of the forty structures, ten were boulder weirs, nine were boulder deflectors, eleven were boulder groups, six were boulder/log cover structures, and four were scour logs. Prior to construction, the channel was mapped and photo points were established. An excavator was used to place large rock and woody materials. Local boulders were used for the structures, which are held together with the use of Hilti adhesive and cables. Future maintenance and monitoring costs were assumed by the USDA Forest Service.

These efforts improved stream, pool, and spawning habitat, as well as streamside cover, channel stability, and shade. All of these steps created an environment more hospitable to trout growth and survival. The original structures were later modified to make them more compatible with kayak use on the river. At this juncture, the instream structures are still in place and benefits are expected to last from 15 to 20 years.

**PRODUCTS RECEIVED:** Pre-construction maps of stream channel reach  
Cross-sectional profiles at 40 structure sites  
Pre- and post-construction photographs from permanent photo points  
“As-built” maps of the channel showing all habitat improvements constructed

## *Special Events*

**DATE FUNDED:** 1997-2003

**DURATION OF PROJECT:** Seven years

**GRANTEE:** California Department of Fish and Game; California State University, Chico Research Foundation

**AMOUNT GRANTED:** \$444,727

**AMOUNT SPENT:** \$442,717

**BACKGROUND:** The Cantara Trustee Council (Council) funded seven annual grants to the California Department of Fish and Game (DFG) to coordinate community education programs and special event projects in Siskiyou and Shasta Counties. The DFG subcontracted a volunteer coordinator, through the California State University, Chico Research Foundation, to run the project. The volunteer coordinator was funded half time the first year and full time in subsequent years.

Funded activities continued and expanded DFG's previous educational efforts, as some of the special events had been held in the past; some for several years. Events and activities provided under this grant were regularly supported by volunteers from DFG and the community. Volunteer time and expertise were a significant in-kind contribution. The volunteer coordinator recruited, trained, and assigned the corps of volunteers involved in this project.

**BENEFITS:** In keeping with the Council's education goal, the project promoted valuing coldwater lotic and riparian habitats and the importance of stewardship for these resources, primarily to children and their parents. Special events were accompanied by advertisements and media coverage, including interviews and feature articles in local publications and on television and radio stations. These activities further raised awareness in the general population and contributed to broad education and stewardship promotion.

Interpretive displays were a significant component of the various special events and educational activities. Most of the presentations and interpretive displays included coldwater lotic environments and references to the Cantara spill and subsequent restoration efforts. Through the course of the project,

presentations were provided to schools, community service groups, and special interest groups.

Each year 600-750 students and accompanying adults participated in joint field trips to the Battle Creek Wildlife Area (BCWA) in Shasta County and to nearby Coleman Fish Hatchery. Nearly 3,000 participants enjoyed these tours from fall, 1998 through spring, 2004.

Among the primary hands-on special events were fishing days, called “Kid’s Fishing Day” or “Take a Kid Fishing Day.” These events helped generate a lifelong appreciation in the young attendees for watershed resources and provided an excellent opportunity for educational interventions. Annual attendance by children and their adults increased from 925 at two events the first year to 5,000 at five events the last year. Overall attendance at these fishing days was nearly 25,000 children and adults over the course of the grants.

Other cornerstone special events were the Dunsmuir River Festival and the Return of the Salmon Festival in Anderson. Participants in these events varied year-to-year, but generally increased over the time of the grants, ranging from 10,000 to 15,000 attendees annually. For the seven funded years, total attendance exceeded 50,000 participants.

The project also participated at large community events such as the Siskiyou and Shasta County Fairs and the Nor-Cal Boat Show. Though less of a hands-on educational intervention, important exposure and promotion were achieved to attendees at these events, which ranged from 150,000 to 175,000 participants annually, or more than 1,000,000 potential contacts over the life of the grants.

PRODUCTS RECEIVED: Quarterly progress reports



## *Spring Creek Culvert Replacement Project*

**DATE FUNDED:** 1998

**DURATION OF PROJECT:** Three years

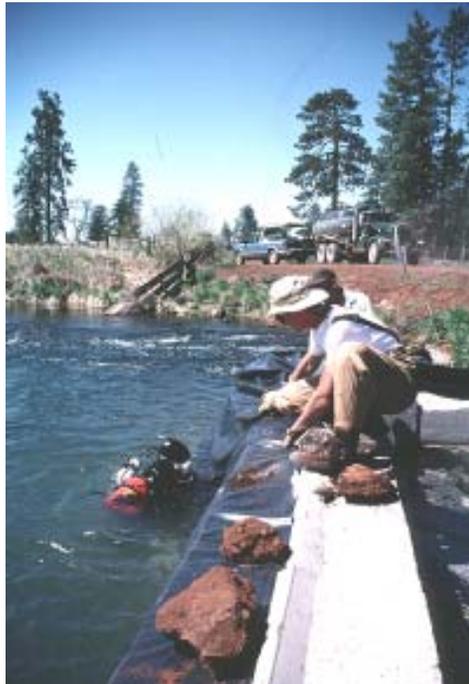
**GRANTEE:** Maria Ellis (Spring Rivers Ecological Services)

**AMOUNT GRANTED:** \$130,000

**AMOUNT SPENT:** \$130,000

**BACKGROUND:** Using funds supplied by the Cantara Trustee Council (Council), and materials donated by Shasta County, Spring Rivers Ecological Services contracted to replace four culverts and re-establish a velocity barrier at the Spring Creek crossing.

The Shasta crayfish (*Pacifasticus fortis*) is a federally- and state-listed endangered species, found only in the Pit River drainage of northern California. This native is threatened by the non-native signal crayfish (*P. leniusculus*), which out-competes the Shasta where the two occur together. The largest known remaining viable Shasta crayfish population occurs in Spring Creek, a tributary to Fall River, near Dana, in Shasta County. At one time, this population was protected from signal crayfish by a velocity barrier formed by culverts under Spring Creek Road. Over time, this barrier deteriorated to the extent that signal crayfish were invading upstream of the culverts in considerable numbers.



As part of this project, Spring Rivers Ecological Services also performed extensive snorkeling surveys to capture and remove all signal crayfish from the reach of Spring Creek above the crossing.

**BENEFITS:** The primary benefit of this project was long-term protection of the largest existing population of an endangered species, the Shasta crayfish. This species is a significant component of Fall River, a cold-water lotic system with many biological characteristics similar to the upper Sacramento River. Signal crayfish were present in the Sacramento River above Shasta Lake prior to the Cantara spill, and though they were non-native, they had an important role ecologically. Resource agencies determined it was not practicable to attempt crayfish restoration within the Cantara spill area, so the Spring Creek project provided an off-site benefit by enhancing native crayfish populations in a similar ecosystem.

**PRODUCTS RECEIVED:** The Council received monthly progress reports and an extensive final report documenting velocity barrier completion, including before and after pictures, and the results of the signal crayfish eradication effort. The four culverts are in place and acting as a velocity barrier to signal crayfish.

## *Spring Creek and Thousand Springs Shasta Crayfish Habitat Enhancement*

**DATE FUNDED:** 1999

**DURATION OF PROJECT:** Three years, six months

**GRANTEE:** Spring Rivers Ecological Services

**AMOUNT GRANTED:** \$32,190

**AMOUNT SPENT:** \$32,190

**BACKGROUND:** After completing the Spring Creek Culvert Replacement Project<sup>1</sup>, the Cantara Trustee Council funded Spring Rivers Ecological Services to enhance Shasta crayfish (*Pacifastacus fortis*) habitat in Spring Creek and Thousand Springs. The Shasta crayfish is a federally and state-listed endangered species found only in the midreaches of the Pit River watershed in Shasta County. The project locations serve as headwaters to the Fall River drainage, which is a tributary to the Pit River. With less than half a dozen viable populations of this endangered species, the Shasta crayfish will benefit from habitat enhancement in any of its remaining refugia. The Spring Creek culvert replacement restored a barrier to stop signal crayfish, (*Pacifastacus leniusculus*) from migrating upstream into upper Spring Creek. There is evidence that even in the absence of competition and predation from non-native crayfish, lack of usable habitat may limit the numbers of Shasta crayfish that can occupy this headwater area. Shasta crayfish are often found living in high densities under large lava boulders; rarely are they found under smaller rocks, which can be easily overturned by mammalian and avian predators, such as muskrats, raccoons, and herons. As part of the project, native lava rocks were placed within Shasta crayfish habitat on Thousand Springs and Spring Creek ranches. Population surveys were conducted pre- and post-placement to evaluate the efficacy of the project.

**BENEFITS:** Additional lava rock habitat was successfully placed in the project sites. Post-placement surveys indicated that Shasta crayfish were occupying the new habitat. One year after placement of the lava rocks, all 20 new boulders were in use by 84 Shasta crayfish at Thousand Springs. Approximately half of the 15 Shasta Crayfish surveyed at Spring Creek were under one of the 55 new boulders placed there. The surveys also found that signal crayfish have continued to move upstream in both areas. The development of new barrier methods was recommended to protect against further incursion into Shasta crayfish areas.

The primary benefit of this project was to enhance the size of two of the few remaining populations of Shasta crayfish. In addition, this species is a significant component of the Fall River, a cold-water lotic system with many biological characteristics similar to the upper Sacramento River. Crayfish were present in the Sacramento River above Shasta Lake prior to the Cantara spill, and though they were non-native, had an important ecological role. Resource agencies determined it was not practicable to attempt restoration of crayfish within the spill area, particularly as they easily recolonized the river from the tributaries. The Spring Creek project provided an off-site benefit by enhancing native crayfish populations in a similar ecosystem.

**PRODUCTS RECEIVED:** The Council received periodic progress reports, including before and after pictures, and a final report, "*Shasta Crayfish Habitat Enhancement Project*," documenting placement of habitat enhancements and results of population monitoring.



<sup>1</sup> See Spring Creek Culvert Replacement summary.

## *Sucker Springs Signal Crayfish Eradication Project*

**DATE FUNDED:** 2000

**DURATION OF PROJECT:** Three years

**GRANTEE:** Spring Rivers Ecological Services

**AMOUNT GRANTED:** \$45,000

**AMOUNT SPENT:** \$45,000

**BACKGROUND:** Sucker Springs Creek, Shasta County, contains the largest known population of the endangered Shasta crayfish along the main stem of the Pit River. The population is confined to a few ponds that were part of a now closed Department of Fish and Game hatchery. The headwaters for the creek are just above the ponds. Each pond is separated from the one below it by a weir, designed to prevent the entrance of non-native signal crayfish into the ponds. However, over the years, signal crayfish have managed to enter the lower ponds. As this species is an aggressive direct competitor with Shasta crayfish, the population of the latter at Sucker Springs Creek is now threatened.

Using funds supplied by the Cantara Trustee Council (Council), Spring Rivers Ecological Services attempted to remove all Shasta crayfish from the lower ponds and place them in the uppermost pond, where no signal crayfish exist, and to eradicate signal crayfish from the lower ponds.



A Shasta crayfish.

**BENEFITS:** During the three field seasons of the project, 2,717 signal crayfish were removed from the lower ponds and 88 Shasta crayfish were moved to the upper pond. Unfortunately, signal crayfish reproduced in some of the lower ponds in 2002 and 2003. Though the catch rate of signal crayfish was again declining by the end of 2003, the goal of finding no signal crayfish for six consecutive surveys was not reached. Recommendations include continuing eradication efforts and redesigning Sucker Springs Creek's weirs to prevent signal crayfish from moving into the upper ponds.

The primary goal of this project was to protect the remaining Shasta crayfish in Sucker Springs Creek from competition with the signal crayfish. By the conclusion of the project it was demonstrated that the eradication techniques employed will work, but in this case, will probably not be successful without weir modifications to prevent signal crayfish moving into the upper ponds.

**PRODUCTS RECEIVED:** The Council received periodic progress reports and an extensive final report documenting the eradication efforts. The report also discussed some habitat modification measures that were taken during the project to assist the eradication effort, and made recommendations for future work.



A Signal crayfish.

## *Sulphur Creek Restoration Projects*

**DATE FUNDED:** 1997 & 2000

**DURATION OF PROJECT:** One year; five year augmentation

**GRANTEE:** Sacramento Watersheds Action Group

**AMOUNT GRANTED:** \$215,825.00 (\$27,000 and \$188,825)

**AMOUNT SPENT:** \$215,728

**BACKGROUND:** The Cantara Trustee Council funded two grants for the Sacramento Watersheds Action Group (SWAG) to implement projects in Sulphur Creek. Because the projects were interrelated, the grants are dealt with jointly here. The first grant was a \$27,000 project to produce a Sulphur Creek Watershed Assessment and Action Plan (SCWAAP). Located entirely within Shasta County, Sulphur Creek watershed encompasses 3000 acres and seven miles of seasonal creek. The lower half of the creek, including the mouth where it flows into the Sacramento River, is within the city limits of Redding. The California Department of Fish and Game and the Department of Water Resources have identified Sulphur Creek as an important tributary to the Sacramento River, supporting rainbow trout, steelhead trout, Chinook salmon, and other aquatic species. Unfortunately, the creek has been severely affected by mining and urban development.

To create the SCWAAP, a pre-project inventory of fish habitat and riparian habitat resources was conducted. An action plan was developed in accordance with techniques described in the California Salmonid Stream Habitat Restoration Manual and included prioritization and cost estimates for proposed phases of work. The grant also provided support for the Sulphur Creek Coordinated Resource Management and Plan (CRMP). The Sulphur Creek CRMP used the plan to develop specific restoration projects in lower Sulphur Creek.

One of the larger lower reach restoration projects was funded through the second grant (\$188,825). Re-establishing viable fish habitat in the creek approaches to the Sacramento River was deemed essential before future upstream projects could be effective. Due to historic gold dredge mining and more recent gravel mining activities, the creek bed had been diverted from its original channel. Confined to a channel of large cobble, it easily went subsurface as temperatures warmed and the water table fell rapidly. Many young fish were frequently stranded in pools isolated in the creek, and became the target of rescue efforts.

Additional data was collected on the lower stream and a hydrologic analysis for stream flow characteristics for bank-full, 10-year, and 100-year events was completed. From these, and the SCWAAP, plans were developed for revegetation and erosion control, an interpretive trail, and monitoring and maintenance of efforts. A design and related hydraulic analysis to restore the lower creek to most of its original channel was developed. Extensive hydrologic modeling was conducted of variations in flow regime as part of the full permitting process. Channel construction and realignment began in June, 2004 and was completed in November, 2004.

**BENEFITS:** This project developed the first planned approach to manage the Sulphur Creek watershed. The stream channel restoration reduces instability and erosion through the lower section of the creek. It also re-establishes the creek's viability for fisheries and riparian habitat. In addition, use by rainbow trout and anadromous salmonids will be enhanced, while stranding of young fish (smolts and fry) will be reduced. Raised trails and informational postings built to border the new stream channel area will provide increased recreational and educational benefits for years to come. Overall, the projects have laid the groundwork for future efforts to continue returning this important waterway to its original riparian fish-friendly habitat.

**PRODUCTS RECEIVED:** SWAG provided a Sulphur Creek Watershed Assessment and Action Plan, a related Data Collection Report, Hydrologic Analysis Reports, Maintenance and Monitoring Plan, and a Restoration Design Plan. They also provided reports on permit approvals, a Site Preparation Plan, and a construction schedule. Additionally, copies of press releases and flyers developed for different stages of the project were submitted. Once construction began, quarterly reports on revegetation status and erosion control were provided and a final report was completed after the project concluded.



## *Tate Creek Restoration Project*

**DATE FUNDED:** 2001

**DURATION OF PROJECT:** Three years

**GRANTEE:** USDA Forest Service, Shasta-Trinity National Forest

**AMOUNT GRANTED:** \$155,500

**AMOUNT SPENT:** \$120,401

**BACKGROUND:** The Tate Creek Riparian Reserve is located in Siskiyou County on National Forest Service lands. Tate Creek is a tributary to the McCloud River and a key component of the designated redband trout domain. In an effort to prevent federal listing of redband trout as a threatened species, the USDA Forest Service (Forest Service) has undertaken actions to address damages to the trout's environment that occurred from past management practices or flood events. Several assessments were conducted to develop the Tate Creek Restoration Plan. The first phase of the plan was implemented in 2000. Tasks carried out treated the worst of the resource damage in the upper half of the project area, returned the creek to the location of the pre-flood channel, and reconstructed and revegetated part of the most upstream gully.

The Cantara Trustee Council (Council) funded the Forest Service to implement the second phase of the larger restoration plan for Tate Creek. This grant supported efforts to restore and enhance aquatic and riparian habitats.



Activities focused on channel stability and improving habitat conditions for redband trout. The project area comprised 20 acres, entirely composed of montane riparian terrestrial and cold water lotic aquatic habitat that was adversely affected by a 50-100 year storm event in 1997. Flooding severely aggraded the creek channel with sediment, formed numerous logjams, and diverted the creek flow into an adjacent road paralleling the channel. The road flow created two large gullies that retained about half of the total Tate Creek flow after the floodwaters receded. These gullies provided no pool habitat or riparian vegetation and their banks remained in an unstable state.

At the downstream end of the project area, abandoned fishery ponds from the 1930's contributed to the flood backflow and presented additional restoration challenges. The pond berms and decades of beaver activity combined to create a valuable wetland component to the area. While artificial, this wetland complex provided a unique riparian environment for aquatic dependent plants and animals, including redband trout. A determination was made to re-establish the original Tate Creek flood channel while still maintaining the wetland area. Subsequent monitoring of the project's effects and implementing additional restoration efforts will be provided by the Forest Service.

**BENEFITS:** The project successfully implemented several measures in the Tate Creek Restoration Plan. A concrete dam at the upstream end of the project area was removed to open up the floodplain which was then re-contoured to match floodplain elevation during high flow periods. Remaining portions of the gullies were filled and borrow ponds were constructed in the upstream gully. The gullies, ponds, and the re-contoured floodplain were revegetated with native willow, alder, dogwood, and hazel species. Upland conifers were planted in dryer sites. Care was taken to ensure that future flood events would not rechannel the previous gullies. These activities represent the type of montane riparian habitat restoration that the Council targets to help replace similar habitat lost during the Cantara spill. This project provides the added benefits of improving water quality through sediment reduction, enhancing redband trout conservation efforts, and preserving a wetland complex.

**PRODUCTS RECEIVED:** Progress report with implementation schedule, maps, and photographs  
Final report with photographs, summary of restoration activities, and monitoring plan

## *Taubindauli Park and Trail*

**DATE FUNDED:** 1999

**DURATION OF PROJECT:** SevenYears

**GRANTEE:** Dunsmuir Garden Club

**AMOUNT GRANTED:** \$741,834

**AMOUNT SPENT:** \$578,864

**BACKGROUND:** The Cantara Trustee Council (Council) funded the Dunsmuir Garden Club (Garden Club) in 1999 to enhance and restore riparian vegetation in Dunsmuir, Siskiyou County. The project site is located along the upper Sacramento River at the Upper Soda Springs area on properties owned by Union Pacific Railroad, Pacific Power Corporation, the City of Dunsmuir, and the California Departments of Transportation and of Fish and Game. Objectives included moving and reconstructing levees, constructing trails, installing picnic tables, and providing fishing access. To accomplish these tasks the Garden Club moved and replaced existing infrastructure: power and phone poles, a sewer line, a fire hydrant, and fencing. A city street that crossed the site was realigned and repaved. Excess soil and rock were removed, the topography was graded into a natural form, exotic plant species were removed, and the site was replanted with native riparian species. Riparian woodland plantings included willow, cottonwood, creek dogwood, red twig dogwood, big leaf maple, and western azalea. Other areas in the park were planted with native upland species including Douglas fir, incense cedar, ponderosa pine, black oak, canyon live oak, and western redbud. Native sedges and rushes were planted in wetland areas and native wildflowers and grasses were seeded in various locations. A self-guided interpretive trail was constructed on the site to provide public education. The Garden Club established an endowment account through which to raise funds and additional community support for the project. Account funds will be used for maintenance and management of the park beyond the term of this grant. The grant project contributed \$163,000 to the account, and \$15,000 in donations have been raised for the endowment. In addition, the value of in-kind contributions over the duration of the project is projected to exceed \$120,000. Under a separate agreement with the Council, the Wildlife Conservation Board accomplished land acquisition and/or easements needed for fishing and river access<sup>1</sup>.

**BENEFITS:** The Tauhindauli Park and Trail was dedicated on September 27, 2003. Having completed construction, the Garden Club is now in the maintenance and monitoring phases funded for the project. In addition, the Garden Club will conduct summer on-site education programs and focus on increasing the endowment fund for long-term park support. This project meets three of the four major goals of the Council: Restoration, Rehabilitation and Enhancement; Habitat Acquisition and Resource Protection; and Public Information and Education. In addition to the benefits the river park project has provided in educating and developing community support for watershed stewardship, the riparian vegetation enhancement and restoration will make long-term contributions to the upper Sacramento River's water quality. The park is also adjacent to the Rhinesmith property to which the Council contributed a significant portion of acquisition funds.

**PRODUCTS RECEIVED:** The Dunsmuir Garden Club provided quarterly progress reports and copies of its quarterly newsletter (which usually featured updates on the project). They also provided copies of necessary permits and agreements associated with the project, including construction plans. Annual reports were provided for 2004 — 2006 on vegetation monitoring that included photo point documentation, mapping, numbers of plants established, and progress on meeting success criteria for vegetation establishment.



<sup>1</sup>See Upper Sacramento River Acquisition summary.

## *Trailside Video*

**DATE FUNDED:** 1998

**DURATION OF PROJECT:** One year, six months

**GRANTEE:** Teaching Learning Network

**AMOUNT GRANTED:** \$25,000

**AMOUNT SPENT:** \$25,000

**BACKGROUND:** The Cantara Trustee Council (Council) funded the Trailside Video in 1998. This project designed a 30-minute video segment for 300 Public Broadcast System (PBS) stations over a two-year period as part of the *Trailside, Make Your Own Adventure* series. The video program focused on the upper Sacramento River, highlighting its recovery from the 1991 metam sodium spill. The Council awarded the project as part of efforts to address public perceptions that the upper Sacramento River was still contaminated. In addition to a message of river ecosystem recovery, the video was also viewed as an education tool about stewardship of natural resources, in keeping with the Public Relations and Education Operational Plan for the Council. Filming took place in May, 1999.

**BENEFITS:** Entitled “Fly Fishing in Mount Shasta,” the completed video is available to the public through the *Trailside, Make Your Own Adventure* series website ([www.trailside.com](http://www.trailside.com)). The website also features a description of the Cantara Trustee Council and a link back to the Council’s website. The show aired during the October, 1999 — October, 2000 season on PBS network stations which includes over 300 stations and reaches 2.2 million households nationwide. Film production also generated local media coverage which provided additional exposure of the Council’s success in the river’s recovery.

**PRODUCTS RECEIVED:** The Teaching Learning Network provided copies of draft scripts, press releases, and advertising copy. The Council also received one master BETA and 25 VHS copies of the final video segment. Additionally, a copy was provided of a full-page four-color advertisement placed in a national outdoor publication. Cantara Trustee Council information was published on the *Trailside, Make Your Own Adventure* website ([www.trailside.com](http://www.trailside.com)).

## *Upper Big Bear Creek Restoration Project*

**DATE FUNDED:** 2002

**DURATION OF PROJECT:** Five years, two months

**GRANTEE:** Fall River Resource Conservation District

**AMOUNT GRANTED:** \$695,545

**AMOUNT SPENT:** \$693,580

**BACKGROUND:** In 2002, the Cantara Trustee Council (Council) funded the Fall River Resource Conservation District (RCD) to implement two projects within the upper Bear Creek watershed, located in northeast Shasta County and southeast Siskiyou County. This grant represented continued support for restoration efforts on Bear Creek<sup>1,2</sup>, a primary tributary to Fall River. Bear Creek is important habitat for rainbow and brown trout, and for Shasta crayfish, an endangered species.

This grant consisted of the following two RCD projects for riparian and fluvial restoration:

- McCloud River Railroad Culvert Replacement - the existing culvert was a barrier to fish migration. In addition, a culvert under the railroad on Cold Creek, a tributary to Bear Creek was undersized, had become plugged several years previous, had diverted the creek to flow along the railroad grade, and was causing serious erosion problems.
- Upper Big Bear Flat Meadow Restoration Plan - flow had shifted from the meadow to an incised gully which reduced the water table and vegetation in the meadow.

**BENEFITS:** The railroad culvert was successfully replaced by fall, 2005. Two undersized culverts were replaced with 20-foot and 16-foot steel culverts, both of which were placed so the bottom of the culverts were below the natural grade of the creek channel. In addition, the Cold Creek culvert was replaced and the creek put back into its historic channel. The new culverts permit fish migration to historical habitat upstream, and reduce sediment loss and debris clean-up expenses. Willow, native grasses, sod mats, and sedges were planted

in the construction zone. Monitoring through the end of 2005 indicated successful revegetation and bank structure stability.

Originally, Council funding included implementing restoration of Big Bear Flat. Unfortunately, cost over-runs for culvert replacement, primarily due to sharp increases in steel costs in 2004-2005, required modifying the grant to only include plan development. The restoration plan, completed in 2006, provides design and engineering recommendations to re-establish Bear Creek in its historical channel through the meadow. Once implemented, the restoration will reduce sediment loss through erosion, improve and increase fish habitat, raise the water table, and increase riparian plant communities. The Fall River RCD will seek new funding from other sources for the restoration.

PRODUCTS RECEIVED: Monthly progress reports



<sup>1</sup> See Big Bear Creek Meadow Restoration Monitoring summary

<sup>2</sup> See Big Bear Restoration Design summary

## *Upper Sacramento River Aquatic Macroinvertebrate Baseline Study*

**DATE FUNDED:** 2001

**DURATION OF PROJECT:** One year, six months

**GRANTEE:** California Department of Water Resources

**AMOUNT GRANTED:** \$26,512

**AMOUNT SPENT:** \$25,148

**BACKGROUND:** The Cantara Trustee Council (Council) funded the Aquatic Macroinvertebrate Baseline Study in 2001. This project was initiated as a request by the Council to conduct a follow-up to prior studies. Previous macroinvertebrate surveys were conducted in 1991, 1992, 1993, and 1996. The Council felt that collecting another round of data to mark the 10-year period following the Cantara spill would provide more accurate species information.



**BENEFITS:** A reference collection of macroinvertebrates was made from six sites along the length of the river. Specimens collected were identified to the lowest practical taxonomic level, and preserved in ethanol. All specimens were properly archived, and are housed at the California Department of Water Resources office in Red Bluff.

Data collected in 2001 was analyzed and compared with previously collected data. The analyses included diversity, equitability, species richness, evenness, EPT index, ratio of EPT abundance to chironomid abundance, community similarity, and functional group ratios. This information helps document species recovery following the spill, and provides a baseline in case of future environmental damage to the area.

**PRODUCTS RECEIVED:** Comprehensive final report  
Macroinvertebrate reference collection



## *Upper Sacramento River Aquatic Macroinvertebrate Recovery Assessment*

**DATE FUNDED:** 1996

**DURATION OF PROJECT:** Eleven months

**GRANTEE:** California Department of Water Resources

**AMOUNT GRANTED:** \$40,000

**AMOUNT SPENT:** \$38,198

**BACKGROUND:** The California Department of Water Resources (DWR) began assessing damage to aquatic macroinvertebrates within two weeks following the Cantara spill in 1991. In December of 1991, the Department of Fish and Game contracted with DWR to conduct macroinvertebrate assessment on the upper Sacramento River through October 1993.

Some macroinvertebrate species repopulated riffle areas within a few months following the spill. Many other macroinvertebrate species have take considerably longer to reestablish. Because many species had not shown substantial signs of recovery three years following the spill, the Cantara Trustee Council funded DWR in 1996 to continue monitoring macroinvertebrates for one additional year.

The objectives of the study were to determine baseline conditions of the aquatic macroinvertebrate communities in the upper Sacramento River, effects of the spill on these communities and recovery. The results of the study were compared with samples collected in 1991 through 1993.



**BENEFITS:** Sampling was conducted in July and October of 1996. Aquatic macroinvertebrates were collected at six stations in the upper Sacramento River. One station was upstream of Cantara Loop, while the remaining five stations were distributed along the river from about 1,000 yards downstream of the spill site to just upstream of Shasta Lake. The station upstream of Cantara Loop was considered the control station since it was not directly exposed to the chemical spill. Five macroinvertebrate samples were collected at each monitoring station using a kick screen.

The aquatic macroinvertebrate community has made significant recovery at stations affected by the Cantara spill. Large numbers of macroinvertebrates representing diverse species have recolonized affected monitoring stations. However, community composition of riffles affected by the spill is not similar to that of the upstream control station. Comparisons of the aquatic macroinvertebrate community at each individual monitoring station over time showed substantial differences in similarity, which may indicate that recovery is not yet complete or that some perturbation has affected the river so that the composition of the communities sampled in 1996 are dissimilar to those occurring earlier.

**PRODUCTS RECEIVED:** The Cantara Trustee Council received a memorandum report titled: "*Aquatic Macroinvertebrate Recovery Assessment in the upper Sacramento River, 1991-1996.*"

## *Upper Sacramento River Avian Recovery Monitoring*

**DATE FUNDED:** 1996

**DURATION OF PROJECT:** Nine months

**GRANTEE:** Point Reyes Bird Observatory

**AMOUNT GRANTED:** \$45,000

**AMOUNT SPENT:** \$44,999



**BACKGROUND:** Immediately following the Cantara Spill and continuing through 1995, the California Department of Fish and Game contracted with the Point Reyes Bird Observatory (PRBO). The purpose was to study short and long-term spill effects on terrestrial bird populations that use the upper Sacramento River riparian habitat. Monitoring results from the 1995 field season showed that productivity, adult abundance and adult survival, were depressed in relation to vegetation damage. Because terrestrial bird populations were showing little sign of recovery, the Cantara Trustee Council (Council) funded PRBO to continue avian monitoring in 1996. The purposes of the study were to document recovery and identify factors impeding or potentially promoting recovery, such as habitat features. Terrestrial bird communities were evaluated using three measures: bird species richness, species diversity, and total abundance (number of individuals detected). Productivity, comparing the number of juvenile birds to adult birds, was also assessed.



Eight impacted sites varying in vegetation injury, were monitored on the upper Sacramento River. These were compared with two control sites on Squaw Creek, a tributary to Shasta Lake. Point-count census surveys were conducted three times during the breeding season, between mid-May and early July. Using mist netting to provide an independent measure of total abundance and evaluate condition, productivity was determined for nine of the most commonly captured species:

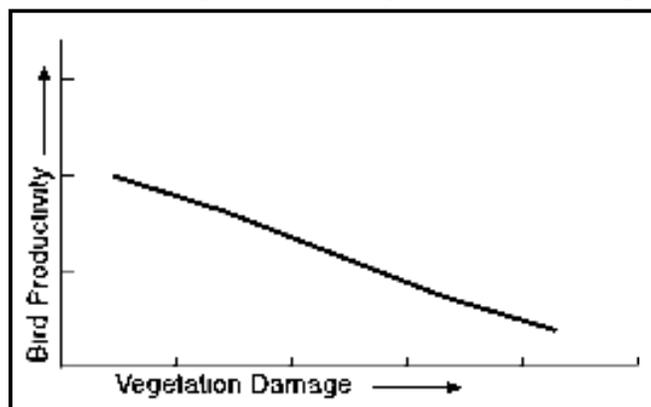
the American robin, black-headed grosbeak, MacGillivray's Warbler, orange-crowned warbler, song sparrow, spotted towhee, western tanager, yellow-breasted chat, and yellow warbler.

**BENEFITS:** All eight impacted sites and one control site were surveyed every seven to ten days, between May and August. Bird species richness, diversity and overall abundance, as determined through point-count censuses, declined significantly in relation to increased vegetation damage among sites. Mist netting studies revealed the same results. Overall, it is estimated that adult abundance was reduced each year following the spill (from 1992-1995) by 2,400 birds. When adding mortality figures from 1991, it is estimated that more than 12,700 birds were lost because of the spill.

The 1996 survey shows that the pattern of declining bird abundance and bird species richness, with respect to vegetation damage, was similar in 1995 but less pronounced than in 1994. When compared with previous years, results indicated that productivity was beginning to show signs of recovery. Understanding the long-term impact of the Cantara spill on avian species was critical for remediation efforts and to Council planning.

**PRODUCTS RECEIVED:** The Cantara Trustee Council received a final report titled *“Assessing the Impact of the Cantara Spill on Terrestrial Bird Populations along the Sacramento River: Results from the 1996 Field Season and Comparison with Results, 1992-1995.”*

**1996 Bird Productivity in  
Relation to Vegetation Damage From Cantara Spill**



## *Upper Sacramento River Creel Survey*

**DATE FUNDED:** 2001

**DURATION OF PROJECT:** Nine months

**GRANTEE:** CSU, Chico Research Foundation

**AMOUNT GRANTED:** \$56,734

**AMOUNT SPENT:** \$51,360

**BACKGROUND:** The Sacramento River above Shasta Lake was closed to all angling after the 1991 chemical spill at Cantara Loop above Dunsmuir. The river was re-opened to fishing in 1994, with a zero-fish limit and restrictions requiring use of artificial lures and barbless hooks on all but six miles of the river around Dunsmuir. In this section there were no gear restrictions, a five fish limit was in place, and stocking of hatchery trout was allowed. By 2000, the California Department of Fish and Game (DFG) determined there had been significant recovery of the trout stocks, and developed a formal long-term fishery management plan for the upper Sacramento River. This plan included several regulation changes which expanded the zone of no gear restriction, allowed a two trout limit in the lower 22 miles of the river, and formally designated the areas outside the zone around Dunsmuir as Wild Trout water, beginning in 2002.

To evaluate the effects of these new regulations on the wild trout population and on angler satisfaction, DFG received a grant from the Cantara Trustee Council (Council) to conduct a creel survey in the two zones of the upper Sacramento River where the new rules had gone into effect. This grant was administered by the California State University, Chico, Research Foundation, which hired the creel clerks.

**BENEFITS:** The survey estimated a harvest of 2-2.5% of the wild trout population present in the new two fish limit zone, which is less than 1/3 the estimated annual natural mortality in that stretch. The survey also estimated that 66% of the stocked trout in the Dunsmuir zone were harvested by anglers. Eighty percent of anglers reported the fishing as good to excellent and 63% favored the new management strategy. The study also found that almost 2/3 of those interviewed traveled more than 100 miles to fish the upper Sacramento River.

The primary benefit of this project was to document the effectiveness of the fishing regulation changes on the upper Sacramento River in terms of the affect on wild trout populations and angler satisfaction. The angler survey, along with other data on trout populations collected by DFG, enables the DFG to make informed decisions about the area's trout management in the future, especially if, as planned, the survey can be repeated periodically.

**PRODUCTS RECEIVED:** The Council received periodic progress reports during the course of the survey and a final report, including numerous statistical tables, describing the results of the survey and recommendations for future work.



## *Upper Sacramento River Exchange*

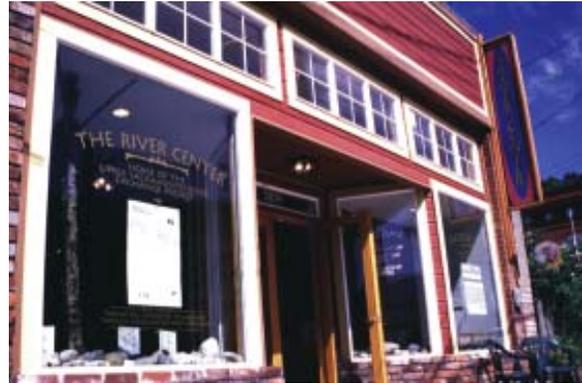
**DATE FUNDED:** 1996

**DURATION OF PROJECT:** One year, nine months

**GRANTEE:** City of Dunsmuir

**AMOUNT GRANTED:** \$320,000

**AMOUNT SPENT:** \$320,000



**BACKGROUND:** In 1996, the Cantara Trustee Council (Council) funded the City of Dunsmuir to create the Upper Sacramento River Exchange (River Exchange). The Council extended the program with supplemental funding through June 30, 1998. The goals of the project were to build community-wide stewardship for the upper Sacramento River watershed, and educate students and the public about the 1991 Cantara spill. To meet proposed goals, the project established the River Center (Center). The Center provided year-round public access to information on the river, recreation, recovery efforts, and a library and displays related to the Cantara Spill. Center staff developed an extensive school link program to serve students and educators in the watershed. To involve the community in the upper Sacramento River watershed, the Center offered public field trips related to restoration, river cleanups, fishing clinics, and recreation; interpretive shows on river access, natural history, human history, and wildlife; volunteer programs involving restoration projects in the watershed; and an annual River Festival. The Center facilitated public exchange meetings regarding topics important in the watershed, and partnered with other agencies and private interests to facilitate planning and restoration in the watershed. Staff also collaborated with the Council in areas of planning, such as hosting “Restoration Roundtables” and providing public outreach.

**BENEFITS:** This project supported the Council's education and promotion objectives. A greater awareness and understanding of the value of the upper Sacramento River watershed was promoted to the community. An appreciation of the importance to maintain a healthy ecosystem that all can depend upon and continue to enjoy was fostered.

During the contract term, the River Exchange became a nonprofit organization, formed a board of directors, and served over 17,400 people. The Center officially opened its doors on April 25, 1997, coinciding with the first annual Dunsmuir River Festival. Cosponsored by Dunsmuir schools, this event attracted more than 600 visitors. The Center's school link program served over 4,500 students and educators through classroom watershed presentations, watershed restoration field trips, tours of the Center, and a stewardship day camp during the summer. During this time frame, 5,600 residents and visitors attended interpretive field trips, river cleanups, educational presentations, and public exchange meetings.

**PRODUCTS RECEIVED:** The River Exchange provided the Council with quarterly status reports. They produced quarterly newsletters, and developed and maintained a web page.



\* See Upper Sacramento River Exchange Vision 2002 Project summary.

## *Upper Sacramento River Exchange Vision 2002 Project*

**DATE FUNDED:** 1997

**DURATION OF PROJECT:** Four years and one month

**GRANTEE:** Upper Sacramento River Exchange, Inc.

**AMOUNT GRANTED:** \$601,904

**AMOUNT SPENT:** \$601,904

**BACKGROUND:** In 1997, the Cantara Trustee Council (Council) funded the Upper Sacramento River Exchange (River Exchange) to continue community programs begun in 1996 through a Council grant to the City of Dunsmuir<sup>1</sup>. The Council extended the program with supplemental funding through June 30, 2002.

Operating out of the River Center (Center), established through the 1996 grant, the River Exchange provided services and activities in three main areas: 1) services for visitors to the Center; 2) educational programs for local schools called "School Link"; and 3) community-based education, promotion, and stewardship activities. The Center also provided information on recreation activities along the upper Sacramento River.

School Link programs were open to all local schools and grade levels but primarily focused on elementary school students. Programs included classroom watershed presentations, watershed restoration field trips, tours of the Center, and a stewardship day camp during the summer. The Center also provided a library and displays related to the Cantara spill and other watershed and stewardship topics.

The River Exchange also conducted watershed education and promotion activities throughout the local community. These included a large variety of activities, including an annual River Festival, interpretive field trips, river cleanups, educational presentations, and public exchange meetings.

**BENEFITS:** This project supported the Council's education and promotion objectives. During the contract term, the River Exchange reached more than 40,000 people, including more than 17,000 visitors to the Center, 13,000 students and educators through the School Link program, and approximately 10,000 residents and visitors who participated in community-based activities. By the end of this grant, the River Exchange succeeded in diversifying its funding to continue services and programs into the future.

**PRODUCTS RECEIVED:** The River Exchange provided the Council with quarterly status reports. They also produced quarterly newsletters, maintained a web page, and managed the River Center.



<sup>1</sup> See Upper Sacramento River Exchange summary.

## *Upper Sacramento River Fishery - Monitoring and Baseline Studies*

**DATE FUNDED:** 1996, 1998, 2001

**DURATION OF PROJECT:** Ten years

**GRANTEE:** Thomas R. Payne and Associates

**AMOUNT GRANTED:** \$162,950; 117,516; 140,897 = \$421,363

**AMOUNT SPENT:** \$162,950; 85,441; 140,887 = \$389,278

**BACKGROUND:** Thomas R. Payne and Associates (TRPA) monitored fish populations in the upper Sacramento River (River), through snorkel surveys, from 1992 through 1995. These studies were funded by the Department of Fish and Game. To continue this work, the Cantara Trustee Council (Council) provided funding for annual surveys from 1996, through 2005. This summary combines the three grants awarded to TRPA by the Council.

To maintain comparability of data, snorkel surveys followed protocols established in 1992, but also modified the scope and procedures as deemed appropriate through experience. Annual surveys monitored rainbow trout (*Oncorhynchus mykiss*), pikeminnows (*Ptychocheilus grandis*), Sacramento suckers (*Catostomus occidentalis*), and spotted bass (*Micropterus punctulatus*). The surveys conducted in 1997 and 2001 also assessed population densities for riffle sculpin, Pacific giant salamanders, crayfish, and any other large benthic species observed. Assessments were conducted in a variety of habitats by a team of four to five divers. Surveys were conducted in the summer and fall of each year. For monitoring purposes, the River was divided into four reaches. Reach One extended from Campbell Creek, just north of Shasta Lake, upstream to Mears Falls. Reach Two extended upstream from Mears Falls to Soda Creek, just south of Dunsmuir. Reach Three covered the span from Soda Creek, upstream to the Cantara Loop. Reach Four encompassed the portion of river upstream from the Cantara Loop to Box Canyon Dam, and served as a control.

The fish population estimates were based on the observation sample. It was not possible to determine how annual fish populations compared with pre-spill populations, as there was no pre-spill data for comparison. The population estimates were most useful for comparing and contrasting trends from year to year.

**BENEFITS:** The Council received annual indexes of abundance for the principal fish species surveyed in each reach. Annual index estimates were compared to estimates from each previous year's survey to evaluate recovery trends. Data was provided for fish species by size and habitat type. The information was considered by the Council when making funding decisions and re-evaluating priorities.

Overall, the trend for most fish from 1992-2001 was similar: significant annual increases until 1997, when flood events reduced populations, followed by gradual increases each subsequent year - though not to the level of the 1996 peak. It is believed that the 1997 floods modified tributary and River habitat which led to a slower population recovery than was observed in the initial years after the spill.

For example, rainbow trout (>4 inches) population estimates peaked in 1996 at 2,738 fish per mile. The population estimate dropped to 1,376 fish per mile in 1997 and then to 1,093 in 1998. Fish per mile estimates then increased to 1,309 in 1999 and 2,198 in 2000 before falling off again to 1,962 in 2001. The rainbow trout also exhibited a strong correlation by cohorts (e.g., juveniles). It is believed that the rainbow trout population has reached a baseline status which changes annually within normal cyclical patterns.

Another trend observed was an increase in suckers and bass in Reach One, presumably from fish swimming upstream from Shasta Lake to fill vacated habitat. Pikeminnows, suckers, and bass were typically only observed in Reach One. Pikeminnows and suckers were usually observed in large schools in a small number of deep pools in the reach. These fish appeared to return to the lake as adults.

Data from the TRPA studies have been useful in making fishery management decisions. The findings were considered each year when determining fish limit and catch and release areas. It also contributed to the decision to permit winter catch and release fishing, which started in November, 2004. The data were also used by the Department of Fish and Game to identify stretches of the River to use in its own fish monitoring activities.

After the Cantara spill, the lack of pre-existing fish population information hampered restoration and recovery efforts. Baseline data provided from these surveys will help manage restoration efforts if any future spills were to occur in the River. It also provided useful information for mitigation, monitoring, or restoration efforts in other comparable stream systems or watersheds.

**PRODUCTS RECEIVED:** Annual reports for 1996, 1997, and 1998  
Combined report for 1999-2001  
Copy of paper submitted to peer reviewed journal  
Final report

## *Upper Sacramento River - Identification and Control of Pollution Sources*

**DATE FUNDED:** 1996

**DURATION OF PROJECT:** Five years

**GRANTEE:** Regional Water Quality Control Board - Central Valley Region Board

**AMOUNT GRANTED:** \$610,017

**AMOUNT SPENT:** \$474,001

**BACKGROUND:** In 1996, the Cantara Trustee Council awarded a grant to the Regional Water Quality Control Board (RWQCB) to achieve four objectives: 1) collect water quality data, identify pollution sources and impacts, and establish baseline water quality conditions for the upper Sacramento River; 2) identify restoration work to address existing problems; 3) review proposed projects; and 4) increase the RWQCB regulatory presence for major point-source dischargers.

RWQCB staff monitored water quality and investigated causes and potential causes of pollution in the upper Sacramento River during summer and/or fall months beginning in June 1997, through February 2001. Monitoring activities included: 1) water temperature and quality (21 parameters) at twelve river stations and air temperature at three of those stations from 1997 through 2000; 2) water temperature at additional sites at the mouths of Soda, Castle, Hazel, Shotgun, North Salt, Slate and Mosquito Creeks in 1999 and 2000; and 3) effluent from the cities of Mt. Shasta and Dunsmuir wastewater treatment facilities. Of the parameters monitored, water temperature and sediments (suspended, settleable, and turbidity) are the most critical factors affecting aquatic life in the river.



**BENEFITS:** Based on the results of monitoring activities that took place within this grant agreement, several determinations were made regarding the water quality. River water temperature is mostly affected by tributary stream volume. Wet years with substantial snowpack result in higher and cooler tributary flows which keep the river cooler for a greater distance downstream of Box Canyon Dam. In dry years, maximum water temperatures downstream of Sims reach levels that are believed to be stressful to trout. Releases from Box Canyon Dam also affect river temperatures. In spring and early summer months, the releases tend to maintain lower river temperatures than during pre-dam conditions. In fall months, releases cause warmer river temperatures than would occur without the dam. Another factor in both river and tributary water temperature is shading. The presence of a vegetative canopy in the riparian zone of these drainages is mandatory for preventing temperature increases.

Erosion is being controlled in the river and tributaries except in Little Castle Creek where there is an active land slide, which is on USDA Forest Service land; efforts to address erosion from the slide are still continuing. Overall, the project determined that suspended and settleable sediment concentrations at river stations were less than levels believed to be detrimental to aquatic life. Metals, nutrients, and other chemical parameter results are generally indicative of unpolluted water that is supportive and non-limiting to aquatic life. However, more work is needed to determine if beneficial uses are impacted by natural sources of arsenic and nickel in the river. Effluent from the Mt. Shasta and Dunsmuir wastewater treatment plants was in compliance with RWQCB waste discharge requirements. These discharges are not believed to be limiting to aquatic life or to pose a problem for public health, including body contact activities such as fishing and swimming.

**PRODUCTS RECEIVED:** In addition to quarterly reports, the Cantara Trustee Council received a final report titled "*Identification and Control of Pollution Sources in the upper Sacramento River*".

## *Upper Sacramento River Mollusk Field Guide*

**DATE FUNDED:** 2001

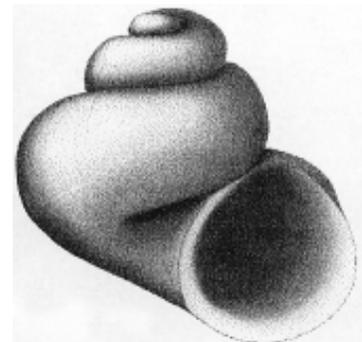
**DURATION OF PROJECT:** Seven years

**GRANTEE:** Deixis Consultants

**AMOUNT GRANTED:** \$231,805

**AMOUNT SPENT:** \$149,592

**BACKGROUND:** This grant funded Deixis Consultants to: (1) formally describe and name the many new species they discovered during the course of monitoring and sampling activities conducted as a result of the Cantara spill; (2) prepare a field guide of mollusks in the upper Sacramento River watershed; and (3) to print and distribute the field guide to interested parties. Deixis had previously completed mollusk surveys in 1991 -1997 as part of the initial Cantara spill response and recovery efforts. Response and assessment efforts after the Cantara spill were hampered by a lack of detailed information about mollusk populations in the upper Sacramento River. Follow-up surveys found mollusks to be severely impacted and among the slowest fauna to recover from the spill. As it was found that no additional efforts could increase the speed of natural mollusk recovery, the Council decided that study, description, and the naming of these new species would provide the best restoration that could be taken. In addition, a color field guide would enhance the opportunities to educate scientists, resource managers, the interested public, and others about the mollusk fauna of the upper Sacramento River watershed. For the scientific papers, Deixis collaborated with researchers from the U.S. Natural History Museum (Smithsonian), University of Denver, and the University of Alabama. Deixis also coordinated collecting specimens and material for morphological, anatomical, scanning electron micrographs, and DNA work to make taxonomic determinations. For the field guide, Deixis prepared all components of the guide, including text, illustrations, specimen and habitat photographs, drawings, and maps. Over 550 sites were mapped and reviewed in the process of developing the field guide.



**BENEFITS:** The first scientific paper, Rissoidan Snails from the Pit River Basin, California by R. Hershler, T.J. Frest, H.-P. Liu, and E.J. Johannes (The Veliger 46 : 275-304, 2003) treated Pit River basin populations of *Pyrulopsis* and *Colligyrus*. The second technical paper: Extensive diversification of the pebblesnails (Lithoglyphidae: *Fluminicola*) in the upper Sacramento River basin, northwestern USA by R. Hershler, H-P Liu, T.J. Frest, and E.J. Johannes, was published in the Zoological Journal of the Linnean Society (149: 371-422, 2007), and described 13 new species of *Fluminicola*. The information gathered in this project is critical for understanding the integral role mollusks play in a healthy lotic riparian habitat. Mollusks are significant components of the ecosystem, both as consumers of algae and detritus, and as a source of food themselves for fish, birds, and other riparian species.

Though not as obvious as insects, mollusks actually represent the majority of invertebrate biomass in the aquatic system. In fact, mollusks are a better indicator than insects of a stream's biogeography and past climate, environment, and drainage history. That is because, though slower to recover, mollusks are also generally more stable and difficult to eradicate than insect species. For example, they are more likely to survive changes in annual precipitation and water flow. Surveys conducted to prepare the field guide identified several new mollusk species found to be endemic to the upper Sacramento River and it is likely that isolated unidentified species were completely eradicated by the Cantara spill.

The field guide will be a valuable resource, filling a previous void about these unique and essential members of benthic ecosystems. Biologists, ecologists, agency employees, and groups involved in mitigation will find the guide an excellent reference in surveying and monitoring for these organisms. It also serves to stimulate interest in these often overlooked invertebrates and can be a useful tool for fishermen. Finally, the taxonomic data and established naming of new endemic species could have an affect on future impact surveys in the upper Sacramento River area.

As of June 2007, the field guide was still in preparation, its completion has been slowed by the complexity of identifying the new species and thus must await the completion of that work to make the field guide as comprehensive and complete as possible. At this time it's projected completion date is mid-year 2008, and it will be distributed to public natural resource agencies, and will be available for purchase by the public.

**PRODUCTS RECEIVED:** Bimonthly progress reports  
Field guide  
Copies of scientific papers

## *Upper Sacramento River Mollusk Identification and Recovery Monitoring*

**DATE FUNDED:** 2001

**DURATION OF PROJECT:** Three years, three months

**GRANTEE:** Deixis Consultants

**AMOUNT GRANTED:** \$117,840

**AMOUNT SPENT:** \$82,511

**BACKGROUND:** In 2001, the Cantara Trustee Council (Council) funded Deixis Consultants to conduct additional mollusk identification and monitoring studies on the upper Sacramento River (River). Deixis had been funded by the Council in 2000 to research and produce a field guide for River mollusks<sup>1</sup> and had previously completed mollusk surveys in 1991 - 1997 as part of the Cantara spill response and recovery efforts.

For mollusk identification, Deixis conducted field work to collect specimens and material for morphological, anatomical, and DNA analysis of the genus *Juga*, of which, more potential species were being encountered. The DNA work was subcontracted to the University of Alabama. Recovery monitoring involved resurveying nine sites previously surveyed in 1993, 1994, and 1996 along the River between the mouth of Campbell Creek and Box Canyon Dam. Quadrat sampling was conducted using the same methodology from previous years and water quality was monitored as well (temperature, dissolved oxygen, pH, total dissolved solids, and conductivity).

In 2006, the Council granted an additional \$50,400 to Deixis for continued work on *Juga*. In the original budget, it was anticipated that there would be five new *Juga* species and by 2006, it appeared there would be approximately 16-19 potential new species. The greater number of new species will add many new pages to the mollusk field guide in preparation by Deixis (which was funded by the Council) and approximately \$15,000 of the \$50,400 will be used for the enlarged field guide.



**BENEFITS:** Deixis conducted mollusk identification field work and data analysis and synthesis and coordinated with subcontractors for DNA work, scientific illustrations, maps, scanning electron micrographs, and anatomical drawings. They also coordinated collaboration between subcontractors to interpret, synthesize, and analyze morphological, anatomical, and DNA analyses to make taxonomic determinations. A minimum of 15 species of *Juga* were identified in the upper Sacramento River watershed through this project, which triples the number of species previously thought to live in the watershed. Two papers which are in the manuscript phase and will be submitted for publication are: (1) Molecular and anatomical evidence on the phylogeny of the freshwater gastropod *Juga* (Gastropoda: Cerithioidea: Pleuroceridae: Semisulcospirinae) from the northwestern United States, by Terrence Frest, David Campbell, Stephanie Clark, Edward Johannes, and Charles Lydeard; (2) On the anatomy and systematics of *Juga* from western North America (Gastropoda: Cerithioidea: Pleuroceridae), by Ellen E. Strong and Terrence Frest.

Recovery monitoring was conducted in 2002-2003. As of spring, 2007, the report was nearing completion, so no summary results are available for this sheet.

**PRODUCTS RECEIVED:** The Council received bimonthly reports on mollusk identification activities and manuscript reprints from the taxonomic papers treating Sacramento basin populations of *Juga* and *Vorticifex*, including a description of new species recognized.

A special workshop was organized by Terrence Frest (Deixis) for the 2006 joint annual meeting in Seattle, Washington, of the American Malacological Society and the Western Society of Malacologists and titled "Contributed Workshop: New Frontiers in Western U.S. Non-marine Malacology", to discuss much of the research work of Deixis, that has been extensively supported by the Council during the past seven years.

A final report on recovery monitoring results is nearing completion as of Spring 2007.

<sup>1</sup>See Upper Sacramento River Mollusk Field Guide summary.

## *Upper Sacramento River Mollusk Recovery Monitoring*

**DATE FUNDED:** 1996

**DURATION OF PROJECT:** Nine months

**GRANTEE:** Deixis Consultants

**AMOUNT GRANTED:** \$36,820

**AMOUNT SPENT:** \$36,012



**BACKGROUND:** Immediately following the Cantara spill and continuing through 1994, the California Department of Fish and Game contracted with Deixis Consultants (Deixis) to study the recovery of upper Sacramento River (River) mollusks. Survey results of the 1994 field season showed that mollusks suffered widespread reduction and even extirpation in some areas, as a result of the spill. Because the mollusk populations were showing very little signs of recovery, the Cantara Trustee Council funded Deixis to continue mollusk surveys on the River in 1996. The goals of the study were to: 1) resurvey a selection of sites along the River from the initial Cantara spill survey and from those sampled in 1994; 2) survey selected new sites along the River and; 3) survey major tributaries of the River to locate colonies of certain mollusk species for potential reintroduction into the River. Surveys on the mainstem of the river were conducted to: 1) determine spill effects on the mollusk fauna, by assessing species occurrence and densities upstream and downstream of the spill site; 2) make determinations of the likelihood of the extent and timing of natural re-colonization by individual species; and 3) make recommendations for possible recovery of mollusk species through planned re-introductions.

**BENEFITS:** The primary benefit of this monitoring study was to further advance knowledge of the mollusk species inhabiting the watershed. Prior to the Cantara spill no complete surveys had been undertaken of the watershed for mollusk species. As surveys were completed, and the collections made, it became apparent that there were many species new to science that would require formal descriptions and names.

For a number of mainstem river species no tributary populations were found. At some of the mainstem refugial sites, established in previous surveys, there were indications that slight density increases had occurred. Other refugial colonies appeared smaller or less densely populated than in 1994. None of the mainstem sites showed improvement for such rare taxa as *Juga* spp., and at one of the few river sites for this genus, no individuals could be found in 1996. A small population of *Vorticifex* not present in 1994 was located, indicating that re-colonization from unknown sources might have occurred.

Surveys revealed that many tributaries have sparse mollusk faunas. Often the tributary species required specialized microhabitats, such as small-stream or springs, and hence would be unlikely to survive in the mainstem of the river. Other species were found in such small numbers at tributary sites that they would not serve as sources for reintroduction. Several tributary streams with reaches showing recent dredging or mining appeared devoid of mollusks; other reaches, showing effects from a combination of logging, grazing, and human habitation, had mollusk species which appeared to be much reduced in numbers and distribution from what would be expected in equivalent healthy habitat.

Reintroduction of mollusks was determined to be too risky as they may spread microorganisms or parasites into areas of the upper Sacramento ecosystem that they do not currently inhabit.

Overall, the mainstem showed initial signs of re-colonization by mollusks, but rates of recovery were far below those of other organisms affected by the spill. The Cantara spill completely decimated all mollusks in the mainstem river. Natural recovery has had insufficient time to occur and has been incomplete. Unfortunately, no comprehensive surveys for mollusks in the upper Sacramento River watershed were conducted prior to the spill, so pre-spill distribution and abundance of species will never be known with certainty. Natural recovery will be a very slow process that will take many decades to achieve.

**PRODUCTS RECEIVED:** The Cantara Trustee Council received a final report titled "*Upper Sacramento System Freshwater Mollusk Monitoring, California with Particular Reference to the Cantara Spill, 1996 Yearly Report*".

## *Upper Sacramento River Rainbow Trout Genetics*

**DATE FUNDED:** 1996

**DURATION OF PROJECT:** One year, five months

**GRANTEE:** USDA Forest Service, Pacific Southwest Forest

**AMOUNT GRANTED:** \$59,996

**AMOUNT SPENT:** \$59,996

**BACKGROUND:** In 1994, the California Department of Fish and Game (DFG) contracted with Dr. Jennifer Nielsen of the USDA Forest Service, Pacific Southwest Forest, to conduct genetic analyses and re-colonization patterns of rainbow trout in the upper Sacramento River and compare them to samples taken of dead fish from the Cantara spill. Rainbow trout were analyzed for mitochondrial DNA (mtDNA) and nuclear microsatellite polymorphisms using fish killed by the Cantara spill, hatchery strains of rainbow trout, and wild trout populations from the river and its tributaries, collected in 1993. Study results led to several questions about the evolutionary significance of unique trout populations found in the river, their relationship to other trout populations in northern California, and the potential impacts of hatchery stocked trout movement from reservoirs into adjacent wild trout populations. Because of this, the Cantara Trustee Council awarded this grant in 1996 to continue genetic analyses on rainbow trout from the upper Sacramento River, its tributaries, and hatchery populations. DFG had closed the river and all its tributaries to sport fishing for three years after the Cantara spill. Trout stocking and sports capture was initiated again in 1994. This project sought to address several questions including: How did mainstem habitats recruit their current trout numbers? What type of genetic population structure can evolve over the short-term following a fish-kill event? What type of management strategy should be in place for recreational fishing and wild trout conservation?



**BENEFITS:** Genetic analyses were performed on 939 wild rainbow trout collected from throughout the mainstem of the upper river, and in eight tributaries, during 1993 and 1996. Wild trout genotypes were compared to 104 Mt. Shasta Hatchery rainbow trout. Collections of wild trout made in 1993, two years after the spill, showed close genetic ties between upper Sacramento River tributary populations and mainstem fish in the upper watershed, suggesting re-colonization of the upper mainstem directly from adjacent tributaries. Trout collections made in 1996 showed significant genetic variation for mitochondrial DNA and microsatellites when compared to fish from the same locations in 1993. Five years after the spill, no significant genetic associations were found between mainstem trout populations and geographically proximate trout. Wild rainbow trout captured in the upper Sacramento River, and its tributaries, were found to differ genetically from Mt. Shasta Hatchery trout for both years. The notable exception to this were trout collected in the lower mainstem river near Shasta Lake; mitochondrial DNA and microsatellite data suggested upstream colonization by hatchery fish from the lake into the lower reaches of the river.

These findings demonstrated that wild trout were genetically different from hatchery trout stocked into the upper Sacramento River. This finding was important in developing a strategy to allow the wild fish to recover substantially before allowing stocking. Upper Sacramento River wild trout population recovery was dependent on wild trout descending from tributaries and re-establishing themselves down the full length of the river. The study further indicated that this re-population process was well underway by 1996. The results of the genetic study were instrumental in developing angling regulations that ensured wild trout were re-established before fish harvesting opportunities were permitted.

**PRODUCTS RECEIVED:** The Cantara Trustee Council received a report titled "*Molecular Analysis of Population Genetic Structure and Recolonization Trends in Rainbow Trout following a Fish-Kill Event*".

## *Upper Sacramento River Rapid Bioassessment Project*

**DATE FUNDED:** 2001

**DURATION OF PROJECT:** Five years

**GRANTEE:** California Department of Fish and Game

**AMOUNT GRANTED:** \$12,452

**AMOUNT SPENT:** \$6,072

**BACKGROUND:** This Cantara Trustee Council grant funded the California Department of Fish and Game (DFG) to assess aquatic macroinvertebrates in the upper Sacramento River. Project objectives were to conduct three annual spring and fall assessments at three sites (one each on the upper, middle, and lower river reaches) from Box Canyon Dam to Shasta Lake. The grant was subsequently extended for two more years of study and analysis. Established rapid bioassessment techniques were used to collect and analyze macroinvertebrate samples. The collection protocol was coordinated with a sampling program conducted by the Department of Water Resources — Red Bluff (DWR). DFG Wild Trout Program staff implemented the project, which included training volunteers to assist in the collections. This allowed for continued aquatic macroinvertebrate monitoring beyond the length of this funding. Samples collected were forwarded to a qualified private lab or college for processing and identification. A duplicate set of specimens was submitted to the California Academy of Sciences for deposition.



**BENEFITS:** Samples were collected in 2001, 2002, 2003, and 2004. Initially, samples were collected in both the spring and fall, but it was found that the spring sample had too much variance, due to changes in annual winter weather to be a reliable indicator. So, the later spring samples were cancelled and only the more stable fall survey was conducted. Thanks to the volunteer participation and coordination with the DWR program, the contract proved to be a very low cost, but extremely valuable assessment project. The specimens collected were archived for long-term maintenance and referral. The assessment findings provide a trend analysis of stream flow and macroinvertebrate variation for over 15 taxa. This analysis, in turn, provides insight into the health of wild trout populations and of the upper Sacramento River ecosystem overall. The trained volunteers provide continuity for continued assessments and future stewardship of the river watershed.

**PRODUCTS RECEIVED:** Bimonthly progress reports  
Annual reports  
Report on collaboration between this project and the DWR sampling program  
Report on long-term maintenance of program beyond contract end

## *Upper Sacramento River Riffle Sculpin Population Assessment*

**DATE FUNDED:** 1996

**DURATION OF PROJECT:** Two years

**GRANTEE:** Thomas R. Payne and Associates

**AMOUNT GRANTED:** \$75,531

**AMOUNT SPENT:** \$52,825

**BACKGROUND:** Immediately following the Cantara spill, Thomas R. Payne and Associates (TRPA) contracted with the California Department of Fish and Game to document the rate of fish population recovery in the affected reach of the upper Sacramento River (River). Riffle sculpin (*Cottus gulosus*) were the most abundant fish in the River at the time of the spill; it is estimated that over 700,000 perished. Due to a low reproduction rate and poor dispersal capabilities, initial recovery rates were much slower for sculpin than for many other species. This led to concern over their ability to repopulate the affected reach. Sculpin abundance estimates prior to 1996 showed extreme variation in densities, particularly below Mears Falls, which may act as a migrational barrier. Mears Falls is a whitewater cascade section of the River upstream of the confluence with Mears Creek.

To better determine the recovery of riffle sculpin populations, the Cantara Trustee Council (Council) awarded a grant to TRPA to conduct quadrat sampling of riffle sculpin in the River, during 1996 and 1997. The goal of the study was to describe the abundance of sculpin in the River. The river was divided into three sections. The lower reach runs from Mears Falls, downstream to the mouth of Campbell Creek, near the point where the



River feeds into Shasta Lake; and the middle reach extends from Mears Falls, upstream to the Cantara Loop Bridge. Mears Falls is about halfway between the Cantara Loop and Shasta Lake. These two reaches represented the spill-affected portions of the River. The upper reach, extending upstream from the Cantara Loop to Box Canyon dam, was only surveyed in 1997 and was used for control comparison purposes.

In both years, 20 run habitats were surveyed in the lower and middle reaches. In 1997, 20 run habitats in the upper reach were also surveyed. Additionally, three pool and three riffle habitats in each reach were sampled in 1997 to compare densities and size distributions of sculpin according to habitat type.

**BENEFITS:** In 1996, twenty counts produced an overall population estimate of 732,885 riffle sculpin in the lower and middle reaches combined, which was a 49 percent increase from 1995. However, the rate of increase in the lower reach (21%) was much less than in the middle reach (85%). Still, the estimated density of sculpin in the lower reach remained greater (68,572 fish per mile) than in the middle reach (60,565 fish per mile). Sculpin also appeared to be successfully repopulating previously low density areas above Mears Falls and in the vicinity of Dunsmuir.

In 1997, riffle sculpin counts remained relatively stable at an estimated 762,643 fish in the lower and middle reaches, combined. However, overall sculpin density declined 15 percent compared to 1996. The decline was entirely in the lower reach, which was the first time that reach had a density decrease since sampling began in 1994. The density estimate for the lower reach was 42,818 fish per mile, a 38 percent decrease; the middle reach density was 62,717 fish per mile, a moderate increase of 4 percent. These changes could be due to random factors, but channel scouring that resulted from a January 1997 flood event probably caused considerable mortality to this species. The proportion of adult sculpin captured in 1997 in the two spill-affected reaches (10%) remained lower than the proportion captured in the control reach (19%), which may indicate that the fish population was still recovering from the Cantara spill. However, the degree of inter-annual variation to be expected in a "healthy population" is still unknown.

These surveys provided important information on the River's continued recovery from the Cantara spill. The findings were helpful to additional planning and funding decisions made by the Council.

**PRODUCTS RECEIVED:** The Council received one draft report titled "*Draft Report Describing Fish Distribution and Abundance in the Upper Sacramento River, July-October 1996*" and one final report titled "*Recovery of Fish Populations in the Upper Sacramento River following the Cantara Spill of July 1991, 1997 Annual Report*".

## *Upper Sacramento River Riparian Riprap Revegetation Project*

**DATE FUNDED:** 2001

**DURATION OF PROJECT:** One year, eight months

**GRANTEE:** Upper Sacramento River Exchange

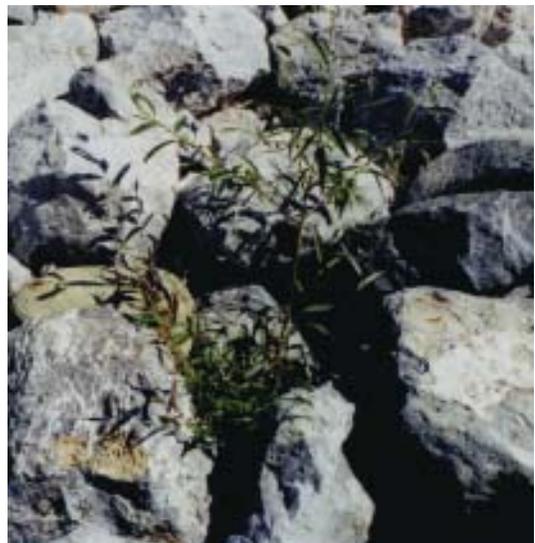
**AMOUNT GRANTED:** \$45,200

**AMOUNT SPENT:** \$40,725

**BACKGROUND:** In 2001, the Cantara Trustee Council (Council) funded the Upper Sacramento River Exchange to plant 11,200 native willow cuttings among railroad riprap adjacent to the upper Sacramento River (River). This grant expanded the successful elements of a pilot project, funded by a Council minigrant and implemented during winter and early spring of 2000, to suitable sites on the entire River. All plantings were within the railroad right-of-way.

The project included two phases: January-November, 2002 and January-June, 2003. Each phase consisted of four elements: 1) Project Design; 2) Preliminary Site Survey; 3) Planting; and 4) Monitoring. Project design included safety protocol and written materials development, staff preparation and scheduling, equipment and materials acquisition, and coordination with Union Pacific Railroad. Site surveying included all riprap environments adjacent to the railroad right-of-way from the Cantara Loop downstream to Campbell Creek at Shasta Lake.

Surveys identified 27 potential riprap sites along the River and rated them from poor to good. Fourteen of the best sites were selected for Phase 1 and the project expanded to 22 sites for phase 2. Willow cuttings were planted in rock crevices as close to the waterline as possible. Monitoring was conducted at randomly selected sites during the last two



months of each phase to determine willow cutting survival rates and general site conditions. Based on pilot study experience, a target for success was set as a cutting survival rate of at least 50 percent.

**BENEFITS:** A total of 2,325 willow cuttings were planted during Phase 1. An additional 3,165 cuttings were planted in Phase 2. Of the 5,490 total cuttings planted, an average of 56 percent survived at the time of monitoring for each phase, which exceeded the target of 50 percent survival. Total cuttings were below projected amounts because, based on Phase 1 experience, a different, more labor intensive and time consuming procedure was used for most of the cuttings in Phase 2.

Survival rates were highest for those cuttings planted closest to the waterline. Cuttings placed higher up the riprap slope were more likely to dry out before becoming well established. Survival rates were also higher for the upper reaches of the River compared to the lower. This was due to a greater waterline change in the lower reaches caused by increased seasonal influxes from tributaries.

Another lesson learned was how important cooperation and support from the railroad was for site access. Close communication with the railroad is recommended for similar future projects. It was also found that the riprap sites themselves were difficult to work on and required professional staff. The rugged site planting conditions were deemed inappropriate for volunteer helpers though volunteers were helpful for other steps, including gathering willow cuttings.

The project provided multiple benefits to River plant and animal communities which rely on its ecosystem. These direct in-kind benefits will improve the aquatic environment through sediment reduction, bank stabilization, and increased habitat and shading. Long-term survival of the plantings may also increase connectivity in the riparian corridor as the railroad riprap areas will no longer represent a break in otherwise continuous riparian habitat.

**PRODUCTS RECEIVED:** Final report for Phase I and Phase II

## *Upper Sacramento River Vegetation Baseline Project*

**DATE FUNDED:** 2001

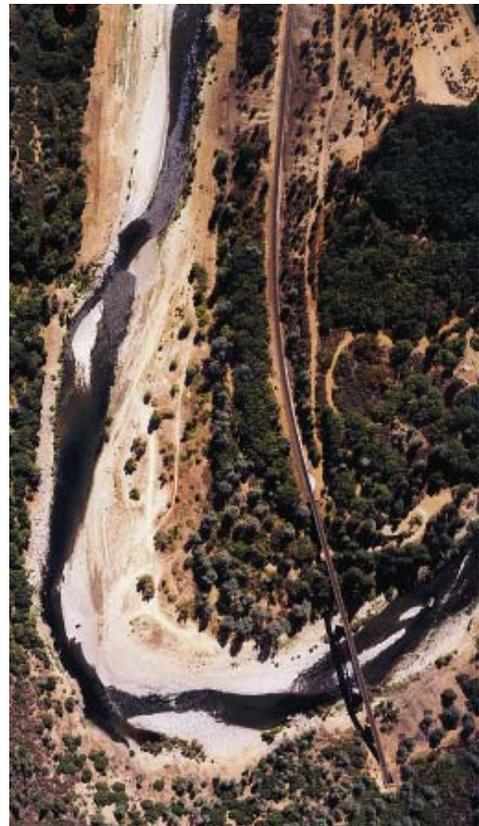
**DURATION OF PROJECT:** Four years

**GRANTEE:** CSU, Chico Research Foundation

**AMOUNT GRANTED:** \$186,755

**AMOUNT SPENT:** \$152,018\*

**BACKGROUND:** This grant by the Cantara Trustee Council funded the California State University (CSU), Chico Research Foundation to produce baseline data and a map of the riparian vegetation for the upper Sacramento River from Box Canyon Dam to Shasta Lake. The project was conducted through the CSU, Chico Research Foundation under Cantara Trustee Council staff supervision and utilized the services of the Geographic Information Center at CSU, Chico. Though much data was collected during the Cantara program from 1991- 1997, it was determined that new technological developments could now provide greater resolution, detail, and accuracy than previously available. Existing data also lacked information on the significant impacts experienced by upper Sacramento riparian communities from high river flows in 1997 and 1998. The project included plant community delineation (polygoning), arcview analysis, GIS work, data collation, harmonization, analysis, map and graphics production, comparative analysis, report preparation, field ground-truthing, and selected plot re-sampling. In addition, 1991 map



overlays were developed to compare and contrast with the 2001 findings. Ten year vegetation recovery statistics for the spill impacted area were then calculated.

**BENEFITS:** All previous vegetation data from the Cantara program was utilized and a new flight-line of aerial photographs was taken in 2001. This detailed riparian vegetation baseline of the upper Sacramento River corridor provides a ten-year comparison to Cantara spill vegetation analyses from 1991. It also will be useful in future studies of this watershed and will be valuable for other future studies of wildlife habitat for species which utilize, or are dependent on, riparian vegetation.

**PRODUCTS RECEIVED:** In addition to monthly progress reports and a final report, this project will also produce a table of previously collected Cantara vegetation data. Electronic and hard copy versions of maps, graphics, and interpretation work will also be provided, as well as a copy of the new aerial photograph flightline for 2001.

\*Grant still open as of March 2007.

## *Upper Sacramento River Warden Staffing*

**DATE FUNDED:** 1997

**DURATION OF PROJECT:** Three years

**GRANTEE:** California Department of Fish and Game

**AMOUNT GRANTED:** \$278,583

**AMOUNT SPENT:** \$227,253

**BACKGROUND:** The Cantara Trustee Council (Council) funded the California Department of Fish and Game (DFG) to provide a warden dedicated to the upper Sacramento River (River) from 1997 to 2000.

Prior to the Cantara spill, a warden was not dedicated to the River. Subsequent to the spill, DFG found it necessary to staff a warden to monitor various post-spill activities on the River, especially enforcing new fish angling regulations specific to the upper River. The position was initially funded, from closure of the river after the Cantara spill until June 30, 1997, through a Cantara Restoration and Monitoring Account established at DFG. When funding from that account ended, the Council opted to continue warden funding with this grant. Regular DFG staff continued to provide supervisory and administrative support to the warden throughout the grant term.

**BENEFITS:** Continued funding for a warden dedicated to the River provided a physical presence to deter violations of laws and regulations designed to protect River resources. Obtaining compliance to new and changing angling regulations was particularly important to ensure River recovery. When violators were identified, the warden took action through the criminal justice system. Additionally, the warden was able to observe and monitor resource related activities, such as dredging, logging, and streambed alterations within the watershed. This helped ensure water quality was protected, as he was available to provide immediate response to pollution and/or hazardous materials incidents on the River.

Over 90 percent of the warden's contacts with people were to provide public information and education related to River resources status, studies, and special regulations. This friendly public figure provided a critical presence to ensure compliance and support for resource regulations, helping make River fishery management successful.

**PRODUCTS RECEIVED:** The DFG maintained records on contacts made and documented required enforcement actions. During the course of the grant, the files were available upon request from the Council.



## *Upper Sacramento River Watershed Conceptual Acquisition Plan - GIS*

**DATE FUNDED:** 1997

**DURATION OF PROJECT:** Two years

**GRANTEE:** Department of Fish and Game - GIS Division

**AMOUNT GRANTED:** \$30,426

**AMOUNT SPENT:** \$30,426

**BACKGROUND:** One of the primary goals of the Cantara Trustee Council (Council) was habitat acquisition and resource protection. Specifically, habitat was acquired for the purpose of protecting its resources. To assist the Council in this effort, an Upper Sacramento River Resource Protection Plan (RPP) was developed. Part of that plan was based on Geographic Information System (GIS) techniques to identify, prioritize, and select parcels for acquisition by the Council within the upper Sacramento River watershed. In 1997, the Council funded the Department of Fish and Game (DFG) GIS Division to support this effort.

The DFG Northern California/North Coast Region GIS unit implemented the grant and coordinated with concurrent Council grants for plant community characterization and mapping with KEA Environmental<sup>1</sup> and the California State University, Chico Research Foundation<sup>2</sup>. These projects, in turn, provided additional data for the RPP. DFG GIS staff identified, gathered, and developed data for parcels in the upper Sacramento River watershed based on parcel selection criteria established by the Council to purchase and protect:

- equivalent natural resources to offset habitat losses from the spill that cannot be replaced through restoration and enhancement;
- landscape linkages connecting the upland and stream side parts of the watershed;
- biological resources most affected by the spill from further degradation; and
- biological resources and human use values.

GIS staff gathered and developed data layers that included roads, soils, hydrology, parcels, vegetation, watershed boundaries, wildlife values, threatened and endangered species, public ownership, fire potential, and land use. DFG GIS also factored in the ENPLAN gap analysis<sup>3</sup> efforts, such as parcel maps. The data were mapped and analyzed in keeping with the Council's

acquisition objectives as well as other management considerations such as parcel size, access, adjacent land use, restoration potential, and the ability of a parcel to maintain its resource values over time.

**BENEFITS:** This GIS-based analysis represented a very sophisticated use of this analytical tool. Methodology used encompassed a detailed and disciplined approach that served as a model for other acquisition efforts. Resulting acquisition priorities had a sound scientific basis that could be easily explained or defended.

Parcel analysis in the upper Sacramento River watershed was used by Council staff to develop a comprehensive resource protection plan. The effort put into developing the plan was a measure of the Council's interest in making best use of funds at its disposal.

The RPP enabled the Council to be proactive in directing acquisition efforts toward certain protection goals and to better evaluate the merits of public proposals. For acquisition efforts, the plan identified and analyzed 89 parcels along the upper Sacramento River. Of these, 13 were identified as having the most value towards achieving the Council's resource protection goals. The majority of these were later eliminated from consideration either because the owner did not want to sell, or did not want to sell at a price based upon the property's appraised value.

However, three of these high priority parcels were successfully purchased. These properties are further discussed under a separate grant summary<sup>4</sup>.

**PRODUCTS RECEIVED:** Monthly progress reports  
Final data layers, maps, and analysis in electronic format

<sup>1</sup> See Upper Sacramento River Watershed Plant Community Characterization summary.

<sup>2</sup> See Upper Sacramento River Watershed Plant Community Mapping summary.

<sup>3</sup> See Upper Sacramento River Watershed Gap Analysis summary.

<sup>4</sup> See Sacramento River Property Acquisition summary.

## *Upper Sacramento River Watershed Gap Analysis*

**DATE FUNDED:** 1996

**DURATION OF PROJECT:** One year

**GRANTEE:** Enplan Environmental Scientists and Planners

**AMOUNT GRANTED:** \$32,490

**AMOUNT SPENT:** \$32,490

**BACKGROUND:** The Cantara Trustee Council (Council) funded ENPLAN Environmental Scientists and Planners to identify resource protection and acquisition priorities within the upper Sacramento River watershed (from Campbell Creek above Shasta Lake to Box Canyon dam) using a gap analysis methodology. ENPLAN proposed to collect GIS data of the upper Sacramento River canyon showing land ownership and physical features, and to perform an information gap analysis. ENPLAN also proposed to hold a workshop for the Council and Department of Fish and Game (DFG) staff to provide preliminary analysis and recommendations regarding resource protection and acquisition priorities. After initiating the project, it became apparent that there was not sufficient base information available to do a gap analysis. The project scope was reworked to focus exclusively on the biggest need, which was to develop assessor parcel coverage data to support Council resource protection activities.

**BENEFITS:** This project helped the Council meet its goal for study and research and provided data to aid the Council's goal for resource protection and acquisition. ENPLAN produced parcel map data for major portions of the watershed showing ownership that was tied to physical features, such as rivers, lakes, and streams, roads and railroads, and topography. These data sets were used by the DFG Geographic Information Systems (GIS) unit to produce maps for analysis by Council staff<sup>1</sup>. Although a formal gap analysis was not possible, parcels for which information was not available provided a de facto sense of gaps in available data. The GIS property ownership layer helped the Council identify key areas for resource protection and prioritize appropriate conservation actions for specific sites.

**PRODUCTS RECEIVED:** Draft and final report  
Supporting maps in digital formats

<sup>1</sup> See Upper Sacramento River Watershed Conceptual Acquisition Plan — GIS summary.

## *Upper Sacramento River Watershed Plant Community Characterization*

**DATE FUNDED:** 1997

**DURATION OF PROJECT:** One year

**GRANTEE:** KEA Environmental

**AMOUNT GRANTED:** \$170,905

**AMOUNT SPENT:** \$170,889



**BACKGROUND:** The Cantara Trustee Council (Council) funded KEA Environmental (KEA) in 1997 to survey, sample, and characterize plant communities in the entire upper Sacramento River watershed.

In 1991, the California Department of Fish and Game (DFG) collected vegetation data from transects within the spill impacted area between the Cantara Loop and the edge of Shasta Lake. The data were used to quantify plant composition, density, diversity, and to evaluate injury and mortality to riparian vegetation due to the spill. Additional data was collected from transects upstream from the spill and from several tributaries to provide controls. Follow-up data was collected from these transects in 1992 and 1993 and from a subset of sites in 1994.

For this project, KEA revisited the 1994 survey sites and expanded the survey to include the entire upper Sacramento River watershed. Information

on all upper Sacramento River watershed vegetation was identified as an important unmet need in another Council-funded grant that conducted an information gap analysis<sup>1</sup>. KEA also worked cooperatively with the California State University Chico Foundation (Foundation) to map plant community distributions within the upper Sacramento River watershed under another separate agreement with the Council<sup>2</sup>.

This project included three primary tasks: 1) pre-field studies; 2) plant community characterization; and 3) ground-truthing aerial photos and supplementary plant community characterization. For the pre-field studies, the grantee collected and reviewed existing information on vegetation resources in the watershed, developed a data collection methodology and sampling protocol, coordinated with Humboldt State University to obtain plot locations and assess the accuracy of Landsat image classification, and obtained permission from private landowners to collect vegetation data on their property. The plant community characterization was then implemented following the developed methodology. The ground-truthing and follow-up characterization activities were coordinated with the Foundation which conducted an aerial survey of the upper Sacramento River and watershed<sup>2</sup> and DFG Geographic Information System (GIS) staff. Mapping data was further utilized for other GIS projects<sup>3</sup>.

**BENEFITS:** Data on species composition, vegetation cover, and density were collected from 380 plots throughout the upper Sacramento River watershed. This information was then used to describe plant communities and classify vegetation into wildlife habitat types using the DFG's Wildlife Habitat Relationships System.

The new vegetation maps were used by the Council to model habitat values for spill-affected wildlife. Using this application in a GIS framework greatly assisted the Council and other land managers to focus conservation efforts within the watershed. The information was an important contribution to the Council's Resource Protection Plan.

This project also provided documentation on more than 30 special status plant populations and a data set that could be used in the future to assess the accuracy of large scale satellite mapping efforts.

**PRODUCTS RECEIVED:** The end product for this project was a vegetative data set produced and utilized by the Foundation and DFG GIS staff. KEA's data set and ground truthing results were utilized within other projects (as mentioned above).

<sup>1</sup> See Upper Sacramento River Watershed Gap Analysis summary.

<sup>2</sup> See Upper Sacramento River Watershed Vegetation Mapping summary.

<sup>3</sup> See Upper Sacramento River Watershed Conceptual Acquisition Plan — GIS summary

## *Upper Sacramento River Watershed Plant Community Mapping*

**DATE FUNDED:** 1997

**DURATION OF PROJECT:** Two years

**GRANTEE:** California State University, Chico Research Foundation

**AMOUNT GRANTED:** \$136,781

**AMOUNT SPENT:** \$136,781

**BACKGROUND:** In 1997, the Cantara Trustee Council (Council) funded two grants, summarized here, with the California State University, Chico Research Foundation (Foundation), in coordination with the university's Geographic Information Systems (GIS) unit, to map vegetation in the upper Sacramento River (River) watershed.

In 1991, the California Department of Fish and Game (DFG) collected vegetation data from transects within the impact assessment area for the Cantara spill between the Cantara Loop and the edge of Shasta Lake. The data was used to quantify plant composition, density, and diversity, and to evaluate injury and mortality to riparian vegetation due to the spill. Additional data was collected from transects upstream from the spill site and from several tributaries to provide controls. Follow-up data was collected from these transects in 1992 and 1993 and from a subset of sites in 1994. In 1996, the Council funded ENPLAN to conduct an upper Sacramento River gap analysis<sup>1</sup> which identified an absence of vegetation map data for the drainage. The Council responded in 1997 by funding a grant with KEA Environmental (KEA) to revisit the subset of transect sites from the 1994 survey and to develop a plant community characterization for the entire upper Sacramento River watershed<sup>2</sup>.

The Foundation grants were closely linked with the KEA study and further coordinated with DFG GIS staff to feed into larger mapping efforts for the Council to help establish land acquisition priorities<sup>3</sup>.

Foundation staff used a combination of aerial photo interpretation and ground-truthing to identify and map plant communities within the upper Sacramento River watershed. The entire watershed was aerially photographed with color infrared equipment in the summer of 1997. The color infrared photos were digitized and synchronized with map control points using United States Geological Survey digital quadrangles, Global Positioning System units, and other sources. Field inspections were conducted by the

mapping team and by KEA to verify general vegetation classifications made through photo interpretation. Finally, the data was woven into GIS computer applications to create maps that showed vegetation classifications and allowed integration of the vegetation overlays into other mapping applications.

**BENEFITS:** Data on species composition, vegetation cover, and density was collected from 380 plots throughout the upper Sacramento River watershed. This information was used to describe plant communities and classify vegetation into wildlife habitat types using the DFG's Wildlife Habitat Relationships (WHR) System.

The new vegetation maps were used by the Council to model habitat values for spill-affected wildlife. Using this application in a GIS framework greatly assisted the Council and other land managers with conservation efforts within the watershed.

This project also provided documentation on more than 30 special status plant populations and a data set that could be used to assess the accuracy of large scale satellite mapping efforts.

**PRODUCTS RECEIVED:** Monthly progress reports  
Copies of color infrared aerial photographs of the upper Sacramento River watershed  
Files with scanned images and digital orthophotographs  
Plant community coverages in Arc/Info format  
Metadata file with description of the coverages, vital statistics, data dictionary, and data quality assessment  
List of sites, GIS data layers, descriptions, and interactive model



<sup>1</sup> See Upper Sacramento River Watershed Gap Analysis summary.

<sup>2</sup> See Upper Sacramento River Watershed Plant Community Characterization summary.

<sup>3</sup> See Upper Sacramento River Watershed Conceptual Acquisition Plan — GIS summary.

## *Upper Sacramento River Winter Angler Survey*

**DATE FUNDED:** 2004

**DURATION OF PROJECT:** Six months

**GRANTEE:** Upper Sacramento River Exchange

**AMOUNT GRANTED:** \$11,818

**AMOUNT SPENT:** \$11,818

**BACKGROUND:** In 2004, the Cantara Trustee Council (Council) funded the Upper Sacramento River Exchange to provide two creel clerks to conduct angler surveys on the upper Sacramento River (River). With continued recovery of fish populations in the River, the California Fish and Game Commission (Commission) adopted a new regulation in 2004 to open the entire River, above Shasta Lake and below Box Canyon Dam, to winter fishing for two years. Angling was restricted to artificial lures with barbless hooks and a zero fish limit. The goal of the winter angling season was to maximize angler opportunity while minimizing effects on the wild trout population. The angler survey was developed to monitor the winter season results. Specific objectives of the angler survey were to estimate total angler effort, catch, and incidental trout hooking mortality; determine average catch rates and fishing methods; and identify levels of angler satisfaction and where the anglers came from. Survey methodology included a variety of observations, including one-on-one interviews with anglers, for a randomly selected portion of winter season days and sites.



**BENEFITS:** Surveys were conducted throughout the winter catch-and-release fishing season, which ran from November 16, 2004 through April 29, 2005. Results of the winter angler survey indicated that the Commission's goal was met. Projections estimated from the 191 anglers interviewed indicated that the season provided 7,316 additional hours of angler effort, and an estimated incidental hooking mortality of 242 trout, far less than the pre-season estimate of 1,500 trout. Angler satisfaction was high and, based on the survey results, the California Department of Fish and Game plans to recommend continuing the winter season regulation when the commission convenes in September, 2006. Having demonstrated that zero-fish-limit winter angling did not damage upper Sacramento River fishery resources, five other fisheries in California are also considering implementing a similar winter angling season.

**PRODUCTS RECEIVED:** The Council received periodic progress reports and a final progress report entitled, "*Upper Sacramento River Winter Season Angler Survey 2004-05.*"

## *Wagon Creek Fish Passage Enhancement*

**DATE FUNDED:** 2001

**DURATION OF PROJECT:** One year, one month

**GRANTEE:** California Trout, Inc.

**AMOUNT GRANTED:** \$78,480

**AMOUNT SPENT:** \$18,159

**BACKGROUND:** In 2001, the Cantara Trustee Council (Council) funded California Trout, Inc. (CalTrout) to improve fishery conditions in Wagon Creek by restoring fish passage to the crossing at North Shore Road. Wagon Creek is a tributary to Lake Siskiyou within the upper Sacramento River watershed. A perennial stream and important spawning tributary, trout access to Wagon Creek was limited to the lower half-mile of the creek due to a fish passage barrier at North Shore Road Crossing. The crossing consisted of two 10-foot diameter, 50-foot long culverts. One culvert was no longer carrying stream flow; the other provided a substantial fish passage barrier due to high water velocity and a significant drop at the outlet. Enhancing the crossing to permit fish passage would enable spawning trout to access eight stream-miles up to the headwaters of Wagon Creek near Mount Eddy. Anticipated results included improvements to floodplain access during peak events and reduced maintenance due to improved energy dissipation and flood flow dispersal from storm events.

The project was designed in two stages. Stage I was Planning, Design, and Permits which included a preliminary engineering analysis of the culvert location, hydrologic and geomorphology analysis of Wagon Creek, a cost-benefit analysis, and permit approval process. Stage II was Construction Stream Channel Enhancement, and Post-Construction Evaluation. This would include arch and bridge construction of the road, stream channel enhancement, and post-construction evaluation and monitoring to ensure the structure was meeting expectations.

**BENEFITS:** This project was cancelled before construction started. Stage I analysis found that the costs of the proposed work would be more than twice the originally estimated costs. This was because: 1) Siskiyou County required the road to remain open during construction; 2) flow requirements for the new culvert required a larger replacement than originally planned; and 3) these changes significantly increased associated planning and engineering costs. The Council reviewed the increased costs with CalTrout and, while the increased costs were not the grantee's fault, the Council determined to cancel the grant agreement and recover remaining funds.

**PRODUCTS RECEIVED:** Initial surveying, geomorphologic, and engineering design and analysis were completed. As the project was cancelled prior to the implementation stage, no final product was required.



## *Willow Creek Riparian Restoration Project*

**DATE FUNDED:** 1997

**DURATION OF PROJECT:** One year, five months

**GRANTEE:** Ducks Unlimited

**AMOUNT GRANTED:** \$10,500

**AMOUNT SPENT:** \$10,500

**BACKGROUND:** The Cantara Trustee Council (Council) funded Ducks Unlimited to implement riparian enhancement in a portion of Modoc National Forest, in Modoc County. Specifically, the project was to fence 3.5 miles of Little Willow and Fletcher creeks, plant native willows and cottonwoods, remove encroaching junipers, and implement a riparian grazing system on the pastures affected by the project.

Similar projects in the vicinity had resulted in significant improvements to riparian habitats. Herbaceous cover and woody riparian vegetation returned. Stream channels deepened, overhanging banks and vegetation developed, water temperatures decreased, and stream flow changed from ephemeral to mostly perennial as surface flow occurred well into the summer months. It was hoped that this project would achieve similar results.

The Council reimbursed Ducks Unlimited for the purchase of fencing materials, while the USDA Forest Service (Forest Service) constructed the fence, planted the willows and cottonwoods, and removed the junipers. The Forest Service also developed and managed a grazing plan.

**BENEFITS:** The 3.5 miles of fence actually enhanced six miles of riparian habitat, as two streams flow through the project area. The Forest Service owns the fence and has ongoing responsibility for project monitoring and maintenance.

Development of the willow/cottonwood overstory likely benefited the state-threatened willow flycatcher, as this species has returned to a similar project area downstream of this site. The two creeks currently have populations of Lost River and shortnosed suckers, as well as redband trout. The project resulted in reduced water temperatures, improved water quality, and longer periods of flow. Increases in deep pools within the streams provided refugia for these fish species during times of drought. Removal of junipers protected and enhanced a stand of aspen on the property, a species which provides benefits to many wildlife species.

Forest Service personnel report that good streambank recovery and regeneration of willows have occurred, to date.

**PRODUCTS RECEIVED:** 3.5 miles of fence  
Before and after photographs of the project site

