D.W. ALLEY & Associates aquatic biology

RIPARIAN CORRIDOR WOOD SURVEY IN THE SAN LORENZO, SOQUEL AND CORRALITOS WATERSHEDS, 2011

Bedrock Corner Pool – Bear Creek in December 2011

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Scope of Work

Three half-mile stream segments previously habitat typed and sampled for steelhead were surveyed for wood in 2011. In the San Lorenzo watershed they included Bean 14c and Bear 18a (**Appendix A**). In the Soquel watershed they included Mainstem Soquel 8. Live and dead wood greater than 1 foot in diameter was tallied according to size, location (low-flow channel, bankfull channel, perched riparian, riparian and upslope) and habitat function for salmonids (structure forming for rearing and overwinter or extra). Results were compared to survey data collected from 6 segments in 2010 (**Alley 2011a**) and other Central Coast steelhead/coho streams in San Mateo County in 2002, using the same methodology developed by Smith and Leicester (**2005**).

Project Relevance

Instream wood has been identified as critically important in providing overwintering and rearing habitat for juvenile steelhead and especially coho salmon (**Alley et al. 2004; Alley 2011b**). These wood surveys provide baseline information about the density of instream wood and natural recruitment potential in reaches that could greatly benefit salmonids from wood enhancement projects. Wood surveys in Zayante and Bean creeks confer data in the most likely tributaries in the San Lorenzo system to provide future habitat for coho salmon, an Endangered species that NOAA Fisheries will focus recovery activities for in the San Lorenzo watershed. Bean segment 14c is accessible and previously used by coho salmon in 2005 and isolated enough from streamside residences in places to allow wood projects and instream wood without jeopardizing structures. Bear Creek segment 18a has many deep bedrock corner pools that would benefit from more instream wood without jeopardizing structures. The mainstem Soquel segment 8 is very isolated from residences over most of its extent, making it a good candidate for retaining instream wood and engineering wood projects. It was also identified as a reach that could be utilized by coho salmon if water temperatures were sufficiently low (**Alley 2003a**).

Methods

Each 1/2 –mile surveyed segment was divided into two 1,000-foot sub-segments and one 600-foot sub-segment. For all but the Bean 14b segment, two, 200-foot sites in each 1000-foot sub-segment and one 200-foot site in the furthest upstream 600 feet were selected in a stratified random manner and inventoried for live trees and dead wood, totaling 5 sites. In the Bean 14b segment, three, 200-foot sites in each 1,000-foot sub-segment and two, 200-foot sites in the last 600 feet of the segment were stratified randomly surveyed (totaling 8 sites). Distance was measured with a hip chain. The beginning and ending points of each segment was located with a Garmin GPS unit. A Large Woody Debris (LWD) inventory form was used (**Figure 1**) that was similar to the Flosi form in the 1998 CA Salmonid Stream Habitat Restoration Manual, but provided more functional habitat information, and was developed by Master’s graduate student Michelle Leicester and Dr. Jerry Smith, fishery professor at San Jose State University. Large wood pieces and standing trees (alive and dead) were inventoried according to 1-foot diameter size increments for pieces =>1 foot, length (6-20 feet and >20 feet), species and location (within stream bankfull channel and 75 feet beyond bankfull channel on left and right bank). Trees were measured with metal graduated rulers.

The bankfull channel was divided into the low flow channel (wood as structure forming/ enhancing or extra) and the bankfull channel beyond the low-flow channel (wood as backwater forming/ enhancing or extra) (**Figure 2**). Wood that was part of jams was denoted. Old wood was denoted when bark was absent. The right and left banks were divided into perched (standing within the channel or on the edge of the bankfull (active) channel and likely to be recruited at high flows), riparian and upslope zones within 75 feet beyond the bankfull width. Distances were measured with a rangefinder. Wood was categorized as dead-down, dead-standing and live within the 75-foot riparian/upslope widths beyond the bankfull channel on either side of the creek. The boundary between riparian and upslope zones was based on distribution of typical riparian broadleaf species.

In addition, the amount of entrenchment was measured (ratio of the flood-prone width divided by the bankfull width). Widths were measured with a tape measure. The Width/Depth ratio was measured (ratio of the bankfull width divided by the average bankfull depth) with the stream gradient estimated from map contours. The most common streambed particle size was visually estimated. Depths were measured with a graduated stadia rod. Using these stream characteristics, each inventoried segment was classified into Rosgen channel types (**Rosgen 1996**). Upslope angles were measured with clinometers. All significant logjams found in each ½-mile segment was inventoried and located by GPS coordinates, when possible. Field tallies (piece/tree counts) were organized by 200-foot surveyed sites, and total piece counts were compiled and multiplied by a factor of 2.5 to represent 1,000 ft segments and added together to represent the entire reach. Densities of logs and trees/1,000 feet were grouped as conifer and hardwood and graphed for the entire reach for comparisons with other reaches and streams previously surveyed. Densities of logs and trees were also graphed by 1,000 foot sub-segment by component within the bankfull channel, perched and upslope zones.

Relative proportions of in-channel wood providing structure forming habitat function versus that providing nonfunctional extra wood were graphed for the reach to compare with other previously surveyed reaches and streams, using Microsoft EXCEL software. In-channel wood (functional and extra) was graphed by 1000-foot sub-segment. Average riparian widths were also graphed by 1,000 foot sub-segment.

Results and Discussion

Overall In-channel Wood Density. Gazos, Waddell and Scott creeks were the last creeks south of the San Francisco Bay to have coho salmon populations and presently retain steelhead populations. Coho salmon are more exclusively pool-dwelling than steelhead and require more escape cover, which is usually provided by instream wood. Though not necessarily ideal in-channel wood densities exist in these 3 streams, a management goal should be to establish structure-forming in-channel wood densities in our 2010 and 2011 surveyed segments comparable with the best conditions in these 3 streams. The Bean 14c and Soquel 8 had total in-channel wood densities within the range of Gazos, Waddell and Scott creeks, with Bear 18a having less (Figures 3 and 4). Bean 14c and Soquel 8 also had higher total in-channel densities than the 6 segments surveyed in 2010. Bean 14c owed its relatively high density to one major wood cluster within the low-flow channel, while Soquel 8 had one large wood accumulation on an island within the bankfull channel. In decreasing order of in-channel wood densities, the 2011 segments were Soquel 8 (31 pieces), Bean 14c (23 pieces) and Bear 18 (11 pieces).

In comparing densities of the longer-lasting, in-channel conifer pieces, Bean 14c (12 pieces), Bear 18a (4 pieces) and Soquel 8 (15 pieces) had lower densities per 1000 ft than either Gazos (21.5 pieces) or Waddell (18.4 pieces) but were similar or higher than Scott (5.9 pieces) (**Table 1; Figure 3**). Bear 18a had similar in-channel conifer densities to other segments surveyed in the San Lorenzo and Soquel drainages in 2010, but it had half that found in Corralitos 3 (11 pieces).

Table 1. 2010/2011 Densities of In-channel Wood in Santa Cruz Mountain Stream Reaches Compared to Gazos, Waddell, Scott and Lower Soquel Creeks in 2001-2002.

	Hardwood In-channel (pieces/ 1000 ft)	Conifer In-channel (pieces/ 1000 ft)	Total In-channel (pieces/ 1000 ft)
Gazos (4.5 mi.)	9.4	21.5	30.9
Waddell (6.4 mi.)	13.9	18.4	32.3
Scott (7.8 mi.)	10.6	5.9	16.5
Lower Soquel (10.2 mi.)	1.2	0.9	2.1
Zayante 13i >Mt. Charlie-2010	9	4	13
Zayante 13c-2010	4	1	5
Bean 14b-2010	6.3	1.9	10.3
Bean 14c-2011	11	12	23
Bear 18a-2011	7	4	11
Soquel 8-2011	16	15	31
Soquel 9a-2010	11	6	17
Soquel 12a-2010	5	5	10
Corralitos 3-2010	4	11	15

Maximum densities of in-channel conifers in 200-ft sites in Bean 14c (50 pieces) and Soquel 8 (55 pieces) were comparable to maximum densities in individual reaches of Gazos and Waddell, while the maximum density in Bear 18a (10 pieces) was comparable to the maximum in reaches of Scott Creek. However, in both of these 2011 reaches, wood accumulations were concentrated in mainly one location in each reach and not spread out through the reach. Reaches 3 and 6 in Gazos Creek had as many as 50−60 instream conifer pieces/1000 ft, while Reach W1 in Waddell Creek had 50+ pieces/1000 ft (**Leicester 2005**). Reaches 5, 6 and 8 in Scott Creek had 10−15 pieces/1000 ft. While Gazos, Waddell and Corralitos 3 were clearly dominated by in-channel conifers pieces, the other 2010 surveyed segments and Bear 18a had mostly in-channel hardwood pieces (**Figure 3**). Bean 14c and Soquel 8 had approximately equal in-channel densities of conifer and hardwood pieces.

Regarding in-channel densities per 1000 ft of the shorter-lasting hardwood pieces, Soquel 8 (16 pieces), Bean 14c (11 pieces) and Soquel 9a (11 pieces) had relatively similar densities compared to overall densities in Gazos (9.4 pieces), Scott (10.6 pieces) and (13.9 pieces) creeks (**Figure 3**). Bear 18a (7 pieces) had a comparable density to other segments surveyed in 2010. The Zayante 13i in-channel hardwood density per 1000 ft (9 pieces) was greater than all other 2010 surveyed segments except for Soquel 9a. Lower density segments included Bean 14b (6.3 pieces) Soquel 12a (4 pieces), Zayante 13c (4 pieces), and Corralitos 3 (4 pieces).

<u>In-channel Structural Wood Density.</u> An even more important management goal than enhancing overall in-channel wood density should be to increase densities of in-channel conifer pieces actually providing habitat structure comparable to the best densities found in reaches of Gazos, Waddell and Scott creeks. Densities per reach were not provided in Leicester (**2005**), but may be available from the author. Overall Creek densities were provided, with Gazos, Waddell and Scott conifer vs. hardwood pieces per 1000 feet being 8.3 vs. 3.5, 5 vs. 3 and 2.8 vs. 3.9 respectively (**Table 2; Figure 4**). Overall, densities of structure-forming conifer and hardwood pieces in Soquel 8 (14 vs. 14), Bean 14c (11 vs. 9) and Corralitos 3 (8 vs. 4) compared favorably with overall Gazos densities of structure-forming conifers, while other 2010 and 2011 surveyed segments did not in decreasing order; Soquel 12a (5 vs. 4), Soquel 9a (4 vs. 10), Bear 18 (4 vs. 5) Zayante 13i (2.5 vs. 6), Bean 14b (1.3 vs. 5.6), and Zayante 13c (1 vs. 3).

According to NOAA Fisheries restoration guidelines (**Jonathan Ambrose, personal communication**), the frequency of structural in-channel wood is within the “good” range when it reaches 18−34 pieces/ 1,000 ft (6-11 pieces/ 100 meters) for streams with bankfull widths of 1-10 meters and 4−12 pieces/ 1,000 ft (1.3−4 pieces/ 100 meters) for streams with bankfull widths of >10 meters. Both Bean 14c and Soquel 8 were rated “good” by this standard. As mentioned earlier the high densities in Soquel 8 and Bean 14c resulted from one accumulation on an island in the former and one low-flow channel wood cluster in the latter.

In our habitat typing of Gazos Creek in 2001 (**Alley 2003**), it was determined that 56% of the inventoried pools (184 of 327) were scoured and formed by instream wood that was mostly previously cut redwood stumps and redwood logs resulting from past logging and past stream channel clearing activities. None of the segments surveyed in 2010 or 2011 went above 28% (Soquel 9a) for wood scour pools (**Table 2**).

Table 2. 2010/2011 Densities (pieces/ 1000 ft) of In-channel Wood Providing Habitat Structure in Santa Cruz Mountain Stream Reaches Compared to Gazos, Waddell, Scott and Lower Soquel Creeks in 2001-2002.

	Conifer Structure (pieces/ 1000 ft)	Hardwood Structure (pieces/ 1000 ft)	Total Structural (pieces/ 1000 ft)	Percent of Pools With Wood Structures Creating Scour
Gazos (4.5 mi.*)	8.3	3.5	11.8	56 (**Alley 2003b**)
Waddell (6.4 mi.*)	5	3	8	–
Scott (7.8 mi.*)	2.8	3.9	6.7	–
Lower Soquel (10.2 mi.*)	0.3	0.3	0.6	–
Zayante 13i >Mt. Charlie-2010	2.5	6	8.5	16
Zayante 13c-2010	1	3	3	5
Bean 14b-2010	1.3	5.6	6.9	11
Bean 14c-2011	11	9	20 (Good**)	10
Bear 18a-2011	4	5	9	0
Soquel 8-2011	14	14	28 (Good)	11
Soquel 9a-2010	4	10	14	28
Soquel 12a-2010	5	4	9	21
Corralitos 3-2010	8	4	12	13

*** From Leicester (2005).**
****NOAA Fisheries Standard.**

<u>**Perched Riparian Wood Density.**</u> The Zayante 13i reach had the highest density of perched conifer and hardwood trees/logs by far of any reach or overall stream surveyed thus far, and, therefore, the highest potential recruitment of perched trees/logs to the active channel in the event of a large stormflow capable of undermining those trees (**Table 3 and Figure 5; Leicester**

2005). Zayante Reach 13i had 21.5 perched conifer trees/logs per 1000 ft and 67.5 perched hardwood trees/logs per 1000 ft. In 2011, Bean 14c and Soquel 8 segments had higher perched densities of conifers and hardwoods compared to those in Waddell and Gazos creeks. Scott Creek had similar perched hardwood densities as in all three 2011 surveyed segments, including Bear 18a. Compared to average density for all streams surveyed thus far for perched tree/log densities, Bean 14c and Soquel 8 segments had slightly above average perched densities of conifers (7 and 10, respectively) and near-average densities of perched hardwoods (30 and 28, respectively). Bear 18a was below average in perched density for conifers (1) and near average for hardwoods (28). The relatively higher densities of perched trees in surveyed upper reaches of watersheds in 2010 and 2011 are to be expected when compared to perched densities in Gazos, Waddell and Scott creeks because lower reaches of watersheds tend to have lower densities, especially conifers. Lower Reach 2 in Scott Creek had a similar hardwood perched density, and Reach 3 in Gazos Creek had similar conifer perched densities (**Leicester 2005**). All surveyed segments in 2010 had higher perched hardwood densities than those along the stream-wide surveyed reaches surveyed in 2002 in Gazos, Waddell and Scott creeks.

Riparian Wood Density Beyond the Perched Zone. Of the 2011 surveyed segments, both Bean 14c and Soquel 8 had higher riparian densities beyond the perched zone of conifers and hardwoods compared to Gazos Waddell and Scott creeks (**Table 4 and Figure 5**). This was also the case for 2010 surveyed segments Soquel 12a (more than 3 times as much), Corralitos 3,and Soquel 9a. Bear 18a had relatively low riparian conifer densities. All 2010 and 2011 surveyed segments except Zayante 13i and Bear 18a (with their narrow riparian widths) had higher hardwood riparian densities than those three creeks, especially Soquel 12a, Bean 14b and Soquel 9a, with 2–3 times as much. Bean 14c had above average riparian densities of conifers and somewhat below average densities of hardwoods. Bear 18a had below average riparian densities of both conifers and hardwoods. Soquel 8 had near average riparian densities of both conifers and hardwoods.

Table 3. Wood Density in the Perched Riparian Zone of Surveyed Streams and Reach Segments.

Stream or Reach Segment (Year)	Zone	Conifer Density (trees/logs per 1000 ft)	Hardwood Density (trees/logs per 1000 ft)	Total Density (trees/logs per 1000 ft)
Gazos (2002*)	Perched Riparian	4.8	19.1	23.9
Waddell (2002*)	Perched Riparian	4.4	15.2	19.6
Scott (2002*)	Perched Riparian	6.4	30.1	36.5
Lower Soquel (2002*)	Perched Riparian	0.5	2.1	2.6
Zayante 13i (2010)	Perched Riparian	21.5	67.5	89
Zayante 13c (2010)	Perched Riparian	2	43	45
Bean 14b (2010)	Perched Riparian	0	24.4	24.4
Bean 14c (2011)	Perched Riparian	7	30	37
Bear 18a (2011)	Perched Riparian	1	28	29
Soquel 8 (2011)	Perched Riparian	10	28	38
Soquel 9a (2010)	Perched Riparian	6	31	37
Soquel 12a (2010)	Perched Riparian	5	45	50
Corralitos 3 (2010)	Perched Riparian	11	39	50
Average	Perched Riparian	6	31	37

*** From Leicester (2005).**

Table 4. Wood Density in the Riparian Zone Beyond the Perched Zone of Surveyed Streams and Reach Segments.

Stream or Reach Segment (Year)	Zone	Conifer Density (trees/logs per 1000 ft)	Hardwood Density (trees/logs per 1000 ft)	Total Density (trees/logs per 1000 ft)
Gazos (2002*)	Riparian Beyond Perched	19.9	25.9	45.8
Waddell (2002*)	Riparian Beyond Perched	25.6	35.6	61.2
Scott (2002*)	Riparian Beyond Perched	18.7	49.1	67.8
Lower Soquel (2002*)	Riparian Beyond Perched	1.1	9	10.1
Zayante 13i (2010)	Riparian Beyond Perched	7	13.5	20.5
Zayante 13c (2010)	Riparian Beyond Perched	7	94	101
Bean 14b (2010)	Riparian Beyond Perched	11.3	116.3	127.6
Bean 14c (2011)	Perched Beyond Riparian	42	56	98
Bear 18a (2011)	Riparian Beyond Perched	6	33	39
Soquel 8 (2011)	Riparian Beyond Perched	25	67	92
Soquel 9a (2010)	Riparian Beyond Perched	27	114	141
Soquel 12a (2010)	Riparian Beyond Perched	92	158	250
Corralitos 3 (2010)	Riparian Beyond Perched	73	62	79
Average	Riparian Beyond Perched	27	64	87

*** From Leicester (2005).**

Upslope Wood Density. Of the 3 segments surveyed for upslope densities in 2011, Bear 18a had the highest (189 trees/logs per 1000 feet) and Soquel 8 had the third highest (140 pieces) of those surveyed thus far, with Bean 14c somewhat above average (199 pieces) (**Table 5 and Figure 5**). Bear 18a had the second highest density of conifers (101 pieces) and by far the highest density of hardwoods (88 pieces; mostly California bay). Bean 14c and Soquel 8 had similar densities of upslope conifers that were above average. Soquel 8 was tied for second highest in upslope hardwood densities (64 pieces; mostly oak and California bay), while Bean 14c was much below average for upslope hardwoods (a few oak and California bay) in a redwood-dominated forest. Bear 18a, like Zayante 13i, had relatively high upslope densities of trees/logs because of its narrow riparian zone. When riparian and upslope zones were combined to determine conifer densities per 1000 feet, the Bear 18 density (117 pieces) was similar to combined zones in Zayante 13i (122.5 pieces) and other streams or reaches with wider riparian zones that took up most of the 75-foot width beyond perched, such as Waddell (119.4 pieces), Corralitos 3 (115 pieces), and Soquel 9a (102 pieces) but was still considerably less than Soquel 12a (173 pieces).

If riparian or upslope conifers were to be cut to supply instream structures or catcher logs, ample conifers (primarily redwoods) would be available in all 2011 surveyed segments and all 2010 surveyed segments except Zayante 13c and Bean 14b.

Recommendations

1. Protect natural recruitment of wood pieces to the stream channel. If concern develops for manmade structures possibly jeopardized by instream wood, seek county and fishery biologist guidance on any proposed wood removal. Wood recruitment is likely to occur primarily during large flood events and must be judiciously managed so that adequate wood remains in the stream channel between large, episodic recruitment events.

2. If it is decided that naturally occurring wood clusters must be modified for safety reasons, cut and remove a minimum of instream wood.

3. If funds are available, initiate a program to artificially introduce secured redwood logs (preferably with attached rootwads) to the stream channel, with a goal of increasing wood-scoured pools containing structure-forming wood to at least 50%. An additional goal should be to increase the frequency of structural in-channel wood to within the "good" range (NOAA Fisheries restoration guidelines (**J. Ambrose, personal communication**) of 18−34 pieces/ 1,000 ft (6-11 pieces/ 100 meters) for streams with bankfull widths of 1-10 meters and 4−12 pieces/ 1,000 ft (1.3−4 pieces/ 100 meters) for streams with bankfull widths of >10 meters.

4. Establish an educational outreach program for streamside residents in the vicinity of intended enhancement to facilitate local cooperation.

5. The intent of habitat enhancement with wood should be to place the most wood into the channel as cheaply as possible. Onsite sources of logs are preferable to offsite. Engineered, cabled wood clusters should be avoided due to their relatively high cost/ benefit ratio. Placement of secured catcher logs which will gradually accumulate instream wood during ensuing winter stormflows is the preferred technique.

6. Felling of large, tall redwood trees in close proximity to the stream channel is recommended to make vehicular access less important for wood placement. It may be possible to wench cut logs into place without the need for heavy equipment. Felling of a relatively small number of redwoods in each reach will not significantly reduce stream shading or increase streambank erosion.

Table 5. Wood Density in the Upslope Zone Beyond the Riparian Zone and Within 75 Feet of the Bankfull Channel of Surveyed Streams and Reach Segments.

Stream or Reach Segment (Year)	Zone	Conifer Density (trees/logs per 1000 ft)	Hardwood Density (trees/logs per 1000 ft)	Total Density (trees/logs per 1000 ft)
Gazos (2002*)	Upslope	49.5	8.6	58.1
Waddell (2002*)	Upslope	93.8	19.8	113.6
Scott (2002*)	Upslope	55.4	3.3	58.7
Lower Soquel (2002*)	Upslope	4.9	1.9	6.8
Zayante 13i (2010)	Upslope	115.5	28.5	144
Zayante 13c (2010)	Upslope	6	64	70
Bean 14b (2010)	Upslope	1.3	4.4	5.7
Bean 14c (2011)	Upslope	82	17	99
Bear 18a (2011)	Upslope	101	88	189
Soquel 8 (2011)	Upslope	76	64	140
Soquel 9a (2010)	Upslope	75	15	90
Soquel 12a (2010)	Upslope	81	25	106
Corralitos 3 (2010)	Upslope	42	30	72
Average	Upslope	53	28	82

*** From Leicester (2005).**

7. Position catcher logs that extend into the low-flow channel where they may be wedged between existing trees to help secure them in place most cheaply by cabling. These locations would preferably be at the heads of existing pools or where new pools may be scoured, allowing high flows to spread out to provide backwaters for overwintering fish. If trees may be felled into place, so much the better. Bedrock streambed should be avoided because added wood would have the lowest potential to create complexity.

8. Prior to introducing wood to the stream and floodplain, collect fall baseline salmonid density and habitat data in the stream segments to be enhanced.

9. Annually monitor salmonid density and habitat in enhanced segments to assess benefits of wood placement.

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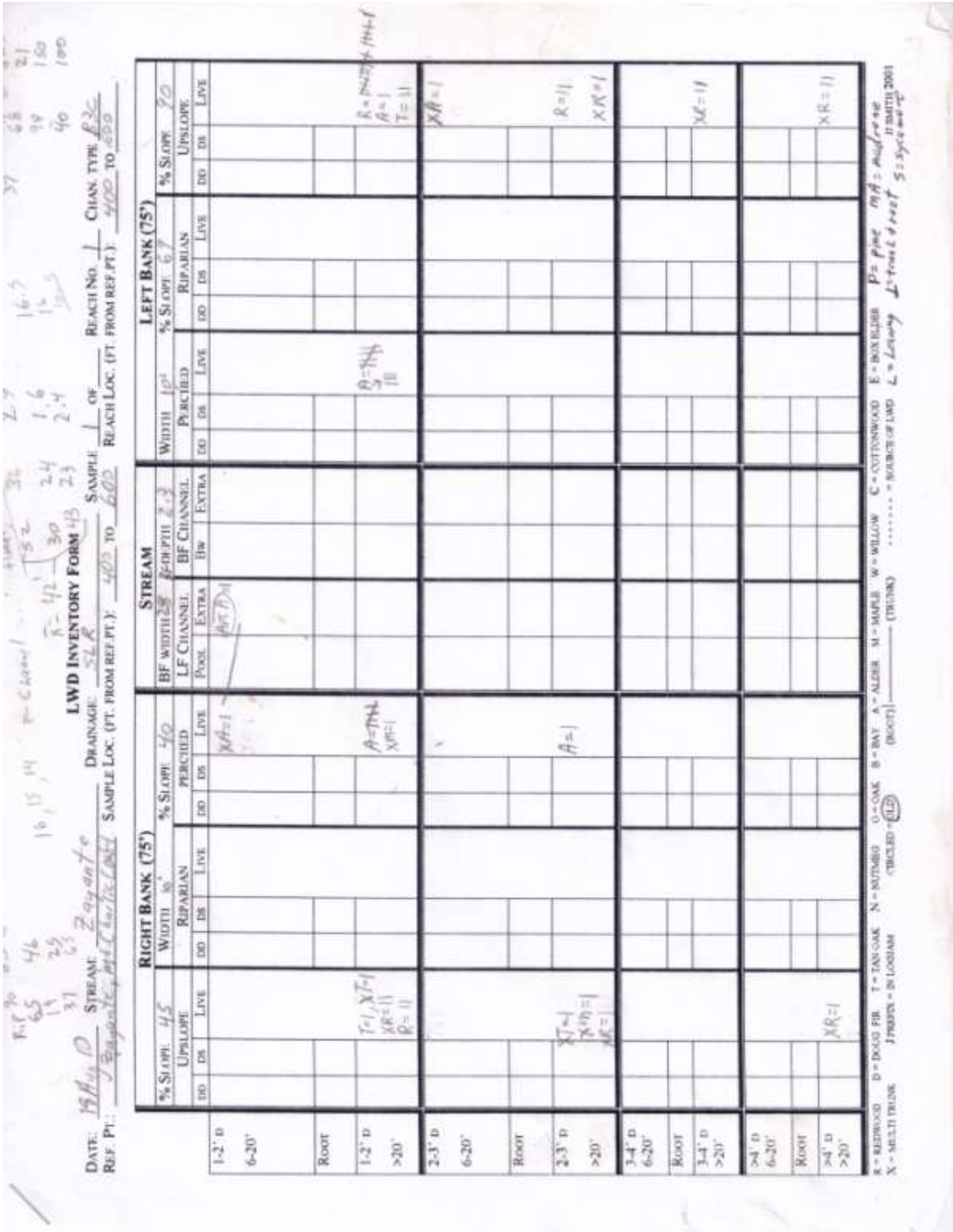

LWD INVENTORY FORM

DATE: 19 Aug 10 STREAM: Zayante DRAINAGE: SLR SAMPLE 1 OF ___ REACH NO. 1 CHAN. TYPE B3c

REF. PT.: SAMPLE LOC. (FT. FROM REF. PT.): 400 TO 600 REACH LOC. (FT. FROM REF. PT.): 400 TO 600

RIGHT BANK (75') — STREAM — LEFT BANK (75')

R = REDWOOD D = DOUG FIR T = TAN OAK N = NUTMEG O = OAK B = BAY A = ALDER M = MAPLE W = WILLOW C = COTTONWOOD E = BOX ELDER

Figure 1. Wood Survey Data Sheet (from Leicester's Thesis (2005)).

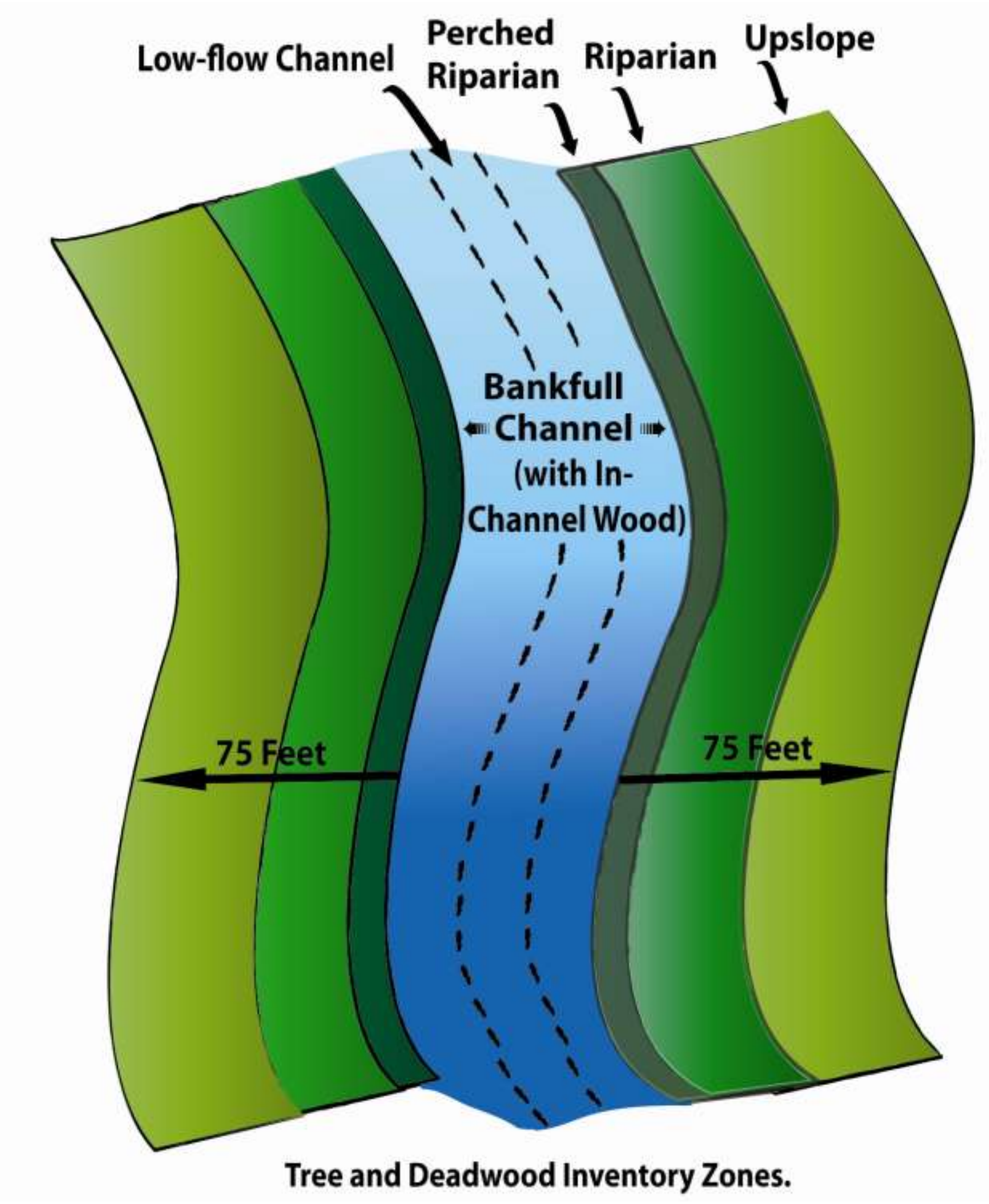


Figure 2. Tree and Deadwood Inventory Zones.

Figure 3. 2010/2011 Densities of In-channel Wood in Santa Cruz Mountain Stream Reaches Compared to Gazos, Waddell, Scott and Lower Soquel Creeks in 2001-2002.

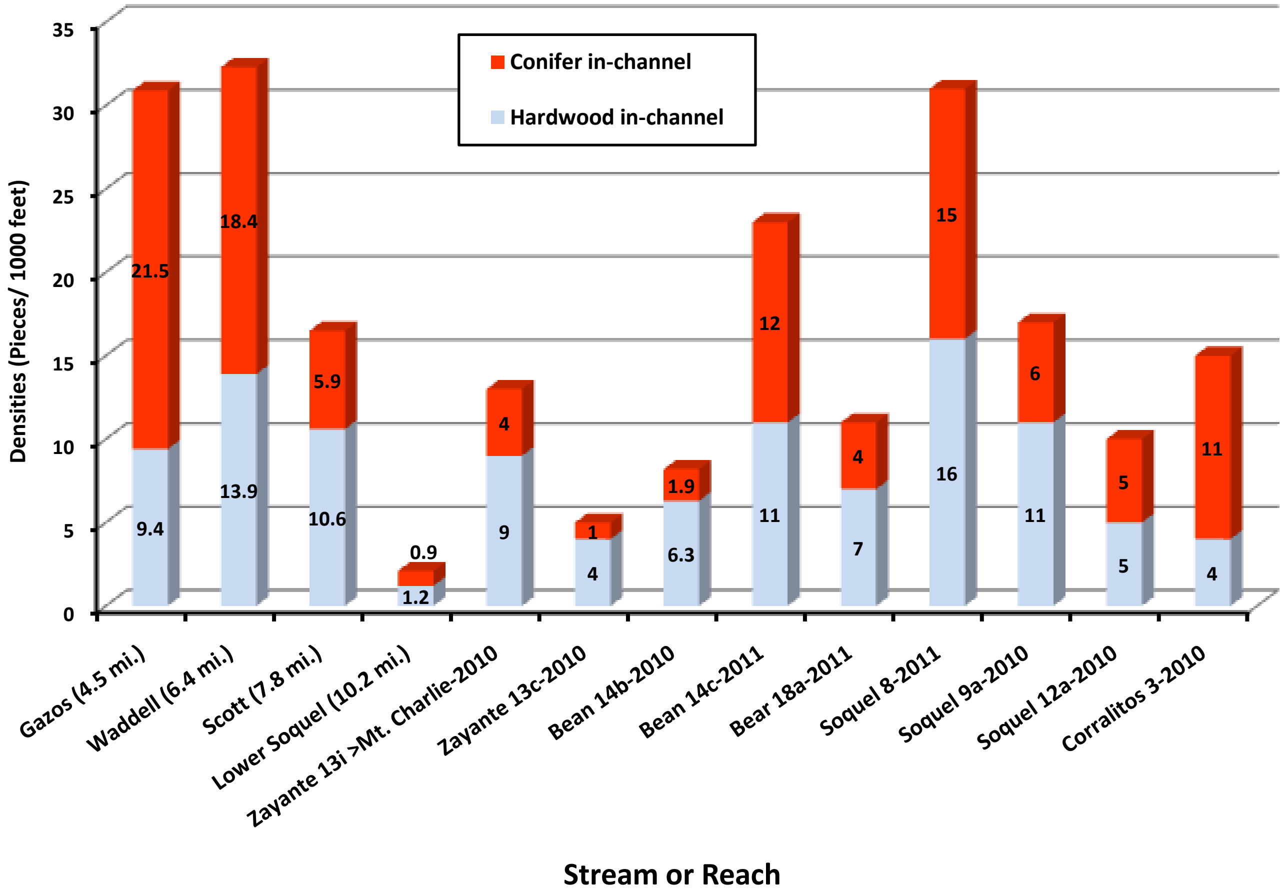
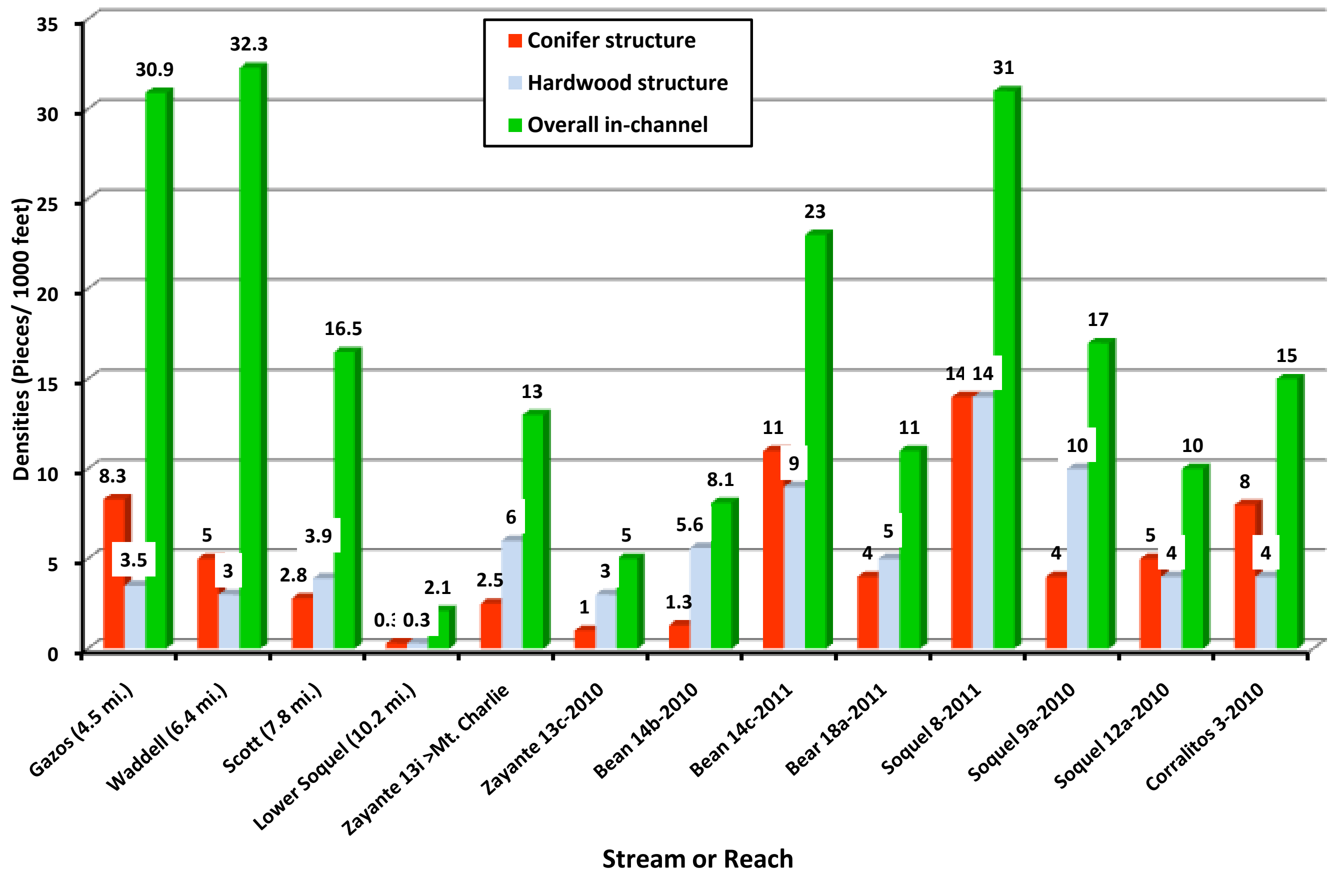


Figure 4. 2010/2011 Densities of In-channel Wood Providing Habitat Structure in Santa Cruz Mountain Stream Reaches Compared to Gazos, Waddell, Scott and Lower Soquel Creeks in 2001-2002.



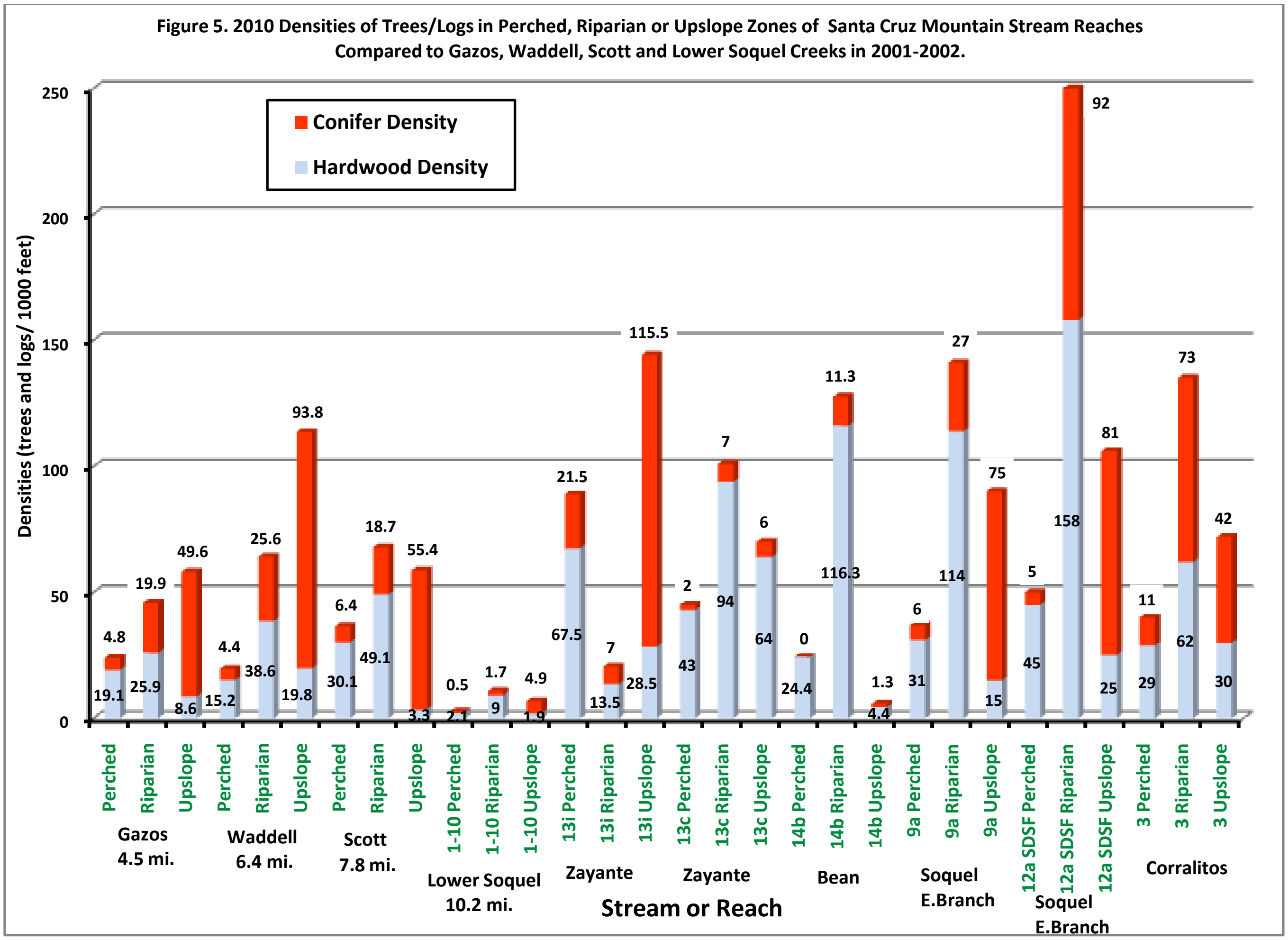


Figure 5. 2010 Densities of Trees/Logs in Perched, Riparian or Upslope Zones of Santa Cruz Mountain Stream Reaches Compared to Gazos, Waddell, Scott and Lower Soquel Creeks in 2001-2002.
Conifer Density
Hardwood Density
Densities (trees and logs/ 1000 feet)
Stream or Reach
Gazos 4.5 mi.
Waddell 6.4 mi.
Scott 7.8 mi.
Lower Soquel 10.2 mi.
Zayante
Zayante
Bean
Soquel E.Branch
Soquel E.Branch
Corralitos
Perched
Riparian
Upslope
1-10 Perched
1-10 Riparian
1-10 Upslope
13i Perched
13i Riparian
13i Upslope
13c Perched
13c Riparian
13c Upslope
14b Perched
14b Riparian
14b Upslope
9a Perched
9a Riparian
9a Upslope
12a SDSF Perched
12a SDSF Riparian
12a SDSF Upslope
3 Perched
3 Riparian
3 Upslope

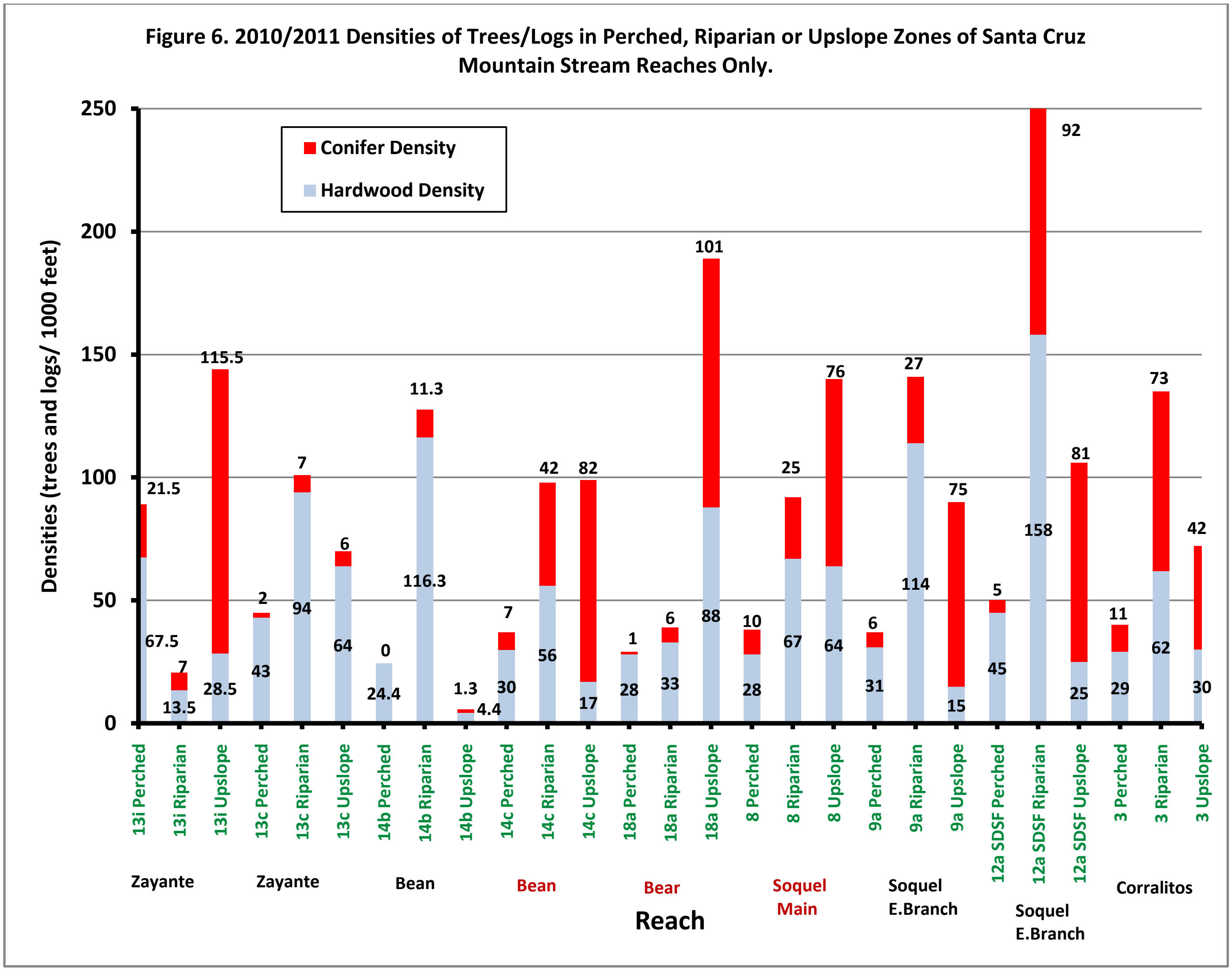


Figure 6. 2010/2011 Densities of Trees/Logs in Perched, Riparian or Upslope Zones of Santa Cruz Mountain Stream Reaches Only.
Conifer Density
Hardwood Density
Densities (trees and logs/ 1000 feet)
250
200
150
100
50
0
21.5
67.5
7
13.5
115.5
28.5
2
43
7
94
6
64
0
24.4
11.3
116.3
1.3
4.4
7
30
42
56
82
17
1
28
6
33
101
88
10
28
25
67
76
64
6
31
27
114
75
15
5
45
92
158
81
25
11
29
73
62
42
30
13i Perched
13i Riparian
13i Upslope
13c Perched
13c Riparian
13c Upslope
14b Perched
14b Riparian
14b Upslope
14c Perched
14c Riparian
14c Upslope
18a Perched
18a Riparian
18a Upslope
8 Perched
8 Riparian
8 Upslope
9a Perched
9a Riparian
9a Upslope
12a SDSF Perched
12a SDSF Riparian
12a SDSF Upslope
3 Perched
3 Riparian
3 Upslope
Zayante
Zayante
Bean
Bean
Bear
Soquel Main
Soquel E.Branch
Soquel E.Branch
Corralitos
Reach

APPENDIX A. WATERSHED MAPS

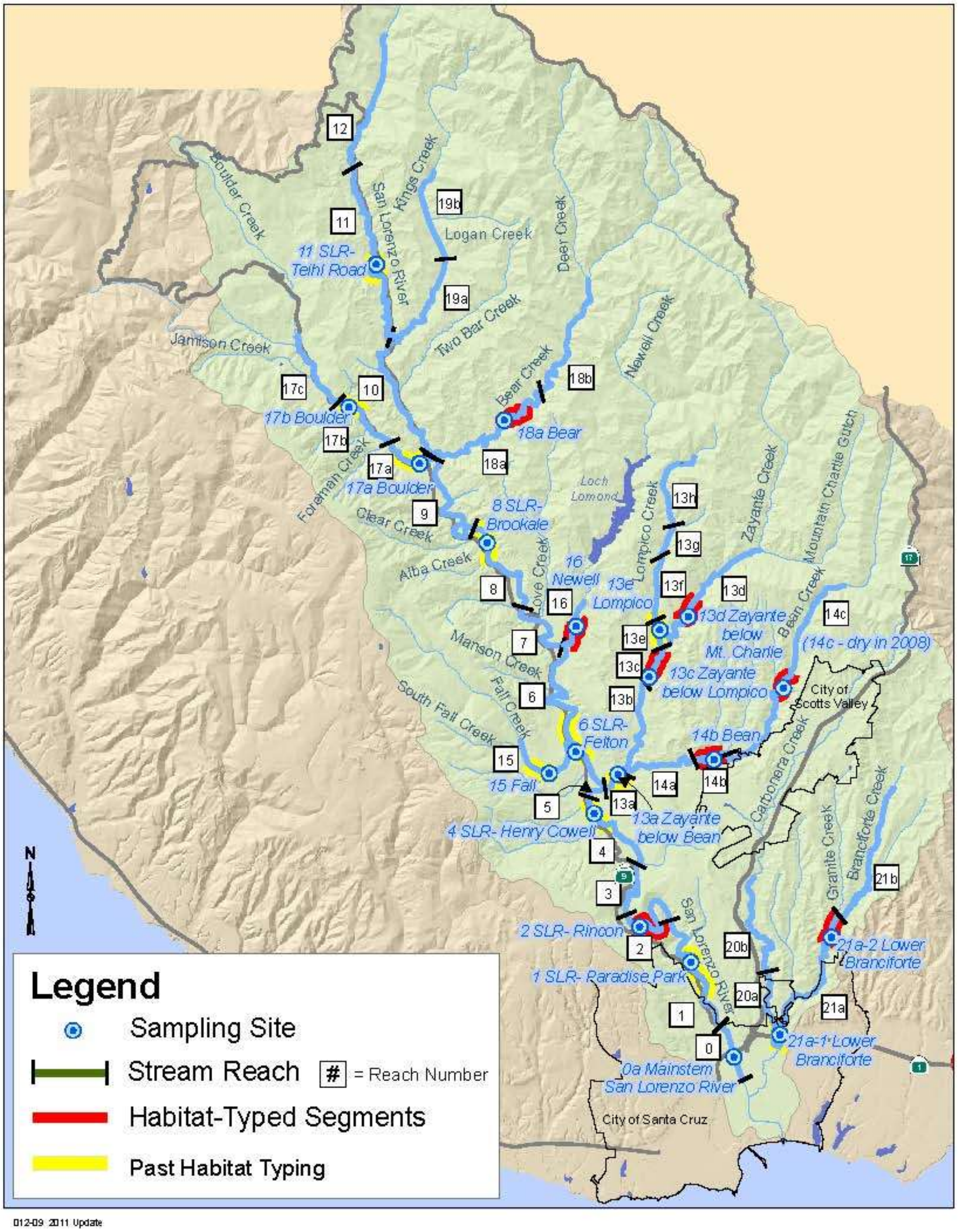


Figure 1. San Lorenzo River Watershed, Showing Wood Survey Segments in Zayante 13c, Bean 14b and unmarked Reach 13i (where Zayante Creek is Labeled Above Reach 13d and Upstream of Mountain Charlie Gulch Confluence).

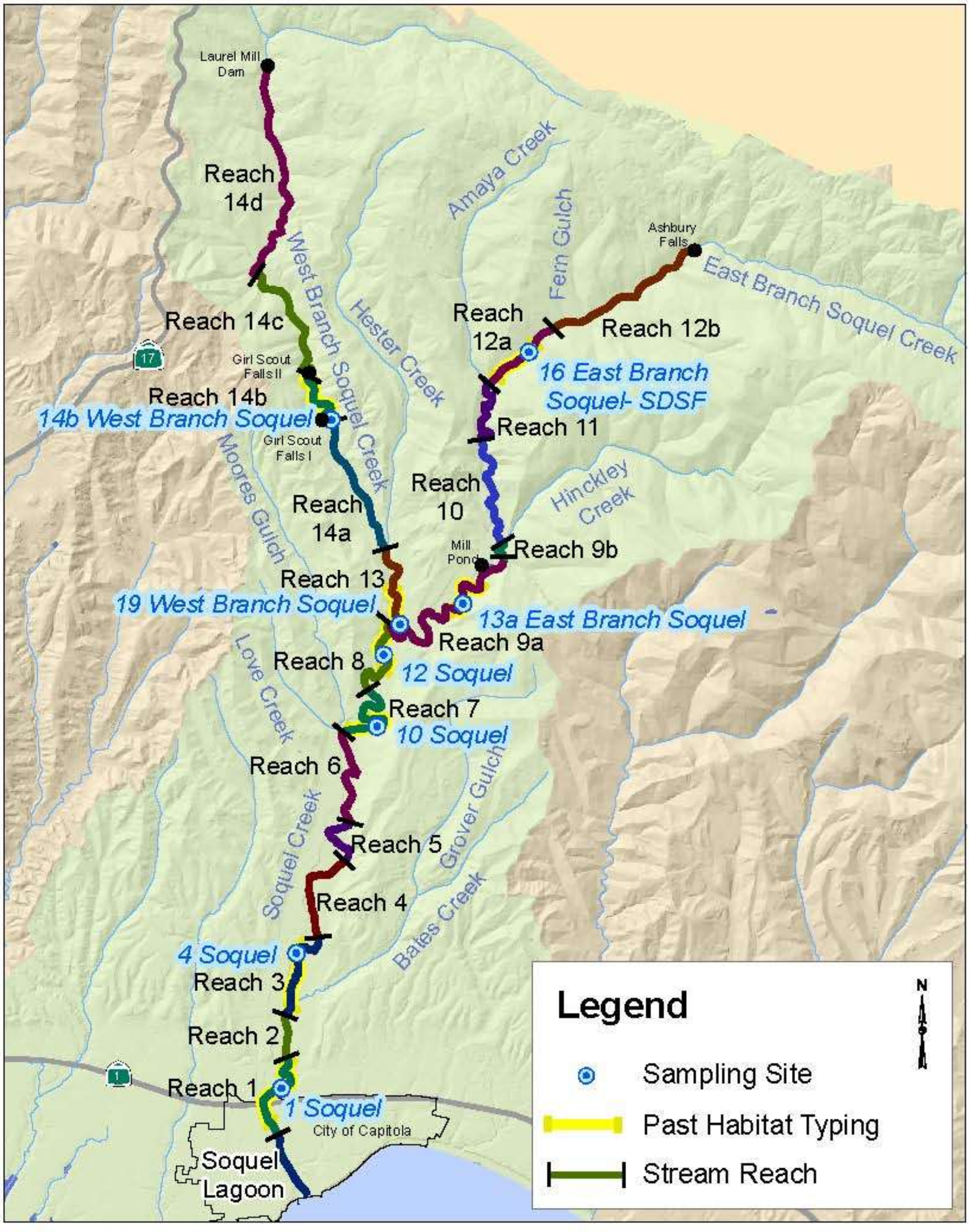


Figure 2. Soquel Creek Watershed, Showing Wood Survey Segments in Reaches 9a and 12a (yellow).

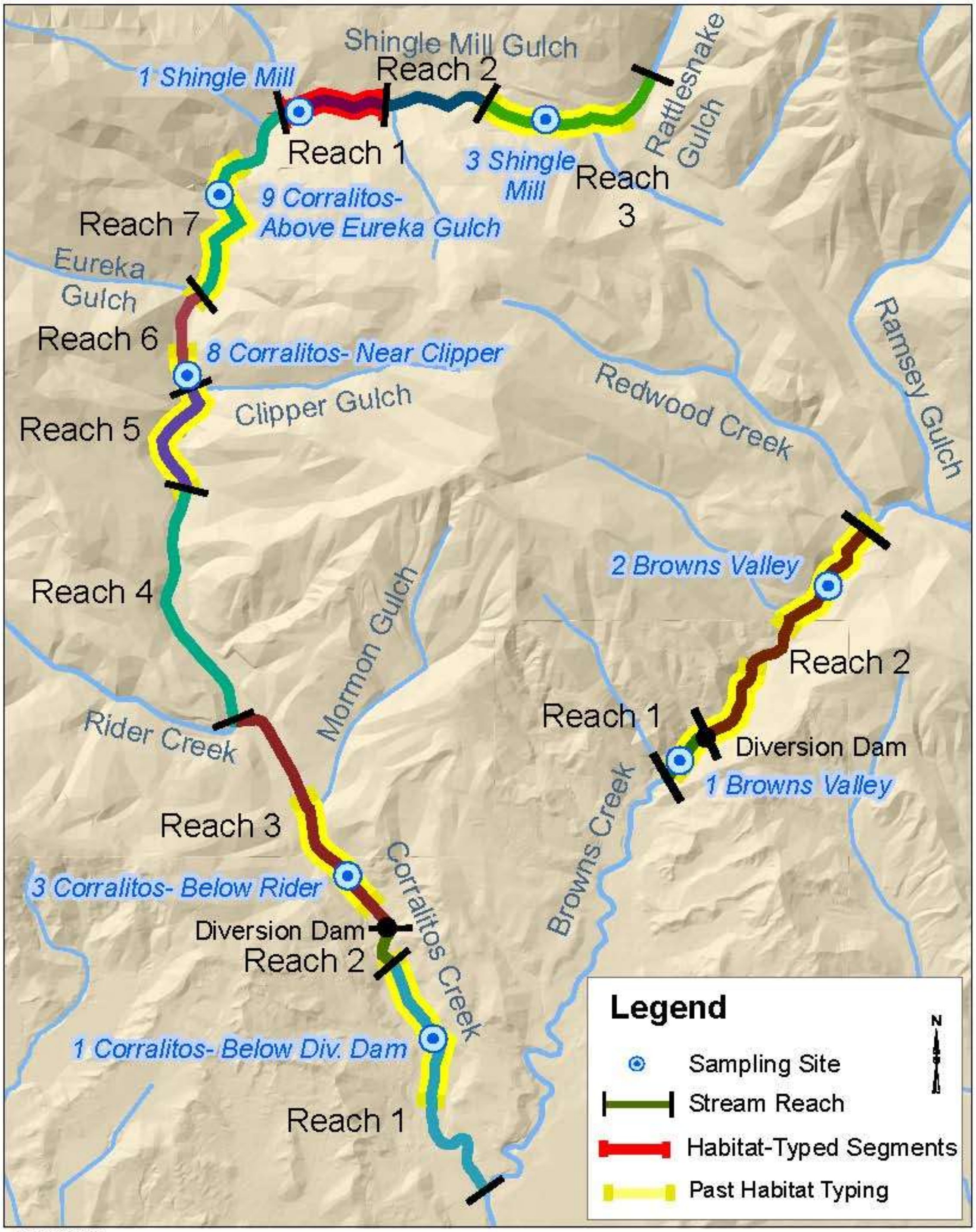


Figure 3. Upper Corralitos Creek Sub-Watershed, Showing Wood Survey Segment 3 (yellow) Above Diversion Dam.