# STREAM INVENTORY REPORT

# GREEN RIDGE CREEK

## INTRODUCTION

A stream inventory was conducted during the summer of 1991 on Green Ridge Creek to assess habitat conditions for anadromous salmonids. The inventory was conducted in two parts: habitat inventory and biological inventory. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Green Ridge Creek. The objective of the biological inventory was to document the salmonid species present and their distribution. After analysis of the information and data gathered, stream restoration and enhancement recommendations are presented.

There is no known record of adult spawning surveys having been conducted on Green Ridge Creek. The objective of this report is to document the current habitat conditions, and recommend options for the enhancement of habitat for chinook salmon, coho salmon and steelhead trout.

## WATERSHED OVERVIEW

Green Ridge Creek is a tributary to Oil Creek, a tributary to the Upper North Fork Mattole River, a tributary to the Mattole River located in Humboldt County, California (Figure 1). The legal description at the confluence with Oil Creek is T02S R01W S12. Its location is 40°18'46" N latitude and 124°08'02" W longitude. Green Ridge Creek is a second order stream. The total length of blue line stream, according to the USGS Bull Creek and Buckeye Mountain quadrangles is 1.6 miles.

Green Ridge Creek drains a watershed of approximately 1.15 square miles. Douglas fir forest and oak grassland dominate the watershed. The watershed is owned by the Pacific Lumber Company and is managed for timber production and cattle grazing. In the summer of 1991, a timber harvest plan was carried out in this watershed. This was in response to a large portion of the headwaters being subjected to extensive forest fires in the summer of 1990. The road system in this watershed was upgraded under the Department of Fish and Game and the Department of Forestry. This was due to anticipated and projected sediment yield increases from burned areas of the watershed. Vehicle access exists from U.S. Highway 101, via the Bull Creek/Mattole Road. Follow the Bull Creek Road for approximately 12 miles to the top of the ridge. At the ridge, a private road heads

northwest for seven miles and leads to Rainbow Ranch. From Rainbow Ranch, a private road heads west and leads to Green Ridge Creek, 2.5 miles from Rainbow Ranch.

## METHODS

The habitat inventory conducted in Green Ridge Creek follows the methodology as presented in the California Salmonid Stream Habitat Restoration Manual (Flosi and Reynolds). The inventory was conducted by a two person team. The California Conservation Corps (CCC), Technical Advisors conducting the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). Green Ridge Creek personnel were trained in May and June, 1991, by Gary Flosi and Scott Downie.

## HABITAT INVENTORY COMPONENTS

A standardized habitat inventory form has been developed for use in California stream surveys and can be found in the California Salmonid Stream Habitat Restoration Manual. This form was used in Green Ridge Creek to record measurements and observations. There are nine components to the inventory form.

### 1. Flow:

Flow is measured in cubic feet per second (cfs) at the bottom of the stream survey reach using standard flow measuring equipment, if available. In some cases flows are estimated. Flows should also be measured or estimated at major tributary confluences.

### 2. Channel Type:

Channel typing was conducted according to the classification system developed by David Rosgen (1985). This methodology is described in the California Salmonid Stream Habitat Restoration Manual. Channel typing is conducted simultaneously with habitat typing operations and follows a standard form to record measurements and observations. There are four measured parameters used to determine channel type: 1) water slope gradient, 2) channel confinement, 3) width/depth ratio, 4) substrate composition.

### 3. Temperatures:

Both water and air temperatures are taken and recorded each tenth unit typed. The time of the measurement is also recorded. Temperatures are taken in fahrenheit at the middle of the habitat unit and within one foot of the water surface.

4. Habitat Type:

Habitat typing used the 24 habitat classification types defined by McCain and others (1988). Habitat units are numbered sequentially and assigned a type identification number selected from a standard list of 24 habitat types. Dewatered units are labeled "dry". Green Ridge Creek habitat typing used standard basin level measurement criteria. These parameters require that the minimum length of a described habitat unit must be equal to or greater than the stream's mean wetted width. Channel measurements were accomplished using hip chains, range finders, tape measures, and stadia rods. Unit measurements included mean length, mean width, mean depth, and maximum depth. Depth of the pool tail crest at each pool habitat unit was measured at the thalweg. All measurements were taken in feet to the nearest tenth.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out reaches is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Green Ridge Creek, embeddedness was ocularly estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3), 76 - 100% (value 4).

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide salmonids protection from predation, reduce water velocities so fish can rest and conserve energy, and allow separation of territorial units to reduce density related competition. The shelter rating is calculated for each habitat unit by multiplying shelter value and percent cover. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All cover is then classified according to a list of nine cover types. In Green Ridge Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. Thus, shelter ratings can range from 0-300, and are expressed as mean values by habitat types within a stream.

7. Substrate Composition:

Substrate composition ranges from silt/clay sized particles to

boulders and bedrock elements. In all habitat units, dominant and sub-dominant substrate elements were ocularly estimated using a list of seven size classes.

8. Canopy:

Stream canopy is estimated using handheld spherical densiometers and is a measure of the water surface shaded during periods of high sun. In Green Ridge Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of each unit. The percentages of the total canopy area was then further analyzed and recorded according to whether it was composed of either coniferous or deciduous trees.

9. Bank Composition:

Bank composition elements range from bedrock to bare soil. However, the stream banks are usually covered with grass, brush, or trees. These factors influence the ability of stream banks to withstand winter flows. In Green Ridge Creek, the dominant composition type in both the right and left banks was selected from a list of eight options on the habitat inventory form. Additionally, the percent of each bank covered by vegetation was estimated and recorded.

## BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. Biological inventory is conducted using one or more of three basic methods: 1) stream bank observation, 2) underwater observation, 3) electrofishing. These sampling techniques are discussed in the California Salmonid Stream Habitat Restoration Manual.

## SUBSTRATE SAMPLING

Gravel sampling is conducted using either a 6 or 9 inch diameter standard McNeil gravel sampler. Sample sites are identified numerically beginning at the most upstream site in the stream.

Gravel samples are separated and measured to determine respective percent volume using five sieve sizes (25.4, 12.5, 4.7, 2.37, and 0.85 mm). During field analysis, fine sediment suspended in the liquid portion of the sample is settled in Imhoff cones for one

hour, measured, and recorded on a standard field form. The remainder of the sample is sealed in plastic bags with an identification and information ribbon, then taken to the laboratory for final processing.

In the laboratory the samples are wet sieved using standard Tyler screens. All particles greater than 0.85 mm diameter are measured by displacement in graduated cylinders. The volume of fine sediment less than 0.85 mm is measured following one hour of settling in graduated cylinders or Imhoff cones. The fines measured in the field are added to these results.

Gravel sampling is conducted to determine the percentage of fine sediment present in probable fish spawning areas. These areas are generally found in low gradient riffles, at the tail-out of a pool, in the thalweg. The higher the percent of fine sediment, the lower the probability for eggs to survive to hatch. This is due to the reduced quantity of oxygenated water able to be percolated through the gravel, or because of the fine sediment capping the redd and preventing fry from emerging from the gravel.

## DATA ANALYSIS

Data from the habitat inventory form is entered into Habtype, a dBASE 3+ data entry program developed by the Department and Fish and Game. From Habtype, the data is summarized by Habtab a dBASE 4.1 program in development by DFG.

The Habtab program produces the following summary tables:

- Riffle, flatwater, and pool habitat types
- Habitat types and measured parameters
- Pool types
- Maximum pool depths by habitat types
- Dominant substrates by habitat types
- Mean percent shelter by habitat types

Graphics are produced from the tables using Lotus 1,2,3. Graphics developed for Green Ridge Creek include:

- Riffle, flatwater, pool habitats by percent occurrence
- Riffle, flatwater, pool habitats by total length
- Total habitat types by percent occurrence
- Pool types by percent occurrence

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- Total pools by maximum depths
- Embeddedness
- Pool cover by cover type
- Dominant substrate in low gradient riffles
- Percent canopy
- Bank composition by composition type

HABITAT INVENTORY RESULTS

* ALL TABLES AND GRAPHS ARE LOCATED AT THE END OF THE RESULTS *

The habitat inventory of August 9, 1991, was conducted by Shea Monroe and Brian Humphrey (CCC). The total length of the stream surveyed was 3,710 feet.

Green Ridge Creek is a A2 channel type from the confluence with Oil Creek to the end of the stream reach surveyed. A2 channels are steep boulder channels, with a 4.0 - 10.0% gradient, and are very well confined.

Water and air temperatures were not measured in Green Ridge Creek during the survey. However, on 28 August, 1991 at 1700 hours water temperature was measured at 62° F, the air at 78° F.

Table 1 summarizes the riffle, flatwater, and pool habitat types. By percent **occurrence**, riffles made up 8.3%, flatwater types 53%, and pools 38.9% (Graph 1). Riffles made up 4.1% of the total **length**, flatwater habitats 85.7%, and pools 10.2% (Graph 2).

Nine habitat types were identified. The data are summarized in Table 2. The most frequent habitat types by percent **occurrence** were step runs, 44.4%, step pools and mid-channel pools, 13.9%, and plunge pools, 8.3% (Graph 3). By percent total **length**, step runs made up 84.1%, step pools made up 6.6%, and high gradient riffles made up 3.6%.

Table 3 summarizes the pool habitat types. Of these pools, 71.4% were main channel pools. These main channel pool types comprised 86.5% of the total length for all pools (Graph 4).

Table 4 (Graph 5) is a summary of maximum pool depths by pool habitat types. Depth is an indicator of pool quality. The maximum depth for 13 of the 14 pools (92.9%) was less than two

feet. This level indicates a poor quality of pool habitat in Green Ridge Creek.

The depth of cobble embeddedness was estimated at the pool tail-outs. Of the 11 pool tail-outs, 1 had a value of 1 (9.1%); 3 had a value of 2 (27.3%); 3 had a value of 3 (27.3%); and 4 had a value of 4 (36.4%). Graph 6 describes embeddedness.

A shelter rating was calculated for each habitat unit and expressed as a mean value for each habitat type within the survey using a scale of 0-300. Flatwater types had the highest shelter rating at 44.7 (Table 1). For the pool types, the scour pools had the highest mean shelter rating at 36.3, and main channel pools had a rating of 24.0 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Green Ridge Creek and are extensive. White water is the next most common cover type. Graph 7 describes the pool cover in Green Ridge Creek.

Table 6 (Graph 8) describes the dominant substrate by habitat type. No low gradient riffles were observed in Green Ridge Creek survey; therefore, Graph 8 has been omitted.

Nearly 79% of Green Ridge Creek lacked shade canopy. Of the 21% of the stream that was covered with canopy, 74% was composed of deciduous trees, and 26% was composed of coniferous trees. Graph 9 describes the canopy in Green Ridge Creek.

Table 2 summarizes the mean percent of the right and left stream banks covered with vegetation by habitat unit type. For the stream reach surveyed, the mean percent right bank vegetated was 69.4%. The mean percent left bank vegetated was 63.8%. The elements composing the structure of the stream banks consisted of 6.9% bedrock, 12.5% boulder, 6.9% cobble/gravel, 15.3% bare soil, 20.8% grass. Additionally, 25.0% of the banks were composed of deciduous trees, and 12.5% of coniferous trees, including downed trees, logs, and root wads (Graph 10).

## BIOLOGICAL INVENTORY RESULTS

Biological sampling was not conducted in Green Ridge Creek, but YOY steelhead were observed throughout the survey.

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## GRAVEL SAMPLING RESULTS

McNeil sediment samples were taken by Greg Moody, Scott Downie, and Gary Flosi near the Quiggly Road crossing on August 28, 1991. The four samples taken from Green Ridge Creek had a combined mean of 52.3% for fine sediments < 4.7 mm. The combined mean of sediments < 0.86 mm in the samples was 23.0%. These are above threshold levels for optimum salmonid egg and embryo incubation. Table 7 describes the percentage of fines in the McNeil sediment samples by sample and particle size. The last column describes the total percentage of all fines < 4.7 mm.

## DISCUSSION

The A2 channel type is generally not suitable for fish habitat improvement structures. A2 channels are found in high energy, steep gradient stream reaches. They have channels dominated by boulders, do not retain gravels very well, but do have stable stream banks. Usually within the A2 channel there are zones of lower gradient where structures designed to trap gravels can be constructed. This seems to be the case in Green Ridge Creek, but any structure sites must be selected with care because of the high stream energy which can create problems with stream bank erosion and structure stability.
Flatwater habitat types make up 85.7% of the total length of Green Ridge Creek, with pools only 10.2%. It is desirable to have pool habitat comprise approximately 50% of the total stream. The pools are relatively shallow with 13 of the 14 pools having a maximum depth of less than 2 feet. Therefore, installing structures that will increase or deepen pool habitat is recommended for locations where their installation will not be threatened by high stream energy.

Seven of the 11 pool tail-outs measured had embeddedness ratings of 3 or 4. Only one had a 1 rating. Embeddedness in excess of 26%, a rating of 2 or more, is considered poor quality for fish habitat. In Green Ridge Creek, sediment sources should be mapped and rated according to their potential sediment yields, and control measures taken.

The mean shelter rating for pools was low with a rating of 27.5. The shelter rating in the flatwater habitats was better at 44.7. However, a pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by boulders in all habitat types.

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Log and root wad cover structures in the pool and flatwater habitats are needed to improve both summer and winter salmonid habitat. Log cover structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

There were no low gradient riffles in the surveyed reach of Green Ridge Creek. This is not a desirable condition for spawning salmonids.

The mean percent canopy for the survey reach was only 21%. This is a very low percentage of canopy, since 80 percent is generally considered desirable. In areas of stream bank erosion, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

## RECOMMENDATIONS

1) Green Ridge Creek should be managed as an anadromous, natural production stream.

2) Where feasible, design and engineer pool enhancement structures to increase the number of pools. This must be done within the channel reaches of lowest gradients.

3) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from boulders. Adding high quality complexity with woody cover is desirable.

4) Inventory and map sources of stream bank erosion, and prioritize them according to present and potential sediment yield. Identified sites, should then be treated to reduce the amount of fine sediments entering the stream.

## PROBLEM SITES AND LANDMARKS

The following landmarks and possible problem sites were noted. All the distances are approximate and taken from the beginning of the survey reach.

| | |
|---|---|
| 0' | Begin survey at confluence with Oil Creek. Gradient is > 10% for first 50'. A2 channel type for the entire stream reach surveyed. |
| 109' | Large bedrock mound with large log on left bank |

creating pool.

321' Right bank slide 100' long x 75' high pushing stream channel into left bank.

453' Bedrock spring right bank.

727' Unstable left bank 120' long x 60' high and right bank 120' long x 70' high, both depositing substrates.

745' Unstable cobble/gravel slide on left bank 120' long x 12' high.

1370' Unstable right bank slide 150' long x 40' high, vegetated.

1638' 70' long x 25' wide island braided with deep channels.

1720' LDA 15' wide x 8' long x 6' high, retaining boulders and creating a step pool with a 6' high step. YOY observed above this unit.

1819' Man made pool.

1888' Road crossing through stream.

2209' YOY observed.

2923' Right bank slide 100' long x 100' high, large logs spanning channel, retaining gravels 4' high.

3199' Fallen oak retaining gravel and forming pool.

3460' Small right bank slide 60' long x 50' high, vegetated.

3701' Left bank slide 80' high x 60' wide, depositing trees and boulders, very steep gradient.

3710' Plunge pool, 5' plunge. No YOY observed above this unit. End of survey.