

2022 Channel and Habitat Changes at Six Long-term Index Sites on Scott Creek from the CZU Fire.

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INTRODUCTION

Eight to ten index sites in the Scott Creek watershed have been annually sampled by electrofishing from 1992-2019. In 2020 the CZU fire impacts prevented sampling, and in 2021 only three sites were sampled, and one other observed for habitat conditions, prior to a substantial early October storm. Six of the historic middle watershed sites were resampled in October 2022 (Figure 1). This brief report summarizes the general habitat changes that occurred in 2021 and 2022 due to the direct effects of the fire and the indirect effects of the fire on watershed runoff, channel changes from high flows, substantial watershed erosion, and large wood inputs and movement.

METHODS

Sampling has mostly been conducted at the same sites since 1992, including at the same individual habitats when possible. Coho were the primary target of sampling, habitats sampled were weighted towards pools. Channel changes among years have generally been relatively small, with the same general habitats persisting through most mild years. More wood was added and relocated within Scott Creek in 2017 (very wet), 2018 (moderately wet), and 2019 (moderately wet; Smith 2021). However, there was notably little channel and habitat change at Scott watershed sites in 2019, allowing comparisons between 2019 (before the fire) and 2021 (at 4 sites) and 2022 (at 6 sites), after the fire. Pool depths, channel rearrangements, substrate condition, and channel wood, were assessed based upon notes and photographs from 2022 (see Appendix).

RESULTS AND DISCUSSION

Riparian Canopy Change

Although individual trees were burned near all six sample sites, significant loss of riparian canopy was limited to two surveyed sites, on lower Mill Creek and lower Big Creek at Swanton Road. Summer water temperature effects would have been insignificant at the four other sample sites. Canopy loss from burn (California bay and alders at the Mill Creek site; and alders at the Big Creek site) didn't increase summer water temperatures more than 1-2 degrees at those two sites, at least partially because summer stream flows were higher than would be expected from the third consecutive drought year.

Stream Flows

Winter.--The winter of 2020-21 was dry, but the watershed had lost much of its canopy and understory protection against slope erosion to the CZU Fire, and there was little reestablishment until winter 2021-22. Despite the mild winter (Figures 2), there was some sedimentation and channel change in 2021 in

the Scotts Creek watershed (and in the Waddell and Gazos creek watersheds). In contrast, the winter of 2021-2022 had relatively large storms at the end of October and in December 2021 (Figure 2), before most recovery of the understory vegetation began. The storm flows were actually of higher magnitude in the watersheds of the CZU Fire in 2021-22 than the USGS gage for Pescadero Creek (Figure 2) indicates, since the Pescadero watershed was largely outside of the intense CZU Fire burn. Storm flow heights in Scott Creek were estimated to have been at least 1-2 times bankfull.

Summer.—Despite the third consecutive year of drought, summer and fall stream flows were sustained throughout the watershed in 2022. This differed from droughts in 2007-2009 and 2012-2015, when extensive sections of the stream upstream of Big Creek were intermittent or dry (Smith 2021). (The granitic sand watershed of Big Creek results in good summer stream flows in Big Creek and Scott Creek downstream of Big Creek in all years). The extensive tree mortality and canopy loss by surviving trees resulted in reduced watershed vegetation water uptake and improved summer stream flow, with summer stream flows similar to that of wet years like 2017 and 2019. The high summer stream flow also delayed full closure of the sand bar at the mouth until late August.

Channel, Habitat, and Substrate Changes and Wood Loading and Movement

Modest watershed erosion in winter 2020-2021 produced some changes in channel configurations by 2021, mostly by fallen trees (primarily alders) and localized sediment inputs. The large storms in October and December 2021 were sufficient to add, rearrange and move channel wood. Heavy hillslope erosion deposited and extensively moved sediment in the channels. Channels rearranged, and there was extensive filling of existing and rearranged pools. Fine sediment coated the substrate surface of most pool and glide habitats. The watershed was not surveyed for potential logjams as fish passage problems, but no significant passage problems were noted at or near the six resurveyed sampling sites. In the past the relatively wide channel of Scott Creek and the sandy banks have usually allowed the stream to at least partially cut under or around log jams, allowing fish passage. This contrasts with the narrow entrenched channel of Gazos Creek and entrenched portions of Waddell Creek, where logjams frequently are large, tightly packed, and persistent, and have been fish passage issues (Smith 2021 and in preparation).

The mild winter after December allowed for good coho and steelhead redd survival, and the relatively high summer stream flow (considering the dry year) resulted in high young-of-year (YOY) steelhead and coho densities. However, the shallower, simpler habitats, from the December storms and major sediment inputs and movement, should reduce over-winter survival of the abundant YOY fish.

LITERATURE CITED

- Smith, J. J. 2021. Distribution and Abundance of juvenile coho and steelhead in Gazos, Waddell, and Scott creeks in 2021. Cumulative results and discussion (summaries of previous years remain in report for comparison: fish sampling results 1992-2021 and habitat conditions 2007-2021) 116 page unpublished report.
- Smith, J. J. 2022. In preparation, Distribution and Abundance of juvenile coho and steelhead in Gazos, Waddell, and Scott creeks in 2022.

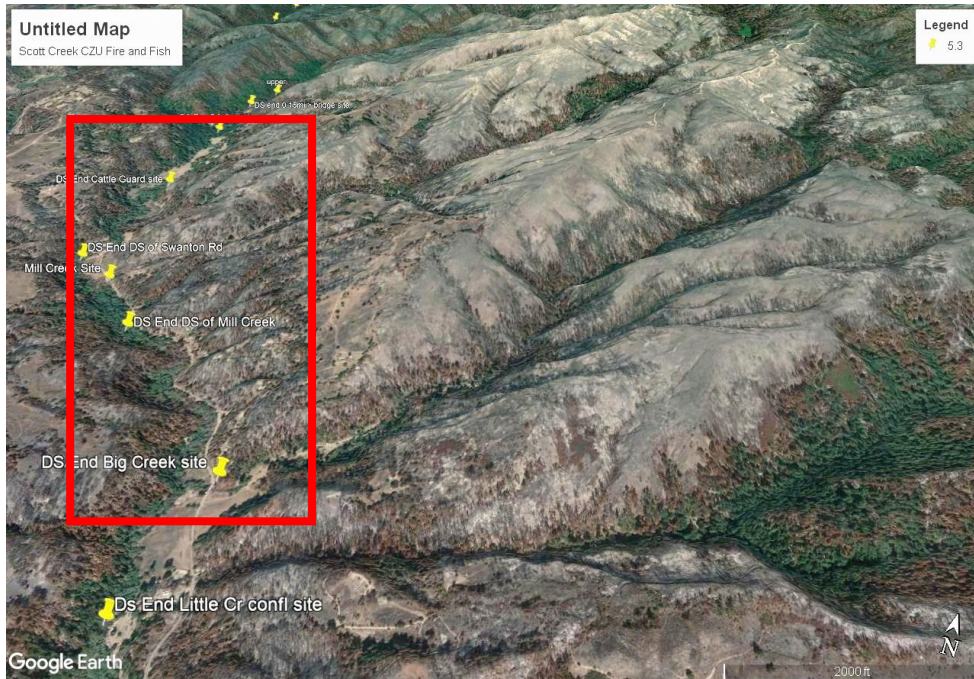


Figure 1. Google Earth aerial photo of Scott Creek watershed upstream of Little Creek in September 2020. The burn was most severe in Little Creek, Big Creek, Mill Creek, and the upstream portion of Scott Creek (the right two-thirds of photo). The direct impacts at the regular fish sampling sites on Scott Creek (most of icons) were light to moderate. Sampling in 2022 was at six sites within the red rectangle.

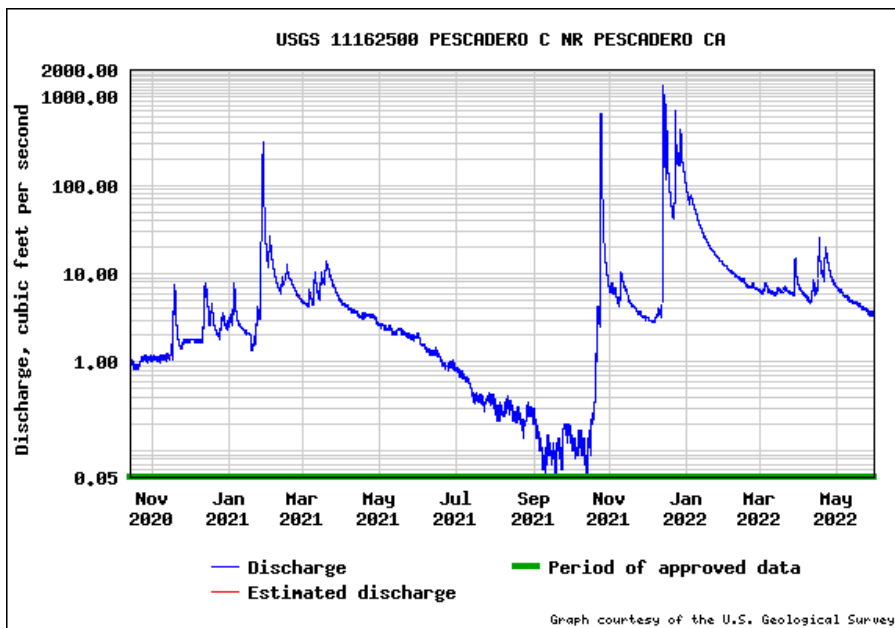


Figure 2. Low stream flow in Pescadero Creek in 2020-2021, with only a brief moderate late January storm, compared to relatively large storms in October and December 2021. The general pattern would be similar in Scott Creek, but with relatively larger flood peaks.

Appendix: 2022 Site Photos (arranged from downstream to upstream).

Big Creek, Upstream of Swanton Road



Photo 1. Looking upstream of Swanton Road (1 Oct 2022). Open canopy due to fallen and cut alders (to prevent bridge blockage). Pool above bridge and pocket water along the banks was lost by high flows and bedload movement. Channel composed of runs and short riffles, and channel armored with cobbles and small boulders, with little change from 2021.



Photo 2. Looking downstream towards Swanton Road. Pool with undercut bank along left bank present in both 2021 and 2022.



Photo 3. Looking downstream. Narrow, shallow pool and run has replaced a deeper pool (about 50% filled).



Photo 4. Looking downstream at tail of pool below V-weir. Short moderately deep pool mostly filled. Alders down and canopy opened.



Photo 5. Decades old V-weir was substantially rinsed under the cap logs, mostly eliminating the protected undercut that provided high flow velocity refuge and escape cover. The average depth of the pool below the weir has been reduced by at least half. Streamside alder canopy is mostly gone.



Photo 6. Looking upstream from V-weir. Shallow pools with undercut right bank substantial filled. Most of the streamside alder canopy is gone.

Scott Creek Downstream of Mill Creek at the Cathedral Redwoods (Mile 3.05)



Photo 7. Looking downstream. Canopy partially opened by loss of alders. Shallow pools and runs with scattered logs in channel.



Photo 8. Looking upstream. Lowermost sampling habitat is a shallow pool and glide. Undercut banks have been reduced and depths formerly associated with wood in the channel have been reduced. Stream bed with a layer of fine silt.



Photo 9. Partial log jam present in 2021 has been reduced, but the stream channel upstream (to the right) has been rearranged from the far bank to the near bank (foreground). The formerly deep pool (now under the logs) at the large redwood stump on the far bank is now half filled with sediment and is now largely isolated from the main current and stagnant; this has eliminated the fast-water feeding habitat and few fish were present. The stump pool does provide high flow over-wintering habitat.



Photo 10. Looking upstream. The deep tail of the pool upstream of that shown in Photo 9 is partially filled with sediment and organic matter. Limited sampling in the stagnant habitat caught no fish. The larger portion of the moderately deep pool upstream to the bend was still present in 2021, but was completely filled by 2022, eliminating two-thirds of the pool habitat (Photo 11).



Photo 11. Looking upstream. The head of the former bend pool was along the right bank (left in the photo) in 2021, but was lost to sediment deposition in 2022. The habitat is now bypassed by a shallow riffle and run.



Photo 12. Looking upstream. The partial logjam from 2017 and 2019 was associated with a long pool at and upstream of the jam. The wood in the partial jam was tripled in 2022, and much of the pool upstream has been filled.



Photo 13. Looking downstream. The backwater effect of the jam in the distance (and in photo 12) has resulted in filling much of the pool and glide upstream.



Photo 14. Scour at the bend upstream has produced a short 2 ft deep pool with a small partial jam at its tail and a fast-water feeding “head of pool” habitat upstream.

Mill Creek, Downstream of Swanton Road



Photo 15. Looking downstream. The lower bend pool (>2 ft deep) downstream of, and parallel to, Swanton Road has modified little since 1992, mostly with the amount of accumulated large wood. Shading of the pool was reduced by the burning of several large bay trees at and upstream of the pool.



Photo 16. Looking upstream. A guide and shallow pool associated an in-channel trunk (now gone) was converted to run and riffle habitat in 2021. The section was recut in by 2022, with a narrow, shallow (< 1 ft) pool within the run. The Lockheed Reservoir upstream on Mill probably substantially attenuated the brief period of high flows in December 2021.



Photo 17. A narrow pool and deeply undercut bank had been present since the 1990's. It received some filling in 2021, but was narrowed and substantially filled in 2022. Half of the undercut bank survived and still provided habitat for steelhead YOY and yearlings in 2022.



Photo 18. Accumulated large wood created a deep, complex pool in 2021 at the bottom of the horseshoe bend downstream of Swanton Road. It was unchanged in 2022.

Scott Creek Downstream of Swanton Road (Mile 3.55)



Photo 19. Looking upstream. The site of a logjam and deep pool and glide in 2017-2019, the channel up and downstream was scoured of wood and filled with sediment. This habitat immediately upstream of the PIT antenna is now shallow pool/glide and run habitat.



Photo 20. Looking upstream. Run and glide habitat, with canopy intact.



Photo 21. Looking upstream. Glide and shallow (1-2' ft) pool habitat is shallower and has lost bank undercuts and much of the overhanging vegetation. The low flow channel is primarily sand and silt, although the flood plain is gravel. The head of the pool upstream provides fast-water feeding habitat.



Photo 22. Looking upstream of the sample reach. The sandy glide and run habitat is similar to earlier years, except small and medium wood is now absent from the channel.

Scott Creek near Cattle Guard (Mile 4.25)



Photo 23. Looking downstream. A series of pools to 2-2.5 ft deep downstream to a sharp bend were rearranged and filled. This photo shows a formerly long 2.5 ft deep pool, with deeply undercut right bank. The pool was almost completely filled and is now a shallow run moved to the left bank. Canopy is still intact.



Photo 24. Looking downstream. A new, long glide and pool (to 1-1.5 ft deep) has formed along the right bank, where a glide/run had previously crossed from left to right to enter the pool in the previous photo.



Photo 25. Looking downstream. A deep pool (to 3+ ft) with undercut bank and large wood in a backwater alcove to the left had been present since 1992. The straightened stream channel with a shallower pool now bypasses the 80% filled alcove/backwater.



Photo 26. Looking upstream. The shallow run that used to enter the alcove pool has been scoured to a short, moderately deep (2+ ft) pool and glide immediately below a large log.

Downstream of Big Creek Lumber Gate (Mile 4.9)



Photo 27. Looking upstream. The formerly deep pool at the bend at the downstream end of the sample site was often too deep to sample effectively. The pool configuration has changed and the pool has lost more than half of its depth.



Photo 28. Looking downstream. In 2017- 2019 several deep (2.5+ ft) pools associated with large wood in the middle of the sample reach were rearranged and replaced by shallow pools and runs. The channel additionally rearranged and shifted within the flood plain in 2021 and 2022. The pool shown is less than 1 ft deep.



Photo 29. Looking upstream. Tail of a long, narrow glide and shallow pool (mostly <math><1.5\text{ ft}</math>) in a channel with most wood removed and a sand/silt substrate.



Photo 30. Looking downstream. Head of pool in photo 29, with narrow pool, glide, and run habitat.



Photo 31. Looking upstream. Narrowed and partially (50%) filled downstream portion of pool at bend.



Photo 32. Looking upstream. Head of the pool in photo 31, located at the bend. The pool has been present since 1992, when the right bank multi-trunked California bay tree had partially fallen into the channel. In 2021 the pool at the bend was 4 times as wide, contained several fallen trees, and was up to 4 ft deep (and difficult to sample!). In 2022, the scoured pool (<2.5 ft deep) was narrowed to the undercut right bank.



Photo 33. Looking upstream. From 1992-2021, deep pool and glide occupied all but the foreground of this photo, extending upstream to the sharp bend (and often even farther upstream around the bend). The configuration moderately changed over the years. In 2021 most of the pool was too deep to effectively electrofish. In 2022 the habitat was narrowed (the pool was previously bank to bank) and about three-fourths of the habitat filled. Only a narrow deep channel exists along the left bank.