STREAM INVENTORY REPORT

DOTY CREEK

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1.0 INTRODUCTION

A stream inventory was conducted during the fall of 1994 on Doty Creek to assess habitat conditions for anadromous salmonids. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Doty Creek. This report serves to document the current habitat conditions as well as recommend options for the potential enhancement of habitat for coho salmon and steelhead trout. After analysis of the information and data gathered, stream restoration and enhancement recommendations are presented.

2.0 WATERSHED OVERVIEW

Doty Creek is tributary to the Little North Fork Gualala River, tributary to the North Fork Gualala River, tributary to the Gualala River, located in Mendocino County, California. Doty Creek's legal description at the confluence with the Little North Fork Gualala River is T1 IN R15W S10. Its location is 38°49'15" N. latitude and 123°31'54" W. longitude. Doty Creek is a second order stream and has approximately 2.6 miles of perennial stream, according to the USGS Gualala 7.5 minute quadrangle. Doty Creek drains a watershed of approximately 1.75 square miles. Elevations range from about 200 feet at the mouth of the creek to 1,800 feet in the headwater areas. Redwood, douglas fir, and mixed hardwoods dominate the watershed. The watershed is privately owned and is managed for timber production. Vehicle access exists via private roads on Gualala Redwoods property.

3.0 METHODS

The habitat inventory conducted in Doty Creek follows the methodology presented in the California Salmonid Stream Habitat Restoration Manual (Flosi and Reynolds. 1991). The ENTRIX fisheries biologist that conducted the inventory has extensive experience conducting habitat inventories utilizing the methodologies of the California Department of Fish and Game (DFG) and Region 5 of the U.S. Forest Service (USFS). This inventory was conducted by a two person team.

3.1 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 Doty 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 also are 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 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 were taken and recorded at each tenth unit typed. The time of the measurement was also recorded. Temperatures were taken in Fahrenheit at the middle of the habitat unit and within one foot of the water surface.

4. Habitat Type:

Habitat typing uses the 24 habitat classification types defined by McCain et al. (1988). Habitat units were numbered sequentially and assigned a type identification number selected from a standard list of 24 habitat types (See Appendix B). Dewatered units are labeled "dry". Doty 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 dimensions were measured using hip chains, range finders, tape measures, and stadia rods. Unit measurements included mean length, mean width, mean depth, and maximum depth. Pool tail crest depth at each pool unit was measured in the thalweg. All measurements were taken in feet to the nearest tenth. Additionally, every tenth habitat unit was marked in the field using survey flagging in order to facilitate relocation of any unit(s) in the future.

5. Embeddedness:

The depth of substrate embeddedness in pool tail-outs was measured by the percent of the cobble that is surrounded or buried by fine sediment. In Doty 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 Doty 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 a measure of the water surface shaded during periods of high sun. In Doty Creek, an estimate of the percentage of the habitat unit covered by canopy was made both ocularly and using a handheld spherical densiometer from the center of each unit. The area of canopy was further analyzed to estimate its percentages of coniferous or deciduous trees, and the results recorded.

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 Doty 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.

3.2 DATA ANALYSIS

Data from the habitat inventory form are entered into Habitat Runtime, a dBASE 4.1 data entry program developed by the California Department of Fish and Game. This program processes and summarizes the data, and produces the following six 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 were produced from the data using Quattro Pro. Graphics developed for Doty 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
- Total pools by maximum depths
- Embeddedness
- Pool cover by cover type
- Dominant substrate in low gradient riffles
- Percent canopy
- Bank composition by composition type

4.0 HABITAT INVENTORY RESULTS

The habitat inventory on Doty Creek was performed on October 11, 1994 by Dan Gale and Dan Lipman of ENTRIX. The survey began at the confluence with the Little North Fork Gualala River and extended up Doty Creek to a major log and debris jam located adjacent to the Doty Creek Fish Hatchery. The total length of the stream surveyed was 4,512 feet, with no side channels encountered.

Flow was estimated to be 1-2 cfs at the mouth of Doty Creek during the survey period, with four sections of dry channel (zero flow) encountered throughout the survey reach.

Three reaches were identified in the surveyed portion of Doty Creek. Reach 1 begins at the mouth of Doty Creek and is a B4 channel type which totals 2,147 feet in length. B4 channels are moderately steep (1.5-4% gradient), well confined streams with unstable stream banks and are dominated by gravel substrate. Reach 2 is a B3 channel type totalling 1,829 feet in length. B3 channel types are similar to B4 channels except that they are dominated by cobble substrate. Reach 3 is a BI channel type totalling 536 feet which ends at the major logjam adjacent to the Doty Creek fish hatchery (end of survey). BI channel types are similar to B3 and B4 channels except that they are dominated by boulder substrate.

Water temperatures ranged from 52.0 to 55.5 degrees fahrenheit. Air temperatures ranged from 48.0 to 69.5 degrees fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent occurrence, riffles made up 37%, flatwater types 20%, pools 41% and dry channel 3% (Figure 1). Flatwater habitat types made up 21% of the total survey length, riffles 33%, pools 24% and dry channel 22% (Figure 2).

Fourteen Level IV habitat types were identified. The data are summarized in Table 2. The most frequent habitat types by percent occurrence were low gradient riffles, 29%; mid-channel pools, 12%; and plunge pools, 12% (Figure 3). By percent total length, low-gradient riffles made up 26%, step runs 14%, and high gradient riffles, runs, mid-channels pools, and step pools all totaled 6%.

Sixty pools were identified (Table 3). Scour pools were most often encountered at 60% and comprised 46% of the total l ength of pools (Figure 4). Main channel pools accounted for 37% of the pools encountered, yet they accounted for 51% of the total length of pools.

Table 4 is a summary of maximum pool depths by pool habitat types. Depth is an indicator of pool quality. Seven of the 60 pools (12%) had a depth of two feet or greater (Figure 5).

The substrate embeddedness was estimated at main and scour pool tail-outs. Of the 57 pool tail-outs measured, six had a value of 1 (10.5%); 30 had a value of 2 (52.6%); 21 had a value of 3 (36.8%); and none of the tailouts had an embeddedness rating of four (Figure 6). On this scale, a value of one is the best for fisheries.

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. Pool habitat types had the highest shelter rating at 74 (Table 1). Flatwater habitats followed with a rating of 18. Of the pool types, the scour pools had the highest mean shelter rating at 95, backwater pools rated 45, and main channel pools rated 43 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris is the dominant cover type in Doty Creek, with small woody debris and terrestrial vegetation comprising the subdominant cover types. Figure 7 describes the pool cover in Doty Creek in more detail.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 24 of the 42 low gradient riffles (57%). Small cobble was the next most frequently observed dominant substrate type, occurring in 40% of the low gradient riffles (Figure 8).

The mean percent of open canopy for the entire portion of the stream surveyed was 10%. Of the 90% of the stream covered with canopy, 28.5% was composed of deciduous trees, and 71.5% was composed of coniferous trees. Figure 9 describes the canopy composition in Doty Creek.

Table 2 summarizes the mean percentage of the right and left stream banks covered with vegetation by habitat type. For the stream reach surveyed, the mean percent right bank vegetated was 34.0%. The mean percent left bank vegetated was 37.2%. The dominant elements composing the structure of the stream banks consisted of 0.0% bedrock, 1.4% boulder, 49.3% cobble/gravel, and 49.3% silt/clay. The dominant vegetation present on both banks throughout the survey reach included 1.4% grass and 23.8% brush, while 36.7% of the banks were covered with deciduous trees and 22.1% with coniferous trees, including downed trees, logs, and root wads (Figure 10).

5.0 DISCUSSION

The B channel types are excellent for many types of low and medium stage instream enhancement structures. All of the reaches surveyed in Doty Creek were comprised of B channel types, and there were adequate sources of large organic debris (LOD) either in or nearby the stream. Many

Doty Creek

Drainage: North Fork Gualala River

Table 1 - SUMMARY OF RIFFLE, FLATWATER, AND POOL HABITAT TYPES

Survey Dates: October 11, 1994

Confluence: QUAD: Gualala LEGAL DESCRIPTION: T11NR15WS10 LATITUDE: 38°49'0" LONGITUDE: 123°32'0"

UNITS MEASURED	HABITAT TYPE	HABITAT PERCENT OCCURRENCE	MEAN LENGTH (ft.)	TOTAL LENGTH (ft.)	PERCENT TOTAL LENGTH	MEAN WIDTH (ft.)	MEAN DEPTH (ft.)	MEAN AREA (sq. ft.)	TOTAL AREA (sq. ft.)	MEAN VOLUME (cu. ft.)	TOTAL VOLUME (cu. ft)	MEAN RESIDUAL POOL VOL (cu. ft.)	MEAN SHELTER RATING
54	RIFFLE	37	28	1505	33	7.5	0.2	136	7334	23	1256	0	16
29	FLATWATER	20	32	934	21	6.0	0.3	165	4787	39	1131	0	18
60	POOL	41	18	1092	24	8.5	0.6	138	8285	93	5583	58	74
4	DRY	3	245	981	22	0.0	0.0	0	0	0	0	0	0

TOTAL UNITS	TOTAL LENGTH (ft.)	TOTAL (sq. ft.)	TOTAL (cu. ft.)
147	4512	20407	7971

Doty Creek

Drainage: North Fork Gualala River

Table 2 - SUMMARY OF HABITAT TYPES AND MEASURED PARAMETERS

Survey Dates: October 11, 1994

Confluence: QUAD: Gualala LEGAL DESCRIPTION: T11NR15WS10 LATITUDE: 38°49'0" LONGITUDE: 123^{0}32'0"

UNITS MEASURED	HABITAT TYPE	HABITAT OCCURRENCE	MEAN LENGTH	TOTAL LENGTH	TOTAL LENGTH	MEAN WIDTH	MEAN DEPTH	MAXIMUM DEPTH	MEAN AREA	TOTAL AREA	MEAN VOLUME	TOTAL VOLUME	MEAN RESIDUAL POOL VOL	MEAN SHELTER RATING	MEAN RT. BANK VEGETATED	MEAN LT. BANK VEGETATED	MEAN CANOPY
#		%	ft.	ft.	%	ft.	ft.	ft.	sq. ft.	sq. ft.	cu. ft.	cu. ft.	cu. ft.		%	%	%
42	LGR	29	28	1190	26	8	0.2	0.6	159	6695	28	1166	0	14	37	40	91
11	HGR	7	23	257	6	6	0.1	0.4	57	622	8	89	0	22	29	33	85
1	CAS	1	58	58	1	1	0.1	0.4	17	17	2	2	0	30	15	25	90
1	POW	1	12	12	0	7	0.3	0.4	63	63	19	19	0	50	60	35	90
14	RUN	10	20	278	6	7	0.3	0.8	122	1702	29	401	0	16	33	47	92
14	SRN	10	46	644	14	5	0.3	1.0	216	3022	51	711	0	18	36	40	89
18	MCP	12	16	280	6	7	0.4	1.4	105	1881	46	832	25	41	34	36	91
4	STP	3	68	273	6	8	0.4	1.8	426	1703	177	707	76	51	24	30	94
13	LSL	9	17	227	5	7	0.5	2.0	118	1537	70	916	49	109	28	30	89
5	LSR	3	17	84	2	9	0.7	2.2	152	758	109	544	74	100	37	30	99
18	PLP	12	10	187	4	12	1.0	2.7	121	2180	137	2463	93	83	31	30	a?
1	BPL	1	20	20	0	5	0.7	1.1	100	100	70	70	0	50	0	0	90
1	DPL	1	21	21	0	6	0.4	0.8	126	126	50	50	25	40	35	35	85
4	DRY	3	245	981	22	0	0.0	0.0	0	0	0	0	0	0	54	69	86

TOTAL UNITS	LENGTH (ft.)	AREA (sq. ft)	TOTAL VOL. (cu. ft)
147	4512	20407	7971

Doty Creek

Drainage: North Fork Gualala River

Table 3 - SUMMARY OF POOL TYPES

Survey Dates: October 11, 1994

Confluence: QUAD: Gualala LEGAL DESCRIPTION: T11NR15WS10 LATITUDE: 38°49'0" LONGITUDE: 123°32'0"

UNITS MEASURED	HABITAT TYPE	HABITAT PERCENT OCCURRENCE	MEAN LENGTH (ft.)	TOTAL LENGTH (ft.)	PERCENT TOTAL LENGTH	MEAN WIDTH (ft.)	MEAN DEPTH (ft.)	MEAN AREA (sq. ft.)	TOTAL AREA (sq. ft.)	MEAN VOLUME (cu. ft.)	TOTAL VOLUME (cu. ft)	MEAN RESIDUAL POOL VOL. (cu. ft.)	MEAN SHELTER RATING
22	MAIN	37	25	553	51	7.0	0.4	163	3585	70	1540	34	43
36	SCOUR	60	14	498	46	9.6	0.8	124	4475	109	3923	75	95
2	BACKWATER	3	21	41	4	5.5	0.6	113	226	60	120	13	45

TOTAL MEASURED	TOTAL LENGTH (ft.)	TOTAL AREA (sq. ft.)	TOTAL VOL. (cu. ft.)
60	1092	8285	5583

Doty Creek

Drainage: North Fork Gualala River

Table 4 - SUMMARY OF MAXIMUM POOL DEPTHS BY POOL HABITAT TYPES

Survey Dates: October 11, 1994

Confluence: QUAD: Gualala LEGAL DESCRIPTION: T11NR15WS10 LATITUDE: 38°49'0" LONGITUDE: 123°32'0"

UNITS MEASURED	HABITAT TYPE	HABITAT PERCENT OCCURRENCE	<1 FOOT MAXIMUM DEPTH	<1 FOOT PERCENT OCCURRENCE	1-<2 FT. MAXIMUM DEPTH	1-<2 FOOT PERCENT OCCURRENCE	2-<3 FT. MAXIMUM DEPTH	2-<3 FOOT PERCENT OCCURRENCE	3-<4 FT. MAXIMUM DEPTH	3-<4 FOOT PERCENT OCCURRENCE	>=4 FEET MAXIMUM DEPTH	>=4 FEET PERCENT OCCURRENCE
18	MCP	30	8	44	10	56	0	0	0	0	0	0
4	STP	7	1	25	3	75	0	0	0	0	0	0
13	LSL	22	7	54	5	38	1	8	0	0	0	0
5	LSR	8	0	0	4	80	1	20	0	0	0	0
18	PLP	30	2	11	11	61	5	28	0	0	0	0
1	BPL	2	0	0	1	100	0	0	0	0	0	0
1	DPL	2	1	100	0	0	0	0	0	0	0	0

TOTAL UNITS

60

Doty Creek

Drainage: North Fork Gualala River

Table 5 - SUMMARY OF MEAN PERCENT COVER BY HABITAT TYPE

Survey Dates: October 11, 1994

Confluence: QUAD: Gualala LEGAL DESCRIPTION: T11NR15WS10 LATITUDE: 38°49'0" LONGITUDE: 123°32'0"

UNITS MEASURED	HABITAT TYPE	MEAN % UNDERCUT BANKS	MEAN % SWD	MEAN % LWD	MEAN % ROOT MASS	MEAN % TERR. VEGETATION	MEAN % AQUATIC VEGETATION	MEAN % WHITE WATER	MEAN % BOULDERS	MEAN % BEDROCK LEDGES
42	LGR	6	6	20	1	25	0	0	6	0
11	HGR	5	12	23	5	16	0	0	3	0
1	CAS	0	30	50	20	0	0	0	0	0
1	ROW	0	20	60	0	20	0	0	0	0
14	RUN	12	4	18	7	24	0	0	0	0
14	SRN	2	23	16	10	21	0	0	14	0
18	MCP	14	32	33	5	10	0	0	6	0
4	STP	5	10	38	10	5	0	0	33	0
13	LSI	12	17	52	8	12	0	0	0	0
5	LSR	11	4	26	46	13	0	0	0	0
18	PLP	5	12	58	15	7	0	1	3	0
1	BPL	0	0	100	0	0	0	0	0	0
1	DPL	20	0	50	30	0	0	0	0	0
4	DRY	0	0	0	0	0	0	0	0	0

Doty Creek

Drainage: North Fork Gualala River

Table 6 - SUMMARY OF DOMINANT SUBSTRATES BY HABITAT TYPE

Survey Dates: October 11, 1994

Confluence: QUAD: Gualala LEGAL DESCRIPTION: T11NR15WS10 LATITUDE: 38°49'0" LONGITUDE: 123°32'0"

UNITS MEASURED	HABITAT TYPE	# UNITS SILT/CLAY DOMINANT	% TOTAL SILT/CLAY DOMINANT	# UNITS SAND DOMINANT	% TOTAL SAND DOMINANT	# UNITS GRAVEL DOMINANT	% TOTAL GRAVEL DOMINANT	# UNITS SM COBBLE DOMINANT	% TOTAL SM COBBLE DOMINANT	# UNITS LG COBBLE DOMINANT	% TOTAL LG COBBLE DOMINANT	# UNITS BOULDER DOMINANT	% TOTAL BOULDER DOMINANT	# UNITS BEDROCK DOMINANT	% TOTAL BEDROCK DOMINANT
42	LGR	0	0	0	0	24	57	17	40	1	2	0	0	0	0
11	HGR	0	0	0	0	3	27	3	27	5	45	0	0	0	0
1	CAS	0	0	0	0	0	0	0	0	1	100	0	0	0	0
1	ROW	0	0	0	0	0	0	0	0	1	100	0	0	0	0
14	RUN	0	0	0	0	10	71	2	14	2	14	0	0	0	0
14	SRN	0	0	0	0	10	71	2	14	2	14	0	0	0	0
18	MCP	0	0	2	11	12	67	3	17	1	6	0	0	0	0
4	STP	0	0	0	0	2	50	2	50	0	0	0	0	0	0
13	LSL	0	0	2	15	6	46	4	31	1	8	0	0	0	0
5	LSR	0	0	0	0	5	100	0	0	0	0	0	0	0	0
18	PLP	4	22	3	17	10	56	0	0	1	6	0	0	0	0
1	BPL	1	100	0	0	0	0	0	0	0	0	0	0	0	0
1	DPI	0	0	0	0	1	100	0	0	0	0	0	0	0	0
4	DRY	0	0	0	0	2	50	1	25	1	25	0	0	0	0

Figure 1. Doty Creek Habitat Types by Percent Occurence

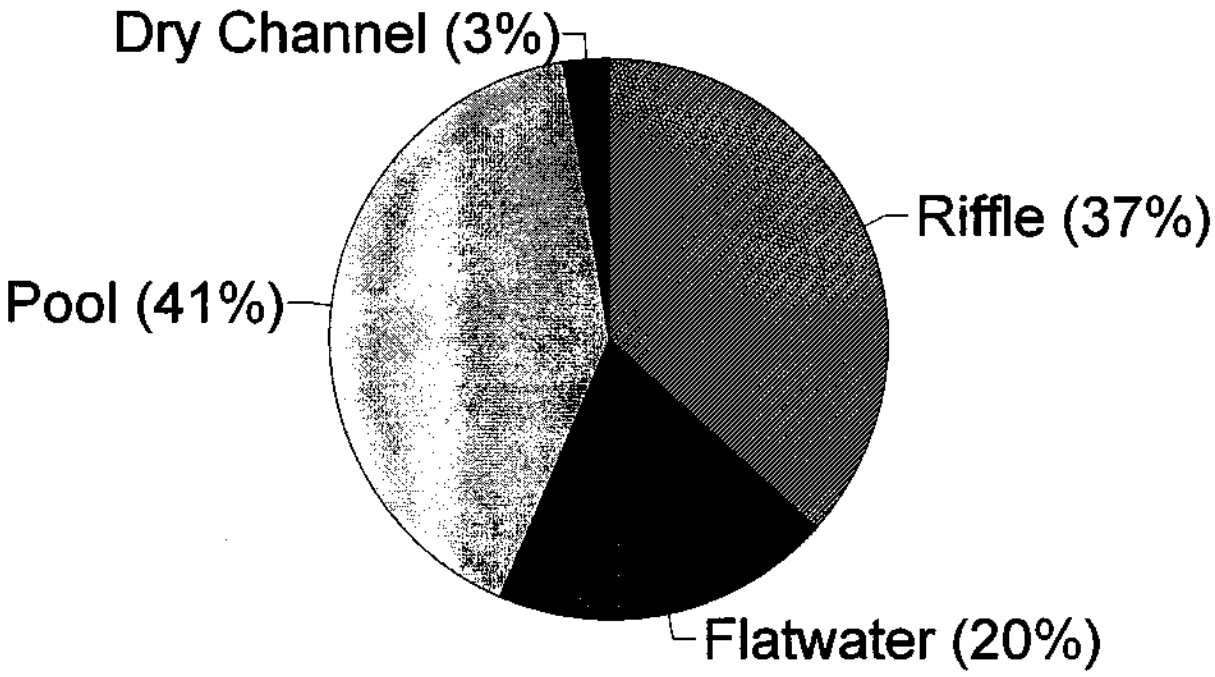


Figure 2. Doty Creek Habitat Types by Percent of Total Length

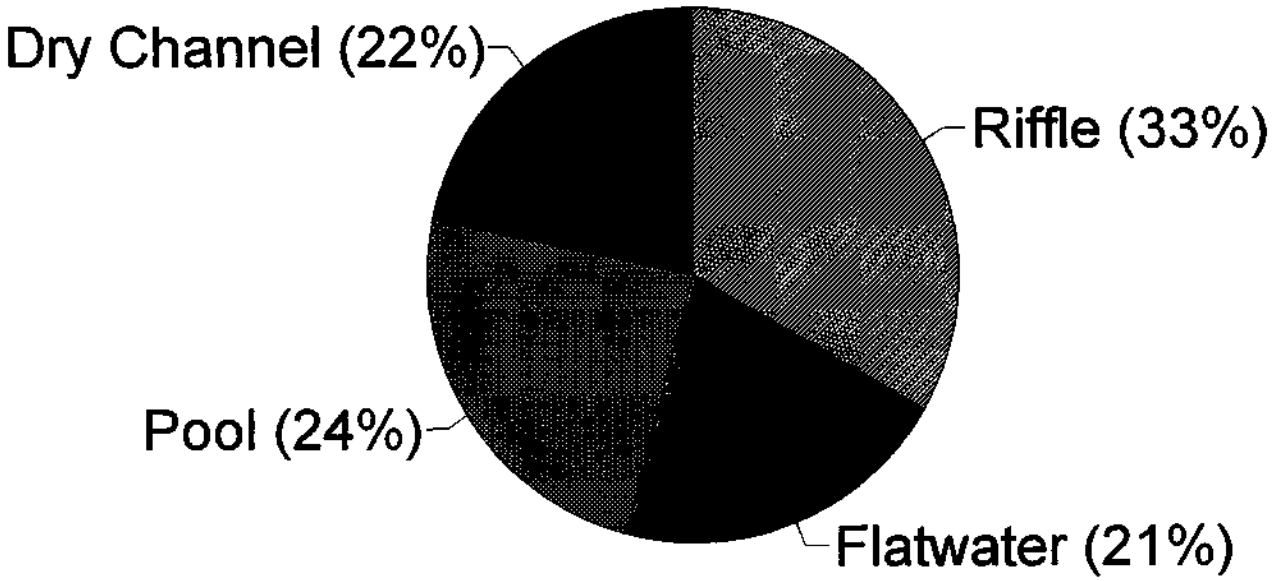


Figure 3. Doty Creek Level IV Habitat Types by Percent Occurence

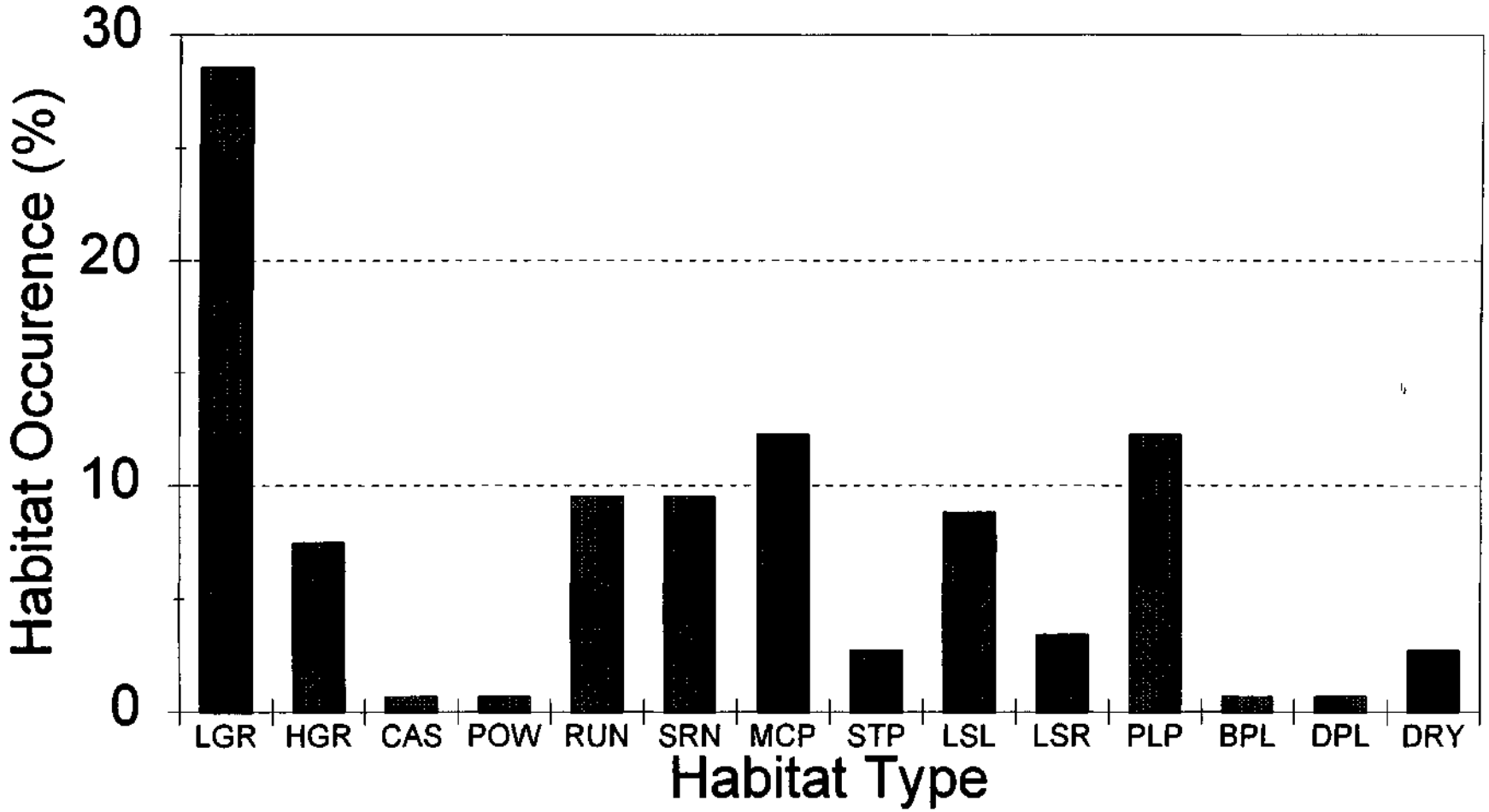


Figure 4. Doty Creek Pool Types by Percent Occurence

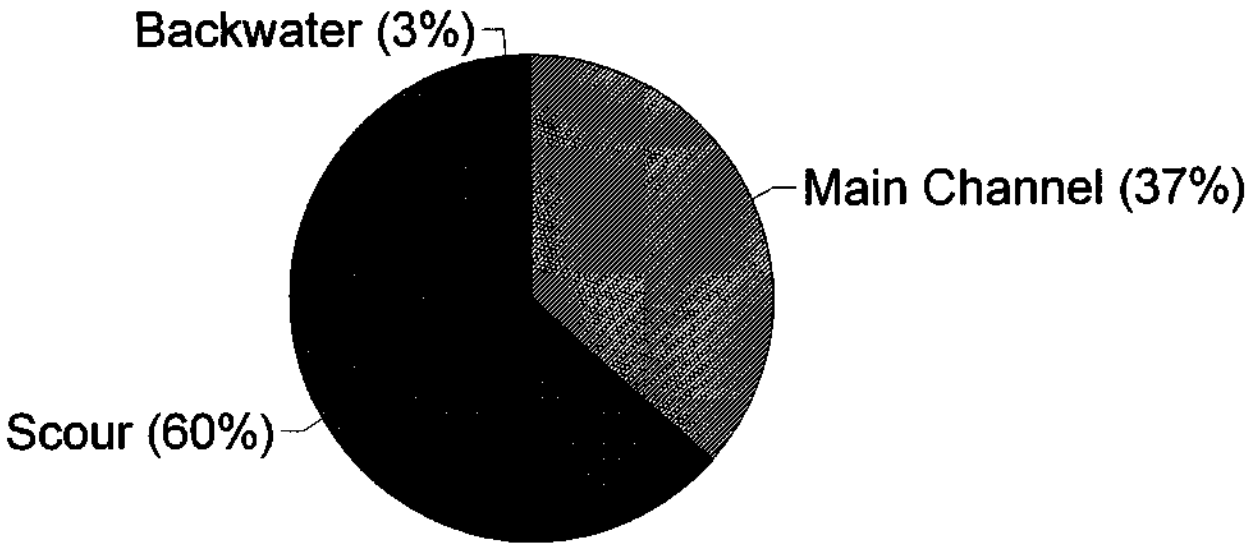


Figure 5. Doty Creek Total Pools by Maximum Depth

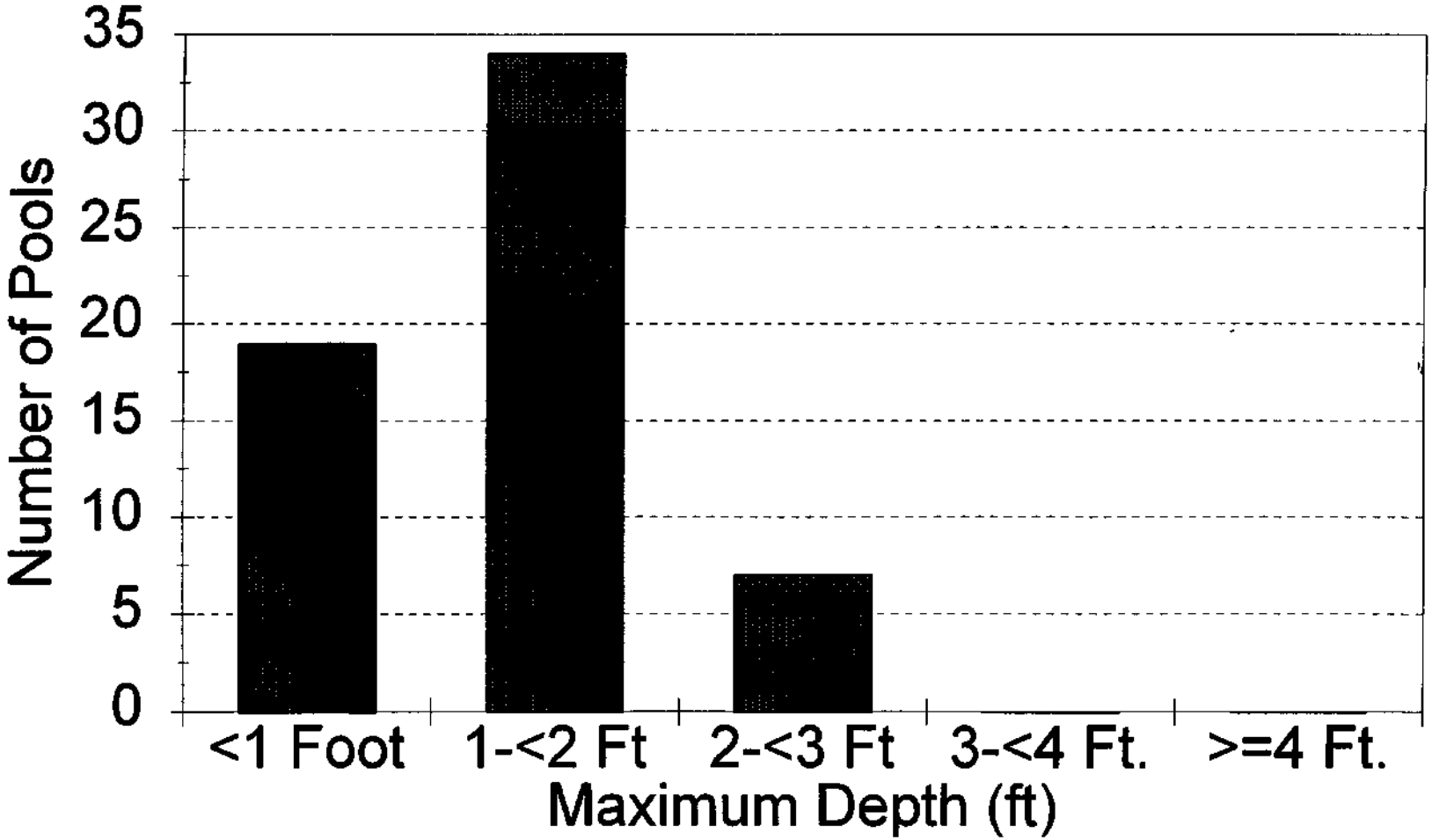


Figure 6. Doty Creek Pool Tail-out Percent Substrate Embeddedness

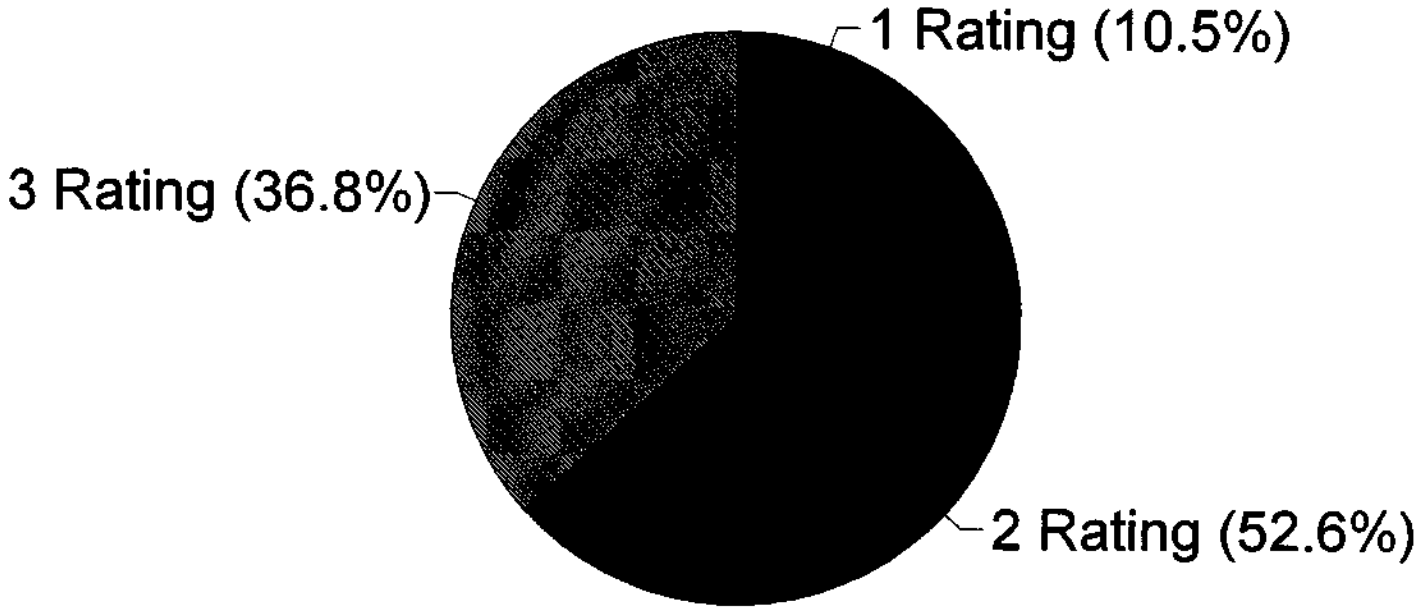


Figure 7. Doty Creek Pool Cover by Cover Type

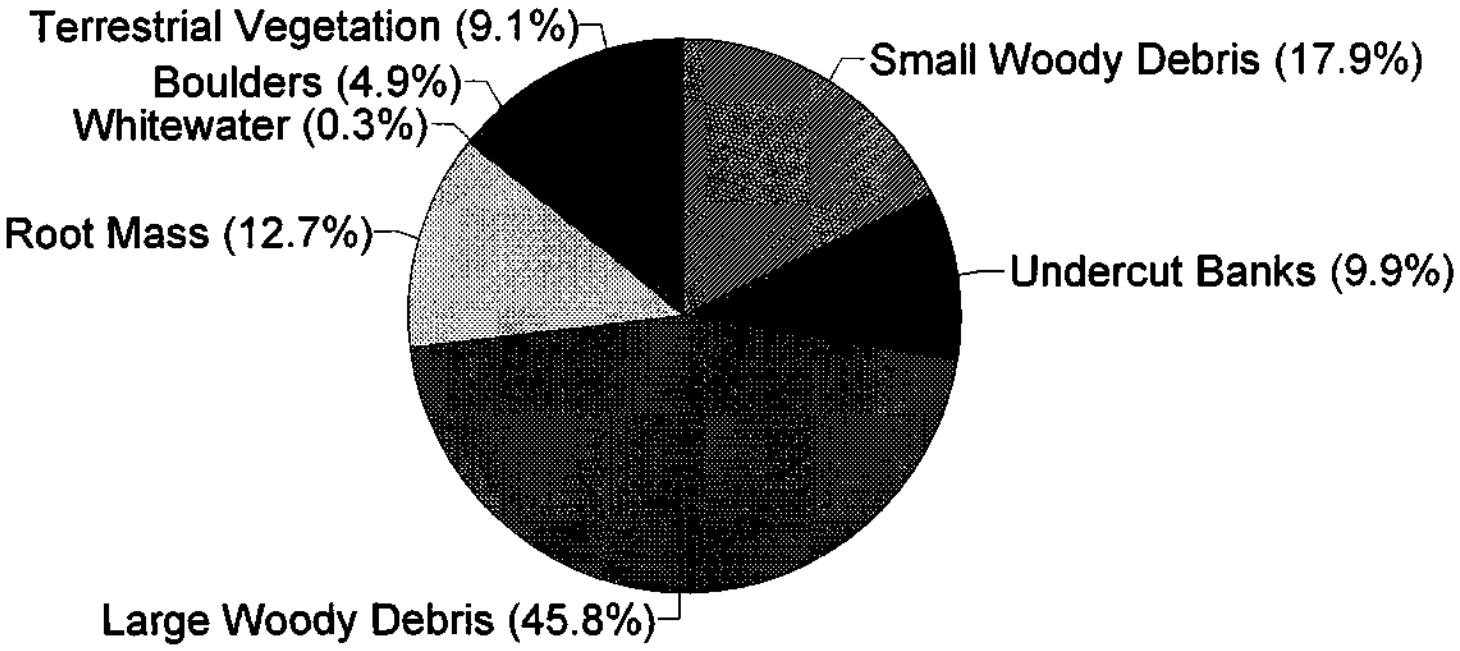


Figure 8. Doty Creek Dominant Substrate Type in Low Gradient Riffles

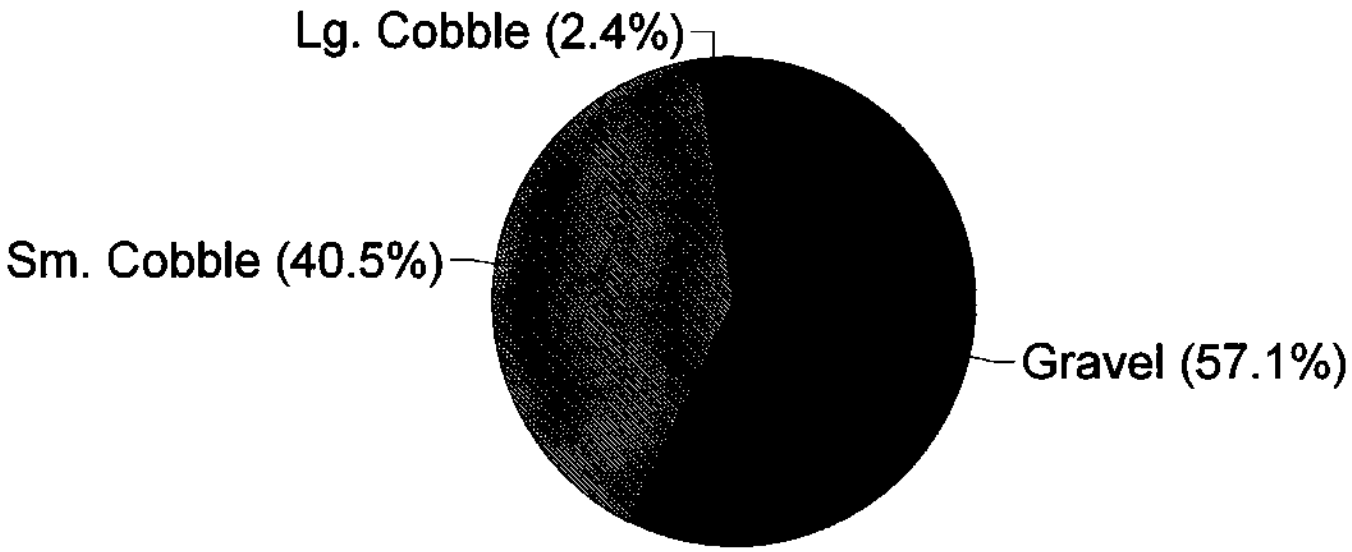


Figure 9. Doty Creek Canopy Composition

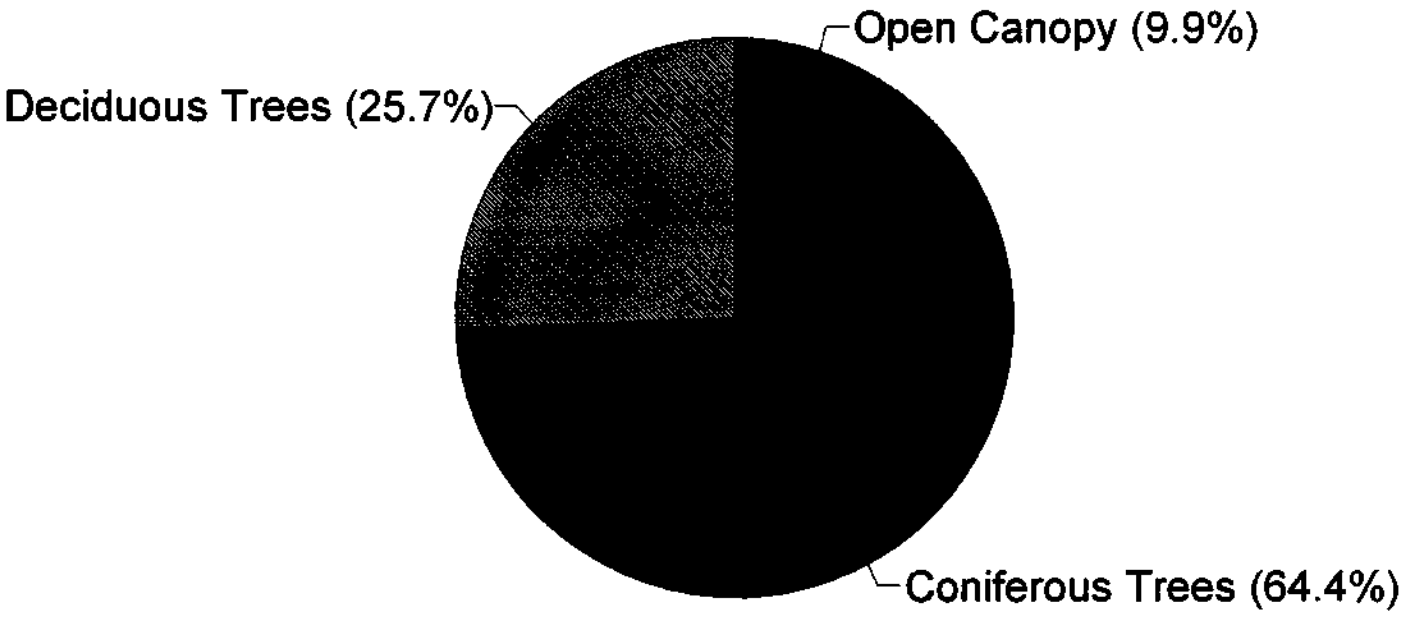
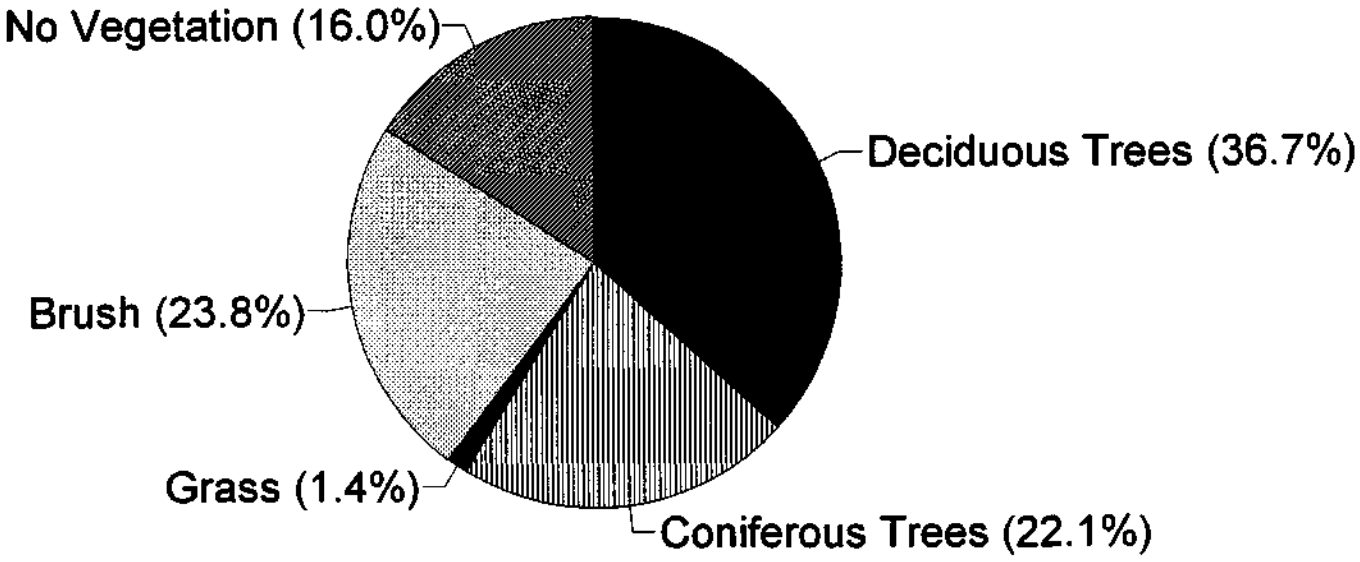


Figure 10. Doty Creek Bank Composition by Dominant Vegetation Type



site specific projects can be designed within these channel types, especially to increase pool frequency, volume and pool cover.

The water temperatures recorded during the survey on October 11, 1994 ranged from 52°-55.5° F. Air temperatures ranged from 48°-69.5°F. Bell (1984) identifies the preferred temperature range for steelhead as 45°-58°F with an optimum range of 50°-55°F and an upper lethal limit of 75°F, while the preferred range for coho salmon is 38°-69°F with an optimum range of 53°-58°F and an upper lethal limit of 78.5°F. The water temperatures observed in Doty Creek during the survey fall well within the preferred range and for the most part within the optimum range of both species, indicating that Doty Creek has an excellent water temperature regime for salmonids. To make any further conclusions, temperatures would need to be monitored throughout the warm summer months during low flow conditions.

Flatwater habitat types comprised 21% of the total length of this survey, riffles 33%, pools 24% and dry channel 22%. The pools are relatively shallow with only 7 of the 60 pools having a maximum depth greater than 2 feet. In coastal coho and steelhead streams, it is generally desirable to have primary pools comprise approximately 50% of total habitat. In first and second order streams a primary pool is defined as having a maximum depth of at least two feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. 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, cause streambank erosion, or conflict with the modification of the numerous log debris accumulations (LDA's) in the stream. The LDA's in the system are retaining needed gravels. Any necessary modifications to them should be done with the intent of metering the gravels out to downstream reaches that will trap the gravel for future spawning use. Therefore, gravel retention features may need to be developed prior to any LDA modification.

Fifty-one of the 57 pool tail-outs measured had embeddedness ratings of 2 or 3, while only six had a 1 rating. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered best for the needs of salmon and steelhead. In Doty Creek, sediment sources should be mapped and rated according to their potential sediment yields, and control measures taken.

The mean shelter rating for riffles and flatwater habitats was low with ratings of 16 and 18 respectively. The shelter rating in the pools was improved at 74. However, a pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by large woody debris in all habitat types. Additionally, terrestrial vegetation, small woody debris, rootwads, and undercut banks contribute smaller amounts. Log, rootwad and boulder 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.

Fourty-one of the 42 low gradient riffles had gravel or small cobble as the dominant substrate. This is generally considered excellent for spawning salmonids.

The mean percent canopy for the stream was 90.1%. This is a relatively high percentage of canopy, since 80 percent is generally considered optimum in these north coast streams. In areas of stream bank erosion, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

6.0 RECOMMENDATIONS

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

2) Temperatures in this section of Doty Creek, as well as upstream, should be monitored to determine if they are having a deleterious effect upon juvenile salmonids. To achieve this, biological sampling is also required.

3) Where feasible, design and engineer pool enhancement structures to increase the number and depth of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

4) Increase woody cover in the pools and flatwater habitat units. Adding high quality complexity with woody cover is desirable and in some areas the material is at hand.

5) Inventory and map sources of stream bank erosion, and prioritize them according to present and potential sediment yield. Identified sites, like the sites at 2,230 ft and 2,396 ft, should then be treated to reduce the amount of fine sediments entering the stream.

6) Active and potential sediment sources related to the road system need to be identified, mapped, and treated according to their potential for sediment yield to the stream.

7) There are several log debris accumulations present on Doty Creek that are retaining large quantities of fine sediment. The modification of these debris accumulations is desirable, but must be done carefully, over time to avoid excessive sediment loading in downstream reaches.

7.0 LITERATURE CITED

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APPENDIX A

PROBLEM SITES AND LANDMARKS

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

Stream Length (ft)	Comment
91	Crayfish and small fish (3 "-4") observed in unit.
107	Bridge crossing over upstream end of unit.
255	Photo *#1* (camera #4)- view downstream through unit.
289	Upstream end of unit flagged.
400	Great fish cover.
619	Unit flagged at upstream end.
748	Photo facing upstream through units 26-30.
786	Temp recorder anchored in middle of pool.
845	Unit flagged at upstream end.
858	Small fish observed in unit.
897	Majority of right bank is raw, incised soil.
1124	Unit flagged at upstream end.
1229	Small fish observed in unit.
1271	Photo - view from downstream in unit 43.
1356	Unit flagged at upstream end.
1391	Medium-sized log jam on right bank.
1409	Two photos

1434	Water flows subsurface into unit #54.
1499	Unit flagged at upstream end.
1653	Unit marked by DFG with metal flashing on left bank: upstream end point of sample reach dated 10/18/93. Also flagged: "start of CDFG Reach 10/19/93 PMP" Photo - View from downstream end.
1704	Unit flagged @ upstream end.
1799	Small fish observed in unit.
1846	Top 25% of unit is dry - subsurface flow.
2140	Channel went subsurface very abruptly above unit #78. Area has good habitat and cover (several pieces of LWD), but flow is subsurface. Photo taken from top of unit #78, + 3 more photos taken from middle of dry channel.
2147	Pool usually 3 ft max depth when full. Unit flagged at upstream end.
2230	Both banks incised 3-5 ft along units#83-89.
2310	Small fish observed in unit.
2324	Small fish observed in unit.
2359	Unit flagged at upstream end.
2396	Channel confined by steep slopes in this portion of the drainage - channel has been deeply incised and banks scoured heavily in places - It appears to have occurred fairly recently. 2 Photos taken.
2410	Small fish observed in unit. Photo of unit taken.
2463	Logjam used to span across unit and has been cleared - now only present on banks.
2519	Photo - view downstream from top of unit.
2540	Small fish observed in unit. Unit flagged at upstream end.

2582	Photo. Several small fish in unit (appear to be California roach).
2753	Unit flagged at upstream end.
2849	Major logjam along units #112-117 - Jam has been cleared over active channel. Gradient noticably steeper along these units. Four photos taken.
2965	Age 0+ Steelhead observed in unit. 1/3 of unit is subsurface flow.
3179	Channel levels out and flow becomes subsurface. Road becomes adjacent to channel at downstream end of unit.
3190	Many small fish and 1 6" salmonid observed in pool. Photo.
3780	Two cars and a trailer abandoned on roadside adjacent to unit.
3976	Upstream end of unit flagged.
3993	Road begins incline uphill and channel gradient increases, along with # of boulders.
4067	Channel much more stable/less incised + scoured upstream of hugh log jam.
4285	Small logjam over left side of unit.
4341	Unit flagged at upstream end.
4413	Diverted water re-enters creek at top of unit on right - Photo. Water is return flow from hatchery.
4444	Small fish observed darting in unit.
4460	Doty Creek Hatchery on right bank.
4478	Doty Creek Hatchery on right bank.
4498	Doty Creek Hatchery on right bank.
4512	Hugh log jam over top of unit - Upstream channel is 12 feet higher than channel below logjam. END OF SURVEY

APPENDIX B

LEVEL III and LEVEL IV HABITAT TYPE KEY

HABITAT TYPE	LETTER	NUMBER
RIFFLE		
Low Gradient Riffle	[LGR]	1.1
High Gradient Riffle	[HGR]	1.2
CASCADE		
Cascade	[CAS]	2.1
Bedrock Sheet	[BRS]	2.2
FLATWATER		
Pocket Water	[POW]	3.1
Glide	[GLD]	3.2
Run	[RUN]	3.3
Step Run	[SRN]	3.4
Edgewater	[EDW]	3.5
MAIN CHANNEL POOLS		
Trench Pool	[TRP]	4.1
Mid-Channel Pool	[MCP]	4.2
Channel Confluence Pool	[CCP]	4.3
Step Pool	[STP]	4.4
SCOUR POOLS		
Corner Pool	[CRP]	5.1
Lateral Scour Pool - Log Enhanced	[LSL]	5.2
Lateral Scour Pool - Root Wad Enhanced	[LSR]	5.3
Lateral Scour Pool - Bedrock Formed	[LSBk]	5.4
Lateral Scour Pool - Boulder Formed	[LSBo]	5.5
Plunge Pool	[PLP]	5.6

BACKWATER POOLS

Secondary Channel Pool	[SCP]	6.1
Backwater Pool - Boulder Formed	[BPB]	6.2
Backwater Pool - Root Wad Formed	[BPR]	6.3
Backwater Pool - Log Formed	[BPL]	6.4
Dammed Pool	[DPL]	6.5