STREAM INVENTORY REPORT

Hayshed Gulch

WATERSHED OVERVIEW

Hayshed Gulch is a tributary to the Noyo River (Figure 1). Elevations range from 0 feet at the mouth of the creek to 600 feet in the headwater areas. Hayshed Gulch's legal description at the confluence with the Noyo River is T18N R17W S15. Its location is 39°25'42"N. latitude and 123°43'43"W. longitude according to the USGS Noyo Hill 7.5 minute quadrangle.

HABITAT INVENTORY RESULTS

The habitat inventory of September 31 through August 1, 1996, was conducted by Dave Wright. The total length of surveyed stream in Hayshed Gulch was 5,572 feet (1.1 miles, 1.7 KM) (Table 1). There were no side channels in this creek.

Flow measured at the mouth of Hayshed Gulch on July 31, 1996 was 0.202 cubic feet per second (cfs).

Hayshed Gulch consists of one reach: a B3 for the entire length of surveyed stream.

Table 1 summarizes the Level II riffle, flatwater and pool habitat types. By percent occurrence riffles comprised 16%, flatwater 40% and pools 43% of the habitat types (Graph 1). By percent total length, riffles comprised 8%, flatwater 62% and pools 29% (Graph 2).

Thirteen Level IV habitat types were identified and are summarized in Table 2. The most frequently occurring habitat types were step runs, 26%, low gradient riffles, 16% and both mid-channel pools and lateral scour log pools at 12% each (Graph 3). The most prevalent habitat types by percent total length were step runs at 49%, lateral scour log pools at 9% and low gradient riffles at 8% (Table 2).

Table 3 summarizes main, scour and backwater pools which are Level III pool habitat types. Scour pools were most often encountered at 67% occurrence and comprised 66% of the total length of pools.

Table 4 is a summary of maximum pool depths by Level IV pool habitat types. In second order streams, pools with depths of two feet (0.61 m) or greater are considered optimal for fish habitat. In Hayshed Gulch, 18 of the 54 pools (33%) had a depth of two feet or greater (Graph 4).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the pool tail-outs measured, 0% had a value of 1, 0% had a value of 2, 0% had a value of 3 and 100% had a value of 4 (Graph 5).

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Of the Level II habitat types, pools had the highest mean shelter rating at 29 (Table 1). Of the Level III pool habitat types, scour pools had the highest mean shelter rating at 35 (Table 3).

Of the 54 pools, 39% were formed by large woody debris (LWD): 30% by logs and 9% by root wads (calculated from Table 4).

Table 6 summarizes dominant substrate by Level IV habitat types. Of the low gradient riffles fully measured, 25% had gravel and 25% had small cobble as the dominant substrate (Graph 6).

Mean percent closed canopy was 86%: 44% coniferous trees and 42% deciduous trees. Mean percent open canopy was 14% (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 62% while mean percent left bank vegetated was 61%. Grass was the dominant bank vegetation type in 45% of the units fully measured. The dominant substrate composing the structure of the stream banks was sand/silt/clay, found in 74% 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 Hayshed Gulch can be obtained over time.

Level II habitat types by percent occurrence and length

Flatwater habitat types comprised a high percentage of the units by both percent occurrence and length at 40% and 62% 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 16% and 8% respectively. Pools, however, comprised a higher percentage by both percent occurrence and length at 43% and 29% 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 salmon. 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. Hayshed

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Gulch, a second order stream, is comprised mainly of shallow pools with 33% of the pools having a maximum depth of two 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, small woody debris, boulders, rootwads, terrestrial vegetation, aquatic vegetation, bedrock ledges and undercut banks. Of the Level II habitat types, pools had the highest shelter rating at 29. Of the Level III habitat types, scour pools had the highest shelter rating at 35. 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 Hayshed Gulch was 39%. 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 salmon 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 salmon 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 Hayshed Gulch

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 Hayshed Gulch was 86%. This is relatively high since a canopy cover of 80% or higher is considered optimum (Flosi and Reynolds,1994).

Coniferous trees occupied a slightly larger portion of the canopy than did deciduous trees. Coniferous trees comprised 44% and deciduous trees 42% of the canopy. The significance of this is that wood from coniferous species does not deteriorate as rapidly as alders 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 Hayshed Gulch, 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 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.

Substrates 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 Hayshed Gulch, 100% 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 Hayshed Gulch, 25% of the low gradient riffles had gravel and 25% had small cobble as the dominant substrate. Collectively, the high concentration of gravel and small cobble in riffles indicates that there is a sufficient amount of substrate available as potential spawning habitat. 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 16% (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, Hayshed Gulch appears to have a relatively low percentage of primary pools, low shelter values and high embeddedness values. In addition, while there was sufficient substrate for spawning, habitat for spawning appeared to be limited. This creek does appear to have sufficient canopy and LWD formed pools.

Georgia-Pacific recognizes that there are areas of Hayshed Gulch 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

1) Hayshed Gulch should be managed as an anadromous, natural production watershed.

2) 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.

3) Shelter values throughout Hayshed Gulch could be increased by addition of large logs and root wads, boulder clusters, log and boulder weirs 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.

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

5) 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.

COMMENTS AND LANDMARKS

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

Position (ft):	Comments:
183’	Bridge.
335’	Four salmonids observed.
346’	No salmonids observed (NSO).
450’	Three salmonids observed.
492’	Four salmonids observed.
1,358’	Five salmonids observed.
1,669’	Five salmonids observed.
1,703’	Six salmonids observed, possible coho.
1,988’	Three salmonids observed.
2,329’	Approximately 15 salmonids observed.
2,454’	Approximately 25 salmonids observed.
2,479’	Approximately five coho observed.
2,851’	Approximately 12 coho observed.
2,956’	Approximately 15 steelhead observed.
3,406’	Five coho observed.
3,892’	Approximately 15 coho observed.
4,244’	Approximately 10 coho observed.
4,338’	Confluence with Side Gulch.

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4,546’ 10 to 15 coho and steelhead observed.

4,821’ Five to 10 salmonids observed.

4,873’ Five salmonids observed.

4,989’ Tributary.

5,551’ Ten coho observed.

5,572’ End of survey. Survey ends where creek splits into two smaller branches. East branch appears to be a "class 2", no fish observed. West branch also appears to be non-fish bearing; it may be too small to support anadromous fish.

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