STREAM INVENTORY REPORT
SOUTH FORK NOYO RIVER

WATERSHED OVERVIEW

South Fork Noyo River is a tributary to the Noyo River (Figure 1). Elevations range from 30 feet at the mouth of the creek to 1,400 feet in the headwater areas. South Fork Noyo's legal description at the confluence with the Noyo River is T18N R17W Sec14. Its location is 39°25'28"N. latitude and 123°42'59"W. longitude according to the USGS Noyo Hill 7.5 minute quadrangle. South Fork Noyo River drains a watershed of approximately 11,095 acres.

HABITAT INVENTORY RESULTS

The habitat inventory of September 5 through September 14, 1995 was conducted by Chris Coyle (CCC) and Kyle Young (WSP/AmeriCorps). The portion of the stream surveyed by this crew includes the section from the confluence of Kass Creek to the end of the stream. Another habitat inventory was conducted by Diana Hines (Georgia Pacific) on August 19, 1996 and includes the portion of stream from the confluence with the Noyo River to the confluence of Kass Creek. This report includes a compilation of the data from the two surveys. The total length of surveyed stream in South Fork Noyo River was 54,134 feet (10.3 miles, 16.4 KM) (Table 1). Side channels comprised 920 feet of this total. Flow measured at the mouth of South Fork Noyo River on 9/20/1995 was 1.9 cubic feet per second (cfs).

South Fork Noyo River consists of three reaches: An F4 for the first 38,919 feet, an F1 for the next 9,458 feet and an F3 for the remaining 4,837 feet.

Table 1 summarizes the Level II Riffle, Flatwater and Pool Habitat Types. By percent occurrence Riffles comprised 22%, Flatwater 34% and Pools 44% of the habitat types (Graph 1). By percent total length, Riffles comprised 12%, Flatwater 31% and Pools 57% (Graph 2).

Twenty-two Level IV Habitat Types were identified and are summarized in Table 2. The most frequently occurring habitat types were Glides and Mid Channel Pools both at 21% each and Low Gradient Riffles at 20% (Graph 3). The most prevalent habitat types by percent total length were Mid Channel Pools at 26%, Glides 21% and Low Gradient Riffles 11% (Table 2).

Table 3 summarizes Main, Scour and Backwater pools which are Level III Pool Habitat Types. Main Channel Pools were most often encountered at 56% occurrence and comprised 55% of the total length of pools.

Table 4 is a summary of maximum pool depths by Level IV Pool Habitat Types. In third order streams pools with depths of three feet (.91 m) or greater are considered optimal for fish habitat. In South Fork Noyo River, 158 of the 482 pools (33%) had a depth of three feet or greater (Graph 4).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the pool tail-outs measured, 27% had a value of 1, 35% had a value of 2, 26% had a value of 3 and 11% had a value of 4 (Graph 5).

Of the Level II Habitat Types, Pools had the highest mean shelter rating at 21 (Table 1). Of the Level III Pool Habitat Types, Backwater Pools had the highest mean shelter rating at 29 (Table 3).

Of the 482 pools, 15% were formed by Large Woody Debris (LWD): 6% by logs and 8% by root wads (calculated from Table 4).

Table 6 summarizes dominant substrate by Level IV Habitat Types. Of the Low Gradient Riffles fully measured, 73% had gravel and 27% had small cobble as the dominant substrate (Graph 6).

Mean percent closed canopy was 91%: 68% coniferous trees and 23% deciduous trees. Mean percent open canopy was 9% (Graph 7, calculated from Table 7).

Table 7 summarizes the mean percent substrate/vegetation types found along the banks of the stream. Mean percent right bank vegetated was 81% while mean percent left bank vegetated was 80%. Grass was the dominant bank vegetation type in 41% of the units fully measured. The dominant substrate composing the structure of the stream banks was Sand/Silt/Clay, found in 46% of the units fully measured.

DISCUSSION

The information gathered in the process of habitat typing will provide Georgia-Pacific with baseline data on the current condition of this creek and the available habitat for salmonids. These data can be used to identify components of the habitat in need of enhancement so appropriate conditions for South Fork Noyo River can be obtained over time.

Level II habitat types by percent occurrence and length

Flatwater habitat types comprised a moderate percentage of the units by both percent occurrence and length at 34% and 31% respectively (Table 1 and Graph 1). These unit types usually do not provide optimal spawning or rearing habitat for salmonids. Riffle habitat units comprised a low percentage of the stream by both percent occurrence and length at 22% and 12% respectively. Pools, however, comprised a higher percentage by both percent occurrence and length at 44% and 57% respectively. Riffles usually provide good spawning habitat while pools provide important rearing habitat. In addition, Mundie (1969) reported that invertebrate food production is maximized in riffles while pools provide an optimum feeding environment for coho. In fact, the most productive streams are those consisting of a pool to riffle ratio of approximately one to one (Ruggles 1966).

Pool Depth

According to Flosi and Reynolds (1994), a stream with at least 50% of its total habitat comprised of primary pools is generally desirable. Primary pools are at least two feet deep in first and second order streams and at least three feet deep in third order streams. The information from Graph 4 on maximum depth in pools was used to determine percent of primary pools. South Fork Noyo River, a fourth order stream, is comprised mainly of shallow pools with 33% of the pools having a maximum depth of three feet or greater.

Instream Shelter

Instream shelter ratings are derived from two measurements: instream shelter complexity and instream shelter percent cover. The first is a value rating which provides a relative measure of the quality and composition of the shelter, and the second is a measure of the area of a habitat unit covered by shelter. The various types of instream shelter include LWD, SWD, boulders, root wads, terrestrial vegetation, aquatic vegetation, bedrock ledges and undercut banks. Of the Level II habitat types Pools had the highest shelter rating at 21. Of the Level III habitat types Backwater Pools had the highest shelter rating at 29. These values are low as shelter values of 80 or higher are considered optimal for good rearing habitat (Flosi and Reynolds 1994).

Large Woody Debris

The presence of Large Woody Debris in streams is a significant component of fish habitat. Woody debris creates areas of low flow, providing a refuge for fish during periods of high flow (Robison and Beschta, 1990). Woody debris also provides cover for fish, lowering the risk of predation. The percent of pools formed by LWD in South Fork Noyo River was 15%. Whether these numbers are high or low, relative to the needs of salmonids is difficult to ascertain since the optimum amount of woody debris in streams has not been specified (Robison and Beschta 1990). However, based on data from Georgia-Pacific's 1995 Aquatic Vertebrate Study, the only coho found in the Ten Mile River Basin were in stream reaches where approximately 50% of pools were formed by large woody debris. Those reaches that did not support coho had a significantly lower percentage of pools formed by large woody debris (Ambrose et al, 1996). This suggests that a low percentage of LWD formed pools could adversely affect juvenile Coho Populations (C.S. Shirvel 1990).

The above LWD analysis pertains only to pools formed by logs or root wads as described in Flosi and Reynolds (1994)**:** Lateral Scour Pool Log Enhanced, Lateral Scour Pool Root Wad Enhanced, Backwater Pool Log Formed and Backwater Pool Root Wad Formed. Other pools containing LWD as a component were not included in the calculation. For example, plunge pools may be formed by boulders, bedrock or LWD but are not described as such by habitat unit types. Therefore, the LWD formed pool calculation is limited to four pool types and does not quantify the total amount of LWD in South Fork Noyo River.

Canopy

There are two important benefits of canopy cover in coastal streams. Canopy keeps stream temperatures cool as well as providing nutrients in the form of leaf litter and organic material (Bilby 1988). This leaf litter, organic material, and their associated nutrients are utilized as a food source by benthic macroinvertebrates (aquatic insects). The macroinvertebrates, in turn, are major food sources for most fish species in forested areas (Gregory et al., 1987). Mean percent canopy cover for the South Fork Noyo River was 91%. This is high since a canopy cover of 80% or higher is considered optimum, Flosi and Reynolds (1994).

Coniferous trees occupied a larger portion of the canopy than did deciduous trees. Coniferous trees comprised 68% and deciduous trees 23% of the canopy. The significance of this is that wood from coniferous trees does not deteriorate as rapidly as alder and most other deciduous species (Sedell, *et al*. 1988). Therefore, more LWD would be available in the future for fish cover and LWD formed pools in this creek and others dominated by coniferous species.

Embeddedness

High embeddedness values (silt levels), such as those found in South Fork Noyo River, have been associated with many negative impacts to salmonids. These negative impacts can be observed in important environmental components of salmonid habitat, such as pool habitats, dissolved oxygen levels and water temperatures.

The impact high silt levels have on pool habitat is that they fill in and eventually eliminate pools. As already mentioned, pools provide important habitat for rearing salmonids.

High silt levels also impact oxygen levels in the water. They do so by reducing water circulation within the substrate, thus lowering the oxygen levels needed by salmonid eggs (Sandercock, 1991). This can hinder the survival of the eggs deposited in the redds, as well as the survival of juvenile salmonids.

Water temperature is impacted by high silt levels in several ways. Hagans et al (1986) reported the following impacts to water temperatures: 1) the loss of a reflective bottom; 2) darker sediment (as opposed to clean gravels) storing heat from direct solar radiation which is then transferred to the water column; and 3) a reduction in the flow of water through the substrate interstitial spaces thereby exposing more of the water column to direct solar radiation.

Another means by which water temperatures are increased is through the widening of stream channels: over time, high silt levels increase the substrate surface level of the creek, resulting in a wider, shallower stream channel (Flosi and Reynolds 1994). In shallow streams more surface area is exposed to the sun relative to the volume of water, leading to an increase in solar heating which in turn leads to higher water temperatures.

Substrate embedded with silt in varying degrees were given corresponding values as follows: 0-25%= value 1, 26 - 50% = value 2, 51 - 75% = value 3 and 76 - 100% = value 4. According to Flosi and Reynolds (1994), creeks with embeddedness values of two or higher are considered to have poor quality fish habitat. In South Fork Noyo River, 73% of the pool tail-outs measured had embeddedness values of two or more.

It is important to consider, however, that the above embeddedness values were obtained in the summer during low flow conditions. In winter and spring, flows are usually higher due to the rainy season and the lowered evapotranspiration of the trees. This higher flow can carry away some of the previously deposited silt to sites further downstream. Therefore, embeddedness values may fluctuate throughout the year along different sections of the stream.

Substrate

In South Fork Noyo River, 73% of the Low Gradient Riffles had gravel and 27% had small cobble as the dominant substrate. The high concentration of gravel and small cobble in riffles indicates that there is a sufficient amount of substrate available as potential spawning habitat in this creek. While this creek had sufficient substrate for spawning in the riffles surveyed, the overall percentage of riffles in the surveyed portions of the creek was low at 22% (Table 1). Subsequently, there may be a lack of sufficient spawning habitat. Another point to consider is that regardless of the amount of substrate or spawning habitat available, this habitat may not be suitable for salmonids if it is highly embedded.

Overall, South Fork Noyo River appears to have a relatively low percentage of primary and LWD formed pools. This stream also appears to have low shelter values and high embeddedness values. In addition, while there was sufficient substrate for spawning, habitat for spawning appeared to be limited. This stream does appear to have sufficient canopy.

Georgia-Pacific recognizes that there are areas of South Fork Noyo River in need of enhancement, and where feasible will attempt to restore those areas over time as part of its long term management plan. The company will also attempt to facilitate a healthy environment for salmonids in this creek through sound management practices.

RECOMMENDATIONS

South Fork Noyo River should be managed as an anadromous, natural production watershed.

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

Shelter values throughout South Fork Noyo River could be increased by addition of large logs and root wads, boulder clusters, log and boulder wiers and log and boulder deflectors. These need to be placed carefully to prevent washing out in high flows. The Stream Habitat Restoration Manual, by Flosi and Reynolds, 1994, provides detailed descriptions for restoration efforts.

Log debris accumulations retaining large quantities of fine sediment should be modified if necessary, over time, to avoid excessive sediment loading in downstream reaches.

Sources of stream bank erosion should be mapped and prioritized according to present and potential sediment yield. Identified sites should then be treated to reduce the amount of fine sediment entering the stream. In addition, sediment sources related to road systems need to be identified, mapped and treated according to their potential for sediment yield to the watershed.

SURVEY MEMOS

The following memos were taken in the field at the time of survey. All distances are approximate and measured in feet from the confluence.

319 Six young of year (yoy) approximately two inches

440 Three yoy, two inches

634 Bridge over unit at 10'

2297 Three yoy two inches

2616 Tributary entering left bank at 128'

3113 Two redds, large log jam over pool, both lwd and swd. one redwood tree and one alder fallen over. log jam is 25'w x 10'h x 30'l

3452 End of survey completed in 1996 by G.P. at confluence with Kass Creek.

3483 Begin survey (completed by Fish and Game in 1995) at confluence with Kass Creek, the mouth of which is dry for approximately ten feet

3674 (+25) (56') log stringer bridge, 11'hx50'wx12'l, (+135)(166') lb tributary, dry

3786 (277') debris raft 40'lx50'w, not a barrier, no gravel retention

5220 Juvenile frog

5639 Frog-likely

6976 (#4 on map) (3524') top of unit lb tributary. mouth dry, but flow approximately. 0.05 cfs. accessible to fish.

7220 (3695') (+10) lb slide, lx50'h contributing fines/debris

7312 Coho

7497 (3915')sunfish!!!!!!

8827 (#5 on map)(5375') top of unit: rb tributary, mouth dry, but flow approximately 0.01cfs. accessible to fish

9344 Adult

9721 (+90) (6232') lb tributary approximately. 0.01 cfs, not accessible to fish,

10589 (+5)(7069') dry lb tributary

11128 (+35) lb tributary, <0.01 cfs, not accessible to fish (NAF)

11421 Juvenile frog

14283 (+14)(10636') rb tributary approximately. 0.01 cfs. accessible to fish. none observed.

14793 Frog

15980 (+18)(12516') rb 3’ diameter. cmp culvert. no outfall (+30)(12528') rb spring

16402 (+20)(12942') lb tributary, approximately 0.01 cfs. NAF

17698 Top of unit (14246') rb tributary, dry

18464 (+104)(14940') lb tributary <0.01 cfs NAF

20561 (+112)(17058') rb 1.5 diameter. cmp culvert. no flow.

21230 (+216)(17611') rb 1.5’ diameter. cmp no flow

22842 (+91)(19347') lb 2'd cmp culvert. approximately 1gpm outfall
23574 Plunge from egg-taking station apron/dam at head of pool.
23599 Dam spillway. 3' jump onto spillway (4% slope) 1.2'h weir at top of spillway. possible velocity barrier-apparently designed to be so.
23860 Yoy salmonids above dam. (+211)(20358') nfsf noyo enters rb
24129 (+77)(20584') road crossing, jdsf rd. 350. metal arch bridge. 24'wx36'lx7' clearance

25187 (+55)(21720') log stringer footbridge. 8'lx35'wx7' clearance
25438 (+8)(21981') rb 1.5'd cmp culvert. no flow.
25765 (+10)(22243') Peterson gulch enters lb approx. 0.1 cfs. yoy salmonids observed.

26596 (+20)(23113') rb 1.5'd cmp culvert. no flow.
27508 (+19)(24035')lb tributary, approximately. 1gpm, NAF
28027 (+14)(24553') rb 1.5'd cmp culvert. no flow.
29261 (+17)(25788') bear gulch enters rb approx. 0.05cfs. yoy salmonids observed
30332 (+28)(26880') lb tributary <0.01 cfs, NAF
32168 (+16)(28708') rb 2'd cmp culvert. no flow.
35085 (+46)(31606') rb ravine
35376 Draft site 31840'
36946 (+62)(33494') lb relic trestle
37487 (34022') dam approximately. 2% gradient on spillway with 1' slot weir at top. no fishway. possible velocity barrier.
37977 (+35)(34504') parlin crk enters rb
38206 (+10)(34735') lb tributary. approximately. 0.1 cfs. yoy tributary
38825 (+26)(35352') lb tributary. mouth dry. upstream flow <0.1 cfs yoy observed in tributary.
38961 Channel change f4->f1
39027 (+10)(35575') trestle bridge, rd. 320, 15'lx50'wx11' clearance
41492 (+23)(38040') rb tributary. <0.01 cfs accessible but probably not fish-bearing
41753 Adult rlf
42625 (15+)(39133') rb erosion 10'hx30'l, contributing fines/cobble
43903 Frog
44975 (+32)(41510') sculpin observed, lb tributary <0.01 cfs,
45189 (+26)(41704') lb tributary <0.01 cfs naf
45361 (+22)(41909') rb tributary. residual pools only, no fish observed.
45713 (+34)(42261')fallen log at top of unit creates low flow barrier
46024 Frog
46500 (+6)(42997') lb tributary approximately. 0.01 cfs. accessible. no fish observed.
47431 (+5)(43960') lb ravine

47780 Frog
48063 Frog
48407 (44925')channel change f1-f3
49755 (+47)(46303) lb seep
50495 (+51)(47013) rb tributary <0.1 cfs, probably fish bearing
50512 (+11)(47054') old fording
50752 Frog
51175 (+50)(47723') rb tributary. residual pools. no fish observed. difficult access. probably not fish-bearing.
51868 Frog
52271 Juvenile frog
52299 Juvenile frog
52686 Juvenile frog
52702 There are frogs and tadpoles all over this stream. no more notes
52942 Coho
53060 (+13)(49576') lb erosion 10'hx58'l contributing fines and gravel
53088 Remnant pool
53114 Five foot jump at top
53214 End of Survey. (49762') spillway for dam. residual trickle coming over spillway. no fish observed since unit #1038

DIH